CREST EXPLORATION LIMITED
SUMMARY REPORT OF WORK CONDUCTED ON
YUKON IRON & MICA CLAIMS
SNAKE RIVER AREA
YUKON TERRITORY

ASSESSMENT REPORT

Map No.: 106-F-2 etc Type of Work: Report on Iron Formation

Report filed under: Crest Exploration Ltd.

Date performed: Sep 62

Location: Lat.: same

Long:

Area:

CLAIM Name & No.:

Crest claims

Work done by: Dr. W.G. Wahl

Work done for: Above

Date	Good standing to	Date	Good standing to
31 Dec	1993		

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Calgary, Alberta,
June 10, 1963

In June of 1962, Crest Exploration Limited acquired a large number of claims in the Yukon and Northwest Territories which had been staked on a discovery of iron ore. The deposit straddles the Yukon - Northwest Territories border in the vicinity of the Snake and Cranswick Rivers. The deposit is now known as the Snake River Iron Ore Deposit.

This report is submitted by Crest Exploration Limited in support of, and in conjunction with, its applications for Certificates of Work on its Yukon claims. The report outlines Crest's operations and associated costs since the claims were recorded and until April 30th, 1963. Detailed reports on the geology, assaying, geophysical surveys, iron ore beneficiation tests are presented with the report. A report prepared by Canadian Bechtel Limited, and covering an overall feasibility study carried out by that company, has been presented to the Minister of Northern Affairs by the President of Crest Exploration Limited.

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Gravel airstrip, May, 1963.

Pacific Western Airlines C-46 aircraft unloading
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ACCOMPANYING REPORTS AND DATA

Geology

Geological Report on Snake River Iron Ore Deposit - by Dr. R. A. Stuart, Crest Exploration Limited.

Report by consultant geologist, Dr. W. G. Wahl, on Snake River Deposit.

Geophysics

Report on ground gravimeter and magnetometer Surveys - Sulmac Exploration Ltd.,

Report on Air Magnetometer Survey - Spartan Air Services Ltd.,

Beneficiation

Reports on Beneficiation Tests carried out by:

Ontario Research Foundation
Humphreys Engineering Ltd.
The Mineral Processing Division of the Department of Mines and Technical Surveys.

Assays

Copies of original assay determinations.

Copies of Strip Logs of channelled and other examined sections

Topographic Base Map of Snake River area

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INTRODUCTION

Location

The Snake River Deposit is located as shown on the preceding map. The area staked on the deposit covers approximately 150 square miles, lying between longitudes 132° 15' W. to 133° 25' W. and latitudes 65° 08' N. to 65° 22' N. The area is within the Mackenzie Mountains and is one of rugged topography. Maximum elevations range up to 6,000 or 7,000 feet, with local relief of 3,000 feet being common. With the exception of a few scattered stands of trees, the area is above the timber line and within the region of permafrost. Access into the area is difficult and is readily available only to aircraft.

History of Discovery and Staking



Staking Claims, June 1962.

The occurrence of hematite float in the Peel drainage system has been frequently reported since the gold rush days and many published reports have speculated the existence of large iron ore deposits in the Mackenzie and Wernecke mountains. However, the location of such deposits remained unknown until the late summer of 1961. In August, 1961, the Snake River deposit was discovered by geologists of the California Standard Company carrying out regional stratigraphic and structural work related to oil and gas. Their geological reconnaissance indicated that a hematite deposite of immense size had been discovered.

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Prior to spring break-up in May, 1962, an advanced party was flown into the area to establish a camp and generally make arrangements for the subsequent staking operations. Actual staking operations got underway early in June and the bulk of the claims were staked by mid-July. There were 493 claims recorded in the Yukon and 369 in the Northwest Territories, covering an area of close to 100,000 acres. These claims were acquired from the stakers by Crest Exploration Limited, a subsidiary of the Standard Oil Company of California.

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SUMMARY OF OPERATIONS JULY 1962 - APRIL 30, 1963

On the completion of staking and recording of claims, an exploration program was begun to determine, in detail, the magnitude and grade of the deposit. Topographic and geological maps were prepared. Sampling crews measured, described and took channel samples of the iron bearing formation at numerous locations across the deposit. One experimental diamond drill hole was cored through the iron formation. Considerable difficulty was involved in the drilling, but as a result valuable experience was gained with respect to the type of drilling equipment and drilling techniques required to efficiently drill the iron formation. Ground magnetometer and gravimetric surveys, and an airborne magnetometer survey were run to determine whether the iron bearing formation could be traced geophysically.

Following the field season, and through the winter months, studies and investigations werecarried out by Crest to further evaluate the deposit. Much of the sampled material was assayed. Crest personnel in Calgary compiled geological data on maps and sections, prepared grade estimates, carried out engineering, economic and marketing studies and laid plans for the 1963 program. We also guided, reviewed and appraised the work of a number of consulting organizations which were retained to investigate various aspects of the deposit and its development. Canadian Bechtel Limited completed an overall feasibility study. The Ontario Research Foundation, Humphreys Engineering and the Mineral Processing Division of the Department of Mines and Technical Surveys carried out beneficiation tests on the ore. Dr. W. G. Wahl, consulting geologist, was retained to advise on a future exploration program.

In order to facilitate the movement of supplies and personnel a permanent airstrip is being built in the Snake River area. Other methods of moving in supplies etc. were investigated and it was determined that over the years an airstrip was most economical and certainly more efficient. The move-in of construction equipment began on March 8, 1963, and construction of the airstrip began on April 12th. By the end of April, aircraft, at least up to the size of a Curtis C-46, were able to use the strip. As of May 15th it has been built to a length of 3500 feet, 130 feet wide, with a gravel surface 2 to 3 feet thick. Some 40,000 cubic yards of gravel have been excavated and used in the construction. It is planned to lengthen the runway to approximately 5000 feet during the late spring and summer of 1963.

Because of its remoteness and rugged terrain, requiring the extensive use of fixed wing aircraft and helicopters, the cost of operating in the Snake River area is extremely high. The work carried out by Crest on, and in the evaluation of, its Yukon claims during the 1962-63 year, subsequent to staking, is shown in the following summary. It is this work and expenditures that are submitted in our applications for Certificates of Work.

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CREST EXPLORATION LIMITED

Summary of Work & Expenditures on Yukon Claims

Snake River Iron Ore Deposit

July 1962 - April 30, 1963

Project		Yukon Expenditures
Channel Sampling & Section preparation		$ 65,141
Assaying		11,589
Geology:		
Field surveys & mapping	$ 18,761	
Consulting	3,871	
Office Studies	3,810	26,442
Geophysics:		
Ground Surveys	7,165	
Aeromag. Survey	2,800	9,965
Topographic Base Map Construction		5,995
Beneficiation Testing		16,295
Canadian Bechtel Feasibility Study		175,017
Head Office Administration at 12½%		44,150
Airstrip Construction (To May 15, 1963) Excavated and used		40,000 cu. yds. gravel

For the calendar year of 1963 Crest has budgeted for $1,042,000. A large part of this budget will be spent directly on the deposit - on airstrip and road construction, channel sampling, diamond drilling, claim surveying and further geological work, to delineate the ore zone in more detail. A substantial portion of the budget will go to extensive iron ore beneficiation testing, assaying and engineering studies - pointed particularly to the problem of economically transporting the ore 600 miles from Snake River to tidewater. On this problem extensive studies are being carried out to determine the feasibility of shipping the ore in slurry form by pipeline. In addition, considerable effort will be placed on the problems of economics and marketing.

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SUMMARY OF RESULTS OF OPERATINGS TO APRIL 30, 1963

Our investigations to date clearly indicate that the Snake River Iron Deposit is extremely large - one of the world's largest. Preliminary estimates of reserves indicate that 20 to 30 billion tons of iron ore lie within the claim boundaries.

The iron bearing formation is a sedimentary deposit of hematite with associated lenses of jasper. Bands of sandstone and conglomerate make up 15 to 25 percent of the ore zone. The main ore zone varies in thickness from 100 to 350 feet, with the thickest section being centred in the Yukon block of claims. A lower iron bearing band, approximately 50 feet thick, is separated from the main band by a bed of conglomerate approximately 70 feet thick. Our investigations to date have been concerned primarily with the main upper zone.

The iron formation is well exposed across the area in a band 30 to 40 miles long. In many cases full sections are exposed on the valley walls and in creek bottoms.

In a number of locations the exposure at surface is ideally suited for open pit mining, with a minimum amount of overburden. The most favourable area, which is shown in the preceding map, is along and north of Iron Creek. It is in this area where a large part of our work has been done, not only because the formation is well exposed, but it is in this area that the main iron zone reaches its maximum thickness of approximately 350 feet. The reserves in the Iron Creek area, with maximum stripping ratios of 1:1, have been estimated at 6 billion tons. In and immediately adjacent to Iron Creek, alone, one billion tons of ore are available with practically no overburden problem.

Assays of the iron ore have indicated an iron content averaging 46.5%, silica 24.8% and phosphorous 0.37%. In grade, the ore is remarkably consistent across the entire deposit and vertically through the formation. These assays, in conjunction with our market studies and Bechtel's report, indicate that in order to produce a marketable product, beneficiation of the iron ore will be necessary. Modern day steel manufacturers are demanding concentrates of at least 62% - 65%. In laboratory beneficiation tests carried out to date we have been able to obtain this grade. Whether these results can be reproduced economically in a full scale plant has yet to be determined.

In summary then, we now know that the Snake River Iron Ore Deposit is trmendously large and that some day it must ultimately be utilized. Whether its development is near or in the future is primarily dependent on three factors: beneficiation, transportation and marketing. As noted above, an economic method of beneficiation will have to be determined. The distance by air to the closest seaport - Skagway - is 420 miles and by a possible railway route close to 600 miles. Transportation costs will be extremely high and detailed engineering studies and investigation of transportation methods will have to be carried out. The markets for the ore will be in the Pacific area, on the west coast of Canada and the United Stated, but primarily in Japan. Today there is no shortage of iron ore in this area, particularly with the development of Australian iron ore resources. Yukon iron ore would have to be priced to meet considerable competition in the iron ore market.

Each of these factors will have to be evaluated in detail and solved before the huge investment for development can be justified. As mentioned previously, Crest has begun studies and has retained competent consulting firms to investigate each of these problems.

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Some idea of the magnitude of investments required can be seen by a comparison of other large iron ore developments that have taken place in Canada over the past few years, as shown in the following table. These projects developed iron ore deposits which were much smaller, and certainly more accessible.

Company	Reserves (Mill.Tons)	Grade Mined	Length of Railway Built	Investment in Mills.$	Annual Prod.Rate (Mills.Tons)
Iron Ore Co. of Can. Quebec	400 initially	53%	357 mi.to port	250	10 to 12 ore
Iron Ore Co. of Can. Labrador	1,500	37%	Half of 38 mi.*	210	5.5 pellets 1.5 concentrate
Wabush Mines Ltd. Labrador	1,000	37%	Half of 38 mi.*	235	6 concentrate
Quebec Cartier Quebec	400 initially	32%	193 mi.to port	250	8 concentrate

* This is a branch line of the main line over which ore is transported another 225 miles to port.

OUTLINE OF WORK CARRIED OUT BY CREST EXPLORATION
ON THE YUKON IRON AND MICA CLAIMS -JULY, 1962 - APRIL 30, 1963

In the spring and early summer of 1962, 493 iron and mica claims were acquired by Crest Exploration in the Yukon, on the Snake River Iron deposit. Our work, subsequent to the recording of the claims, has indicated that 69 claims might be abandoned. Our application for Certificates of Work, therefore, concerns the remaining 424 claims which are covered by 42 groups.

For the purpose of this report, and for accounting of work costs, April 30th, 1963, has been considered the close of our 1962 work year. With the exception of the airstrip construction which began in March, all of our other 1963 field activities began in May or early June. The costs referred to in the subsequent outline, therefore, cover the period July, 1962, to April, 1963 inclusive.

Air Support and Camp



Hiller 12E helicopter in flight

Due to the remoteness of the Snake River area all personnel, equipment and supplies were flown into the area. During the winter of 1961-62 fuel was cached in the area by California Standard Beaver aircraft. In the spring and summer of 1962 equipment and supplies were trucked to Mayo or flown to Norman Wells Calstan DC-3 and Boeing aircraft. From these points, Beaver aircraft flew to a small lake approximately 30 miles from the deposit. Helicopters completed the final leg of the haul to the Sanke River base camp. During the summer 2 helicopters, under contract from Okanagan Helicopters Ltd., were used in the operations. Without the use of helicopters the delineation of the ore zone would have taken many years.

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The total cost of the fixed wing aircraft, charged to work on the Yukon claims, amounted to $33,920 - close to 350 hours were flown. Helicopter charges amounted to $50,655, for a total flight time of close to 400 hours. These costs have been charged to the individual work projects and included in the project work costs as noted in the following sections.

A base camp was set up on a small tributory of the Snake River which has been given the name of Iron Creek. The camp was located approximately 10 miles southeast of the junction of Iron Creek with Snake River, and is ideally located in one of the few stands of reasonably good sized timber in the area. The camp was large enough to comfortably house and feed 25 to 30 men. Camp costs chargeable to work carried out in the Yukon claims amounted to $17,609. These costs have been allocated to the various work projects.



Snake River Base Camp on Iron Creek

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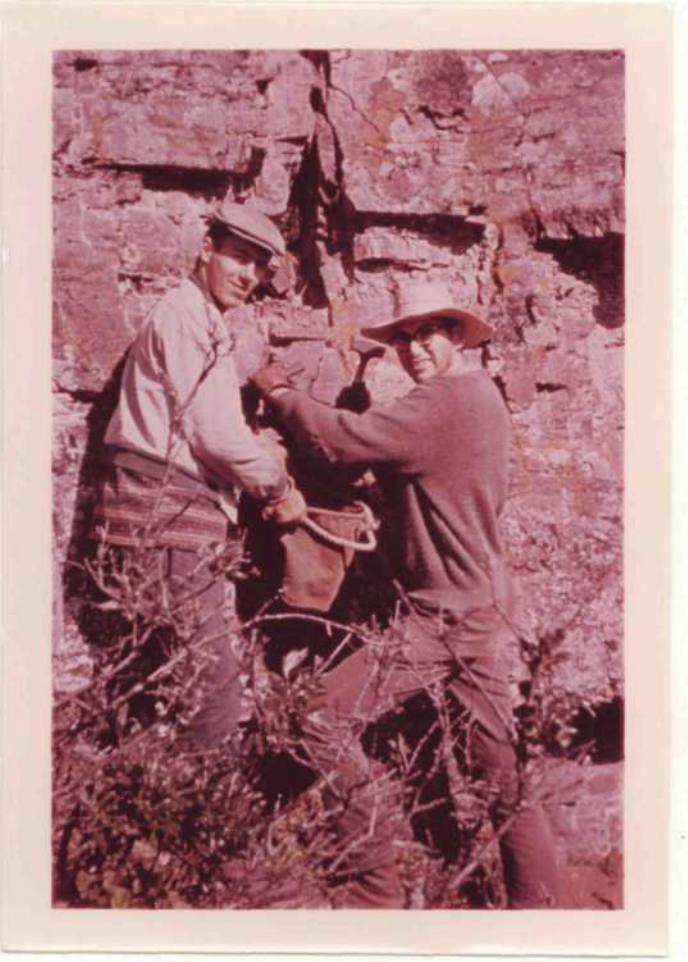
Channel Sampling and Section Preparation Costs



Channel across face of Iron Ore Outcrop



Samplers cutting channel

In order to obtain a representative suite of iron ore samples for subsequent assaying and beneficiation tests, a total of 2291 feet of channel samples were taken from 16 locations in the Yukon. The sampling involved locating a suitable section of iron formation outcrop, marking and describing it, and cutting a channel approximately 4 to 6 inches wide and 1 inch deep down the face of the outcrop. As the iron formation is extremely hard and resistant to breaking, and as the channels were cut by hand, considerable time was taken with the sampling program. Great care was taken that the channel was cut a right angles to the bedding and that the samples caught were truly representative of the iron formation at a particular point. In addition to the sections channel sampled, an additional 21 sections totalling 6600 feet were located, marked and examined for possible future channelling. Locations of all sections are shown on the maps attached to the applications for Certificate of Work forms.

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The total cost of our channel sampling and section preparation in the Yukon amounted to $65,141. The main items were:

Salaries and Wages	$ 15,378
Fixed Wing Aircraft expenses	14,316
Helicopter expenses	22,944
Camp expenses	10,156
Sampling supplies	2,146

Assaying

Of the 2291 feet of channel sample collected, 2185 feet were assayed. The bulk of the assaying was done by Coast Eldridge Engineers and Chemists of Vancouver, British Columbia. Each sample was assayed for iron, silica and phosphorous. A number were also assayed for sulphur, but as the sulphur content was low, this was discontinued. On two channelled sections spectrographic analyses were run on the samples. The following chart shows the average analyses for iron, silica and phosphorous for each channel section, the average over the block of claims, and the average in the Iron Creek area. One notable result is the remarkable uniformity of grade across the area.

The total cost of assaying iron samples from the Yukon amounted to $11,662. A complete set of the assay determinations accompany this report.

COMPILATION OF ASSAY RESULTS
SNAKE RIVER AREA

Channel Section		Claim	Weighted Average Assays Fe%	P.%	SiO_2%
Yukon	IF 6	Lure - 12	48.67	0.33	24.32
	IF 7	Lure - 12	46.96	0.37	24.90
	IF 9	Quest - 12	47.29	0.34	24.66
	IF 13	Ole - 16	46.97	0.50	24.46
	IF 14	Dido - 10	46.18	0.36	25.29
	IF 16	Joy - 17	46.33	0.33	25.89
	IF 19	Lure - 14	46.32	0.33	23.68
	IF 21	Joke - 13	42.36	0.39	26.90
	IF 29	Ivy - 22	45.05	0.30	23.75
	IF 32	Honor - 21	47.63	0.28	25.33
	IF 33	Beebee - 10	45.94	0.33	24.92
	IF 37	Neil - 13	46.28	0.37	25.86
	IF 38	Quest - 17	46.10	0.41	25.93
	IF 39	Rose - 17	48.07	0.38	25.59
	IF 43	Dorine - 17	45.24	0.29	23.90
	IF 44	Joy - 18	45.92	0.41	24.59
Weighted Average of all sections			46.48	0.35	24.85
Weighted Average of Secs. in Iron Creek			47.03	0.37	24.74

Note: The above averages indicate the grade of the ore material. In mining there would be contamination by included sandstone and conglomerate which would lower the iron assay of the mill feed.

Diamond Drilling

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Mr. G. L. Knox, President of Crest Exploration Limited, Dr. C. D. A. Dahlstrom, Manager of Operations, and Dr. R. A. Stuart, geologist, examining diamond drill core August, 1962.

A diamond drilling program was commenced during the first week in August, 1962. The program was, in large part, experimental to determine the type of equipment and required drilling techniques best suited to the area. The ore material is made up of hematite and jasper. The hematite is the type known as black diamond in the jewellery trade, while the jasper is a form of quartz. Both are extremely hard and there was considerable concern as to what drilling method should be used. In other iron areas diamond drills, percussion drills, rotary and churn drills have been used. Because of the advantage of obtaining a diamond core, rather than drilling chips, it was decided that diamond drills would be attempted initially, to determine whether the method would work at all, and if so, the type of drills, bits, etc. and drilling techniques required. It was realized that a number of drills would ultimately be required to carry out an adequate program in the area, but in order to evaluate the diamond drilling method only one drill was moved in. In 1963, and as a result of our 1962 experience, we are putting three diamond drills into the area. We feel that with the knowledge gained in 1962 an efficient diamond drill program can be carried out.

In 1962 it was planned that possibly three holes would be drilled prior to the end of the season. The diamond drilling was done by Mannix Company of Calgary, using a Longyear Junior Streamline drill with a 23 H.P. air cooled gas engine and size "A" rods and core bits. Unfortunately this drilling equipment was much

too light and numerous breakdowns occurred. There were many other problems and delays which would normally occur in breaking into a new area but which were multiplied by the fact that the drilling crews had little or no experience in drilling this type of material. As a result, over the period of a month, to September 7th, only one diamond drill hole was completed. Because of the numerous breakdowns, many of which required the bringing in of replacement parts, considerable aircraft and helicopter time was spent on the diamond drilling operation. In addition, all of the expense of flying in the equipment and personnel which normally would have been distributed over a number of holes, was, by necessity, charged to the one hole.

The diamond drill hole was located on claim Tang 18. It was drilled and cored to a depth of 350 feet and, except for a few feet of surface gravel, was completely in iron formation. The full section of iron formation was penetrated and excellent core recovery was obtained. A strip log of the hole accompanies this report.

The total cost of our diamond drilling operation amounted to $42,758. Major items of cost were:

Diamond drilling contract	$ 15,042
Aircraft	11,102
Helicopter	12,519
Camp	4,040

Topographic Base Map Construction

Since there were no published detailed topographic maps covering the Snake River area, on a reasonably large scale, the construction of an accurate base was necessary. From aerial photographs and with some ground control the firm of Geophoto Services of Calgary constructed the base. The map is on a scale of one-half inch equals one mile, and the topographic contour interval is 100 feet. Copies of this map are presented with this report.

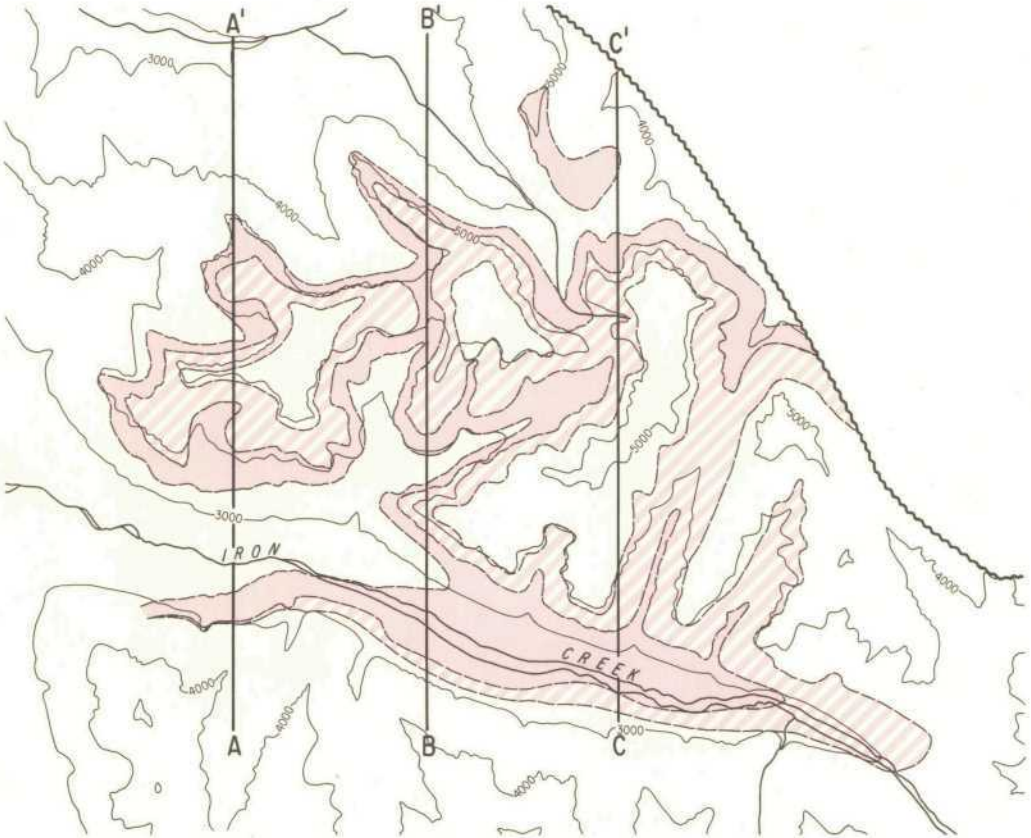
In the Yukon Territories the mapped area covers 644 square miles. The total cost of construction was $7,995. On the basis of the area mapped, the cost of the Yukon section was $5,995.

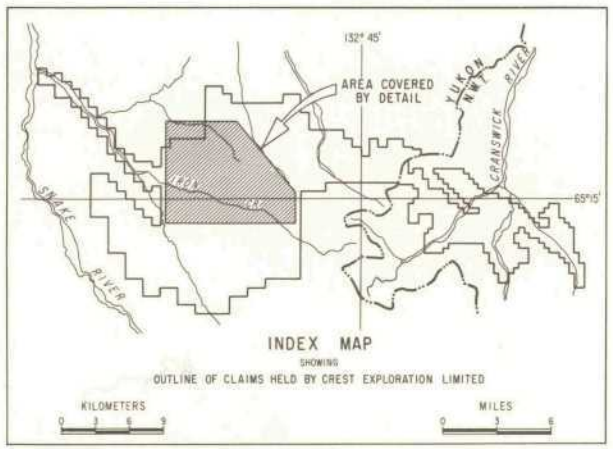
Geology and Ore Zone Delineation

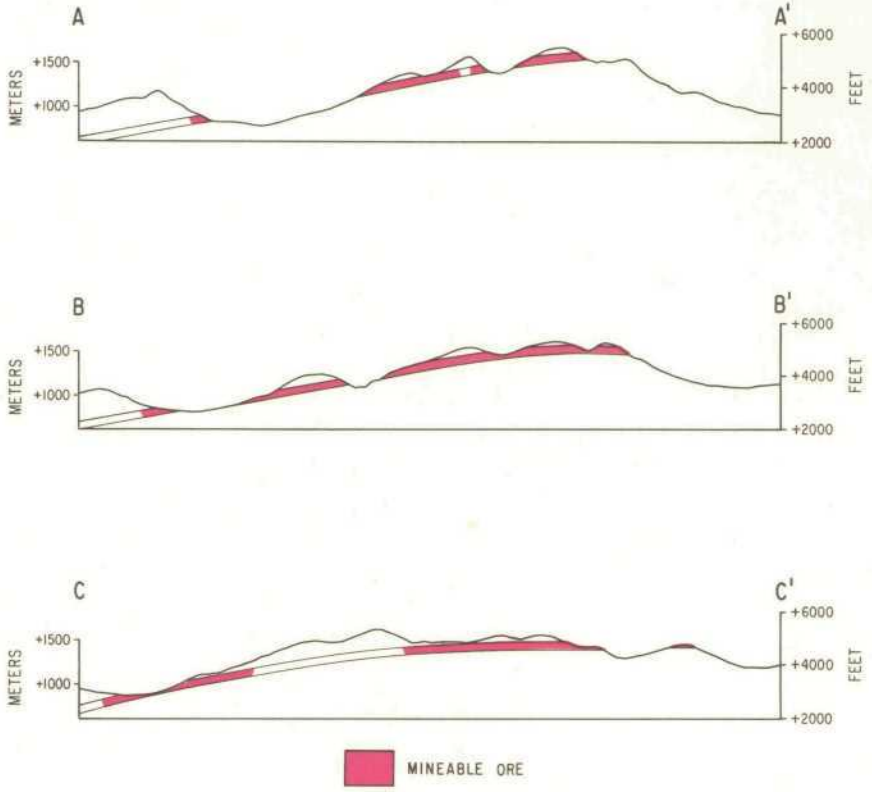
During the summer of 1962 systematic geological mapping of the Snake River area within the claim boundaries was carried out. A few problems related to the detailed geology still remain which will be investigated in 1963. During the winter months the geological data gathered in the field and that taken from a study of the aerial photographs was assembled and a complete and accurate geological map prepared. In addition, mineralogical studies of the iron ore were conducted.

A consulting geologist, Dr. W. G. Wahl, was retained by Crest in August, 1962. He was asked not only to give his appraisal of the ore body but to recommend a future program of exploration. Dr. Wahl's report was completed in September, 1962.

OPEN PIT ORE - IRON CREEK BLOCK







PROFILES

LEGEND

EXPOSED.

STRIPPABLE AT LESS THAN 1:1

6 BILLION TONS AVAILABLE AT STRIPPING RATIO OF 0.2:1

SCALE IN MILES

0 ½ 1 1½ 2

SCALE IN KILOMETERS

0 ½ 1 1½ 2

A complete geological report by Crest Exploration and a copy of Dr. Wahl's report accompany this review of operations.



Iron Ore outcrop along north side of Iron Creek Valley

It should be pointed out that as the iron formation is a primary sedimentary deposit its characteristics and grade are relatively consistent across the area. The formation is very well exposed and readily mappable. A great deal of the information on the ore zone, normally obtained by trenching, drilling, tunnelling, etc. on a buried or poorly exposed deposit can , in the Snake River area, be acquired by careful geological mapping and study in conjunction with our extensive sampling program. The geological work carried out, therefore, has a more direct application in overall reserve and grade calculations than in most mining properties.

The costs of our geological investigation of the Yukon claims amounted to $26,442. Of this, geological mapping accounted for $18,761, office studies $3,810 and consulting $3,871.

In addition to the geological costs directly chargeable to the Yukon claims, an additional $48,000 was spent in prospecting for the iron ore in a wide area outside the claim boundaries. These prospecting costs have, or course, not been applied for as representation work.

Geophysical Operations

During August a program of ground gravimeter and magnetometer surveys, as well as an airborne magnetometer survey, was carried out. This program was undertaken to determine whether the iron bearing formation could be located and

mapped by geophysical methods. The ground surveys were carried out by Sulmac Exploration Services Ltd., under the direction of Crest and California Standard personnel. The airborne magnetometer was flown by Spartan Air Services Ltd.

On the ground a number of gravity and magnetometer lines were run at particular locations where the presence of the iron formation and its contacts were known. A few lines were run in valley bottoms where, although the presence of the iron formation contact was suspected, it was in fact covered by recent stream deposits. Detailed reports on both aspects of the geophysical survey accompany this report. To summarize, however, none of the methods were successful in locating the iron ore, although the magnetometer was able to indicate the massive conglomerate formation within which the iron formation is associated.

Gravity and magnetic readings were taken at some 207 stations on eight lines, extending over a total distance of six miles. Two airborne magnetometer lines were flown roughly northeast - southwest across the central part of the Yukon claim block, and beyond the outer boundary for some distance to gain background control. The total distance flown was 119 miles. The ground and air geophysical lines are shown on maps attached to applications for Certificates of Work.

The cost of the geophysical program in the Yukon was $9,965, of this the ground survey cost $7,165 and the air survey $2,800.

The Bechtel Feasibility Study

In September, 1962, Crest Exploration requested Canadian Bechtel Limited to undertake a feasibility study on the Snake River Deposit. The purpose of the study was to prepare engineering estimates, capital investment and operating costs for the development and operation of mining facilities, beneficiation and pelletizing, and ocean shipping to Pacific markets. Costs were to be calculated at three delivery rates of 5 million, 10 million and 20 million tons of concentrate per year. Bechtel's final report was completed in January, 1963.

The importance of the Bechtel study, as it affected the decision to continue exploratory work at a high rate, cannot be too strongly stressed. At the time of initiating the study, because of the remoteness of the deposit, Crest Exploration was well aware that the investment costs to develop the property might be so high as to make the project economically unfeasible. The Bechtel study has shown that, although the investment and operating cost will be high, development of the deposit is not a financial impossibility. Admittedly, further cost savings will probably have to be made, particularly in the field of transportation, and a method of beneficiation to economically produce a high grade concentrate must be determined. But Crest Exploration is convinced that, with careful engineering and economic planning, both of these problems will be solved and that with favourable market conditions the Snake River deposit will eventually be developed.

The Bechtel report has shown those aspects of the Snake River development which are most critical and required immediate investigation. An example of one form of engineering study now being carried out is the transportation of iron ore, in a slurry form, by pipeline. If this method proves to be practical, considerable savings in transportation costs could be made. The Bechtel study also pointed

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to the fact that large scale beneficiation tests should be carried out. Beneficiation tests are being carried out and a large volume of iron ore will be gathered this summer for more intensive beneficiation tests during 1963. On the other hand, the Bechtel study showed us areas of development that did not require a great deal of study at this time - for example mining. The open pit methods they recommended are straightforward and efficient and, while the more critical aspects of development are being investigated, the details of mining could be deferred for some time.

The total cost of the Bechtel feasibility study amounted to $218,000. Of this amount, $175,000 has been allocated to those claims in the Yukon. Practically all of the study was primarily concerned with the Yukon - railway routes across the Yukon and mine development in the Iron Creek area. The cost allocation was, therefore, made on the basis of the proportion of acreage held under claims in the Yukon and Northwest Territories.

The total acreage held in both the Yukon and Northwest Territories is 96,940 acres with 77,880 acres or 80% of the acreage being in the Yukon.

A copy of Canadian Bechtel's feasibility report was presented to the Minister of Northern Affairs by the President of Crest Exploration Limited on May 28th, 1963.

Beneficiation Testing

The grade of the iron ore as assayed averages 46.5% iron, 24.8% silica and 0.35% phosphorous. At the present time steel producers in North American and Japan are demanding a concentrate feed of 62% to 65% iron and a low percentage of silica and phosphorous. In order to determine the most efficient and economical process to provide a high grade concentrate, a program of beneficiation testing was commenced in 1962 and will continue on an increasing scale in 1963. Part of our 1963 field program is solely devoted ot obtaining sufficient iron ore material that large scale beneficiation testing can be carried out.

Iron ore beneficiation tests were conducted by three recognized testing laboratories. The Ontario Research Foundation in Toronto investigated gravity concentration methods, roasting and magnetic separation. The Humphreys Engineering Company of Denver, Colorado, conducted tests using the Humphreys Spiral concentrator. The Mineral Processing Division of the Department of Mines and Technical Surveys investigated gravity separation, floatation, roasting and high intensity magnetic separation.

Reports from each of these organizations accompany this report. To summarize, however, many of the tests to date have produced concentrates approaching the required specifications, however, in many cases the methods were not too efficient in that the total iron recoveries were low. We have been encouraged recently, however, by a combination of jigging, roasting and magnetic separation carried out by the Mineral Processing Division. On these tests a 65% iron concentrate was produced with a total iron recovery of 50% - 60%. In many of the tests the phosphorous content in the concentrates has been reduced to some degree. The silica content can readily be reduced to well within acceptable standards.

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Beneficiation tests on an increased scale, and with greater amounts of iron ore material, will continue during the next year. The results to date are encouraging in that they indicate that a high grade product can be produced, at least by laboratory methods. Whether these same results can be produced economically in a full scale operation remain to be determined.

The costs of the beneficiation studies carried out during the past season amounted to $20,295. As practically all of the iron ore material used was from the Yukon, particularly from the Iron Creek area, $16,295 has been allocated to the Yukon claims. This amount was calculated on the basis of the proportion of acreage held under claim in the Yukon and Northwest Territories.

Airstrip Construction



Northwest, along gravel airstrip, May 2nd, 1963.
At this stage the strip is only 90 feet wide.

In order to move the large volume of supplies, fuel, equipment and personnel into the Snake River area quickly and efficiently an airstrip was required capable of handling multi-engine aircraft.

Other alternatives for the moving in of supplies etc. were studied but were rejected. The methods used in 1962 - trucking freight to Mayo and ferrying from there to Snake River by Beaver aircraft and helicopters - was not

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practical for the large amount of supplies and fuel required in 1963. The possibility of renovating the Wind River trail for trucking or the use of a large winter tractor train were also studied. In the final analysis, however, for use over a period of years, the construction of the permanent airstrip was determined to be the most efficient and economical way of moving in large volumes of supplies, equipment and personnel.

The contract for building the airstrip was awarded to Proctor Construction of Whitehorse. On March 8th, 1963, a tractor train of construction equipment left Mayo for the 260 mile trip to Snake River. The train consisted of two bulldozers, a power scraper, a grid roller, a truck and trailers of fuel, supplies and sleeping quarters. The route taken was north along the Wind River Trail to the junction of a D.E.W. line trail near Hungry Creek, then east along this trail to the valley of the Snake River. South along the Snake River an 18 mile bulldozed trail was made to the junction of the Snake and Iron Creek. The airstrip is located along a bench on the north side of Iron Creek where it joins the Snake River. Its coordinates are 65° 21' N. and 133° 22' W. Initially a winter strip of graded and packed snow was completed in order that additional supplies needed for the construction of the permanent strip could be flown in. On April 12th construction of the permanent gravel strip was commenced and by the latter part of April aircraft as large as a Curtis C-46 were able to utilize it.

As of May 15th, 1963, the construction of the strip has progressed to a length of 3,500 feet, width of 130 feet and with a gravel surface averaging 2½ feet thick. A radio homing beacon has been erected to assist the approach of aircraft during conditions of low ceiling. The beacon has a range of approximately 50 miles.



Pacific Western Airlines C-46 aircraft unloading fuel at Snake River winter strip, April, 1963.

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Using California Standard's DC-3 and Boeing aircraft and a chartered Curtis C-46 from Pacific Western Airlines, over 100 tons of freight and 85,000 gallons of fuel have been flown in for use in the 1963 field program.

In the construction of the airstrip 40,000 cubic yards of gravel were excavated from three pits averaging a one-half mile haul to the airstrip.

CREST EXPLORATION LIMITED,

R. J. FLOWER
Assistant to
General Manager Operations

RJF/mp

GEOLOGY OF THE SNAKE RIVER IRON DEPOSIT

CREST EXPLORATION LIMITED

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Member, Alberta Association of Professional Engineers

JULY, 1963

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Figure 1 - Sample channel in iron formation
Figure 2 - Sample channel in iron formation

I. INTRODUCTION

During the autumn of 1961 members of a geological exploration crew employed by The California Standard Company discovered outcroppings of hematite-rich iron formation in the vicinity of Snake River, Yukon Territory. Preliminary exploration and sampling led to a decision to stake the deposit and during the period June 1st - July 8th, 1962, a total of 833 claims were staked in the Yukon Territory and Northwest Territories. These claims were acquired by Crest Exploration Limited and are presently being explored and evaluated by that organization.

The following report is based on field work completed during the summer of 1962.

A. Location and Topography

The iron formation that constitutes the Snake River iron deposit crops out in the northern Mackenzie Mountains in an area bounded by Latitudes 65° 10' N. and 65° 20' N. and Longitudes 132° 15' W. and 133° 20' W. (Figure 1). This area, which straddles the Yukon Territory - Northwest Territories boundary near the headwaters of the west branch of the Cranswick River, exhibits maximum topographic elevations of nearly 7000 feet though local relief rarely exceeds 3000 feet. The elevation of timber line is approximately 2600 feet and consequently most of the area is treeless, however evergreens with base diameters of up to 24" occur in stream valleys below timber line.

The area is drained by the Snake and Cranswick Rivers, both of which flow in relatively broad, alluvium-floored valleys (Figure 1, Photo Plate 1), and has been dissected by the many tributaries to these rivers. The major tributaries flow in steep-walled valleys up to one or two miles wide that are floored with alluvium (Iron Creek, South Iron Creek, Discovery Creek) but the minor tributaries occupy narrow valleys cut into bedrock over much of their length (Gypsum Creek, Bluff Creek, etc.).

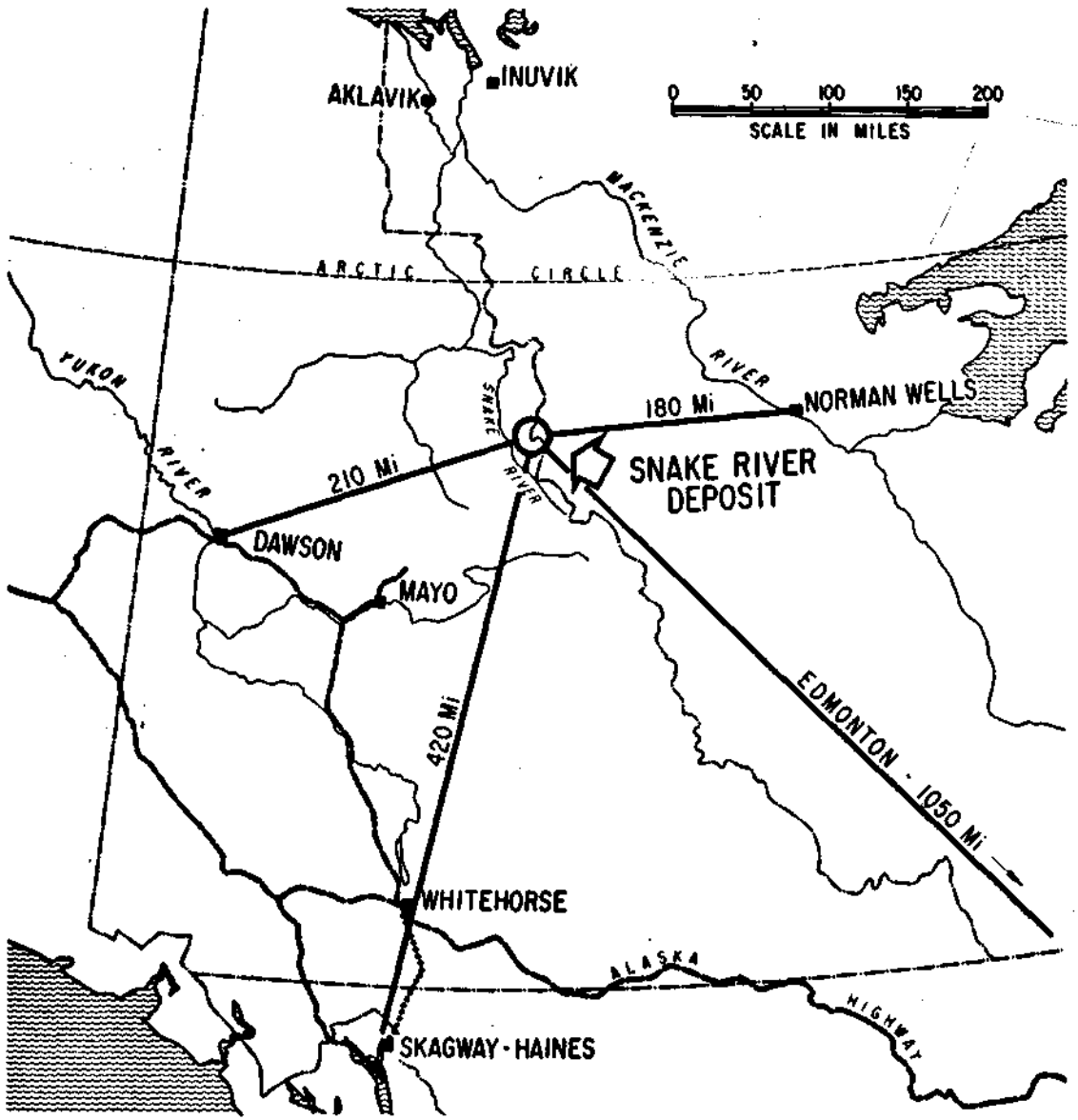
B. Climate

Although no weather records are available in the near vicinity of the Snake River area, the climatic conditions are expected to be similar to those recorded at Elsa, Yukon Territory. At Elsa records kept over the last seven years show mean maximum temperatures and daily mean temperatures of 67° F. and 57° F. for July and mean minimum and daily mean temperatures of -16° F. and -10° F. for January. Annual rainfall is approximately 15 inches.

C. Access

During 1962 access to the iron deposit was neither easy nor inexpensive as the nearest all-weather road terminates at the mining community of Elsa, 120 air miles southwest of the deposit. Whitehorse, an additional 300 air miles to the south, is the northern terminus of the nearest railroad, and Skagway, still 100 air miles farther south is the nearest seaport. Other settlements in the

LOCATION MAP - SNAKE RIVER IRON DEPOSIT



vicinity of the deposit include Mayo Landing, 150 miles southwest, Dawson City, 210 miles west - southwest, Norman Wells, 180 miles east, and Inuvik, 210 miles north. During the summer of 1962 personnel and material required for the evaluation of the Snake River iron deposit were transported to Mayo Landing by wheeled aircraft or by truck, transferred to float-equipped Beaver aircraft and flown to Snake Lake or Fairchild Lake (30 miles northwest and 35 miles southwest of the iron deposit, respectively), and finally transferred to a helicopter for delivery at the campsite.

LOCATION MAP

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II. GENERAL GEOLOGY

A. General Information

The Snake River area was virtually unknown geologically until the mid-1950's when petroleum exploration companies became active in the Mackenzie Mountains. In 1961 the area was examined by geologists of The California Standard Company in the course of the completion of an extensive program of regional structural and stratigraphic geological mapping. As a result of this examination the Snake River iron formation was discovered and its general thickness and distribution determined. In 1962, following the completion of the staking of the iron formation, a more detailed geological examination was initiated with the following objectives in view:

1. To locate and map the boundaries of the iron formation.
2. To study the stratigraphy of the iron formation.
3. To map the structure of the beds in which the iron formation is contained.
4. To guide the efforts of the crews employed to sample the iron formation.
5. To collect any additional data required for an initial evaluation of the grade, quantity, and mineability of the iron formation.

The geological data were collected in three different ways:

1. By aerial geological mapping, in which one geologist in a helicopter locates and traces geological features from the air and plots them directly on air photographs. During the course of this work the geologist:

   (a) makes aerial observations of formation contacts, faults, folds, bedding, attitudes, etc.

   (b) defines areas in which ground traverses will be required to clarify the geological picture.

   (c) locates the best areas for detailed stratigraphic work.

   He may also collect detailed structural data by landing at critical locations and making direct geological observations.

2. By ground traversing, in which a geologist, usually accompanied by an assistant, makes direct observations along a previously selected traverse route. These traverses are supplementary to the aerial geological mapping and are usually selected:

(a) to provide detailed structural information.

(b) to provide data in areas where the outcrop conditions do not permit reliable aerial mapping.

(c) to resolve structural or stratigraphic problems that cannot be resolved by aerial mapping.

The helicopter is used to transport the crew to and from the traverse and to scout out the route of the traverse. During the 1962 season traverse data were collected at the localities plotted on Plate I.

3. By detailed stratigraphic description, in which one geologist and an assistant carefully measure the stratigraphic thickness and describe the lithologic variations of selected sections or portions of sections. As in the ground traversing, the helicopter is used to transport the crew.

The sections measured during the summer of 1962 were selected during the aerial mapping and subsequent traversing and were so located as to establish the lateral and vertical variability of the iron formation and the underlying and overlying rocks. (See Plate IV).

The geological studies described above were conducted by a crew of four geologists and two geological assistants supported by the full or part-time services of twelve camp and aircraft personnel. The geological personnel included the following:

R. A. Stuart	-	geologist
R. M. Williams	-	geologist
W. H. Nixon	-	geologist
W. Hamilton	-	geologist
J. Brandt	-	geological assistant
D. Steele	-	geological assistant

Support aircraft utilized during the operation include the following:

CF-OKG:	Hiller 12E helicopter, part-time service
CF-OKJ:	Bell J. helicopter, part-time service
CF-GQG:	Beaver floatplane, based at Mayo and available on request
CF-IAZ:	Douglas DC-3 twin-engine land plane, by-monthly supply trips and personnel transport
CF-JRQ:	Boeing 247 twin-engine land plane, available on request for supply or personnel transportation

Following the suspension of field operations in September, 1962, the accumulated geological data were used in the preparation of the various maps and structural and stratigraphic cross-sections accompanying this report and in the analysis of the results of the sampling program conducted concurrently

with the geological investigations. In addition, a petrographic study of the iron formation was initiated. The following professional personnel contributed to this work:

K. A. Harris	-	geologist
A. E. Kliske	-	geologist
R. A. Stuart	-	geologist
R. M. Williams	-	geologist

B. Stratigraphy

Rocks exposed in the Snake River area range in age from probable Early Cambrian to Middle Devonian. Stratigraphic sections were not measured in detail except through the iron formation and the thicknesses quoted in the following Table of Formations are approximate only

Period	Lithology	Approximate Thickness	Map Unit
Middle Devonian	Carbonates	2000'+	#7 to #10
Silurian & Upper Ordovician	Dolomite	1000'	#6
Middle & Lower Ordovician	Carbonates & shaly carbonates	500'	#5
Upper Cambrian	Carbonates	1000'	#4
	Angular Unconformity		
Cambrian (?)	Shale & Siltstone	1000'+	#3
	Green & red conglomerate with iron formation	5000'+	#2
	Angular Unconformity		
Cambrian (?)	Recessive buff-weathering carbonate with occasional zones of shale and resistant carbonate	2500'+	
	Gypsum and shale	500'	
	Buff-weathering shaly carbonate and carbonate	500'	#1
	Grey resistant limestone	1000'	
	Black shale	500'	
	Quartzite, conglomerate, carbonate and shale	3000'+	

TABLE I

Table of Geological Formations

The oldest rocks exposed within the map area comprise a thick sequence of variably resistant quartzite, conglomerate, carbonate and minor black shale. No fossils have been collected from these rocks within the map area, but rocks thought to be correlative have yielded Lower Cambrian fossils at a locality some 20 miles southeast of the area. This sequence is overlain by a relatively thin black shale unit followed by a very massive light grey cliff-forming limestone and a thick sequence of recessive buff-weathering carbonates and shaly carbonates with a distinctive gypsum shale member near the base and several resistant carbonate members in the upper portion. These rocks are grouped together as map-unit #1 on the geological map, Plate II.

A marked angular unconformity overlies the strata of map-unit #1 (Figure 2, Photo Plate I), and as much as 3500 feet of stratigraphic truncation can be recognized within the map area. The unconformity is overlain by 5000 feet or more of silty conglomerate and conglomeratic shale and siltstone (map-unit #2), which pass upward into 1000 feet or more of grey silty shale (map-unit #3). The lower 2000 to 3000 feet of the conglomerate and siltstone are typically highly ferruginous, are dark maroon in colour, and contain iron formation at several horizons within the lower 1000 feet. The upper part of the sequence is dominantly grey-green in colour, though some highly ferruginous maroon beds are present. The coarse fragmental material in the conglomeratic rocks probably represents less than 10% of the volume of the rocks, and most of the beds should properly be called conglomeratic siltstone. The fragments are rounded to subangular, range in size from sand grains to boulders over 15 feet long, and consist of carbonate, basic igneous rock, sandstone, quartzite and shale, in order of decreasing abundance. (Figure 1, Photo Plate 2). Beds of true conglomerate, sandstone, siltstone and shale occur at numerous horizons throughout the conglomeratic sequence. Although no complete sections of the sequence have been measured as yet, a partial section has been described in some detail and included in this report as Appendix A. The shale that overlies the conglomeratic rocks occurs only in the southeast part of the map-area and has not been examined in detail.

The conglomeratic beds are overlain by a major angular unconformity that truncates at least 6000, and possibly as much as 10,000 feet of stratigraphic section within the limits of the map area (Figure 2, Photo Plate 2). The regional dip of the strata below the unconformity is to the south and successively older beds are present at the unconformity from south to north. A varying degree of angularity between strata above and below the unconformable surface establishes the fact that there was at least gentle folding prior to the erosional episode, but there does not appear to have been any wide-spread severe pre-unconformity deformation. However, a strong fault crossing the headwaters of Gypsum Creek may be pre-unconformity in age.

The unconformity is overlain by a conformable sequence of carbonate and shaly carbonate ranging in age from Late Cambrian to Middle Devonian. The Late Cambrian is represented by light-coloured grey and buff weathering limestone and dolomite containing

occasional fossils (map-unit #4). This is overlain by a dark grey-weathering recessive sequence of oncholitic argillaceous limestone and limestone in Early and Middle Ordovician age (map-unit #5), followed by massive, medium grey weathering fossiliferous dolomite of Upper Ordovician and Silurian age (map-unit #6). This dolomite is separated from overlying massive light grey limestone and dolomite (map-unit #8) by a zone of buff-weathering dolomite (map-unit #7). Neither the buff-weathering nor the massive grey carbonate contains diagnostic fossils and both may be either Silurian or Devonian in age. They are overlain by a thin orange-buff weathering dolomite (map-unit #9) followed by fossiliferous light to dark grey Middle Devonian limestone (map-unit #10). At the mountain front north of the map area the Middle Devonian limestone is overlain by Upper Devonian black shale, which dips northward beneath Cretaceous sandstones and shales underlying the Peel Plateau to the north and east.

C. Structure

Regionally the Snake River area is located on an east-west trending portion of the Mackenzie Mountain System. It is bounded on the north by a belt of Upper Cambrian to Upper Devonian strata deformed into east-west trending folds asymmetric to the north and locally cut by reverse faults dipping steeply south. This belt forms the front of the Mackenzie Mountains. Bounding the area to the south is a broad zone of Lower Paleozoic and possibly Precambrian strata that strike east-west, dips predominantly south, and are cut by a series of steep, south-dipping reverse faults. Within the map-area however, both folds and faults trend northwest at an oblique angle to the regional trend, and the degree of deformation is somewhat less than it is to the north and the south. The reason for this discordant structural trend is not clear, although it is possible, in view of the relative mildness of the deformation, that it was inherited from an earlier structural trend that has been obliterated by the stronger deformation in the structural belts to the north and south.

The major structural features of the area are three major northwest-trending westerly-dipping reverse faults that divide the area into three blocks (Plates IIA and IIB). The westernmost or "Iron Creek" block is from ten to fifteen miles wide and extends west of the map-area to its boundary fault west of the Snake River. This block is folded along northwest-trending axes into several anticlines and synclines. The folds are broad and the strata generally dip at less than twenty degrees except where they are steepened by faulting, as at the eastern boundary of the block where the east limb of the easternmost anticline is vertical to overturned against the boundary fault. The folds appear to plunge gently away from a culmination trending southwest across the central part of the block. In addition to the folds there are some relatively minor faults in the Iron Creek block. One of these dislocates the iron formation on the west limb of an Devonian. [illegible] is represented by light-colli[illegible] grey and buff [illegible] stone and dolomite containing

anticline trending along South Iron Creek. This fault appears to be an east-dipping reverse fault. Another east-dipping reverse fault is located near the east boundary of the block between the west-dipping boundary fault and a subsidiary west-dipping fault lying to the west. The combination of the three faults produces a horst-graben pair of narrow blocks, as illustrated on the structural cross-section L-M and O-P, Plate IIB. A structure contour map of the portion of the Iron Creek block in which iron formation is most abundant is included as Plate III of this report. The structure contours are drawn on the top of the iron-rich zone and illustrate the gently folded character of the block. The peculiar pattern of contours at the head of Gypsum Creek outlines a structural terrace flanked to the southwest by a local anticlinal nose (see 5000- and 5500-foot contours). A similar pattern could be produced by a northwest-trending fault passing through the minor anticline outlined by the 5500-foot contour and uplifting the beds on the southwest. If such a fault does exist its displacement must decrease along strike to the southeast where the structure contours appear to be undisturbed. The eastern part of Iron Creek block is bounded to the south by an east-west trending high angle reverse fault lifting Cambrian rocks of map-unit #1 on the south against Middle Devonian carbonates of map-units #7 to #10 on the north. This fault appears to lose displacement westward, and cannot be traced west of Longitude 132° 55' W. where both hanging wall and footwall rocks are conglomerates of map-unit #2. A second east-west trending reverse fault forms the south boundary of the western part of the Iron Creek block. This fault lies south of the western extension of the more easterly boundary fault and may either continue to the east as a separate fault or swing slightly to the north and join with the more easterly fault.

The central or "Discovery Creek" fault block ranges in width from seven miles at the north to five miles at the south. It consists of a block of relatively underformed, predominantly west-dipping strata with gentle plunges to the northwest and southeast from a culmination at Latitude 65° 15' N. to 65° 20'N. Locally the strata are crumpled against the western boundary fault, and dragged into steep northeast dips against the eastern boundary fault, but otherwise they dip southwesterly at less than fifteen degrees. The boundary fault to the west, which raises the Iron creek block 2000 to 3000 feet relative to the Discovery Creek block, changes character from a simple fault in the northwest and southeast to a complex zone of faulting and tight folding in the centre. The tight folding is restricted to a very narrow zone adjacent to the fault, and occurs in the same area in which vertical to overturned beds may be oversved in the Iron Creek block on the hanging wall of the fault. An anticlinal drag fold is located at the eastern boundary fault of the block in the vicinity of Latitude 65° 15' N. This fold, the axis of which is slightly oblique to the trend of the fault, strikes into the fault to the south and passes into southwest-dipping monoclinal beds to the north. The eastern boundary fault is a single well-defined break that dips steeply to the southwest

and displaces the hanging wall at least 2500 feet upward with respect to the footwall.

The eastern or "Cranswick River" fault block resembles the central block both in dimensions and in structure. It is five to seven miles in width, wider in the north than the south, and constitutes a southwest-dipping monocline locally deformed adjacent to the boundary faults. Hematitic conglomerates containing iron formation occur only in the southwestern part of the block and consequently the northern and eastern parts have not been completely mapped and the eastern boundary fault has not been traced along its full length. Within the area the eastern fault exhibits a minimum displacement of approximately 1000 feet, but beyond the area to the southeast the same fault has been observed to displace the hanging wall beds on the west upward at least 2500 feet relative to the footwall beds on the east. The magnitude of this fault is, therefore, similar to that of the other major faults in the area. The sedimentary strata constituting the Cranswick River fault block tend to dip slightly more steeply than those in the two blocks to the west and dips between twenty and thirty degrees are common in the southwestern part of the block.

The southwestern termination of the Discovery Creek and Cranswich River fault blocks lies to the east of the map-area and is marked by a belt of east-west trending folding and reverse faulting that is on strike with the faults marking the south limit of the Iron Creek block. It is of interest to note that the southeasterly continuation of all three of the major boundary faults within the map-area show a tendency to merge tangentially with this zone of faulting and deformation. It is, therefore, possible that both structural trends are of the same age, and that the northwesterly-trending folds and faults have split away from the dominant east-west trend. A reasonable explanation of this divergence is that the deforming forces were deflected by trends established during an earlier period of deformation. Such an earlier deformation can be demonstrated to have taken place in the Richardson Mountains, and the oblique trends in the Snake River area are on strike with the structural trend resulting from that deformation.

III. IRON FORMATION

A. Description

A jasper-hematite type of iron formation constitutes a significant proportion of the lower 1000 feet of the hematitic conglomerate of Cambrian age identified as map-unit #2 on the accompanying geological map. The greater part of the iron formation occurs in a restricted zone between 500 and 1000 feet above the unconformity marking the base of the conglomerate, although iron formation bands of variable thickness have been observed in the lower 500 feet of conglomerate in several parts of the area. The iron-rich zone has been traced laterally for over thirty miles along an outcrop belt up to ten miles in width (see the geological map, Plate II). The zone attains its maximum thickness of 500 feet in the area immediately north of Iron Creek, and a general thinning toward both the east and the west suggests that it may be lenticular. However, the erosional removal of the iron formation to the north and its disappearance beneath younger strat to the south has prevented the determination of the absolute shape and dimensions of the iron-rich zone.

During the summer of 1962 a number of good exposures of the iron formation and associated sedimentary rocks were carefully measured and described (Figure 2, Photo Plate 3). The locations of the measured sections are shown on Plate IV, and a typical field description is included in Appendix B of this report. This work showed that the iron-rich zone consists of varying proportions of three basic constituents: hematite, chert, and clastic sedimentary rocks. The hematite and chert were almost invariably closely associated with one another, and the clastic sedimentary rocks form intercalated bands and lenses of variable dimensions. The following types of iron formation can be distinguished on the basis of the hematite - jasper inter-relationship:

(a) Nodular iron formation

This consists of 60% to 90% of dense very fine grained, steel-grey to maroon-tinted hematite containing small rounded or ovoid nodules of orange-red jasper. The jasper nodules are typically 1/8 to 1/4 inch in maximum dimension and may be scattered throughout the hematite or concentrated into bands (Figure 1, Photo Plate 4). Frequently the nodules exhibit corroded margins and a hematite-rich core, suggesting that there has been some replacement of jasper by hematite. The hematite is essentially structureless when it is steel-grey but frequently shows a faint lamination and streaky augen-like texture when maroon-tinted. The maroon tint is an indication of the presence of disseminated finely divided silica in the hematite, and becomes more pronounced as the amount of disseminated silica increases. The nodular iron formation frequently contains thin tabular plates of orange jasper aligned parallel with the bedding (Figure 2, Photo Plate 4). Some exposures have been seen that suggest that

these plates originate through the fragmentation of a continuous band of jasper (Figure 1, Photo Plate 5).

(b) Banded Iron Formation

This consists of interbanded hematite and jasper. The bands may range from a fraction of an inch to several feet in thickness, they may be structureless or laminated, and they may be interbedded in any relative proportion (Figure 2, Photo Plate 5, Figure 1, Photo Plate 6). The jasper bands exhibit a range in colour from bright orange to dark maroon that apparently reflects an increasing amount of disseminated hematite. The hematite bands range in colour from steel grey to dark metallic maroon, depending on the amount of disseminated silica that they contain. It is common to find that the jasper bands tend to be relatively thick where the hematite bands are thick and to be thin where the hematite bands are thin, and that definite zones of thick or thin bands occur in the section. However, no attempt has yet been made to determine whether these zones can be correlated from section to section. It is also common to find that the jasper bands have been broken and tilted, especially where they constitute a minor proportion of the iron formation. In such cases planar features in the hematite characteristically show flowage structures around the broken ends of the jasper bands (Figure 2, Photo Plate 6).

(c) Irregular Iron Formation

This type of iron formation is characterized by irregular masses and intergrowths of hematite and jasper. Either constituent may form the continuous phase, and complex flow-like structures are frequently observed (Figure 1, Photo Plate 7). The hematite tends to contain a high proportion of disseminated silica and the chert tends to contain a high proportion of hematite, giving both a dark maroon cast. In some sections this type of iron formation has been traced laterally into coarse conglomerates containing pebbles of jasper and hematite.

The three basic types of iron formation may be very closely associated with one another, although the irregular type tends to be restricted to low-grade zones. Interbedded units of banded and nodular iron formation are very common (Figure 2, Photo Plate 7) and banded zones frequently contain scattered nodules (Photo Plate 8).

The clastic sedimentary rocks associated with the iron formation in the iron-rich zone include conglomerate, sandstone, siltstone and shale. Conglomerate is most abundant and forms beds ranging in thickness from a few inches to thirty feet or more. Most of the beds are persistent, though many are highly variable in thickness and some pinch out entirely in rather short distances. The conglomerate consists of poorly sorted, sand to boulder-sized

fragments in a hematitic silty matrix that typically constitutes between 75% and 90% of the rock. The fragments consist dominantly of limestone, dolomite and basic igneous rocks but include quartzite, sandstone, shale and iron formation (Photo Plate 9). The fragments of iron formation may include both hematite and jasper and are locally very abundant, particularly where the conglomerate forms a lense enclosed by iron formation or where conglomerate and iron formation are thinly interbedded. The contacts of the conglomerate beds tend to be rather irregular and several examples of the channelling of underlying strata have been observed. Some of the lenses of conglomerate enclosed in iron formation may actually represent gravel-filled scour channels.

Sandstone is not a particularly abundant constituent of the iron-rich zone and is notable chiefly for the persistence of its beds, particularly in the Iron Creek block. One bed, ranging in thickness from five to ten feet, occurs near the middle of the zone and has been used as the reference datum in the correlation of measured sections because of its widespread distribution, and a second bed that occurs near the top of the zone is nearly as persistent. These sandstones are moderately well-sorted, fine to medium grained, and consist of grains of quartz, chert and feldspar. Some of the sandstone in the section is actually micro-conglomerate similar in composition with the normal conglomerate and consisting of poorly sorted angular to rounded grains of carbonate, igneous rocks, quartzite, sandstone, chert, iron formation and shale. One rather widespread sandstone bed occurring near the top of the iron-rich zone consists of grains of iron formation in a silty hematitic matrix and locally contains as much as 40% hematite. Small scour channels filled with sandstone have been observed in many parts of the map-area, some exhibiting graded bedding.

Shale and siltstone are not volumetrically important in the section and usually form beds two feet or less thick and very limited in areal extent. Most of such beds are sandy and many contain scattered small pebbles. Several thick beds of shale have been described but as these are silty and conglomeratic and grade laterally into conglomerate, it is most likely that they are simply pebble-poor exposures of normal conglomerate beds.

Carbonate is present as a minor constituent of both the iron formation and the clastic sedimentary beds. It is most common as thin beds of silty brown-weathering microcrystalline limestone interbedded with other rocks, but also occurs frequently in lenses and nodules within beds of iron formation. These nodules usually contain crystalline quartz and a rusty-weathering brown carbonate that is probably ankerite or siderite.

A program of detailed petrographic study of the iron formation has been begun but is, as yet, in the very early stages and will not be reported at this time. However, the preliminary work has shown that the iron formation consists mineralogically of hematite and silica with minor carbonates (calcite, dolomite and siderite) and accessory apatite, chlorite and greenalite. Hematite occurs in the form of rod-like crystals and rounded grains from one to

thirty microns in maximum dimension. Silica occurs chiefly as jasper, a variety of cryptocrystalline quartz, but some cryastalline quartz occurs in association with carbonates in nodules and irregular bands. Carbonates occur as scattered rhombic crystals in jasper and as anhedral grains in the quartz-rich nodules and bands. Apatite in the form of stubby prisms up to twenty-five microns in length is sparsely disseminated through much of the jasper and is locally concentrated in narrow discontinuous quartz-carbonate bands.

B. Stratigraphy

The stratigraphic and areal distribution of the iron formation and sedimentary rocks in the iron-rich zone is shown on Plates V-1 to V-5, stratigraphic cross-sections based on the detailed measurements and descriptions completed in 1962. The persistence of the sandstone beds and the tendency of the conglomerate beds to change thickness rather abruptly or to pinch out entirely, are well illustrated by these cross-sections. The cross-sections also illustrate the manner in which iron formation is concentrated into a 100 to 300-foot section in the middle to upper part of the iron-rich zone and a 50 to 100-foot section in the lower part. The upper concentration of iron formation has been designated the "Main Zone" and has been traced continuously from the Snake River to the Cranswick River. It is thickest in the area north of Iron Creek and thins to the southwest and to the east, apparently by an interfingering with, and ultimate replacement by, conglomerate in the upper and lower parts of the zone. A similar transition from iron formation to conglomerate through a stratigraphic interval of increasing conglomerate is typical of the top and bottom of the iron-rich zone, although the detailed descriptions completed in 1962 and used in the preparation of Plates I to V were not carried far enough above and below the zone to demonstrate this.

The lower concentration of iron formation has not yet been traced throughout the map-area. However, it has been observed in the Iron Creek block and the Discovery Creek block, and is probably represented by the esternmost measured section in the Cranswick River block (IF-20-62). The latter occurrence has not, as yet, been proven to represent the lower concentration but it lies much closer to the base of the conglomerate sequence than the iron formation exposed immediately west of the Cranswick River (IF-18-62) and is most likely stratigraphically lower.

The occurrence of the iron formation as regular and persistent beds in a sequence of sedimentary rocks argues very strongly for a simple sedimentary origin for the deposit. This argument is supported by the presence in the iron formation of sedimentary structures such as bedding, scour channels containing graded beds, and flowage structures, and there can be little doubt that the iron formation is simply an unusual sedimentary rock. Although there are abundant evidences of local replacement of silica by hematite it is probable that this replacement is diagenetic and that it represents a re-distribution of constituents rather than an addition of iron to the original sediment. The diagenetic

character of the replacement is suggested by iron formation pebbles and boulders that exhibit replacement features and that occur in the conglomerates associated with the iron formation. An indication of the lack of post-depositional enrichment in iron is afforded by the uniformity in iron content of the iron formation, which is described below.

C. Grade

The 1962 exploratory program included the sampling of a number of well-exposed sections of the iron formation. The samples were collected from channels yielding approximately four pounds of sample per foot of channel and were bagged at three-foot intervals (Photo Plate 10). Waste bands up to one foot in thickness were included in the channels, although the thicker waste bands were not sampled. Several sampled sections were submitted for complete chemical and spectrographic analysis of the three-foot samples, and when a review of the results indicated that a larger sample interval would be satisfactory, the remaining sections were submitted as composited samples each representing a nine to twelve-foot interval.

The distribution of the major constituents in the sections analyzed in detail is shown on Plate VI, in which the reference datum is the same sandstone bed used as the datum for the stratigraphic cross-sections. The four sections shown are widely spaced in the area of most abundant iron formation in the Iron Creek block. Plate VI indicates the following:

(1) Correlations of significant chemical variations in the iron formation conform with correlations of the physical variations represented by changes in lithology. This is best illustrated by the zones of relatively high CaO, MgO, Mn and CO_2 that occur above and below the lower sandstone marker bed, and by the zone of relatively high phosphorus adjacent to the upper sandstone marker.

(2) There is no major systematic variation in the iron content of the iron formation either among the analyzed sections or from top to bottom in a given section. Furthermore, the variation in iron content from sample to sample is relatively minor.

(3) The phosphorus content of the iron formation increases regularly from the base of the iron-rich zone to the top.

In view of the apparent lateral chemical continuity of the iron formation the iron-rich zone was subdivided into subzones at depositonal breaks in the section represented by beds of clastic sedimentary rocks. These subzones are defined on Plates VII-1 to VII-5, which are modified copies of the stratigraphic sections through the iron-rich zone. Five subzones can be recognized in sections in the central part of the Iron Creek block, and a sixth zone has been sampled in several sections in which exposures of the basal part of the sections are available. To the south and west, where the total iron-rich zone thins, the upper and lower subzones disappear. The subzones cannot all be identified to the

east in the Discovery Creek and Cranswick River blocks but subzones 1 and 2 combined appear to represent a continuous horizon.

The average grade of the iron formation in each subzone in the Main Zone was calculated for each sampled section in the Iron Creek block with the results presented in Table A. In all calculations of average values the individual assays were weighted according to the length of the channel represented by the sample.

	Zone 1		Zone 2		Zone 3		Zone 4		Zone 5	
Section	Fe(%)	P.(%)	Fe(%)	P.(%)	Fe(%)	P.(%)	Fe(%)	P.(%)	Fe(%)	P.(%)
IF-6-62	47.9	0.44	48.6	0.34	47.8	0.32	48.4	0.28	48.8	0.27
IF-7-62	45.5	0.57	47.6	0.32	48.3	0.34	45.7	0.26	49.1	0.25
IF-9-62	45.0	0.53	47.5	0.33	47.4	0.36				
IF-13-62	46.1	0.70	47.0	0.40	46.7	0.31	47.0	0.30	48.4	0.26
IF-16-62	45.78	0.55	46.38	0.37	46.46	0.34	46.96	0.27	45.4	0.21
IF-19-62	45.9	0.58	47.5	0.33	43.8	0.28	48.3	0.27	45.6	0.25
IF-37-62	45.3	0.49	46.9	0.35	47.7	0.40	47.3	0.26	47.5	0.31
IF-38-62	46.1	0.45	46.5	0.38						
IF-39-62	46.5	0.49	48.4	0.35	47.6	0.30	47.5	0.36	49.5	0.24
IF-44-62	45.7	0.68	45.9	0.35	45.2	0.35	46.4	0.28	46.8	0.22
AVERAGE	45.97	0.55	47.15	0.35	46.82	0.33	46.96	0.30	47.65	0.27

TABLE 2*

Average iron and phosphorus values by subzone in sections in the Iron Creek block

* Values for covered intervals in the sections have been extrapolated from adjacent sections for the purpose of determining average grades.

This table confirms both the general uniformity of iron content in the iron formation indicated by the detailed analyses of Plate VI and the progressive increase in phosphorus content from the base of the iron rich to the top (Subzone 5 to Subzone 1).

Table 3 presents the combined averages of all subzones in each of the sampled sections in the area. The variation in iron content evident in these sections is much greater than that of Table 2, an is attributable largely to a general decrease in iron content of iron formation away from the centre of the Iron Creek block. This decrease is illustrated by Plate VIII, a map showing the geographic locations and average assays of the sampled sections.

Section	Thickness of Iron Formation (Ft.)	Fe.(%)	P.(%)
IF-6-62	222	48.2	0.32
IF-7-62	198	47.3	0.34
IF-9-62	350	47.1	0.36
IF-13-62	255	47.1	0.41
IF-14-62	137	46.37	0.38
IF-16-62	214	46.25	0.33
IF-18-62	75	43.2	0.38
IF-19-62	238	46.3	0.33
IF-20-62	50	40.6	0.17
IF-21-62	99	42.4	0.41
IF-2 -62	114	45.1	0.30
IF-32-62	107	47.6	0.28
IF-33-62	158	45.8	0.32
IF-37-62	260	46.9	0.36
IF-38-62	138	46.4	0.41
IF-39-62	246	48.0	0.35
IF-43-62	182	45.2	0.30
IF-44-62	184	45.9	0.40

TABLE 3*

Average iron and phosphorus values in section sampled in 1962

* Values for covered intervals in the sections have been extrapolated from adjacent sections for the purpose of determining average grades.

The uniformity of grade of the iron formation demonstrated by Tables 2 and 3 and Plate VIII is to be expected in an unmetamorphosed and unenriched sedimentary deposit and serves to confirm the assumption of sedimentary origin for the deposit. In addition, it permits the placing of a greater degree of confidence on the results of tests and analyses that are performed on samples that are extremely small and widely spaced in comparison with the total size of the deposit.

D. Reserves

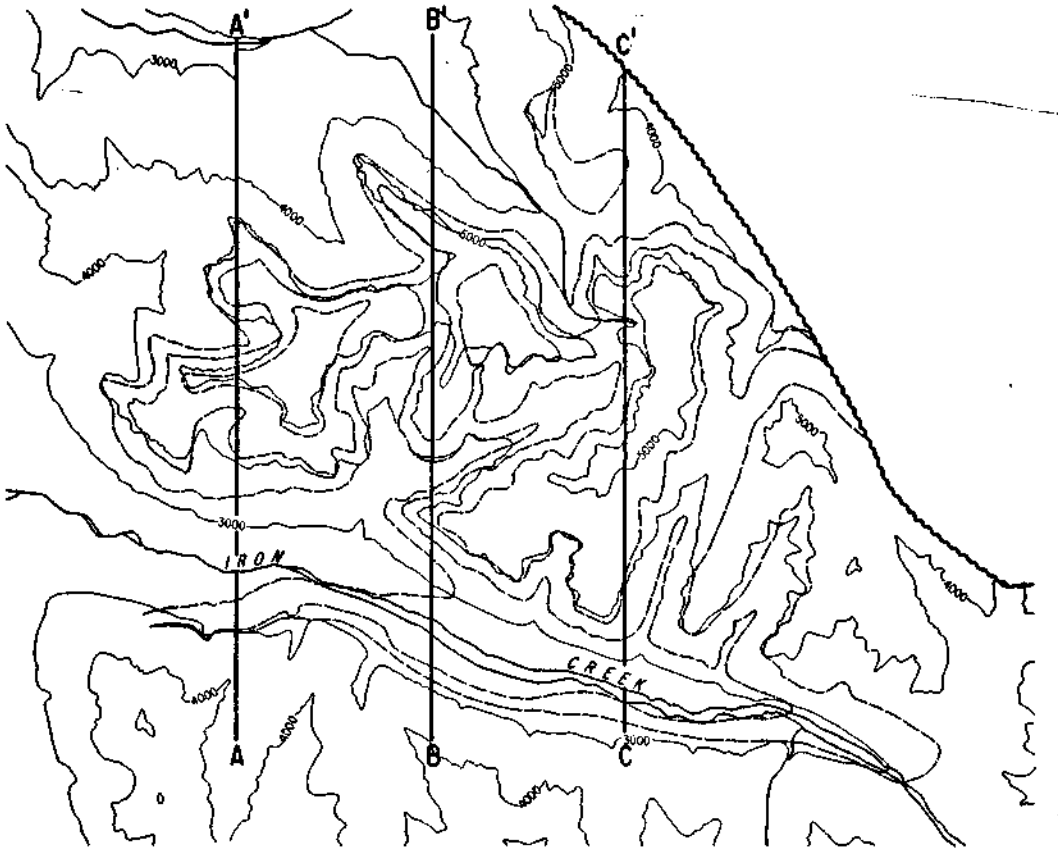
Rough calculations of the amount of iron formation present in the Snake River area indicate reserves in excess of twenty billion tons, and because the reserves are so large it has not been thought necessary to make precise calculations of total reserves. However, further calculations of mineable reserves in the area of highest grade and maximum thickness in the Iron Creek block have been made. These calculations indicate that over six billion tons of iron formation averaging 47.2% Fe (not including waste) are available for mining by open pit methods from the ten square mile area shown in Figure 2. These reserves and the additional reserves available elsewhere in the area make this deposit of iron ore one of the largest known today.

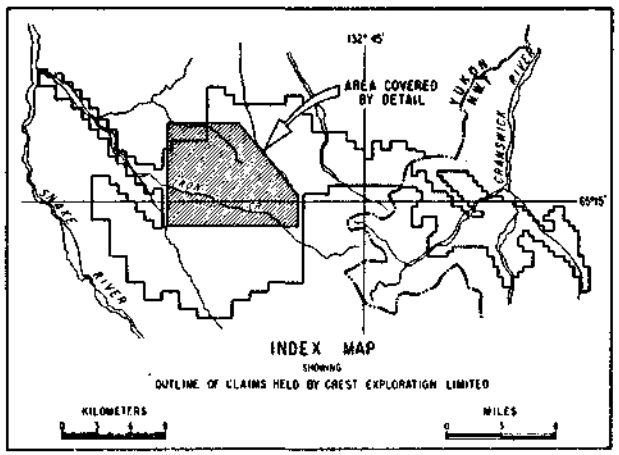
R. A. Stuart

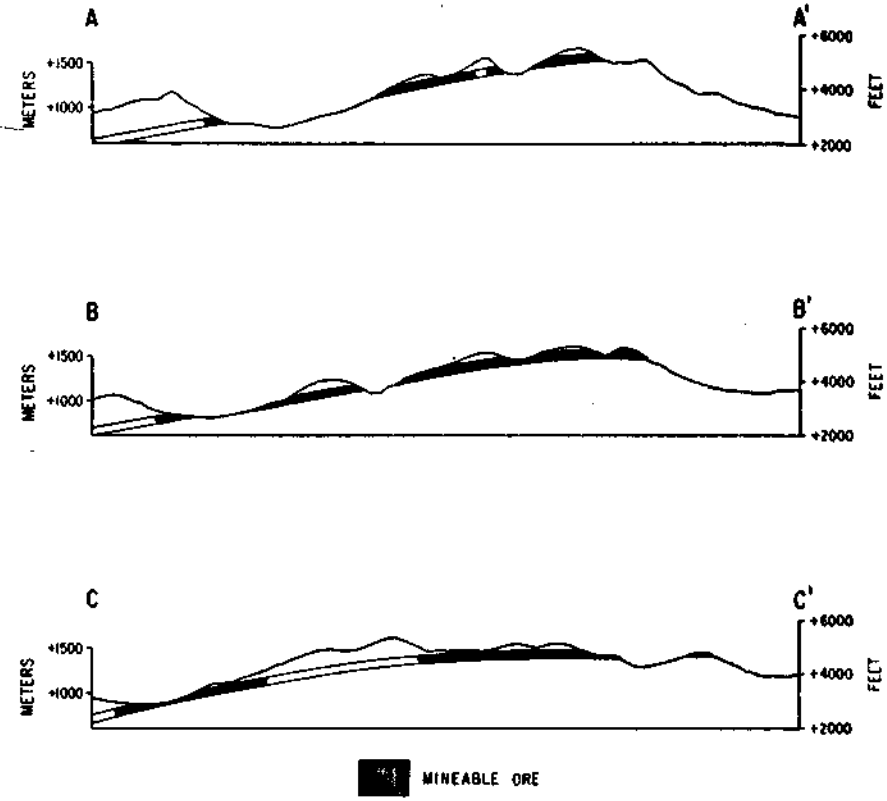
R. A. STUART,
Member, Alberta Association
of Professional Engineers

July, 1963.

OPEN PIT ORE - IRON CREEK BLOCK







PROFILES

LEGEND

EXPOSED

STRIPPABLE AT LESS THAN 1:1

6 BILLION TONS AVAILABLE AT STRIPPING RATIO OF 0.2:1

SCALE IN MILES

0 ½ 1 1½ 2

SCALE IN KILOMETERS

0 ½ 1 1½ 2

APPENDIX "A"

Personnel: Hamilton & Brandt
Weather: Warm, Sunny, few clouds
Air Photo: A12148-276

Section of Conglomerate H-9-62

Beginning in tributary on east side of Iron Creek, in second big gulley before sharp eastward bend of Iron Creek. Working up gulley.

Measuring up section. Beds nearly flat. No attitude available. Pogo stick.

0' - 40'

Conglomerate. Weathered surface, maroon - dark brownish-grey. Fresh surface, maroon, purplish, grey-slightly calcareous. Matrix, very fine sandstone, containing about 10% angular green fragments, less than $\frac{1}{4}$". Pebbles: 10% of rock (more than $\frac{1}{2}$"). Most are angular to sub-angular but become rounded as size increases. Majority of pebbles range from $\frac{1}{2}$" to $1\frac{1}{2}$" but range up to boulders $1\frac{1}{2}$' in diameter. Most boulders (more than 8") are greenstone and are well-rounded. Conglomerate is massive-bedded and bedding not perceptible except from a distance. Well-jointed and cleaved. Cleavage near vertical causing rock to weather in slabs 1" thick. Slabby.
0' - 10' - Carbonate/Greenstone/Quartzite = 50/48/2.
15' - 20' - Range from $\frac{1}{2}$" to 3", average $1\frac{1}{2}$" - carbonate/greenstone/quartzite = 30/50/20. Greenstone pebbles generally larger, more rounded. Carbonate pebbles smaller (less than 1"). Sandstone lense at about 40' - lenticular in shape, about 20' long and $1\frac{1}{2}$' thick. Sandstone - weathered surface, dark grey - fresh surface, medium-greenish-grey, very calcareous, fine-grained, well-sorted, calcite cement. Sandstone lense sits above a pebble band at about 35'. Pebble band about 3' thick with pebbles from 2" - 8" in diameter, average about 4". Consists mostly of greenstone with some carbonate (80/20). Another pebble band at about 55' consisting of greenstone and carbonate (50/50) - average 6 - 8" diameter.

40' - 105'

Conglomerate as before, but pebble content increasing gradually in amount and size. At 60 - 65'; Pebble content about 25%. Range from $\frac{1}{2}$" to 4" with boulders $1\frac{1}{2}$' in diameter. Average size about $2\frac{1}{2}$" Rounded. Carbonate/greenstone/quartzite - 50/45/5. Occasional concentrations of large pebbles and boulders over 1' - 3' interval at 55', 75' 90' and 100'. Average pebble size about 6" diameter. Well-rounded. Mostly greenstone (60 - 70%) with carbonate and quartzite. At 100' - 105', many large boulders up to 3' in diameter in pebble band. This marks top of unit and slight colour change compared to overlying strata.

091697

Section H-9-62

105' - 185'

Conglomerate. Weathered surface, dark chocolate-brown. Fresh surface, dark chocolate-brown to maroon. Matrix: siltstone/very fine sandstone. Pebbles: less than 5%, sub-angular/sub-rounded, range from ½ - 3", most are less than 1". Carbonate/greenstone/quartzite = 56/40/4. Massive-bedded, forming vertical cliffs. Well-jointed. Blocky.

145' - 147' - Conglomerate, as before, but matrix poorly sorted, containing abundant coarse sand fragments of greenstone, pink quartzite, in the siltstone cement. Conglomerate cut by narrow network of thin vertical veins. Most are less than 1½" wide but one is about 6" wide. Mineral of the veins is a pale pink carbonate, rather heavy.

165' - 170' - Pebbles less than 5% of rock. Range from ½ - 8" in diameter. Most are less than 1". Sub-angular/sub-rounded. Carbonate/greenstone/quartzite = 40/56/4. Larger boulders mostly greenstone. Occasional lenticular zones where matrix becomes poorly sorted coarse sand. Zones less than 1' thick. Wavy laminations.

Note - 147' marks the top of a resistant cliff forming unit about 15' thick, which can be traced around hillside.

185' - 205'

Conglomerate. Weathered surface, dark greenish-grey/brownish-grey. Fresh surface, medium greenish-grey/brownish-grey. Colours appear to change laterally and vertically from green to maroon, and grade into each other. The dominant colour is a green shade, however. Pebbles about 5 - 10% of rock. Massive-bedded as before. Rubbly weathering. Slabby.

205' - 260'

Increase in pebble content and size. About 20% of rock average size about 3". Range up to 12". Well-rounded. Pebble content decreases gradually to about 10% at 260'. Carbonate/greenstone/quartzite = 66/30/4. Conglomerate is medium purplish-grey - weathered surface and fresh surface.

260' - 400'

Conglomerate. Weathered surface and fresh surface, medium purple-grey. Matrix: siltstone, as before. Pebbles: ½ - 12", average 2". About 10% of rock appearing to increase upward slightly. At 320', about 15% pebbles. Massive-bedded. Slabby/blocky. Irregular jointing.

315' - 320' - Carbonate/greenstone/quartzite = 63/35/2.

H-9-62 - Cont'd.

400' - 435'

Conglomerate color and matrix as before. Pebble content increases upward from about 15% at base to 25% at 435'. Carbonate/greenstone = 66/34.

435' - 450'

Boulder conglomerate. Weathered surface and fresh surface, medium purplish-grey. Coarse clastics range up to 2' diameter. Most are about 6" diameter. About 40% of rock. Boulders well-rounded, mainly greenstone.

450' - 615'

Conglomerate, as before, with pebbles about 10 - 15% of rock. Average size about 2". Pebble band at 497' about 4' thick, with pebbles about 30% of rock. Average size about 3 - 4".

615' - 635'

Conglomerate, as before, with pebbles about 20% of rock. Average size about 2". Sub-angular/sub-rounded. Weathered surface, medium greenish-grey/brownish-grey. Fresh surface, medium greenish-grey. Carbonate/greenstone/quartzite = 65/27/8. Very rare chert and jasper pebbles seen.

635' - 845'

Conglomerate. Weathered surface, medium brownish-green. Fresh surface, medium greenish-grey/brownish-green. Pebbles about 5%. Most are less than 2" diameter. Abundant smaller pebbles (less than $\frac{1}{4}$") occur in the matrix, including greenstone and jasper. Sub-angular/sub-rounded. At 715', pebble content increases to about 15%. At 740', pebble band occurs, about 5' thick. Pebbles about 40% of rock. Range up to 8", most are about 3 - 4" average. Carbonate/greenstone/quartzite/chert/others = 50/28/10/7/5. At 810', pebble content increases to 15% of rock. Chert pebbles appear to become more common. At 840', boulder conglomerate, with boulders about 30%. Boulders consist of greenstone, mostly, with some carbonate and light bluish green igneous rock (?). Rare boulders of pink quartzite. Boulder conglomerate about 5' thick.

845' - 1060'

Conglomerate. Weathered surface, medium brownish-grey. Fresh surface, medium purplish-grey. Pebbles about 10% of rock, consisting of greenstone, carbonate, quartzite, chert and unknown igneous rock. Unsorted mixture of pebble sizes from $\frac{1}{2}$" - 6" diameter. Pebble content decreases slightly upward to about 5% at 1020'. At 1020', boulder conglomerate, with boulders from 3" to 2' diameter. Boulders well-rounded, consist of greenstone, igneous rock and carbonate. Conglomerate about 2' thick. Above boulder conglomerate, pebble content about 15%. At 1050' - 1055', Carbonate/greenstone/quartzite/chert = 56/28/6/10.

Section H-9-62

Weather: Cool, cloudy 9/10
Personnel: Hamilton & Steele

1060' - 1085'

Sandstone argillaceous. Weathered surface and fresh surface, medium brownish-green, poorly sorted and conglomeratic, very-fine-grained/siltstone, conglomerate with coarse angular fragments ¼" or less. Massive. Rubbly weathering, forms recessive unit.

1085' - 1205'

Conglomerate. Weathered surface, dark grey/dark greenish-grey. Fresh surface, medium olive-green. Matrix: very fine sandstone/siltstone, slightly calcareous, poorly sorted with some coarser (up to ¼") angular fragments. Pebbles: 5 - 10% of rock, from ½" - 4" diameter, average about 3/4". Mostly carbonate, sub-angular/sub-rounded. Unit massive, resistant. Pebble count at 1090'/1100': Carbonate/greenstone/chert/quartzite/sandstone = 70/16/6/4/4. Pebble content and average size increasing upward. At 1130', pebbles, about 15%, average size about 1½". From 1135' - 1145', boulder conglomerate, with boulders averaging about 5" diameter. Boulders about 60% of rock, mostly well-rounded. Carbonate/greenstone/sandstone/quartzite = 36/27/24/13. From 1145' - 1175', pebble content about 5 - 10%. Average size about 1", sub-angular/sub-rounded. At 1175', boulder pavement, with huge sub-rounded/rounded boulders up to 4' across. Boulders of carbonate, greenstone, quartzite, basalt (?) and sandstone. Band spans about 4'. Above 1180' to 1205', pebble content increases slightly upward from about 10% at 1180' to 15% at 1205'. 1205' marks the top of the resistant conglomerate unit, and the unit is overlain by a recessive conglomerate. The upper 4' of the unit has somewhat larger pebbles, forming a resistant cap at 1205', pebbles average 2". Within the interval, 1180'/1205', a colour change takes place. Change is gradational from olive-green/greenish-grey/purplish-grey, upward. At 1205': conglomerqte - weathered surface, dark grey/dark chocolate-brown. Fresh surface, medium purplish-grey/maroon. Pebble count at 1180'/1190': Carbonate/greenstone/sandstone/quartzite = 44/40/13/3.

1205' - 1240'

Conglomerate. Weathered surface, dark maroon/dark grey. Fresh surface, medium purplish-grey/medium grey. Matrix: siltstone/very fine sandstone, Pebbles: 5%, unsorted mixture from ½" to 2" diameter, angular/sub-rounded. Recessive, rubbly weathering.

1240' - 1255'

Conglomerate, as before, but pebble content greater. At 1240', a 1' band has about 30% pebbles, from 1" to 8" diameter, angular/sub-rounded. Above this pebble band, pebble content about 10% to 1255'. Pebble count at 1250'/1255': Carbonate/sandstone/greenstone/quartzite/chert = 61/22/13/2/2.

H-9-62 - Cont'd.

1255' - 1270'

Conglomerate, as below, but with pebble content about 25 - 30%. Pebbles mostly well-rounded, average about 2" diameter.

1270' - 1275'

Covered.

1275' - 1295'

Conglomerate. Weathered surface, dark chocolate-brown. Fresh surface, purplish-maroon with specks of medium bluish-green giving a mottled effect. Blue-green specks are small (less than $\frac{1}{4}$") clastics in maroon matrix. Matrix: siltstone/very fine sandstone, slightly calcareous, well-indurated. Pebbles: about 10% of rock, range from $\frac{1}{2}$ - 4" diameter, mostly sub-angular. This unit is hard, resistant cliff-forming, weathers blocky. Occasional fine sand laminations in wavy discontinuous lenses. Pebble count at 1290'/1295': Carbonate/greenstone/sandstone = 57/38/5.

1295' - 1370'

Partly covered. Appears to be mostly conglomerate. Weathered surface, medium to dark grey. Fresh surface, olive-green. Pebbles about 5%. Recessive, rubbly weathering.

1370' - 1385'

Sandstone - conglomeratic, slightly calcareous. Weathered surface, light yellowish-green. Fresh surface, medium yellowish-green, medium green, poorly sorted with grains up to 2mm., well-rounded, Occasional pebbles 1" diameter. Somewhat friable but forms resistant band which can be traced around hillside. Cut by vertical cleavage to give slabby rubble. Occasional pebbles up to 4" diameter seen along bedding.

1385' - 1405'

Conglomerate. Weathered surface and fresh surface, medium grey-green, Pebbles about 5%. Fairly recessive unit. This unit is capped by a bed of: Sandstone, weathered surface, dark grey/dark brown-grey. Fresh surface, medium greenish-grey, fine-to medium-grain, poorly sorted, sub-angular/sub-rounded, conglomeratic in part with some coarser fragments up to 1" diameter. Forms hard bed 2' thick, Blocky. Pebble count at 1400'/1405': carbonate/greenstone/quartzite/sandstone = 81/11/4/4.

Section H-9-62

1405' - 1425'

Conglomerate. Weathered surface, dark grey/dark brown grey. Fresh surface, medium greenish/brownish grey. Matrix: very fine to fine sandstone, silty, slightly calcareous, poorly sorted with some coarse sand grains, sub-angular/rounded. Pebbles: about 5%, occasionally concentrated in bands 2 - 3" thick. Range up to 2", average about 3/4", sub-angular/sub-rounded. This unit is massive, stands out as vertical cliff. Blocky. Laminations of fine sand seen throughout. Pebble count at 1415'/1420': greenstone/sandstone/carbonite/quartzite = 64/26/8/2.

1425' - 1450'

Conglomerate. Weathered surface, dark chocolate-brown/maroon. Fresh surface, purplish-maroon. Matrix: Siltstone/very fine sandstone, poorly sorted, calcareous. Pebbles: less than 5% of rock. Most are small (½") angular fragments of greenstone. Well-bedded, in beds 1' - 3' thick, blocky. At 1438' occurs a 1' bed of sandstone - weathered surface, dark green-brown. Fresh surface, medium bluish-green, coarse-grained, angular, contains colourless, green, pink and red fragments, calcareous, well-sorted. At 1440', is a thin pebble band 1' thick, pebbles well-sorted, 1" diameter, well-rounded. Pebble count at 1440'/1445': greenstone/carbonate - 95/5.

1450' - 1460'

Covered recessive unit.

1460' - 1475'

Conglomerate, as below. Pebbles less than 5% but large (1½' plus) boulders are quite common, scattered haphazardly. Consist mainly of greenstone, sandstone, carbonate. From a distance this unit appears quite well-bedded, with beds approximately 6" thick.

1475' - 1480'

Covered. Recessive.

1480' - 1510'

Conglomerate. Weathered surface, dark chocolate-brown. Fresh surface, purplish-maroon. Pebbles about 15% - locally, in discontinuous bands, about 25%. Range up to 5", average about 2". Sub-angular/rounded. Forms massive, almost vertical cliff, weathers rubbly. Pebble count at 1495'/1500': carbonate/greenstone/quartzite/chert/sandstone = 51/40/3/3/3.

Section H-9-62

1510' - 1530'

Conglomerate, as below, but distinctly banded, as illustrated.

dark chocolate brown	
light chocolate brown	
light green-grey	20'
dark chocolate brown	
light chocolate brown	

Pebbles about 15% in this unit, and large boulders are common. Boulders mostly greenstone and carbonate. Occasional thin ($\frac{1}{2}$") partings of dark maroon mudstone. This banded unit forms a good marker that can be followed easily around the cliff.

1530' - 1615'

Conglomerate. Weathered surface, dark chocolate-brown. Fresh surface, dark purplish-grey. Matrix: siltstone/very fine sandstone, calcareous, occasional bands where Matrix is poorly sorted very-fine/fine-grained sandstone. Pebbles about 10% of rock, poorly sorted mixture up to boulders 2' in diameter. Most pebbles are less than one inch. Unit is well-bedded, beds are mostly about 2' thick and some are finely laminated. Blocky. Occasional partings of dark red/maroon mudstone, never more than $\frac{1}{2}$" thick. Helps to give well-bedded appearance.

Above this is a massive unit, and this contact with the well-bedded conglomerate below and massive conglomerate above, is one that can be carried around the hill.

Pebble count at 1545'/1550': carbonate/greenstone/chert/sandstone/quartzite = 57/29/7/6/1.

Pebble count at 1600'/1605': greenstone/carbonate/chert = 74/23/3.

APPENDIX "B"

Team: Nixon and Hovdebo
Weather: Sunny - warm
Photo: A12148-182 106F - (11)2

Section I.F. - 37-62

Measuring up the section as shown on aerial photo; Beginning in lower unit of iron formation (pogo stick). Bedding at 0 - 125°; 26 S.W.

0' - 6'

Iron formation. Hematite, steel-grey and jasper. Discreet bands of maroon jasper to 3" containing thin continuous bands of orange-red jasper to ¼" thick. Large (2") nodules of maroon jasper with marginal bands 1/8" thick of orange-red jasper. Irregular discontinuous maroon jasper bands ½ - 3/4" thick. Spheroidal - ellipsoidal and irregular orange-red nodules (1/8 - ½") disseminated through steel-grey hematite. In upper 1', conglomerate lenses 4 - 6" thick. Hematite - 50 to 55%. Flaggy - blocky.

6' - 19'

Conglomerate. Weathered surface, brown-grey. Fresh surface, brown-grey. Angular to sub-rounded, sparse (1 - 5%) coarse clastics - poorly sorted - in brown-grey sandy to siltstoney matrix. Blocky.

19' - 58' (approximately with pogo stick)

Covered interval.

58' - 74'

Conglomerate. Weathered surface, dark chocolate-brown-grey. Fresh surface, chocolate-brown. Sparse (1-5%) sub-angular to sub-rounded coarse clastics, poorly sorted in chocolate-brown, predominately silty matrix. Blocky - rubbly.

74' - 110'

Covered interval.

110' -126½'

Iron formation. Hematite, steel-grey and jasper. Streak-like discontinuous bands of maroon jasper with 1/8" margin of orange-red jasper. Abundant spheroidal, ellipsoidal and irregular-shaped orange-red and maroon nodules 1/8" - 3/4". Continuous and discontinuous thin (¼") discreet bands of orange-red jasper. Jasper present predominately as disseminated nodules. Hematite - 75 to 80%. Massive.

Section K.F. - 37-62

126½' - 127½'

Iron formation. Hematite, steel-grey and maroon orange-red jasper. 1' irregular band of orange-red jasper containing nodules of steel-grey and maroon hematite and irregular streaks of steel-grey hematite to ½" . Hematite - 40%. Blocky.

127½' - 151'

Conglomerate. Weathered surface, dark brown-grey with sub-metallic lustre in part. Fresh surface, maroon-brown. Sub-angular to rounded coarse clastics (to boulder size) 5% - poorly sorted - in a maroon band, sandy to silty matrix. Occasional large (1 - 3') irregular lense-like mass of orange-red jasper. Massive. Prominent. At 148', brown-weathering hematitic lens 3' thick.

151' - 165'

Covered interval.

165' - 171'

Iron formation. Hematite, steel-grey and jasper. Abundant sub-spheroidal, ellipsoidal and irregular shaped nodules. Thin (½ - 1½") continuous nodular aggregate bands. Irregular streak-like bands of maroon jasper with thin (1/8") orange-red margin. Hematite - 60 to 65%. Massive.

171' - 172½'

Iron formation. Hematite, steel-grey and jasper. Very small (1/32" - 1/8" nodules occasional. Thin discreet maroon band 3/4" thick. Hematite - 80%. Platy.

172½' - 181½'

Iron formation. Hematite, steel-grey and jasper. Elongated, ellipsoidal, sub-spheroidal nodules to ½" thick. Irregular nodular maroon bands 5 - 12" thick with streaks and irregular masses of steel-grey hematite (1/8 - 1"). Continuous, distinct maroon bands with thin 1/32 - ½" bands of steel-grey hematite. Thin (½" - 2") crusty nodular aggregate bands. Thin discreet (½") bands of orange-red jasper. Hematite - 60 to 65%. Flaggy - blocky.

181½' - 184'

Iron formation. Hematite, steel-grey and jasper. Abundant sub-spheroidal nodules ¼ - 3/4". Thin nodular bands, 1". Faint orange-red bands with birdseye texture - continuous. Hematite - 70%. Blocky - massive.

Section I.F. - 37-62

184' - 185'

Sandstone, Weathered surface, dark grey-green. Fresh surface, grey-green. Medium-grained, equigranular, compact, abundant light coloured grains give fresh surface speckled appearance. Platy.

185' - 192½'

Covered interval.

192½' - 198'

Iron formation. Hematite, steel-grey and jasper. Nodular maroon bands to 8" - continuous and distanct. Spheroidal, ellipsoidal and irregular nodules to 3/4". Faint discreet streak-like bands orange-red jasper ½ - 3/4" thick. Discreet crusty nodular aggregate bands. Hematite-60%.Blocky.

198' - 200'

Conglomerate. Weathered surface, brown-grey. Fresh surface, dark brown-grey - dark brown-green. Abundant coarse clastics (to cobble size)(40%) well-rounded, poorly sorted, in sandy dark brown-green matrix. Flaggy - rubbly.

200' - 202'

Iron formation. Hematite, steel-grey and jasper. Irregular streaks of maroon jasper. Abundant, spheroidal, ellipsoidal and irregular nodules disseminated. Hematite - 50%. Blocky.

202' - 203'

Conglomerate. Weathered surface, grey-brown-green. Fresh surface, grey-green-brown. Sub-angular - rounded pebbles, poorly sorted, contained in sandy grey-brown matrix. Platy. Recessive.

203' - 219'

Iron formation. Hematite, steel-grey and jasper. Elongated, irregular streak-like bands of maroon jasper ½" to 5" thick, often with then border or margin from 1/16 to 1/8" thick of orange-red jasper. Ellipsoidal - sub-spheroidal, elongated and irregular nodules disseminated in hematite 1/16 to 3/4" thick. Vague, discontinuous bands approximately 4" thick, containing abundant small 1/16 - ¼" nodules - birdseye texture. Thin irregular (½") continuous crusty nodular bands (orange-red). Thin crusty nodular lenses (½ - 3/4" thick). Hematite -65%. Blocky- massive.

219' - 222'

Iron formation. Hematite, steel-grey and jasper. Continuous maroon bands (1') containing streaks and very irregular bands of steel-grey hematite - (1/8 - ½"). Occasional elongated lenses of orange-red jasper, ½" thick. Hematite - 50%. Blocky.

222' - 225'

Covered interval.

Section I.F. - 37-62

225' - 230'

Iron formation. Hematite, steel-grey and jasper. Abundant elongated, spheroidal ellipsoidal, irregular nodules of maroon and orange-red jasper. Continuous crusty nodular bands and crusty lens ($\frac{1}{2}$ - 1" thick). Discontinuous, distinct thin, to $\frac{1}{4}$", bands of orange-red jasper. Hematite - 60%. Massive - blocky.

230' - 231'

Conglomerate. Weathered surface, yellow-green-grey. Fresh surface, mottled, yellow-green-brown-purple. Abundant (50%) coarse clastics, to cobble size, sub-rounded to rounded, poorly sorted - sandy to silty green-brown-grey matrix. Blocky - rubbly.

231' - 234½'

Covered interval.

234½' - 238'

Sandstone. Weathered surface, dark green-grey. Fresh surface, grey-green. Medium-grained, equigranular, speckled with light coloured grains - compact. Platy. Slabby to flaggy in upper foot of interval.

238' - 244'

Covered interval.

244' - 253'

Iron formation. Hematite, steel-grey and jasper. Nodular bands 2" thick - continuous. 4" bands of small birdseye-type nodules 1/8" thick. Spheroidal, ellipsoidal, irregular nodules 1/16 - 3/4". Crusty nodular bands and lenses to 1" thick. At 246', a wavy erosional surface (?) - platy high grade steel-grey hematite. Hematite - 65%. Blocky to massive.

253' - 254'

Iron formation. Hematite, steel-grey and jasper. Platy hematite in plates 1 - 2½" thick. Containing some irregular cherty siltstone lenses and very sparse small ½" nodules. Hematite - 75%.

254' - 262'

Iron formation. Hematite, steel-grey and jasper. Thin continuous maroon bands, ½" thick. Crusty elongated lenses to 3/4". Abundant disseminated, spheroidal - ellipsoidal and irregular nodules (1/8 - 3/4"). 4" silty chert band at 258'. At 258½', an 8" band of platy hematite and cherty silt. Hematite - 60%. Flaggy - blocky.

Section I.F. - 37-62

262' - 269'

Iron formation. Hematite, steel-grey. Elongated ellipsoidal and sub-spheroidal nodules to ½". Crusty nodular bands ½", continuous. Crusty nodular lense 1" thick. Continuous maroon bands 1 - 2". Hematite - 70%. Massive. Prominent.

269' - 284'

Iron formation. Hematite, steel-grey and jasper. Abundant, thin, discreet bands of maroon jasper (½"), discontinuous and continuous. Abundant spheroidal - ellipsoidal and elongated nodules 1/16 - 3/4". Continuous wavy bands orange-red jasper ½" thick. Hematite, 60 to 54%. Flaggy - blocky.

284' - 297'

Covered interval.

297' - 315'

Iron formation. Hematite, steel-grey to maroon jasper. Vague 4" band of maroon hematite containing thin 1/16" streaks of steel-grey hematite. Abundant spheroidal, ellipsoidal, irregular nodules ½" - 3/4". Continuous maroon jasper bands - ½ - 2" thick. Continuous red nodular bands, abundant birdseye nodules. Hematite - 55 to 60%. Flaggy - blocky.

315' - 317'

Conglomerate. Weathered surface, dark brown-grey. Fresh surface, brown-grey - chocolate brown. Sub-rounded, poorly sorted, coarse clastics (to pebble size) in silty sandy chocolate-brown matrix. Flaggy. Recessive.

317' - 322'

Iron formation. Hematite, steel-grey and jasper. Continuous bands and streaks of maroon jasper to 1½". Platy 2" layers high grade steel-grey hematite. Thin dark brown cherty silt band 8" at 321'. Hematite - 50 to 55%. Flaggy.

322' - 342'

Iron formation. Hematite, steel-grey and jasper. Discreet continuous maroon bands ½ - 2" thick. Spheroidal, ellipsoidal, irregular nodules disseminated through steel-grey hematite. Hematite - 55 to 60%. Flaggy to blocky.

342' - 345'

Conglomerate (hematitic). Weathered surface, dark brown-grey with sub-metallic lustre in part. Fresh surface, steel-grey (?) and brown. Sparse coarse clastics, sub-rounded, poorly sorted. Large lensoid mases of orange-red jasper to 1½' thick, containing some thin streaks and irregular masses steel-grey hematite (1/8"). Massive- rubbly.

Section I.F. - 37-62

345' - 347½'

Iron formation. Hematite, steel-grey and jasper. Discreet, continuous maroon bands to 3" containing thin 1/16" bands steel-grey hematite. Abundant elongated thin ¼" to 1/8" orange-red jasper nodules also thin continuous bands. Hematite - 50 to 55%. Blocky.

347½' - 359

Sandstone, Weathered surface, dark grey. Fresh surface, light brown-grey. Fine-to medium-grained, equigranular. Thinly bedded (½"). Platy. Recessive.

359' - 369'

Iron formation. Hematite, steel-grey and jasper. 4 to 6" discreet bands maroon hematite, containing abundant small birdseye nodules 1/8" thick. Discreet continuous maroon bands ½ - 4" thick. Crusty nodular aggregate bands, continuous, 1½" thick. Hematite - 55 to 60%. Blocky.

369' - 390'

Covered interval.

390' - 397'

Conglomerate (hematitic). Weathered surface, chocolate-brown. Fresh surface. Maroon to steel-grey. Well-rounded coarse clastics to cobble size, in a coarse sandy, hematite - silt - jasper matrix. Massive. Continuous 1½" lens (?) of maroon hematite. Hematite - 10 to 30%.

397' - 407'

Hematite sand. Weathered surface, maroon - red-grey. Fresh surface, maroon-grey sub-metallic. Medium-to coarse-grained, equigranular, compact. Upper 2" continuous 2 - 6" bands of nodular jasper and steel-grey hematite - alternating layers of hematite sand. Hematite - 30 to 40%.

407' -

Conglomerate.



FIG. 1

Cranswick River Valley. Looking north (downstream).



FIG. 2

Angular unconformity at base of ferruginous conglomerate.
(Between Map-Units 1 and 2)

PHOTO PLATE 1



FIG. 1
Exposure of ferruginous conglomerate.



FIG. 2
Angular unconformity at top of ferruginous conglomerate.
(Between Map Units 2 and 4)

PHOTO PLATE 2

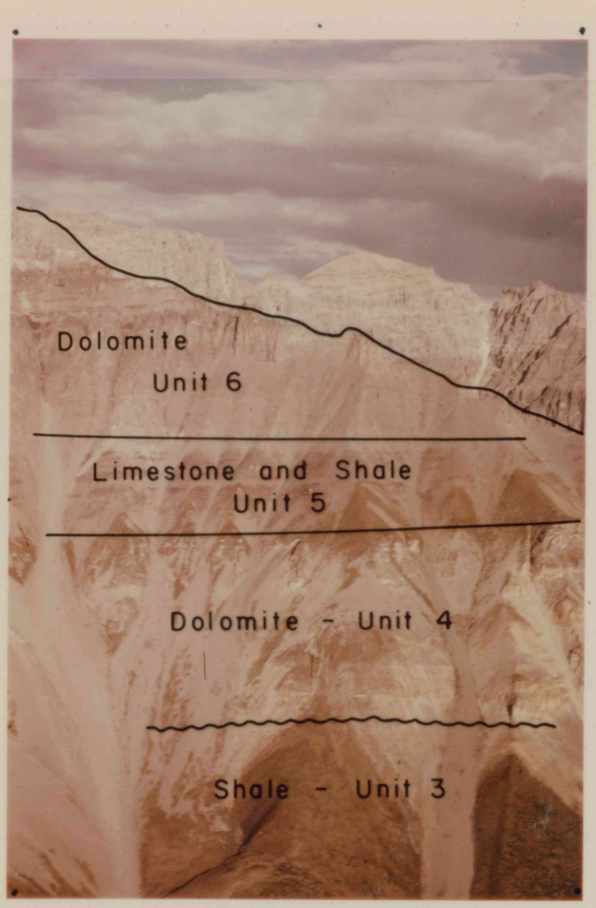


FIG. 1

Lower part of Paleozoic carbonate sequence. (Map Units 4, 5, 6 & 7)



FIG. 2

Typical outcropping of iron formation.

PHOTO PLATE 3



FIG. 1

Nodular iron formation.



FIG. 2

Nodular iron formation with aligned tabular plates of orange jasper. Note sample channel outlined in red paint.



FIG. 1

Nodular iron formation. Note the fragmented band of orange jasper below the painted mark.



FIG. 2

Banded iron formation; hematite predominant.

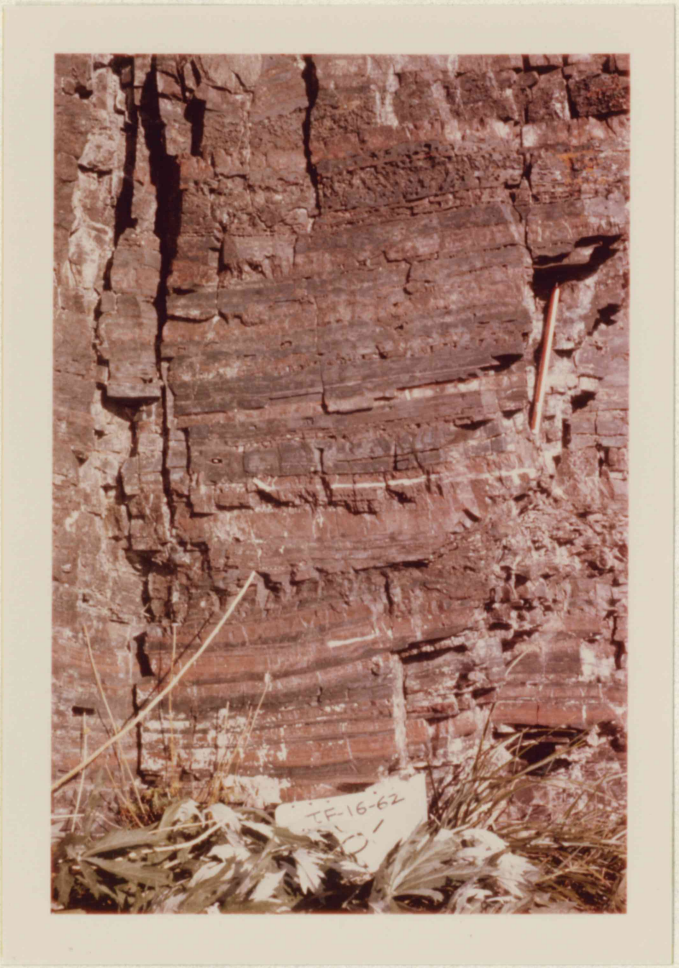


FIG. 1

Banded iron formation; jasper predominant.



FIG. 2

Dislocated maroon jasper band. Note flowage structure in hematite defined by orientation of orange jasper plates.

PHOTO PLATE 6



FIG. 1

Irregular iron formation. Note discordance in banding suggesting a "rolling up" of the jasper mass.



FIG. 2

Associated nodular and banded iron formation.

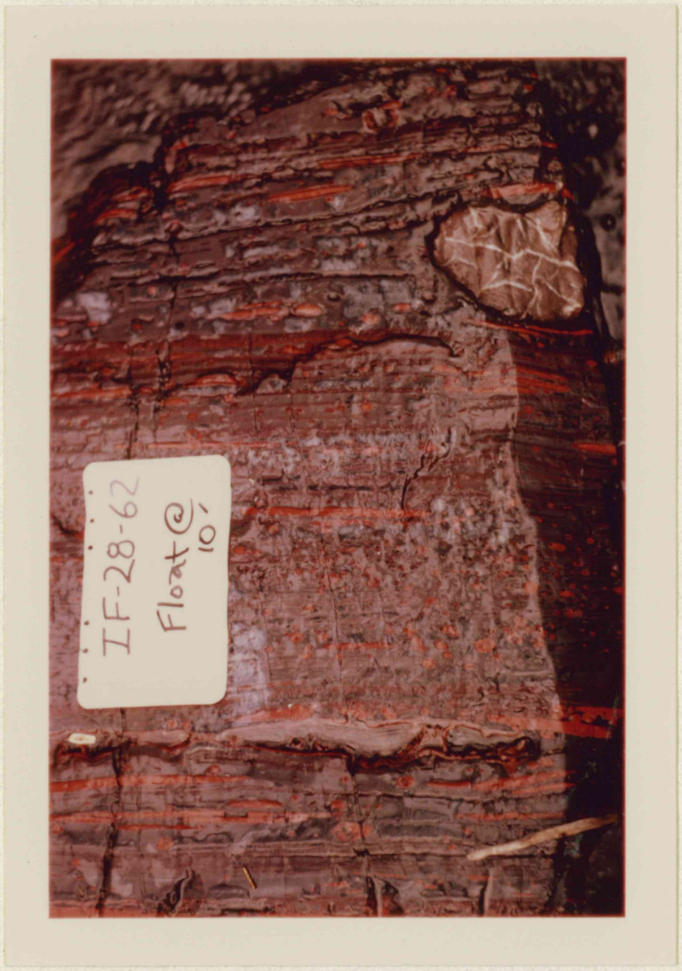


FIG. 1

Bed of banded iron formation with scattered jasper nodules between two beds of nodular iron formation. Note limestone pebble imbedded in hematite in upper-right corner.



FIG. 2

Banded iron formation with scattered chert nodules.

PHOTO PLATE 8



FIG. 1

Typical conglomeratic siltstone. Note pebble of orange jasper in upper-left corner. Boulder of nodular iron formation near head of axe is not in place.



FIG. 2

Large boulders of iron formation in conglomerate overlying main iron-rich zone.



FIG. 1

Sample channel in iron formation (outlined in red paint).



FIG. 2

Sample channel in iron formation (outlined in red paint).

091697

OPERATIONAL REPORT

GEOPHYSICAL SURVEYS

SNAKE RIVER PROPERTY, YK. and N.W.T.

for

CREST EXPLORATIONS LIMITED

September, 1962.

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OPERATIONAL REPORT

SNAKE RIVER PROPERTY
YK. and N. W. T.

INTRODUCTION

It is the purpose of the following remarks to outline the extent of the geophysical surveys that were conducted during August, 1962, on the Snake River claims group of Crest Explorations Limited by personnel of Sulmac Exploration Services Limited; to outline the procedures used and derivation of data, and to comment briefly on the results which accompany this report.

PURPOSE

The purpose of the programme, consisting of ground magnetic and gravimetric surveys over selected lines, was to determine the effectiveness of these techniques for the determination of iron ore, either directly or indirectly, through closely associated rock types.

Relative to the magnetic ground work, there was a co-ordination with a series of airborne magnetic profiles flown within the area by Varian equipped aircraft of Spartan Air Services Limited (flown August 12th, 1962).

For the above purpose, the diurnal for the period of flight was recorded from readings at base camp on a Watt's Magnetometer after synchronizing time.

A portion of two of the airborne lines was covered by ground magnetics (lines two and five Cranswick Creek Area).

PERSONNEL

The following personnel of Sulmac Exploration Services Limited performed the work:

D. W. Smellie, Ph. D., P. Eng.
- Geophysical Consultant

D. P. Robertson, B.A., P. Eng.
- Party Leader

W. Kleinhout
- Assistant

Dr. Smellie was concerned with the air survey and with the air-ground magnetic relations. After completing his assignment, he left the field on August 10th. Dr. R. Bostrom of California Standard accompanied the group to the camp and was instrumental in fitting the programme to the company's requirements and assisted as well in the ground work until his departure of August 12th, after which date, Robertson and Kleinhout with J. Brandt of Crest Explorations Limited, operated from a fly camp in the Cranswick Creek Area, Northwest Territories.

One day only was available in the field for calculation purposes, consequently, the considerable amount of gravity and magnetic raw data was processed after the return of the party to Calgary and Toronto. Preliminary field draughted profiles were, however,

completed at the base camp and, in several cases, these were subsequently re-calculated.

EQUIPMENT

The following equipment was used:

(1) Wild Theodolite - T16 with E stadia rod, 200 foot chain.

(2) Brunton compass

(3) Watt's Vertical Field Magnetometer, sensitivity 27.0γ/ Scale Division

(4) Sharpe A2 Vertical Field Magnetometer, sensitivity 20.0γ/ Scale Division

(5) Sharpe (Canadian) Gravimeter, sensitivity 0.1008 Mg/Scale Division

In addition, although auxiliary magnets were available for the vertical field magnetometers, unusually high magnetic responses would have been resolved with two standby Radar torsion wire magnetometers with a direct reading range of 300,000γ. In addition to the Theodolite was a Beaman Arc Alidade, and plane table provided by California Standard, but which was not required.

The usual standards of acceptance for reading the instruments were followed. The magnetometers were interpreted to .1 scale division after an adjustment in latitude was made. The gravimeter was also adjusted where required by latitude or elevation and read to .1 scale division (1/100th mg approximately).

Elevations were obtained to .1 foot by a Theodolite survey where gravity was used. In the Cranswick Creek Area, the five lines were tied together as to their relative gravity values and to their magnetic values with the exception of Line 1 and to elevations in the case of the first four. This was based upon an assumed elevation of approximately 2,500 feet for Station "O" on Line 1. This value approximates the one taken from the topographic map of the area.

Where only the magnetometers were used, slopes and horizontal angles were noted from a Brunton compass and the distance was measured by chain.

Diurnal and drift was accounted for in the magnetic surveys either by reading back to established bases on the lines or by keeping a base camp record of the diurnal. This was aided by looping in a series of base units with helicopter transportation.

The gravity bases were re-read every one to one and one-half hour intervals, and a looped series of bases established by helicopter.

RESULTS

A total of 13 lines was surveyed. These have been draughted in cross-sections, five in the Cranswick Creek Area, and the remainder in the general area of the base camp on Iron Creek.

The locations and attitudes of these lines are indicated on a portion of a topographic map enlarged from 4 miles equal 1 inch (Snake River Map, Topographic Series).

The lines will be described individually later in the report. The positions as shown, though undesirably small in scale, were selected using stereo photos ($\frac{1}{2}$ mile to 1 inch) and are believed accurate. Minor corrections may be made by Dr. R. Stuart whose knowledge of the geology and topographic details is, of course, necessary in the interpretation of the data. Because of this, comments on these profiles are preliminary only.

Due to the very rugged topography, gravity was run either in or adjacent to creek beds with little change in elevation or on elevated benches without steep slopes to eliminate terrain correction. The magnetic profiles, being unaffected by elevation, were surveyed on ridges having large changes in slope.

Gravity

As the gravity profiles were made to outline anticipated anomalies due to density difference between the hematite band and background density, it was necessary to compute the latter as no comprehensive average density was available from samples. A number of densities were tried in the calculations and the best one selected is shown, although additional profiles with alternate densities

are sometimes plotted.

The two lines in the South Iron Creek Valley and Number 5 line of Cranswick Creek Area appear to require densities of 5 to satisfy the levelling of the lines. These are considered excessive so that nominal values are used. The corrections applied to the respective lines are mentioned later.

Regional effect is not known but may be a factor as in South Iron Creek, where the terrain did not permit longer lines in the direction used. Also, in the case of the South Iron Creek profiles, bed rock configuration may have influenced the results.

Terrain effect is best reduced from information on detailed topographic maps which were not available and this information would not have been economical to obtain by stadia. This lack of correction will give a profile of a 'bumpy' character instead of a smooth flowing one.

Although the density difference between rock types in the area and that of hematite (+5) is large, this ideal situation could not be expected to prevail on any of the profiles and, in fact, probably does not according to geological information which indicates lensing out or thinning of beds (Iron Creek and South Iron Creek) or diminution of density due to jasper content (as evidenced by outcrops in the river in Cranswick Creek, near Line 2). Chances of obtaining

recognizable anomalies attributable to the iron are greatly diminished and, therefore, require the usual precautions of careful readings, of selecting stations, obtaining station elevations and calculation of data. Nevertheless, enough density can be expected here to be able to distinguish anomalies in spite of the lack of terrain correction.

As presented, the profiles are corrected for instrumental drift, for free air and Bouguer effects, and latitude effects, but not for regional or terrain effects.

MAGNETICS

The general level of response in the magnetic survey was low, particularly so since for most iron ore, some magnetite is usually present, and serves to give a direct relation between anomalies in iron rich bands.

In this area, the lowest level occurs with pre-conglomerate beds, and the highest is due to the conglomerate unit itself, with little recognizable response to the iron ore itself. As the broad conglomerate facies includes the iron band, magnetic surveys will not always distinguish between the two.

The usual operating procedure was employed for single line magnetometer surveys and each station was read twice. The average reading was then multiplied by the scale constant. Values

were corrected with reference to one station, usually Station "O" on each line, except as noted for the Cranswick Creek Area.

The Bear Ridge profile shows the clearest results since the formations are nearly vertical, which is an exceptional case. The magnetic profiles on the whole, while giving contrast between conglomerate and carbonates, do not show distinction between the iron band and the associated conglomerate. As the ineffectiveness of this technique became apparent, it was not employed in the South Iron Creek profiles, which are the last completed.

DISCUSSION OF PROFILES

(A) Cranswick Creek Area

In regard to the Cranswick Creek lines, horizontal and vertical control was made using stadia to complete the magnetic and gravity profiles.

Across the broad low area, where several branches of Cranswick Creek join, the location of the iron band is not known and all lines had the common purpose of indicating whether or not iron is present and in what relative amount. In accordance with the previous magnetics obtained around the base camp area, the survey here was not definitive as to iron content and will not be discussed. In this case, there may or may not be structural indications, depending on the amount of geological knowledge.

Several density values for calculation purposes were tried on most lines and the most appropriate used. The lowest value (d=2.0) was used on Line Number 4, as this seemed to give the best levelling effect and is in accord with its location in the broad flat-lying gravel stream bed.

On Line 1, it is possible that different densities may apply due to the presence or absence of lighter carbonates.

Line No. 1

There is an apparent terrain effect on Station 3. A high mountain rises to the south of Station "O" and the first few stations are on wet ground. The lower values on Stations "O" to "4" may be due to terrain effect from this feature.

There is a possible anomaly from Station "10" southward due to iron but the indication is not clear.

Obviously, a higher density than 2.8 would level out the line but the value used is as high as one should go in view of the presence of conglomerate.

Line No. 2

No geology survey was attempted while doing the lines but an outcrop of conglomerate was noted at Station "52" on this line, while opposite Station "72" in the river, a south dipping band of iron formation with considerable jasper content was seen.

Using a density of 2.8, it is believed that an anomaly from Station "54" to Station "69" and one from Station "71" to Station "89" are due to two bands of iron formation. As these are relatively near the surface, the milligal value of $1\frac{1}{2}$ reflects the lower grade material found in the river bed.

Line No. 3

The elevation profile rises at a constant rate from the north to the south end of the line (at 70). There are, however, minor fluctuations in the relief, giving rise to terrain effects between stations. There is an obvious terrain effect at Station "25".

On the whole, the gravity profile has been suitably corrected with a density of 2.7. There is some indication of an anomaly from Station "4" to "52" but again this may be caused by terrain effect. Unless geological information indicates otherwise, one may conclude that no iron band is present.

Line No. 4

This line lies in the centre of a broad gravel-bottomed valley with very uniform slope to the river bed so that the terrain effect is slight. The density used was 2.0 having regard to the presumably deep underlying layer of gravel. The gravity profile rises only slightly between Stations "20" to "50". This is probably due to bed rock configuration.

Line No. 5

A distinct anomaly exists on this line from Station "10" to the north end of the line whether a density of 2.5 is used or one of 5.0 (which was calculated to see what value was most appropriate to level the profile). As the calculations were done after the field work, there was no indication of this anomaly at the time the survey was made, otherwise the line would have been extended. It will be interesting to compare this anomaly with the geology of the iron formation known to occur on the east bank of the adjacent creek.

(B) Base Camp Profiles

South Iron Creek

Two profiles were run from a common zero point on the east side of South Iron Creek Valley as shown on the location map. The purpose of these lines was to detect the iron formation where it presumably crosses the valley floor at this point. After free air and Bouguer corrections, and latitude correction, a large anomalous trend exists on both lines rising towards the "O" Station.

It is difficult to analyze the cause of this feature. Obviously, an additional line is required running for a couple of miles down the valley across this section to obtain more information.

Approximately 200 feet east of Station "O", there are outcrops of conglomerate, with no iron observed for at least a few

hundred feet back. If the anomaly is the west flank of an anticlinal structure, then the surface of the iron should be exposed some distance up the draw, back of Station "O".

One would presume that the valley bed rock profile on section is "U" shaped. One can hardly conceive an asymmetrical bed rock profile with the deepest portion immediately below the west side mountains that would account for a rise in the gravity values as shown here.

More work will be required here before the answer will be known unless present geological knowledge can throw light on the problem.

Upper and Lower Iron Creek Profiles

As these two profiles were run on the creek bed gravel with a consistent change in elevation, any deviations from a smooth curve are due to bed rock irregularities or to the presence of iron.

Although the true profiles are some $2\frac{1}{2}$ miles apart, it appears that the rise in gravity at the lower end of the upper profile and a corresponding rise at the east end of the lower profile may be related and may indicate the presence of an intervening mass of iron formation. Geological knowledge and drill hole results will help to further the interpretation.

Base Camp Ridge Profile

This is a magnetic profile run from a ridge near base camp on a downward sloping incline, slope angles and chained distances being used for control. The purpose of this survey was to show the effect of magnetic survey in crossing from a conglomerate to a pre-conglomerate formation. There is a contrast between the two as indicated around Station "13" and the response of the carbonates and siltstones is lower. Outcrops observed place the contact at about this point. The usual erratic nature of magnetic survey over the conglomerate is evident here.

Transverse Profile

This profile was run to observe the magnetic effect over a contact of iron formation and conglomerate where the iron formation outcrops.

As with other profiles across the two rock types, no characteristic interpretation is obtained.

Iron Cap Ridge

This profile extends in a south to north direction from the valley bottom across the ridge to the river bed on the north side. As the contacts indicate, this is a simple geological picture. The iron formation is exposed on top of the ridge and has a small dip which is common to the area.

This profile is an excellent example for the method used. The effect from the iron formation is similar in character and amplitude to that of the conglomerate. No differentiation is possible and in this respect as the magnetic survey does not provide useful information. On the north flank of this profile, as in the Bear Ridge profile, the contrast in susceptibility between pre-conglomerate and the conglomerate-iron formation series is evident.

Bear Ridge Profile

The low response of pre-conglomerate and the erratic character of the magnetic values from the conglomerate are quite evident in this profile. The distinction between the types is intensified because of the nearly vertical attitude of the beds.

The iron formation, even here, cannot be identified or separated from conglomerate in the profile.

COMMENT ON METHODS

Magnetic Surveys

Sufficient profiles were obtained under varied geological conditions to evaluate this technique in this area. It is obvious that the results on the ground do not distinguish iron formation from conglomerate and its further use for this purpose is not recommended.

Gravity Surveys

Some factors detrimental to this method are:

(1) Lack of bed rock information.

(2) Lack of information for terrain corrections on the line.

(3) Limitation of locations to areas away from the large terrain features.

(4) Limited information available on character of ore (i.e., jasper to hematite ratio, thickness, attitude) affecting interpretation of the data.

Terrain effect is not a problem, although not entirely tested. However, it is judged that an anomaly would still be apparent.

Having regard to the above factors, the method is a valid one as used in this area for the detection of iron in overburden areas. As with all gravity surveys, the more information available about depths to bed rock, densities, geology, etc., the more specific can be the interpretation. Stadia control is preferable over altimeters for control in the type of survey conducted.

The following points are suggestions for the improvement of gravity surveys:

(1) Either a computer should be employed, or time be allowed for computations by the crew every two or three lines, so that the computed profile can be kept up to date. This would allow inspection as to extensions of lines or re-reading of stations to be done while in the area.

(2) A depth of overburden seismic survey should be considered as in South Iron Creek for depth to bed rock determinations.

The use of helicopters to establish base stations greatly speeds up the production. This was done in the present survey.

Respectfully submitted,

SULMAC EXPLORATION SERVICES LIMITED

D. P. Robertson, P. Eng.

Toronto, Ontario

September 15, 1962

OPERATIONAL REPORT

AIRBORNE MAGNETIC SURVEY

SNAKE RIVER PROPERTY, YUKON AND N.W.T.

FOR

CREST EXPLORATIONS LIMITED

091697

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INTRODUCTION

The following report describes the performance of a reconnaissance airborne magnetic survey conducted over four selected lines traversing the iron bearing formations on the property staked by Crest Explorations Limited, in the Snake River area. Instrumentation, purpose of survey, description of method and some comments on results are included.

PURPOSE

During August 1962, a combination gravity and magnetic ground survey was conducted on selected portions of the claim area. It consisted of a series of separate profiles whose purpose was to determine the effectiveness of the techniques in locating the iron bearing formations and in defining its magnitude, if possible, in overburden areas.

At the same time it was considered essential to determine if the iron bearing beds would give a response to an airborne magnetometer, sufficiently strong that this method could be used to locate extensions to the known zone, laterally or down dip or to locate new prospects in other areas by means of a regional survey.

Two lines in the Cranswick Creek area were flown over two lines located on the ground.

INSTRUMENTATION

The survey was flown by Spartan Air Services Limited using an Aztec twin engine aircraft equipped with a Varian Proton Precession Magnetometer. A crew of three were employed, the navigator, operator, and captain T. Appleton.

The Varian instrument provides data in strip record form of the earth's total magnetic intensity. Readings are recorded every 0.6 seconds and the sensitivity is from 0.5 gamma to 1.0 gamma. At the speed of the aircraft - about 120 miles per hour, a total intensity reading is taken over 106 feet, approximately. A continuous recording altimeter is kept and track flown is recovered by use of a 35 millimeter tracking camera. Fiducial points are marked simultaneously on the film and tapes.

Ordinarily, diurnal variations are noted on a Varian type station recorder located in the vicinity of the survey. As this was impractical for several reasons, a Watt's Magnetometer, sensitivity 20 gammas per scale division, was set up at the base camp of the project, and after synchronizing times with the aircraft on the day of the flight, readings were taken every minute.

Tenths of scale divisions were read - probably errors in readings should not exceed three to four gammas.

The results of this ground diurnal record, were incorporated in the airmagnetic profiles, the form in which the results were presented.

SELECTION OF LINES

The locations of the lines flown were chosen in the field under the direction of Dr. R. Stuart, Project Manager. Regard was given to the number of survey miles to be flown, approximately 160, and to the geology of the deposits.

Other factors of topography and flying capabilities had to be considered.

At a point, about fiducial Number 183, on flight line Number 2, a ground magnetic line was run for about 10,000 feet. On line Number 3, the portion between fiducials 261 and 264, approximately, was also covered on the ground.

A map indicating these flown lines and flight directions accompanies this report. Marked on the trace of these lines are fiducial numbers corresponding to those on the tapes.

Line Number 1

To be flown at constant altitude to clear mountain tops, direction Southwest to Northeast.

Line Number 2

To be flown at 1,000 feet terrain clearance, as near as possible from the head waters of the west branch of the Cranswick Creek, Northeast up the Cranswick Creek Valley.

Line Number 3

This line was to be flown at 1,000 feet terrain clearance and again at 6,000 feet constant altitude. It was in fact flown at 1,000 feet terrain clearance and 4,000 feet constant altitude.

Line Number 4

The longest line, was to be flown from the point indicated on the North (well beyond the iron occurence), to a point about 45 miles South of the base camp at a constant altitude to give a one line regional profile over the area.

The aircraft operated out of Norman Wells some 150 miles to the East. Due to weather conditions the survey was completed on August 12th, five days after arrival at that airport. In all, 220 miles of survey were completed,

and the results given in profile form. The lines were flown substantially as requested.

RESULTS

To do a detailed analysis of the results would require relating the location of anomalies to the geology in the area of the deposits. Since the path is recovered on an air photo mosaic and numerous fiducial points are marked, this can be done. A profile of the detailed geology, where known, placed on each profile would most readily show the relationship.

However, this detailed information is not available to the writer. This correlating is, in fact, beyond the requirements of the survey which were to obtain the data.

The profiles as a whole, show only slight changes in magnetic 'relief'. A regional trend increasing to the North is evident in them, with a rise of about 400 gammas, in 40 miles in a North East direction. Line Number 1 gives the greatest slope whereas line Number 4, which is more Northerly, gives a lesser gradient.

All lines appear to indicate the anomalous conglomerate band with which the iron formation is associated, although, here again the anomalies must be located with regard

to the geology mapped by Crest Explorations Limited. The anomalies arising from this zone are roughly 100 gammas to 150 gammas, depending on the altitude flown. Though not large, they are quite evident on the profiles.

The regional rise may be due to the Pre-Cambrian basement lying closer to the surface at the North end of the traverse. This assumption is substantiated by the change of relief from a mountainous to a broad valley topography, about 20 to 25 miles North of base camp, which suggests, as one would expect, that the sediments forming the mountains occupy the South flank of a basin dipping to the Southwest.

Line 1

Flight direction Southwest to Northeast. At fiducials 484, 492, 497, sharp to small anomalies reflect the conglomerate and iron formation on the hills Southwest of South Iron Creek, and the outcrops Northeast of the main base.

Line 2

The anomalous portion of the profile is found from fiducials 180 to 185. Referring to the mosaic, this lies in the area in which Dr. Stuart was interested, believing the iron formation to cross the creek in this vicinity.

In fact some outcrops were noted in the creek on the east bank at station 72, of the ground survey. Two gravity anomalies on the ground between stations 54 and 69, are indicative of this iron. The ground magnetic profile is not as clear.

Line 3

This line was flown twice, once in a Northeast, Southwest direction and in the reverse direction. Altitudes of 1,000 feet terrain clearance and 4,000 feet constant altitude were maintained.

A very close correspondence between the two profiles is apparent if one is reversed on the other, with fiducials 266 and 230 coinciding. The average decrease in amplitude from 1,000 feet to 4,000 feet is about 25 gammas. At the fiducial points mentioned, the anomalies indicate that the conglomerate, if not the iron, continues East past this point, beyond its detected presence in the west branch of Cranswick Creek.

A sheared conglomerate outcrop was found on the approximate location of an East West fault shown on the map, which Dr. Stuart believed existed in that location.

From an inspection of the photo mosaic at this time, I believe that the north end of the ground survey line

Number 4, Cranswick Creek, had not quite reached the anomalous zone detected in the air survey, which explains the absence of this feature on the ground profile.

Line 4

Flight direction North to South on this line; the section between fiducials 350 and 360 shows the anomalous effects of the conglomerate facies from my recollection of the geology at the plotted points. At fiducials 390 and 398, there are much larger anomalies. The ground at these points might well be prospected to explain them. Possibly the conglomerate series outcrop again at high altitudes and may still contain iron of interest.

Note: These fiducials are located beyond the boundary of the mosaic supplied and the points would have to be picked for the exact locations.

COMMENT

A copy of Dr. Smellie's memorandum, prepared at the time of reviewing the raw data in September 1962, is enclosed with the report. It should be pointed out that the difficulty he mentioned of picking up anomalies on valley bottoms does not apply to the flights which were flown along rather than across the structures.

I believe that a close study of these profiles with interpretation work, in conjunction with geological data would be advantageous, particularly in the East part of the claim group.

If the iron formation does not outcrop there, it appears likely that additional airborne lines would detect the anomalous horizon marker, which is the conglomerate, and that either gravity surveys over the anomalous zone or drilling would provide the required information on the presence or absence of the iron.

RECOMMENDATIONS

Consideration should be given to:

1. Investigating the reasons for anomalies at 390 and 398 on line Number 4,
2. Possible additional lines to be flown to the East of the claim area to follow the conglomerate horizon marker.

Respectfully submitted

SPARTAN AIR SERVICES LIMITED

D. R. Robertson, P.Eng.

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

Toronto, Ontario
May 14th, 1963

C E R T I F I C A T E

I, DONALD PETER ROBERTSON, of Cooksville, Ontario, Toronto Township, do hereby certify:

1. That I am a geologist residing at 2131 Courtland Crescent, Cooksville, Ontario,

2. That I am a graduate of Queens University with a B.A. degree in Geology and that I have been practicing my profession for 22 years,

3. That I am a Registered Professional Engineer of the Provinces of Ontario and Manitoba, a Fellow of the Geological Association of Canada and other professional organizations,

4. That I have compiled this report from personal knowledge of the operation, having assisted in the planning and execution of it.

D. P. Robertson, P.Eng.
SPARTAN AIR SERVICES LIMITED

REGISTERED PROFESSIONAL ENGINEER
D. P. ROBERTSON
PROVINCE OF ONTARIO

Dated this 14th day of May 1963

Copy of Memorandum from Dr. D. W. Smellie
Dated: August 2nd, 1962

GEOPHYSICAL TEST WORK, SNAKE RIVER AREA, YUKON TERRITORY, FOR CREST EXPLORATIONS LIMITED

I participated in ground magnetic and gravity test work in the Snake River area between August 3 and 10, in company with Mr. D. P. Robertson. We did selected traverses of the Iron Formation and adjacent formations. Only the Sharpe A-2 magnetometer was used on rugged topography. Work with the Sharpe "Canadian" gravimeter was confined to valley bottoms. Mr. Robertson will be in the best position to report on the gravity work. The ground magnetic anomaly over the I.F. was only about 200 - 500 gammas, with slightly less intensity over the conglomerate, the latter occurring both above and below the I.F. The pattern over both formations was erratic. My calculations on the basis of these results indicated that the corresponding aeromagnetic anomaly at a height of 1000 - 2000 feet would be of the order of 50 - 100 gammas, but that the anomaly from a greater depth, i.e. valley bottoms, might be difficult to pick on the aeromagnetic records. The remaining problem was to establish that these weak anomalies could be recognized on the aeromagnetic

tapes and distinguished from the more regional variation due to basement effects.

I inspected the aeromagnetic record tapes from Spartan's test survey in the Snake River area on August 18. Low amplitude but localized anomalies were recognized that correlated with iron formation and associated ferruginous conglomerate. They showed on the 1000 ft. MTC profiles in the Cranswick Creek area but were not readily discernible on the 6000 ft. ASL profile. Elsewhere, the 6000 ft. ASL flying revealed recognizable anomalies in some cases where the magnetic horizon was near mountain-top level, but did not readily detect the horizon in valley bottoms. The converse relationship, i.e. the I.F. being always marked by an aeromagnetic anomaly, is not firmly established.

It is known from our ground reconnaissance that the ferruginous conglomerate is almost as magnetic as the iron formation. If the magnetic ferruginous conglomerate occurs only adjacent to iron formation, then magnetic anomalies are a good pointer to I.F. The green conglomerate to the southwest of the Snake River showed no aeromagnetic anomaly, so that this may be the case.

We do not know the variation of magnetic polarization from place to place with the I.F. Generally speaking, however,

it seems possible in most cases to detect the magnetic horizon with 6000 ft. ASL flying when it is near mountain-top elevation. At a guess, I would say 2000 feet below the aircraft is quite feasible. There is also a good possibility that it can be detected in the valley bottoms with the aid of special interpretational techniques such as the Downward Continuation method. These points were discussed with Dr. Bostrom of California Standard Company this morning.

I expressed the opinion that aeromagnetic work at constant height above sea level would serve as a good reconnaissance for areas of Iron Formation but would not serve to map it in detail. Dr. Bostrom was of the opinion that they should come to a decision on future work when they can compare the geophysical test data with this season's geological mapping.

NATIONAL TOPOGRAPHIC SYSTEM 1:250,000 **CANADA** FIRST EDITION SHEET 106 F

SNAKE RIVER

YUKON TERRITORY-NORTHWEST TERRITORIES

(1387)

Scale 1:250,000

1 Inch to 4 Miles Approximately

Miles 5 0 5 10 15 20 Miles

Kilometres 5 0 5 10 15 20 25 30 Kilometres

Transverse Mercator Projection

Contour interval 500 Feet
Elevations in Feet above Mean Sea Level
North American Datum 1927

Produced and printed by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF MINES AND TECHNICAL SURVEYS, 1959, from air photographs taken in 1949, 1953 and 1954.

Copies may be obtained from the Map Distribution Office, Department of Mines and Technical Surveys, Ottawa, at 25 cents each.

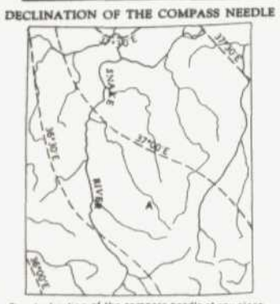
REFERENCE

Wagon or winter road
Trail or portage
Boundary: provincial
Village or settlement O
Post office P
Building or cabin •
Horizontal control point △
Astronomical position ⊕
Spot elevation (in feet) .2905

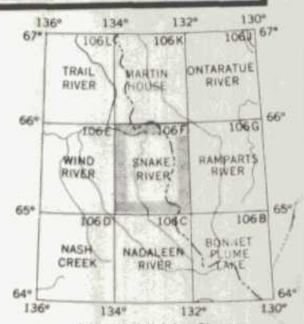
REFERENCE

Streams:
intermittent or dry
dry river bed
Sand, gravel or mud
Marsh or swamp
Intermittent lake
Contours:
elevation 2500
depression 2500
approximate 2500
Forest

THE DECLINATION OF THE COMPASS NEEDLE 1959



The declination of the compass needle at any place along a broken line is the declination given on that broken line. At other places the declination is between those given on the neighbouring broken lines; thus at the place marked A, the declination is between 36°30'E and 37°00'E. The declination of the



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091697

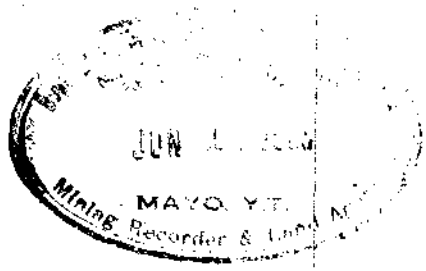
Department of Engineering & Metallurgy

File 512.4

Report of Investigation
No. 0-63306

A Continued Study of the Beneficiation Characteristics of Iron Ore from the Snake River Iron Ore Deposit

Crest Exploration Ltd.



M. O. PEARCE

March 4th, 1963

Report of Investigation No. 0-63306

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Report of Investigation
No. O-63306

A Continued Study of the Beneficiation Characteristics of Iron Ore from the Snake River Iron Ore Deposit

Crest Exploration Ltd.

INTRODUCTION

During the latter part of 1962, the Ontario Research Foundation undertook an investigation to evaluate the mineral dressing potential of a sample of iron ore from the Snake River deposit in the Yukon Territory.

This investigation mainly comprised a mineralogical examination of the ore along with a study of the amenability of the ore to sink float or gravity concentration, these methods being the most economical types of separation.

The results of this testwork, completed on fourteen samples from section IF-13-62, were reported on December 12th, 1962, in O.R.F. Report No. O-62341.

On January 7th, 1963, Dr. C. D. Dahlstrom of Crest Exploration Limited, requested that O.R.F. proceed with a test program outlined by our Mr. R. L. Cavanagh in a letter dated December 21st, 1962.

Briefly, this testwork consisted of:

(1) Magnetizing roast tests followed by magnetic tube tests,

(2) Flotation tests both anionic and cationic,

(3) A grindability study,

(4) High intensity magnetic separation tests, and

(5) Chemical leaching tests.

INTRODUCTION - cont'd

In a telephone conversation with Mr. M. Pearce on February 8th, 1963, Dr. Dahlstrom also requested that O.R.F. pursue a brief study, investigating the possibilities of removing gangue from a sponge iron product.

In order to complete this investigation, Crest Exploration submitted thirteen new samples from section IF-13-62.

SUMMARY AND CONCLUSIONS

1. HEAD ANALYSIS

The average head analysis of the thirteen "as received" samples was 43.9 percent total iron. This analysis was considerably lower than the average head analysis (47.3 percent total iron) of the fourteen original samples from section IF-13-62, which were treated during the previous investigation.

2. MAGNETIC ROASTING TESTS

Minus 10 mesh heads of each of the "as received" samples were roasted for one hour at 1650°F under equilibrium conditions ($\frac{5\ CO_2}{1\ CO}$).

Head samples of each magnetic roast product were ground to -100 mesh and -325 mesh. These samples along with the "as roasted" -10 mesh heads were tested in the Davis Tube, a laboratory wet magnetic testing device.

The overall average grade of concentrate and recovery produced at each grind was as follows:

Grind	Average Concentrate (% Fe)	Average Fe Recovery (%)
"As Roasted"		
-10 Mesh	49.3	99.5
-100 Mesh	57.8	93.5
-325 Mesh	60.2	91.1

SUMMARY AND CONCLUSIONS - cont'd

2. MAGNETIC ROASTING TESTS - cont'd

A composite head sample was roasted under identical conditions to those described above. The roast product was ground to -325, -400 and -500 mesh, and was then tested in the Davis Tube. In these tests the Davis Tube conditions were altered to give a more severe rinsing action and thus a higher grade concentrate.

The following results were obtained:-

Grind	Concentrate (% Fe)	Fe Recovery (%)
-325 Mesh	61.4	90.0
-400 Mesh	61.5	89.3
-500 Mesh	62.3	89.0

Premium grade concentrates (+ 66% Fe) were not achieved even after grinding to 500 mesh (25 μ).

These tests once again indicate the extremely fine grained nature of the Snake River ore, as previously determined by mineralogical examination (O.R.F. Report No. 0-62341).

3. FLOTATION TESTS

A series of flotation tests were completed using samples of the following products as feed to the flotation cell:

a) An overall composite head sample,
b) A spiral concentrate,
c) A -200 mesh slime fraction,
d) A calcined head sample, and
e) A composite head sample.

which had been roasted to magnetite and then concentrated.

These tests indicated that it would be difficult to achieve any significant concentration using froth flotation methods. The standard or usual procedures, successful on most iron ores were not effective.

SUMMARY AND CONCLUSIONS - cont'd

3. FLOTATION TESTS - cont'd

The highest concentrate grade achieved using flotation on a composite head sample was 53.1 total iron. The corresponding iron recovery in this particular test was 52.9 percent.

The relatively poor beneficiation achieved during these tests can probably be attributed to the presence of extremely fine middling particles, even after grinding to -200 mesh. These fine middlings effectively reduce the selectivity of the flotation reagents.

4. GRINDABILITY

A standard grindability test was completed at -28 mesh. This grind was chosen since it was felt that in any commercial operation, there would be preliminary roughing separation in this size range.

The ball mill work index (Wi) obtained at this size was 21.8. The work index is the comminution parameter which expresses the resistance of the material to crushing and grinding.

During the testwork, it was found that the reduction ratio was different for each passing size. A corrected figure based on an average reduction ratio was calculated as 18.5.

These figures are relatively high when compared with the average values quoted in the literature for various iron ores.*

	Wi
Hematite	12.68
Specular Hematite	15.40
Limonite	8.45
Magnetite	10.21
Taconite	14.87

* Reference - Crushing and Grinding with Pyro-Processing
F. C. Bond, Pit and Quarry, January 1962

SUMMARY AND CONCLUSIONS - cont'd

5. HIGH INTENSITY SEPARATION

Tests conducted on a -20 mesh composite head sample, sized into narrow screen fractions, indicated that this method of concentration had little potential as far as the Snake River ore is concerned.

The highest concentrate grade obtained was from a -20 +48 mesh screen fraction. A grade of 51.9 percent iron with a recovery of 59.8 percent of the iron values in the screen fraction was the best separation achieved.

In each test there was a definite visible separation, a tailing product being rejected from the laminated rotor and a concentrate product being pinned to the rotor. However, the poor separation achieved can probably be attributed to the relative absence of completely liberated grains even in the finer screen fractions.

6. CHEMICAL TREATMENT

A rather complicated flowsheet was attempted in an effort to upgrade the ore. This flowsheet included the following stages:

(i) Grinding to -10 mesh;

(ii) Magnetic roasting;

(iii) Grinding to -65 mesh followed by a roughen magnetic separation;

(iv) A low temperature pressure leach; and

(v) Grinding to -325 mesh followed by a cleaner magnetic separation.

This flowsheet produced a concentrate grading 66.2 percent iron from a composite head analyzing 44.4 percent iron. The iron recovery in the concentrate was 92.4 percent.

Another test was attempted using a flowsheet which consisted of:

(i) Grinding to -48 mesh;

(ii) Tabling to produce a concentrate;

(iii) A steam, chemical leaching roast on the table concentrate; and

(iv) Tabling of the roasted product.

SUMMARY AND CONCLUSIONS - cont'd

6. CHEMICAL TREATMENT - cont'd

This flowsheet produced a concentrate grading 65.4 percent iron. The iron recovery was low (17.1 percent) but this was due to the fact that

a) the test was of a preliminary nature only, designed to determine the possibility of producing any high grade concentrate,

b) the capacity of the roasting furnace was relatively small, necessitating the use of the table as a concentrating device, and

c) middling products from both tabling stages were not treated.

7. MAGNETIC SEPARATION OF A GROUND SPONGE IRON PRODUCT

The possibility of eliminating gangue more readily from a sponge iron product was considered.

A composite head sample was reduced to sponge iron (82.0% reduction). The sample was then ground to -325 mesh and separated in the Davis Tube using a high wash water flow and a low field strength. The Davis Tube concentrate produced during this test along with that produced in a similar test using a magnetically roasted product are summarized as follows:

	Davis Tube Concentrate			
Product	% Fe	% Fe Rec.	% SiO_2	% P
Magnetite (-325 M)	61.4	90.0	11.5	0.33
Sponge Iron (-325 M)	78.5	93.6	16.2	0.30

There does not appear to be any improvement in gangue elimination from the sponge iron product. If the magnetite concentrate considered above was reduced to sponge iron, the calculated silica content of the final product would increase to approximately 15.0 percent.

RECOMMENDATIONS

Magnetic roasting, followed by fine grinding and magnetic separation did not produce the premium grade concentrates (+ 66% Fe) which would most likely be necessary for a profitable operation. This is particularly true when considering the additional financial burden involved in agglomerating any fine concentrate product.

Neither flotation nor high intensity magnetic separation appeared to have any promise or potential as methods of beneficiating this ore.

One promising aspect of the investigation has been the concentration obtained after chemical leaching.

A flowsheet comprising magnetic roasting, grinding and magnetic separation, pressure leaching and further grinding and magnetic separation produced both a high grade concentrate (66.2 percent total iron) and a high iron recovery (92.4%). At the present stage, such a flowsheet is probably of a more academic than practical value.

A second flowsheet combining gravity separation on a table, a low temperature steam leach, and a final table separation produced a high grade concentrate (65.4 percent total iron). Concentrate grade was the prime consideration during this test and consequently iron recovery was neglected. However, recovery could certainly be improved if the middling products from both tabling operations were given further treatment. This flowsheet would be both simpler and cheaper than the first flowsheet outlined above.

It would probably be worthwhile investigating this flowsheet more thoroughly on a larger scale. The table could then be replaced by a more suitable unit such as a Humphrey spiral or a vibrating MacNutt spiral.

SAMPLE DISPOSAL

Test products will be held for a six month period. They will then be disposed of unless notified otherwise.

TESTWORK BY

J. Biskupski

P. Meredith

A. Risdon

M. Pearce

M. Pearce, P.Eng.,
Research Engineer,
Department of
Engineering and Metallurgy.

March 4th, 1963.

MP:mcd

ORE DRESSING TESTS

Test Procedure and Results

1) Head Samples - Chemical Analyses

Heads of all the footage samples were split out for iron analyses.

The average head analysis was 43.9 percent total iron. Most analyses differed considerably from those previously obtained on footage samples from the same section. O.R.F. has rechecked both sampling and analytical procedures and can trace no error. Any discrepancies are probably due to the original sampling operation.

Table I summarizes the chemical analyses on the "as received" samples.

2) Magnetic Roasting Tests

Minus 10 mesh heads of all the footage samples were roasted in a small externally heated rotary kiln using the following conditions:

Time	-	60 minutes
Temperature	-	1650°F
Atmosphere	-	5/1 CO_2/CO (Total 9.0 cfh)

The samples were preheated to the roasting temperature in air. After roasting, the samples were cooled in nitrogen.

Ferrous and total iron analyses on the roasted products indicated that the roasting tests had been quite efficient.

Samples of the "as received" heads were concentrated in the Davis Tube. Samples were also ground to -100 and -325 mesh for Davis Tube concentration. Standard Davis Tube conditions were used in these tests:

Wash water	-	200 ccs/min
Oscillations	-	100 strokes/min
Amperage	-	2.0 amperes

Test Procedure and Results - cont'd

2) Magnetic Roasting Tests - cont'd

Test results are summarized in Tables II and III.

A composite head sample was also roasted under conditions similar to those described above. The roast product was ground to -325, -400 and -500 mesh and tested in the Davis Tube. The test conditions were altered to give a more severe rinsing action and a cleaner concentrate.

Wash water	-	300 ccs/min
Oscillations	-	100 strokes/min
Amperage	-	1.5 amperes

A similar series of tests was completed on Sample No. 4, which had produced the highest grade concentrate in the series of tests using standard Davis Tube conditions. These tests are summarized in Table IV.

Premium grade (+ 66% total iron) concentrates were not obtained even after grinding to -500 mesh.

3) Flotation Testwork

A series of tests was undertaken to determine the potential of flotation as a method of beneficiating:

(a) a composite sample as a whole,

(b) a sample of the -200 mesh material, removed prior to the spiral operation. (Note O.R.F. Report No. 0-62341),

(c) a composite head sample which had been calcined,

(d) a composite head sample which had been roasted to Fe_3O_4, and

(e) a sample of spiral concentrate. (Note O.R.F. Report No. 0-62341).

Test Procedure and Results - cont'd

During this phase of the investigation, the following approaches were considered:

(i) Anionic flotation of the SiO_2,

(ii) Cationic flotation of the SiO_2,

(iii) Anionic flotation of the Fe with fatty acids, and

(iv) Anionic sulphonate flotation of the iron.

All flotation tests were done in a 600 gram Fagereen cell. No significant upgrading was achieved in any of the forty-one flotation tests. In many tests, microscopic examination of the flotation products was sufficient to show that little beneficiation had been achieved.

The remaining test results are outlined in Tables V, VI, VII and VIII.

The relatively poor separation attained can be traced to:

(1) the presence of extremely fine middlings and the necessity of fine grinding to eliminate as many of these middling particles as possible;

(2) the production of slimes during grinding.

4) Grindability

A standard feed was prepared for a grindability test by stage crushing a head sample of the Snake River ore to -4 mesh. This sample was given a screen analysis to determine the size distribution (Table IX).

The weight of 700 ccs. of -4 mesh feed was placed in a 12" x 12" ball mill and ground for 100 revolutions. The ball charge weighed approximately 20,125 gms. and had a surface area of about 842 square inches.

After the first grinding period, the mill was dumped and the charge was screened at -28 mesh, the particular grind considered during this investigation. The undersize was weighed and fresh feed was added to the oversize to bring its weight back to that of the original charge. It was

Test Procedure and Results - cont'd

4) Grindability - cont'd

then returned to the mill and ground for the number of revolutions calculated to produce a 250 percent recirculating load. The number of revolutions required is calculated from the results of the previous grinding period to produce sieve undersize equal to 1/3.5 of the original total charge in the mill.

The grinding cycles were continued until the net grams of sieve undersize produced per mill revolution approached equilibrium. Generally, equilibrium is reached before the test is discontinued, but in this case the number of grinding cycles was exceptionally high and the feed which had been prepared was completely used. However, it is apparent from Graph I that the equilibrium value will be close to 1.2 gms/revolution.

The undersize and the circulating load were then screen analyzed as indicated in Table IX and plotted in Graph II.

The ball mill work index (Wi) was calculated using the Bond equation:

$$\underset{(28\ \text{mesh})P_i}{Wi} = \frac{44.5}{0.23 \times G_{bp}^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)} = \underline{21.8}$$

where:

G_{bp} = ball mill grindability (1.2 gms/rev)

F = size in microns which 80% of the new ball mill feed passes (2470 μ)

P = size in microns which 80% of the last cycle undersize product passes (410 μ)

The work index value was now introduced in the basic work index equation, which in various forms can be used in nearly all crushing and grinding problems:

Test Procedure and Results - cont'd

4) Grindability - cont'd

$$W = \frac{10\ Wi}{\sqrt{P}} - \frac{10\ Wi}{\sqrt{F}} = \underline{\underline{6.37}}\ \text{Kwh/short ton}$$

where:

W = energy input in Kwh/short ton

Wi = work index

P = product size, expressed as the size in microns of the square opening through which 80% of the ground product passes

F = feed size, expressed as the size in microns of the square opening through which 80% of the crushed feed will pass

Thus, 6.37 Kwh/short ton is the calculated required work input to reduce from feed size F to product size P.

If the material is homogenous to size reduction, Wi will be constant for all size reduction stages. However, this is not the case with the Snake River ore. Graph II shows that the feed and product sizing are not parallel on a log-log plot. This indicates that the reduction ratio is different for each passing size. The Wi has been corrected on the basis of an average value of the reduction ratio and the latest Bond work index formula has been applied.

$$W = Wi\frac{\sqrt{Rr - 1}}{\sqrt{Rr}} - \sqrt{\frac{100}{P}} = \underline{\underline{6.37}}\ \text{Kwh/ton}$$

where:

Rr = reduction ratio = $\frac{2470}{410} = \underline{\underline{6.0}}$

Since product sizing is not parallel to feed sizing on the log-log plot, the reduction ratio varies as follows:

Test Procedure and Results - cont'd

4) Grindability - cont'd

% Passing	Reduction Ratio
90%	6.2
70%	6.6
50%	8.0
30%	11.4
10%	21.7
Average =	10.8

Using W, previously computed as 6.37 Kwh/short ton, the work index is recalculated as:

$$Wi = W \times \frac{Rr}{Rr - 1} \times \frac{P}{100}$$

$$= 6.37 \times \frac{3.286}{2.286} \times \frac{20.249}{10}$$

$$= \underline{18.5}$$

Numerically, the work index is the Kwh per short ton required to produce a product 80% of which passes a 100 μ opening or 67 percent passing -200 mesh.

5) High Intensity Separation

High intensity magnetic separation tests were run on a laboratory model Carpco induced roll unit. A head sample was stage ground to -20 mesh and then closely sized into screen fractions.

Test Procedure and Results - cont'd

5) High Intensity Separation - cont'd

Screen Fraction	% Wt.	% Fe
-20 +48 mesh	67.3	45.1
-48 +65 mesh	9.1	43.2
-65 +100 mesh	7.6	43.2
-100 +200 mesh	6.9	43.3
-200 +325 mesh	3.8	42.4
-325 mesh	5.3	45.5

Each screen fraction was individually treated on the Carpco separator.

Amperage	-	2.0
Speed	-	60 - 80 rpm

All of the samples exhibited a definite visible separation with the exception of the -325 mesh fraction. This fine material agglomerated in the feeding ropper.

The test results, summarized in Table X, indicate that this method of treatment is not suitable for this ore.

6) Chemical Treatment

Two preliminary flowsheets, both of which included a chemical leaching step, were tested.

Flowsheet 1 (note Figure 1) was based on a pressure leach on a roasted concentrate. The leached product was ground in a laboratory rod mill for two, ten and twenty minutes. Samples of the ground product were taken after each interval and tested in the Davis Tube.

A -325 mesh grind produced a Davis Tube concentrate analyzing 66.2 percent iron. Iron recovery in this concentrate was 92.4 percent.

Test Procedure and Results - cont'd

6) Chemical Treatment - cont'd

The test results are outlined in Figure 1.

A second flowsheet (Flowsheet 2, Figure 2) was also tested. This flowsheet was considerably simpler than the previous flowsheet since gravity separation was used to replace the more expensive magnetic roasting and magnetic separation. The prime consideration in this test was the production of a premium grade concentrate. Since only small quantities of material are usable in the present experimental leaching arrangement, and since tabling was used as a concentration method after leaching, the recovery figures are quite low. These recovery figures could certainly be improved in a larger scale test simply by reclaiming the middling products from the gravity concentration steps.

The test results are summarized in Figure 2.

7) Magnetic Separation of a Ground Sponge Iron Product

In order to examine how readily gangue could be eliminated from a sponge iron product, a -10 mesh composite head sample was semi-reduced in a small rotary kiln (1650°F; 3/1 CO/H_2).

Samples of the reduced product were then ground to -100 and -325 mesh and concentrated in the Davis Tube. Davis Tube conditions were set to produce a clean concentrate.

The test results are reported in Table XI.

Compared to the beneficiation obtained in a similar Davis Tube test on a -325 mesh roast product, there does not appear to be any significant difference in the concentration of a -325 mesh semi-reduced product with respect to silica elimination. While it is evident that a high iron product can be made, it appears that silica cannot be readily reduced to a reasonable level (<3%) acceptable in sponge iron for re-melting. An example of the probable best sponge grade would be as follows by calculation:

Test Procedure and Results - cont'd

7) Magnetic Separation of a Ground Sponge Iron Product

Assume:

(1) Head analysis 43.9% Total Fe,

(2) A final gangue content of approximately 16% SiO_2 + 2% other gangue, and

(3) 95% reduction to metallic iron.

Then a final concentrate would contain approximately:

		%
Metallic iron	-	76.7
FeO	-	5.3
SiO_2	-	16.0
Gangue	-	2.0
		100.0

This is only an approximate calculation representing the probable concentrate which would be obtained after reduction was increased to 95.0% from 82.0%.

TABLE I

Chemical Analyses on Head Samples

Sample No.	Footage	% Total Fe Bulk Sample No. 2 (Jan./63)	% Total Fe Bulk Sample No. 1 (Oct./62)
1	20 - 35'	39.1	44.2
2	56 - 69'	42.1	46.1
3	82 - 90'	45.8	56.1
4	90 - 100'	46.1	48.6
5	100 - 109'	45.2	49.6
6	130 - 138'	38.3	45.9
7	142 - 155'	46.4	37.6
8	175 - 185'	45.4	48.8
9	200 - 207'	39.2	44.7
10	110 - 120'	-	47.8
11	120 - 130'	50.1	51.8
12	155 - 165'	48.9	46.5
13	165 - 175'	39.6	43.8
14	185 - 196'	44.4	51.3
Arithmetic Average		43.9	47.3

TABLE II

Analyses on Roasted Products

		Roast Product		
Sample No.	% Wt. Loss	% Total Fe	% FeO	Fe^{++}/TFe
1	4.2	41.4	19.8	0.37
2	3.5	46.6	21.9	0.36
3	4.4	48.8	22.7	0.36
4	4.7	49.2	22.0	0.35
5	4.6	46.8	21.0	0.35
6	3.9	41.6	18.7	0.35
7	3.9	49.9	21.0	0.33
8	5.9	49.3	24.2	0.38
9	5.8	43.3	20.6	0.37
11	4.4	53.6	24.3	0.35
12	7.3	52.2	24.2	0.36
13	5.7	44.2	21.2	0.37
14	6.2	48.6	20.7	0.33
Arithmetic Average	5.0	47.2	21.7	0.35

TABLE III

Davis Tube Tests on Roasted Products

Sample No.	Davis Tube Product	GRIND														
		"As Roasted" (-10 Mesh)					(-100 Mesh)					(-325 Mesh)				
		% wt.	% Fe	Fe Distn	% SiO_2	% P	% wt.	% Fe	Fe Distn	% SiO_2	% P	% wt.	% Fe	Fe Distn	% SiO_2	% P
1	Head*	100.0	41.4	100.0	-	-	100.0	42.2	100.0	-	-	100.0	41.2	100.0	-	-
	Conc.	96.2	42.8	99.4	31.4	0.92	70.6	53.4	89.3	19.7	0.86	63.1	56.0	85.7	16.8	0.73
	Tails	3.8	6.0	0.6	-	-	29.4	15.4	10.7	-	-	36.9	16.0	14.3	-	-
2	Head*	100.0	46.8	100.0	-	-	100.0	47.3	100.0	-	-	100.0	46.0	100.0	-	-
	Conc.	95.8	48.5	99.3	25.2	0.64	78.1	56.4	93.1	16.8	0.51	70.3	58.8	89.9	13.6	0.50
	Tails	4.2	7.4	0.7	-	-	21.9	14.9	6.9	-	-	29.7	15.7	10.1	-	-
3	Head*	100.0	50.3	100.0	-	-	100.0	49.1	100.0	-	-	100.0	49.7	100.0	-	-
	Conc.	98.0	51.2	99.8	23.2	0.49	79.6	59.3	96.1	13.9	0.35	75.9	62.3	95.2	10.1	0.33
	Tails	2.0	4.2	0.2	-	-	20.4	9.4	3.9	-	-	24.1	9.9	4.8	-	-
4	Head*	100.0	49.5	100.0	-	-	100.0	50.0	100.0	-	-	100.0	49.0	100.0	-	-
	Conc.	95.2	51.8	99.7	19.4	0.56	77.6	61.9	96.2	10.8	0.35	73.3	63.2	94.6	8.6	0.33
	Tails	4.8	2.9	0.3	-	-	22.4	8.6	3.8	-	-	26.7	9.9	5.4	-	-
5	Head*	100.0	47.4	100.0	-	-	100.0	47.2	100.0	-	-	100.0	48.0	100.0	-	-
	Conc.	97.0	48.7	99.7	26.5	0.33	77.2	57.1	93.4	15.7	0.27	72.3	60.7	91.3	12.5	0.26
	Tails	3.0	5.3	0.3	-	-	22.8	13.8	6.6	-	-	27.7	15.0	8.7	-	-
6	Head*	100.0	41.3	100.0	-	-	100.0	40.2	100.0	-	-	100.0	40.6	100.0	-	-
	Conc.	95.3	42.7	98.5	37.4	0.22	66.1	52.2	85.8	24.2	0.17	59.7	55.7	81.9	20.6	0.15
	Tails	4.7	13.5	1.5	-	-	33.9	16.8	14.2	-	-	40.3	18.3	18.1	-	-
7	Head*	100.0	50.4	100.0	-	-	100.0	50.4	100.0	-	-	100.0	49.0	100.0	-	-
	Conc.	98.3	51.1	99.7	26.3	0.24	76.7	58.6	89.7	17.7	0.18	67.6	60.8	83.9	13.4	0.17
	Tails	1.7	8.6	0.3	-	-	23.3	22.2	10.3	-	-	32.4	24.3	16.1	-	-

* Calculated

.....continued

TABLE III (continued)

Sample No.	Davis Tube Product	GRIND														
		"As Roasted" (-10 Mesh)					(-100 Mesh)					(-325 Mesh)				
		% wt.	% Fe	Fe Distn	% SiO_2	% P	% wt.	% Fe	Fe Distn	% SiO_2	% P	% wt.	% Fe	Fe Distn	% SiO_2	% P
	Head*	100.0	50.0	100.0	-	-	100.0	50.1	100.0	-	-	100.0	48.6	100.0	-	-
8	Conc.	96.5	51.6	99.6	24.6	0.23	83.1	58.2	96.6	18.4	0.20	77.3	59.8	95.0	15.0	0.18
	Tails	3.5	6.3	0.4	-	-	16.9	10.2	3.4	-	-	22.7	10.6	5.0	-	-
	Head*	100.0	43.1	100.0	-	-	100.0	42.6	100.0	-	-	100.0	42.3	100.0	-	-
9	Conc.	97.8	43.9	99.7	32.8	0.23	75.4	53.0	93.7	24.0	0.16	66.4	57.6	91.8	17.8	0.15
	Tails	2.2	6.0	0.3	-	-	24.6	10.9	6.3	-	-	33.6	12.2	8.2	-	-
	Head*	100.0	52.6	100.0	-	-	100.0	54.6	100.0	-	-	100.0	52.8	100.0	-	-
11	Conc.	96.6	54.3	99.7	20.4	0.41	85.4	62.4	97.6	12.2	0.31	81.0	62.9	96.5	9.2	0.17
	Tails	3.4	5.1	0.3	-	-	14.6	8.9	2.4	-	-	19.0	9.7	3.5	-	-
	Head*	100.0	53.7	100.0	-	-	100.0	53.7	100.0	-	-	100.0	51.4	100.0	-	-
12	Conc.	97.4	55.0	99.8	18.5	0.31	84.3	62.1	97.5	12.1	0.20	78.5	63.0	96.3	9.3	0.18
	Tails	2.6	4.8	0.2	-	-	15.7	8.5	2.5	-	-	21.5	8.9	3.7	-	-
	Head*	100.0	44.5	100.0	-	-	100.0	43.8	100.0	-	-	100.0	43.1	100.0	-	-
13	Conc.	91.4	48.2	98.9	22.8	0.31	73.5	56.5	94.9	16.6	0.29	66.3	60.4	92.8	14.2	0.22
	Tails	8.6	5.7	1.1	-	-	26.5	8.4	5.1	-	-	33.7	9.2	7.2	-	-
	Head*	100.0	49.6	100.0	-	-	100.0	50.2	100.0	-	-	100.0	49.1	100.0	-	-
14	Conc.	97.3	50.7	99.5	25.2	0.26	77.0	60.0	92.1	16.5	0.20	71.6	61.2	89.2	12.5	0.18
	Tails	2.7	9.6	0.5	-	-	23.0	17.3	7.9	-	-	28.4	18.6	10.8	-	-
Average Conc.		96.4	49.3	99.5	25.7	0.40	77.3	57.8	93.5	16.8	0.31	71.0	60.2	91.1	13.4	0.27

*Calculated

TABLE IV

Davis Tube Tests** on Finely Ground Roasted Products

Grind (Mesh)	Davis Tube Test	Composite Head					Sample No. 4				
		% wt.	% Fe	Fe Distn	% SiO_2	% P	% wt.	% Fe	Fe Distn	% SiO_2	% P
	Head	100.0	46.0*	100.0	-	-	100.0	48.6*	100.0	-	-
-325	D.T.Conc.	67.4	61.4	90.0	11.5	0.33	71.5	64.8	95.4	7.1	0.36
Mesh	D.T.Tails	32.6	14.2	10.0	-	-	28.5	7.9	4.6	-	-
	Head	100.0	46.1*	100.0	-	-	100.0	48.7*	100.0	-	-
-400	D.T.Conc.	66.9	61.5	89.3	11.4	0.28	71.4	64.9	95.1	6.7	0.32
Mesh	D.T.Tails	33.1	14.6	10.7	-	-	28.6	8.3	4.9	-	-
	Head	100.0	46.0*	100.0	-	-	100.0	48.8*	100.0	-	-
-500	D.T.Conc.	65.7	62.3	89.0	10.9	0.25	71.2	65.0	94.8	6.1	0.28
Mesh	D.T.Tails	34.3	14.7	11.0	-	-	28.8	8.8	5.2	-	-

*Calculated

**D.T. conditions altered to give clean concentrates.

TABLE V

Results of Batch Flotation on Crest Samples

Cationic Removal of SiO_2

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lb./ton	Grind % -200 M.	Remarks
1) Spiral	Slime	42.8	49.0	43.2	NaOH	1.05	87.4	Slime loss high.
Slimes	Tailing	9.5	44.2	8.7	Gum 9072	1.75		Frother not required
	Concentrate	47.7	49.0	48.1	Armac 'C'	0.58		
P.H. 10.4	Composite	100.0	48.5	100.0	M.I.B.C.	0.13		
2) Spiral	Tailing	25.8	48.4	25.7	NaOH	0.60	87.4	No selectivity
Slimes	Concentrate	74.2	48.6	74.3	Gum 9072	1.00		
P.H. 10.0	Composite	100.0	48.5	100.0	Armac 'C'	.33		
5) Spiral	Tailing	10.7	47.1	10.4	Gum 9072	0.50	87.4	Slimes inhibited selectivity
Slimes	Concentrate	89.3	48.6	89.6	Armac 'C'	0.10		No regulator used
P.H. 8.8	Composite	100.0	48.4	100.0				
7) Spiral	Slime	46.8	47.7	46.5	Gum 9072	1.00	87.4	
Slimes	1st Tailing	3.9	46.2	3.8	Armac 'C'	0.20		
	2nd Tailing	7.0	46.5	6.8		(2 additions)		
	Concentrate	42.3	48.7	42.9				
P.H. 8.2	Composite	100.0	48.0	100.0				
26) Composite	Tailing	15.3	39.8	13.6	Gum 4356	1.00	62.1	Floats 26 and 27 conditions
Bulk	Concentrate	84.7	46.2	86.4	Cyanamid	0.40		were identical, except that
Sample	Conc. Slime	-	-	-	3037			27 was a deslimed feed, also
P.H. 8.4	Composite	100.0	45.3	100.0	Dow 250	0.06		requiring additional 3037 to
								produce a silica float

...continued

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lb./ton	Grind % -200M.	Remarks
27) Composite Bulk Sample P.H. 8.5	Slime	26.8	46.5	27.1	Gum 4356	1.00	62.1	
	Tailing	25.0	33.4	18.1	Cyanamid 3037	1.00 (2 additions)		
	Concentrate	45.9	53.1	52.9	Dow 250	.06		
	Conc. Slime	2.3	37.5	1.9				
	Composite	100.0	46.0	100.0				
28) Composite Bulk Sample Calcined for 1 hr. at 1000°C	Tailing	7.3	43.9	7.0	Gum 4356	1.00	54.4	Floats 28 and 29 were identical, except that 29 was a deslimed feed but the calcining reduced the amount of slimes produced
	Concentrate	92.7	46.1	93.0	Cyanamid 3037	0.80		
	Conc. Slime	-	-	-				
	Composite	100.0	45.9	100.0	Dow 250	0.06		
29) As for Float 28 P.H. 8.2	Slime	0.5	-	-	Gum 4356	1.00	54.4	
	Tailing	7.2	41.5	6.5	Cyanamid 3037	0.80		
	Concentrate	91.2	46.8	93.5				
	Conc. Slime	1.1	-	-				
	Composite	100.0	45.8	100.0	Dow 250	0.06		
33) Composite Bulk Sample Reduced and Magnetically Concentrated P.H. 11.4	Tailing	5.6	38.0	3.8	NaOH	1.00	93.0	This float produced tailing with no free iron, but mixed grains were visible in the concentrate
	Concentrate	91.1	57.9	95.2	Gum 9072	1.00 (4 additions)		
	Conc. Slime	3.3	16.2	1.0				
	Magnetic Conc	100.0	55.4	100.0	Armeen 'C' 100% neutralized.	0.40 (4 additions)		

...continued

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lb./ton	Grind % -200M.	Remarks
38) Bench II	Slime	17.5	60.2	18.0	NaOH	1.00	67.5	Mixed grains were predomin-
Humphrey Spiral	Tailing	6.3	56.6	6.1	Gum 9072	1.00		ant in the tailing and
Concentrate	Concentrate	75.1	59.2	75.9		(4 additions)		concentrate. Insufficient
	Conc. Slime	1.1	-	-	Armac 'C'	1.00		liberation.
P.H. 11.0	Spiral Conc.	100.0	58.6	100.0		(4 additions)		

TABLE VI

Results of Batch Flotation on Crest Samples.

Anionic Removal of SiO_2

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lbs./ton	Grind % -200M.	Remarks
22) Composite	Tailing	4.1	-	-	NaOH	3.00	17.3	These 2 floats were obviously too coarse and insufficient was floated to warrant analyzing.
Bulk Sample	Concentrate	95.9	-	-	Gum 9072	1.60		
	Composite	100.0	45.6	100.0	$CaCl_2$	1.00		
P.H. 11.5					Distilled Oleic	1.33	(All -28M)	
23) Composite	Slime	3.2	-	-	NaOH	3.00	32.7	
Bulk	Tailing	6.4	-	-	Gum 9072	1.60		
Sample	Concentrate	90.4	-	-	$CaCl_2$	1.00		
P.H. 11.5	Composite	100.0	45.6	100.0	Distilled Oleic	1.33	(All -48M)	
24) Composite	1st Tailing	6.5	39.0	5.6	NaOH	3.00	69.0	
Bulk	2nd Tailing	7.5	42.2	7.0	Gum 9072	1.60		
Sample	Concentrate	82.9	46.2	84.2	$CaCl_2$	1.00		
P.H. 11.4	Conc. Slime	3.1	48.5	3.2	Distilled		(All -100M)	
	Composite	100.0	45.5	100.0	Oleic	1.33		
25) Composite	1st Tailing	9.3	42.8	8.8	NaOH	3.00	100.0	
Bulk	2nd Tailing	9.9	43.7	9.6	Gum 9072	1.60		
Sample	Concentrate	51.6	45.9	52.3	$CaCl_2$	1.00		
	Conc. Slime	29.2	45.4	29.3	Distilled			
P.H. 11.2	Composite	100.0	45.2	100.0	Oleic	1.33		

....continued

TABLE VI (continued)

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lbs./ton	Grind % -200M.	Remarks
8) Spiral	1st Tailing	9.0	32.1	6.0	NaOH	2.50	87.4	The next 9 floats were
Slimes	2nd Tailing	10.3	40.3	8.5	Gum 9072	1.60		identical. Only the
	Concentrate	80.7	51.2	85.5	$CaCl_2$	1.00		anionic promoter was
P.H. 11.2	Composite	100.0	48.4	100.0	Distilled Oleic	1.33		changed.
10) Spiral	1st Tailing	5.2	28.6	3.1	NaOH	2.50	87.4	
Slimes	2nd Tailing	9.8	39.5	8.2	Gum 9072	1.60		
	Concentrate	85.0	49.5	88.7	$CaCl_3$	1.00		
P.H. 11.3	Composite	100.0	47.4	100.0	Double distilled oleic	1.33		
11) Spiral	1st Tailing	8.5	34.8	6.3	NaOH	2.50	87.4	
Slimes	2nd Tailing	10.0	38.7	8.2	Gum 9072	1.60		
	Concentrate	81.5	49.5	85.5	$CaCl_3$	1.00		
P.H. 11.5	Composite	100.0	47.2	100.0	No.4 Reg Oleic	1.33		
13) Spiral	1st Tailing	14.0	33.4	9.9	NaOH	2.50	87.4	
Slimes	2nd Tailing	14.5	40.3	12.4	Gum 9072	1.60		
	Concentrate	71.5	51.3	77.7	$CaCl_3$	1.00		
P.H. 11.4	Composite	100.0	47.2	100.0	No.4 distilled oleic	1.33		

....continued

TABLE VI (continued)

Float No.	Product	Weight %	Analysis % Fe	Distn % Fe	REAGENT Type	REAGENT lbs./ton	Grind % -200M	Remarks
15) Spiral	1st Tailing	7.0	31.6	4.6	NaOH	2.50	87.4	
Slimes	2nd Tailing	11.7	38.1	9.4	Gum 9072	1.60		
	Concentrate	81.3	50.5	86.0	$CaCl_3$	1.00		
P.H. 11.3	Composite	100.0	47.7	100.0	Corn Fatty Acid	1.33		
16) Spiral	1st Tailing	21.7	37.4	17.1	NaOH	2.50	87.4	
Slimes	2nd Tailing	21.1	43.5	19.4	Gum 9072	1.60		
	Concentrate	57.2	52.7	63.5	$CaCl_3$	1.00		
P.H. 11.3	Composite	100.0	47.4	100.0	Sylvatol 40 DD	1.33		
18) Spiral	1st Tailing	13.8	35.8	10.3	NaOH	2.50	87.4	
Slimes	2nd Tailing	10.2	38.8	8.3	Gum 9072	1.60		
	Concentrate	76.0	51.1	81.4	$CaCl_3$	1.00		
P.H. 11.2	Composite	100.0	47.7	100.0	Sylvat 94	1.33		
20) Spiral	1st Tailing	18.0	37.2	14.4	NaOH	2.50	87.4	
Slimes	2nd Tailing	14.8	43.0	13.8	Gum 9072	1.60		
	Concentrate	67.2	49.6	71.8	$CaCl_3$	1.00		
P.H. 11.2	Composite	100.0	46.4	100.0	Cyanamid 710	1.33		
21) Spiral	1st Tailing	9.3	34.4	6.8	NaOH	3.00	87.4	This was identical to
Slimes	2nd Tailing	10.0	42.7	9.0	Gum 9072	1.60		float 8. The combined
	Concentrate	51.4	48.4	52.4	$CaCl_3$	100		Concentrate and slimes
	Conc. Slime	29.3	51.6	31.8	Oleic			wt. are identical but
P.H. 11.5	Composite	100.0	47.5	100.0	Distilled	1.33		grade lower 49.5% Tot.Fe

TABLE VI (continued)

Float No.	Product	Weight %	Analysis % Fe	Distn % Fe	REAGENT Type	REAGENT lbs./ton	Grind % -200M	Remarks
34) Composite	1st Tailing	21.3	36.5	17.0	NaOH	3.00	62.9	By microscopic examination
Bulk Sample	2nd Tailing	20.0	40.0	17.5	Gum 9072	1.60		there did not appear to be
Calcined for	3rd Tailing	15.7	44.5	15.3	$CaCl_3$	1.00		any free gangue in the
1 hr. at	4th Tailing	5.4	47.7	5.6	Pamak IV	1.33		concentrate
670°C.	Concentrate	36.4	54.3	43.0				
	Conc. Slime	1.4	55.0	1.6				
P.H. 11.6	Composite	100.0	45.8	100.0				
40) Bench II	1st Tailing	9.7	56.6	9.2	NaOH	2.00	67.5	
Humphrey	2nd Tailing	11.9	58.7	11.7	Gum 9072	1.60		
Spiral	3rd Tailing	11.6	59.6	11.5	$CaCl_3$	1.00		
Concentrate	Concentrate	66.8	60.6	67.6	Pamak IV	1.33		
P.H. 11.5	Composite	100.0	59.9	100.0		(3 additions)		
42) Composite	1st Tailing	26.9	40.4	23.8	NaOH	3.00	100.0	
Bulk Sample	2nd Tailing	23.6	44.8	23.1	Gum 9072	1.60		
	3rd Tailing	17.4	47.4	18.0	CaCl	1.00	(96%	
	4th Tailing	16.6	49.5	18.0	Pamak IV	1.33	-325M)	
	Concentrate	15.5	50.3	17.1				
P.H. 11.8	Composite	100.0	45.7	100.0				

TABLE VII

Iron Flotation by Anionic Sulphonate Collectors

Float No.	Product	Weight %	Analysis % Fe	Distn. % Fe	REAGENT Type	REAGENT lbs./ton	Grind % -200M	Remarks
31) Composite	Slime	20.3	45.7	20.1	Cyanamid 801	2.00	75.2	Insufficient Fe concentrate
Bulk Sample	Concentrate	19.8	52.7	22.6				was floated. Uneconomical
	Tailing	59.9	44.1	57.3	Fuel Oil	1.00		quantity of H_2SO_4
P.H. 4.0	Composite	100.0	46.1	100.0	H_2SO_4	12.00		required.
					Pine Oil	0.05		

TABLE VIII

Iron Flotation by Anionic Collectors

43) Spiral	Concentrate	21.3	53.3	23.4	H_2SO_4	2.50	87.4	Insufficient Fe Concentrate
Slimes	Tailing	78.7	47.3	76.6	Na_2SiO_3	.25		was floated
	Composite	100.0	.48.6	100.0	Fuel Oil	6.00		
P.H. 6.2					Sylvatol 40 DD	2.00		

TABLE IX

Grindability Test

Size Analyses of Test Products

Mesh	Feed		Circulating Load		Product (-28 Mesh)	
	Cum. % Retained	Cum. % Passing	Cum. % Retained	Cum. % Passing	Cum. % Retained	Cum. % Passing
+4	1.6	98.4	2.8	97.2		
+6	8.8	91.2	17.3	82.7		
+8	22.4	77.6	38.8	61.2		
+10	42.3	57.7	64.3	35.7		
+14	60.0	40.0	79.3	20.7		
+20	70.7	29.3	90.9	9.1		
+28	80.1	19.9	99.1	0.9	0.6	99.4
+35	84.9	15.1	99.9	0.1	18.8	81.2
+48	89.1	10.9	100.0		34.5	65.5
+65	92.0	8.0			47.0	53.0
+100	94.1	5.9			56.8	43.2
+150	95.5	4.5			64.3	35.7
+200	96.4	3.6			70.4	29.6
+270	97.3	2.7			78.8	21.2
+325	97.9	2.1			84.6	15.4
-325	2.1				15.4	

TABLE X

High Intensity Magnetic Separation Tests

Screen Fraction	Separator Product	% Wgt.	% Fe	Fe Units	Fe Distn.
-20 +48 M	Concentrate	35.0	51.9	18.17	40.8
	Tailing	32.3	37.8	12.21	27.3
-48 +65 M	Concentrate	5.5	47.9	2.63	5.9
	Tailing	3.6	36.1	1.30	2.9
-65 +100 M	Concentrate	5.2	45.6	2.37	5.3
	Tailing	2.4	38.2	0.92	2.1
-100 +200 M	Concentrate	4.8	44.8	2.15	4.8
	Tailing	2.1	40.0	0.84	1.9
-200 +325 M	Concentrate	2.3	42.6	0.98	2.2
	Tailing	1.5	42.0	0.63	1.4
-325 M	Concentrate	4.1	45.6	1.87	4.2
	Tailing	1.2	45.4	0.54	1.2
Head *	-	100.0	44.6	44.61	100.0

* Calculated

TABLE XI

Davis Tube Tests on a Semi-Reduced Sponge Iron Product

-100 Mesh

		Total Fe			Metallic Fe			SiO_2	P
	Wgt. %	%	Units	Distn.	%	Units	Distn.	%	%
Head	100.0	55.4	55.38	100.0	45.5	45.49	100.0	-	-
D. T. Conc.	68.2	76.5	52.17	94.2	66.7	45.49	100.0	17.8	0.30
D. T. Tails	31.8	10.1	3.21	5.8	Nil	-	-	-	-

-325 Mesh

		Total Fe			Metallic Fe			SiO_2	P
	Wgt. %	%	Units	Distn.	%	Units	Distn.	%	%
Head	100.0	55.4	55.35	100.0	45.3	45.34	100.0	-	-
D. T. Conc.	66.0	78.5	51.81	93.6	68.7	45.34	100.0	16.2	0.30
D. T. Tails	34.0	10.4	3.54	6.4	Nil	-	-	-	-

$$\% \text{ Reduction} = \frac{\text{Met. Fe Units}}{\text{Total Fe Units}} = \underline{82.0\%}$$

FIGURE 1

Silica Elimination

Flowsheet 1 - Test Results

Flowsheet 1	Stage	% Wgt.	% Fe	Fe Units	% Fe Rec.	% SiO_2	% P
Head - Stage Grind To -10 Mesh	1	100.0	44.4	44.40	100.0	-	-
↓							
Magnetic Roast (1650°F; 5/1 CO_2/CO)	2	94.6	46.9	44.40	100.0	-	-
↓							
Grind to -65 Mesh Rougher Magnetic Separation	3	74.0	56.4	41.73	94.1	18.1	0.37
↓							
Pressure Leach	4	63.2	65.5	41.39	93.3	-	-
↓							
Rod Mill Grind plus Magnetic Separation	5						
(a) 38% -325 M	(a)	60.7	65.7	39.88	89.9	6.0	0.33
(b) 89.7% -325 M	(b)	61.8	66.1	40.85	92.1	5.9	0.32
(c) 97.6% -325 M	(c)	61.9	66.2	40.98	92.4	5.5	0.28

FIGURE 2

Silica Elimination

Flowsheet 2 - Test Results

Flowsheet 2	Stage	% Wgt.	% Fe	% Fe Rec.
Head - Stage Grind to -48 Mesh	1	100.0	44.0	100.0
↓				
Deister Concentrating Table *	2	30.5	56.2	39.0
↓				
Low Temp. Steam, Leach on Table Concentrate only	3	27.4	62.6	39.0
↓				
Deister Concentrating Table *	4	11.5	65.4	17.1

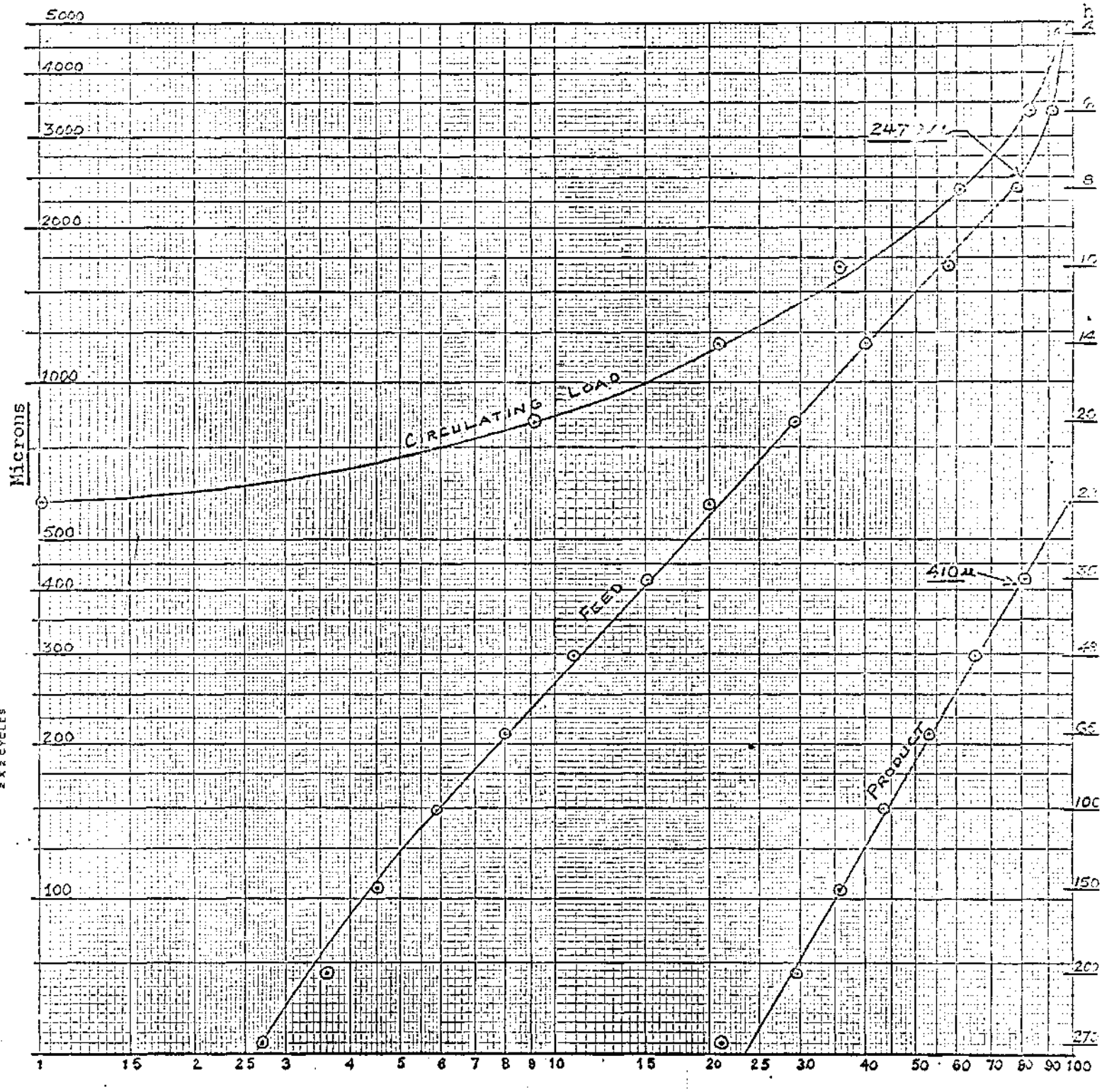
* The split on the table was set so that only a small fraction of the higher grade material was reclaimed.

GRAPH I — Grindability Test

Determination of Equilibrium Value

GRAPH II - Grindability Test

Sizing of Feed and Product



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Report of Investigation No. O-62341

The Beneficiation Characteristics of a Sample of Iron Ore from the Snake River Iron Ore Deposit

Crest Explorations Limited

M. PEARCE

December 12th, 1962

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*Figures 1-16 follow Table XIV.

ONTARIO RESEARCH FOUNDATION

Department of Engineering and Metallurgy

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Crest Explorations Limited

Introduction

On September 11th, 1962 Dr. W. G. Wahl, Consulting Geologist to Crest Explorations Limited of Calgary, Alberta requested the O.R.F. undertake an investigation to evaluate the mineral dressing potential of a sample from the Yukon Territory. The ore, a banded type hematite with intermixed gangue nodules, was from the Snake River Iron Deposit.

Nine bags of ore identified as sample numbers 1 - 9 were received on October 1st. On October 10th an additional five samples identified as numbers 10 - 14 were received. All samples were from section IF-13-62. The total weight of sample was approximately 1500 lbs.

A preliminary meeting to outline the purpose of the investigation and to discuss the prospective testwork was held at the O.R.F. Rexdale pilot plant on October 4th. The following attended this discussion:

W. G. Wahl	-	W. G. Wahl Ltd.
R. S. Shoemaker	-	Bechtel Corporation
R. L. Walker	-	Bechtel Corporation
C. E. White	-	Bechtel Corporation
C. D. Dahlstrom	-	Crest Explorations Ltd.
W. Cook	-	Crest Explorations Ltd.
R. L. Cavanagh	-	Ontario Research Foundation
F. J. Everard	-	Ontario Research Foundation
M. O. Pearce	-	Ontario Research Foundation

It was decided that the prime objective of the testwork should be the evaluation of the amenability of this ore to sink float or gravity concentration, these methods being the simplest and the cheapest types of separation.

Dr. Wahl and Mr. Shoemaker were present at the O.R.F. pilot plant during various phases of the testwork.

Summary and Conclusions

1. HEAD ANALYSIS

The average head analysis of the "as received" sample of hematite was as follows:

Fe	SiO_2	P
47.3	24.1	0.46

All test results determined during this investigation were based on this particular channel sample and the various footage samples taken along it.

2. IRON DISTRIBUTION

The iron was evenly distributed throughout the sample. Chemical analyses on various screen fractions of samples numbers 5 and 8, along with analyses of the -200 mesh slime fractions of the remaining twelve footage samples showed no significant break in the iron distribution which could be used to advantage in any mineral dressing operation.

3. MINERALOGY

A mineralogical investigation of this particular ore is detailed in Part B of this report. Briefly, this study indicated the presence of gangue in two different size ranges, both of which determine the ore dressing procedure which can suitably be applied to the sample. The gangue was distributed as follows:

(1) Coarse gangue in the form of nodular and banded areas ranging in size from 2 cms. to 1 mm. A high proportion of this gangue could probably be liberated by coarse grinding (-10 mesh). These areas contain a high percentage of iron. As a result the iron recovery in a coarse concentrate will be lowered.

(2) Fine gangue, principally quartz, the average grain size being in the order of 10-15 microns. These impurities, some of which are as fine as 2 microns, are found in what appear to be solid hematite bands. This gangue will limit the possibilities of obtaining premium grade concentrates (+66 percent iron) even after grinding as fine as 325 mesh or 44 microns. This has been shown experimentally. Magnetic separation tests on roasted head samples (numbers 5 and 8) only produced concentrates grading 63 percent iron even after grinding to 100 percent -325 mesh.

4. GRINDING

Mineralogical examination of the ore showed that the hematite was extremely fine grained (20-30 u). Indications were that the ore would slime relatively easily when being ground. This would create problems in any subsequent mineral dressing operation.

Although all samples used in the testwork were carefully reduced in size by stage crushing and grinding there was still a considerable proportion of -200 mesh slimes produced when grinding to sizes finer than 10 mesh. Grinding conditions were conducive to the production of as few slimes as possible. It would be difficult to approach these conditions in any commercial grinding and classification circuit.

5. LABORATORY GRAVITY TESTS

The simplest and the most economical types of concentration are the gravity methods. To evaluate the applicability of gravity separation to this ore, several laboratory tests were completed on samples ground through various mesh sizes in that range where gravity techniques can be effectively used.

-4" Lump Ore. Tests were run on three different samples using an Erickson cone and a specific gravity of 3.8. These tests indicated that between 65-80 percent of the iron could be recovered while upgrading the iron content of the concentrate product between 6-10 percent.

-1" Lump Ore. Minus 1" heads of all the footage samples were treated in the Erickson cone at a specific gravity of 3.8. An overall average concentrate grade of 56.8 percent iron was achieved with an iron recovery of 70.8 percent.

It would appear that crushing to 1" or coarser would not sufficiently liberate the ore so that any subsequent sink-float treatment would produce a salable product.

-10 Mesh. Heavy liquid tests, a simple method of determining the optimum separation which can be obtained using gravity techniques, showed that

(a) a grind of approximately -10 mesh gave the best liberation. Grinding finer than this size, but in the range where gravity methods still apply, failed to improve on the separation obtained in the laboratory heavy-liquid tests.

(b) at -10 mesh an average grade of 58.5 percent iron was obtained at a specific gravity of 3.3. The iron recovery averaged 85.8 percent. On -1/4" material similar tests gave an average concentrate grade of 56.6 percent Fe with 91.2 percent recovery.

Increasing, the specific gravity of the liquid to 4.2 gave an average concentrate grading 64.2 percent iron with 67.5 percent recovery. Similar tests on -1/4" material gave an average concentrate 61.9 percent iron with 65.1 percent recovery.

These figures represent "test tube" or ideal gravity conditions. In the heavy liquid test there is only one variable, specific gravity.

6. TESTWORK ON GRAVITY SEPARATORS

Gravity type separators treating -10 mesh and -28 mesh feed produced lower grade concentrates and lower iron recoveries than those obtained in heavy-liquid tests. This is reasonable since in the commercial or laboratory model gravity unit there are several variables which must be controlled. However, the poor performance attained on both a Deister Shaking Table and a Humphrey Spiral can chiefly be attributed to the heavy middling particles which exist in the size ranges which are suitable for gravity separation.

Deister Shaking Table. Although the shaking table is not suitable for the iron ore industry (primarily because of its relatively low throughput per unit area of separator), several tests were run on a laboratory unit since it required smaller samples of feed material than a spiral.

These tests showed that concentrate grades comparable to those obtained in the heavy-liquid tests could be achieved. However, because of the middlings present the iron recoveries were considerably lower. If the product cut taken on the table was such that the resultant concentrate compared in grade with that produced in a heavy-liquid test at a specific gravity of 3.7-4.2 then the resultant iron recovery was lowered by 40-60 percent. If this product split was altered to give a concentrate similar in grade to that produced in a heavy-liquid test at a specific gravity of 3.3 then the iron recovery was approximately 10-20 percent lower.

Humphrey Spiral. Tests on this unit produced an overall concentrate grading 57.7 percent iron, 12.4 percent SiO_2 and 0.33 P with an iron recovery of 54.2 percent. These test results were obtained feeding -28 mesh material to the spiral. The concentrate from the rougher operation was given a second pass over a cleaning stage. Minus 10 mesh feed was originally used but this size was too coarse for efficient spiral operation. The poor performance can again be attributed to the middling particles which are difficult to spread out in a flowing film type concentrator. The heavy middlings like any liberated iron values tend to settle to the bottom of the spiral trough and report as concentrate.

Unfortunately, testwork on this unit was limited by the amount of material available. These results could probably be improved in a continuous spiral pilot plant operation.

The testwork has indicated that separation on Humphrey Spirals at -28 or -35 mesh would probably be the simplest and most economical method of producing a concentrate.

7. MAGNETIC ROASTING

Although magnetic roasting would no doubt be too costly a means of beneficiation, magnetic separation tests on roasted samples showed how difficult it would be to obtain high grade concentrates even after grinding to -325 mesh (43 microns).

8. REDUCIBILITY

Reducibility tests on this ore indicated that reduction could be obtained without difficulty in a moderate time.

Based on the results obtained from this investigation, the grades and recoveries obtained from this one sample do not appear suitable to envisage the development of a commercial iron ore operation at the present time. This seems more apparent when one considers

(a) the location of the property;

(b) the increasing demands of steel producers for higher grade premium concentrates; and

(c) the increasing competition from South American sources which have the advantage of relatively low costs, particularly labour.

9. RECOMMENDATIONS

The spiral testwork undertaken during this investigation was limited by the material available. More batch tests should be considered so that controllable variables such as wash water, feed rate, etc. can be examined in more detail. These tests would require 300-400 pounds of head sample. Consideration might also be given to a continuous pilot plant spiral operation. A continuous operation would probably give slightly better results than those obtained in a batch operation.

Testwork on a Humphrey Spiral fitted with a special cyclone attachment should be considered. This counter flow sizer is used to remove coarse heavy particles ahead of the spiral and thus improve spiral efficiency.

At the present time neither flotation nor magnetic roasting appear to be suitable methods of treating this ore. This is mainly due to the higher costs involved in these operations. No flotation testwork has been done on this ore. However, a limited investigation of its potential would be advisable.

Middlings present the greatest problem in any gravity separation. Finer grinding and separation on a new type of gravity unit, a vibrating spiral known as the McNutt Spiral might possibly provide a method of treating this ore. Unfortunately this unit has not as yet been applied to the treatment of iron ores. However, there are indications that the unit provides better recovery of fine values than the conventional spiral. (A McNutt Spiral unit of 10 ton per hour capacity is presently set up at the O.R.F. for testing).

It should be emphasized that this investigation was based on a single channel sample. Microscopic or mineralogical testwork might be considered on other samples to check that the physical aspects of the remainder of the ore body are relatively uniform. Such work should proceed before any future ore dressing testwork.

Sample Disposal

Test products will be held for a period of six months and will then be disposed of unless notified otherwise.

Testwork by:

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MP:rh

December 12th, 1962.

Section A

Ore Dressing Tests

Test Procedure and Results

1) HEAD SAMPLES - CHEMICAL AND SPECTROGRAPHIC ANALYSES

Heads of all the footage samples submitted were split out for chemical and spectrographic analyses.

Each head sample was analyzed for total iron, acid soluble iron, silica, phosphorus and loss on ignition. These analyses are summarized in Table I.

The results of the spectrographic analyses are summarized in Tables I-A to I-N inclusive.

2) IRON DISTRIBUTION

One of the first phases of the investigation was to check the iron distribution of the iron in the sample. Many ores exhibit a sharp break in iron distribution with size and this size effect can be used to advantage in the concentration of the ore.

However, chemical analyses of -200 mesh slime fractions, produced when grinding the various footage samples, indicated that there was probably no such break in the iron distribution of this particular hematite ore. This was checked by analysing various screen fractions of -10 mesh heads of samples numbers 5 and 8. These results are shown in Table II. The iron was evenly distributed throughout both samples, thus indicating that simple particle sizing could not be profitably used as a mineral dressing technique on this ore.

3) MINERALOGY

A mineralogical study of the ore is discussed in Part B of this report.

4) GRINDING

Compared to other iron ores this ore seemed to slime relatively easily when ground finer than 10 mesh. This was no doubt due to the fine grained nature of the ore, the average grain size of the hematite being in the 20-30 μ range.

The sliming which occurs during grinding is undesirable since fines are harmful in most subsequent mineral dressing operations.

The samples used during the various phases of the investigation were reduced in size by stage crushing and grinding. This method limited the amount of -200 mesh fines product. However, in a commercial grinding and classification circuit, it would be difficult to approach such conditions.

5) LABORATORY GRAVITY TESTS

The simplest and the cheapest methods of concentration are those which depend on gravity. In order to examine the possibilities of adapting gravity methods to the concentration of this ore several laboratory tests were completed on various samples which had been crushed or ground to a size suitable for sink float or gravity separation as follows:

(a) Erickson Cone Tests. The Erickson Cone was used to test +1" material. This unit consists of two cones, one above the other. Medium is circulated upward by a pump to the top cone. The sink product is collected in a basket in the top cone. The gangue material floats over the lip of the top cone and is collected in a basket in the lower cone. In this unit the upward current is just low enough to counterbalance the tendency of the medium to settle. This gives test results close to those obtained using a true heavy liquid.

(b) Heavy Liquid Tests. This test is a simple and accurate method of separating the ore into fractions of varying specific gravity. It consists simply of immersing a sample of ore in a heavy liquid, e.g. thallium formate of known density. The test can be used to predict the optimum separation which could be expected in a sink float or gravity process.

During the investigation, laboratory gravity tests were completed on samples representing a wide range of sizes as shown below. Samples of lump ore (+1") were screened at 1/4" prior to the sink float tests while samples finer than this were deslimed at -200 mesh.

-4" Lump Ore. Three different samples were tested in an Erickson cone using spherical ferrosilicon and a specific gravity of 3.8. The test results are shown in Table III.

These tests indicate that it would not be feasible to attempt any upgrading in this size range.

-1" Lump Ore. Minus 1" heads of all the footage samples were treated in the Erickson cone at a specific gravity of 3.8. Any -1/4" material was screened out prior to the test.

The test results which appear in Table IV indicate that crushing to 1" did not give sufficient liberation to produce a salable product using gravity methods.

-10 Mesh Ore. Heavy liquid tests on heads of samples numbers 5 and 8 indicated that grinding to 10 mesh gave the best liberation. Grinding finer than this size,but in the range where gravity separation methods can still be used, did not result in improved concentration.

The results of these heavy liquid tests are shown in Tables V and VI. The heavy liquid used was methyl iodide (S.G. 3.3).

It can be seen that there was no appreciable increase in concentrate grade beyond 10 mesh. Microscopic examination of the concentrate showed the presence of extensive middlings right down to 65 mesh.

Heavy liquid tests were then completed on -10 mesh heads of all the footage samples. Tests run using methyl iodide (specific gravity 3.30) are summarized in Table VII. These test results indicate an average concentrate grading 58.5 percent iron with an iron recovery of 85.8 percent.

Minus 10 mesh head samples were also tested using thallium formate (specific gravity 4.2). Although this gravity is considerably higher than that normally expected in a sink-float process, the tests indicate how much high grade concentrate is liberated at -10 mesh. The results obtained using thallium formate are shown in Table VIII. Results show an average concentrate grading 64.2 percent iron and an iron recovery of 67.5 percent. This series of tests showed that there was +60% iron present at -10 mesh. However, the immediate problem was to concentrate as much of this +60% iron as possible on a commercial separator.

A complete range of heavy liquid tests was completed on six representative -10 mesh head samples. The specific gravities of the heavy liquids used in these tests varied from 3.3 to 4.2. The samples chosen included numbers 1, 3, 5, 7, 8 and 11. These samples seemed to represent the extremes found in the original fourteen samples yet, at the same time, the average of any test results produced using these six samples was quite

close to the average results obtained when using all the original "as received" samples. The test results which are outlined in Table IX also indicate the phosphorus rejection at various specific gravities.

In order to check that there was a definite increase in grade between 1/4" and 10 mesh, 1/4" heads of the same six samples were treated in a similar manner. Results summarized in Table X indicate that at 1/4" an average concentrate grading 56.6 percent iron can be obtained at a specific gravity of 3.3. The average recovery was 91.2 percent. Increasing the specific gravity of the liquid to 4.2 gave an average concentrate grading 61.9 percent iron with 65.1 percent recovery.

Graph A and Table XI show the average grade and recoveries obtained from samples 1, 3, 5, 7, 8 and 11 at the two different grinds, 10 mesh and -1/4". An increase of concentrate grade by approximately 2 percent iron is obtained by grinding to -10 mesh rather than to -1/4".

Graph B shows the average phosphorus content of the concentrates obtained from the same heavy liquid tests at grinds of -1/4" and 10 mesh.

It should be emphasized that these results represent laboratory conditions. In the heavy liquid test there is only one variable, specific gravity.

6) TESTWORK ON GRAVITY SEPARATORS

The laboratory tests described previously give the optimum results which could be expected in any sink-float or gravity process. In such tests there is only one significant variable, specific gravity. In a commercial high capacity gravity unit such as a spiral there are several variables which must be considered.

Two gravity type separators were used during this phase of the testwork.

a) Deister Shaking Table. Several tests were run on a laboratory shaking table.

Tests performed on -10 mesh heads of sample numbers 1, 3, 4, 7 and 8 are summarized in Table XII.

These tests indicate that concentrates comparable in grade to those produced in the heavy liquid tests can be obtained from the shaking table. However, because of the heavy middlings present in the samples the corresponding iron recoveries are considerably lower.

b) Humphrey Spiral. Because of the amount of material required relative to the amount of sample available, tests were run on the spiral using three bench samples.

The three bench samples were as follows:

Bench I - Samples 1 - 2 - 3 - 4
Bench II - Samples 5 - 10 - 11 - 6 - 7
Bench III - Samples 12 - 13 - 8 - 14 - 9

The test results are summarized in Table XIII.

An average concentrate grading 57.7 percent iron, 12.4 percent silica and 0.33 percent phosphorus was obtained. Because of the heavy middlings present the iron recovery in the cleaner concentrate was only 54.2 percent.

7. MAGNETIC ROASTING

Magnetic roasting tests were completed on -10 mesh heads of samples numbers 5 and 8. The -10 mesh roasted heads were passed through the Davis Tube, a laboratory wet magnetic separator. Samples of the -10 mesh roasted heads were ground to -100, -200 and -325 mesh and also passed over the Davis Tube. The test results are detailed in Table XIV.

The samples were roasted in a small externally heated rotary kiln under the following conditions:

Time - 60 minutes
Temperature - 1650°F
Atmosphere - 5/1 CO_2/CO (Total 9.0 cfh)
Preheating - 15 minutes at 1650°F in air.

X-Ray diffraction analyses of the roasted product indicated that the roasting tests were quite efficient, the product being magnetite with only traces of other iron oxides.

8. REDUCIBILITY

Reducibility tests were completed on (-1/2" +1/8") samples of number 5 and number 8.

The reducibility index (the time in minutes required for 90 percent reduction) for sample 5 was 33.5 and for sample 8 was 29.0.

These results compare favourably with commercial pellets having a reducibility index of 32-35 which could be considered average.

Section B

Mineralogical Examination

Introduction

A mineralogical examination was conducted on the Snake River samples No. 5 (footage 100 to 108) and No. 8 (footage 175 to 185). To facilitate this examination thin sections were taken through the areas of visible gangue minerals (i.e nodules, jasper bands) and polished sections through the bands of apparently solid hematite.

This examination was primarily directed towards the ore dressing problems inherent in such a complex ore. As such, it may be mineralogically brief, since only those minerals present in sufficient abundance to affect concentrating qualities were identified.

Sample Description

Both samples No. 5 and No. 8 appear to be mineralogically and structurally similar.

The iron formation consists of;

1) Areas of interbanded (1 to 10 mm.) hematite and jasper (quartz) with minor amounts of carbonates (see Figures 12, 14 and 15).
2) Apparently solid bands (10 to 25 mm.) of hematite, usually laminated (see Figures 1 to 6).
3) (a) intermixed nodular structures (1 to 10 mm.) of jasper (quartz) and carbonates set in a grey hematite mass.
3) (b) larger lenticular masses of quartz and carbonate formed into bands (up to 2 cm.) surrounded by hematite. (see Figures 7 to 11, 13 and 16).

Note: Size ranges noted above are approximate only.

In addition to the major minerals hematite, quartz (jasper) and the carbonates siderite and calcite, there are accessory minerals such as apatite, greenalite, limonite and chlorite which are present in minor amounts.

Comment

1) Nodular areas, interbanded hematite and jasper, lenticular quartz carbonate masses.

These areas contain the major proportion of the gangue mineralization. Their composition varies from 10 to 60% quartz and 5 to 20% carbonates with the remainder largely hematite. The grind required to liberate these areas is difficult to determine since they vary in size from about 2 cm. to less than 1 mm. A grind of 10 mesh would probably free many of these areas. However since they contain a considerable proportion of hematite, concentrating recoveries will be adversely affected. Also a number of "middling" particles will be produced due to the composition of these gangue areas.

2) Solid Hematite Bands

Each of samples 5 and 8 contained bands (10 to 25 mm.) of apparently solid hematite (see Figures 1, 3 and 5). These bands can be shown in polished section to contain an estimated 15 to 20% quartz (see Figures 2, 4 and 6) with minor amounts of carbonate. This quartz ranges in size from 60 μ to less than 2 μ, the average size being from 10 to 15 μ. Therefore any gravity concentrating process such as heavy media or spiral concentration at coarser sizes will tend to produce a low iron, high silica product. The hematite in these bands (and the rest of the sample as well) appears to be quite fine grained (from 20 to 30 μ). It is quite probable therefore that grinding and concentrating processes will tend to produce slimes.

3) Apatite

The phosphorus in these samples (.43% in No. 5 and .33% in No. 8) is present as the mineral apatite. When observed, apatite appeared to be confined to some of the nodular or lenticular bands. The elimination of these areas should therefore tend to reduce the phosphorus content.

Photomicrographs

On the following pages is shown a series of photomicrographs of some of the samples used in this investigation. Figures 1 to 6 depict the apparently solid hematite layers as revealed in polished section. Figures 7 to 16 are views of typical thin sections showing the complex structures present in these nodular, lenticular gangue areas. Beside each section is a brief description of the mineral assemblages present and a visual estimate of the mineral composition. Colour photographs were not used because of the cost and the weakness of most of the colours.

TABLE I

Chemical Analyses on Head Samples

Sample No.	Footage	% Total Fe	% Acid Sol/Fe	% SiO_2	% P	% L.O.I.
1	20-35'	44.2	43.7	30.5	0.93	1.5
2	56-69'	46.1	45.9	23.8	0.80	1.6
3	82-90'	56.1	55.8	13.0	0.55	1.7
4	90-100'	48.6	48.5	22.6	0.61	1.8
5	100-109'	49.6	49.1	19.6	0.43	2.8
6	130-138'	45.9	45.3	30.4	0.36	1.4
7	142-155'	37.6	37.4	38.9	0.39	1.6
8	175-185'	48.8	48.4	21.9	0.33	2.7
9	200-207'	44.7	44.3	24.2	0.30	3.6
10	110-120'	47.8	47.3	26.9	0.39	1.0
11	120-130'	51.8	51.8	21.3	0.40	1.0
12	155-165'	46.5	46.5	19.2	0.39	4.8
13	165-175'	43.8	43.6	24.6	0.34	3.1
14	185-196'	51.3	51.3	20.3	0.25	2.0
Arithmetic Average		47.3	47.1	24.1	0.46	2.2

TABLE NO. I-A

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 1

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	T(.05%)	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.005%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	FT
Gallium	ND	Titanium	TL(.1%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	T(.05%)
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM(1%)
Manganese	T(.05%)	Calcium (CaO)	LM(2%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	L(.5%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.002%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-B

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 2

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.001%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM(1%)
Manganese	T(.05%)	Calcium (CaO)	LM(1%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	TL(.3%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found, X - Not looked for

TABLE NO. I-C

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 3

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.005%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	FT
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	T(.01%)
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	TL(.1%)
Manganese	T(.05%)	Calcium (CaO)	LM(1%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	T
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.

MH - Medium High - 5 - 50% approx.

M - Medium - 1 - 10% approx.

LM - Low Medium - .5 - 5% approx.

TL - Trace Low - .05 - .5% approx.

T - Trace - .01 - .1% approx.

FT - Faint Trace - approx. less than .01%

PT - Possible Trace - Presence not certain

ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-D

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 4

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	ND	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.002%)	Tellurium	ND
Cobalt	FT(.001%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.001%)	Tin	FT
Gallium	ND	Titanium	T(.02%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT(.005%)
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	T(.01%)
Manganese	T(.05%)	Calcium (CaO)	LM(1%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	T
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-E

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 5

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.002%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	ND
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	FT
Lead	FT(.002%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM
Manganese	TL(.1%)	Calcium (CaO)	LM
Mercury	ND	Iron (Fe)	H
Molybdenum	ND	Magnesium(MgO)	L
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.002%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-F

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 6

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.002%)	Tellurium	ND
Cobalt	FT(.001%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.002%)	Tin	FT
Gallium	ND	Titanium	T(.02%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT(.001%)
	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	T(.01%)
Manganese	T(.05%)	Calcium (CaO)	L(.5%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	TL(.2%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-G

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 7

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	T(.03%)	Tellurium	ND
Cobalt	FT(.003%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.002%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	T
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM(.5-1%)
Manganese	T(.02%)	Calcium (CaO)	L
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	L(.5%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.005%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	ND

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-H

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 8

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	FT(<.0001%)
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.005%)	Tellurium	ND
Cobalt	FT(.005%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	X
Copper	FT(.003%)	Tin	ND
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	X
Hafnium	ND	Vanadium	FT(.005%)
Indium	ND	Yttrium (Y_2O_3)	ND
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	FT
Lead	ND	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM(.5-1%)
Manganese	T(.01%)	Calcium (CaO)	T(.03%)
Mercury	ND	Iron (Fe)	H
Molybdenum	ND	Magnesium(MgO)	T(.05%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH(10%)
Nickel	FT(.003%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	ND

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-I

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 9

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	FT(.0001%)
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.001%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.01%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	ND
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	TL(.2%)
Manganese	T(.05%)	Calcium (CaO)	LM(1%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	TL(.3%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.

MH - Medium High - 5 - 50% approx.

M - Medium - 1 - 10% approx.

LM - Low Medium - .5 - 5% approx.

TL - Trace Low - .05 - .5% approx.

T - Trace - .01 - .1% approx.

FT - Faint Trace - approx. less than .01%

PT - Possible Trace - Presence not certain

ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-J

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 10

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	T(.01%)	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.005%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.002%)	Tin	FT
Gallium	ND	Titanium	TL(.1%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT(.005%)
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	LM(1%)
Manganese	T(.05%)	Calcium (CaO)	L(.5%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	L(.5%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-K

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 11

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	T(.03%)	Tellurium	ND
Cobalt	FT(.003%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.002%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.02%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	T
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	TL(.2%)
Manganese	T(.02%)	Calcium (CaO)	L
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	TL(.2%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.002%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-L

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 12

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	T(.01%)	Tellurium	ND
Cobalt	FT(.001%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.002%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.02%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	T
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	TL(.2%)
Manganese	T(.05%)	Calcium (CaO)	L
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	LM(1%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.002%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-M

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 13

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	T	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismith	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.001%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.005%)	Tin	FT(.001%)
Gallium	ND	Titanium	T(.03%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	L(.5%)
Manganese	TL (.1%)	Calcium (CaO)	LM(1%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	FT(.001%)	Magnesium(MgO)	LM(.3%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	ND
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High- 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain
ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE NO. I-N

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

SAMPLE NO. 14

Antimony	ND	Phosphorus	ND
Arsenic	ND	Platinum	ND
Barium	FT	Rhenium	X
Beryllium (BeO)	ND	Rhodium	ND
Bismuth	ND	Rubidium	X
Boron	ND	Ruthenium	ND
Cadmium	ND	Silver	ND
Cerium (CeO_2)	ND	Strontium	ND
Caesium	X	Tantalum (Ta_2O_5)	ND
Chromium	FT(.005%)	Tellurium	ND
Cobalt	FT(.002%)	Thallium	ND
Columbium (Cb_2O_5)	ND	Thorium (ThO_2)	ND
Copper	FT(.001%)	Tin	FT
Gallium	ND	Titanium	T(.05%)
Germanium	ND	Tungsten	ND
Gold	ND	Uranium (U_3O_8)	ND
Hafnium	ND	Vanadium	FT(.005%)
Indium	ND	Yttrium (Y_2O_3)	FT
Iridium	ND	Zinc	ND
Lanthanum (La_2O_3)	ND	Zirconium (ZrO_2)	ND
Lead	FT(.001%)	ROCK FORMING METALS	
Lithium (Li_2O)	ND	Aluminum (Al_2O_3)	TL(.2%)
Manganese	T(.05%)	Calcium (CaO)	L(.5%)
Mercury	ND	Iron (Fe)	MH
Molybdenum	T(.01%)	Magnesium(MgO)	L(.5%)
Neodymium (Nd_2O_3)	ND	Silica (SiO_2)	MH
Nickel	FT(.001%)	Sodium (Na_2O)	FT
Palladium	ND	Potassium (K_2O)	T

Figures are approximate:

C O D E

H - High - 10 - 100% approx.
MH - Medium High - 5 - 50% approx.
M - Medium - 1 - 10% approx.
LM - Low Medium - .5 - 5% approx.
TL - Trace Low - .05 - .5% approx.
T - Trace - .01 - .1% approx.
FT - Faint Trace - approx. less than .01%
PT - Possible Trace - Presence not certain

ND - Not Detected - Elements looked for but not found. X - Not looked for

TABLE II

Iron Distribution

(Samples 5 and 8)

Screen Fraction	Sample 5			Sample 8		
	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.
-10 +20M	39.35	50.9	40.1	42.37	48.1	42.7
-20 +35M	28.26	49.2	27.8	27.39	47.6	27.3
-35 +48M	7.60	48.8	7.4	7.23	47.5	7.2
-48 +65M	5.70	49.1	5.6	5.07	47.1	5.0
-65 +100M	4.76	49.2	4.7	4.05	47.3	4.0
-100 +200M	5.22	50.8	5.3	4.05	42.5	3.6
-200 +325M	2.61	49.5	2.6	2.05	47.1	2.0
-325M	6.50	49.7	6.5	7.79	49.9	8.2

TABLE III

Erickson Sink Float Tests* - (-4" Lump Ore)

Sample No.	Sink (-4" +1/4")			Float (-4" +1/4")			-1/4"		
	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.
2	64.5	56.4	79.0	31.4	25.4	17.3	4.1	41.4	3.7
9	59.4	53.1	69.6	39.0	34.2	29.4	1.6	27.3	1.0
13	54.4	50.2	66.2	44.1	30.2	32.3	1.5	43.6	1.5

* Specific Gravity of Media - 3.8

TABLE IV

Erickson Sink Float Tests* - (-1" Lump Ore)

Sample No.	Sink (-1" + ¼")			Float (-1" + ¼")			- ¼"		
	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.
1	49.2	52.1	60.1	31.5	25.5	18.9	19.3	46.5	21.0
2	64.0	58.7	74.9	24.9	32.2	15.9	11.1	41.7	9.2
3	69.3	62.0	78.5	15.0	28.8	7.9	15.7	47.8	13.6
4	63.4	58.7	75.3	21.1	25.9	11.0	15.5	43.8	13.7
5	67.3	58.8	76.3	17.0	30.4	9.9	15.7	46.1	13.8
6	58.7	57.3	72.0	28.3	26.6	16.1	13.0	42.6	11.9
7	37.2	55.9	56.4	44.5	25.0	30.1	18.3	27.5	13.5
8	68.4	50.3	75.0	19.4	30.0	12.6	12.2	47.0	12.4
9	52.3	54.1	63.1	27.8	29.6	18.4	19.9	41.6	18.5
10	56.0	59.3	69.5	28.0	26.9	15.8	16.0	44.3	14.7
11	66.3	60.0	75.9	18.5	29.5	10.4	15.2	47.0	13.7
12	62.2	54.9	73.2	22.8	26.3	12.9	15.0	43.1	13.9
13	54.2	54.3	69.3	28.4	23.6	15.8	17.4	36.4	14.9
14	62.4	58.8	71.3	19.4	29.0	10.9	18.2	50.5	17.8
Arithmetic Average	59.4	56.8	70.8	24.8	27.8	14.8	15.8	43.3	14.4

* Specific gravity of media 3.8

TABLE V

Heavy Liquid Tests (S.G. 3.3)
Sample No. 5 (Head -49.6 Fe)

Head Sample Size	Sink Product			Float Product			-200 M Slimes		
	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.
-1"	90.6	55.5	95.9	8.8	21.6	3.6	0.6	39.7	0.5
-1/2"	83.6	56.8	93.7	15.2	17.6	5.3	1.2	42.2	1.0
-1/4"	78.1	57.9	91.5	20.1	17.1	6.9	1.8	43.2	1.6
-10M	70.1	60.0	84.3	19.0	12.6	4.8	10.9	50.2	10.9
-20M	64.7	60.4	78.6	18.9	12.5	4.7	16.4	50.6	16.7
-35M	42.0	60.7	51.2	12.7	12.0	3.1	45.3	50.3	45.7
-48M	41.1	61.0	49.7	12.8	12.9	3.4	46.1	50.2	46.9
-65M	35.7	60.8	43.1	10.9	13.4	2.9	53.4	50.9	54.0
							63.9	~~51.5~~	~~66.2~~
-100M.	24.4	60.0	29.3	11.7	19.4	4.5	~~60.4~~	~~50.5~~	~~66.4~~

TABLE VI

Heavy Liquid Tests (S.G. 3.3)
Sample No. 8 (Head ~43.2 Fe)

Head Sample Size	Sink Product			Float Product			-200 M Slimes		
	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.	Wt. %	Fe %	Distn.
-1"	92.0	53.1	97.4	7.6	15.2	2.3	0.4	38.7	0.3
-1/2"	88.4	52.5	96.1	10.2	12.8	2.7	1.4	43.3	1.2
-1/4"	86.4	54.0	94.3	11.0	15.1	3.4	2.6	44.9	2.3
-10 M	76.3	54.8	86.3	14.0	13.1	3.8	9.7	49.3	9.9
-20 M	66.9	54.8	75.9	13.2	13.0	3.5	19.9	50.2	20.6
-35 M	63.4	53.7	71.1	11.6	12.8	3.1	25.0	49.4	25.8
-48 M	56.1	53.0	62.3	10.3	12.7	2.7	33.6	49.5	35.0
-65 M	41.7	52.7	45.9	10.0	18.4	3.8	48.3	49.9	50.3
-100M.	31.9	53.5	35.0	7.7	16.7	2.6	60.4	50.5	62.4

TABLE VII

Heavy Liquid Tests on -10M Head Samples
(Specific Gravity 3.3)

Sample No.	Head		Sink Product				Float Product			-200 M Slimes		
	Fe %	P %	Wt. %	Fe %	P %	Fe Distn.	Wt. %	Fe %	Fe Distn.	Wt. %	Fe %	Fe Distn.
1	44.2	0.93	72.5	53.6	0.86	88.3	22.1	12.8	6.4	5.4	43.2	5.3
2	46.1	0.80	73.7	54.5	0.71	89.0	21.3	13.0	6.1	5.0	43.6	4.9
3	56.1	0.55	76.6	64.1	0.37	89.6	15.6	11.8	3.4	7.8	49.5	7.0
4	48.6	0.61	67.9	62.7	0.28	87.3	24.3	11.3	5.6	7.8	44.0	7.1
5	49.6	0.43	70.1	60.0	0.33	84.3	19.0	12.6	4.8	10.9	50.2	10.9
6	45.9	0.36	61.3	59.5	0.23	82.1	33.2	16.1	12.1	5.5	46.5	5.8
7	37.6	0.39	55.5	57.2	0.18	80.9	39.0	13.6	13.5	5.5	40.4	5.6
8	48.8	0.33	76.3	54.8	0.23	86.3	14.0	13.1	3.8	9.7	49.3	9.9
9	44.7	0.30	66.0	57.7	0.19	85.6	27.6	13.1	8.1	6.4	43.8	6.3
10	47.8	0.39	66.5	60.5	0.18	84.5	24.7	12.9	6.7	8.8	47.4	8.8
11	51.8	0.40	70.2	61.5	0.26	84.3	21.4	17.5	7.3	8.4	51.2	8.4
12	46.5	0.39	68.7	57.2	0.23	85.2	21.8	11.6	5.5	9.5	45.3	9.3
13	43.8	0.34	67.6	54.9	0.26	85.3	25.1	13.1	7.6	7.3	42.6	7.1
14	51.3	0.25	74.7	61.4	0.12	89.0	19.0	12.6	4.6	6.3	52.1	6.4
Arithmetic Average	47.3	0.46	69.1	58.5	0.31	85.8	23.4	13.2	6.8	7.5	46.4	7.4

TABLE VIII

Heavy Liquid Tests on -10M Head Samples
(Specific Gravity 4.2)

Sample No.	Specific Gravity of Liquid	Head		Sink Product				Float Product			-200 M Slimes		
		Fe %	P %	Wt. %	Fe %	P %	Fe Distn.	Wt. %	Fe %	Fe Distn.	Wt. %	Fe %	Fe Distn.
1	4.24	44.2	0.93	34.1	61.4	0.68	48.7	60.5	32.6	45.9	5.4	43.2	5.4
2	4.18	46.1	0.80	55.9	60.9	0.58	72.7	39.1	27.2	22.7	5.0	43.6	4.6
3	4.24	56.1	0.55	70.6	67.0	0.24	84.3	21.6	23.1	8.9	7.8	49.5	6.8
4	4.25	48.6	0.61	59.9	66.1	0.22	80.2	32.8	20.1	13.3	7.3	44.0	6.5
5	4.27	49.6	0.43	57.9	63.2	0.30	74.4	34.0	24.9	17.3	8.1	50.2	8.3
6	4.25	45.9	0.36	43.5	66.0	0.13	64.6	51.0	25.8	29.6	5.5	46.5	5.8
7	4.15	37.6	0.39	41.0	62.8	0.14	65.6	53.5	21.1	28.7	5.5	40.4	5.7
8	4.27	48.8	0.33	36.3	63.3	0.12	48.9	55.1	35.8	42.0	8.6	49.3	9.1
9	4.30	44.7	0.30	48.5	63.9	0.12	69.6	45.1	23.7	24.0	6.4	43.8	6.4
10	4.21	47.8	0.39	50.9	64.6	0.17	70.8	40.3	23.3	20.2	8.8	47.4	9.0
11	4.30	51.8	0.40	52.9	66.4	0.20	68.9	38.7	29.9	22.7	8.4	51.2	8.4
12	4.23	46.5	0.39	38.0	65.3	0.14	54.0	52.5	32.1	36.7	9.5	45.3	9.3
13	4.21	43.8	0.34	47.2	61.6	0.13	67.2	45.5	24.3	25.6	7.3	42.6	7.2
14	4.25	51.3	0.25	57.7	65.6	0.09	74.8	36.0	26.5	18.8	6.3	52.1	6.4
Arithmetic Average	4.24	47.3	0.46	49.6	64.2	0.23	67.5	43.3	26.5	25.4	7.1	46.4	7.1

TABLE IX

Heavy Liquid Tests on -10 Mesh Head Samples at Various Specific Gravities

SAMPLE	SPECIFIC GRAVITY OF HEAVY LIQUID															
	S.G. - 3.30				S.G. - 3.53				S.G. - 3.74				S.G. - 4.24				
	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Sink	72.5	53.6	0.86	88.3	65.1	54.7	0.83	82.3	59.2	56.4	0.81	77.1	34.1	61.4	0.68	7.4	48.7
1 Float	22.1	12.8	-	6.4	29.5	18.1	-	12.3	35.4	21.5	-	17.6	60.5	32.6	-	-	45.9
Slimes (-200M)	5.4	43.2	-	5.3	5.4	43.2	-	5.4	5.4	43.2	-	5.3	5.4	43.2	-	-	5.4
	S.G. - 3.30				S.G. - 3.49				S.G. - 3.73				S.G. - 4.24				
Sink	76.6	64.1	0.37	89.6	75.0	65.1	0.32	88.9	74.3	65.8	0.29	88.2	70.6	67.0	0.24	2.3	84.3
3 Float	15.6	11.8	-	3.4	17.2	13.0	-	4.1	17.9	15.1	-	4.9	21.6	23.1	-	-	8.9
Slimes (-200M)	7.8	49.5	-	7.0	7.8	49.5	-	7.0	7.8	49.5	-	6.9	7.8	49.5	-	-	6.8
	S.G. - 3.30				S.G. - 3.52				S.G. - 3.75				S.G. - 4.27				
Sink	70.1	60.0	0.33	84.3	68.7	60.9	0.33	82.2	63.5	63.1	0.31	78.1	57.9	63.2	0.30	4.6	74.4
5 Float	19.0	12.6	-	4.8	20.4	17.4	-	7.0	25.6	22.5	-	11.2	34.0	24.9	-	-	17.3
Slimes (-200M)	10.9	50.2	-	10.9	10.9	50.2	-	10.8	10.9	50.2	-	10.7	8.1	50.2	-	-	8.3

Cont'd

TABLE IX (Continued)

Heavy Liquid Tests on -10 Mesh Head Samples at Various Specific Gravities

	SAMPLE	SPECIFIC GRAVITY OF HEAVY LIQUID														
		S.G. - 3.30				S.G. - 3.52				S.G. - 3.75				S.G. - 4.15				
		% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
7	Sink	55.5	57.2	0.18	80.9	50.7	59.4	0.15	76.8	47.6	60.8	0.14	73.7	41.0	62.8	0.14	8.4	65.6
	Float	39.0	13.6	-	13.5	43.8	15.6	-	17.5	46.9	17.3	-	20.6	53.5	21.1	-	-	28.7
	Slimes (-200M)	5.5	40.4	-	5.6	5.5	40.4	-	5.7	5.5	40.4	-	5.7	5.5	40.4	-	-	5.7
		S.G. - 3.30				S.G. - 3.49				S.G. - 3.72				S.G. - 4.27				
8	Sink	76.3	54.8	0.23	86.3	71.1	55.0	0.17	81.9	67.1	56.1	0.16	78.5	36.3	63.3	0.12	6.0	48.9
	Float	14.0	13.1	-	3.8	19.2	20.2	-	8.1	23.2	23.7	-	11.5	55.1	35.8	-	-	42.0
	Slimes (-200M)	9.7	49.3	-	9.9	9.7	49.3	-	10.0	9.7	49.3	-	10.0	8.6	49.3	-	-	9.1
		S.G. - 3.30				S.G. - 3.53				S.G. - 3.75				S.G. - 4.30				
11	Sink	70.2	61.5	0.26	84.3	60.7	64.5	0.22	76.8	59.7	65.0	0.21	76.0	52.9	66.4	0.20	3.2	68.9
	Float	21.4	17.5	-	7.3	30.9	24.3	-	14.8	31.9	25.4	-	15.6	38.7	29.9	-	-	22.7
	Slimes (-200M)	8.4	51.2	-	8.4	8.4	51.2	-	8.4	8.4	51.2	-	8.4	8.4	51.2	-	-	8.4

TABLE X

Heavy Liquid Tests on -1/4" Head Samples at Various Specific Gravities

SAMPLE	SPECIFIC GRAVITY OF HEAVY LIQUID															
	S.G. - 3.30				S.G. - 3.47				S.G. - 3.72				S.G. - 4.25				
	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Sink	75.1	51.3	0.91	90.5	67.3	54.0	0.90	86.6	61.1	54.2	0.87	79.8	36.3	60.0	0.73	7.3	52.8
1 Float	23.0	14.2	-	7.7	30.8	15.8	-	11.6	37.0	20.6	-	18.4	61.8	30.3	-	-	45.4
Slimes (-200M)	1.9	40.7	-	1.8	1.9	40.7	-	1.8	1.9	40.7	-	1.8	1.9	40.7	-	-	1.8
	S.G. - 3.30				S.G. - 3.48				S.G. - 3.70				S.G. - 4.30				
Sink	83.8	61.6	0.48	94.8	82.9	61.9	0.46	93.6	78.5	63.5	0.41	91.0	69.8	65.7	0.32	2.9	83.4
3 Float	14.8	15.0	-	4.1	15.7	18.3	-	5.3	20.1	21.5	-	7.9	28.8	29.6	-	-	15.5
Slimes (-200M)	1.4	44.5	-	1.1	1.4	44.5	-	1.1	1.4	44.5	-	1.1	1.4	44.5	-	-	1.1
	S.G. - 3.30				S.G. - 3.47				S.G. - 3.80				S.G. - 4.30				
Sink	78.1	57.9	0.41	91.5	74.3	58.1	0.40	87.4	71.2	58.7	0.34	84.6	57.2	62.3	0.32	6.2	72.8
5 Float	20.1	17.1	-	6.9	23.9	22.9	-	11.1	27.0	25.4	-	13.9	41.0	30.6	-	-	25.6
Slimes (-200M)	1.8	43.2	-	1.6	1.8	43.2	-	1.5	1.8	43.2	-	1.5	1.8	43.2	-	-	1.6

TABLE X (Continued)

Heavy Liquid Tests on -1/4" Head Samples at Various Specific Gravities

SAMPLE	SPECIFIC GRAVITY OF HEAVY LIQUID														
	S.G. - 3.30				S.G. - 3.53				S.G. - 3.80				S.G. - 4.25				
	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Sink	62.8	55.6	0.22	85.9	61.9	56.8	0.19	84.4	53.6	58.9	0.16	75.3	38.5	59.1	0.16	9.3	59.8
7 Float	36.2	14.8	-	13.2	37.1	16.5	-	14.7	45.4	22.0	-	23.8	60.5	24.7	-	-	39.3
Slimes (-200M)	1.0	36.3	-	0.9	1.0	36.3	-	0.9	1.0	36.3	-	0.9	1.0	36.3	-	-	0.9
	S.G. - 3.30				S.G. - 3.53				S.G. - 3.80				S.G. - 4.15				
Sink	86.4	54.0	0.28	94.3	80.9	54.2	0.27	90.7	64.0	56.0	0.17	73.3	31.5	60.3	0.16	8.7	41.3
8 Float	11.0	15.1	-	3.4	16.5	20.2	-	6.9	33.4	35.5	-	24.3	65.9	39.4	-	-	56.3
Slimes (-200M)	2.6	44.9	-	2.3	2.6	44.9	-	2.4	2.6	44.9	-	2.4	2.6	44.9	-	-	2.4
	S.G. - 3.30				S.G. - 3.50				S.G. - 3.80				S.G. - 4.15				
Sink	76.2	59.3	0.29	89.9	75.0	60.1	0.28	89.1	66.6	63.2	0.23	82.5	65.4	64.1	0.23	5.0	80.4
11 Float	21.0	19.3	-	8.1	22.2	20.2	-	8.9	30.6	25.8	-	15.5	31.8	29.0	-	-	17.6
Slimes (-200M)	2.8	44.6	-	2.0	2.8	44.6	-	2.0	2.8	44.6	-	2.0	2.8	44.6	-	-	2.0

TABLE XI

A Summary of the Average Concentrates Obtained from Heavy Liquid Tests on Six Representative Samples

Grind -1/4"

Specific Gravity of Heavy Liquid	Grade % Fe		Recovery %	% P
	Float	Sink		
3.30	15.9	56.6	91.2	0.43
3.50	19.0	57.5	88.6	0.42
3.77	25.1	59.1	81.1	0.36
4.24	30.6	61.9	65.1	0.32

Grind -10 Mesh

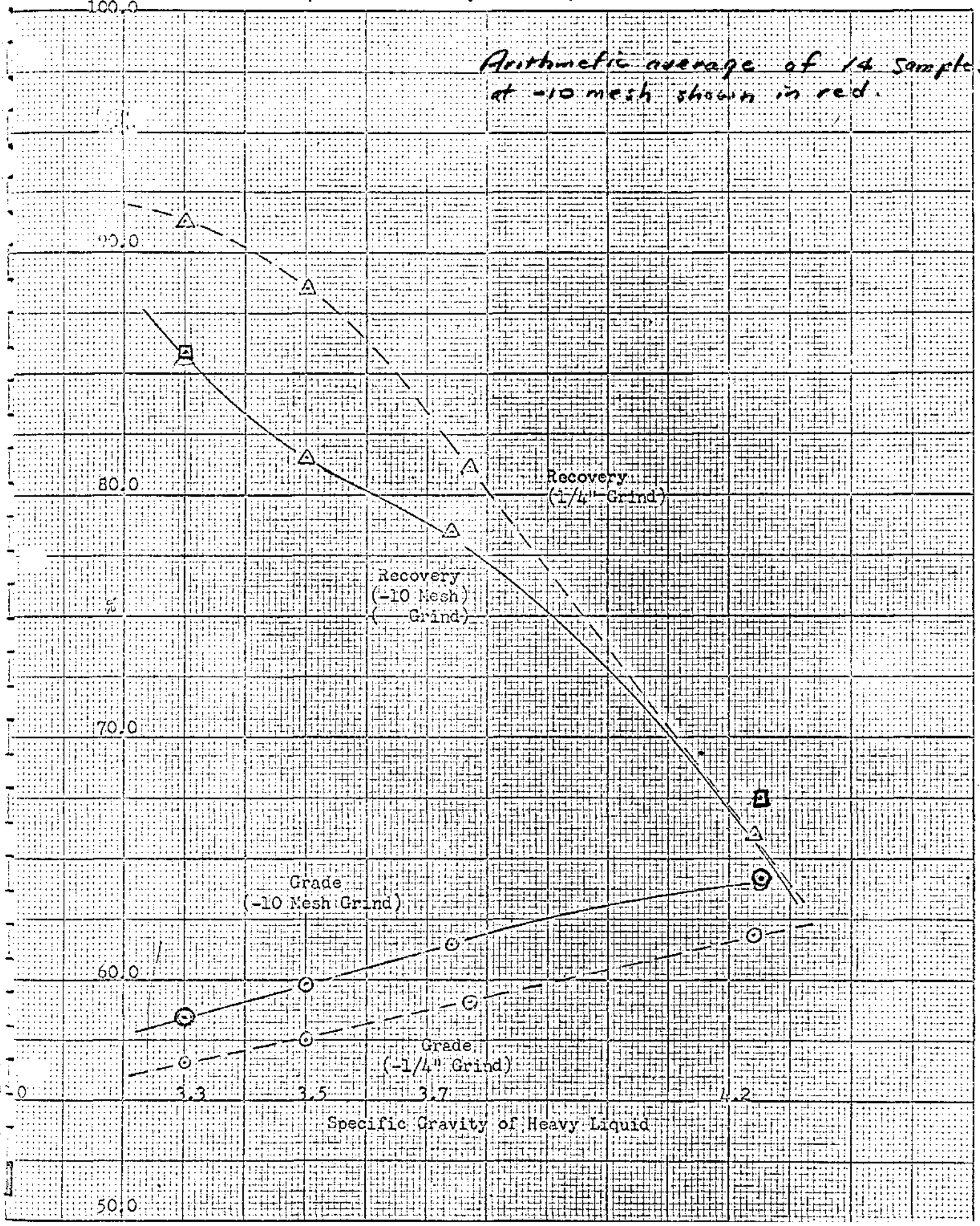
Specific Gravity of Heavy Liquid	Grade % Fe		Recovery %	% P
	Float	Sink		
3.30	13.5	58.5	85.6	0.37
3.51	18.1	59.9	81.5	0.34
3.74	20.9	61.2	78.6	0.31
4.25	27.9	64.0	65.1	0.28

All samples. Average

3.30	13.2	58.5	85.8	0.31
4.24	26.5	64.2	67.5	0.23

GRAPH A

Comparison of Average Grade and Recoveries Obtained from Heavy Liquid Tests on Six Representative Samples at -1/4" and -10 Mesh



HUGHES OWENS 315F 20x20

Comparison of Phosphorus Content of Concentrates Obtained from Heavy Liquid Tests on Six Representative Samples at -1/4" and -10 Mesh

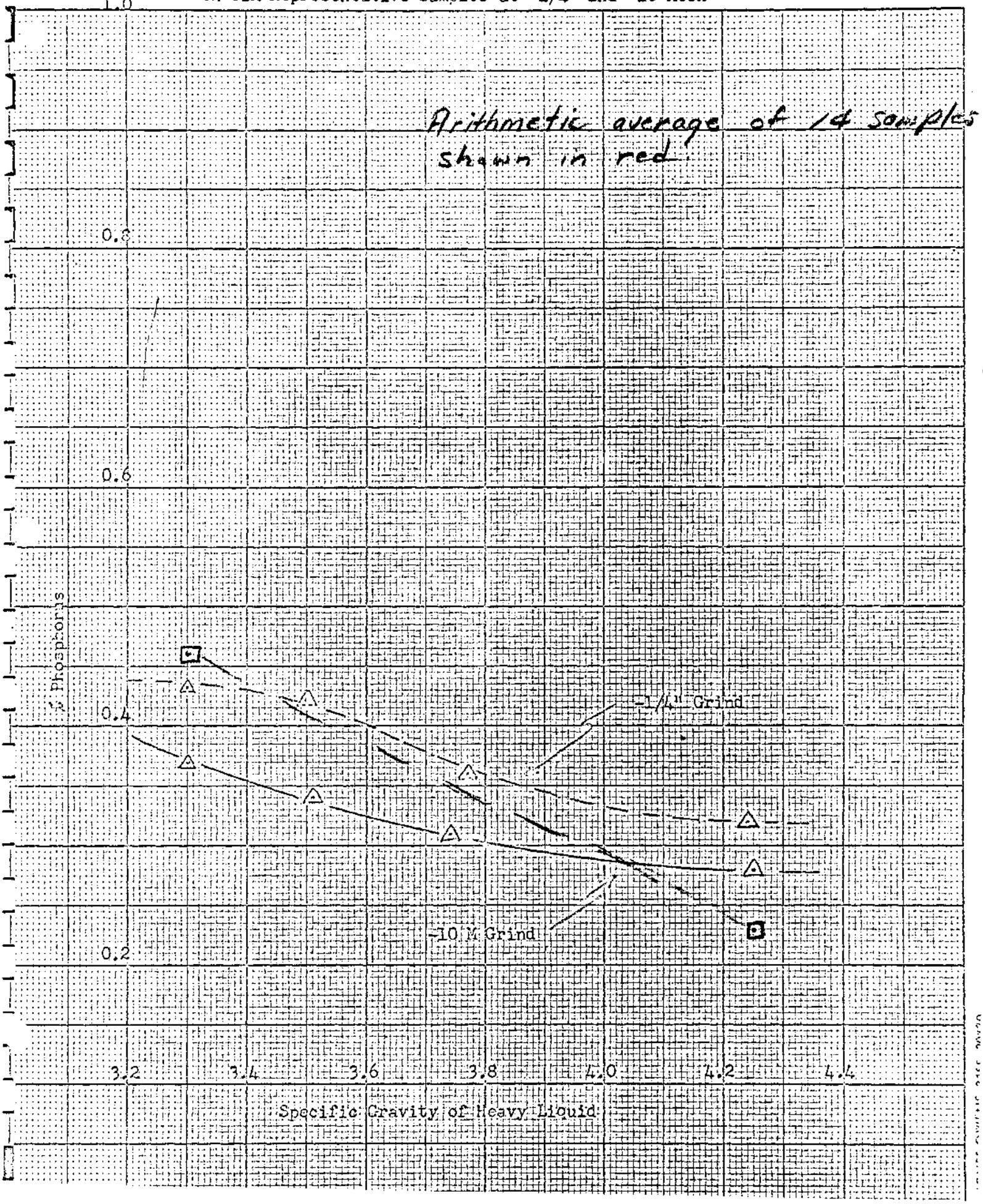


TABLE XII

Humphrey Spiral Tests *

BENCH I	BENCH II	BENCH III
Samples (1 - 2 - 3 - 4)	Samples (5 - 10 - 11 - 6 - 7)	Samples(12 -13 - 8 - 14 - 9)
Conc. Outlets - 3,5,7,9,11.	Conc. Outlets - 5,7,9,11.	Conc. Outlets - 5,7,9,11.
Middling Outlets - 14, 15.	Middling Outlets - 14, 15.	Middling Outlets - 14, 15.
Pump - 1320 RPM	Pump - 1320 RPM	Pump - 1320 RPM
Wash Water - 5 GPM	Wash Water - 5 GPM	Wash Water - 5 GPM
Feed Pulp - 24 GPM	Feed Pulp - 20 GPM	Feed Pulp - 20 GPM
Feed Rate - 1.5 dry tons/hr.	Feed Rate - 1.5 dry tons/hr.	Feed Rate - 1.5 dry tons/hr.

Product Balance: Rougher Stage

	BENCH I			BENCH II			BENCH III		
	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.
Head	100.0	47.4	100.0	100.0	46.6	100.0	100.0	46.4	100.0
Rougher Conc.	64.2	51.4	69.6	61.1	53.4	68.3	63.6	49.6	68.1
" Mids.	10.6	28.7	6.4	10.8	25.7	5.8	10.0	30.0	6.5
" Tails	3.7	28.4	2.2	4.8	20.9	2.1	4.2	29.5	2.7
-200M Slimes	21.5	47.9	21.8	23.3	48.7	23.8	22.2	47.5	22.7

Product Balance: Cleaner Stage

	BENCH I			BENCH II			BENCH III		
	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.	% Wt.	% Fe	Distn.
Head	64.2	51.4	69.6	61.1	53.4	68.3	63.6	49.6	68.1
Cleaner Conc.	44.4	57.4	53.7	46.0	59.5	57.2	42.7	56.1	51.7
" Mids.	14.0	42.7	12.6	9.5	40.3	8.0	14.3	41.2	12.7
" Tails	5.8	27.2	3.3	5.6	26.1	3.1	6.6	26.0	3.7

Chemical Analyses Cleaner Concentrate

BENCH I	BENCH II	BENCH III
% Fe - 57.4 % P - 0.54 % SiO_2 - 12.4	% Fe - 59.5 % P - 0.23 % SiO_2 - 11.4	% Fe - 56.1 % P - 0.22) % SiO_2 - 13.4)

* Mean?

TABLE XIII

Deister Shaking Table Tests*

Sample 1	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Conc.	13.1) 64.8	57.0) 52.5	0.75	11.9	17.0
Mids.$_1$	51.7)	51.4)	-	-	60.4
Mids.$_2$	27.4	25.6	-	-	15.9
Tailing	7.8	37.8	-	-	6.7

Sample 3	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Conc.	21.4) 71.9	66.6) 62.8	0.26	3.2	26.4
Mids.$_1$	50.5)	61.2)	-	-	57.2
Mids.$_2$	16.8	24.8	-	-	7.7
Tailing	11.3	41.6	-	-	8.7

Sample 4	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Conc.	28.7) 56.2	63.6) 60.7	0.33	5.2	37.9
Mids.$_1$	27.5)	57.7)	-	-	33.0
Mids.$_2$	24.9	31.0	-	-	16.0
Tailing	7.5	17.2	-	-	2.7
-150 M Slimes	11.4	43.7	-	-	10.4

Sample 7	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Conc.	16.2) 55.1	57.9) 52.1	0.19	14.3	24.0
Mids.$_1$	39.1)	49.7)	-	-	49.7
Mids.$_2$	33.2	20.9	-	-	17.8
Tailing	11.5	28.8	-	-	8.5

Sample 8	% Wt.	% Fe	% P	% SiO_2	Fe Distn.
Conc.	26.8) 60.9	58.0) 54.1	0.15	11.0	32.3
Mids.	34.1)	51.0)	-	-	36.1
Tailing	27.0	34.3	-	-	19.2
-150 Mesh Slimes	12.1	49.2	-	-	12.4

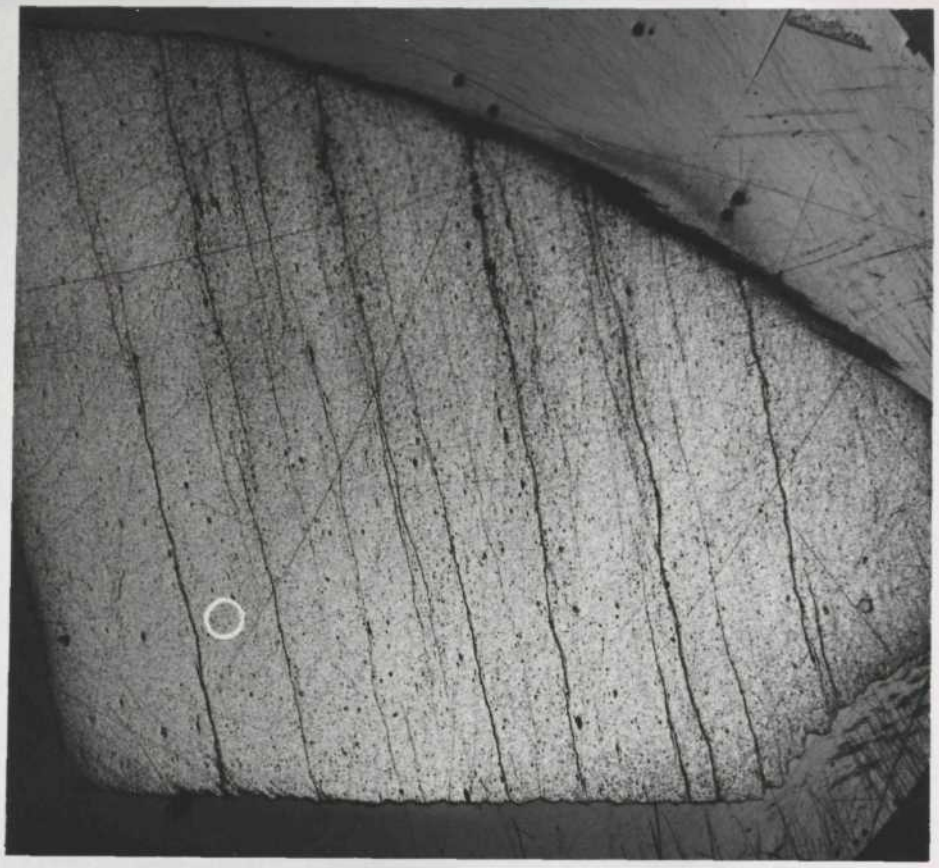
* Feed to this unit - all -10 mesh

TABLE XIV

Magnetic Separation Tests on Reducing Roast Products

		SAMPLE 5				SAMPLE 8			
Roast Product	Davis Tube	% Wt.	% Fe	% P	Fe Distn.	% Wt.	% Fe	% P	Fe Distn.
	Head*	100.0	52.8	-	100.0	100.0	51.6	-	100.0
-10 M Head	D.T. Conc.	94.6	55.4	.40	99.3	92.7	55.2	.28	99.1
"As Roasted"	D.T. Tails	5.4	7.0	-	0.7	7.3	6.2	-	0.9
	Head*	100.0	52.9	-	100.0	100.0	52.0	-	100.0
Roast Head	D.T. Conc.	78.8	62.5	.33	93.1	83.1	60.7	.18	96.9
-100 M	D.T. Tails	21.2	17.1	-	6.9	16.9	9.5	-	3.1
	Head*	100.0	52.1	-	100.0	100.0	52.2	-	100.0
Roast Head	D.T. Conc.	75.7	62.8	.29	91.3	82.4	61.4	.17	96.9
-200 M	D.T. Tails	24.3	18.6	-	8.7	17.6	9.2	-	3.1
	Head*	100.0	52.1	-	100.0	100.0	52.9	-	100.0
Roast Head	D.T. Conc.	75.3	63.1	.28	91.2	81.0	62.9	.15	96.4
-325 M	D.T. Tails	24.7	18.7	-	8.8	19.0	10.1	-	4.6

* Calculated



1 cm = 2 mm.

Figure 1 - Sample 5

Polished Section

Magnification x 5

Apparently solid band of hematite showing parallel laminations or fractures common to these bands. Contains Quartz from 60 μ to 1.3 μ average size 14 μ



1 mm. = 2 μ

Figure 2 - Sample 5

Area Circled Above

Magnification x 500

Quartz (grey) from 24 μ (top centre) to less than 2 μ
Hematite white

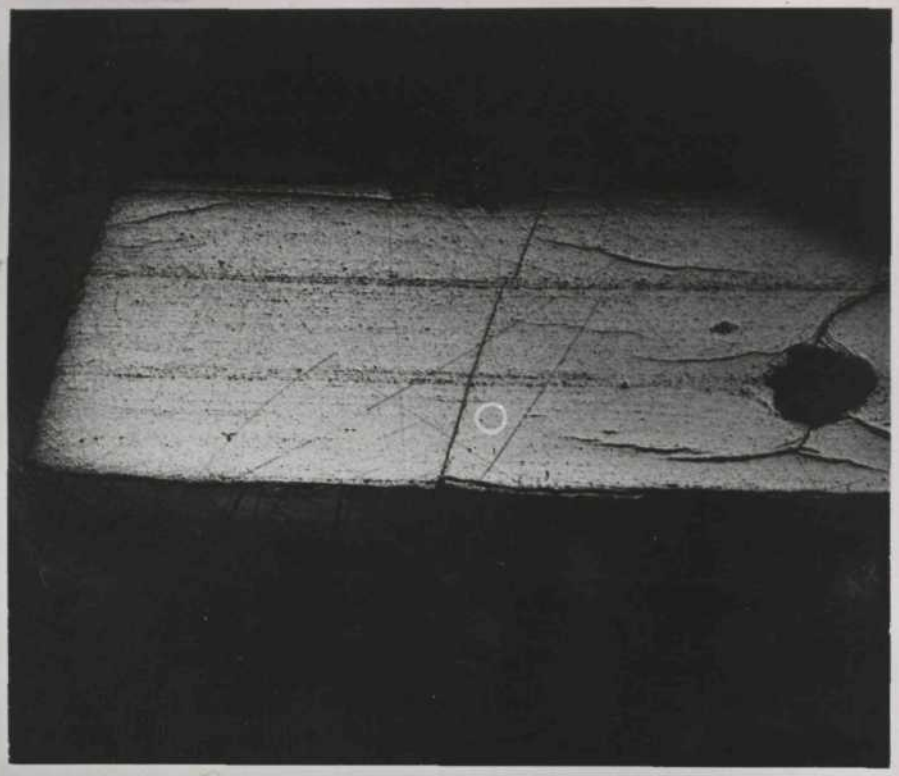


Figure 3 - Sample 5

Polished Section

Magnification x 5

Similar band to Fig. 1.
Large black area to right is jasper nodule
Quartz from 39.4 μ to 2.6 μ
average size 13.4 μ

1 cm = 2 mm.

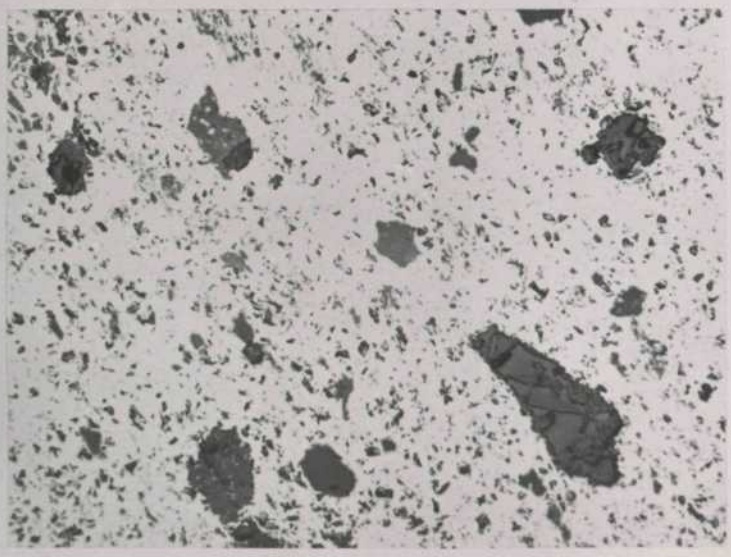


Figure 4 - Sample 5

Area Circled Above

Magnification x 500

Quartz (grey) 53 μ
x24 μ (largest) to
less than 2 μ
Hematite (white)

1 mm. = 2 μ



Figure 5 - Sample 8
Polished Section

Magnification x 5

Nodular band of what appeared to be mainly hematite.
No size measurements taken (see below)

1 cm = 2 mm.



Figure 6 - Sample 8
Area Circled Above

Magnification x 500

Quartz (grey)
Hematite (white)

1 mm. = 2 μ

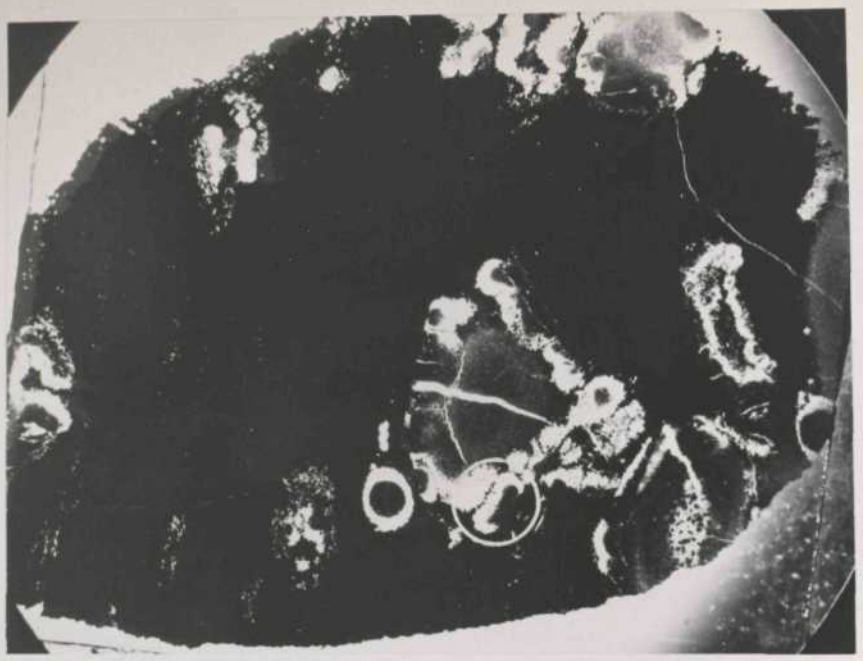


Figure 7 - Sample 5

Thin Section

Magnification x 5

Nodular structures in grey hematite mass. Typical nodules have quartz (white) outer rim and inner core of quartz, carbonate and hematite.

Estimated composition

Quartz 10%
Hematite 80%
Carbonate 10%
Traces greenalite, apatite, limonite

1 cm = 2 mm.

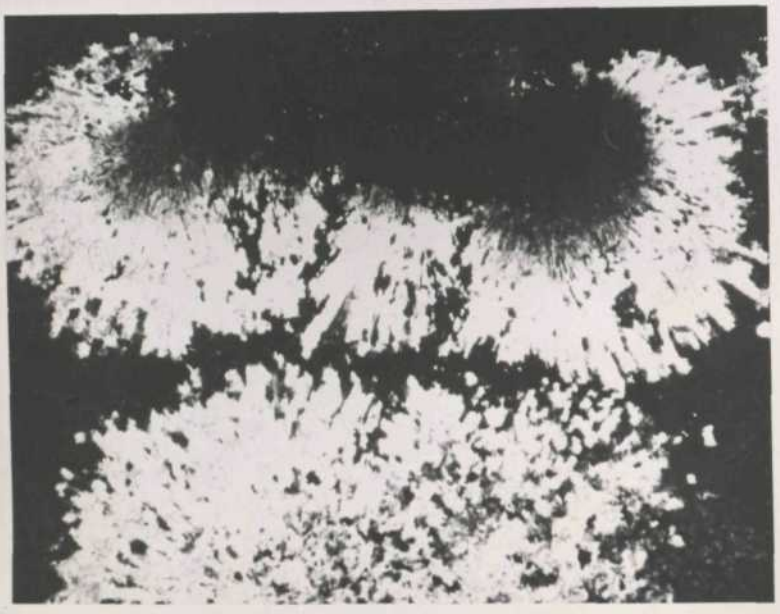
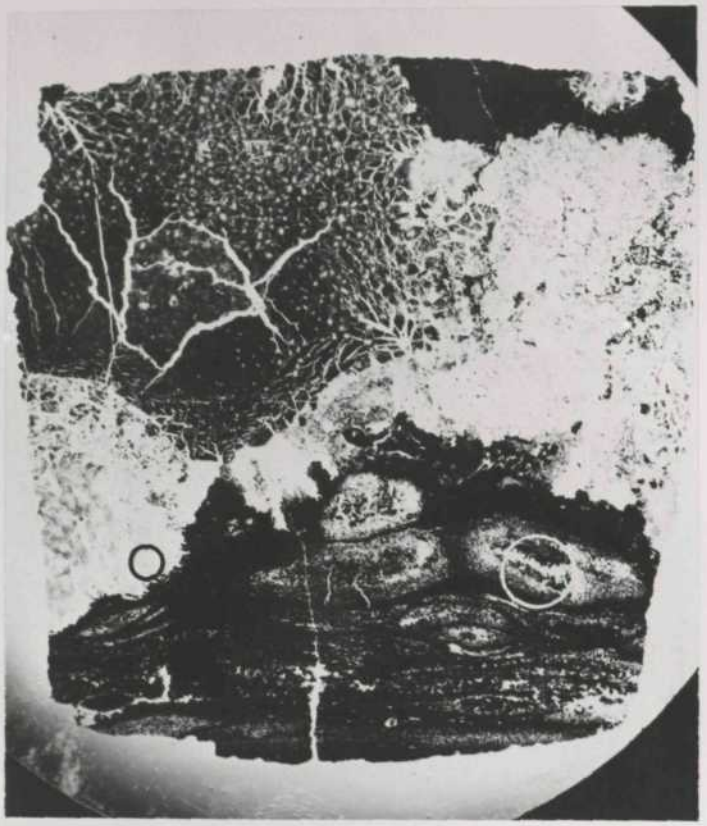


Figure 8 - Sample 5

Area Circled Above

Magnification x 56

Typical structure. Core of top nodule is quartz-carbonate (dark) surrounded by quartz (white) with intermittent hematite (black)



Area 1 Area 2

1 cm = 2 mm.

Figure 9 - Sample 8

Thin Section

Magnification x 5

Nodular spherulitic structures. Large patch top left corner is a zone composed of an aggregate of quartz (white) spherulites defined by dusty inclusions of limonite and hematite.
This zone is cut by veinlets of clear quartz.

Estimated overall composition

Hematite 40%
Quartz 30%
Carbonate 20%
Limonite 10%
Trace Greenalite

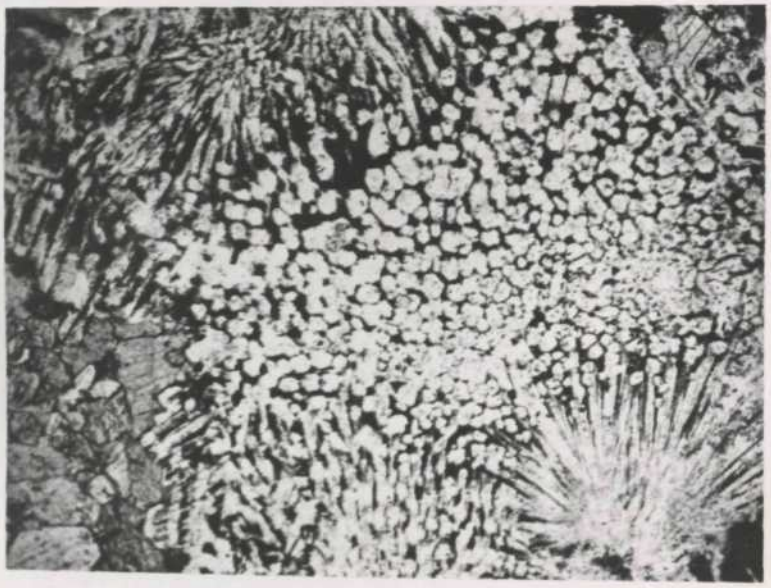


Figure 10 - Sample 8

Area 1 Circled Above

Magnification x 56

Some of the unusual structures present in these gangue areas.
Quartz (white) as hexagonal and radiating replacements.
Carbonate (grey) bottom left hand side
Hematite (black)

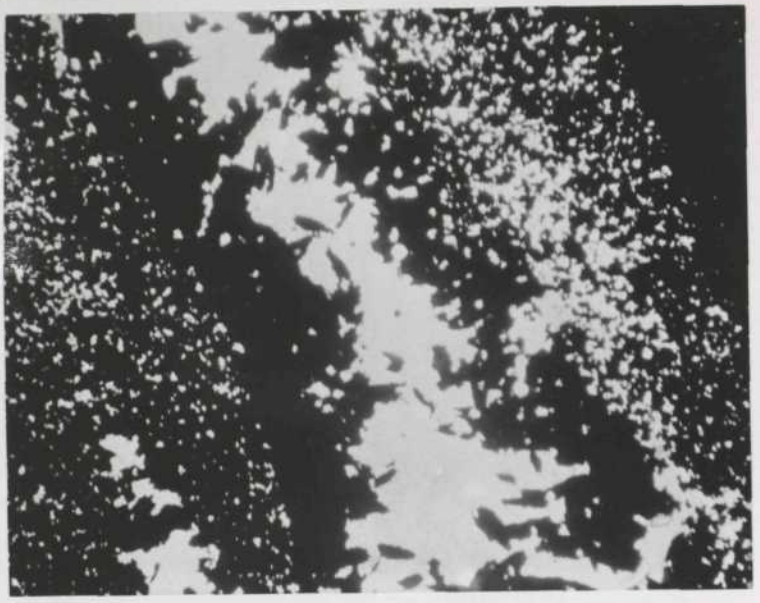
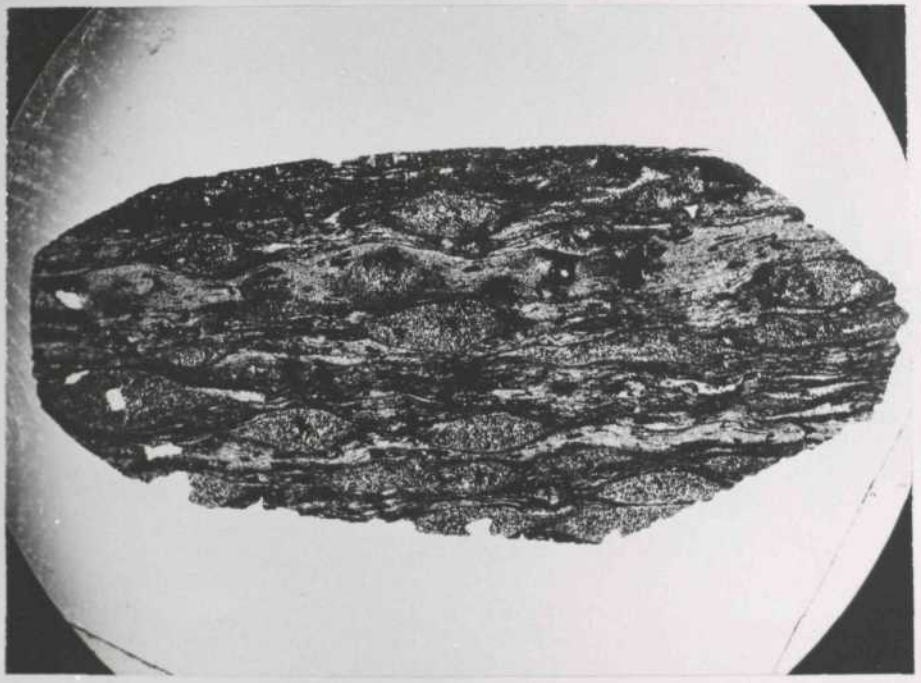


Figure 11 - Sample 8

Area 2 (Fig. 9)

Magnification x 56

Quartz, hematite nodule.
Quartz (white)
Hematite (black)
Quartz about 15 μ
average size. Smallest
quartz 4 μ, smallest free
hematite 4 μ



1 cm = 2 mm.

Figure 12 - Sample 8

Thin Section

Magnification x 5

Intermixed hematite (black)
and quartz (white) as
lenticular masses. Estimated
composition

Quartz 50%
Hematite 40%
Carbonate 5%
Limonite 5%
Trace of Greenalite



1 cm = 2 mm.

Figure 13 - Sample 8

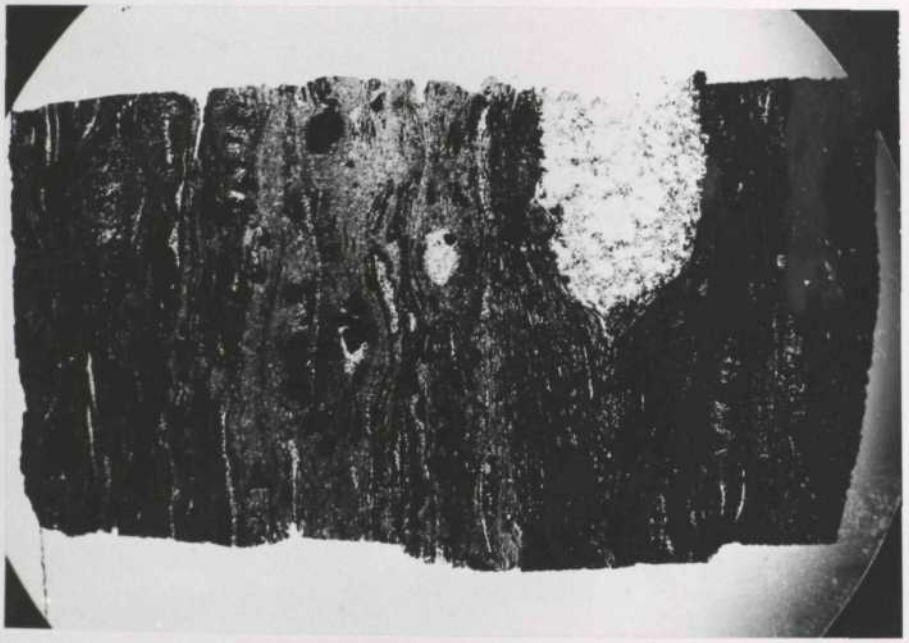
Thin Section

Magnification x 5

Banded quartz (white) Hematite (black) deflected around a large zone of quartz spherulites defined by dusty inclusions of hematite.

Estimated composition

Quartz 60%
Hematite 35%
Carbonate 5%
Traces of limonite and greenalite



1 cm = 2 mm.

Figure 14 - Sample 8

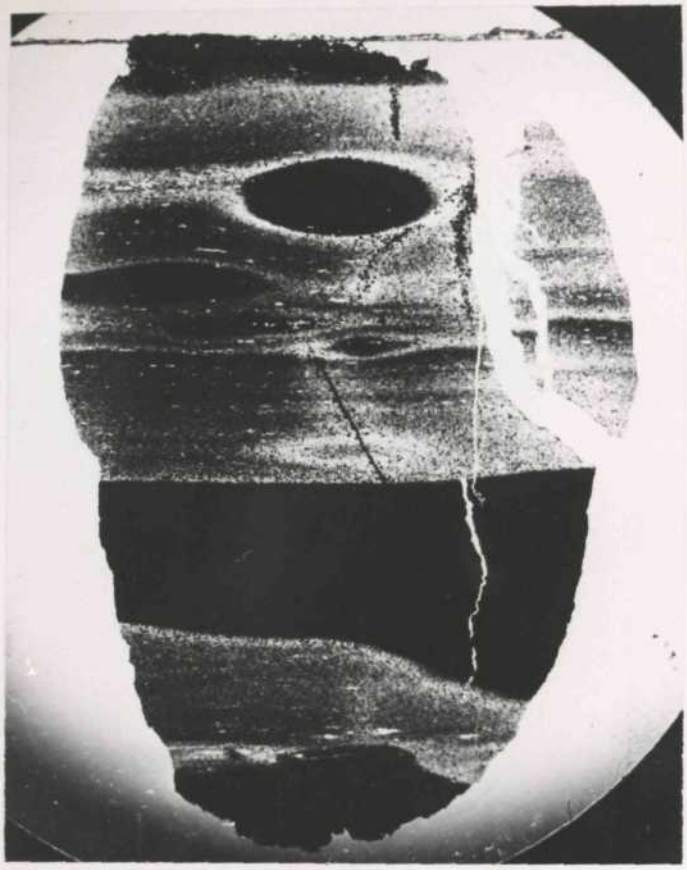
Thin Section

Magnification x 5

Interbanded quartz (white), hematite (black) surrounding quartz-carbonate nodules.

Estimated composition

Hematite 60%
Quartz 30%
Limonite 5%
Carbonate 5%
Traces of greenalite and apatite



1 cm = 2 mm.

Figure 15 - Sample 5

Thin Section

Magnification x 5

Interbanded quartz (white) and hematite (black). Top central nodule is hematite with red jasper centre (not visible). Lenticular patches below this are also jasper. Solid hematite band (lower portion of slide) contains quartz as in Figs. 1 and 3.

Estimated composition

Hematite 50%
Quartz 45%
Carbonate 5%
Traces of limonite, apatite, greenalite



1 cm = 2 mm.

Figure 16 - Sample 5

Magnification x 5

Typical nodular zone in hematite (black). Nodules composed of quartz (white), carbonate and fine hematite (black).

Estimated composition

Quartz 60%
Hematite 30%
Carbonate 5%
Greenalite 5%
Trace limonite

REPORT ON 091697
IRON ORE BENEFICIATION TESTS
CARRIED OUT BY
HUMPHREYS ENGINEERING CO.
FOR
CREST EXPLORATION LIMITED

HUMPHREYS ENGINEERING COMPANY
810 AMERICAN NATIONAL BANK BUILDING
DENVER 2, COLORADO

December 28, 1962

CABLE ADDRESS "HUMPHREYS"

OUR REF. G-1241-HEC
YOUR REF. Lot 1608/09

Dept. of Northern Affairs & National Resources
Northern Administration Branch
RESOURCES DIVISION
JUN 12 1963
MAYO, Y.T.
Mining Recorder & Land Agent

091697

Dr. R. A. Stuart
Crest Exploration Ltd.,
Medical Arts 329-A, 6th Avenue Southwest
Calgary, Alberta
CANADA

Dear Dr. Stuart:

The following is a preliminary report which summarizes the test work we have completed to date on your iron ore.

Our primary objective was to determine if the Humphreys spiral concentrator would produce a +60% Fe concentrate at a satisfactory iron recovery. In tests reported here the highest grade concentrate made assayed 59.9% Fe and represented an overall iron recovery of only 25.5%. Other cleaner spiral concentrates assayed 56.6% Fe and 56.9% Fe and represented overall iron recoveries of 65.7% and 69.5%. These data confirm the conclusion of the Ontario Research Foundation that the test objective will be difficult to realize. However, we are more optimistic than the Foundation in view of the fact that the best results reported here were made on ore ground only to -10 mesh and processed without sizing or fines removal. Even iron recoveries in the 65-70% range are not so bad when it is realized that part of the iron in the ore is present as jasper which can never be recovered in a commercial iron product and should not be considered as iron ore. Also, part of the loss reported here is as middlings which are potentially recoverable , at least in part, by their regrind and retreatment.

All spiral tests reported here were observed by Mr. Pearce of the Ontario Research Foundation. Except for two screen analyses, all tests reported were made on your sample IF9. Splits of all test products (except possibly screen partials) will be sent for your own evaluation. Samples of some products were taken by Mr. Pearce for assay at the Foundation. Splits of the remaining products are being mailed to Mr. Pearce. In addition, we are mailing him a copy of this preliminary report.

Screen data on both your IF9 and IF13 samples show the coarsest screen products to be the highest grade with the grade decreasing for each partial down to 325 mesh. This offers some

encouragement since it indicates the presence of some moderately high grade rock in the coarse sizes. This is confirmed by ORF sink-float data for tests made in a +4 gravity liquid.

Your IF13 sample has been crushed to -10 mesh and will all be used for a 3-stage spiral or sizer-spiral test. The objective of these tests will be to obtain, if possible, some +60% Fe concentrate at the 10 mesh grind. All "middling" products will then be re-ground and again spiralled in an attempt to obtain additional +60% Fe concentrate. We plan to run this the second week in January and will appreciate your comments on data in this report before that time.

The ore tends to break into flakes and splinters. This tendency is accentuated by the crushing rolls used to grind these samples. Since these tabular particles are more difficult to separate than are blocky particles, regardless of the concentration method used; a different and better crushing method if it can be found, would be expected to yield better concentrates. Consequently, a crushing-grinding study would be very much justified if you go ahead with plans to develop this property.

Detailed data for all the tests completed are given in the attached tables.

Best wishes for the New Year!

Very truly yours,

HUMPHREYS ENGINEERING COMPANY

Metallurgical Engineer

hs/g
encls
cc-ORS
Lab
Office

HUMPHREYS ENGINEERING COMPANY
910 AMERICAN NATIONAL BANK BUILDING
DENVER 2, COLORADO

CABLE ADDRESS
"HUMPHREYS"

December 28, 1962
OUR REF. S-1080-HEC
YOUR REF. Lot 1608

Mr. Mike Pearce
Ontario Research Foundation
43 Queen's Park Crescent East
Toronto 5, Ontario
CANADA

Dear Mike:

Attached is a copy of our preliminary report as mailed to Dr. Stuart.

I am more encouraged with these data now they are complete than I was with the partial data available when you were here. Data generally confirm your own conclusions that the problem is a rough one. In general, we got a little higher iron recovery than you did. I believe this is because we spiralled with slimes in the sample while you removed them prior to spiralling. I think this treatment of ore with slime in also made it possible for us to handle the -10 mesh in the spiral.

I believe results justify completion of the tests on Channel sample IF 13 as outlined to Dr. Stuart. On completion of that work a review of all test data should be made to see if any promising leads have been developed or if testing along these lines should be discontinued.

I enjoyed meeting you again and appreciate your help very much. I hope you made your plane connections okay.

We will write Mr. Everard next week relative to our loaning this spiral to you.

Best wishes for the New Year,

Yours very truly,

HUMPHREYS ENGINEERING COMPANY

Henry Snedden

Henry Snedden

HS/sg

Table No. 1

HUMPHREYS LABORATORY TEST

Date: 12/20/62 Lot No.: 1608 Test No.: Summary

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF9

Object of Test: To obtain the maximum iron recovery in a concentrate that assays, or can be cleaned to, +60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION % Single Stage	WEIGHT DISTRIBUTION % 2-stage O'all	Fe Assay %	Fe Distribution % single stage	Fe Distribution % 2-stage O'all	Sizer-Spiral Composite Assay % Fe	Sizer-Spiral Composite O'all Distribution % Wgt	Sizer-Spiral Composite O'all Distribution % Fe
D92	-10 mesh Ro. Conct.	74.7		50.52	81.7				
H-2	-10 mesh Sizer-cleaner conct.	26.7	25.5	59.90	31.2	25.5)	P = 0.24%		
J-2	-10 mesh spiral cleaner conct.	35.7	26.7	54.78	38.2	31.2)	56.8	~~62.4~~ 52.2	56.7
E-2	-10 mesh spiral rougher conct.	66.2		53.68	76.3				
F-2b	-10 mesh spiral cleaner conct.	81.0	53.6	56.94	86.1	65.7	P = 0.27%		
F-2	-10 mesh spiral cleaner conct.	86.4	57.2	56.62	91.0	69.5			
G-2	-20 mesh spiral rougher conct.	70.7		51.84	78.5				

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T.J. Ferree

Table No. 2

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 12/18/62 Lot No.: 1608 Test No. D Stage: 1st (Rougher) Spiral Model: 24A-A5 MRL

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF 9 Grind Used: -10 mesh ✓

Object of Test: To obtain the maximum iron recovery in a +55% Fe concentrate.

Conc. Outlets: 2,3,5,7,12,15 Midd. Outlets: ----- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.34:1

Wash Water Volume GPM: Total: 6 Excess: 1 Feed Pulp Volume GPM: 17 Feed Pulp % Solids: 26 Feed Rate per Spiral Dry Pounds/hr.: 2200

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
D-2	Concentrate	1645	74.7	50.52		81.7			
D-3	Sand Tail	435	19.8	30.70		13.1			
D-4	Slime Tail	120	5.5	43.55		5.2			
	Calculated Head	2200	100.0	46.22		100.0			
B-1	-10 mesh head	2700		47.47					
	(Spiral Feed)								
D-6	Conct. Taken on Vanner @ Start of Test			53.57					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 3

HUMPHREYS LABORATORY TEST

Date: 12/20/62 Lot No.: 1608 Test No.: H - J

Customer: Crest Exploration Limited

Ore: Rougher concentrate D-2 from Crest Channel Sample IF 9

Object of Test: To obtain the maximum iron recovery in a +60% concentrate when cleaning spiral rougher concentrate in a Humphreys sizer - spiral circuit at -10 mesh.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Overall		
			%	Assay %	Distribution		Assay %	Distribution %	
				%		%	Fe	Wgt	Fe
H-2	Sizer-Conct.		26.7	59.90		31.2)	(	19.9	25.5
J-2	Spiral conct.		35.7	54.78		38.2)	56.8(	26.7	31.2
J-4	Spiral tail		37.6	41.82		30.6	(	28.1	25.0
	Calculated head		100.0	51.27		100.0		74.7	81.7
D-2	Rougher conct. (Test head)			50.52				74.7	81.7

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 4

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 2/19/62 Lot No.: 1608 Test No. E Stage: 1st (Rougher) Spiral Model: 24A5 MRL

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF9 Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate assaying +55% Fe.

Conc. Outlets: 2,3,5,7,12,15 Midd. Outlets: ----- Circulating Midd. Dry Pounds/hr.: ---- Ratio of Wt. Concentration: 1.5:1

Wash Water Volume GPM: Total: 6 Excess: 1 Feed Pulp Volume GPM: 19 Feed Pulp % Solids: 24 Feed Rate per Spiral Dry Pounds/hr.: 2650

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Fe		
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%	%		%
E-2	Concentrate	1755	66.2	56.91		77.3	*53.68		76.3
E-3	Sand Tail	565	21.3	26.67		11.7	26.67		12.2
E-4	Slime Tail	330	12.5	42.90		11.0	42.90		11.5
	Calculated Head	2650	100.0	48.71		100.0	46.58		100.0
B-1	-10 mesh head	2700		47.47					

Remarks: * This concentrate assay is calculated from the cleaner tests F & Fb. It looks more in line than the actual assay of 56.91% Fe.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden
T. J. Ferree

Table No....5.....

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 12/19/62 Lot No.: 1608 Test No. Fb Stage: 2nd (Cleaner) Spiral Model: 24A5 MRL

Customer: Crest Exploration Limited

Ore: Rougher spiral concentrate E-2 (IF9) Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate assaying +60% Fe.

Conc. Outlets: 2,3,5,7,9,12,15 Midd. Outlets: ------ Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.2:1

Wash Water Volume GPM: Total: 7 Excess: 1 Feed Pulp Volume GPM: 18 Feed Pulp % Solids: 21 Feed Rate per Spiral Dry Pounds/hr.: 2240

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Overall		
				Assay	Distribution		Assay	Distribution %	
		Lbs/Hr	%	%		%		Wgt	Fe
F-2b	Concentrate	1815	81.0	56.94		86.1		53.6	65.7
F-3b	Sand Tail	318	14.2	35.28		9.3		9.4	7.1
F-4b	Slime Tail	107	4.8	51.40		4.6		3.2	3.5
	Calculated Head	2240	100.0	53.60		100.0		66.2	76.3
E-2	Rougher Conct. (Test Head)	2260		*53.68				66.2	76.3

Remarks: * The calculated assay of 53.68% Fe is used instead of the assay value of 56.91% Fe until the latter figure can be checked.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T.J. Ferree

Table No. 6

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 12/19/62 Lot No.: 1608 Test No. G Stage: 1st (Rougher) Spiral Model: 24A5 MRL

Customer: Crest Exploration Limited

Ore: Crest channel sample IF9 Grind Used: -20 mesh

Object of Test: To obtain the maximum iron recovery in a +55% Fe concentrate.

Conc. Outlets: 2,3,5,7,9,12,15 Midd. Outlets: ----- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.9:1

Wash Water Volume GPM: Total: 5 Excess: 1 Feed Pulp Volume GPM: 19 Feed Pulp % Solids: 23 Feed Rate per Spiral Dry Pounds/hr.: 2660

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe				
				Assay	Distribution		Assay	Distribution
		Lbs/Hr	%	%		%		
G-2	Concentrate	1880	70.7	51.84		78.5		
G-3	Sand Tail	440	16.5	25.70		9.1		
G-4	Slime Tail	340	12.8	45.08		12.4		
	Calculated Head	2660	100.6	46.66		100.0		
C-1	-20 mesh head	2700						

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 7

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 12/19/62 Lot No.: 1608 Test No. F Stage: 2nd (Cleaner) Spiral Model: 24A5-MRL

Customer: Crest Exploration Limited

Ore: Crest Channel sample IF 9 Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate assaying +60% Fe.

Conc. Outlets: 2,3,5,7,9,12,15 Midd. Outlets: ------ Circulating Midd. Dry Pounds/hr.: ----- Ratio of Wt. Concentration: 1.2:1

Wash Water Volume GPM: Total: 7 Excess: 1 Feed Pulp Volume GPM: 19 Feed Pulp % Solids: 23 Feed Rate per Spiral Dry Pounds/hr.: 2840

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Overall		
			%	Assay	Distribution		Assay	Distribution %	
		Lbs/Hr		%		%		Wgt	Fe
F-2	Concentrate	2450	86.4	56.62		91.0		57.2	69.5
F-3	Sand Tail	310	10.8	32.23		6.5		7.1	4.9
F-4	Slime Tail	80	2.8	48.70		2.5		1.9	1.9
	Calculated Head	2840	100.0	53.76		100.0		66.3	76.3
E-2	Rougher Conct. (Test Head)	2260		56.91				66.2	76.3
				*53.68					

Remarks: * Calculated head

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 8

HUMPHREYS LABORATORY TEST

Date: 12/12/62 Lot No.: 1603 Test No.: A-1

Customer: Croat Exploration Limited

Ore: Iron ore sample IF-9-62

Object of Test: A screen analysis made wet to determine the size distribution of iron in the sample as received..

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe				
			%	Assay	Distribution		Assay	Distribution
				%		%		
A-1.1	+4 mesh		20.7	43.76		21.7		
A-1.2	-4+10 mesh		39.5	46.02		39.6		
A-1.3	-10+200 mesh		32.7	45.49		31.9		
A-1.4	-200+325 mesh		1.7	49.59		1.5		
A-1.5	-325 mesh		5.4	45.73		5.3		
	Calculated Head		100.0	46.60		100.0		
A-1	Assay Head (as received)			47.47				

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Sneddon

Table No.....9....

HUMPHREYS LABORATORY TEST

Date: 12-13-62 Lot No.: 1608 Test No.: B-1

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF9-62, *Roll Crusted to -10 mesh

Object of Test: To determine the size of distribution of this ore after stage crushing it to -10 mesh.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Not Assayed					
			%	Assay	Distribution		Assay	Distribution	
B-1.1	-10 +14 mesh		18.7						
B-1.2	-10 +20 mesh		22.9						
B-1.3	-20 +28 mesh		14.0						
B-1.4	-28 +35 mesh		9.8						
B-1.5	-35 +48 mesh		7.6						
B-1.6	-48 +65 mesh		5.3						
B-1.7	-65 +100 mesh		4.1						
B-1.8	-100 + 150 mesh		3.1						
B-1.9	-150 +200 mesh		2.1	1.6					
B-1.10	-200 +325 mesh		2.8						
B-1.11	-325 mesh		9.6						
	Calculated -10 head		100.0						
B-1	-10 mesh head			47.47					

Remarks: *The ore breaks into tabular grains or flakes & splinters. For this reason the last 10% of the sample was stage ground in a Braun pulverizer. Samples was wet screened on 200 & 325 mesh screens then dry screened in a Rotap.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer:

Table No. 10

HUMPHREYS LABORATORY TEST

Date: 12-13-62 Lot No.: 1608 Test No.: C-1

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF0 *Roll crushed to -20 mesh

Object of Test: To determine the percentages of -200 +325 & -325 mesh fines that result from a -20 mesh.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Not Assayed					
			%	Assay	Distribution		Assay	Distribution	
C-1.1	-20 +200 mesh		70.5						
C-1.2	-200+325 mesh		7.4						
C-1.3	-325 mesh		22.1						
	Calculated -20 head		100.0						

Remarks: *The ore breaks into tabular, flaking or splintered grains that do not break readily when roll crushed. For this reason the last 10% of the sample was crushed in a Braun pulverizer. All screening was done wet.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden, T.J. Ferree

Table No. 11

HUMPHREYS LABORATORY TEST

Date: 12-13-62 **Lot No.:** 1609 **Test No.:** A-1

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF 13 As Received

Object of Test: To determine the size and iron distributing particularly in the -200 mesh sizes for the ore as received (Approximate grind -3/8")

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
			%	Assay	Distribution		Assay	Distribution	
				%		%			
A-1.1	+4 mesh		11.9	50.08	5.96	12.9			
A-1.2	-4 +10 mesh		45.6	46.81	21.35	46.3			
A-1.3	-10 +200 mesh		35.2	44.20	15.56	33.8			
A-1.4	-200 +325 mesh		1.5	38.32	0.57	1.2			
A-1.5	-325 mesh		5.8	45.73	2.65	5.8			
	Calculated as Recd. Head		100.0	46.09	46.09	100.00			
A-1	Head as Recd.			46.38					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden, T. J. Ferree

Table No....12...

HUMPHREYS LABORATORY TEST

Date: 12-17-62 Lot No.: 1609 Test No.: B-1

Customer: Crest Exploration Limited

Ore: Crest Channel Sample JF 13. Roll crushed to -10 mesh

Object of Test: To determine the percentages of -200 +325 and -325 mesh fine that result from a -10 mesh crush.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Not Assayed				
			%	Assay	Distribution		Assay	Distribution
B-1.1	-10 +200 mesh		87.5					
B-1.2	-200 +325 mesh		3.0					
B-1.3	-325 mesh		9.5					
	Calculated -10 head		100.0					
B-1	Assayed -10 head.			44.86				

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden, T. J. Ferree

HUMPHREYS ENGINEERING COMPANY
910 AMERICAN NATIONAL BANK BUILDING
DENVER 2, COLORADO

CABLE ADDRESS
"HUMPHREYS"

January 23, 1963

OUR REF. G-1353-HEC
YOUR REF. Lot 1609

Mr. Roy Stuart
Crest Exploration Limited
Medical Arts Building
329A - 6th Avenue SW
Calgary, Alberta
CANADA

Dear Roy:

The enclosed tables give results of our 3-stage concentration test as made on your channel sample IF-13. These tests were made at a -10 mesh grind. The objective of the tests was to obtain some plus 60% Fe concentrate.

As you can see in Table No. 1, the actual 3rd stage concentrate assayed only 58.58% Fe. However, the "slime" tailing for this test assayed 60.21% Fe. This slime tailing was made up primarily of flat high grade iron particles which, because of their shape, travel in the slime zone of the spiral. The particular product had very little true slime present.

I still believe that we can clean more material up to +60% Fe. To check this belief we plan a fourth concentration stage which will be a combined sizer-spiral test using E-2 as feed. We also plan some screen tests on other products.

Phosphorous analyses are not yet available on these concentrates. Phosphorous, reported as P205, for two concentrates from our Lot 1608 are as follows: H-2, 0.54% P205 and F2b, 0.62% P205. 0.24% P 0.27% P.

I wish to thank you for Mr. Maltby's report which I found very interesting.

We will complete our tests as soon as possible but doubt that the data will be available before February. I hope we have results that are more promising at that time.

Very truly yours,

HUMPHREYS ENGINEERING COMPANY

Henry Sneddon

Metallurgical Engineer

hs/g
encls

Table No. 1

HUMPHREYS LABORATORY TEST

Summary

Date: January 22, 1963 **Lot No.:** 1609 **Test No.:** C-D-E

Customer: Crest Exploration Limited

Ore: Crest channel sample IF 13 crushed to -10 mesh

Object of Test: To obtain, at maximum iron recovery, a concentrate assaying +60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Composite FE concentrate		
			%	Assay	Distribution		Assay	O'all Distribution %	
				%		%	% Fe	Wgt	Fe
E-2	ReCl. Conct.		41.4	58.58		53.7)	58.73	45.4	59.0
E-4	" " Slime Tail		4.0	60.21		5.3)			
D-4	Cl. " "		4.7	49.43		5.1			
C-4	" " "		11.0	39.30		9.6			
E-3	ReCl. Sand Tail		7.2	39.63		6.3			
D-3	Cl. " "		11.3	32.01		8.0			
C-3	Ro. " "		20.4	26.57		12.0			
	Calculated Head		100.0	45.19		100.0			
A-1	Assay Head			46.41					
	(ore as received)								

Remarks: We plan further tests as follows:
On E-2 - spiral-sizer 4th stage of cleaning ← Gave 81% of feed at 60.6% Fe (50.2% of head Fe)
On E-4, D-4 and C-4 - screen and possibly spiral
On E-3, D-3 and C-3 - scavenger spiral test, possibly preceded by a re-grind.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No....2....

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 1/17/63 Lot No.:1609 Test No. E Stage: Third Recleaner Spiral Model: 24A5

Customer: Crest Exploration Limited

Ore: Cleaner spiral concentrate from IF-13 Grind Used: -10 mesh

Object of Test: To obtain, at maximum iron recovery, a concentrate assaying +60% Fe.

Conc. Outlets: 2,3,5,7,9,12,15 Midd. Outlets: - Circulating Midd. Dry Pounds/hr.: - Ratio of Wt. Concentration: 1.3:1

Wash Water Volume GPM: Total: 7.2 Excess: 0.3 Feed Pulp Volume GPM: 19 Feed Pulp % Solids: 9 Feed Rate per Spiral Dry Pounds/hr.: 1739

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Composite Fe		
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%	%		%
E-2	Concentrate	1369	78.7	58.58		82.1)			
						)	58.73		90.4
E-4	Slime Tail	134	7.7	60.21		8.3)			
E-3	Sand Tail	236	13.6	39.63		9.6			
	Calculated Head	1739	100.0	56.12		100.0			
D-2	Cleaner Concentrate (Test Head)			57.73					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 3

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 1/16/63 Lot No.: 1609 Test No. D Stage: 2nd (Cleaner) Spiral Model: 24/5

Customer: Crest Exploration Limited

Ore: Rougher spiral concentrate from IF-13 Grind Used: -10 mesh

Object of Test: To obtain at maximum iron recovery a concentrate that will clean to +60% Fe.

Conc. Outlets: 2, 3, 5, 7, 9, 12, 15 Midd. Outlets: ---- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.3:1

Wash Water Volume GPM: Total: 6 Excess: 1 Feed Pulp Volume GPM: 21 Feed Pulp % Solids: 12 Feed Rate per Spiral Dry Pounds/hr.: 2183

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr.	%	%		%			
D-2	Concentrate	1677	76.8	57.73		83.8			
D-3	Sand Tail	358	16.4	32.01		9.9			
D-4	Slime Tail	148	6.8	49.43		6.3			
	Calculated Head	2183	100.0	52.95		100.0			
C-2	Rougher Conct.			53.46					
	(Test Head)								
D-5	Wet Feed			51.39					

Remarks:

D-2 assays 15.0% SiO2

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden & T.J.Ferree

Table No. 4

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 1/15/63 Lot No.: 1609 Test No. C Stage: 1st (Rougher) Spiral Model: 24A-5

Customer: Crest Exploration Limited

Ore: Crest channel sample IF-13 Grind Used: -10 mesh

Object of Test: To obtain, at maximum iron recovery, a concentrate that will clean to +60% Fe.

Conc. Outlets: 2,3,5,7,12,15 Midd. Outlets: ---- Circulating Midd. Dry Pounds/hr.:----- Ratio of Wt. Concentration: 1.5:1

Wash Water Volume GPM: Total: 4.8 Excess: 0.7 Feed Pulp Volume GPM: 22 Feed Pulp % Solids: 13 Feed Rate per Spiral Dry Pounds/hr.: 2540

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
			%	Assay	Distribution		Assay	Distribution	
		Lbs/Hr		%		%			
C-2	Concentrate	1742	68.6	53.46		79.0			
C-3	Sand Tail	518	20.4	26.57		11.7			
C-4	Slime Tail	280	11.0	39.30		9.3			
	Calculated Head	2540	100.0	46.41		100.0			
A-1	Head			46.38					
	(as rec'd)								

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden & T. J. Ferree

HUMPHREYS ENGINEERING COMPANY
910 AMERICAN NATIONAL BANK BUILDING
DENVER 2, COLORADO

CABLE ADDRESS
"HUMPHREYS"

OUR REF. G-1463-HEC
YOUR REF. Lot 1615

March 19, 1963

Dr. Roy Stewart
Crest Exploration Limited
329A 6th Avenue SW
Calgary, Alberta
CANADA

Dear Roy:

The enclosed tables give detailed results for the spiral-sizer tests made to produce concentrate for pumping tests. Table No. 1 is indicative of the overall results obtained in these tests. As I explained in Monday's phone conversation, we composited products from a number of tests for roughing, cleaning and recleaning in order to obtain the maximum amount of concentrate assaying approximately 60% Fe. As a result it is difficult to show exact overall recovery for any one test series. In consequence, the data shown in Table 1 does not represent a specific test series, however, I feel the data are valid and represent what occurred in the tests. The other tables show results of individual rougher, cleaner and recleaner tests and they also represent data from which Table No. 1 was made. If you have any questions, please write or phone me.

If you should decide to run a pilot plant on the property next summer, we will be pleased to work with you on details of the spiral section of such a plant.

Best personal regards.

Very truly yours,

HUMPHREYS ENGINEERING COMPANY

Thomas H. Steece
Metallurgical Engineer

hs/g
cc-Lab
w/encls

Table No. 1

HUMPHREYS LABORATORY TEST

Date: 4/19/63 Lot No.: 1615 Test No.: Composite

Customer: Crest Exploration Limited

Ore: Composite of Crest samples IF9, IF13 and IF19

Object of Test: To obtain maximum iron recovery in a +60% Fe concentrate

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
			%	Assay	Distribution		Assay	Distribution	
				%		%			
	Recleaner Conct.		49.9	60.55		64.1			
	Recleaner Tail		9.6	38.88		7.9			
	Cleaner Tail		13.0	34.50		9.5			
	Rougher Tail		27.5	31.62		18.5			
	Calculated Head		100.0	47.13		100.0			
	Assay Head			47.92					

Remarks: These data are a composite of results obtained while producing approximately 500 lbs. of 58-60% Fe concentrate.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: T. J. Ferree
H. Snedden

Table No. 2

HUMPHREYS LABORATORY TEST

Date: 3/12/63 Lot No.: 1615 Test No.: D-E

Customer: Crest Exploration Limited

Ore: Rougher spiral concentrate B-2 & C-2 (IF19)

Object of Test: To obtain the maximum iron recovery in concentrates that will assay 58-60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
D-2	Sizer Conct.	509	25.8	59.26		29.0			
D-2.1	Sizer-Conct.Slime	10	0.5	50.21		0.5			
E-2	Spiral Const.	1100	55.8	55.48		58.8			
E-4	Spiral Tail	353	17.9	34.50		11.7			
	Calculated Head	1972	100.0	52.67		100.0			
B-2/ C-2	Rougher Conct. (Test Head)			53.3					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: T.J. Ferree and H. Snedden

Table No. 3

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 3/12/63 Lot No.: 1615 Test No. C Stage: 1st (Rougher) Spiral Model: 24A-5

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF19 Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate that can be cleaned to 58-60% Fe. (This is a continuation of Test B)

Conc. Outlets: 2,3,4,6,9,12,15 Midd. Outlets: ---- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.4:1

Wash Water Volume GPM: Total: 5.9 Excess: 1.3 Feed Pulp Volume GPM: 17 Feed Pulp % Solids: 28 Feed Rate per Spiral Dry Pounds/hr.: 2957

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
C-2	Concentrate	2052	69.4	53.30		77.6			
C-4	Tailing	905	30.6	34.80		22.4			
	Calculated Head	2957	100.0	47.64		100.0			
A-1	Assay Head			46.33					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: T. J. Ferree and H. Snedden

Table No. 4

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 3/7/63 Lot No.: 1615 Test No. B Stage: 1st (Rougher) Spiral Model: 24A-5

Customer: Crest Exploration Limited

Ore: Crest Channel Sample IF19 Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate that can be cleaned to 58-60% Fe.

Conc. Outlets: 2,3,4,6,9,12,15 Midd. Outlets: ---- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.4:1

Wash Water Volume GPM: Total: 5.6 Excess: 1.0 Feed Pulp Volume GPM: 16 Feed Pulp % Solids: 23 Feed Rate per Spiral Dry Pounds/hr.: 3116

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
B-2	Concentrate	2259	72.5	53.29		81.6			
B-4	Tailing	857	27.5	31.62		18.4			
	Calculated Head	3116	100.0	47.33		100.0			
A-1	Assay Head			46.33					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: T.J. Ferree and H. Snedden

Table No. 5

HUMPHREYS LABORATORY TEST

Date: 3/4/63 Lot No.: 1608-1609 Test No.: K-L

Customer: Crest Exploration Limited

Ore: Composite of rougher concentrate rejects from previous tests

Object of Test: To obtain a 58-60% Fe concentrate for pipe line tests.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
K-2	Sizer-Conct.	701	35.1	56.08		36.7			
L-2	Spiral Conct.	959	48.0	59.06		52.9			
L-4	Spiral Tail	338	16.9	33.21		10.4			
Calculated Head		1998	100.0	53.64		100.0			
K-1	Test Head			53.24					

Remarks: On the basis of preliminary assays K-2 and L-2 were composited. This composite assayed 56.62% Fe and was cleaned in test No. 1615 R-3.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 6

HUMPHREYS LABORATORY TEST

Date: 3/14/63 Lot No.: 1615 Test No.: R-S

Customer: Crest Exploration Limited

Ore: Composite of 1615 Y-2 and Z-2 and 1608-9 K-2 and L-2

Object of Test: To obtain maximum iron recovery in a concentrate assaying 58-60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
			%	Assay	Distribution		Assay	Distribution	
		Lbs/Hr		%		%			
K-2	Sizer Concentrate	517	27.0	61.05		29.4			
Z-2	Spiral Concentrate	1088	56.8	58.86		59.6			
Z-4	Spiral Tail	311	16.2	38.38		11.0			
	Calculated Head	1916	100.0	56.13		100.0			

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 7

HUMPHREYS LABORATORY TEST

Date: 3/14/63 Lot No.: 1615 Test No.: Y-Z

Customer: Crest Exploration Limited

Ore: X-2 Concentrate made from IF9, IF13 and IF19 ore.

Object of Test: To obtain the maximum iron recovery in a concentrate assaying 58-60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Overall		
			%	Assay	Distribution		Assay	Distribution %	
		Lbs/Hr		%		%		Wgt	Fe
Y-2	Sizer Conct.	1119	49.4	57.47		56.4		30.8	40.3
Z-2	Spiral Conct.	678	29.9	52.70		31.3		18.7	22.4
Z-4	Spiral Tail	469	20.7	29.82		12.3		12.9	8.8
	Calculated Head	2266	100.0	50.32		100.0		62.4	71.5
X-2	Rougher Conct. (Test Head)			52.90				62.4	71.5

Remarks: Sizer and spiral concentrates were combined and composited with other sub-grade material in the re-cleaner test R-S.

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No. 8

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 3/13/63 Lot No.: 1615 Test No. X Stage: 1st (Rougher) Spiral Model: 24A-5 MRL

Customer: Crest Exploration Limited

Ore: Composite rougher concentrate Grind Used: -10 mesh

Object of Test: To obtain the maximum iron recovery in a concentrate that will clean to 58-60% Fe.

Conc. Outlets: 2,3,4,6,9,12,15 Midd. Outlets: ---- Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.6:1

Wash Water Volume GPM: Total: 7.4 Excess: 2.4 Feed Pulp Volume GPM: 17 Feed Pulp % Solids: 23 Feed Rate per Spiral Dry Pounds/hr.: 2434

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
X-2	Concentrate	1519	62.4	52.90	✓	71.5			
X-4	Tail	915	37.6	35.00	✓	28.5			
	Calculated Head	2434	100.0	46.17		100.0			
X-1	Assay Head			47.92	✓				

Remarks: Head feed for this test was a composite of assay pulp rejects from Crest samples IF9, IF13 and IF19. It represented raw head feed grade.

Test Engineer: T. J. Ferree
H. Snedden

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Table No. 9

HUMPHREYS LABORATORY TEST

Date: 3/5/63 Lot No.: 1608-9 Test No.: N-P

Customer: Crest Exploration Limited

Ore: Rougher spiral concentrate M-2 made from IF9 and IF13

Object of Test: To obtain the maximum iron recovery in a concentrate assaying 58-60% Fe.

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe			Overall		
			%	Assay	Distribution		Assay	Distribution %	
		Lbs/Fe		%		%	% Fe	Wgt.	Fe
N-2	Sizer Conct.	488	26.0	62.04		29.0)			
P-2	Spiral Conct.	1036	55.2	58.27		57.9)	59.48	56.7	67.7
P-4	Spiral Tail	353	18.8	38.59		13.1		13.1	10.2
	Calculated Head	1877	100.0	55.55		100.0		69.8	77.9
M-2	Rougher Conct. (Test Head)			54.88				69.8	77.9

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden and T. J. Ferree

Table No.....

HUMPHREYS SPIRAL CONCENTRATOR TEST

Date: 3/4/63 Lot No.: 1608-9 Test No. M Stage: 1st (Rougher) Spiral Model: 24A-5

Customer: Crest Exploration Limited

Ore: Mixture of IF9 and IF13 Heads Grind Used: Mixture of -10 & -14

Object of Test: To obtain the maximum iron recovery in a concentrate that will clean to 58-60% Fe.

Conc. Outlets: 2,3,4,6,9,12,15 Midd. Outlets: ------ Circulating Midd. Dry Pounds/hr.: --- Ratio of Wt. Concentration: 1.4:1

Wash Water Volume GPM: Total: 6.2 Excess: 1.7 Feed Pulp Volume GPM: 15 Feed Pulp % Solids: 22 Feed Rate per Spiral Dry Pounds/hr.: 2889

SAMPLE NO.	PRODUCTS	WEIGHT DISTRIBUTION		Fe					
				Assay	Distribution		Assay	Distribution	
		Lbs/Hr	%	%		%			
M-2	Rougher Conct.	2017	69.8	54.88		77.9			
M-4	Rougher Tail	872	30.2	35.99		22.1			
	Calculated Head	2889	100.0	49.18		100.0			
M-1	Assay Head			48.92					

Remarks:

HUMPHREYS ENGINEERING CO. LABORATORY
2219 Market Street, Denver 5, Colo., U.S.A.

Test Engineer: H. Snedden & T. J. Ferree

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

March 19, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
R-2T						60.45				
S-2T						60.65				

Gold at $_____ per ounce
Silver at_____ per ounce
Lead at_____ per lb.
Copper at_____ per lb.
Zinc at_____ per lb.

Charges
$4.00

The Henry E. Wood Assaying Co.

By _____

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

Dec. 14, 1952

We hereby certify that the samples assayed for [illegible] gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1608							Pulps			
A-1						47.47	28.72			
A-1.1						48.72				
A-1.2						48.32				
A-1.3						48.40				
A-1.4						20.56				
A-1.5						45.72				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 15.00

The Henry E. Wood Assaying Co.

By [signature]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

Dec. 1, 1962

We hereby certify that the samples assayed for [illegible] gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1668 B-1						47.47 ✓				

Gold at $_____ per ounce
Silver at_____ per ounce
Lead at_____ per lb.
Copper at_____ per lb.
Zinc at_____ per lb.

Charges

$2.00

The Henry E. Wood Assaying Co.

By [signature]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

Dec. 19, 1962

We hereby certify that the samples assayed for Mountain Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1603										
D-2						50.52 ✓				
D-3						50.70 ✓				
D-4						43.55 ✓				
D-6						53.57 ✓				

Gold at $____ per ounce
Silver at ____ per ounce
Lead at ____ per lb.
Copper at ____ per lb.
Zinc at ____ per lb.

Charges

$ 8.00

The Henry E. Wood Assaying Co.

By [signature]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 | DENVER 4, COLORADO | 733 W. COLFAX AVE.

Dec. 21, 1962

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1608										
E-2		56.91								
E-3		26.67								
E-4		42.90								
F-2		56.62								
F-3		32.23								
F-4		48.78								
X-1		49.00								

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 14.00

The Henry E. Wood Assaying Co.

By [signature]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

Dec. 24, 1962

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1600										
F-2b						56.94	✓			
F-3b						35.28	"			
F-4b						52.40	"			
G-2						51.84	"			
G-3						25.70	"			
G-4						45.08	✓			
H-2						59.90	✓			
J-2						54.76	✓			
J-4						41.32	✓			

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$20.00

The Henry E. Wood Assaying Co.

By _____

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

Jan. 12, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
									P205	
Lot 1608 II-2 F-2b									0.54 0.62	

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges
$ 8.00

The Henry E. Wood Assaying Co.

By [signature]

2114 CURTIS STREET

TELEPHONE MAin 3-1852

CHARLES O. PARKER & CO.

CHEMISTS • ASSAYERS • ENGINEERS

DENVER 5, COLORADO

Folio 7899

Date March 11, 1963.

Humphreys Engineering Co.,
910 American National Bank Bldg.,
Denver, Colorado.

We hereby Certify, that the samples assayed for you gave the following results:

DESCRIPTION	GOLD OUNCES PER TON	SILVER OUNCES PER TON	COPPER PER CENT (WET)	LEAD PER CENT (WET)	ZINC PER CENT	IRON PER CENT	INSOLUBLE PER CENT	VALUE PER TON
Lot 1608 K1-2						55.80 ✓		

Gold at _____ per ounce Copper at _____ per unit

Silver at _____ per ounce Zinc at _____ per unit

Lead at _____ per unit

Charge $ 2.50

CHARLES O. PARKER & CO.

CHEMISTS, ASSAYERS and ENGINEERS

ESTABLISHED 1878 GAYLE F. FARNHAM

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 DENVER 4, COLORADO 733 W. COLFAX AVE.

March 12, 1963

We hereby certify that the samples assayed for Minerals Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1-62 KL-2						56.67 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 2.00

The Henry E. Wood Assaying Co.

By Newell R.

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 — DENVER 4, COLORADO — 733 W. COLFAX AVE.

March 19, 1963

We hereby certify that the samples assayed for Northrop Engineering Company
gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1506										
N-2.1						60.65 ✓				
P-2.2						57.47 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 4.00

The Henry E. Wood Assaying Co.

By Harold E. _____

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 | DENVER 4, COLORADO | 733 W. COLFAX AVE.

Nov. 10, 1962

We hereby certify that the samples assayed for [illegible] Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1609										
A-1						46.38	✓			
A-1.1						50.03	✓			
A-1.2						46.81	✓			
A-1.3						44.20	✓			
A-1.4						38.22	✓			

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 10.00

The Henry E. Wood Assaying Co.

By [illegible]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 | DENVER 4, COLORADO | 733 W. COLFAX AVE.

Dec. [illegible], 1962

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1609										
A-15						42.05 ✓				
B-1						44.86 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 4.00

The Henry E. Wood Assaying Co.

By [illegible]

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 DENVER 4, COLORADO 733 W. COLFAX AVE.

Jan. 23, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1609							SiO2	P2O5		
C-2						53.46				
C-3						26.57				
C-4						39.30				
D-2						56.73	15.00	0.95		
D-3						32.01				
D-4						49.42				
D-5						51.39				
E-2						58.58	11.35	1.29		
E-3						39.63				
E-4						60.21				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 34.00

The Henry E. Wood Assaying Co.

By H W H

2114 CURTIS STREET

TELEPHONE MAin 3-1852

CHARLES O. PARKER & CO.

CHEMISTS • ASSAYERS • ENGINEERS

DENVER 5, COLORADO

Folio 7883

Date Jan. 22, 1963.

Humphreys Engineering Co.,
910 American National Bank Bldg.,
Denver, Colorado.

We hereby Certify, that the samples assayed for you gave the following results:

DESCRIPTION	GOLD OUNCES PER TON	SILVER OUNCES PER TON	COPPER PER CENT (WET)	LEAD PER CENT (WET)	ZINC PER CENT	IRON PER CENT	INSOLUBLE PER CENT	VALUE PER TON
Lot 1609								
E-2						58.50 ✓		
E-4						59.20 ✓		

Gold at _____ per ounce Copper at _____ per unit

Silver at _____ per ounce Zinc at _____ per unit

Lead at _____ per unit

Charge $ 5.00

CHARLES O. PARKER & CO.

CHEMISTS, ASSAYERS and ENGINEERS

ESTABLISHED 1878

GAYLE F. FARNHAM

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816

DENVER 4, COLORADO

733 W. COLFAX AVE.

COLFAX

Jan. 23, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
						fusion	Acid Fe			
Lot 1609										
L-4.1						60.97	✓60.54			
L-4.2						50.52	✓49.97			

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 4.00

The Henry E. Wood Assaying Co.

By [signature]

2114 CURTIS STREET TELEPHONE MAin 3-1852

CHARLES O. PARKER & CO.

CHEMISTS • ASSAYERS • ENGINEERS
DENVER 5, COLORADO

Folio 7885

Date Jan. 28, 1963.

Humphreys Engineering Co.,
910 American National Bank Bldg.,
Denver, Colorado.

We hereby Certify, that the samples assayed for you gave the following results:

DESCRIPTION	GOLD OUNCES PER TON	SILVER OUNCES PER TON	COPPER PER CENT (WET)	LEAD PER CENT (WET)	ZINC PER CENT	IRON PER CENT	INSOLUBLE PER CENT Silica	Phosphorus	VALUE PER TON
Lot 1609									
F-2 Sizer Concs						63.30	6.22	0.216% ✓	
G-2 Spiral Concs						59.50	10.26	0.164% ✓	

Gold at _____ per ounce Copper at _____ per unit

Silver at _____ per ounce Zinc at _____ per unit

Lead at _____ per unit _____

Charge $ 21.00

CHARLES O. PARKER & CO.
CHEMISTS, ASSAYERS and ENGINEERS

CHARLES O. PARKER & CO.

CHEMISTS • ASSAYERS • ENGINEERS

DENVER 5, COLORADO

Folio 7897

Date March 5, 1963.

Humphreys Engineering Co.,
910 American National Bank Bldg.,
Denver, Colorado.

We hereby Certify, that the samples assayed for you gave the following results:

DESCRIPTION	GOLD OUNCES PER TON	SILVER OUNCES PER TON	COPPER PER CENT (WET)	LEAD PER CENT (WET)	ZINC PER CENT	IRON PER CENT	INSOLUBLE PER CENT	VALUE PER TON
Lot 1608-9								
K-2T						59.58 ✓		
K-2						59.78 ✓		

Gold at _____ per ounce Copper at _____ per unit

Silver at _____ per ounce Zinc at _____ per unit

Lead at _____ per unit _____

Charge $ 5.00

CHARLES O. PARKER & CO.

CHEMISTS, ASSAYERS and ENGINEERS

ESTABLISHED 1878 GAYLE F. FARNHAM

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 DENVER 4, COLORADO 733 W. COLFAX AVE.

March 12, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1615										
D-1						46.33 ✓				
D-2						53.29 ✓				
D-4						31.62 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges
$ 6.00

The Henry E. Wood Assaying Co.

By Daniel H.

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 DENVER 4, COLORADO 733 W. COLFAX AVE.

March 13, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1615 C-2						53.30 ✓				
C-4						34.80 ✓				
L-2						59.26 ✓				
L-2.5						50.21 ✓				
E-2						55.48 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 10.00

The Henry E. Wood Assaying Co.

By Samuel H.

Certificate of Assay

THE HENRY E. WOOD ASSAYING COMPANY

TELEPHONE KEYSTONE 4-4816 DENVER 4, COLORADO 733 W. COLFAX AVE.

March 14, 1963

We hereby certify that the samples assayed for Humphreys Engineering Company gave the following results per ton of 2000 lbs.

MARKED	GOLD OZS.	SILVER OZS.	WET LEAD PER CENT	COPPER PER CENT	ZINC PER CENT	IRON PER CENT	INSOL. PER CENT	SULPHUR PER CENT	PER CENT	VALUE
Lot 1615										
X-1						47.92 ✓				
X-2						52.90 ✓				
X-4						35.00 ✓				
D-2T						59.46 ✓				
E-4						34.50 ✓				

Gold at $_____ per ounce
Silver at _____ per ounce
Lead at _____ per lb.
Copper at _____ per lb.
Zinc at _____ per lb.

Charges

$ 10.00

The Henry E. Wood Assaying Co.

By [signature]

REPORTS ON
IRON ORE BENEFICIATION TESTS
CARRIED OUT BY
THE DEPT. OF MINES & TECHNICAL SURVEYS
FOR
CREST EXPLORATION LIMITED

MAP No. 106 F 2, 3, 6, 7

ASSESSMENT REPORT ☒
N. M. E. A. P. ☐
CONFIDENTIAL ☒
OPEN FILE

TYPE OF WORK: BENIFICIATIONTESTS: ASSAYS: GEOPHYSICS: GEOLOGY: DIAMOND DRILLING MAPPING

REPORT FILED UNDER	CREST EXPLORATION LTD. — DOCUMENT NO. 091697
DATE PERFORMED	1962 — DATE FILED: JUNE 12, 1963
LOCATION – LAT.	65°10'N - 65°20'N — AREA: SNAKE RIVER
LONG.	132°15'W -133°20'W
CLAIM NO.	CREST - IRON and MICA claims numbers 1-493
VALUE $	
WORK DONE BY	R.A. STUART ET AL
WORK DONE FOR	CREST EXPLORATION LTD.
REMARKS	Ten reports are contained together describing the Snake River Iron deposit. The deposit consists of 60% to 90% fine grained hematite with ovoid jasper nodules. Thickness of the formation ranges from 50' to 350'. In excess of 20 billion tons of ore grade material are indicated, making this one of the largest iron formations found to date.

#2 CREST

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 4, Ontario,
December 4, 1962.

Dr. C. D. A. Dahlstrom,
Division Exploration Supt.,
Mineral Division,
Crest Exploration Limited,
329A - 6th Avenue, S.W.,
Calgary, Alta.

Re: Crest Iron Ore Progress Report #1

Dear Dr. Dahlstrom:

Work has started on your 5 samples of Crest iron ore. Heavy media separation, jigging and tabling - all types of gravity separation - are being done on each sample. So far tests have been completed on sample C only.

Test procedure has been to screen out minus 1/4 in. material first. The plus 1/4 in. fraction was then sized on 3/4 in. The plus 3/4 in. was crushed and screened again on 3/4 in. Eventually the sample was reduced to minus 3/4 in. from which three fractions were separated - minus 3/4 plus 1/4 in., minus 1/4 in. plus 20 mesh, and minus 20 mesh. The coarse fraction was treated by sink-float, the next coarsest by jigging, and the fines by tabling. The combined results on sample C are shown in the table below.

.... 2

TABLE 1

Treatment of Sample C

Product	Weight %		% sol Fe	% SiO_2	Distn % Sol Fe	
Sink @ sp gr 3.45	44.5	33.4	60.2	11.60	63.4	47.7
Float "	55.6	41.8	27.77		36.6	27.6
		75.2				75.3
Jig conc	64.4	11.4	58.59	13.62	87.0	15.9
" tail	24.3	4.3	13.28		7.6	1.4
" bed	11.3	2.0	20.44		5.4	1.0
		17.7				18.3
Table conc	45.1	3.2	57.98	13.50	68.8	4.4
" midd	40.8	2.9	19.64		20.3	1.3
" tail	14.1	1.0	30.99		10.9	0.7
		7.1				6.4
Feed*		100.0	42.12			100.0

*calculated

The combined concentrates show a recovery of 68% of the iron in the feed at a grade of 59.7% Fe. Similar tests will be done on the other four samples, and it is hoped to recover additional iron at an acceptable grade by treating the 'float' at lower medium densities. The reason for the relatively high table tailing, was due to the fraction consisting entirely of iron slimes.

The head samples have all been analysed for iron and silica with the results shown in Table 2.

TABLE 2

Head Analyses of Samples

Sample	% Sol Fe		% SiO_2	
	Recalc head		nearest Channel samp	
A	49.6	48.16	50.40	23.11
B	47.8	46.24	50.30	22.43
C	42.1	40.12	46.77	35.37
D	36.2	37.04	41.73	31.00
E	43.1	37.35	39.51	29.91

The results of further work will be reported as soon as they are known. Any comments you have on the work done so far will be appreciated.

Yours very truly,

Peter Maltby

P. D. R. Maltby,
for L. E. Djingheuzian,
Chief of Division.

DEC 17 1951

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 4, Ontario,
December 18, 1962.

Dr. C. D. A. Dahlstrom,
Division Exploration Supt.,
Mineral Division,
Crest Exploration Limited,
329A - 6th Avenue S.W.,
Calgary, Alta.

Re: Crest Iron Ore Progress Report #2

Dear Dr. Dahlstrom:

Preliminary gravity separation tests have now been completed on the remaining four samples of Crest iron ore. Test procedure was similar to that followed on sample C (see Progress Report #1). Each sample was crushed and screened so that three size fractions were made. A minus 1 in. plus 1/4 in. fraction was treated by heavy-media separation, a minus 1/4 in. plus 20m fraction was treated by jigging, and the minus 20m fines were treated by tabling. Test results are enclosed on separate pages of this letter.

The aim of the tests completed so far has been to produce concentrates containing about 60% iron as simply and economically as possible. The results show that samples A and B can be upgraded to over 55% iron, whereas samples D and E do not yield concentrates much better than 50% iron using gravity separation on the size ranges shown. The heavy-media tests were carried out on ore at the lower size range considered suitable. It is felt that gangue rejection would be better if theore was crushed fine to minus 1/4 in., and then treated, after screening, by jigging the coarse fraction and by tabling or spiralling the fine fraction. Another possibility is to treat the ore by heavy-media cyclones after crushing to 1/4 in. This procedure would involve a lengthy pilot plant test with the proper equipment.

.... 2

These concentrates could either be used 'as is' or upgraded by flotation or magnetic roasting after fine grinding.

In order to do further test work, we would like to know (1) whether concentrates containing approximately 60% iron are desirable, and (2) if the samples submitted can be combined into one composite sample representative of the present known orebody. Best results would be obtained by discarding sample D entirely and working on the other four samples.

I have just received your letter of December 11th and will have phosphorus determinations done on the sample feeds and concentrates.

Yours very truly,

P D Maltby

P. D. Maltby,
for L. E. Djingheuzian,
Chief of Division.

RESULTS

The results of heavy-media separation using galena are shown in Table 1.

TABLE 1

Results of Heavy-Media Separation

$-1'' + \frac{1}{4}''$ $-\frac{3}{4}'' + \frac{1}{4}''$

Nodular ore - hi-grade. Thin banded - hi-grade. Irreg nods + sh & sgi. Silic hem, nod. Wide-banded - med grade

Product	Ore A Weight %	Ore A Sol Fe %	Ore A Distn % Sol Fe	Ore B Weight %	Ore B Sol Fe %	Ore B Distn % Sol Fe	Ore D Weight %	Ore D Sol Fe %	Ore D Distn % Sol Fe	Ore E Weight %	Ore E Sol Fe %	Ore E Distn % Sol Fe	Ore C Weight %	Ore C Sol Fe %	Ore C Distn % Sol Fe
Sink at 345	79.5	54.25	86.5	51.1	55.29	59.0	37.6	50.46	52.5	64.3	50.62	74.5	44.5	60.2	63.4
Sink at 325	11.2	37.75	8.5	46.3	40.64	39.3	18.7	35.73	18.5	14.4	37.34	12.3			
Sink at 310	3.4	33.80	2.3	1.3	36.30	0.9	17.3	29.05	13.9	12.0	34.04	9.3	55.6	27.77	36.6
Float at 310	5.9	23.26	2.7	1.3	28.81	0.8	26.4	20.68	15.1	9.3	18.19	3.9			
Feed*	100.0	49.9	100.0	100.0	47.9	100.0	100.0	36.1	100.0	100.0	43.7	100.0	100.0	42.2	100.0

* calculated

The feed was screened between 1/4 and 1 in. The float at a medium sp gr of 3.45 was treated at 3.25, and the float at 3.25 was treated at 3.10.

The sample fractions between 1/4 in. and 20m were treated by a Denver laboratory jig at full stroke using a 1/4 in. screen. The jig bed was made up of ore from the sample being treated. The results are shown in Table 2.

TABLE 2

$-\frac{1}{4}'' + 20$ m.

Results of Jigging Tests

Product	Ore A Weight %	Ore A Sol Fe %	Ore A Distn % Sol Fe	Ore B Weight %	Ore B Sol Fe %	Ore B Distn % Sol Fe	Ore D Weight %	Ore D Sol Fe %	Ore D Distn % Sol Fe	Ore E Weight %	Ore E Sol Fe %	Ore E Distn % Sol Fe	Ore C Weight %	Ore C Sol Fe %	Ore C Distn % Sol Fe

The remaining sample fractions of minus 20m material were treated by tabling. Due to the small weight of feed, samples B and E, and samples A and D were combined in proportion and then tabled. The results are shown in Table 3.

TABLE 3

Results of Tabling Tests - 20 m.

Product	Ores B and E Weight %	Ores B and E Sol Fe %	Ores B and E Distn % Sol Fe	Ores A and D Weight %	Ores A and D Sol Fe %	Ores A and D Distn % Sol Fe	Ore C wt %	Ore C Sol Fe %	Ore C Distn % Sol Fe
Table conc	42.2	58.43	59.5	10.7	60.85	15.0	45.1	57.98	68.8
" midd	37.2	26.80	24.0	55.5	46.52	59.5	40.8	19.64	20.3
" tail	20.6	33.24	16.5	33.8	32.84	25.5	14.1	30.99	10.9
Feed*	100.0	41.5	100.0	100.0	43.4	100.0	100.0	39.6	100.0

* calculated

A large proportion of the iron in the table tailing was fine slime. The concentrate weight recovery on ores A and D combined was low to obtain a higher iron assay.

The proportion of the feed weights for each separation were calculated for each ore and are shown in Table 4.

TABLE 4

Proportion of Feed Weights

Operation	Ore A Weight %	Ore B Weight %	Ore D Weight %	Ore E Weight %	Ore C
HMS	49.9 86.3	47.9 85.2	36.1 88.4	43.7 85.8	42.2 75.2
Jigging	47.3 11.0	48.4 12.1	35.3 9.6	39.9 11.5	42.2 7.7
Tabling	43.4 2.7	41.5 2.7	43.4 2.0	41.5 2.7	39.6 7.1
Total	100.0	100.0	100.0	100.0	100.0
Calc head	49.6	47.8	36.2	43.1	42.1

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 4, Ontario,
5 February, 1963.

Dr. R.A. Stuart,
Crest Exploration Limited,
Medical Arts Building,
329 A - 6th Avenue S.W.,
Calgary, Alberta.

Dear Dr. Stuart:

Re: Crest Iron Ore Progress Report
No. 3

Thank you for your letter of January 23rd. As soon as the samples have been received, a bulk sample will be made up so that further testwork can be started.

The results of jig tests on samples A and B, crushed first to minus 10 m, are shown on a separate page. On sample A, a concentrate of 63.67% Fe was made but the recovery was not very good. A good deal of fine iron was lost in the jig tailing and an additional recovery might be made by re-jigging this fraction. This will be investigated.

The rejects from the sink product made on sample C at a specific gravity of 3.45 were ground to 90% minus 325 m and treated by high intensity wet magnetic separation. The results of this test are also shown on a separate page. The purpose of this test was to discover what grade could be obtained at this degree of grinding. The concentrate assayed only 63.11% Fe which was disappointing, and indicates that grinding to finer than 30 microns is probably required to obtain a grade of 65% Fe or better.

Yours very truly,

P.D. Maltby

P.D. Maltby

for

L.E. Djingheuzian,
Chief of Division.

PDM:lh

Jigging at Minus 10 Mesh - Samples A and B

Approximately 3000 g each of samples A and B were crushed separately to minus 10 mesh and treated in a Denver mineral jig using a 10 m screen. The results obtained on sample A are shown in Table 1.

Results of $-\frac{1}{4}$" + 20 mesh jigging added.

TABLE 1

Jigging Results on Sample A -- nodular

Product	Weight %			Analysis % sol Fe		Distn % sol Fe		
Jig conc	42.3	39.9	37.0	63.67	60.36	52.3	50.0	46.3
Jig tail	49.5	46.6	40.3	40.94	32.27	39.4	37.6	26.9
Jig slime tail	8.2	7.8		52.23		8.3	8.0	
Jig bed	6.0	5.7	22.7	39.49	57.06	15.0	4.4	26.8
Feed*		100.0		50.8			100.0	

* Calculated

The results obtained on sample B are shown in Table 2.

TABLE 2

Jigging Results on Sample B - thin banded.

Product	Weight %			Analysis % sol Fe		Distn % sol Fe		
Jig conc	47.5	45.2	31.6	58.83	61.63	56.4	54.5	40.3
Jig tail	42.9	40.8	48.3	39.33	36.36	34.1	32.9	36.8
Jig slime tail	9.6	9.1		49.32		9.5	9.2	
Jig bed	10.0	4.9	20.1	34.09	55.05	6.0	3.4	22.9
Feed*		100.0		48.8			100.0	

* Calculated

Jones Separator High Intensity Magnetic Separation

The results obtained on a sample of sink rejects from sample C, ground to 90% minus 325 m and treated by a Jones high intensity wet magnetic separator, are shown in Table 3.

TABLE 3

Results on Sample C Sink Rejects — wide banded.

Product	Weight %	Analysis % sol Fe	Distn % sol Fe
10 amp conc	37.2	63.11	39.8
10 amp midd	30.8	56.09	29.3
10 amp tail	32.0	57.06	30.9
Feed *	100.0	59.02	100.0

* Calculated.

Phosphorous Distribution

A series of phosphorus determinations were done on several of the sink products obtained in heavy media separation. The results are shown in Table 4.

TABLE 4

Results of Phosphorus Determinations

Product		Sol Fe.	Analysis % P
Sink @ 3.20	Sample C		0.33
Sink @ 3.45	Sample C	60.2	0.34
Sink @ 3.25	Sample A	37.75	0.71
Sink @ 3.45	Sample A	54.25	0.54
Sink @ 3.10	Sample B	36.30	1.00
Sink @ 3.45	Sample B	55.29	0.78
Sink @ 3.10	Sample D	29.05	0.42
Sink @ 3.25	Sample D	35.73	0.41
Sink @ 3.45	Sample D	50.46	0.34
Sink @ 3.25	Sample E	37.34	0.32
Sink @ 3.45	Sample E	50.62	0.30

P_2O_5 or PO_4

PDM:lh

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 4, Ontario,
February 14, 1963.

Dr. R. A. Stuart,
Crest Exploration Limited,
Medical Arts Building,
329A - 6th Avenue, S.W.,
Calgary, Alta.

Re: Crest Iron Ore Progress Report No. 4

Dear Dr. Stuart:

The sample material collected at section IF-37 has arrived and test work will be started on a representative sample after proper mixing.

In our Progress Report No. 3, the results of jigging at 10 mesh on samples A and B were shown. For additional iron recovery, the jig tailing and bed were combined and re-jigged using a smaller stroke and a 28 mesh screen. For sample A, an additional concentrate was recovered at a grade of 58.2% Fe. The combined jig concentrate from sample A would assay 62.26% Fe at a recovery of 66.6% of the iron in the original feed.

For sample B, an additional concentrate was recovered at a grade of 60.1% Fe from the jig tailing and bed. The combined jig concentrate from sample B would assay 59.06% Fe at a recovery of 67.7% of the iron in the original feed.

Yours very truly,

P. D. R. Maltby

P. D. R. Maltby,
for L. E. Djingheuzian,
Chief of Division.

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 1, Ontario,
April 29, 1963.

Dr. R. A. Stuart,
Crest Exploration Limited,
Medical Arts Building,
329A - 6th Avenue, S.W.,
Calgary, Alta.

Re: Crest Iron Ore Progress Report No. 6

Dear Dr. Stuart:

The remainder of the results of the serial jigging test are enclosed. Concentrates at 6 and 10 mesh were produced from a 20 lb sample of IF 37 material and the results were reported in Progress Report No. 5. In a subsequent test the 10m jig tailing fraction was treated for further iron recovery with the results shown in Table 1, enclosed herewith. The plus 14 mesh particles were first screened out and discarded. The remaining fraction was jigged at 14 mesh, and the jig tailing re-jigged at 28 mesh. The overall recovery from the 6, 10, 14, and 28 mesh concentrates, together with the original 10 mesh jig bed, is 67.6% of the iron in the original feed at a grade of 62.2% Fe. Weight recovery is 49.3% of the original feed. Some phosphorus and silica assay results from the first part of the test are shown in Table 6. Assays will be obtained on the other concentrates. The results of a screen analysis on the minus 14 mesh jig tailing is shown in Table 2.

Two magnetizing roasting tests were done on samples of the combined concentrates. Two 500-gram samples were roasted at 550°C for 10 minutes in a hydrogen atmosphere, and then cooled in a nitrogen atmosphere. One sample was roasted at 6 mesh while the other sample was first pulverized to 48 mesh. The roasted products were ground and treated by a Jeffrey-Steffensen magnetic separator, and the results are shown in Table 3.

In the case of the 6 mesh roast, the Jeffrey concentrate was 91.6% minus 325 mesh, and, in the case of the 48 mesh roast, the Jeffrey concentrate was 73.9% minus 325 mesh. Due to the low magnetic iron recovery on the 6 mesh roast, the tailing was repassed at 3 amp using a Jones high intensity wet magnetic separator. The results are shown in Table 4.

The results of another jig test on a sample of the crude ore are also included. The feed was screened at 6 mesh and any oversize was crushed below this size. Three fractions were screened out and were jigged separately - a minus 6 plus 14 mesh, a minus 14 plus 28 mesh, and a minus 28 mesh fraction. The size of jig screens used was, respectively, 6, 14 and 28 mesh. The results of this jig test are shown in Table 5. The overall concentrate recovery was 67.1% of the iron at a grade of 62.0% Fe. Weight recovery was 49.5% of the original feed. By calculation, about 50% of the iron in the 6 mesh jig bed is recoverable at grades which would raise the overall iron recovery to 69.3%. These results are comparable to those obtained with serial jigging. A study of the results show that the recovery is low in the finer sizes. It is proposed to re-jig the 28 mesh tailing at 48 mesh after removal of the plus 28 mesh particles.

It seems that the original object of a recovery of 70% of the iron at a grade of 62% Fe is attainable by the relativity cheap process of jigging.

Yours very truly,

Peter Maltby

P. D. Maltby,
for L. E. Djingheuzian,
Chief of Division.

TABLE 1

Results of Serial Jigging at 14 and 28 Mesh

Product	Weight % of orig feed	Analysis % Sol Fe	Distn % of orig feed Sol Fe
-6 +14m fraction*	21.1	28.08	13.5
-14m jig conc	5.0	51.80	5.9
-28m jig conc	0.9	63.14	1.3
jig bed	2.1	36.85	1.8
jig tail (-14m)	27.5	27.30	17.1
Feed**	56.6	30.70	39.6

* removed by screening before jigging ** calculated

TABLE 2

Screen Analysis on Minus 14m Jig Tailing

Size Fraction	Weight %	Analysis % Sol Fe	Distn % Sol Fe	Dist % orig feed Sol Fe
+20m	14.5	17.26	9.1	1.6
-20+28m	12.5	18.32	8.4	1.4
-28+35m	16.5	20.91	12.7	2.2
-35+48m	11.5	22.69	9.6	1.6
-48+65m	10.0	26.74	9.8	1.6
-65+100m	8.5	29.34	9.1	1.6
-100+150m	7.0	35.42	9.1	1.6
-150+200m	6.0	40.68	9.0	1.5
-200m	13.5	46.84	23.2	4.0
Total*	100.0	27.3	100.0	17.1

* calculated

TABLE 3

Results of Magnetic Separation on Roasted Jig Concentrate

Fraction	Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
6m roast	Jeffrey tail	59.4	61.59	57.4
	" midd	16.9	66.86	17.7
	" conc	23.7	67.1	24.9
	Feed*	100.0	63.78	100.0
48m roast	Jeffrey tail	31.9	55.19	27.9
	" midd	21.3	66.62	22.5
	" conc	46.8	66.78	49.6
	Feed*	100.0	63.05	100.0

* calculated

TABLE 4

Jones Separator Test on Jeffrey Tailing From 6m Roast

Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
3 amp conc	70.7	64.19	73.7
3 " midd	18.5	58.19	17.5
3 " tail	10.8	50.25	8.8
Feed*	100.0	61.6	100.0

* calculated

TABLE 5

Results of Jigging On Screened Feed

Fraction	Product	Weight %	Analysis % Sol Fe	Distn % Sol Fe
	Jig conc	28.6	64.06	40.0
-6 +14m	" bed	5.2	38.96	4.4
	" tail	21.9	27.79	13.3
	" conc**	12.7	57.86	16.1
-14+28m	" bed	1.6	19.48	0.7
	" tail	4.5	16.54	1.6
	" conc	8.2	61.21	11.0
-28m	" bed	2.0	39.85	1.7
	" tail	15.3	33.41	11.2
	Feed*	100.0	45.8	100.0

676
62.2 Fe.

* calculated

** This concentrate contains a small amount of tailing which accounts for the low assay. However, this leads to a higher iron recovery so that the balance between grade and recovery is flexible to a certain extent.

TABLE 6

Further Chemical Analysis on Jig Products

Product	Analysis % P	SiO_2
6m jig conc	0.17	5.28
10m " "	0.20	
" " bed	0.29	
" " tail	0.45	

CANADA

FILE NO

DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

MINES BRANCH

Mineral Processing
Division

40 Lydia Street,
Ottawa 1, Ontario,
March 21, 1963.

Dr. R. A. Stuart,
Crest Exploration Limited,
Medical Arts Building,
329A - 6th Avenue, S.W.,
Calgary, Alta.

Re: Crest Iron Ore Progress Report No. 5

Dear Dr. Stuart:

Thank you for your letter of March 8, together with the Ontario Research Foundation report.

Test work is proceeding on the I.F. 37 sample material. A 20 lb head sample was taken and, after analysis, jigged on a 6 mesh screen. A jig concentrate was recovered at 6 mesh, and the jig tailing re-jigged with a 10 mesh screen to recover another concentrate. The 10 mesh jig tailing is now being jigged using a 28 mesh screen to recover the fine iron in another concentrate. The results of the head analysis are shown in Table 1, and the results of jigging so far are shown in Table 2.

It is hoped to obtain a combined jig concentrate assaying about 62% Fe with a recovery of 70% or better of the iron in the original feed. It is hoped to improve the grade of this concentrate by magnetizing roasting followed by magnetic separation after fine grinding or by flotation after fine grinding. The results of these tests will be forwarded to you as soon as possible.

Yours very truly,

P. D. Maltby,
for L. E. Djingheuzian,
Chief of Division.

Encl.

TABLE 1

Results of Head Sample Analysis

Mesh	Weight, %	Analysis, % Sol Fe	Distn % Sol Fe
+4	27.7	46.57	28.6
-4 +10	38.1	45.51	38.4
-10 +20	12.4	43.97	12.1
-20 +35	7.2	43.07	6.9
-35 +48	2.7	43.40	2.6
-48 +65	2.2	43.07	2.2
-65 +100	2.0	41.61	1.8
-100 +150	1.5	45.67	1.5
-150 +200	1.2	43.72	1.3
-200	5.0	41.77	4.6
Total	100.0	45.05	100.0

TABLE 2

Preliminary Results of Jigging

Product	Weight, %	Analysis % Sol Fe	Distn % Sol Fe
6m Jig conc	33.4	64.53	47.3
10m " "	6.7	61.75	9.1
" " bed	3.3	55.51	4.0
" " tail**	56.6	31.86	39.6
Feed*	100.0	45.40	100.0

*calculated **this fraction being re-jigged at 28m.

Silica and phosphorus determinations have not yet been completed on the concentrates.

COMPILATION OF ASSAY DETERMINATIONS
SNAKE RIVER IRON ORE DEPOSIT
YUKON TERRITORY

CREST EXPLORATION LIMITED

Samples From IF-6
Sent To Coast Elanage
To Check Their Original
Assay

~~① Ref~~
② Clint
② ① File Assays
& IF-6.

ACCTIC
Member Canadian Testing Association

PHONE: TR[illegible]Y 6-4111
CABLE ADDRESS "ELDRICO"

FILE NO. 5660

DATE APRIL 29, 1963

To: IF-6
CREST EXPLORATION LTD.
MEDICAL ARTS BUILDING
329-A 6TH AVENUE
CALGARY, ALBERTA

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *samples.*

IF-6 Sample No	Renumbered for Check MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER Original Assay	TOTAL IRON (FE) PER CENT.	TOTAL IRON (FE) Original Assay	SILICA (S102) PER CENT.	SILICA (S102) Original Assay	PHOSPHOROUS	PHOSPHOROUS VALUE PER TON	TOTAL VA PER TON (2000 LBS.)
16	B1		$		$ 49.30	48.33	$ 20.38	21.24	$ 0.17	0.16	$	$
17	B2				50.58	49.75	21.10	22.08	0.30	0.29		
18	B3				51.87	53.59	20.04	18.05	0.31	0.28		
19	B4				49.80	50.25	20.01	21.12	0.29	0.23		
22	B5				52.75	52.27	15.40	16.38	0.28	0.28		
23	B6				50.29	51.77	23.34	21.04	0.23	0.22		
24	B7				44.87	44.29	22.54	23.12	0.38	0.39		
80	B8				43.73	43.98	24.02	23.95	0.32	0.30		
78	B9				44.96	46.01	22.70	21.75	0.26	0.26		
82	B10				45.75	46.21	31.90	31.38	0.27	0.27		
87	B11				49.69	50.35	25.82	25.91	0.28	0.27		
88	B12				54.34	55.91	17.18	17.52	0.32	0.29		
93	B13				53.43	53.89	19.60	19.99	0.29	0.30		
95	B14				44.84	46.41	32.17	32.47	0.29	0.31		
202	B15				51.21	50.76	22.34	23.45	0.39	0.40		
204	B16				49.49	49.45	25.16	26.47	0.42	0.42		
203	B17				47.67	48.94	22.84	23.53	0.50	0.48		
211	B18				46.05	45.40	28.84	30.73	0.45	0.47		
212	B19				50.90	51.57	22.30	22.93	0.50	0.44		

5M

Gold calculated at $.....per ounce. *Calculated at.....cents per lb.*

Silver calculated at $.....per ounce. *Calculated at.....cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shanger ..... *Provincial Assayer*

IF-6

To:

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

SEMI QUANTITATIVE SPECTROGRAPHIC ANALYSES

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

MAYO, Y.T. Mining Recorder & Land Agent
RECEIVED JUN 12 1963

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICO

FILE No. 3127

DATE October 11, 1962

We Hereby Certify that the following are the results of semi quantitative spectrographic analyses made on ..... samples submitted.

SAMPLE IDENTIFICATION	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Ga	Au	Fe
IF-6 6 - 17	1.0	ND	ND	0.008	ND	ND	Trace	ND	4.	0.0005	Trace	0.008	ND	ND	Matr
" 18-20	0.5	ND	ND	0.06	ND	Trace	ND	ND	3.	0.0006	Trace	0.01	ND	ND	Matr
" 214 - 16	0.4	ND	ND	0.008	ND	ND	ND	ND	1.	0.0007	Trace	0.01	ND	ND	Matr
" 3 - 5	0.8	ND	ND	0.005	ND	Trace	ND	ND	1.5	0.0007	Trace	0.01	ND	ND	Matr
" 8 - 21	0.4	ND	ND	0.002	ND	ND	ND	ND	1.5	0.0005	Trace	0.01	ND	ND	Matr
" 25 - 76	0.3	ND	ND	0.003	ND	Trace	ND	ND	1.	0.0006	Trace	0.008	ND	ND	Matr
IF-6 49 - 50	0.3	ND	ND	0.01	ND	Trace	ND	ND	1.2	0.0007	Trace	0.01	ND	ND	Matr
IF-6 11 - 13	0.4	ND	ND	0.02	ND	Trace	ND	ND	1.2	0.0009	Trace	0.008	ND	ND	Matr

SAMPLE IDENTIFICATION	Pb	Mg	Mn	Mo	Nb	Ni	Si	Ag	Sr	Ta	Sn	Ti	W	V	Zn
IF-6 6 - 17	Trace	0.4	0.08	0.001	ND	0.0009	Matrix	0.0003	Trace	ND	0.0005	0.03	ND	0.001	Trac
" 18 - 20	Trace	0.4	0.10	0.002	ND	0.001	Matrix	0.0003	Trace	ND	0.0006	0.03	ND	ND	Trac
" 214 - 16	ND	0.3	0.11	0.001	ND	0.0009	Matrix	0.0002	Trace	ND	0.0005	0.03	ND	ND	Trac
" 3 - 5	Trace	0.7	0.07	0.001	ND	0.001	Matrix	0.0002	Trace	ND	0.0005	0.03	ND	ND	Trac
" 8 - 21	Trace	0.4	0.06	0.001	ND	0.0006	Matrix	0.0001	Trace	ND	0.0006	0.02	ND	ND	Trac
" 25 - 76	Trace	0.3	0.06	0.0009	ND	0.0007	Matrix	0.0002	Trace	ND	0.0005	0.02	ND	ND	Trac
" 49 - 50	ND	0.3	0.05	0.001	ND	0.0008	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	ND	Trac
" 11 - 13	Trace	0.3	0.07	0.001	ND	0.0006	Matrix	0.0002	Trace	ND	0.0005	0.03	ND	ND	Trac

3M-MP-961

Note: Rejects retained one week.
Pulps retained three months.

COAST ELDRIDGE ENGINEERS & CHEMISTS LTD

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CHEMIST

Yours - JF-6

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

SEMI QUANTITATIVE SPECTROGRAPHIC ANALYSES

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-

CABLE ADDRESS: ELDRI

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of semi quantitative spectrographic analyses made on* ____ *samples submitted.*

SAMPLE IDENTIFICATION	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Ga	Au	
JF-6 14 - 81	0.6	ND	ND	0.02	ND	ND	Trace	Trace	1.	0.0005	Trace	0.008	ND	ND	Ma
72 - 80	0.5	ND	ND	0.01	ND	Trace	Trace	Trace	2.5	0.0005	Trace	0.003	ND	ND	Ma
83 - 84	0.3	ND	ND	0.02	ND	Trace	Trace	Trace	0.9	0.0007	Trace	0.008	ND	ND	Ma
85 - 87	0.25	ND	ND	0.01	ND	ND	Trace	Trace	1.2	0.0005	Trace	0.01	ND	ND	Ma
88 - 92	0.4	ND	ND	0.05	ND	ND	Trace	Trace	1.	0.0005	Trace	0.009	ND	ND	Ma
91 - 95	0.5	ND	ND	0.005	ND	ND	Trace	Trace	2.	0.00007	Trace	0.01	ND	ND	Ma
97 - 201	0.4	ND	ND	0.007	ND	Nd	Trace	Trace	2.	0.0007	Trace	0.007	ND	ND	Ma
202 - 04	1.5	ND	ND	0.01	ND	ND	Trace	Trace	1.5	0.0005	Trace	0.007	ND	ND	Ma
JF-6 211 - 212	0.7	ND	ND	0.01	ND	Trace	ND	ND	1.5	0.0005	Trace	0.009	ND	ND	Ma

SAMPLE IDENTIFICATION	Pb	Mg	Mn	Mo	Nb	Ni	Si	Ag	Sr	V	Y	Zn	W		
14 - 81	Trace	0.3	0.04	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	0.0009	Tr
72 - 80	Trace	0.9	0.12	0.001	ND	ND	Matrix	0.0002	Trace	ND	0.0006	0.04	ND	0.0009	Tr
83 - 84	ND	0.3	0.04	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.02	ND	0.001	Tr
85 - 87	ND	0.4	0.06	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.01	ND	0.0003	Tr
88 - 92	Trace	0.4	0.10	0.001	ND	ND	Matrix	0.0002	Trace	ND	0.0005	0.01	ND	0.0008	Tr
91 - 95	ND	0.5	0.15	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.02	ND	0.001	Tr
97 - 201	ND	0.3	0.08	0.0009	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.01	ND	0.0009	Tr
202 - 04	ND	0.5	0.09	0.0009	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.04	ND	[illegible]	Tr
JF-6 211 - 212	Trace	0.2	0.04	0.0007	ND	ND	Matrix	0.0002	Trace	ND	0.0006	0.01	ND	0.001	Tr

[illegible]

Note: Rejects retained one month.
Pulps retained three months.

COAST ELDRIDGE ENGINEERS & CHEMISTS LTD.

ALL REPORTS ARE THE CONFIDENTIAL PROPERTY OF CLIENTS. PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS NOT PERMITTED WITHOUT OUR WRITTEN APPROVAL. ANY LIABILITY ATTACHED HEREBY IS LIMITED TO THE FEE CHARGED.

per [illegible] H. G. Eldridge

IF-6

To:

The California Standard Co.

Medical Arts Building

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTG

PHONE: TRINITY 6-41

CABLE ADDRESS "ELORICO

FILE NO. 2993

DATE October 11, 196

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sample*

MARKED	GOLD		SILVER		Silica (SiO_2)		Alumina (Al_2O_3)		Calcium Oxide (CaO)		XXXXXX XXXXXX XXXXXX Magnes (MgO)
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON	
		$		$		$		$		$	
IF-6											
1					15.22		2.06		1.91		1.27
2					19.85		0.94		2.01		0.25
3					17.89		1.74		4.06		2.62
4					19.26		0.74		1.36		0.49
5					29.90		0.92		1.17		0.34
6					22.05		1.70		3.42		0.68
7					22.22		1.48		6.55		2.06
8					19.10		1.00		2.35		0.73
9					24.84		0.28		2.54		0.74
10					21.44		0.48		1.86		0.35
11					28.10		0.60		2.15		0.52
12					19.20		0.74		1.66		0.44
13					23.00		0.68		1.37		0.13
14					26.90		0.70		1.71		0.25
15					34.04		0.46		1.56		0.25

SN

Gold calculated at $.....*per ounce.*

Silver calculated at $.....*per ounce.*

Calculated at.....*cents per lb.*

Calculated at.....*cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples

Provincial Assaye

To: 1F-6

The California Standard Co.

Medical Arts Building

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC"

FILE NO. 2393

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD		SILVER		Silica (SiO_2)		Alumina (Al_2O_3)		Calcium Oxide		XXXXX XXXXX XXXXX Magn (M
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	
		$		$		$		$		$	
16 B-1					20.38		1.23		4.11		0.60
17 B-2					21.10		1.12		3.57		0.47
18 B-3					20.04		0.70		3.62		0.20
19 B4					20.01		0.98		4.21		0.89
20					21.50		0.70		3.86		0.33
21					27.06		0.76		0.98		0.34
22 B5					15.40		1.84		2.74		1.81
23 B6					23.34		0.74		2.01		0.96
24 B7					22.54		0.60		5.18		2.35
25					26.14		0.34		1.57		0.49
49					21.84		0.48		2.01		0.71
50					30.64		0.64		1.27		0.41
76					31.24		0.88		1.32		0.30
77					23.16		0.52		1.52		0.25
78 B-9					22.70		0.48		4.99		2.12

SM

Gold calculated at $.....*per ounce.*

Silver calculated at $.....*per ounce.*

Calculated at.....*cents per lb.*

Calculated at.....*cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assay*

To: 1F-6

The California Standard Co.
Medical Arts Building
329 A - 6th Ave. S. W.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 2393

DATE October 11, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *samp*

MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	Silica (SiO_2) PER CENT.	Silica (SiO_2) VALUE PER TON	Alumina (Al_2O_3) PER CENT.	Alumina (Al_2O_3) VALUE PER TON	Calcium Oxide (CaO) PER CENT.	Calcium Oxide (CaO) VALUE PER TON	Magne (Mg
		$		$		$		$		$	
79					29.86		0.76		1.17		0.34
80 BB					24.32		1.36		4.60		2.09
81					26.04		1.30		1.42		0.67
82 B10					31.30		0.54		1.03		0.20
83					26.26		0.64		0.83		0.33
84					25.70		0.48		1.12		0.24
85					19.64		0.44		2.84		0.81
86					22.68		0.44		1.71		0.47
87 B-11					25.62		1.06		1.42		0.33
88 B-12					17.18		1.02		1.96		0.77
89					23.74		0.54		1.61		0.16
90					23.56		0.50		2.25		0.69
91					14.58		0.98		5.82		2.73
92					26.04		0.46		4.79		2.22
93 B-13					19.46		0.46		1.47		0.55

5M

*Gold calculated at $*_____*per ounce.*

*Silver calculated at $*_____*per ounce.*

*Calculated at*_____*cents per lb.*

*Calculated at*_____*cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayler *Provincial Assay*

Page Four

1F-6

To:

The California Standard Co.

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329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 2993

DATE October 11, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	Silica (SiO_2) PER CENT.	Silica (SiO_2) VALUE PER TON	Alumina (Al_2O_3) PER CENT.	Alumina (Al_2O_3) VALUE PER TON	Calcium Oxide (CaO)	Calcium Oxide (CaO) VALUE PER TON	XXXXXX XXXXXX XXXXXX Magne (Mg
		$		$		$		$		$	
✓94					20.10		0.60		4.01		2.07
✓95 B-14					32.18		0.68		1.37		0.29
✓96					31.20		1.00		1.91		0.54
✓97					25.50		0.28		1.71		0.46
✓98					35.90		1.94		1.61		1.11
✓99					33.30		0.60		2.00		0.58
✓100					26.26		1.10		1.47		0.49
1F-6 ✓201					12.62		0.56		2.10		0.65
✓202 B-15					22.34		0.68		1.91		0.49
✓203 B-17					22.84		2.16		2.01		1.46
✓204 B-16					25.16		0.66		1.86		0.52

SM

Gold calculated at $.....per ounce. *Calculated at.....cents per lb.*

Silver calculated at $.....per ounce. *Calculated at.....cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assay*

11-6

To: The California Standard Co.
Medical Arts Building
329 A - 6th Ave. S. W.
Calgary, Alberta

Certificate of Assay

COAST ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA
PHONE: TRINITY 6-41
CABLE ADDRESS "ELDRIC"

FILE NO. 2993

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD		SILVER		Silica (SiO_2)		Alumina (Al_2O_3)		Calcium Oxide (CaO)		Magnesia (MgO)
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON	
		$		$		$		$		$	
211 B18					28.84		1.18		1.91		0.59
212 B-19					22.30		0.80		2.69		0.38
213					33.44		1.28		1.56		0.66
214					18.16		0.54		1.66		0.65
215					24.64		0.60		1.37		0.51
216					25.01		0.84		1.37		0.55

5M

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles
Provincial Assay

IF-6

To:

The California Standard Co.

Medical Arts Building,

329 A - 6th Avenue, S. E.,

Calgary, Alberta.

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 2983

DATE October 4, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

IF-6 MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	TOTAL IRON (Fe) PER CENT.	TOTAL IRON (Fe) VALUE PER TON	SULPHUR (S) PER CENT.	SULPHUR (S) VALUE PER TON	PHOSPHORUS (P)	PHOSPHORUS (P) VALUE PER TON	TOTAL V PER T (2000 L
1 Iron Ore		$		$	54.23	$	0.01	$	0.23	$	$
2					53.15		0.01		0.22		
3					48.32		0.02		0.23		
4					54.23		0.01		0.19		
5					47.33		0.01		0.23		
6					48.51		0.02		0.19		
7					42.89		0.03		0.34		
8					52.95		0.02		0.35		
9					48.22		0.01		0.29		
10					52.46		0.01		0.25		
11					46.35		0.03		0.25		
12					53.84		0.02		0.34		
13					53.05		0.01		0.27		
14					49.01		0.01		0.44		
15					43.73		0.01		0.33		
16 B1					49.30		0.02		0.17		
17 B2					50.58		0.02		0.30		
18 B3					51.67		0.02		0.31		
19 B4					49.80		0.02		0.29		

SM

Gold calculated at $.....per ounce. *Calculated at.....cents per lb.*

Silver calculated at $.....per ounce. *Calculated at.....cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assay*

F.C. 2

To: California Standard Co.

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 2993

DATE October 4, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD		SILVER		TOTAL IRON (Fe)		SULFUR (S)		PHOSPHORUS (P)		TOTAL M
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
		$		$		$		$		$	$
✓20					50.09		0.01		0.31		
✓21					49.50		0.04		0.15		
✓22 B5					52.75		0.02		0.22		
✓23 B6					50.23		0.02		0.23		
✓24 B7					44.07		0.02		0.33		
✓25					50.19		0.01		0.24		
✓40					51.53		0.03		0.24		
✓50					46.24		0.02		0.22		
✓76					46.04		0.03		0.21		
✓77					52.07		0.02		0.35		
✓78 B9					44.50		0.01		0.26		
✓79					46.76		0.01		0.17		
✓80 B8					43.73		0.03		0.32		
✓81					49.43		0.01		0.32		
✓82 B10					45.75		0.02		0.27		
✓83					49.09		0.01		0.24		

SM

Gold calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples

Provincial Assay

1F-6

PAGE 3

TO:

CALIFORNIA STANDARD CO.

ARCTIC

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 2003

DATE OCTOBER 4, 19

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *samp*

MARKED	GOLD		SILVER		TOTAL IRON (Fe)		SULPHUR (S)		PHOSPHORUS (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER (2000
		$		$		$		$		$	$
84					50.10		0.01		0.39		
85					51.31		0.01		0.42		
86					51.10		0.01		0.39		
87 B-11					49.39		0.01		0.36		
83 B-12					54.34		0.01		0.32		
89					51.10		0.01		0.40		
90					49.59		0.01		0.33		
91					48.98		0.01		0.41		
92					42.62		0.01		0.34		
93 B-13					53.43		0.01		0.29		
94					48.28		0.01		0.39		
95 B-14					44.84		0.01		0.29		
96					44.44		0.02		0.38		
97					49.39		0.01		0.38		
98					49.70		0.02		0.38		
99					43.93		0.01		0.39		
100					49.19		0.01		0.40		

SM

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles *Provincial Assay*

1F-6

To: PAGE 5

THE CALIFORNIA STANDARD CO.

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 2003

DATE October 4, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *samp*

MARKED	GOLD		SILVER		TOTAL IRON (Fe)		SULPHUR (S)		PHOSPHORUS (P)		TOTAL
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER (2000
		$		$		$		$		$	$
1F-6 201					50.17		0.01		0.35		
✓ 202 B-15					51.21		0.02		0.39		
✓ 203 B-17					47.67		0.01		0.50		
✓ 204 B-16					49.49		0.01		0.42		
✓ 211 B-18					46.05		0.01		0.45		
✓ 212 B-19					50.90		0.01		0.50		
✓ 213					40.90		0.02		0.38		
✓ 214					54.84		0.02		0.25		
✓ 215					50.09		0.02		0.21		
✓ 216					50.09		0.01		0.25		

GH

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shargles *Provincial Assay*

JF 6

Page Eleven

Crest Explorations Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

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ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRinity 6-4

CABLE ADDRESS "ELDRIC

FILE NO. A.3-C.3-63

DATE January 14, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sampl*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
IF-6-62											
205					56.24		0.39		14.56		
206					44.45		0.46		29.64		
207					53.72		0.34		18.33		
208					41.93		0.59		33.00		
209					47.53		0.50		25.96		
210					42.94		0.33		34.06		
217					38.00		0.36		36.35		

To:
The California Standard Co.
Medical Arts Building
329 A 6th Avenue S. W.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC Member Canadian Testing Association

PHONE: T[illegible] TY 6-4111

CABLE ADDRESS "ELDRICO"

FILE NO. 3127

DATE October 11, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *samples.*

MARKED	GOLD		SILVER		Carbon Dioxide		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT. (CO_2)	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TON (2000 LBS.)
		$		$		$		$		$	$
1F-6 ✓1					1.43		0.060				
✓2					1.54		0.070				
✓3					4.34		0.090				
✓4					1.39		0.058				
✓5					1.54		0.076				
✓6					2.64		0.092				
✓7					5.74		0.136				
✓8					1.61		0.076				
✓9					2.27		0.088				
✓10					1.25		0.080				
✓11					2.34		0.116				
✓12					1.61		0.072				
✓13					0.95		0.064				
✓14					0.88		0.058				
✓15					1.25		0.062				

5M

Gold calculated at $.....per ounce.

Silver calculated at $.....per ounce.

Calculated at.....cents per lb.

Calculated at.....cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaples ..... *Provincial Assayer*

IF6

Page Two

To:

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. / VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *sampl*

MARKED	GOLD		SILVER		Carbon Dioxide		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT. (CO_2)	VALUE PER TON	PER CENT.	VALUE PER TON.		VALUE PER TON	PER T (2000 L
		$		$		$		$		$	$
✓16					2.89		0.084				
✓17					2.42		0.060				
✓18					2.64		0.076				
✓19					4.03		0.184				
✓20					2.57		0.028				
✓21					1.39		0.036				
✓22					2.89		0.134				
✓23					2.42		0.104				
✓24					4.77		0.208				
✓25					1.61		0.104				
✓49					1.91		0.060				
✓50					1.39		0.016				
✓76					1.36		0.044				
✓77					0.95		0.040				
✓78					4.55		0.196				

SM

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayler ..... *Provincial Assay*

1F-6

To: The California Standard Co.
Medical Arts Building
329 A 6th Avenue S. W.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *sampl*

MARKED	GOLD		SILVER		Carbon Dioxide		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT. (CO_2)	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
79					1.43		0.044				
80					4.34		0.120				
81					0.99		0.048				
82					1.17		0.044				
83					0.92		0.052				
84					0.55		0.028				
85					2.49		0.056				
86					1.39		0.028				
87					1.47		0.080				
88					1.83		0.076				
89					0.70		0.036				
90					2.06		0.052				
91					5.00		0.240				
92					5.59		0.196				
93					3.52		0.080				

5M

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles

Provincial Assay

1F-6

To:

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC"

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *samp*

MARKED	GOLD		SILVER		Carbon Dioxide		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT. (CO_2)	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER
		$		$		$		$		$	$
✓94					4.34		0.134				
✓95					1.32		0.016				
✓96					1.14		0.050				
✓97					1.21		0.076				
✓98					0.77		0.072				
✓99					1.69		0.096				
✓100					0.77		0.084				
1F-6 201					1.69		0.072				
✓202					1.40		0.108				
✓203					1.07		0.058				
✓204					1.69		0.084				

SM

Gold calculated at $..... per ounce.

Silver calculated at $..... per ounce.

Calculated at ..... cents per lb.

Calculated at ..... cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles ..... *Provincial Assay*

1F-6

To: The California Standard Co.
Medical Arts Building
329 A 6th Avenue
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3127

DATE October 11, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* ... *sampl*

MARKED	GOLD		SILVER		Carbon Dioxide (CO_2)		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
211					1.21		0.040				
212					1.32		0.032				
213					1.21		0.049				
214					1.54		0.112				
215					1.21		0.102				
216					1.39		0.130				

6M

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaples

Provincial Assay

XF-7

To:

Crest Explorations Ltd.

Medic 1 Arts Building

329 A - 6th Avenue S. W.

Calgary, Alberta
Attention: Mr. C. D. A. Dahlstrom

Certificate of Assay

COAST BELDING
ENGINEERING & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS: BALDRIC

FILE NO. A.3-C.3-63

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sampl*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
XF-7-62		$		$		$		$		$	$
51-4					50.50		0.24		23.23		
55-6					31.19		0.22		50.60		
57-61					51.47		0.27		22.20		
62					45.85		0.29		22.88		
63-5					49.11		0.32		24.90		
66-7					48.91		0.38		25.60		
68-9					46.74		0.32		24.92		
70-3					46.74		0.32		21.62		
74-177					48.32		0.31		20.01		
178-80					47.82		0.35		21.66		
181-3					48.91		0.31		23.49		
184-5					49.92		0.33		28.40		

IF-7

PAGE 4

To: California Standard Co.

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS: ELDRIC

FILE NO. 2993

DATE October 4, 193

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD		SILVER		TOTAL IRON (Fe)		SULPHUR (S)		PHOSPHORUS (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
IF-7 186					48.93		0.01		0.46		
187					48.93		0.02		0.49		
188					47.05		0.02		0.49		
189					46.26		0.01		0.47		
190					46.26		0.02		0.63		
191					39.88		0.02		0.59		
192					47.37		0.02		0.73		
193					46.76		0.03		1.09		
194					47.87		0.02		0.84		

SM

Gold calculated at $ ..... per ounce.

Silver calculated at $ ..... per ounce.

Calculated at ..... cents per lb.

Calculated at ..... cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles *Provincial Assay*

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE., VANCOUVER 10, B.C. TELEPHONE: TRINITY 6-4111
CABLE ADDRESS: "ELDRICO"

REPORT OF: Assays.

AT Vancouver Laboratory. ORDER No. 3287

PROJECT: DATE

REPORTED TO: The California Standard Company, FILE November 20, 1962.
4801- 1st. Street S.E.
CALGARY, Alberta.

	Fe.	S.	P.	SiO_2	Al_2O_3	CaO	MgO.	Mn.	CO_2
1F-9-62 #218	50.10	0.01	0.16	21.60	0.38	2.67	0.58	0.02	2.50
219	46.56	0.01	0.24	22.40	0.48	4.20	1.76	0.03	4.84
220	51.81	0.01	0.18	17.44	0.70	3.01	1.21	0.02	3.38
221	50.10	0.01	0.20	21.62	0.16	3.36	0.80	0.02	3.00
222	52.32	0.01	0.25	16.50	1.44	4.15	0.43	0.03	3.60
223	52.12	0.01	0.36	17.92	0.56	3.75	0.78	0.03	3.49
224	48.48	0.01	0.37	9.04	1.56	7.51	3.48	0.04	8.81
225	51.31	0.01	0.25	21.46	1.06	2.47	0.90	0.01	3.23
251	51.81	0.01	0.35	20.42	0.30	2.62	0.79	0.03	2.61
252	48.48	0.01	0.25	22.90	0.40	3.75	1.52	0.02	4.26
253	49.59	0.01	0.26	21.82	Trace	3.11	1.35	0.02	3.38
254	48.38	0.01	0.30	26.08	0.72	2.32	0.78	0.11	2.20
255	48.99	0.01	0.39	24.02	0.20	2.92	1.12	0.08	3.08
256	45.45	0.01	0.18	31.10	0.20	2.67	0.79	0.03	2.75
257	51.41	0.01	0.29	22.94	0.88	1.63	0.67	0.02	1.17
258	46.26	0.01	0.26	27.20	0.10	3.06	1.12	0.02	2.68
259	50.40	0.01	0.26	21.44	0.82	2.42	0.58	0.03	1.87
260	48.28	0.01	0.25	24.30	0.74	2.47	0.78	0.04	2.68
261	48.88	0.01	0.30	22.44	0.54	2.67	1.15	0.03	3.52
262	42.93	0.02	0.29	19.66	1.04	6.42	2.74	0.08	7.71
263	39.29	0.01	0.25	33.84	0.60	3.75	1.34	0.02	4.18
264	56.76	0.02	0.40	10.50	1.62	2.67	1.12	0.03	1.61
265	34.54	0.01	0.35	38.26	0.64	5.83	0.83	0.13	4.99
266	47.57	0.01	0.21	25.52	1.28	2.52	0.88	0.08	2.24
267	53.83	0.01	0.45	19.70	0.93	1.38	0.36	0.05	0.51
268	44.24	0.01	0.34	34.64	0.12	1.25	0.29	0.05	0.73
269	47.57	0.01	0.42	28.84	0.86	1.68	0.41	0.06	0.92
270	47.17	0.01	0.37	28.14	0.20	1.83	0.43	0.07	1.61
271	47.77	0.01	0.30	24.80	0.78	2.27	0.74	0.06	2.42
272	52.82	0.01	0.56	6.60	0.24	6.13	2.88	0.25	6.83

1F-9

Cont'd.....

November 20, 1962

The California Standard Company.

	Fe.	S.	P.	SiO_2	Al_2O_3	CaO.	MgO.	Mn.	CO_2
1F-9-62 #273	46.46	0.01	0.67	12.60	3.16	5.68	3.83	0.21	6.39
274	45.35	0.01	0.33	28.82	0.34	2.67	0.72	0.11	2.46
275	43.94	0.01	0.26	29.64	0.56	2.96	1.22	0.12	3.27
351	44.95	0.01	0.28	30.12	0.70	2.32	0.94	0.10	2.39
352	46.56	0.01	0.35	20.96	1.10	4.69	2.17	0.15	4.84
353	49.69	0.01	0.24	24.06	0.10	2.22	0.85	0.08	2.06
354	50.50	0.01	0.27	21.64	Trace	2.82	1.30	0.05	3.16
355	51.11	0.01	0.30	23.10	0.24	1.53	0.52	0.08	1.76
356	47.07	0.01	0.37	16.02	0.46	6.03	2.88	0.25	8.07
357	44.84	0.01	0.35	23.04	Trace	5.14	1.90	0.19	6.17
358	38.48	0.01	0.31	36.04	Trace	3.46	0.47	0.11	3.89
359	48.99	0.01	0.31	27.56	Trace	1.09	0.25	0.03	0.92
360	49.89	0.01	0.37	18.72	0.06	3.61	1.65	0.14	4.15
361	46.46	0.01	0.33	23.42	0.12	3.51	1.81	0.18	4.84
362	47.17	0.01	0.32	21.44	0.06	4.01	1.68	0.16	4.77
363	50.10	0.01	0.34	22.22	0.06	2.38	0.80	0.11	2.86
364	49.59	0.01	0.31	22.34	0.50	2.52	0.87	0.11	2.98
365	47.87	0.01	0.36	24.62	0.50	2.33	0.77	0.11	2.17
367	45.15	0.01	0.51	22.06	2.64	3.02	2.23	0.09	2.53
476	47.57	0.01	0.26	29.78	0.14	1.04	0.39	0.09	1.06
477	50.80	0.01	0.50	18.14	0.90	4.85	0.22	0.09	3.05
478	44.54	0.01	0.42	29.40	0.18	4.16	0.29	0.12	3.60
479	47.57	0.01	0.33	25.42	0.12	3.17	0.32	0.10	2.97
480	43.73	0.01	0.46	32.38	0.76	1.93	0.43	0.07	1.17
481	50.00	0.01	0.39	21.40	1.08	2.52	0.69	0.09	2.13
482	48.78	0.01	0.45	23.24	0.10	3.66	0.40	0.09	2.94
483	51.11	0.01	0.42	21.30	0.20	2.18	0.45	0.11	2.06
484	43.94	0.01	0.53	30.02	0.12	2.67	0.71	0.17	2.17
485	41.61	0.01	0.35	29.12	0.38	4.01	1.20	0.21	4.40
486	32.93	0.01	0.19	45.78	Trace	2.50	0.62	0.09	3.23
487	35.45	0.01	0.30	41.70	0.50	3.27	0.48	0.10	3.16
488	48.68	0.01	0.36	22.76	0.68	1.78	0.79	0.09	1.98
489	52.22	0.01	0.33	21.30	0.38	1.39	0.40	0.05	0.88
490	47.57	0.01	0.39	26.64	0.70	1.58	0.45	0.05	1.54
491	49.59	0.01	0.34	24.10	Trace	1.19	0.36	0.09	0.81
492	46.06	0.01	0.40	30.20	0.12	1.09	0.22	0.06	2.42
493	41.71	0.01	0.32	33.86	0.14	2.72	0.62	0.13	4.80
494	47.17	0.01	0.24	21.02	0.38	3.71	1.59	0.16	1.84
495	51.61	0.01	0.18	23.40	0.28	0.94	0.30	0.07	3.82
496	48.38	0.01	0.36	19.04	0.10	3.37	1.47	0.15	2.20

1F-9

Cont'd .....

File No. 3287

The California Standard Co.

November 20, 1962

	Fe.	S.	P.	SiO_2	Al_2O_3	CaO.	MgO.	Mn.	CO_2
IF-9-62 #497	48.78	0.01	0.33	23.48	0.08	1.98	0.64	0.07	1.32
498	45.96	0.02	0.22	18.04	0.40	5.05	2.78	0.27	7.70
499	42.72	0.01	0.46	18.00	Trace	6.93	3.42	0.26	11.60
500	51.41	0.01	0.26	23.90	0.04	0.79	0.32	0.05	0.88
526	50.20	0.01	0.43	25.20	0.18	1.04	0.18	0.06	1.47
527	50.30	0.01	0.27	25.64	0.28	0.59	0.27	0.03	1.21
528	47.98	0.01	0.29	29.02	Trace	1.09	0.26	0.07	1.25
529	47.87	0.01	0.27	30.72	0.20	0.89	0.17	0.06	1.17
530	46.86	0.01	0.19	30.36	0.28	0.69	0.30	0.06	0.88
531	48.78	0.01	0.35	23.50	0.80	1.68	0.83	0.13	2.17
532	44.44	0.01	0.40	31.01	0.30	1.73	0.47	0.07	1.76

IF-9

1F-9-62	#533	50.50	0.01	0.43	22.01
1F-9-62	#534	53.13	0.02	0.42	14.50
	535	43.43	0.02	0.53	29.00
	536	43.23	0.01	0.51	31.20
	537	36.66	0.01	0.37	35.62
	538	46.46	0.02	0.32	23.46
	539	37.17	0.01	0.63	35.70
	540	47.67	0.01	0.74	22.80

1F-9

1F-9

TO:

The California Standard Co.

4801 - 1st St. S.E.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERING & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

CABLE ADDRESS: ELDRIDGE

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sample*

MARKED	GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO
1 F - 9 - 62		$		$		$		$		$	$
218 2.0					50.10		0.01		0.16		
219 3.0					46.56		0.01		0.24		
220 3.0					51.81		0.01		0.18		
221 3.0					50.10		0.01		0.20		
222 3.0					52.32		0.01		0.25		
223 3.0					52.12		0.01		0.36		
224 3.0					48.48		0.01		0.37		
225 3.0					51.31		0.01		0.25		
251 3.0					51.81		0.01		0.35		
252 3.0					48.48		0.01		0.25		
253 3.0					49.59		0.01		0.26		
254 3.0					48.38		0.01		0.30		
255 3.5					48.99		0.01		0.39		
256 3.5					45.45		0.01		0.18		
257 3.5					51.41		0.01		0.29		
258 3.0					46.26		0.01		0.26		
259 3.0					50.40		0.01		0.26		
260 3.0					48.28		0.01		0.26		
261 3.0					48.88		0.01		0.30		
262 3.0					42.93		0.02		0.29		

5M

Gold calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaughnessy

Provincial Assaye

Page Two

1F-9

To:
The California Standard Co.
4801 - 1st S. S. E.
Calgary, Alberta

Certificate of Assay

EAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

FILE NO 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sample*

MARKED	GOLD Ounces per ton	GOLD Value per ton	SILVER Ounces per ton	SILVER Value per ton	Iron (Fe) Per cent.	Iron (Fe) Value per ton	Sulphur (S) Per cent.	Sulphur (S) Value per ton	Phosphorus (P)	Phosphorus (P) Value per ton	Total Value per ton
1 F - 9 - 62 263 3.0		$		$	39.29	$	0.01	$	0.25	$	$
264 2.0					56.76		0.02		0.40		
265 2.0					34.54		0.01		0.35		
266 2.0					47.57		0.01		0.21		
267 3.0					53.03		0.01		0.45		
268 2.0					44.24		0.01		0.34		
269 3.3					47.57		0.01		0.42		
270 2.0					47.17		0.01		0.37		
271 3.5					47.77		0.01		0.30		
272 1.5					52.82		0.01		0.56		
273 2.0					46.46		0.01		0.67		
274 3.0					45.35		0.01		0.33		
275 2.5					43.94		0.01		0.26		
351 2.5					44.95		0.01		0.28		
352 2.5					46.56		0.01		0.35		
353 2.6					49.69		0.01		0.24		
354 2.5					50.59		0.01		0.27		
355 3.5					51.11		0.01		0.30		
356 3.0					47.07		0.01		0.37		
357 3.5					44.84		0.01		0.35		

EM

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples

Provincial Assay

1F-9

To:

The California Standard Co.

4801 - 1st St. S. E.

Calgary, Alberta

Certificate of Assay

COLDER BLDRIDGE
PROSPECTORS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

CABLE ADDRESS: ELDRIDGE

FILE NO 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sample*

MARKED	GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO
1F-9-62 358 1.5		$		$	38.48	$	0.01	$	0.31	$	$
359 3.0					48.99		0.01		0.31		
360 3.5					49.89		0.01		0.37		
361 3.5					46.45		0.01		0.33		
362 3.5					47.17		0.01		0.32		
363 3.0					50.10		0.01		0.34		
364 2.75					49.59		0.01		0.31		
365 2.5					47.87		0.01		0.36		
367 3.0					45.15		0.01		0.51		
476 3.0					47.57		0.01		0.26		
477 3.0					50.80		0.01		0.50		
478 2.0					44.54		0.01		0.42		
479 3.0					47.57		0.01		0.33		
480 2.5					43.73		0.01		0.46		
481 3.0					50.00		0.01		0.39		
482 3.0					48.78		0.01		0.45		
483 3.0					51.11		0.01		0.42		
484 3.5					43.94		0.01		0.53		
485 3.5					41.61		0.01		0.35		
486 2.0					32.93		0.01		0.19		

SM

Gold calculated at $____ per ounce. *Calculated at ____ cents per lb.*

Silver calculated at $____ per ounce. *Calculated at ____ cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Langles

Provincial Assaye

1F-9

To

The California Standard Co.

4801 - 1st S. S. E.

Calgary, Alberta

Certificate of Assay

ELECTRIC
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

CABLE ADDRESS

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sample*

MARKED	GOLD Ounces per ton	GOLD Value per ton	SILVER Ounces per ton	SILVER Value per ton	Iron (Fe) Per cent.	Iron (Fe) Value per ton	Sulphur (S) Per cent.	Sulphur (S) Value per ton	Phosphorus (P) Per cent.	Phosphorus (P) Value per ton	Total Value per ton
		$		$		$		$		$	$
1F-9-62 437 3.0					35.45		0.01		0.30		
438 3.0					48.60		0.01		0.36		
439 3.0					52.22		0.01		0.33		
490 3.5					47.57		0.01		0.39		
491 3.5					49.59		0.01		0.34		
492 2.0					46.06		0.01		0.40		
493 3.0					41.71		0.01		0.32		
494 3.0					47.17		0.01		0.24		
495 2.5					51.61		0.01		0.18		
496 3.0					48.38		0.01		0.38		
497 3.0					48.78		0.01		0.33		
498 2.0					45.96		0.02		0.22		
499 2.0					42.72		0.01		0.46		
500 3.0					51.41		0.01		0.26		
526 3.0					50.20		0.01		0.43		
527 3.0					50.30		0.01		0.27		
528 2.0					47.98		0.01		0.29		
529 2.0					47.87		0.01		0.27		
530 2.0					46.86		0.01		0.19		
531 2.0					48.78		0.01		0.35		
1F-9-62 532 2.0					44.44		0.02		0.40		
1F-9-62 533 2.5					50.50		0.01		0.43		
534 2.0					53.13		0.02		0.42		
535 3.5					43.43		0.02		0.53		
536 3.5					43.23		0.01		0.51		
537 2.5					36.66		0.01		0.37		
538 2.0					46.46		0.02		0.32		
539 3.0					37.17		0.01		0.63		
540 2.6					47.67		0.01		0.74		

arrangement.

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To:
The California Standard Co.
Medical Arts Building
329 A 6th Avenue S. W.
Calgary, Alberta

SEMI QUANTITATIVE SPECTROGRAPHIC ANALYSES

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

FILE NO. 3127

DATE October 11, 196

We Hereby Certify that the following are the results of semi quantitative spectrographic analyses made on _____ samples submitted.

SAMPLE IDENTIFICATION	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Ga	Au	[illegible]
1F-13 114 - 117	0.4	ND	ND	0.02	ND	ND	Trace	ND	4.	0.001	Trace	0.01	ND	ND	[illegible]
110 - 113	0.3	ND	ND	0.01	ND	ND	ND	ND	3.5	0.0005	Trace	0.01	ND	ND	[illegible]
106 - 109	0.3	ND	ND	0.01	ND	ND	Trace	ND	1.5	0.0005	Trace	0.02	ND	ND	[illegible]
104 - 105	0.3	ND	ND	0.02	ND	ND	ND	ND	0.9	0.0006	Trace	0.01	ND	ND	[illegible]
102 - 103	0.2	ND	ND	0.03	ND	ND	Trace	ND	0.9	0.0006	Trace	0.015	ND	ND	[illegible]

SAMPLE IDENTIFICATION	Pb	Mg	Mn	Mo	Nb	Ni	Si	Ag	Sr	Ta	Sn	Ti	W	V	Z
1F-13 114 - 117	ND	1.5	0.15	0.001	ND	0.001	Matrix	0.0001	Trace	ND	ND	0.02	ND	0.001	Tr
110 - 113	ND	1.5	0.15	0.001	ND	0.0003	Matrix	0.0001	Trace	ND	ND	0.06	ND	0.002	Tr
106 - 109	Trace	1.5	0.10	0.001	ND	0.0007	Matrix	0.0001	Trace	ND	Trace	0.02	ND	0.002	Tr
104 - 105	ND	1.	0.09	0.001	ND	0.0007	Matrix	0.0001	Trace	ND	Trace	0.05	ND	0.001	Tr
102 - 103	ND	1.	0.09	0.001	ND	0.0007	Matrix	0.0001	Trace	ND	Trace	0.02	ND	0.001	Tr

SM-MF-F61

Note: Rejects retained one week.
Pulps retained three months.

COAST ELDRIDGE ENGINEERS & CHEMISTS LT

ALL RESULTS ARE THE CONFIDENTIAL PROPERTY OF CLIENTS. PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORT IS NOT PERMITTED WITHOUT OUR WRITTEN APPROVAL. ANY LIABILITY ATTACHED HEREIN IS LIMITED TO THE FEE CHARGED.

for CHEMIST

Page Three 1F-13

To:

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

SEMI QUANTITATIVE SPECTROGRAPHIC ANALYSES

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

File No. 3137

Date October 11, 196

We Hereby Certify that the following are the results of semi quantitative spectrographic analyses made on ..... sample(s) submitted.

Sample Identification	Al	Sb	As	Ba	Be	Bi	B	Cd	Cu	Cr	Co	Ga	La	Mn	Au
1F-13 143 - 46	1.	ND	ND	0.03	ND	ND	ND	ND	3.5	0.0007	Trace	0.005	ND	1.0	Ha
137 - 41	1.5	ND	ND	0.03	ND	Trace	ND	ND	3.5	0.0005	Trace	0.005	ND	ND	Ha
131 - 35	0.5	ND	ND	0.01	ND	ND	ND	ND	3.5	0.0005	Trace	0.005	ND	ND	Ha
127 - 30	0.6	ND	ND	0.05	ND	ND	ND	ND	5.	0.0007	Trace	0.007	ND	ND	Ha
122 - 126	0.4	ND	ND	0.02	ND	ND	ND	ND	1.5	0.0007	Trace	0.005	ND	ND	Ha
118 - 121	0.4	ND	ND	0.01	ND	ND	ND	ND	1.2	0.0005	Trace	0.005	ND	ND	Ha

Sample Identification	Pb	Mg	Mn	Mo	Nb	Ni	Si	Ag	Sr	Ta	Sn	Ti	W	V	Zr
1F-13 143 - 46	Trace	0.4	0.04	0.007	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	0.001	Tr
137 - 41	Trace	0.3	0.04	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.02	ND	0.001	Tr
131 - 35	ND	0.3	0.09	0.0009	ND	ND	Matrix	0.0001	Trace	ND	0.0006	0.01	ND	0.0009	Tr
127 - 30	Trace	0.4	0.1	0.0007	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	0.0009	Tr
122 - 126	ND	0.4	0.07	0.0009	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	0.001	Tr
118 - 121	ND	0.4	0.06	0.001	ND	ND	Matrix	0.0001	Trace	ND	0.0005	0.02	ND	0.001	Tr

Note: 1" jaw rotated one week.
Pd, required three months.

REPORT IS THE CONFIDENTIAL PROPERTY OF CLIENT, PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS NOT TO BE MADE WITHOUT OUR WRITTEN CONSENT AND ONLY IN THE FULL FORM AND CONTEXT IN WHICH THEY ARE ISSUED. OUR REPORTS ARE ISSUED SUBJECT TO THE FOLLOWING CONDITIONS:

COAST ELDRIDGE ENGINEERS & CHEMISTS LTD

per O. L. Eldridge

IF-13

To:

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRinity 6-4

CABLE ADDRESS - ELDRIC

FILE NO 2803

DATE Sept. 25, 196

We Hereby Certify *that the following are the results of assays made by us upon submitted* ... IRON ORE ... *samp*

MARKED	GOLD Ounces per ton	GOLD Value per ton	SILVER Ounces per ton	SILVER Value per ton	Total Iron (Fe) Per cent.	Total Iron (Fe) Value per ton	Sulphur (S) Per cent.	Sulphur (S) Value per ton	Phosphorus (P) Per cent.	Phosphorus (P) Value per ton	TOTAL Per ton
1613		$		$		$		$		$	$
101					45.46		0.04		0.34		
102					43.22		0.03		0.41		
103					42.02		0.03		0.26		
104					43.08		0.02		0.39		
105					43.22		0.03		0.40		
106					47.73		0.02		0.53		
107					45.66		0.03		0.18		
108					51.37		0.02		0.44		
109					43.89		0.01		0.44		
110					45.07		0.02		0.44		
111					41.92		0.02		0.57		
112					50.09		0.02		0.44		
113					51.17		0.02		0.23		
114					47.43		0.02		0.44		
115					47.63		0.01		0.34		

831

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Langes

Provincial Assay

Page Two

To: IF-13

The California Standard Co.

Medical Arts Building

629 A-6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6421

CABLE ADDRESS "ELDRIGE"

FILE NO. 2889

DATE Sept. 25, 1952

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sample*

MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	TOTAL IRON (Fe) PER CENT.	TOTAL IRON (Fe) VALUE PER TON	SULPHUR (S) PER CENT.	SULPHUR (S) VALUE PER TON	PHOSPHORUS (P) PER CENT.	PHOSPHORUS (P) VALUE PER TON	TOTAL VALUE PER TON
		$		$		$		$		$	$
116					43.17		0.02		0.41		
117					43.02		0.02		0.38		
118					49.20		0.01		0.49		
119					43.00		0.02		0.42		
120					50.73		0.02		0.22		
121					56.29		0.02		0.44		
122					43.69		0.02		0.62		
123					43.00		0.02		0.44		
124					50.19		0.02		0.47		
125					44.58		0.02		0.43		
126					51.66		0.03		0.19		
127					38.18		0.03		0.31		
128					48.44		0.02		0.43		
129					47.24		0.03		0.52		
130					45.66		0.02		0.73		

SR

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shorgas

Provincial Assayer

To: 1F-13

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERING & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TERMINAL 6-4
CABLE ADDRESS "ELDRIC"

FILE NO. 2980

DATE Sept. 25, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	GOLD		SILVER		TOTAL IRON (Fe)		SULPHUR (S)		PHOSPHORUS (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
131					47.55		0.02		0.59		
132					46.25		0.02		0.91		
133					49.70		0.02		0.75		
134					49.20		0.02		0.48		
135					48.91		0.03		0.66		
136					45.37		0.02		0.45		
137					44.38		0.02		0.57		
138					43.59		0.02		1.04		
139					46.05		0.03		1.40		
140					43.20		0.03		1.10		
141					48.71		0.03		0.77		
143					36.61		0.02		0.79		
144					41.72		0.02		0.92		
145					39.56		0.02		0.83		
146					48.81		0.04		1.15		
147					42.62		0.02		0.37		
148					45.15		0.01		0.27		
149					48.07		0.01		0.32		
150					55.56		0.02		0.23		

Gold calculated at $ ..... *per ounce.* *Calculated at* ..... *cents per lb.*

Silver calculated at $ ..... *per ounce.* *Calculated at* ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shayles *Provincial Assay*

IF-13

To: The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

BRADY ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PACIFIC TRINITY 6-41

CABLE ADDRESS ELDRIDGE

FILE NO. 2883

DATE Sept. 25, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sample*

MARKED	Silica (SiO_2)	Alumina (Al_2O_3)	Calcium Oxide (CaO)	Magnesia (MgO)					
			PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	TOTAL VALUE PER TON
IF-13								$	$
101	24.10	0.40	4.30		1.66				
102	23.14	0.40	3.52		1.10				
103	31.26	0.30	4.21		0.65				
104	29.22	0.46	3.33		1.33				
105	25.64	0.12	2.49		0.67				
106	16.10	0.20	5.43		2.30				
107	30.44	0.88	2.05		0.87				
108	17.70	0.24	3.47		1.61				
109	31.36	0.08	2.15		0.81				
110	15.44	0.90	7.19		3.31				
111	20.74	0.40	6.80		3.09				
112	22.64	0.08	2.15		0.92				
113	23.01	0.40	2.40		0.95				
114	10.06	0.78	7.73		3.75				
115	23.12	0.62	3.96		1.49				

GH

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaylee

Provincial Assayer

Page Two

1F-13

To:

The California Standard Co.

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICO

FILE NO. 2880

DATE Sept. 25, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sampl*

MARKED	Silica (SiO_2)	Alumina (Al_2O_3)	Calcium Oxide (CaO)	Magnesia (MgO)					TOTAL V
			PER CENT	VALUE PER TON	PER CENT	VALUE PER TON		VALUE PER TON	PER TO
								$	$
116	27.01	0.54	3.62		1.36				
117	24.36	0.38	5.97		0.98				
118	21.76	0.38	2.98		0.96				
119	30.80	0.98	1.91		0.94				
120	22.66	0.50	1.32		0.58				
121	14.64	0.86	1.42		0.53				
122	29.80	0.96	2.54		1.00				
123	31.44	0.36	3.18		0.70				
124	22.90	0.10	2.30		0.42				
125	30.20	0.36	1.96		0.47				
126	24.50	0.24	1.08		0.28				
127	32.80	1.20	4.30		1.40				
128	26.50	0.08	2.15		0.30				
129	24.28	0.10	9.49		0.33				
130	24.74	0.06	5.33		0.29				

Gold calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharpes ..... *Provincial Assay*

To: IF-13

The California Standard Co.

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Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-...
CABLE ADDRESS "ELDRIC..."

FILE NO. 2080

DATE Sept. 25, 196...

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE *sample*

MARKED	Silica (SiO_2) PER CENT	Silica (SiO_2) VALUE PER TON	Alumina (Al_2O_3)	Calcium Oxide (CaO) PER CENT	Calcium Oxide (CaO) VALUE PER TON	Magnesia (MgO) PER CENT	Magnesia (MgO) VALUE PER TON		VALUE PER TON	TOTAL VALUE PER TON
	%		%	%		%				
131	22.46		0.28	5.18		0.33				
132	23.06		1.20	3.33		1.22				
133	21.16		0.08	4.45		0.36				
134	23.20		0.38	3.91		0.27				
135	22.30		0.06	3.96		0.30				
136	25.01		0.10	4.79		0.52				
137	25.62		1.18	4.79		0.99				
138	27.56		2.40	4.30		0.98				
139	20.76		3.18	4.99		1.40				
140	29.98		1.20	4.06		0.22				
141	23.80		1.06	2.93		0.16				
143	35.30		3.14	3.47		1.61				
144	26.24		2.12	5.92		0.64				
145	35.56		1.64	3.72		0.31				
146	21.44		1.08	3.91		0.29				

SM

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Hayes

Provincial Assayer

To: 1F-13

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST LABORATORIES

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE TRINITY 6-41

CABLE ADDRESS "KELORIC"

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *sample*

MARKED	GOLD		SILVER		Carbon Dioxide		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT. (CO_2)	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
109					1.84		0.060				
110					6.16		0.240				
111					5.87		0.236				
112					1.91		0.052				
113					2.42		0.076				
114					6.82		0.280				
115					3.82		0.136				
116					3.96		0.096				
117					2.65		0.072				
118					2.13		0.060				
119					1.54		0.064				
120					1.76		0.020				
121					1.19		0.036				
122					1.18		0.028				
123					2.72		0.080				
1F-13 101					3.08		0.168				
102					3.00		0.092				
103					3.08		0.080				
104					2.42		0.076				
105					1.91		0.072				
106					5.14		0.148				
107					2.20		0.030				
108					3.23		0.016				

arrangement.

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To: IF-13

The California Standard Co.

Medical Arts Building

329 A 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

FILE NO. 3127

DATE October 11, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *samp*

MARKED	GOLD		SILVER		Carbon Dioxide (CO_2)		Manganese (Mn)				TOTAL
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T
		$		$		$		$		$	$
124					1.84		0.072				
125					1.47		0.092				
126					0.88		0.052				
127					2.64		0.120				
128					1.54		0.044				
129					2.64		0.096				
130					3.09		0.108				
131					3.08		0.124				
132					1.80		0.056				
133					2.35		0.080				
134					2.35		0.064				
135					2.20		0.040				
136					3.16		0.084				
137					2.21		0.076				
138					2.20		0.044				

SM

Gold calculated at $..... *per ounce.*

Silver calculated at $..... *per ounce.*

Calculated at..... *cents per lb.*

Calculated at..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shanglas ..... *Provincial Assay*

To: 1F-13

The California Standard Co.
Medical Arts Building
329 A 6th Avenue S. W.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC Member Canadian Testing Association

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3127

DATE October 11, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ..... *sampl*

MARKED	GOLD		SILVER		Carbon Dioxide (CO_2)		Manganese (Mn)				TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
		$		$		$		$		$	$
✓139					1.43		0.044				
✓140					3.09		0.040				
✓141					1.76		0.038				
✓143					1.29		0.038				
✓144					3.30		0.068				
✓145					1.69		0.040				
✓146					1.68		0.044				
✓147					5.87		0.250				
✓148					4.62		0.196				
✓149					1.69		0.036				
✓150					1.43		0.024				

1F-13

COAST ELDRIDGE

October 11, 1962

1F-13.

	Silica (SiO_2)	Alumina (Al_2O_3)	Calcium Oxide (CaO)	Magnes (MgO)
1F-13 147	19.42	0.50	8.17	2.31
⌐ 148	22.54	0.36	5.04	1.90
⌐ 149	24.20	1.30	2.20	0.99
⌐ 150	16.78	0.62	1.37	0.20

IF-13

Coast Eldridge Jan 14

					Iron (Fe)		Phosphorus (P)		Silica (SiO_2)	
IF-13-62 800					51.91		0.20		22.34	

IF-14

To:

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICO

FILE NO. A.3-C-3-63

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sample*

IF-14-62	GOLD	SILVER	Iron (Fe)	Phosphorus(P)	Silica (SiO)
333			33.72	0.21	36.12
334-7			47.04	0.34	21.52
338-41			45.16	0.37	21.44
342-6			46.15	0.26	25.02
347			41.81	0.27	34.06
348-50			45.75	0.53	28.56
451			43.78	0.18	32.30
452-5			50.09	0.34	23.30
456-61			43.29	0.27	23.84
462-66			46.15	0.53	25.24
467			27.72	0.42	48.66
468-69			45.56	0.59	21.70

Page Three

To: 1F-16

Crest Explorations Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRIC

FILE NO. A.3-C-3-63

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* **IRON ORE COMPOSITES** *sample*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous(P)		Silica (SiO_2)		TOTAL VA
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO (2000 LB
		$		$		$		$		$	$
1F-16-62											
47-151					46.94		0.27		18.08		
152-4					46.44		0.33		24.68		
155-7					47.92		0.41		21.16		
158-61					45.36		0.29		24.46		
162-5					45.75		0.28		23.46		
166-8					47.13		0.29		19.70		
169-72					47.92		0.33		23.44		
173-5					48.61		0.30		25.24		
276-9					43.59		0.51		27.08		
280-2					45.36		0.54		26.44		
283-5					43.68		0.36		27.14		
286-8					47.88		0.61		24.54		
289					42.40		0.52		31.08		
290-1					47.43		0.76		24.74		
1F-16-62											
26-30					45.95		0.23		22.38		
31-5					48.32		0.19		23.40		
36-8					46.64		0.20		20.98		
39-42					46.34		0.25		23.56		
43-5					42.80		0.15		24.80		
46					44.08		0.26		23.22		
1F-16-62											
661					46.77		0.24		24.70		
662					50.40		0.34		23.40		
663					50.30		0.29		24.80		

Nov. 20, 1962

The California Standard Company.

	Fe.	S.	P.	SiO_2
1F-19-62 #366	48.28	0.01	0.25	20.56
368	41.71	0.01	0.20	19.98
369	45.45	0.01	0.19	21.96
370	23.13	0.01	0.20	24.08
371	50.70	0.01	0.21	22.60
372	52.72	0.01	0.25	20.84
373	51.41	0.01	0.21	21.04
374	49.29	0.01	0.27	20.26
375	48.99	0.02	0.30	11.30
544	45.96	0.02	0.34	19.70
545	51.21	0.01	0.28	20.10
546	47.17	0.01	0.35	22.70
547	45.75	0.02	0.27	21.60
548	49.19	0.01	0.30	23.44
549	41.71	0.01	0.15	37.20
550	46.97	0.01	0.27	15.96
676	48.38	0.01	0.32	23.50
677	44.64	0.02	0.25	22.84
678	47.27	0.01	0.20	22.30
679	46.36	0.01	0.22	23.80
680	45.65	0.01	0.18	24.04
681	42.32	0.01	0.17	28.22
682	41.21	0.01	0.16	22.96

Cont'd .....

1F-19

The California Standard Co. November 20, 1962

	Fe.	S.	P.	SiO_2
1F-19-62 #683	48.38	0.01	0.12	21.90
684	43.73	0.01	0.21	24.02
685	41.31	0.01	0.25	26.84
686	44.24	0.01	0.24	28.30
687	45.96	0.01	0.25	24.66
688	44.04	0.01	0.37	21.10
689	44.04	0.01	0.26	19.98
690	50.60	0.01	0.26	19.20
691	44.64	0.01	0.28	18.40
692	43.03	0.01	0.36	22.44
693	45.05	0.01	0.26	16.90
694	56.56	0.01	0.32	11.68
695	46.86	0.01	0.24	28.02
696	46.06	0.01	0.25	29.46
697	45.55	0.01	0.25	18.72
698	44.54	0.01	0.30	31.16
699	46.86	0.01	0.25	30.12
700	52.82	0.02	0.29	22.20
701	16.16	0.01	0.23	10.10
702	50.30	0.01	0.31	21.50
703	44.84	0.01	0.20	34.72
704	43.73	0.01	0.15	29.92
705	45.96	0.01	0.45	19.86
706	47.47	0.02	0.34	26.70
707	41.61	0.01	0.27	34.66
708	42.82	0.01	0.33	25.70
709	48.78	0.01	0.28	24.40
710	41.31	0.01	0.24	14.96
711	49.69	0.01	0.29	18.90
712	50.60	0.01	0.26	23.94
713	49.59	0.01	0.35	21.74
714	51.91	0.01	0.39	17.16
715	50.50	0.01	0.24	22.40
716	49.39	0.01	0.25	25.84
717	36.26	0.01	0.40	14.22

1F-19

Cont'd .....

November 20, 1962

The California Standard Company.

		Fe.	S.	P.	SiO_2
1F-19-62	#718	44.95	0.01	0.27	23.00
	719	48.18	0.01	0.23	26.44
	720	49.89	0.01	0.33	22.48
	721	51.81	0.01	0.23	22.04
	722	48.58	0.01	0.65	24.90
	723	40.60	0.01	0.30	35.86
	724	48.48	0.01	0.44	24.70
	725	47.57	0.01	0.37	27.30
	826	53.33	0.01	0.32	19.10
	827	44.14	0.02	0.53	29.90
	828	44.84	0.01	0.41	30.50
	829	40.20	0.02	0.31	34.18
	830	41.61	0.01	0.32	31.70
	831	47.67	0.01	0.55	21.74
	832	43.43	0.01	0.52	30.34
	833	44.24	0.01	0.61	26.02
	834	47.57	0.02	0.60	25.76
	835	51.21	0.01	0.50	21.02
	836	46.86	0.01	0.89	25.86
	837	43.43	0.01	0.51	24.06
	838	52.52	0.01	0.74	18.88
	839	45.45	0.02	0.66	29.30
	840	50.90	0.03	0.45	22.10
	841	41.61	0.02	0.79	34.40
	842	36.46	0.02	0.54	37.40
	843	31.31	0.01	0.47	45.70

COAST ELDRIDGE

H. Sharples

H. Sharples.
Chief Assayer.

1F-19

/tm.

Page Eleven

1F-19

To:
The California Standard Co.
4801 1st St. S. E.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRIC

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sampl*

MARKED		GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	Iron (Fe) PER CENT.	Iron (Fe) VALUE PER TON	Sulphur (S) PER CENT.	Sulphur (S) VALUE PER TON	Phosphorus (P)	Phosphorus (P) VALUE PER TON	TOTAL V PER TO (2000 L
1F - 19 - 62	370 3.0		$		$	23.13	$	0.01	$	0.20	$	$
	371 1.0					50.70		0.01		0.21		
	372 3.0					52.72		0.01		0.25		
	373 3.0					51.41		0.01		0.21		
	374 3.0					49.29		0.01		0.27		
	375 2.0					48.99		0.02		0.30		
	544 3.0					45.96		0.02		0.34		
	545 3.0					51.21		0.01		0.28		
	546 2.5					47.17		0.01		0.35		
	547 3.5					45.75		0.02		0.27		
	548 3.0					49.19		0.01		0.30		
	549 3.0					41.71		0.01		0.15		
	550 3.0					46.97		0.01		0.27		
	676 2.5					48.38		0.01		0.32		
	677 2.0					44.64		0.02		0.25		
	678 2.5					47.27		0.01		0.20		
	679 3.5					46.36		0.01		0.22		
	680 3.0					45.65		0.01		0.18		
	681 4.0					42.32		0.01		0.17		
	682 3.5					41.21		0.01		0.16		
1F-19-62	366 3.0					48.28		0.01		0.25		
	368 3.0					41.71		0.01		0.20		
	369 3.5					45.45		0.01		0.19		

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assaye*

To: 1F-19

The California Standard Co.

4801 - 1st St. S.E.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3287

DATE Nov. 15, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sampl*

MARKED	GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
		$		$		$		$		$	$
1F-19-62 6833.0					48.38		0.01		0.12		
684 3.5					43.73		0.01		0.21		
685 3.5					41.31		0.01		0.25		
686 3.5					44.24		0.01		0.24		
687 3.0					45.96		0.01		0.25		
688 3.0					44.04		0.01		0.37		
689 3.0					44.04		0.01		0.26		
690 3.0					50.60		0.01		0.26		
691 3.0					44.64		0.01		0.28		
692 3.0					43.03		0.01		0.36		
693 3.0					45.05		0.01		0.26		
694 3.0					56.56		0.01		0.32		
695 3.0					46.86		0.01		0.24		
696 3.0					46.06		0.01		0.25		
697 2.0					45.55		0.01		0.25		
698 3.0					44.54		0.01		0.30		
699 3.5					46.86		0.01		0.25		
700 3.0					52.82		0.02		0.29		
701 2.5					16.16		0.01		0.23		
702 2.5					50.30		0.01		0.31		

5M

60.0

Gold calculated at $.....per ounce.

Silver calculated at $.....per ounce.

Calculated at.....cents per lb.

Calculated at.....cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaylor *Provincial Assay*

Page Thirteen

To: 1F-19

The California Standard Co.

4801 - 1st St. S. E.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICO

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sample*

MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL VA
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO (2000 LB
1F-19-62	703 3.0		$		$	44.84	$	0.01	$	0.20	$	$
	704 3.0					43.73		0.01		0.15		
	705 3.0					45.96		0.01		0.45		
	706 3.0					47.47		0.02		0.34		
	707 2.0					41.61		0.01		0.27		
	708 3.0					42.82		0.01		0.33		
	709 3.0					48.78		0.01		0.28		
	710 3.0					41.31		0.01		0.24		
	711 3.0					49.69		0.01		0.29		
	712 4.0					50.60		0.01		0.26		
	713 3.0					49.59		0.01		0.35		
	714 3.0					51.91		0.01		0.39		
	715 3.0					50.50		0.01		0.24		
	716 4.0					49.39		0.01		0.25		
	717 3.0					36.26		0.01		0.40		
	718 3.0					44.95		0.01		0.27		
	719 3.0					48.18		0.01		0.23		
	720 3.0					49.89		0.01		0.33		
	721 2.0					51.81		0.01		0.23		
	722 2.0					48.58		0.01		0.65		

SM

59.0

Gold calculated at $.....per ounce.

Silver calculated at $.....per ounce.

Calculated at.....cents per lb.

Calculated at.....cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assaye*

1F-19

TO: The California Standard Co.
4801 - 1st St. S.E.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-4
CABLE ADDRESS "ELDRIC

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *sampl*

MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL V
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
1F-19-62	723 3.0		$		$	40.60	$	0.01	$	0.30	$	$
	724 3.6					48.48		0.01		0.44		
	725 2.3					47.57		0.01		0.37		
	826 3.0					53.33		0.01		0.32		
	827 2.0					44.14		0.02		0.53		
	828 2.0					44.84		0.01		0.41		
	829 3.0					40.20		0.02		0.31		
	830 2.0					41.61		0.01		0.32		
	831 2.5					47.67		0.01		0.55		
	832 2.5					43.43		0.01		0.52		
	833 3.0					44.24		0.01		0.61		
	834 3.0					47.57		0.02		0.60		
	835 3.0					51.21		0.01		0.50		
	836 3.0					46.86		0.01		0.89		
	837 3.0					43.43		0.01		0.51		
	838 2.5					52.52		0.01		0.74		
	839 3.0					45.45		0.02		0.66		
	840 2.5					50.90		0.03		0.45		
	841 3.0					41.61		0.02		0.79		
	842 3.5					36.46		0.02		0.54		
	843 3.5					31.31		0.01		0.47		

SM

58.9

Gold calculated at $ ..... *per ounce.* *Calculated at* ..... *cents per lb.*

Silver calculated at $ ..... *per ounce.* *Calculated at* ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaples *Provincial Assay*

Page Five

To: 1F-21

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10. CANADA

ACCTLC

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. A.3-C.3-63

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sampl*

	GOLD	SILVER	Iron (Fe)	Phosphorous (P)	Silica (SiO_2)	TOTAL V
IF-21-62			35.05	0.15	37.36	
195-7			37.37	0.22	26.50	
198-301			44.08	0.33	22.96	
302-6			45.95	0.26	21.32	
307-8			43.08	0.28	26.10	
309-12			39.44	0.37	34.28	
313-14			42.01	0.53	28.02	
315-18			44.18	0.47	28.46	
319-20			43.09	0.63	26.78	
321-3			42.89	0.47	29.72	
324			30.27	0.42	41.92	
325			35.10	0.56	36.28	
426-7						

IF-29

To:
Crest Explorations Ltd.
329 A - 6th Avenue S. W.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE
ENGINEERS & CHEMISTS LTD.
125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC

PHONE: TRINITY 6-41
CABLE ADDRESS "ELDRIC

FILE NO. A.3-C.3-63

DATE January 14, 1

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sampl*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
IF-29-62		$		$		$		$		$	$
420-3					43.09		0.26		27.56		
424-52					44.27		0.45		26.88		
653-5					47.82		0.37		21.44		
656-9					47.73		0.42		20.38		
660					49.60		0.44		20.94		
IF-29-62											
292-5					39.94		0.18		26.14		
296-31					43.58		0.21		23.46		
332-14					46.64		0.24		24.56		
415-18					48.51		0.20		18.90		
419					40.92		0.29		23.36		
IF-29-62											
667					41.73		0.23		21.74		
668					39.51		0.35		31.54		

SM

Gold calculated at $ ..... per ounce.

Silver calculated at $ ..... per ounce.

Calculated at ..... cents per lb.

Calculated at ..... cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shanges *Provincial Assaye*

IF-32 East Eldridge Jan 14

Iron (Fe) Phosphorus (P) Silica (SiO_2)

IF-32-62												
226					46.05		0.14		23.74			
227					46.35		0.22		30.08			
228-31					50.98		0.20		22.68			
232-4					48.42		0.27		25.06			
235-6					41.13		0.19		32.50			
237-41					43.98		0.31		28.80			
242-4					46.84		0.34		27.20			
245-7					47.43		0.35		25.30			
248-26					50.09		0.34		20.40			
327-30					49.11		0.28		24.42			

SM

Gold calculated at $.....per ounce.

Silver calculated at $.....per ounce.

Calculated at.....cents per lb.

Calculated at.....cents per lb.

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharpe ..... *Provincial Assayer*

TO: IF-33

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICO

FILE NO. A.3-C.3-61

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sample*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL VA
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO (2000 L
IF-33-62		$		$		$		$		$	$
428-31					44.87		0.20		27.06		
432-5					40.63		0.25		28.48		
436-9					43.58		0.28		24.68		
440-3					49.70		0.34		20.14		
445-7					47.04		0.23		25.26		
448					49.11		0.11		24.00		
449-50					44.87		0.28		31.08		
501-3					45.46		0.37		22.40		
504-7					48.61		0.41		21.06		
508-9					41.91		0.32		27.40		
510-13					46.74		0.37		28.74		
514-17					49.20		0.42		23.82		
519-22					48.42		0.51		21.92		
523-02					39.64		0.43		35.62		

File No. 3287

The California Standard Co.

November 20, 1962

	Fe.	S.	P.	SiO_2
1F-37-62 #645	45.45	0.01	0.18	30.90
646	47.67	0.01	0.33	22.64
647	37.98	0.01	0.29	36.42
648	43.13	0.01	0.41	18.72
649	45.15	0.01	0.29	22.92
650	49.69	0.01	0.44	18.08
818	40.60	0.01	0.53	36.46
819	46.56	0.01	0.58	28.24
820	46.26	0.01	0.58	29.90
821	34.34	0.01	0.42	42.88
822	35.45	0.08	0.53	41.64
823	37.37	0.07	0.79	39.36
470	48.48	0.01	0.14	25.02
471	40.80	0.02	0.23	31.08
472	46.86	0.02	0.38	19.36
473	48.88	0.01	0.29	21.06
474	46.26	0.02	0.30	17.90
475	47.77	0.02	0.27	24.86
551	51.01	0.01	0.22	22.84
552	41.41	0.01	0.33	16.02
553	47.87	0.01	0.41	24.56
554	47.37	0.01	0.43	28.50
555	47.17	0.02	0.25	28.28
556	46.16	0.02	0.42	13.72
557	46.66	0.02	0.32	17.74
558	44.64	0.02	0.31	18.98
559	49.79	0.02	0.38	20.12
560	49.49	0.01	0.38	19.98
561	47.67	0.01	0.33	31.40
562	50.00	0.01	0.37	28.86
563	46.46	0.01	0.43	28.70
564	47.98	0.01	0.35	28.86
565	44.05	0.01	0.39	37.84
566	37.67	0.01	0.36	40.90
567	44.84	0.03	0.28	33.70
1F-37-62 #568	39.29	0.01	0.40	25.01
569	46.46	0.01	0.64	28.06
570	48.88	0.02	0.58	25.42
571	44.95	0.03	0.41	32.48

1F-37

	Fe	S.	P	SiO_2.
1F-37-62 #572	46.76	0.02	0.42	28.90
573	43.73	0.01	0.64	26.46
574	50.00	0.01	0.32	26.22
575	47.17	0.01	0.61	29.24
626	43.73	0.01	0.26	29.32
627	41.71	0.01	0.40	31.16
628	26.77	0.01	0.59	20.04
629	50.00	0.01	0.24	23.36
630	46.86	0.01	0.28	30.06
631	49.29	0.01	0.36	24.26
632	48.18	0.01	0.29	24.40
633	48.38	0.01	0.30	20.70
634	54.14	0.01	0.17	20.68
635	42.22	0.01	0.18	38.02
636	41.61	0.01	0.22	25.94
637	47.98	0.01	0.22	25.01
638	44.34	0.01	0.12	34.54
639	50.50	0.01	0.54	23.04
640	44.14	0.01	0.47	25.96
641	50.20	0.01	0.55	22.08
642	46.26	0.01	0.44	24.04
643	52.62	0.01	0.19	23.24
644	49.79	0.01	0.43	17.86

Cont'd .....

1F-37

 1F-37

To:
The California Standard Co.
4801 - 1st St. S. E.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10. CANADA

ACCTLC Member Canadian Testing Association

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. 3287

DATE Nov. 15, 196

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *samp*

MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL V
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
			$		$		$		$		$	$
1F-37-62	563 3.0					46.46		0.01		0.43		
	564 3.0					47.98		0.01		0.35		
	565 2.0					44.05		0.01		0.39		
	566 2.0					37.67		0.01		0.36		
	567 3.5					44.84		0.03		0.28		
	568 3.0					39.29		0.01		0.40		
	569 3.0					46.46		0.01		0.64		
	570 3.0					48.88		0.02		0.58		
	571 3.0 25.5					44.95		0.03		0.41		

1F-37

To:

The California Standard Co.

4801 - 1st St. S. E.

Calgary, Alberta

PHONE: TRINITY 6-4111

CABLE ADDRESS "ELDRICO"

FILE NO. 3287

DATE Nov. 15, 1962

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *samples.*

MARKED	GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL VALUE
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TON (2000 LBS.)
1F-37-62 572 3.0					46.76		0.02		0.42		
573 3.0					43.73		0.01		0.64		
574 4.0					50.00		0.01		0.32		
575 2.5					47.17		0.01		0.61		
626 3.0					43.73		0.01		0.26		
627 2.5					41.71		0.01		0.40		
628 1.0					26.77		0.01		0.59		
629 3.0					50.00		0.01		0.24		
630 3.0					46.86		0.01		0.28		
631 3.0					49.29		0.01		0.36		
632 3.0					48.18		0.01		0.29		
633 3.0					48.38		0.01		0.30		
634 1.5					54.14		0.01		0.17		
35.5											

Gold calculated at $.....per ounce. *Calculated at.....cents per lb.*

Silver calculated at $.....per ounce. *Calculated at.....cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Langley *Provincial Assayer*

To: 1F-37

The California Standard Co.

4801 - 1st St. S. E.

Calgary, Alberta

PHONE: TRINITY 6-4111
CABLE ADDRESS "ELDRICO"

FILE NO. 3287

DATE Nov. 15, 1962

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *samples.*

MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL VALUE
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TON (2000 LBS.)
1F-37-62	635 2.5		$		$	42.22	$	0.01	$	0.18	$	$
	636 2.6					41.61		0.01		0.22		
	637 3.0					47.98		0.01		0.22		
	638 2.0					44.34		0.01		0.12		
	639 3.3					50.50		0.01		0.54		
	640 3.0					44.14		0.01		0.47		
	641 3.0					50.20		0.01		0.55		
	642 3.0					46.26		0.01		0.44		
	643 2.0					52.62		0.01		0.19		
	644 2.0					49.79		0.01		0.43		
	645 2.0					45.45		0.01		0.18		
	646 3.0					47.67		0.01		0.33		
	647 2.5					37.98		0.01		0.29		
	648 3.0					43.13		0.01		0.41		
	649 2.0					45.15		0.01		0.29		
	650 2.0					49.69		0.01		0.44		
	818 3.0					40.60		0.01		0.53		
	819 3.0					46.56		0.01		0.58		
	820 4.0					46.26		0.01		0.58		
	821 3.0					34.34		0.01		0.42		

5M

55.9

Gold calculated at $ ..... *per ounce.*

Silver calculated at $ ..... *per ounce.*

Calculated at ..... *cents per lb.*

Calculated at ..... *cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shaples *Provincial Assayer*

Page Nine 1F-37

To:

The California Standard Co.

4801 - 1st St. S. E.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10. CANADA

ACCTEC Member Canadian Testing Association

PHONE: TRINITY 6-4111

CABLE ADDRESS "ELDRICO"

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORE *samples.*

MARKED	GOLD OUNCES PER TON	GOLD VALUE PER TON	SILVER OUNCES PER TON	SILVER VALUE PER TON	Iron (Fe) PER CENT.	Iron (Fe) VALUE PER TON	Sulphur (S) PER CENT.	Sulphur (S) VALUE PER TON	Phosphorus (P)	Phosphorus (P) VALUE PER TON	TOTAL VALUE PER TON (2000 LBS)
1F - 37-62 822 3.0		$		$	35.45	$	0.08	$	0.53	$	$
823 4.0					37.37		0.07		0.79		
470 2.75					48.48		0.01		0.14		
471 3.25					40.80		0.02		0.23		
472 2.75					46.86		0.02		0.38		
473 3.0					48.88		0.01		0.29		
474 3.0					46.26		0.02		0.30		
475 3.0					47.77		0.02		0.27		
551 3.0					51.01		0.01		0.22		
552 3.0					41.41		0.01		0.33		
553 3.0					47.87		0.01		0.41		
554 3.0					47.37		0.01		0.43		
555 2.0					47.17		0.02		0.25		
556 3.0					46.16		0.02		0.42		
557 3.0					46.66		0.02		0.32		
558 3.0					44.64		0.02		0.31		
559 3.0					49.79		0.02		0.38		
560 2.0					49.49		0.01		0.38		
561 3.0					47.67		0.01		0.33		
562 3.0					50.00		0.01		0.37		

SM

58.75

Gold calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Sharples *Provincial Assayer*

Page Eight IF-38

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC

PHONE: TRINITY 6-41

CABLE ADDRESS "ELDRICC

FILE NO. A.3-C.3-63

DATE January 14, 196

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sample*

	GOLD	SILVER	Iron (Fe)	Phosphorous (P)	Silica (SiO_2)	
IP-38-62 576-9			47.33	0.33	26.88	
IP-38-62	$	$	$	$	$	$
580-2			47.04	0.41	27.32	
583-4			48.12	0.34	24.76	
585-8			43.39	0.36	28.68	
589-93			46.94	0.49	23.10	
596-8			46.44	0.62	23.66	
599-41			44.37	0.90	25.30	
542-3			39.05	1.25	29.22	

To: IF-39

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

CABLE ADDRESS "ELDRICO

FILE NO. A.3-C.3-63

DATE January 14, 19

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sample*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TO 12000 L
IF-39-62		$		$		$		$		$	$
607					47.17		0.50		29.88		
606-2					43.09		0.27		36.00		
601					53.74		0.24		21.26		
2525					51.87		0.28		24.08		
604-5					51.77		0.40		17.98		
2524-3					51.67		0.33		23.70		
2520-2					46.54		0.39		23.90		
2517-19					49.50		0.35		23.22		
2516-12					44.87		0.44		27.80		
2511					45.56		0.32		29.80		
2510-05					47.48		0.48		25.30		
2503-04					49.30		0.67		24.00		
IF-39-62											
619					48.81		0.35		28.52		
618					49.89		0.19		26.70		
617					49.30		0.26		28.32		
616-12					48.22		0.38		24.38		
611					45.26		0.28		32.66		
610					47.23		0.17		30.08		
609					55.32		0.22		19.46		
608					46.05		0.29		31.60		

SM

Gold calculated at $.....*per ounce.* *Calculated at*.....*cents per lb.*

Silver calculated at $.....*per ounce.* *Calculated at*.....*cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a

H. Shanks *Provincial Assay*

To: IF-43

Crest Exploration Ltd.

329 A - 6th Avenue S. W.

Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ACCTLC

PHONE: TRINITY 6-4

CABLE ADDRESS "ELDRIC

FILE NO. A.3-C.3-63

DATE January 14, 19

We Hereby Certify *that the following are the results of assays made by us upon submitted* IRON ORE COMPOSITES *sampl*

MARKED	GOLD		SILVER		Iron (Fe)		Phosphorous (P)		Silica (SiO_2)		TOTAL V
	OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER T (2000 L
IF-43-62		$		$		$		$		$	$
798-7					49.49		0.23		20.04		
795-2					41.02		0.22		29.68		
791-89					46.17		0.27		23.30		
788-5					44.75		0.24		21.84		
784-3					46.74		0.20		23.52		
782-75					12.40		0.19		18.60		
774-2					23.17		0.12		18.72		
771-69					46.05		0.27		23.24		
768-6					46.25		0.23		21.86		
765-4					48.81		0.26		22.44		
763-76					44.27		0.32		22.96		
762-60					44.27		0.28		26.78		
759-54					42.10		0.30		28.62		
753-2					41.71		0.22		30.28		
651-72					42.30		0.42		31.88		
IF-43-62											
854-7					53.22		0.21		16.60		
848-24					45.66		0.25		18.82		
825-94					46.57		0.20		19.00		
IF-43-62		$		$	40.42	$	0.65	$	27.20	$	$
671-69											

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shorjes *Provincial Assay*

File No. 3287

The California Standard Company. November 20, 1962.

		Fe.	S.	P.	SiO_2	Al_2O_3	CaO.	Mgo.	Mn.	CO_2
1F-44-62	#807	46.46	0.01	0.41	22.08	0.58	4.95	1.49	0.09	4.05
	808	49.19	0.01	0.25	23.22	Trace	2.55	0.40	0.05	1.95
duplicate of part of 801/802 & 803	809	47.67	0.01	0.42	18.82	1.28	5.66	0.52	0.05	3.77
	810	42.72	0.01	0.35	33.08	0.40	3.47	0.20	0.06	2.57
	811	44.04	0.01	0.28	23.32	1.66	4.85	0.91	0.09	3.95
	812	49.59	0.02	0.26	13.74	1.90	5.92	1.21	0.12	3.73
	813	44.04	0.01	0.26	22.52	1.52	6.22	1.16	0.08	4.90
	814	44.64	0.01	0.23	28.24	Trace	3.67	0.23	0.07	4.90
	815	46.46	0.01	0.26	21.86	0.80	4.69	1.25	0.12	2.91
	816	51.31	0.01	0.14	20.50	0.12	2.75	0.47	0.07	5.10
	817	49.39	0.01	0.22	20.52	0.82	4.18	1.04	0.06	3.16
	620	44.54	0.01	0.74	31.60	Trace	3.01	0.38	0.04	1.63
	621	43.03	0.02	1.17	22.24	1.72	6.32	1.67	0.09	2.75
	622	47.07	0.01	0.97	26.06	0.44	3.32	0.47	0.06	1.27
	623	51.51	0.01	1.10	15.30	1.26	4.44	1.18	0.04	1.91
	624	42.42	0.01	0.71	35.94	0.04	2.86	0.28	0.06	1.27
	625	47.67	0.01	0.63	27.36	Trace	3.21	0.40	0.06	1.76
1F-44-62	726	45.75	0.01	0.63	26.36	1.42	2.34	1.30	0.05	1.25
	727	44.54	0.01	0.31	26.88	0.60	3.72	0.65	0.07	3.96
	728	44.95	0.01	0.27	29.52	1.44	2.45	1.07	0.09	1.76
	730	41.41	0.01	0.57	31.04	1.36	4.64	0.93	0.08	2.66
	731	51.41	0.01	0.31	22.46	Trace	2.70	0.11	0.06	1.92
	732	44.44	0.01	0.38	31.72	Trace	3.01	0.23	0.09	2.20
	733	45.85	0.01	0.42	25.88	2.12	2.35	1.25	0.08	1.63
	734	34.14	0.01	0.33	31.80	3.94	4.54	3.36	0.14	3.16
	735	44.95	0.01	0.49	29.58	1.28	1.58	1.03	0.06	1.10
	736	49.59	0.01	0.32	25.12	0.36	2.04	0.67	0.05	2.20
	737	47.57	0.01	0.28	25.44	Trace	3.11	1.07	0.12	3.73
	738	44.24	0.01	0.36	32.16	Trace	2.75	1.01	0.09	3.16
	739	50.30	0.01	0.36	18.46	0.06	3.83	1.41	0.07	4.40
	740	49.69	0.01	0.34	23.30	0.16	2.65	0.69	0.06	2.35
	741	43.13	0.01	0.25	18.46	Trace	7.04	3.37	0.30	10.30
	742	47.77	0.01	0.18	22.50	0.18	2.35	2.09	0.19	5.30
	743	45.25	0.01	0.20	24.40	Trace	4.13	1.64	0.18	5.30
	744	53.43	0.01	0.50	19.64	0.24	2.24	0.39	0.06	1.27
	745	42.72	0.01	0.39	14.94	0.56	7.45	3.96	0.33	10.70
1F-44	746	53.03	0.01	0.26	20.30	0.26	2.19	0.51	0.08	1.97
	747	42.32	0.01	0.37	22.84	0.30	6.48	2.61	0.32	8.10
	748	42.22	0.01	0.33	31.16	1.76	2.81	1.30	0.05	2.50
	749	42.42	0.01	0.20	32.84	0.04	2.75	0.92	0.08	2.79
	750	45.05	0.01	0.39	26.86	Trace	3.42	1.17	0.10	3.49
	802	48.58	0.01	0.53	19.30	0.84	3.93	1.38	0.12	1.85
	803	38.28	0.01	0.37	24.36	0.74	7.09	3.12	0.07	9.40
	804	47.07	0.01	0.28	24.20	0.90	3.37	1.15	0.10	3.23
	805	45.75	0.01	0.35	26.96	0.36	3.93	1.22	0.15	3.81
	806	47.27	0.01	0.34	18.90	0.74	4.23	1.65	0.16	4.05

Page Five

1F-44

To: The California Standard Co.
4801 - 1st St. S. E.
Calgary, Alberta

Certificate of Assay

COAST ELDRIDGE

ENGINEERS & CHEMISTS LTD.

125 EAST 4TH AVE. VANCOUVER 10, CANADA

ASCTEC Member Canadian Testing Association

PHONE: TRINITY 6-4111

CABLE ADDRESS "ELDRICO"

FILE NO. 3287

DATE Nov. 15, 1962

We Hereby Certify *that the following are the results of assays made by us upon submitted* ORR *samples.*

MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL VALUE
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TON (2000 LBS.)
1F - 44-62	726 3.0					45.75		0.01		0.63		
	727 3.5					44.54		0.01		0.31		
	728 3.5					44.95		0.01		0.27		
	730 3.0					41.41		0.01		0.57		
	731 3.0					51.41		0.01		0.31		
	732 3.0					44.44		0.01		0.38		
	733 3.0					45.85		0.01		0.42		
	734 3.0					34.14		0.01		0.33		
	735 3.0					44.95		0.01		0.49		
	736 3.0					49.59		0.01		0.32		
	737 3.0					47.57		0.01		0.28		
	738 3.0					44.24		0.01		0.36		
	739 3.5					50.30		0.01		0.36		
	740 4.0					49.69		0.01		0.34		
	741 3.0					43.13		0.01		0.25		
	742 3.0					47.77		0.01		0.18		
	743 3.0					45.25		0.01		0.20		
	744 1.0					53.43		0.01		0.50		
	745 2.5					42.72		0.01		0.39		
5M	57.0											

Gold calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Silver calculated at $ ..... per ounce. *Calculated at ..... cents per lb.*

Note: Rejects retained one week.
Pulps retained three months.
Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Shanges

Provincial Assayer

To: 1F-44.

The California Standard Co.

4801 - 1st St.S. E.

Calgary, Alberta

Certificate of Assay

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ENGINEERS & CHEMISTS LTD.

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MARKED		GOLD		SILVER		Iron (Fe)		Sulphur (S)		Phosphorus (P)		TOTAL VALUE
		OUNCES PER TON	VALUE PER TON	OUNCES PER TON	VALUE PER TON	PER CENT.	VALUE PER TON	PER CENT.	VALUE PER TON		VALUE PER TON	PER TON (2000 LBS.)
			$		$		$		$		$	$
1F - 44-62	746 2.5					53.03		0.01		0.26		
	747 2.5					42.32		0.01		0.37		
	748 2.5					42.22		0.01		0.33		
	749 2.5					42.42		0.01		0.20		
	750 2.5					45.05		0.01		0.39		
	802 2.5					48.58		0.01		0.53		
	803 3.0					38.28		0.01		0.37		
	804 3.0					47.07		0.01		0.28		
	805 3.0					45.75		0.01		0.35		
	806 3.0					47.27		0.01		0.34		
	807 3.0					46.46		0.01		0.41		
	808 3.0					49.19		0.01		0.25		
	809					47.67		0.01		0.42		
	810 Omit					42.72		0.01		0.35		
	811 3.0					44.04		0.01		0.28		
	812 3.0					49.59		0.02		0.26		
	813 3.5					44.04		0.01		0.26		
	814 3.5					44.64		0.01		0.23		
	815 3.0					46.46		0.01		0.26		
	816 3.0					51.31		0.01		0.14		
1F-44-62	817 4.0					49.39		0.01		0.22		
	620 3.0					44.54		0.01		0.74		
	621 3.0					43.03		0.02		1.17		
	622 3.0					47.07		0.01		0.97		
	623 4.0					51.51		0.01		1.10		
	624 3.3					42.42		0.01		0.71		
	625 3.0 (23.3)					47.67		0.01		0.63		

Pulps and rejects may be stored for a maximum of one year by special arrangement.

H. Hargles

Provincial Assayer

269160

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No EF. 101-63 — DATE STARTED JUNE 6/63

DESCRIBED BY C. RIDDELL — DATE COMPLETED JUNE 6/63.

MEASURED BY W. GIBBONS — MEASURING RATE 120' / 6 MINS.

AIR PHOTO No A 12086-184 — COORDINATES 765500 E 80,300 N

AREA 3 MILES UP FROM MOUTH ON WEST SIDE OF IRON CREEK. — CLAIM GLORY 21

WEATHER COLD, OCCASIONAL SHOWERS — MEASURED DOWN

ROCK TYPES

OVOIDS : O O — IRON FORMATION — SILTSTONE

UNALIGNED LENSES: — JASPER — SHALE

ALIGNED LENSES: — CONGLOMERATE — LIMESTONE

BANDS: — BRECCIA — DOLOMITE

SANDSTONE — COVERED

% HEMATITE

STEEL GREY HEMATITE

MAROON HEMATITE

BOTH

SILICEOUS WASTE TYPES

RED JASPER

MAROON JASPER

MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S

CARBONATE C

HEMATITE H

FEW F

MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite

I - IRREGULAR - i.e Uneven boundary between Jasper and Hematite

REMARKS BEDDING STRIKE / DIP eg 125°/ 25°W

FAULT STRIKE / DIP eg 125° 25°E

BRECCIATED ZONE

HALOS OF JASPER

SPHERULITES

FRACTURING

ACCESSORIES - Calcite, Dolomite, Siderite, etc

LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite

Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 2

DATE JUNE 6, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT OVOIDS	UNALIGNED LENSES AMT PER FOOT	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES AMT PER FOOT	ALIGNED LENSES THICK RANGE	BANDS	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA EN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0											OVERBURDEN SOILS CONGLOMERATE INTERBEDDED DARK GREEN PEBBLY SILTSTONE MASSIVE MAINLY RED JASPER WITH MINOR IRON FORMATIONS. SOFT RED AND DARK GREEN SHALE FRAGMENTS. MINOR LIMESTONE FRAGMENTS. PEBBLE MAINLY SMALL IGNEOUS ROCK, SANDY, POORLY CEMENTED									
10											10% IRREGULAR RED JASPER PATCHES, SOME LEACHED OUT NODULES PROBABLY ORIGINAL SIDERITE & CALCITE OVOIDS WITH HEMATITE CORNET			10		2301				
											MANY LEACHED OUT OVOIDS SIDERITE & CALCITE			4.5		2302				
														1		2303				
20														4.5		2304				
											SOME SMALL INCLUDED FRAGMENTS (1/2" TO 1" IN DIAMETER) OF IRON FORMATION WITH IRREGULAR WAVY BANDS - PROBABLY HEMO			10		2305				
30														4		2306				
40														10		2307				
											INTERBEDDED AND INTERMIXED IRON FORMATION & CONGLOMERATE WITH HIGHLY AMYGDOID (10 TO 20% SMALL) IRON FORMATION) SPHERULITIC RHYOLITE FLOWS. ROCKS OF SEDIMENTARY ORIGIN PREDOMINATE OVER FLOWS. STRIKE N40° DIP 30° NW. IN THE FLOWS CAVITIES IN THE FLOW TOPS ARE FILLED WITH SILICA (QUARTZ) AND CARBONATE. SOME INTERBEDDED SANDSTONE AND CONGLOMERATE. SOFT AND VERY FRIABLE IRON FORMATIONS.									
											SILICIFIED WASTE IRON FORMATION AND CONGLOMERATE. CONTAINS MUCH STRAW BUT MINUTE CRYSTALLINE HEMATITE. 50% FINE CONGLOMERATE SOME LARGE MATRIX AND IN PLACES APPROACHES SURFACE. HEMATITE APPEARS MAROON IN HAND SPECIMEN AND IS FINE GRAINED. CONTAINS SOME LARGE ROUNDED RED JASPER PEBBLES, APPARENTLY SOME PEBBLES CONTAIN SPHERULITES. RECRYSTALLIZED. MINOR SILICIFICATION			10		2308				
50																			
60																			
70											BROWN MARROON - OCCASIONALLY APPROACHING CONGLOMERATE. ONE 6" BAND OF IRON FORMATION WITH MANY SMALL ONES. THE ONE BAND OF THIS TYPE BECOMES VERY FERRUGINOUS AND MAGNETIC AND VERY APPROACHING MAROON HEMATITE			4		2309				
											80% JASPER IS SPREAD AROUND IN IRREGULAR PATTERNS MANY END JASPER OUT, SOME ROUND			10		2310				
80											SOME CARBONATE NODULES LEACHED OUT ON WEATHERED SURFACE									
											SOME QUARTZ IN MAINLY JASPER OVOIDS.			10		2311				
90											SLICKENSIDES ? ?			2		2312				
											15% SERIA MATERIAL - 15% JASPER IRREGULAR TO ROUNDED FRAGMENTS TO 1" LONG.			2		2313				
100											SOME CALCITE IN OVOIDS AND SOME LIMONITE AND CALCITE PROBABLY LEACHED FROM SIDERITE HEMATITE CENTRES IN MANY OVOIDS. OCCASIONAL IRREGULAR JASPER BLOTCH.			10		2314				
					TRACE		TRACE													
110											SOME CARBONATE IN JASPER LENSES. SOME CARBONATE AND SANDSTONE LENSES IN BOTTOM 3 FEET. THESE LENSES TO 1" THICK 15% OF INTERVAL IRON FORM.			6		2315				
														7		2316				
120											BASE OF MEASURED SECTION									
											UNDERLYING BEDS									
											30 FEET OF CONGLOMERATE - 5 TO 40% (ALL TYPES) ANGULAR TO MANY ROUNDED FRAGMENTS OF MAINLY LIMESTONE WITH SOME DIABASE AND MINOR QUARTZITE PEBBLES. MATRIX SLIGHTLY SANDY FERRUGINOUS. SAMPLE									

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No I F 10 - 63
DESCRIBED BY C. H. Riddell.
MEASURED BY Gibbins & Folinsbee
AIR PHOTO No A 12148 (FL 11²) - 183
AREA Iron Creek - 4 miles upstream from camp.
WEATHER 4/10 cloudy, light winds, cool

DATE STARTED June 7 1963
DATE COMPLETED June 7 1963
MEASURING RATE 70' / 3 hrs.
COORDINATES 98,200E 98,100 N
CLAIM Pony 17

ROCK TYPES

OVOIDS
UNALIGNED LENSES
ALIGNED LENSES
BANDS

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ
CARBONATE
HEMATITE
FEW
MANY

BOUNDARIES R - REGULAR i.e. Even boundary between Jasper and Hematite
I - IRREGULAR i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 2

DATE June 7 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT OR COMP	UNALIGNED LENSES THICK RANGE	ALIGNED LENSES AMT OR COMP	ALIGNED LENSES THICK RANGE	BANDS AMT OR COMP	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	No RUNS	FT REC	% REC	CRUDE ANALYSIS SAM No	Fe	SiO_2	P
						⅜-1" R ½-8" I		¼-⅜" R		⅜-2" R		St 140°/35° SW. Calcite & minor pyrite in jasper in places & dk. maroon.			3.5		2034			
															1		2035			
						⅜-½" R ½-8" R		⅜-½" R		⅜-1" R		Ca								
10								⅜-½"		¼-25" R		Many bands have abundant Ca. Some of the red jasper bands are brecciated.			10		2036			
															4		2037			
												Conglomerate - fine → coarse sandstone. Fragments 50-60% greenish sub-angular shale; matrix maroon, slightly calcareous shale. Irregular bedded.								
20								⅜-½" R		¼-2" R		Minor Ca in some beds.			10		2038			
															5.5		2039			
30															1.5		2040			
						Trace	Trace	⅜-⅜" R		⅜-3" R		9" band of conglomerate with fragments to 4" carbonate.			5		2041			
40															2		2042			
						Trace	½-¼" R ⅜-¼"		⅜-¼"	¼-2" R		9" band of conglomerate at 43.5			3		2043			
															1.5		2044			
															1.5		2186			
															1		2187			
50						⅜-½" R ¼-4"	Trace			¼-3" R					13		2188			
60															8		2189			
						Trace	Trace			⅜-3" R		Strike 130°/30° S.W. Hematite in some ovoid centers. Ca in some ovoids & surrounding some ovoids.								

GEO-23-2 (R 16-63)

GREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 103-63
DESCRIBED BY Gibbins
MEASURED BY Folinsbee
AIR PHOTO No A 12148 (FI 11² - 183)
AREA Iron Creek - North Side - 3 mi E of camp
WEATHER 0/10 Cloud, light winds, cool

DATE STARTED June 7
DATE COMPLETED June 7
MEASURING RATE 4 hrs / 160
COORDINATES 93,900 E 103,300 N
CLAIM Ole 15

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3

DATE June 7 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															Dk. brown shale - flaky cleavage 1/8" to 1/4" Iron sandstone - 1/2" thick gravel of metallic hematite & red jasper. Trace of Ca matrix								
10															Conglomerate - weathered surface - light brown, fresh surface - dark maroon, angular - rounded pebbles (1/2" to 2" diameter) are (90 - 95%) & trace of (1" to 2" diameter) well rounded jasper quartzite & carbonate (less than 5%)								
20			Trace	5% x 1/4" R 1% x 3/8	H						5%	1/4"	R		Attitude 160°/15°S a 2" boulder of soft dark green shale			10'		3001			
30			Trace												A few blotches of pink jasper (< 2%)			13'		3002			
40															Dark greenish brown, calcareous, medium grained sandstone greenish white sub angular grains in a pale maroon matrix			8'		3003			
50					1/8 - 1/4 / 1/2 - 1/2	1/2 - 1 1/2 / 1/2 - 1 1/2	R	1/8 - 1/4 / 1/2 - 1 1/2	1 - 10	R	1/4 - 2 1/2		R		Some of the aligned lenses are carbonate Bands are irregular in thickness & boundaries			10'		3004			
60																		10'		3005			
70																		11'		3006			
80			Trace								1/4 - 1	R			Conglomerate - w.s. pink covered with carbonate washed from top 4" o.c. maroon matrix - fragments (1/4 - 1/2") & subangular also lumberack 10 to 2" o.c. & well rounded boulders			1		3007			
90															Conglomerate - w.s. very light brown s.s. light maroon, & highly calcareous matrix. Fragments 10 to 2" o.c. of maroon, green & green sandstone etc			2.5'		3008			
100			Trace		1/4 - 4" / 1/2 - 1 1/2		R				1/4 - 4"		R		0.5' at 120.5' of weak iron formation carbonate voids & gritic pebbles			4'		3009			
110																		10'		3010			
120																		10		3011			
130																		15		3012			
140																		23		3013			
150																		10'		3014			
160					1/2 - 1 1/2 / 1/2 - 1 1/2						1/2 - 2		R					10'		3015			
170																		10'		3016			
180																		2'		3017			
190															Attitude 110°/5 - 10° N/W measured down								
200																							

GEO - 23 - 2 - CM (6/63)

091697

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 104-63
DESCRIBED BY C. Riddell
MEASURED BY A. Folinsbee
AIR PHOTO No A 12148-183(FI 11²)
AREA Yukon Mountain North of Camp
WEATHER 4/10 cloud, light breezes, cool

DATE STARTED June 8 1963
DATE COMPLETED June 9 1963
MEASURING RATE 336'/6 hrs
COORDINATES 83,100S 106,400W
CLAIM Kilt 4

ROCK TYPES

OVOIDS: ○ ○
UNALIGNED LENSES:
ALIGNED LENSES:
BANDS:

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 6
DATE June 8 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	BANDS AMT and COMP	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0												Covered interval of about 30' overlying iron formation which is thought to be overlain by shaly conglomerate block which has been measured seems to be slumped slightly.								
												Top of measured section								
												? at 320°/5° SE ? may be slumped								
												Interbedded 25% of interval covered 50% hematite 25% of interval contains 50% hematite			10		2401			
10												Sandstone near base of interval fractured vertically by hand ferruginous			6		2402			
												Some carbonate with beds & small veins Some hematite core to jasper ovoids			10		2403			
20																				
												One 1" hard fine conglomerate, near top. Large dolomite cores to ovoids			10		2405			
															6		2407			
												Poor shaly hematite			4		2408			
30												Highly ferruginous maroon shale			4		2409			
												Poor shaly jasper and iron formation			11		2410			
												Minor carbonate with some red jasper waste			10		2411			
												extremely mineralized maroon shale			9		2413			
															2		2414			
												One irregular blotch of jasper hematite in core of many inserts & small irregular lenses shale completely filled with jasper waste.			6		2415			
												Some quartz with jasper			3		2416			
												Red jasper halos along maroon jasper bands			6		2417			
												Weathered surface dark brown confetti (hematite) making fragments intense			8		2418			
												One 6" shaley iron band & one 2" conglomerate band near top. Many ovoids have hematite core, some altered on and around veins inside. Some irregular & little specular hematite. The limestone fragment seen in iron formation.			10.5		2419			
												Irregular jasper patches (maybe pebble conglomerate beds) 1" thick			11.5		2420			
												Jaspers with ferruginous matrix			2		2421			
												Jaspers with ferruginous matrix			6.5		2422			
												Shale with rock fragments up to 20% Very ferruginous shale & siltstone in places on fresh surface. Some fragments to 1" diameter some rock formed jasper & calcareous ovoids. Some red jasper veined by hematite 1-2" long			10		2423			
												Minor hematite - Red band basick along strike			10		2424			
												W.S. brown 30-50% fragments generally light buff or bright green angular-rounded up to 2"			25		2425			
												Calcite in some ovoids			10		2426			
												Some hematite bands 6" thick up to 80% hematite with red jasper & calcite ovoids some shaly bedded maroon hematite intervals. Massive appearance.			13		2427			
												Weathered surface Jasper Subrounded fragments up to 1" but mainly 1-6 mm in size. About 25-30% fragments			3		2428			
												65% of jasper is in irregular patterns - red			10		2429			
												Ca in some ovoids			11		2430			
												Ca with the jasper in much of the waste			8		2431			
												Shale badly weathered - ferruginous - not SAMPLED			12		2432			
												Much calcite mixed with jasper waste								

Conglomerate W.S. dark brown to maroon
F.S. dark brown
Fragments subangular to rounded
Pebbles are carbonate, quartzite and shale
Poorly bedded
Fragments occupy 20-30% but mainly 25-30%
Shale matrix

1388

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 105 / 63 — DATE STARTED June 8 / 63

DESCRIBED BY Riddell — DATE COMPLETED June 8 / 63

MEASURED BY Rinn — MEASURING RATE 111.5 / 3.5 hrs.

AIR PHOTO No. A 12056 - 356 (Fl. 93) — COORDINATES 71,500E, 91,000N

AREA West side South Iron CREEK 2.5 Mi. up from mouth — CLAIM F - 19

WEATHER Overcast + Windy

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

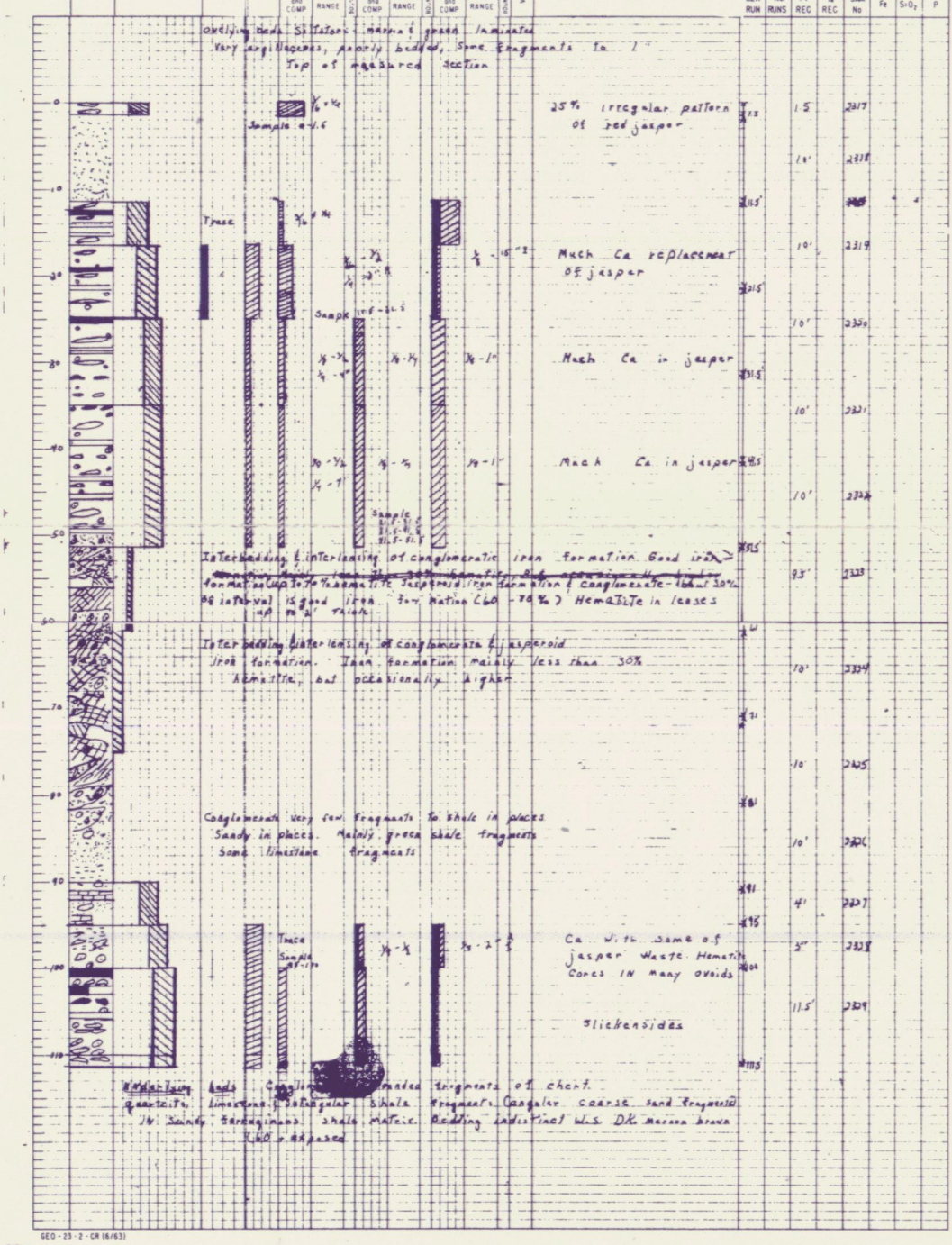
BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 2

DATE June 8/63



GEO - 23 - 2 - CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. I.F. 106-63
DESCRIBED BY Gibbins
MEASURED BY Molinsbee
AIR PHOTO No. A12148 -183 (11")
AREA Iron Creek
WEATHER Overcast - Warm → Warm & Sunny 4/10 (Calm) (Wind 10-20)

DATE STARTED June 10
DATE COMPLETED June 10
MEASURING RATE 80' / 3½ hrs.
COORDINATES 98500 E ; 100, 700 N.
CLAIM Pony 16

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

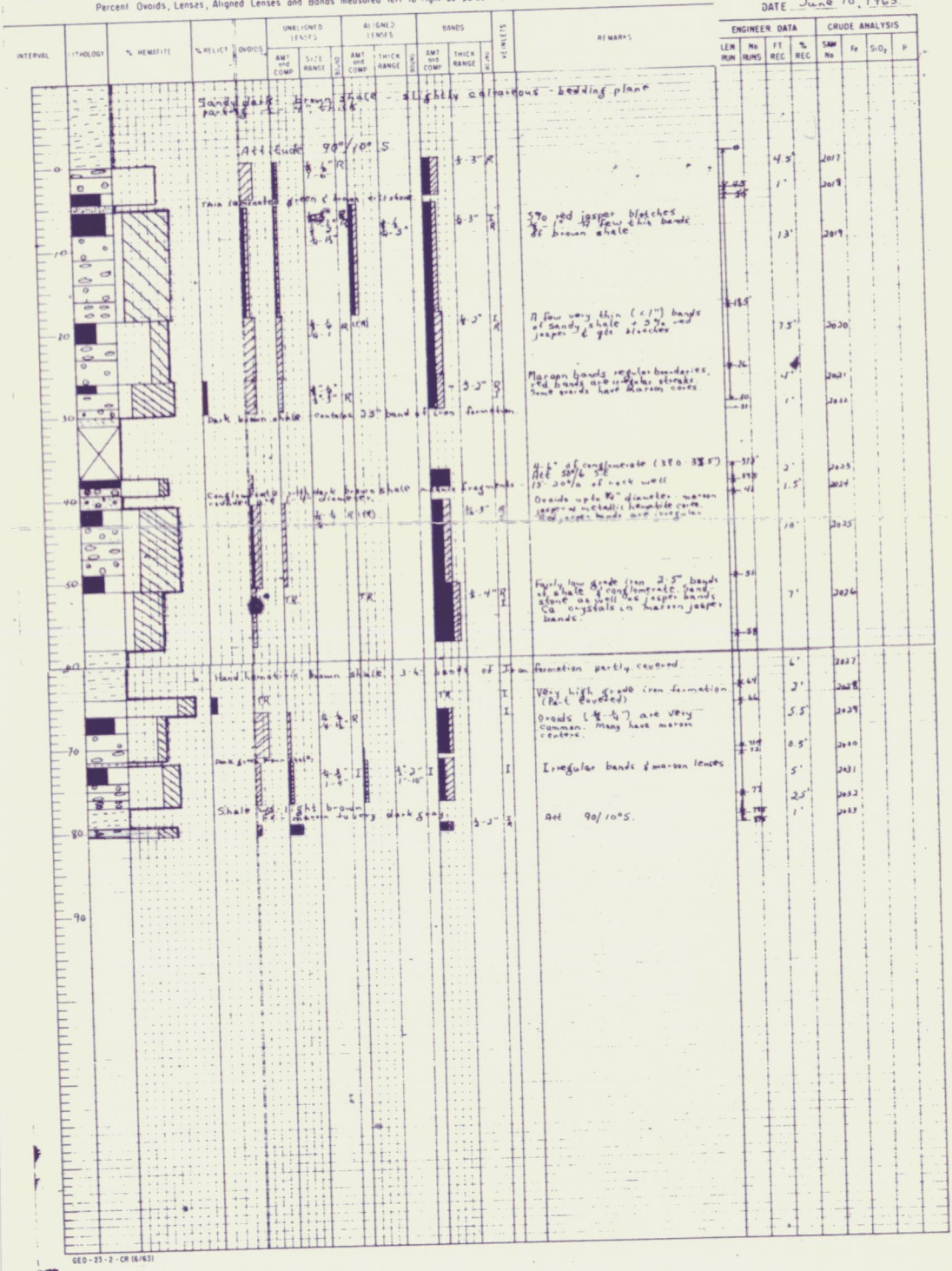
QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES -

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE June 10, 1963.



GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091807

SECTION No. IF-107-63
DESCRIBED BY GIBBINS
MEASURED BY FOLINSBEE
AIR PHOTO No. A 12065 (10)^2 - 284
AREA Iron Creek, 4 mi up stream from mouth, east side
WEATHER Rainy

DATE STARTED June 10/63
DATE COMPLETED June 10/63
MEASURING RATE 250 /6 Hrs
COORDINATES 83,600 E. 85,800 N
CLAIM Klan 20

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE June 10/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	BANDS AMT and COMP	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0																				
10																				
20																				
30																				
40																				
50																				
60																				
70																				
80																				
90																				
100																				
110																				
120																				
130																				
140																				
150																				
160																				
170																				
180																				
190																				
200																				
210																				
220																				
230																				
240																				
250																				

GEO-23-2-CR (6/63)

1389

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. I.F. 108-63
DESCRIBED BY Gibbins
MEASURED BY Folinsbee
AIR PHOTO No. A12056 - FL 9(11) - 351
AREA W. side S. Iron Creek
WEATHER Sunny with a few clouds

DATE STARTED June 14
DATE COMPLETED June 14
MEASURING RATE 176 ft. - 5 hr.
COORDINATES 69,200 E; 95,900 N
CLAIM Fool 18.

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 7 OF 3
DATE June 14, 63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	BANDS: AMT and COMP	BANDS: THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No. RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	GRADE ANALYSIS: SAM No	Fe	SiO_2	P
180												Conglomerate - matrix - Brown to grey jasper pebbles up to 2.0" most pebbles 1 inch - 4 in. Pebbles make up 10% of rock matrix - red shale	180							
												Large unaligned lenses of red jasper. 145-155 ft.			13'		7231			
												Some quartz veins.								
													170		8'		7230			
160															9'		7229			
													160		1'		7228			
															2.5'		7227			
												Unaligned lenses Maroon jasper, irregular, with red jasper halo outside	150		2.5'		7226			
150												Fine conglomerate with 2" siltstone at bottom; quartz pebble size 1-2 mm - particles subangular to round (S 20°)								
															13'		7216			
140													140							
															7.5'		7215			
130													130							
120												Minor slickensiding.	120		10'		7214			
													116							
													115		8.5'		7213			
												50% of waste is due to quartz veining and jasper patches - boundaries have irregular boundaries.								
110													110		10'		7212			
100												Red jasper becomes more common than maroon.	100							
													90		10'		7211			
90												Thin 3.0" bed of brown siltstone at ~~[illegible]~~								
													80		10'		7210			
80												Waste occurs as wide (up to 1.0 foot thick) streaks of bands of red jasper								
													70		6.5'		7209			
70												Dark brown highly hematitic conglomerate - pea-gravel & red jasper pebbles up to 2" diameter, make up less than 5% of the rocks. Beds 1.0' to 2.0' thick, on top 10 feet of unit, rounded boulder								
															10'		7208			
60													65		2.0		7207			
												streaks I Maroon hematite iron formation with red jasper waste								
50												Dark maroon brown sandy to conglomeritic shale fragments 1.5" up to 8" long, well rounded some red jasper boulders near the base - high hematite content.	55		14'		7206			
													45							
															10'		7205			
40													35							
															10'		7204			
30													25							
												Iron formation grades into conglomerate)								
20												streak I Iron formation which is predominately maroon hematite, red jasper (irregular & streaky lenses, & bands & patches)			10'		7203			
													15							
10															1'		7202			
												Some of the maroon bands have red jasper borders.	5		6.5'		7201			
0													0							
												Dark maroon conglomerate - rounded pebbles up to 2.0" across								
-10																				

GEO - 23 - 2 - CR (6/63)

091697

CREST EXPLORATION LIMITED
IRON ROCK LOG CHART

SECTION No.	IF 109-63	DATE STARTED	June 15/63
DESCRIBED BY	C.H. Riddell	DATE COMPLETED	June 21/63
MEASURED BY	K. Culver	MEASURING RATE	320'/6 hrs., 160'/3hrs
AIR PHOTO No.	A 12148 - 183	COORDINATES	90,900 E. 105,300 N.
AREA	Iron Ck. - north side - 3 mi up from camp	CLAIM	Neil 14
WEATHER	Windy & cold		

ROCK TYPES

Ovoids: ○○ — Unaligned lenses — Aligned lenses — Bands

IRON FORMATION, JASPER, CONGLOMERATE, BRECCIA, SANDSTONE, SILTSTONE, SHALE, LIMESTONE, DOLOMITE, COVERED

% HEMATITE

STEEL GREY HEMATITE, MAROON HEMATITE, BOTH

SILICEOUS WASTE TYPES

RED JASPER, MAROON JASPER, MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S, CARBONATE C, HEMATITE H, FEW F, MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 8
DATE June 15/63

Columns: INTERVAL | LITHOLOGY | % HEMATITE | % RELICT | OVOIDS | UNALIGNED LENSES (AMT and COMP, SIZE RANGE) | ALIGNED LENSES (AMT and COMP, THICK RANGE) | BANDS (AMT and COMP, THICK RANGE) | VEINLETS | REMARKS | ENGINEER DATA (LEN RUN, No RUNS, FT REC, % REC) | CRUDE ANALYSIS (SAM No, Fe, SiO_2, P)

Remarks	Ft Rec	Sam No
Overlying beds are laminated maroon & green sandstone & siltstone (argillaceous). Same conglomerate bands.		
Jasper mixed in hematite. Extremely jasperoid poor maroon hematite	6.5'	2131
Sandstone - ferruginous, fine to coarse. Some fragments to 1". Poorly bedded	8.0'	2132
Ferruginous shale - laminated, poorly recessive. Poor jasperoid iron formation approaching ferruginous shale. Weathers blotchy	7.5'	2133
Sandstone, W.S. - dk. brownish grey F.S. maroon brown. Varies fine to coarse grained. Mainly medium grained, Ferruginous subangular	10.5'	2134
Very shaly-jasperoid hematite. Conglomerate lense with sandy matrix. Probably lenses along strike. Shale — mudstone - brownish - poorly bedded. Ferruginous but not as much	5.0'	2135
W.S. - maroon brown F.S. - maroon & green. Fine grained calcareous. Laminated in part - ferruginous but not to much	4.0'	2136
Mostly small lenses but some large lenses of jasper conglomerate near base. Some carbonate. Iron formation crossbedded & lensed. 3 pictures taken 2 with flash, one at Fe. one at 52.	10.0'	2137
Grades from conglomeratic iron formation near top to conglomerate at base of interval. Mainly qtzite & limestone fragments up to 6" in ferruginous (iron formation matrix in places) shale matrix. Lenses along strike.	6.0'	2138
CONGLOMERATE W/ MAROON & GREEN F.S. VARIES FROM GREEN TO MAROON (YELLOW FRAGMENTS) SHALY & SANDY MATRIX. FERRUGENOUS - SOME THIN BANDS SHALY I.F. NEAR BASE.	4.0'	2139
6' APPARENT OUTCROP IN CENTER OF COVERED INTERVAL IS CONGLOMERATE - BROWN ROUNDED FRAGMENTS, TO 6".		
SOME CALCITE VEINS WITH JASPER.	12.0'	2140
SANDSTONE, FINE GRAINED, LAMINATED MAROON & BROWNISH GREEN. FLAGGY BEDDED. CROSS-BEDDED. FERRUGENOUS	6.0'	2141
Ca IN LENSES OF JASPER.	10.0'	2142
Ca COMMON WITH JASPER. QUARTZITE. BOULDER 8" DIAMETER SUBANGULAR, IN MIDDLE OF I.F. SOME CALCITE. PICTURE.	10.0'	2143
Ca WITH SOME OF MAROON JASPER.	6.5'	2144
BROWN, WEATHERING SHALE MATRIX CARBONATE, QTZITE & SHALE FRAGMENTS. LENSES ALONG STRIKE.	3.0'	2145
AS ABOVE. IRON INTERBEDDED IN 3"-6" BANDS.	4.0'	2146
	10.0'	2147
	5.6'	2148
FERRUGINOUS - SHALY I.F. PROBABLY 10% [illegible] IN HEMATITE. XBED BEDDING MAROON BROWN	3.5'	2149
REMAINDER (1) JASPER FINELY DISPERSED IN HEMATITE. SHALY IRON FORMATION	5.0'	2150
CARBONATE WITH LENSES, OVOIDS, & BANDS.	10.0'	2151
SHALY IRON FORMATION. MANY MICROCRYSTALLINE QTZ. OVOIDS IN ONE ONE FOOT LAYER.	10.0'	2152
SOME Ca IN RED JASPER LENSES. SHALY BEDDING IN PARTICULAR. SOME MICROCRYSTALLINE QUARTZ.	10.0'	2153
SOME MICROCRYSTALLINE QUARTZ WITH JASPER	10.0'	2154
	6.0	2155
SANDSTONE, W.S. DARK BROWN. F.S. GREEN GREY. FINE GRAINED, FERRUGINOUS IN PART. CALCITE PARTING MAINLY 1/2"	6.0	2156
	10.0	2157
SOME SHALY BEDDED IRON FORMATION.	10.0	2158
RED JASPER HALOS ALONG SOME OF MAROON JASPER BANDS & ALIGNED LENSES. Ca IN JASPER IN PLACES.	10.0	2159
	9.0	2160
FERRUGINOUS SANDSTONE, FINE-GRAINED PARTING 1/4"-1". CALCAREOUS.	1.5	2161
	3.0	2162
30 - 40% OF JASPER IN IRREGULAR PATTERNS. MAROON SURROUNDED BY RED JASPER. SOME CONGLOMERATE LENSES (1'-2' THICK & 5'-25' LONG. SEEMS TO BE MUCH MORE CONGLOMERATE IN THIS INTERVAL ALONG THE STRIKE.	10.0	2163
	7.0	2164
SHALE WITH SOME ROCK FRAGMENTS. APPROACHES CONGLOMERATE NEAR BOTTOM OF INTERVAL. W.S. DARK BROWN. F.S. MAROON, GREY, FERRUGENOUS. LIMESTONE FRAGMENTS.	6.0	2165
CONGLOMERATE APPROACHES SHALE TO FRAGMENTAL. 10-40% FRAGMENTS. VARIES, FRAGMENTS OF QTZ'TE, LIMESTONE, & SHALE. W.S. DK. BROWN. F.S. MATRIX MAROON BROWN. CALCAREOUS.	10.0	2166
	9.0	2167
	6.0	2168
	10.0	2169
THE FOLLOWING SECTION IS SOUTH OF SECTION I.F. 109-63 DOWN NEAR CREEK. THE TOP OF SECTION 109A-63 IS SOMEWHERE NEAR THE BASE OF SECTION I.F. 109-63 BUT CANNOT BE EXACTLY CORRELATED. (JUNE 21).		
	10.0	2170
CARBONATE IN JASPER & ALSO IN IRREGULAR PATTERNS IN PLACES IN I.F. SLIGHTLY CONGLOMERATIC NEAR BASE.	10.0	2171
FERRUGENOUS, BROWN MAROON, CONGLOMERATIC	2.0	2172
THIS INTERVAL WAS ESTIMATED AS WE MOVED APPROXIMATELY 100 YDS. ALONG STRIKE.		
CONGLOMERATIC SHALE, MAROON BROWN. 5-10% FRAGMENTS. SUB-ANGULAR TO ROUNDED. SIZE UP TO 2" DIAM. BUT MAINLY UNDER 1/2". POORLY BEDDED. SOME GREENISH FRAGMENTS WHICH MAY BE IGNEOUS (?) OR FINE-GRAINED SEDIMENTS. FAIRLY HIGH CARBONATE CONTENT. MAY BE FINE GRAINED CALCAREOUS, CHLORITIC SEDIMENT. SAMPLE OF FRAGMENT I.F. 109A-63 (2173) LITH.	8.0	2173
CONGLOMERATIC SHALE AS ABOVE. FRAGMENTS MAINLY CARBONATE & SILTSTONE.	9.0	2174
CONGLOMERATIC SHALE AS ABOVE.	9.0	2175
CONGLOMERATE. ROUNDED FRAGMENTS OF LIMESTONE & QTZITE MAINLY MAKE UP 70% OF ROCK FRAGMENTS UP TO 6" DIAMETER. MATRIX SANDY.	10.0	2176
SHALY CONGLOMERATE SIMILAR TO 372'-380'	10.0	2177
	6.0	2178
CONGLOMERATIC SHALE SIMILAR TO 372'-380'	11.0	2179
CONTACT BETWEEN CONGLOMERATE & IRON FORMATION PROBABLY AT ABOUT 462'.		
	7.0	2180
	3.0	2181
VERY FERRUGINOUS SILTY SHALE.	3.0	2182
CARBONATE WITH SOME OF THE JASPER. SOME SHALY BANDS. BASAL 2' OF INTERVAL MAINLY JASPER BANDS.	10.0	2183
	8.5	2184
UNDERLYING BEDS FERRUGINOUS, FINE-GRAINED SANDSTONE & FERRUGENOUS SHALE	3.0	2185

Interval scale: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 110-63
DESCRIBED BY Gibbins & Riddell
MEASURED BY Folinsbee
AIR PHOTO No Flight line 9² - 351
AREA 2 miles west of mouth of south iron creek.
WEATHER Cool windy 8/10 cloud

DATE STARTED June 16/63
DATE COMPLETED June 16/63
MEASURING RATE 80'/3 hrs.
COORDINATES 61,600 E. 102,400 N.
CLAIM Cony 15

ROCK TYPES

Ovoids:
Unaligned Lenses:
Aligned Lenses:
Bands:

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict, texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 2
DATE June 16/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	No. RUNS	FT REC.	% REC	CRUDE ANALYSIS SAM No	Fe	SiO₂	P
															Section measured down.								
															Conglomeratic shale, dark maroon brown. Fragments (≈5%) mostly 1/32" - 1/2", subangular. Carbonate shale & qtzite.								
0															Jasperoid hematite conglomerate. Red jasper bands 30% of interval. Approaches shale in places.	0		2'		2046			
				Trace		1/16-1/8 R		1/4-1/2 I			1/4-4" I				Low grade iron formation. Streaky irregular red jasper bands. 135°/53° S.W.	8		6"		2047			
															Appears to be poor jasperoid iron formation. Not sampled!	6							
10						1/8-1/4 R		1/8-1/4 R			1/16-1" I R				Minor slickensides 160°/45° S.W. Conglomeratic.	10		5.5"		2048			
						1/4-3/4									Jasper dispersed in hematite but has quite high S.G. 6" band of conglomerate in interval.	15.5		7.5"		2049			
20															Jasper is mainly in the form of irregular patches & bands with a few aligned lenses. Few calcitic ovoids.	21		7"		2050			
30																28		10'		2045			
						1/8-3/8 R					1/8-4" I				Bands grade to irregular patches. Minor slickensides & conglomerate band near base.	38		10'		2051			
40						1/4-3/4										48				2052			
50															Irregular patches of jasper mainly with much disseminated jasper in hematite, recessive, shaly bedded in part. Few ovoids.	52.5		10"		2053			
60																62.5							
70						1/4-1 R									Outcrop forms a high resistant ridge. 30% of waste is formed by an irregular network & patches of red jasper with some white qtz. & calcite.	68.5		11.5"		2054			
						1/8-1/2 I									Strike 153°/70° S.W. (Probably most accurate.)	80							
80						1/16-1/4 R									Much of jasper is in irregular patches. More recessive than previous interval.			10"		2055			
						1/8-2" R										90		12"		2056			
90																							
100																102							

Underlying beds: Siltstone W.S. - light greenish-brown
F.S. - dark green-grey.
Massive except for shaly cleavage.
Calcareous, ferruginous.

CEC-23-2-CR (6/63)

CREST EXPLORATION LIMITED
IRON ROCK LOG CHART

SECTION No. IF III - 63
DESCRIBED BY Gibbins + Bray
MEASURED BY Gibbins + Bray
AIR PHOTO No. A 12056 (FLT) 3 - 351
AREA 2½ miles west of camp
WEATHER Rain

DATE STARTED June 21
DATE COMPLETED June 21
MEASURING RATE 6 hrs.
COORDINATES 63,400 E 100,000 N
CLAIM Darine 16

ROCK TYPES

OVOIDS: o°o
UNALIGNED LENSES
ALIGNED LENSES
BANDS

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE

SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

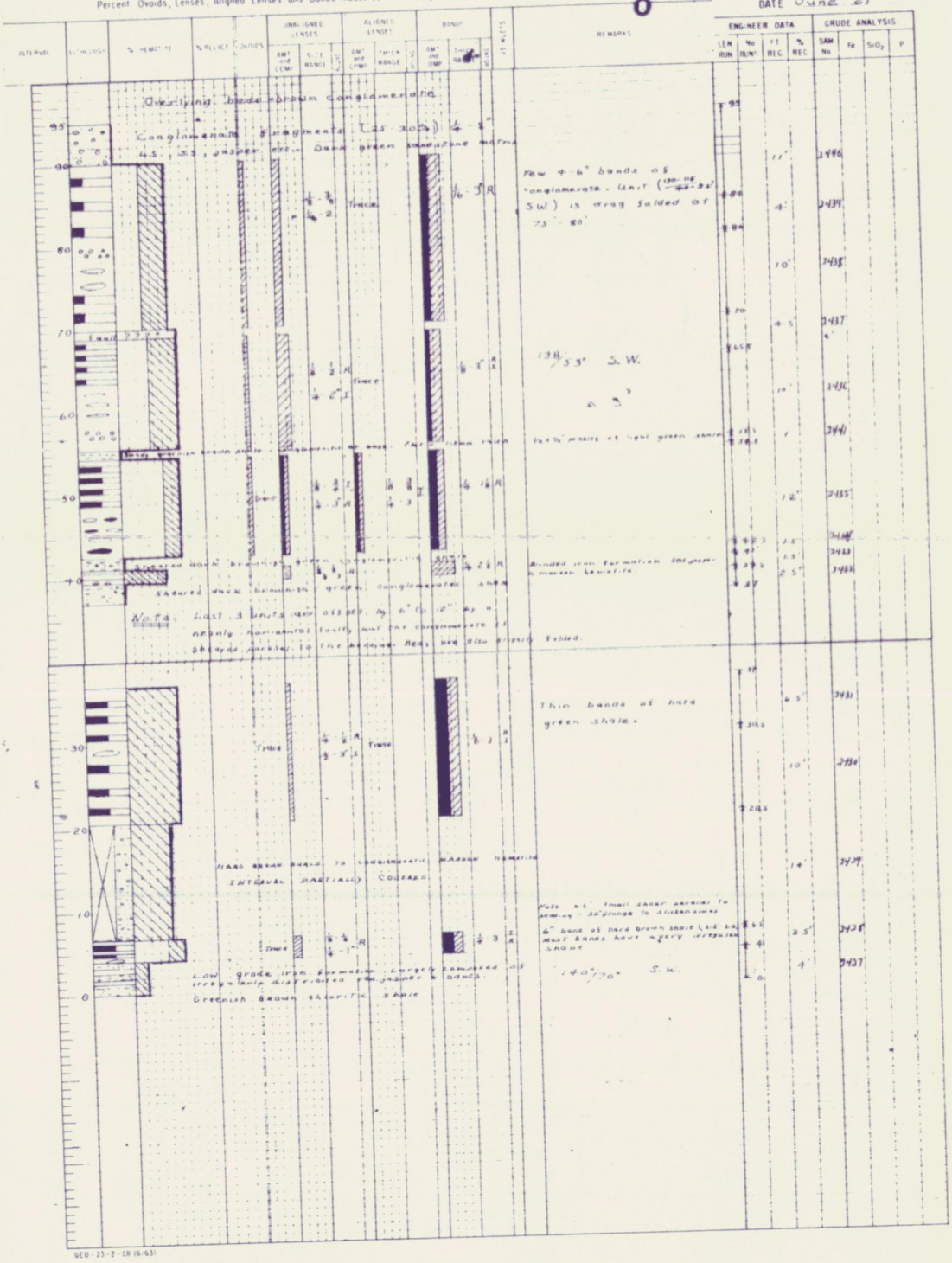
QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE June 21



GEO - 23 - 2 - CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IE - 112 - 63
DESCRIBED BY W. GIBBINS
MEASURED BY R. BRAY
AIR PHOTO No. A 120-56-351
AREA IRON CREEK
WEATHER WARM, 8/10 CLOUDS, 20 M.P.H. WIND

DATE STARTED June 23, 1963
DATE COMPLETED June 23, 1963
MEASURING RATE 5½ hr /97.5'
COORDINATES 70, 900 E., 93,100 N.
CLAIM FERROUS 19

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP ... eg 125°/ 25° W
FAULT STRIKE / DIP ... eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 2

DATE June 23, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ROUND	BANDS AMT and COMP	BANDS THICK RANGE	MIXED	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe
0-10															CONGLOMERATE - HARD, HEMATITIC DARK MAROON SHALE MATRIX FRAGMENTS (30%) & COS. (Diameter), LARGER FRAGMENTS ARE WELL ROUNDED QUARTZITE LIMESTONE (LIGHT GREY), JASPER ETC.						
0-10			TR			Pebbles ¼-4"						¼-3	I	FC	RED JASPER PEBBLES (¼-4" Diameter) UNIT CONTAINS SHALLOW UNDULATING FOLDS & SLICKENSIDES	0		4.6		2494	
0-10															HARD, DARK MAROON SHALE - CALCAREOUS	4.6		1		2495	
0-10			TR		⅛-¼	R I						⅛-2	I	TR S	PATCHES & NODULES OF RED JASPER & BROWN CARBONATE ALMOST HORIZONTAL DIPS - 0°-10° HEMATITE FINE CRYSTALS IN PLACES.	5.6		7.6		2496	
10-20				⅛-½	⅛-½	T.E.		⅛-½	⅛-8"			¼-⅛	I			13.2		5		2497	
10-20					⅛-½	R I						⅛-4	R I		A COUPLE OF 4"-6" IRREG. WARK BANDS OF BROWN CARBONATE & A FEW PATCHES OF RED JASPER.	18.2		10		2498	
20-30					⅛-½	R I						⅛-2"	I		CRYSTALLINITY OF THE HEMATITE & RED JASPER PATCHES CONTINUE.	23.2		7.5		2499	
30-40					⅛-½	R I									DARK BROWN SHALE (5-10% maroon HEMATITE BY TEXT & INCREASING IRON CONTENT TO LIGHT BROWN SHALE M30/21 D.W.)	30.7		3		2500	
30-40															JASPEROID IRON FORMATION	33.7		2		2501	
30-40					⅛-½	I									DARK BROWN SHALE WHICH GRADES INTO A CONGLOMERATE - DISC-SHAPED GREEN FRAGMENTS ORIENTATED ON BEDDING (1-4 mm Diam.) (½-2 mm Thick).	35.7		6.5			
30-40					⅛-½	I						⅛-2"	I		LENSES ALMOST EQUAL PATCHES, & INCLUDE RED JASPER & BROWN CARBONATE.	42.2		7		2502	
40-50					⅛-½	I							R I		FAULT (SLICKENSIDES) DIP 30°	49.2		2		2503	
50-60			TR									⅛-2"	R I		BANDED IRON FORMATION (62'-69') 2 ½" Bands of dark greenish brown (Hematite-chlorite).	51.2		7		2504	
60-70					⅛-½	R		⅛-½	⅛-18"	R		¼-1½	I			58.2		10		2505	
70-80					⅛-½	R		⅛-½	⅛-18"	R		¼-1½	I			68.2		55		2506	
80-90															BADLY WEATHERED IRON FORMATION - BLOCKY & PITTED - TRACE OF RED JASPER BANDS.	123.2		3		2507	
80-90															DARK MAROON SHALE	126.2		6		2508	
90-100															MAROON HEMATITE (90%) IRREGULAR RED JASPER. DARK BROWN SHALE.	132.2		2.5		2509	
90-100															JASPEROID IRON FORMATION. IRREGULAR STREAKS OF RED JASPER & A TRACE OF SMALL (1-2 mm) LENSES.	134.7		2.5		2510	
90-100															CLASTIC DARK BROWN SHALE	137.2		4		2511	

FAULT AT ABOUT 97'. FAULTED IRON FORMATION MEASURED ONTO TOP OF IRON FORMATION PROBABLY REPEATING MOST OF SECTION. SECTION PROBABLY FOLLOWED BY ABOUT 50' OF CONGLOMERATE & THEN FOLLOWED BY 25' IRON FORMATION AT BASE

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 120-63
DESCRIBED BY C. Riddell
MEASURED BY R. Bray
AIR PHOTO No. A 12056 - Fl. 10² - 284
AREA South Iron Creek
WEATHER 8/10 overcast, warm, scattered showers

DATE STARTED June 29/63
DATE COMPLETED June 29/63
MEASURING RATE 2 hrs.
COORDINATES 80,600 E. 94,500 N.
CLAIM J - 19

091697

ROCK TYPES

OVOIDS: IRON FORMATION, SILTSTONE
UNALIGNED LENSES: JASPER, SHALE
CONGLOMERATE, LIMESTONE
ALIGNED LENSES: BRECCIA, DOLOMITE
BANDS: SANDSTONE, COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE June 29/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: BOUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: BOUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: BOUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	Fe	SiO₂	P
						1/8-1/4, 1/4-6" R; 1/16-1/4, 1/8-6" R						1/8-6" R			Interbeds of sandstone (8") and conglomerate up to 6". Some calcite in jasper	0		9'		2258			
10															Mainly ferruginous fine conglomerate with minor jasperoid iron formation.	9'		7.5'		2259			
20															Poor jasperoid iron formation. Red jasper very irregular & conglomerate interbedded & interlensed.	16.5		8.0'		2260			
30																24.5		8.0'		2261			
40																32.5							
50																							
60															W.S. - brown maroon. Varies from fine (→ coarse sandstone) conglomerate to coarse conglomerate. Pebbles up to 12" but mainly 1-3". Pebbles of dolomite, qtzite, green rock (?) & occasional jasperoid iron formation pebble. Mainly rounded. Band of fine conglomerate from 45-60'. Fine conglomerate has more angular fragments. Larger fragments mainly rounded but occasionally angular. Matrix ferruginous, calcareous sandy shale. 50-60% pebbles.																			
70																							
80																							
90															Conglomerate with less pebbles & smaller pebbles up to 2". Calcareous, ferruginous, shale, matrix. Poorly bedded. Weathers more maroon than above.								
100																							
110																							
120																120.5		10'		2262			
130															Conglomerate as above with some lenses & bands of poor jasperoid iron formation. Some sandstone & shale interbeds. Iron & jasper bands & lenses 1-12" thick form about 25% of interval.	130.5		10.5'		2263			
140						1/16-1/4						1/16-3" R				141		7'		2264			
150																148							
160																							
170																							
180																							
190															Interbedded sandstone, shale, & conglomerate. Grades from one to the other. All have ferruginous shale matrix. Shale has sporadic pebbles. Sandstone fine to coarse.								
200																							
210						1/2-3" I; 1/2-18"						1/16-3" I			Few irregular patches	216		5'		2265			
220															red jasper halo around maroon jasper lenses, in places. Some hematite centers to lenses eg. 3" red jasper	220							
230															Underlying beds covered!								

GEO-23-2-CR (6/63)

1391

GREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 121-63
DESCRIBED BY C. H. Riddell
MEASURED BY W. Gibbins
AIR PHOTO No. A12056 - 284
AREA South Iron Creek
WEATHER Very warm, clear, windy

DATE STARTED June 30/63
DATE COMPLETED June 30/63
MEASURING RATE 2.5 hrs.
COORDINATES 83,800 E. 84,800 N.
CLAIM K - 22

ROCK TYPES

OVOIDS : IRON FORMATION
UNALIGNED LENSES : JASPER
ALIGNED LENSES : CONGLOMERATE
BANDS : BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES : R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS : BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE : Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

DATE June 30/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No. RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	GRADE ANALYSIS SAM. No	GRADE ANALYSIS Fe	GRADE ANALYSIS SiO_2	GRADE ANALYSIS P
0															Overlying beds: Conglomerate with dark maroon brown matrix containing pebbles mainly red jasper & maroon shale with some green shale. Pebbles consist of carbonate pebbles (weathered out leaving pits) & jasper pebbles. Pebbles vary but usually less than 1" subangular to subrounded. Matrix very sandy with many angular fragments of jasper. Grades into maroon shale. Fluid calcite cement. Bedding indistinct.	0		10'		2275			
10			Trace		⅛ - ½ R ⅛ - 6" I	Trace	I				⅛ - 6" R				Some carbonate waste mixed with jasper.	10		10'		2276			
20			Trace												Some ¼" to 3" bands of sandstone & shale waste.	20		5'		2277			
25					⅛ - ¾ R ⅛ - 2" R				⅛ - 2"		⅛ - 2" R					25		5'		2278			
30															W.S. Maroon brown pebbles mainly fine grained to ¼" but some to 1". Matrix - sandy shale. Pebbles of jasper, carbonate & shale.	30		13'		2279			
40					⅛ - ½ R ¼ - 3 I	Trace							R I	OF	Some irregular patches of jasper. Some carbonate in jasper lenses.	43		2'		2280			
															Greenish pebbles to 1". Rounded to irregular. About 40% poor Jasperoid iron formation pebbles. Iron formation ½" band of shale.	45				2281			
50					⅛ - ½ R ¼ - 6" I						⅛ - 3 R				Some irregular patches of jasper	61		4'		2282			
															W.S. - green brown to maroon brown - recessive. About 30 - 40% Some fragments up to 2" diameter. Fragments mainly round. Some sandstone. Some poor jasperoid laterbeds of I.F. up to 6"	65		10'		2283			
			Trace		⅛ - ½ I ½ - 6" I				⅛ - ½		⅛ - 1 R I				Some slight tectonic disturbing of beds. Some calcite in jasper. Jasper - silica? Beds thickened out	75							
70																77		12'		2284			
80															W.S. Greyish brown pebbled of gtzite, carbonate & green shale. Lignand to subangular. Fragmented. Minor maroon shaly hematite near top. Calcareous maroon shaly matrix.	89		9'		2285			
															Much disseminated jasper.	96		2'		2286			
90															Ferruginous conglomerate. Many green pebbles (igneous ??) Irregular streaks of greyish jasper in banded bedding slumped slightly.	98		1'		2287			
																99.5		1.5'		2288			
100																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 126-63
DESCRIBED BY C. Riddell
MEASURED BY G. Sutherland
AIR PHOTO No. A 12148 - 183 (43)
AREA Head waters of Gypsum Ck
WEATHER Intermittant sun. between rain storms

DATE STARTED July 8-63
DATE COMPLETED July 8-63
MEASURING RATE 5 hours
COORDINATES 100,500 E 113,200 N
CLAIM Q - 1

ROCK TYPES

OVOIDS : IRON FORMATION; SILTSTONE
UNALIGNED LENSES : JASPER; SHALE
ALIGNED LENSES : CONGLOMERATE; LIMESTONE
BANDS : BRECCIA; DOLOMITE
SANDSTONE; COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES : R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS : BEDDING STRIKE / DIP eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE - Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 6
DATE July 8/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ORIENT	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ORIENT	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: CONT	VEINLETS	REMARKS
0															Overlying beds - About 200' exposed with few covered intervals.
															Conglomerate - W.S. - dark brown maroon 20 - 35 % pebbles of mainly sandstone, shale, dolomite, rarely limestone, chert, jasper, quartz, rarely granite, gneiss, gneissose or schist pebbles. Pebbles up to 12" diameter. Matrix - calcareous. Ferruginous shale.
															Ferruginous shale - Slightly metallic sheen. Occasionally sandy. Grades to less ferruginous, poorly bedded (sandstone) shale.
															Fine, grayish, Ferruginous - grades to shale. Less hematite than above.
															Ferruginous shale - metallic lustre in places.
															Siltstone, ferruginous, grades to shale, calcareous.
															Ferruginous shale - to shaly iron formation. Blocky.
															Shale - to shaly conglomerate. Poorly bedded (mudstone). Slightly calcareous. Silty & laminated.
															Hematitic Sandstone - shaly - metallic lustre in part - calcareous.
40					¼-½	Trace	R	⅛-2°		R					Slickensides. Beds dip slightly north.
60					¼-½	Trace	R	⅛-1"		R					Some very good hematite here.
80					⅛-½		R	⅛-5"		R					Some Ca in lenses.
100					⅛-½		R	⅛-3°							Shaly bedded in part.
120					½-⅛	Trace		⅛-1"		R					Fault with ≥ 60' of displacement. Passes through DF 9-42 with ≈ 150' displacement. 100' / 30° - 60° S. Varies.
140					½-⅛		R	⅛-1"		R					Same as 56' - 66'.
160					⅛-1"		I	⅛-2"		R					Ca in many lenses.
180					½-⅛		R								One 2" sand band.
200					⅛-1"		R	⅛-1"		R					Metallic hematite in maroon
220					⅛-1"		R	⅛-2"		R					Ferruginous, angular, fine grained fragments
240					½-⅛	Trace		⅛-1"		R					W.S. Brown, Green rock fragments & dolomite fragments. Rounder to subrounded pebbles. Shaly calcareous matrix. Some beds shaly at top.
260					⅛-½		R	⅛-½		R					
280					⅛-¼		R	⅛-¼		R					
300					⅛-½		R	⅛-½		R					Brown maroon Ferruginous shale with silty & fine sandstone laminations in shale.
320					½-⅛		R	⅛-8"		R					3"-6" Sandy shale bands (3 in number)
340					⅛-½		R	⅛-4"		R					Some calcite with jasper in lenses. Some hematite in maroon jasper bands. Occasional 2" conglomeratic band.
360					⅛-½		R	⅛-1"		R					Ferruginous, calcareous pebbles to 2" diameter. Pebbles subangular to rounded. 20-30 % fragments.
380					⅛-½		R	⅛-½		R					Ca in much of jasper.
400					½-6"										
420					⅛-½		R	⅛-½		R					Carbonate with jasper.
440					⅛-½		R	⅛-½		R					
460								⅛-1"		R					20% irregular patches of red & maroon jasper. Hematite with maroon jasper.
480					⅛-¾		R								Hard hematitic poorly dressed shale.
500					⅛-¾		R								
520					⅛-2"		R	⅛-3°		I					20% of irregular patches of red & maroon jasper.
540															
560															W.S. Brown green fragments 2" Rounded sandstone pebbles. Occasional lense of banded grayish to reddish hematite - to pebbles. Some of these look like large matrical blocks. 1' x 3'.
580															
600															
620															Poor jasperoid iron formation
640					⅛-¼		R								(15%) 20%? irregular patches of red & maroon jasper. Some Ca with jasper.
660					½-2"		R	⅛-3"		R I					
680															Hard maroon brown ferruginous shale. 2" band jasperoid iron formation
700															
720															Could not measure this interval accurately.
740															
760															
780					⅛-¾		R	¼-1½		I	¼-2"		I		10% irregular patches of red jasper. Much Ca with jasper.
800					½-4"		I								
820					⅛-¼		R	¼-⅝	Trace		¼-2"		R		Some Ca in jasper
840					¼-8"		R								

ENGINEER DATA: LEN RUN	No RUNS	FT REC	% REC	CRUDE ANALYSIS: SAM No	Fe	SiO_2	P
0		6'		2625			
6		3'		2626			
9		2.5'		2627			
11.5		3.5'		2628			
15		1.5'		2634			
16.5		4.5'		2635			
21		9'		2636			
30							
56		10'					
66		2'					
68		9'					
75		2'					
77		2'					
81		2.5'					
83.5		7.5'					
94		7.5					
101.5		1'					
102.5		10'		2637			
112.5		2.5'		2638			
115		10'		2639			
125		9'		2640			
134		1"		2641			
134.5		1.5'		2642			
136		2.5'		2643			
138.5		11.5'		2644			
150		1.5'		2645			
152		7'		2646			
159		7.5'		2647			
166.5		1'		2648			
167.5		10'		2649			
178		11.5'		2650			
181		1"		2651			
182		10'		2652			
192		No 1					
202.5		1.0		2653			
203.5		1.5'		2654			
215		10'		2655			
225		9.5'		2656			
234		9'		2657			
244		10'		2658			
247		6'		2659			
253		1'		2660			
263		5'		2661			
273		10'		2662			
283		10'		2663			
293		10'		2664			
303.5		1.0		2665			
304.5		1.5'		2666			
317		10'		2667			
327		9.5'		2668			
336.5		1.5'		2669			
338		10		2738			
348		5		2739			
353		10.0'		2740			
363							

GEO - 23 2 - CR (6/63)

1392

CREST EXPLORATION LIMITED
IRON ROCK LOG CHART

091897

SECTION No. IF 127-63
DESCRIBED BY C. H. RIDDELL
MEASURED BY G. SUTHERLAND
AIR PHOTO No. A12148-183
AREA 2½ MILES UPSTREAM FROM CAMP ON N. TRIB. OF IRON CREEK
WEATHER 2/10 CLOUD - LIGHT BREEZE - NICEST DAY OF THE YEAR

DATE STARTED JULY 3/63
DATE COMPLETED JULY 3/63
MEASURING RATE 5 Hrs.
COORDINATES 108,900 N; 93,500 E
CLAIM O-13

ROCK TYPES

IRON FORMATION, JASPER, CONGLOMERATE, BRECCIA, SANDSTONE, SILTSTONE, SHALE, LIMESTONE, DOLOMITE, COVERED

% HEMATITE

STEEL GREY HEMATITE, MAROON HEMATITE, BOTH

SILICEOUS WASTE TYPES

RED JASPER, MAROON JASPER, MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite.

REMARKS: BEDDING STRIKE / DIP .... eg 125°/25° W
FAULT STRIKE / DIP .... eg 125°/25° E
BRECCIATED ZONE ....
HALOS OF JASPER ....
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc.
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 6
DATE JULY 3, 1963

Columns: INTERVAL | LITHOLOGY | % HEMATITE | % RELICT | OVOIDS | UNALIGNED LENSES (AMT. and COMP. / SIZE RANGE / BOUND) | ALIGNED LENSES (AMT. and COMP. / THICK RANGE / BOUND) | BANDS (AMT. and COMP. / THICK RANGE / BOUND) | VEINLETS | REMARKS | ENGINEER. DATA (LEN. RUN / No. RUNS / FT. REC. / % REC.) | CRUDE ANALYSIS (SAM. No. / Fe / SiO₂ / P)

Interval	Lenses / Bands	Remarks	Footage	Len. Run	Sam. No.	
		OVERLYING BEDS MAINLY COVERED WITH ODD OUTCROP OF MAROON CONGLOMERATIC SHALE				
0		FERRUGINOUS SANDY SHALE → SHALY SANDY IRON FORMATION → SHALY FERRUGENOUS SANDSTONE. TENDS TO BE FINELY CONGLOMERATIC IN PLACES. BEDS DIP 5-10% South.	0', 3.0	3.0	2811	2291
		SOFT DARK POORLY BEDDED MAROON SHALE.	6.0	3.0	1676	
10		SANDY, FLAKY, TO SHALY IRON FORMATION. FRAGMENTS OF LIMONITE & GREEN SHALE APPEAR OCCASIONALLY. 3' BAND OF OF LESS FERRUGENOUS, DARK BROWN SOFT SHALE NEAR BOTTOM CONTAINING A FEW GREEN SHALE FRAGS. & REDDISH BROWN SHALE FRAGS (SUBANGULAR → ROUNDED). ≈ 0-5% FRAGS (UP TO 10%) UP TO ½" LONG. MOSTLY ⅛"-¼".		10.0	1677	
20		16' → 22' PARTIALLY COVERED.	16.0	6.0	1678	
		ROPY SHALY SANDY IRON FORMATION. RED JASPER IN LARGE & SMALL LENSES. GRADES TO SANDSTONE IN PLACES. POOR QUALITY. SOME BANDS UP TO 1', MAINLY RED JASPER. SOME FINE CONGLOMERATE.	22.0	10.0	2812	2292
30			32.0	9.0	2813	2293
40		MASSIVE WEATHERING CONGLOMERATE. BOULDERS UP TO 1' SUB-ANGULAR TO ROUNDED. MATRIX: VERY FERRUGENOUS MAROON SANDY SHALE	41.0	5.0	2814	2294
		HARD FERRUGENOUS SILTY SHALE. HARD DARK BROWN SHALE WITH OCCASIONAL BREAK GREEN SHALE FRAGS. FERRUGENOUS. 2" BAND OF GREEN SHALE AT ABOUT 46' (SOFT)(TENDS TO SANDSTONE WITH SMALL FRAGS NEAR BOTTOM.)	46.0	2.0	2815	1679
50		INTERBEDDED HARD FERRUGENOUS SHALE AS 45'-46' AND CONGLOMERATE IN 3" TO 12" BEDS. PEBBLES MAINLY SUB ANGULAR DOLOMITE & SANDSTONE 2mm to 1" MATRIX: SANDY MAROON SHALE.	48.0, 53.0	5.0	2816	2295
60		TOP OF MAIN IRON FORMATION	66.0			
70	1/16-3/16, 1/8-4"; ½"-1" I; 1/8-2" R I			10.5	2817	2296
		TOP MARKER SANDSTONE. WS. VERY DARK BROWNISH-GREEN. FS. DK. GREEN-BROWN, FINE + MEDIUM GRAINED. FERRUGENOUS. SL. CALCAREOUS. QUARTZ & OTHER GRAINS SUB-ROUNDED. BEDDING ½-1'.	76.5	7.0	2818	2297
80	Green Large (to ½"); 1/8-1", 3/8-6" R; ½-¼" I; Trace	MOSTLY RED OVOIDS & LENSES SOME CALCITE WITH JASPER WASTE.	83.5	10.0	2819	2298
90	1/8-½", ½-2" R; 1/16-3/4" R	INTERBEDDED SHALY I.F. (60%) & FINE CONGLOM TO SANDSTONE (40%) IN 3-5" BANDS.	93.5, 96.0	2.5, 1.5	2820, 2823	2299, 2300
100	1/16-½", 1/8-6" R Trace; ¼-¾ R	SOME CALCITE IN JASPER.	97.5	10.0	2821	2601
110	Trace; 1/8-½, 1/8-8" R; 1/8-½, 1/4-2"; 1/8-2" R	INTERBEDDED & LENSES OF CONGLOMERATE & (10% of interval) UP TO 8" THICK. OCCASIONAL PATCH OF RED JASPER. CHANGES TO MAINLY CONGLOMERATE ALONG STRIKE.	107.5	6.0	2822	2602
		W.S. BROWN-GREEN FRAGS TO ½" SL. CALCAREOUS SHALY, SANDY MATRIX. QTZITE & CARBONATE PEBBLES. ONE 1' BAND POOR SHALY I.F.	113.5	2.0	2824	2603
		INTERBEDDED CONGLOM & POOR SHALY I.F.	115.5	4.0	2825	2604
120	1/16-3/8, ½-18" R	F S MINOR IRREG PATCHES.	119.5	10.0	2050	2605
	1/16-1" R I; 1/16-1" R I	2 MINOR 3-6" CONGLOM BANDS AT BASE	129.5			
130	1/16-2½"	TENDS TO BE SHALY IN PLACES.	132.0	2.5	2826	2606
	1/32-½ R, 1/4-1"; ½-2" R	SL. MAROON BROWN CONGLOMERATIC SHALE. SHALE BANDS ARE INTERSPERSED WITH CONGLOMERATE. FRAGS: ANGULAR → SUB-ROUNDED NONCALCAREOUS GREEN SHALE & QTZITE 1/16-1/4". OCCASIONAL HALO (HEM. CENTER) SOME RED JASPER STREAKS. & HEMATITIC GREY-MAROON SHALE BANDS NEAR MIDDLE & BOTTOM OF INTERVAL. (8"+5"-4")	134.5, 136.0, 137.6, 142.0	2.5, 1.6, 4.5	1680, 1681, 1682	
140				4.5	2929	2930
150	Small Limonite(?) Jasper Calcite siderite(?); ⅛-¼ R, ½-8" I; ¼-2"; ½-2" I; Trace Trace	WEATHERED-OUT LENSES & BANDS ON WEATHERED SURFACE. OCCASIONAL IRREG. PATCH.	146.0	10.0	2931	2932
160	1/8-1/8, <2"		156.0	10.0	2933	2934
170		MINOR SHALY BEDDED HEMATITE IN MIDDLE 2' of INTERVAL.	166.0	10.0	2935	2936
180	carbonate, calcite & siderite, jasper; ½-1" R; ¼-2" R I; 1/16-¼, 1/8-2" R; ¼-2" R I	SOME SIDERITE & CALCITE VEINS. SLICKENSIDES.	176.0, 184.0	8.0, 3.0	2937, 1683	2938
		SHALE FRAGS 5-10%	186.0	2.0	1684	
		JASPEROID IRON FORMATION 100% RED (¾) & MAROON (¼) JASPER PATCHES.	188.0			
190		SANDSTONE GREY-GREEN - MEDIUM TO COARSE GRAINED.		7.0	1685	
		NB. 183-294 WAS COVERED. MEASURED 100 LONG. STRIPPING REVEALED 4' ERROR. THUS, THOUGH IN REALITY ONLY .7 feet LONG SANDSTONE INTERVAL CALLED 188.0' to 199.0'	199.0			
200	⅛-¾" I; ⅛-½" I; Trace Trace	LOCAL ENRICHMENT (LIMONITE?) OF LENSES, OVOIDS & BANDS BY LIMONITE, SIDERITE (?) & CALCITE. PITTED, WEATHERED SURFACE.		6.0	1686	
210				9.5	1504	1508
		FERRUGINOUS SHALE	214.5	0.5	2939	
		60% of JASPER IN IRREG PATCHES.	215.0	3.0	1501	1502
		W.S. BROWN-GREEN F.S. SAME. FINE TO COARSE - POORLY SORTED. NON-CALC.	218.0	1.5	1503	1505
220		W.S. BROWN-GREEN F.S. SAME ~~FINE TO COARSE - POORLY SORTED NON-CALC.~~ JASPER MAINLY IN IRREG PATCHES. 70% MAROON 30% RED. SOME 1-6" SANDY BEDS.	219.5	4.5	1506	1507
230		50% JASPER IN IRREG PATCHES (½ MAROON, ½ RED). INTERBEDDED GREEN, VERY FINE SANDSTONE AT 232.0'.	224.0	11.5	1687	
		HEMATITIC + CONGLOMERATIC SANDSTONE 15% ANG TO SUBROUND FRAGS GREEN SHALE.	235.5	1.0	1688	
240	⅛-¼ R, ¼-2" I; ¼-6"	50% JASPER IN PATCHES. 6" BAND FINE GRAINED S.S. AT 237' (DK GREEN)(GREEN SHALE FRAGS <5%).	236.5	4.5	1689	
		W.S. BRN GREY 70% PEBBLES OF L.S. DOLOMITE, S.S. & SHALE, IN CALC. SANDY SHALE MATRIX. SUB-ANG TO SUBROUND ½-1" PEBBLES (OCCASIONALLY UP TO 2").	241.0	9.0	1690	
250		(NB) COVERED INTERVAL FOUND SHORTER WHEN EXPOSED. 50% RED JASPER PATCHES OR VERY IRREG BANDS.	249.0	4.0	1691	
260	1/16-½ R, ⅛-1" I; ⅛-½", 1"-2" R; Trace; ¼-6" R I	REMAINDER OF JASPER IN IRREG PATCHES.	253.0	12.5	1692	
270			265.5	8.0	1693	
		GREY-BROWN NON-CALCAREOUS SILTSTONE. 6" BAND OF JASPEROID I.F. MAINLY RED JASPER	273.5	3.0	1694	
280		FINE TO VERY FINE CONGLOMERATE WITH A NON-CALCAREOUS DARK BROWN SILTSTONE TO SHALE MATRIX. FRAGS FROM 0-15% YELLOW & GREEN SHALE, LIMONITE, SANDSTONE, DOLOMITE, QTZ. SUB-ROUND → ROUND (1/64-⅛") (up to ½"). BECOMES FERRUGINOUS IN PLACES WITH GREEN SHALE FRAGMENTS (eg. 297.5-299.5).	276.5	10.0	1695	
290			286.5	13.0	1696	
300		MINOR HEMATITE	299.5	1.5	1697	
		FERRUGINOUS SHALE SLIGHTLY CONGLOMERATIC + 5% FRAGMENTS	301	3	1698	
		LARGE GREEN LIGNEOUS(?) SANDSTONE BOULDER AT 302' (1½'x8'). MINOR SHALY BEDDED IF INTERBEDDED. SOME CALCITE.	304	10	1699	
310	⅜-¾ Q, ¼-6"; ⅛-½; ⅛-1" Q		314	10	1700	
320	⅜-½ Q, ½-8"; ⅛-½ Q; ⅛-1 Q	CALCITE	324	14.6	1458	
330			334, 336	4.5	1459	
340		GREY GREEN VERY FINE GRAINED SANDSTONE TO SILTSTONE. SLIGHTLY FERRUGINOUS IN PLACES	340			
		INTERVAL PARTIALLY COVERED. FRAGMENTS % VARIES GREATLY. NON CALCAREOUS. INTERVAL VARIES FROM INTERBEDDED FINE CONGLOMERATE TO COARSE SANDSTONE TO CONGLOMERATE. MATRIX DARK BROWN SHALE. 353-355 IS COVERED. (covered) (Conal)	344, 346, 353, 355	2, 3	1460, 1461	
360		WS BROWN GRADES TO SANDSTONE TO SHALE TO CONGLOMERATE. PEBBLES TO ½" BUT MAINLY LESS THAN ¼". VERY SHALY & SANDY.		10	1462	
370			365	10	1463	
			375	6	1464	
380	⅛-½ I; TR; ⅛-¼ Q; ⅛-2" I; ⅛-3" I	20-30% RED JASPER IN IRREGULAR PATCHES	381	10	1465	
390			391, 393.5	2.5, 7	1466	
	⅛-½ I, ½-1½ Q; ⅛-1" Q	LAMINATED FERRUGINOUS, CROSS BEDDED SILTSTONE. CALCAREOUS	398	.5	1467	
400		BENEATH THIS BEDS ARE COVERED FOR 50'-70' FOLLOWED BY AN OUTCROP OF CONGLOMERATE. BOULDERS TO 1" MAINLY LESS THAN 1/2" TO 3". BOULDERS OF CARBONATE, QUARTZITE, JASPER. MATRIX IS CALCAREOUS GREEN SANDY SHALE. BENEATH THIS IS COVERED.	400.5			
410						

GEO-23-2-CR (6/63)

(1393)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091697

SECTION No IF 128-63
DESCRIBED BY W. Gibbins
MEASURED BY R Bray
AIR PHOTO No A 1214B (11³) 183
AREA Head waters of Bluff Creek
WEATHER Rain on July 2 Fair July 3

DATE STARTED July 2/63
DATE COMPLETED July 3/63
MEASURING RATE 8hrs.
CO-ORDINATES 98,000 E 114,700 N.
CLAIM P-11

ROCK TYPES

IRON FORMATION, JASPER, CONGLOMERATE, BRECCIA, SANDSTONE, SILTSTONE, SHALE, LIMESTONE, DOLOMITE, COVERED

% HEMATITE

STEEL GREY HEMATITE, MAROON HEMATITE, BOTH

SILICEOUS WASTE TYPES

RED JASPER, MAROON JASPER, MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S, CARBONATE C, HEMATITE H, FEW F, MANY M

BOUNDARIES: R - REGULAR i.e. Even boundary between Jasper and Hematite
I - IRREGULAR i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 6
DATE July 2/63

Columns: INTERVAL | LITHOLOGY | % HEMATITE | % RELICT | OVOIDS | UNALIGNED LENSES (AMT and COMP, SIZE RANGE, BOUND) | ALIGNED LENSES (AMT and COMP, THICK RANGE, BOUND) | BANDS (AMT and COMP, THICK RANGE, BOUND) | VEINLETS | REMARKS | ENGINEER DATA (LEN RUN, No RUNS, FT REC, % REC) | CRUDE ANALYSIS (SAM No, Fe, SiO₂, P)

Remarks (in order down the log)

Section measured down.

Medium grained brown sandstone - F.S. & W.S. greenish brown. Shale & carbonate.

Iron sandstone, fragments of red jasper (0.5 - 2 mm) & brown shale (1-2 mm) & matrix (20-25%) of maroon hematite.

Iron sandstone - more red jasper & larger fragments than above. Becomes conglomeratic (10%) maroon hematite 2-6" conglomeratic sandstone.

Sandstone W.S. medium brown F.S. dark brown. Medium grained, shaly & calcareous. 90°/4° W

Pointed lenses of red jasper, small bands - hematite in jasper & carbonate in hematite.

Iron sandstone. Medium to coarse grains of red jasper & hematite.

Maroon brown shale matrix - fragments (½ - 1½") 20% well rounded light green carbonate & shale.

Dark maroon brown shale - sandy (carbonate) in places.

Nodular iron formation with regular to irregular lenses of red jasper & white qtz & brown carbonate (partially altered to limonite).

Banded iron formation.

Maroon fine to medium grained calcareous sandstone. F.S. - slight greenish tinge. Thin regular to massive bedding.

Iron formation - 10% red jasper & qtz. patches (¼ - 1½" diameter). Regular boundaries. Waste is mostly red jasper.

Maroon hematitic shale.

Iron formation - banded. 15 - 20% of hematite = fine crystals.

Interbedded hematitic brown shale & low grade banded iron formation.
73.5 - 74.5 - shale
74.5 - 77.0 - I.F.
77.0 - 78.5 - shale
78.5 - 79.5 - I.F.
79.5 - 81.0 - shale
Shale - maroon - 20% maroon hematite. Trace of green clastic ⅛-1". Green sandstone & carbonates.
I.F. - 35% maroon hematite - waste bands of red (65%) & maroon (35%) jasper.

"Nodular" iron formation. Some lenses & ovoids of red jasper have hematite cores. Trace of small hard light brown ovoids.

Banded iron formation.

Brown - dark maroon massive shale.

Banded maroon hematite. Trace of brown shale.

10" of conglomerate (maroon) at 106.5' (W.S. - light brown).

Light brown qtz carbonate patches (½-1") (15%) at 110, 6" of iron sandstone calcite & red jasper (½-3 mm) in hematite matrix. 8" of conglomerate at 130.5'.

Banded iron formation.

Maroon hematite & hard medium brown shale.

Banded iron formation. Zone of light brown qtz nodules at 145.0. Maroon hematite.

Maroon hematite.

Dark brown to maroon shale to very fine sandstone. Slightly calcareous.

Low grade maroon hematite. Shale at 152' (10") & 161' (12").

Medium brown & light green siltstone - poor irregular bedding.

Conglomerate: Fragments (80-85%) mostly 2 - 10 mm → 10 mm → 1'. Rounded to angular. Maroon brown shale, light green shale, limestone & dolomite. Matrix brown hematitic shale & crystallized calcite.

Numerous calcareous shaly bands interbedded with ferruginous shales & a few clastic carbonate bands. The clastic carbonate weathers dk brown & contains siliceous & shaly pebbles from ⅛ - ¼" diameter.

Blocky ferruginous shaly band from 210.5 - 211. W.S. dk. brown with a metallic lustre on F.S. Also many R & I lenses and bands (¼ - ½" thick) of a calcareous material. W.S. is dark brown.

Blocky ferruginous shaly band with a metallic lustre on F.S. Composed of maroon (hematite) jasper with some maroon (hematite) jasper.

Light grey-brown on fresh surface with weathered particles of gn. shale. From 32' to 4' W.S. is reddish brown.

F.S. - dk. brown W.S. - reddish brown. Contains yellow-grey, green sandy carbonate particles. Few small grains appear to be red jasper.

Conglomeratic shale - massive & poorly bedded. W.S. & F.S. reddish brown. 10-15% rounded pebbles (½-1") composed of carbonate shales & jasper. Grades to a poor quality iron formation with a more ferruginous matrix.

Massive poorly bedded & irregular patches of red jasper. Also light brown weathering shaly carbonate patches containing veinlets of calcite.

Many red jasper lenses have hematite cores. Numerous small patches of red jasper. Blocky weathering interbedded maroon hematite & silty bands from 302 - 302.5. Silty bands grade to maroon jasper in places.

Maroon jasper bands weathered on surface to limonite.

219 - 219.5 coarse grained carbonate sandstone band. W.S. - light brown. F.S. has a mottled grey appearance.

95°/9° S

Slumped outcrop - appears to be sandy carbonate shales.

Underlying beds are conglomerate composed of 80% well rounded pebbles & boulders with a reddish-brown shaly non-calcareous matrix. Pebbles range from ¼" - 2' in diameter. Pebbles are composed of qtzite (usually largest) dolomite, calcareous sandstones & siltstones.

GEO - 23 - 2 - CR (6/63)

(1394)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 129 – 63 | DATE STARTED JULY 8 1963
DESCRIBED BY GIBBINS & FOLINSBEE | DATE COMPLETED JULY 8 1963
MEASURED BY GIBBINS & FOLINSBEE | MEASURING RATE 3 HRS.
AIR PHOTO No A 12148 (11^{2}) 183 | COORDINATES 85,800 E 100,000 N
AREA IRON CREEK 2 MI. S.W. OF BMRE END | CLAIM L - 13
WEATHER RAIN WITH SUNNY PERIODS

091697

ROCK TYPES

OVOIDS: | IRON FORMATION | SILTSTONE
UNALIGNED LENSES: | JASPER | SHALE
ALIGNED LENSES | CONGLOMERATE | LIMESTONE
BANDS: | BRECCIA | DOLOMITE
SANDSTONE | COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MIXTURE OF JASPER & QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FeW	c
MAH	M

BOUNDARIES R - REGULAR i.e. Even boundary between Jasper and Hematite
I - IRREGULAR i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4

DATE JULY 8 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT TEXTURE	% NON-SILICEOUS LENSES AMT AND SIZE	% NON-SILICEOUS LENSES ORIENTATION	% ALIGNED LENSES AMT AND SIZE	% ALIGNED LENSES THICK RANGE	% BANDS AMT AND SIZE	% BANDS THICK RANGE	% VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0											MEASURING DOWN								
											CONGLOMERATIC BROWN SHALE 75% COVERED NO IRON IN FLOAT								
10																			
20																			
0											HARD SILICEOUS MAROON SHALE - MAROON HEMATITE VARIES FROM 0 TO 10 %.			1.5		2632			
											HARD SILICEOUS MAROON SHALE 30-35% MAROON HEMATITE			.5		2633			
											IRON SANDSTONE COARSE GRAINED RED JASPER 65% MEDIUM TO HARD IRON MATERIAL 20% OTHER CONSTITUENTS (QUARTZ, CARBONATE ETC 15%)			4.5		2634			
											CONGLOMERATE - DARK MAROON SHALE MATRIX (75-80%) ROUND (1/4"-1") WELL ROUNDED PEBBLES MOSTLY SHALE & JASPER (10% - 20%) SOME FRAGMENTS (1/8" TO 3") LARGE FRAGMENTS OF QUARTZITE & GREEN SYENITE. ARE WELL ROUNDED & SMALLER FRAGMENTS (1/8 - 1/2") OF SHALE & CARBONATES ARE ANGULAR TO SUB-ANGULAR NOTE ABUNDANT SHALE PEBBLES			6.5		2635			
30											IRON FORMATION HIGH IN IMPURITIES ALONG STRIKE (60-80% FOR FIRST 1/2) - 30% MAROON MAGNETITE STRIKE 72° / 9° SE (72°/9)			6.5		2636			
											CONGLOMERATE — IRON SANDSTONE MATRIX (2-3%) BEDS OF 200 INCHES MAROON SHALE FRAGMENTS 1/16-1/4" (10%) - 2 1/2") INTERBEDDED LENSES & BROKEN BANDS OF RED JASPER, BANDS OF SILICEOUS SHALE, ROUNDED PEBBLES OF GREEN SHALE (GROUNDMASS)			4.5		2637			
											FLOAT INDICATES HARDER SANDSTONE HAS BEEN CROSSED (CALCAREOUS SANDSTONE & 1 BEDDED SILTSTONE								
40																			
50											50.0-52.5 CONGLOMERATIC CALCAREOUS LIGHT GREEN SHALE 52.5-53.5 DARK MAROON - BROWN SAND (THIN BAND OF HARD GREEN SHALE WEATHERED YELLOWS) BAND OF JASPER & PEBBLE UNDER LARGE			2.5		2638			
60											IRON FORMATION 3' SUG 100 BANDED IRON FORMATION			13.5		2639			
70											MAROON-BROWN SILTSTONE AS UNIT BROWN GREY & SHOWS TAN BEDDING NOT EVIDENT OF IRON			2.5		1701			
80											BANDED IRON FORMATION			10		1702			
														10		1703			
90											CONGLOMERATE - BROWN SHALE MATRIX ANGULAR TO ROUNDED. FRAGMENTS (25% - 30%) LIKE + TO (1/2 TO 3") OF LIGHT GREEN SHALE & MANY SUBCARBONATES. INTERBEDDED WITH REGULAR 2" BANDS OF RED JASPER & A TRACE OF METALLIC & MAROON HEMATITE			6		1705			
100											MINT. AS PARTIALLY DUG OUT					1706			
110											IRON FORMATION LARGE (1/8 - 1/2") OVOIDS MAY HAVE CENTERS OR INNER RINGS OF METALLIC HEMATITE.			10		1707			
120														5					
130											OUTCROP OF IRON IN CREEK 6" THICK								
140											OUTCROPS? OF HEMATITE IN CREEK BED CONFORMS TO BEDDING BUT IS LARGE BLOCKS SMALL 6" OUTCROP IN CREEK OF IRON								
150																			
160																			
170											SILTSTONE IN CK. BOTTOM WEATHERED SURFACE FRESH SURFACE								
180																			
190											CARBONATE LENSES - OVOIDS			5		1708			
200											VERY IRREGULAR PATCHES OF JASPER SOME OF WHICH CONTAIN CALCITE								
210														7.5		1709			
220											CONGLOMERATE FRAGMENTS 1 MM - 1" ACCESSIONAL TO 3" 80% OF ROCK MAINLY SHALES & CONGLOMERATE, MAROON SHARPER FRAGMENTS ROUND - SUB-ANGULAR, MATRIX MAROON SHALE NO BEDDING.								

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. EP 130-63
DESCRIBED BY GIBBINS & FOLINSBEE
MEASURED BY GIBBINS & FOLINSBEE
AIR PHOTO No. A 12056 (10³) 284
AREA SOUTH (3mi) OF CAMP [SOUTH IRON CREEK AREA]
WEATHER 65° (approx) - LIGHT WINDS - 3/10 CLOUD

DATE STARTED JULY 9 1963
DATE COMPLETED JULY 9 1963
MEASURING RATE 200 ft (4.5 hrs)
COORDINATES 81,400 E 92,200 N
CLAIM S-19

091697

ROCK TYPES

OVOIDS: ○ ○ ○
UNALIGNED LENSES: ⬭
ALIGNED LENSES: ⬭ ⬭
BANDS: ═══

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE

SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE JULY 9, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	BANDS: AMT and COMP	BANDS: THICK RANGE	VEINLETS	REMARKS
180				TR	1/8-1/2" R 1/8-2" R		1/8-1/4" R 1/8-1/2" R		1/8-1" R 1/8-3" R		CARBONATE IN BANDS
											SILTSTONE - WEATHERED SURFACE - BROWN, FRESH SURFACE MAROON. POOR CLEAVAGE. ALSO SLIGHTLY BANDED, BECOMES FINER TOWARDS THE TOP.
170					1/8-1/4" R 1/4-2" R		1/8-1/2" R		1/8-4" R		MANY OF THE BANDS CONTAIN CALCITE AND SIDERITE. IT HAS BEEN LEACHED OUT OF THE SURFACE BANDS.
160											
150					1/8-1/2" I 1/8-3" I				1/8-1/2" R		CONGLOMERATE CONTAINING BAND 1-2" THICK OF MAROON HEMATITE & JASPER. CONGLOMERATE MATRIX MAROON SHALE FRAGMENTS 1-2 MM OCCASIONAL 4" MAKE-UP 5% OF ROCK FRAGMENTS SUBANGULAR → ROUND. COMPOSED OF CALCAREOUS SHALES & CARBONATE.
											PART OF JASPER IS COMPOSED OF IRREGULAR PATCHES OF RED JASPER.
140											SOME (10%) LENSES & OVOIDS CONSIST OF CARBONATE (CALCITE & SIDERITE). SOME SMALL CRYSTALS OF HEMATITE LENSES 1/2 x 2" of CALCITE.
				TR					1/8-2" R		SHALEY HEMATITE.
130					1/8-3/4" R 1/2-3/4" R			S R	1/8-4"		SHALEY HEMATITE.
				VERY HARD MAROON BROWN SHALE	1/32-1/4" 1/2-1 1/2" R	MAROON SHALE			1/8-1 1/2" R		IRON FORMATION
120											MAROON SHALE MATRIX. FRAGMENTS 17 MM. to 1/2". CALCAREOUS, SHALE, FRAGMENTS 15% - SUB-ANGULAR.
					1/8-3/4" 1/2-4 1/2" R						TRACE OF BROWN CARBONATE IN SOME OF THE LENSES.
110											
100											
90											
80											
70											
60				TR							CONGLOMERATE - MATRIX MAROON TO SOOTY SHALE FRAGMENTS GREEN SHALE & BUFF CARBONATES. RED JASPER (10%) (1/4" x 1/8 IN 2 1/2 x 2 1/2") SUB-ROUNDED TO ROUNDED. VERY JASPEROID IRON FORMATION (15% JASPER) (RED & MAROON) IN IRREGULAR STREAKS FOLDED & FAULTED AT VARIOUS ATTITUDES.
											SHALEY TO CALCAREOUS IRON FORMATION. BANDED IRON FORMATION. 45°
50					1/8-3/4" R 1/8-2" R		1/8-3/4" R 1/2-2" R				TR
40											
30				TR		TR					SOME OVOIDS OF RED JASPER HAVE CORES OF HEMATITE - CARBONATE LENSES PRODUCE PITS IN WEATHERED SURFACE.
20											
10					1/8-3/4" R 1/4-1" R		1/8-1/2" R 1/4-5" R		1/8-3" R		IRON FORMATION 130 / 5°
0											CONGLOMERATE - MAROON BROWN SHALE MATRIX. FRAGMENTS (15%) (1/8" x 1/8") to (5" x 5") ROUNDED TO SUB-ROUNDED LIGHT BROWN CARBONATE & SHALE, RED JASPER, ETC.
											INTERBEDDED IRON FORMATION (65% BANDED RED JASPER) & CONGLOMERATE. SLICK INSIDES AT BASE

ENGINEER DATA: LEN RUN	No RUNS	FT REC	% REC	CRUDE ANALYSIS: SAM No	Fe	SiO_2	P
	1	7		2783			
		3.5		2784			
		7.6		2785			
		10		2786			
		4.6		2787			
		7.5		2788			
		10		2789			
		5.0		2790			
		2.5		2791			
		3.5		2792			
		1		2793			
		5.5		2794			
		3		2795			
		10		2796			
		2		2797			
		4		2798			
		2		2799			
		11		2800			
		10		1615			
		10		1617			
		10		1618			
		4.5		1619			
		1					

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 131-63
DESCRIBED BY Folinsbee
MEASURED BY Sutherland
AIR PHOTO No A 12148 (113) 183
AREA Indicision Creek (East Branch)
WEATHER C. A. V. U. Warm

DATE STARTED July 4/63
DATE COMPLETED July 4/63
MEASURING RATE 130'/45 hr.
COORDINATES 96,300 E 106,000 N
CLAIM P-14

ROCK TYPES

OVOIDS: IRON FORMATION
UNALIGNED LENSES: JASPER
CONGLOMERATE
ALIGNED LENSES: BRECCIA
BANDS: SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE July 4/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT OVOIDS	UNALIGNED LENSES: AMT PER 10 MM	UNALIGNED LENSES: SIZE RANGE	ALIGNED LENSES: AMT PER 10 MM	ALIGNED LENSES: THICK RANGE	BANDS: AMT PER 10 MM	BANDS: THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	Fe	SiO_2	P
0											+72 - 1-2% Yearly bedded conglomerate. Matrix maroon calcareous shale — subrounded fragments - 2mm. - 6" composed 5% of rock. Rounded fragments - grey green shales tend to siltstone.								
											Banded siltstone (2 mm) Maroon grey bands. Calcareous & poorly bedded W.S. brown.								
20											Non-calcareous shale tending to conglomerate, fragments are round - subangular. Green shales <1% of rock. Ferruginous.								
											Ferruginous conglomerate fragments, non-calcareous shale (1-2 mm.) 50% of rock. Matrix calcareous shale?								
											Fine calcareous siltstone W.S. - grey brown F.S. grey green.								
											Ferruginous conglomerate. Very irregular contact with top of I.F. 130°/8° S.W. 10-12' ferruginous conglomerate. Calcareous in places & irregular boundary	0		7'		9803			
				⅛-½ R ¼-1 I	⅛-1 R I				3" I			7							
40											Ferruginous conglomerate, partially calcareous. Fragments 1% (mm-½") Fragments mostly shale & grain. Poorly sorted - no bedding. Maroon shale fragments 25% mainly green shale. Subangular to angular (1 mm-½") Top W.S. - brown F.S. - red grey Bottom - W.S. grey F.S. maroon	11.5		4.5'		9808			
60																			
												30.5		15'		9809			
				Trace	⅛-3 I	⅛-½ R I			2-2 R			33		7.5'		9810			
											Fine sandstone W.S. brown - slightly calcareous F.S. grey green. Bedding (⅛") Fair								
												39.5							
80											Ovoids contain some carbonate			10'		2611			
				⅛-1 I ¼-4	⅛-½ R I				¼-3 R		Some of the red bands have extreme (irregular boundaries - almost patchy								
												49.5							
100				⅛-½ R ¼-3 I	⅛-½ R				¼-2 R	Fc	Some carbonate in red jasper.								
												59.5		10'		2617			
120				⅛-½ R ¼-3 I	⅛-½ R I				¼-4 R		Carbonate present in lenses								
												66.5		7'		2613			
				Trace	Trace				¼-2 R		Conglomerate - W.S. brown F.S. maroon. Fragments 5% No bedding. Calcareous	68		1.5'		2614			
												70		2'		2615			
				⅛-½ R ¼-3 I	⅛-⅜ R				¼-2 R		W.S. brown F.S. - maroon. Matrix - maroon shale. Frags. subangular. Shales, etc.	71		1'		2616			
				⅛-½ R ¼-3 I	⅛-⅜ R				¼-2 R		Contains lenses (2" wide)	73.5		1.5'		2617			
											W.S. brown F.S. maroon. Matrix - red shale. No bedding. Slightly calc. Frags.	74.5		2'		2618			
140														10'		2619			
				⅛-½ R ¼-2 I	⅛-½ R I				¼-4 R	F.S.	Qtz. vein ½" wide - very irregular boundary. Thin band of hematitic shale.	84.5							
														4'		2620			
160												88.5		4'		2621			
											Shale with conglomerate in bands about 4-6" wide. Shale W.S. brown F.S. maroon. Conglomerate W.S. brown F.S. maroon. Fragments imm-½" subangular. Shales maroon. Shale matrix.	92.5							
														10'		2622			
180				⅛-½ R ¼-3 I	⅛-½ R I				¼-3 R I		Contains ¼" band of siltstone W.S. brown F.S. black. Irregular patches of maroon jasper.	102.5							
														10'		2623			
				⅜-¾ R ⅛-2 I					R I	FS	Patches of red & maroon jasper								
200												112.5		10'		2624			
				⅛-½ R	⅛-1 R I				⅛-1 R F		Many of the ovoids on the surface are leached out & others are from carbonate. Some small ⅛" x ⅜" carbonate lenses.								
220												122.5		10'		2626			
				⅜-½ R ⅛-2 I	⅛-½ R				¼-2 R I										
240											MOST OF RED JASPER CONTAINS QUARTZ	132.5		9.5		1427			
				⅛-1 I ⅛-6	⅛-1 I							142							
260																			
				⅛-1 I ⅛-1½	⅛-2 R I						Q = QUARTZ	151.5		5.5		1428			
280												156.5							
			TRACE	⅛-½ I ⅛-4	⅛-½ R I				¼-½ R			166.5		9.5		1429			
300												170							
			TRACE	⅛-½ I ⅛-4	⅛-⅜ R I				⅛-¼ R			171		2		1430			
												173							
320				⅛-½ I ¼-3	⅛-½ R I				¼-½ I		20% PATCHY MAROON JASPER	178		3.5		1431			
												181.5							
												186		4		1432			
												190							
				⅛-½ I ⅛-3 I	⅛-⅜ I R					R I	SOME QUARTZ IN JASPER			5'		1433			
												195							
										R I	MINOR ILLUCRENSIONS								
			TRACE								SOME QUARTZ IN JASPER			9'		1434			
												204							

204 ft. COVERED

ROUNDED JASPER FRAGMENTS (⅛"-¼") MATRIX CALC. MAROON SHALE MASSIVE

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 132 - 63
DESCRIBED BY Bray
MEASURED BY Riddell.
AIR PHOTO No A 12148 - 183 (11)²
AREA Iron Creek - 2.5 mi upstream from camp.
WEATHER Overcast

DATE STARTED July 2/63
DATE COMPLETED July 2/63
MEASURING RATE 38'/5 hr.
COORDINATES 90,300 E 101,300 N
CLAIM N - 16

091697

ROCK TYPES

OVOIDS:
UNALIGNED LENSES:
ALIGNED LENSES:
BANDS:

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

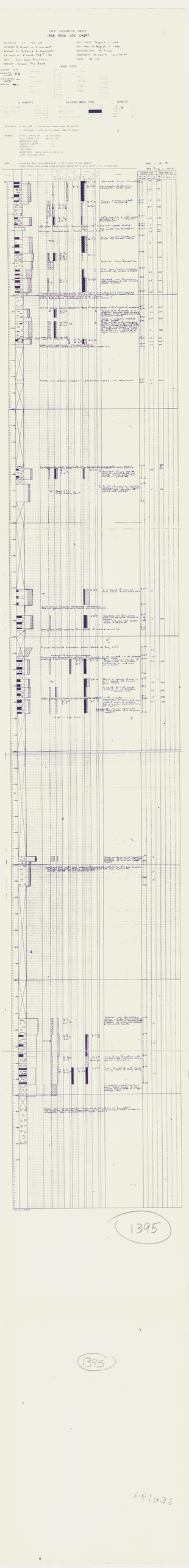
REMARKS
BEDDING STRIKE / DIP eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE ____ OF ____
DATE ____

INTERVAL	THICKNESS	% HEMATITE	% RELICT OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES %	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES %	BANDS AMT and COMP	BANDS THICK RANGE	BANDS %	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	Fe	SiO_2	P
														Section measured up. Overlying massive, poorly bedded conglomerate & ferruginous shales with weathered dark maroon colour with a metallic lustre in some places. Subrounded pebbles from ¼ - 3" diameter. Irregular jasper lenses range to a foot in length. 30% pebbles of dolomite, jasper & shale with a shaly sandy calcareous matrix. Approaches poor iron formation. Not sampled.															
					⅛ - ½" R ¼ - 2" I									30% irregular patches of red jasper with minor maroon jasper.	48		13'		2290			
					⅛ - ½" ⅛ - 2" R			⅛ - ¼ R			1 - 2" R I			Few sandy calcareous bands.								
					⅛ - ⅛" ⅛ - 3" I			⅛ - ¼"			⅛ - 2" R I			Some sandy calcareous bands & lenses from ¼" to 2" thick. Bands weathered out in irregular patches	26		10'		2289			
															15		10'		2190			
															5							
														Lowest most iron band below main iron zone. Fine grained calcareous shale with widely scattered grains of dolomite about ⅛" in diameter. W.S. & F.S. - dark brown								

GEO - 23 - 2 - CR (6/63)


CHEST EXPLORATION LIMITED
IRON ROCK LOG CHART
ROCK TYPES
% HEMATITE
SILICEOUS WASTE TYPES
HEMLETS

1395

1395

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 134-63
DESCRIBED BY Gibbins & Folinsbee
MEASURED BY Gibbins & Folinsbee
AIR PHOTO No A-12148-FL(10)-181
AREA West Side of Gypsum Creek.
WEATHER Sunny, light summer breezes.

DATE STARTED July 12 1963
DATE COMPLETED July 12 1963
MEASURING RATE 420' / 6 hrs.
COORDINATES 92,400E 117,200N
CLAIM N-10

091597

ROCK TYPES

IRON FORMATION | SILTSTONE
JASPER | SHALE
CONGLOMERATE | LIMESTONE
BRECCIA | ARGILLITE
SANDSTONE | GRAVEL

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON SHALE
MAROON SHALE & JASPER

VEINLETS

QUARTZ Q
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR i.e. Even boundary between Jasper and Hematite
I - IRREGULAR i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 7
DATE July 12 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT TEXTURE	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	%	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	%	BANDS: AMT and COMP	BANDS: THICK RANGE	%	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0-40														Conglomerate - 60% 1" to ½" fragments green & dark brown shale & conglomerate (e.g. angular 1" to 6" x ½" to 2" rounded dolomite, limestone & sandstone) matrix is a maroon hematite shale								
0-10			TR	⅛-⅜ ¼-½ R							½-1½ R			Banded iron formation 5% ± fine hematite - trace of carbonate in lenses 2-3" 50 cc	0-9		9		1770			
10-20														Shaly maroon brown sandstone - slightly calcareous, thin regular bedding on weathered surface which is also lighter colored.	9-19		10		1771			
20-30				⅛-¾" ¼-⅝" I										Iron formation - top ½ contains most of the bands - lenses grade into irregular streaks	19-27.5		8.5		1772			
30-40														South side along ridge.	27.5-33		6		1774			
														Iron sandstone (2-3 mm) angular grains of red jasper, hematite calcite & shale - unit is 35% regular bands (1-3") of red jasper	33-41		8	W.S.				
40-50														Conglomerate similar to (-20 to -2) but includes regular bands 3"-1' of maroon shale - mainly hematite 6" vs	41-49		8		1775			
50-60																						
60-70																						
70-80																						
80-90																						
90-100														Maroon hematitic shaley sandstone - calcareous - thin regular bedding.	90-96.5		6.5					
100-110				⅛-½ ¼-1½ R	⅛-⅜ R ¼-4" I					¼-2" R				Brown carbonate in most of the lenses	96.5-102		10					
110-120			TR							¼-2" R				Banded iron formation 2% 140	102-113.5		11.5					
														Maroon hematitic shale & red jasper bands (30%)	113.5-122		8.5					
														Maroon hematitic shale.								
										⅛-3" R				Banded iron - mostly jasper								
										¼-1½ R				Banded jasper								
														Maroon hematitic shale to conglomeratic shale contains bands of red jasper ½-2" thick	122-132		10					
			TR							¼-1½ R				Host waste is red jasper ovoids - a few have hematite & carbonate cores trace of brown carbonate (½" irregular bands)								
				¼-½ ¼-1 R						¼-2" R				Banded iron formation 3-4' of medium brown conglomeratic shale at 129.5'	132-142		10					
															142-146		4					
														Reddish-maroon & green shale w.s. light brown	146-147		1					
140-150			TR	¼-½ R ⅛-6" R						⅛-1" R				Many regular to irregular lenses of red jasper & brown carbonate. Banded iron formation. Brown carbonate lenses & bands - a few are brown carbonate lenses	147-157		10					
150-160				⅛-1" ¼-5" R						⅛-⅜" 1-3" R					157-167		10					
														Jasper								
				⅛-½ ¼-1½ R						¼-½ R				Hematite or carbonate in a seam at the lenses & breaks 9-8 at coarse brown shale at 183.0	167-177		10.5					
														Conglomeratic shale and low grade maroon hematite & jasper.	177-179.5		2.5					
170-180														Sandy maroon shale to calcareous grey green very fine sandstone, thin (⅛") bedding cleavage	179.5-185.5		6					
180-190				⅛-⅜ ¼-2" R	⅛-¼ 1-10" R					¼-2" I				Light brown carbonate bands in iron formation - high in maroon hematite	185.5-196		10					
190-200															196-201		5					
														F.S. maroon shale - trace of small (<2 mm) black to dark green fragments W.S. light brown	201-203.5		2.5					
				⅛-1 ½-8	⅛-1" R					¼-1" I				Large lenses (½ x 3') of carbonate.	203.5-212		8.5					
210-220															212-215.5		4					
														F.S. maroon conglomerate. Fragments subangular 1-2 mm of rock.	215.5-226		10.5					
220-230				⅛-½ ¼-½ I	⅛-¼ R					⅛-4 R				Some of the lenses and ovoids have carbonate centers.								
														Clastic iron formation slightly calcareous fragments 1-2 mm composed of red jasper & carbonate occasional fragments to ½ in. shale and carbonate	226-232		1		1751			
230-240			TR	⅛-½ R ¼-1 R	⅛-½ R					¼-3 R					232-234		2		1752			
															234-240.5		2.5					
														Clastic iron formation, fragments red jasper	240.5-241.5		1		1753			
														Conglomerate w.s. brown F.S. maroon, fragments subangular to round, make up 60% of rock, composed of shales carbonates, red jasper & some maroon hematite. Matrix calcareous maroon shale jasper fragments to ¾ ft.	241.5-251.5		10		1754			
250-260															251.5-264		12		1755			
				⅛-¾ ¼-2" R	⅛-¼ R					⅛-2 R				Some carbonate in the lenses.	264-272.5		8.5		1756			
				⅛-1 ¼-4	⅛-1" R										272.5-276.5		4		1757			
270-280														Shale to siltstone F.S. maroon W.S. brown gray slightly calcareous	276.5-280		3.5		1758			
				⅛-⅛ ¼-½ R	⅛-¼ R										280-288		8		1759			
280-290														Conglomerate w.s. gray fragments (1 mm-3") ; sub-angular to rounded shales, cherts matrix maroon shale jasper, bedding F.S. maroon this bed pinches and swells (1-3 ft) and is discordant under a covered interval, runs for at least 250 ft enclosed	288-290		10		1760			
290-300															290-300		10		1761			
300-310														At 315 ft there is a discontinuous band 1 ft wide of jasper W.S. light brown F.S. maroon shale. The shale & jasper are in band ¼" thick, that pinches & swells and does not follow the bedding.	300-310		10		1762			
															310-319		9		1763			
310-320				⅛-½ ¼-3	⅛-½ R					½-5" I					319-328		9		1764			
				⅛-½ ¼-2	⅛-¼ R					25% bands ¼-½ R				Some carbonate in lenses have been leached out.								
320-330															328-338		10		1764			
															338-348		10		1765			
340-350			TR	TR	⅛-¼ ¼-4" R					⅛-4" R					348-358				1766			
				¼-¼ ⅛-½ R						⅛-¼ R				Carbonate in ovoid centers.	358-367		9		1767			
350-360														Hematitic shale w.s. gray F.S. maroon	367-369		2		1768			
														Waste is carbonate bands & sand included with hematite	369-376		3		1769			
														Hematitic shale								
360-370														Maroon shale								
370-380																						
380-390																						
390-400																						
400-410														F.S. maroon conglomerate fragments rounded to sub angular shales 80% of rock. Matrix maroon shale.								
410-420																						

1396

GREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 135 - 63
DESCRIBED BY GIBBINS & GORVEATT
MEASURED BY GIBBINS & GORVEATT
AIR PHOTO No A12148 - 180 FL 11(2)
AREA 1½ MILES NE of CAMP
WEATHER RAIN - INTERMITTANT SNOW

DATE STARTED AUG 3/63
DATE COMPLETED AUG 3/63
MEASURING RATE 7 hrs.
COORDINATES 83,700 E, 110,900 N
CLAIM K-13

ROCK TYPES

Ovoids: ○ ○
Aligned Lenses: ⬭ ⬭
Unaligned Lenses: ⬭
Bands: ▬

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE AUGUST 3, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0-10															CONGLOMERATE - FRAGMENTS (15%) (¼" - 4") SUBANGULAR TO SUBROUNDED, PEBBLES MAINLY JASPER, MOSTLY RED JASPER, ALSO QUARTZITE & SHALE, ETC CALCAREOUS MATRIX								
10-20															THIN LAMINATED GREEN & BROWN SILTSTONE								
20-30															CONGLOMERATE (15%) DARK BROWN SHALE								
30-40																							
40-50																							
50-60																							
60-70																							
70-80																							
80-90																							
90-100																							
100-110																							
110-120																							
120-130																							
130-140																							
140-150																							
150-160																							
160-170																							
170-180																							
180-190																							
190-200																							
200-210																							
210-220																							
220-230																							

All this could be uncovered.

Hematitic conglomeratic, sandy, shale (15% sandy) (10% Carb.) small x'stals of pyrite? (trace of sulphide)

Brown shale, red particles of brown carbonate (¼ - 1") matrix - sandy maroon shale, slightly hematitic. Est. purple tending to have tarnished appearance.

Hematitic conglomerate - fragments (10%) (¼" - 1") subangular. Pebbles green shale, carbonate, quartz. Matrix - maroon hematitic shale. Becomes more hematitic towards the end of interval.

Sandy (25%) dark brown shale

Marker sandstone w3 - brown - gray e3 - gray with purple patches medium → coarse grained, subrounded grains, bedding plane cleavage (¼" - ½") top of interval bedding poor tending to be massive.

Brown shale w3 - dark brown e3 - dark brown → purple, tending to be massive. Ont calcareous.

Conglomerate, dark brown → maroon fragments (40%) (¼" - 6") subangular → subrounded, pebbles mainly jasper, dolomite, sandstone etc. matrix - maroon shale (25%) → ferruginous. Also large lenses of jasper (some of the jasper occurs in irregular patches about 20% beds along strike are irregularly folded horizontal to vertical position.

Conglomerate fragments (15%), (¼" - 3") subangular to rounded. Pebbles mainly quartz, green shale & limestone matrix, dark brown shale

Maroon sandstone

Conglomerate fragments (15%), (¼" - 4") angular to subrounded - include light green shale & limestone matrix, dark brown shale

Banded iron formation

Massive dark maroon brown shale

Conglomerate fragments (15%), (¼" - 3") subangular to rounded. Pebbles mainly limestone, green shale, quartz. Also a band of (1'6" - 3') consisting of red lenses.

Sandy (25%) dark brown shale

Banded iron formation

Maroon sandstone w3 - brown - gray e3 - gray with purple patches medium → coarse grained, subrounded grains, bedding plane cleavage (¼" - ½") top of internal bedding poor tending to be massive.

Brown shale w3 - dark brown e3 - dark brown → purple, tending to be massive. Ont calcareous.

Conglomerate, dark brown → maroon fragments (40%) (¼" - 6") subangular → subrounded, pebbles mainly jasper, dolomite, sandstone etc. matrix - maroon shale (25%) → ferruginous. Also large lenses of jasper (some of the jasper occurs in irregular patches about 20% beds along strike are irregularly folded horizontal to vertical position.

Hematitic conglomerate - fragments (10%) (¼" - 1") subangular. Pebbles green shale, carbonate, quartz. Matrix - maroon hematitic shale. Becomes more hematitic towards the end of interval.

Conglomerate fragments (15%), (¼" - 3") subangular to rounded. Pebbles mainly limestone, green shale, quartz. Also a band of (1'6" - 3') consisting of red lenses.

Banded iron formation

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 136-03
DESCRIBED BY R BRAY & W GIBBINS
MEASURED BY A GORVEATT
AIR PHOTO No A 12148 (12[1]) - 213
AREA EAST SIDE - Gypsum BLUFF CREEK
WEATHER POOR - RAINY

DATE STARTED JULY 18, 1963
DATE COMPLETED JULY 30, 1963
MEASURING RATE 5 HRS.
COORDINATES 114 - 300 N
CLAIM U - 11

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
VARIOUS JASPER
MICRO-CRYSTALLINE QUARTZ

VEINLETS

QUARTZ	Q
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125°, 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE JULY 18, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: %	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: %	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: CONT.	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															MASSIVE, POORLY BEDDED CONGLOMERATE. 75% WELL ROUNDED TO SUB ANGULAR PEBBLES OF SILTSTONE, DOLOMITE, SHALE & QUARTZITE. FROM 1/8" to 1" DIAMETER. MATRIX CALCAREOUS, SANDY SHALE. W.S. GREEN, BROWN. F.S. GY. GREEN.								
10															NON-CALCAREOUS, VERY CRUMBLY LIGHT BROWN SHALE. WEATHERED F.S. GREEN TO BROWN.								
			TR		1/8"-1/4" 1/8"-1"	R					1/4"-2"	R I			25% RED & MAROON JASPER IN IRREG. PATCHES. MAROON HEMATITE SHALEY IN PLACES.	1		4.5'		2791			
															DARK BROWN, NON-CALCAREOUS SHALE. WEATHERED. GRADES FROM SANDY TO FINE-GRAINED.	4.5 / 6.5		2.0'					
20															AS ABOVE. VERY CRUMBLY.	11.8 / 15.0		3.5'		2794			
															AS ABOVE	15.5 / 19.2		3.5'		2795			
			TR		1/16"-1/8" 1/8"-1/2"	R					1/8"-1"	R I	8"		15% of RED & MAROON JASPER IN IRREGULAR PATCHES. MANY IRREG. LENSES & PATCHES CARBONATE (LIMONITE or SIDERITE?).	19.2 / 23.2		10.0'		2792			
30																32.2		10.0'		2793			
																33.2		10.5'		2796			
40															MANY IRREG. PATCHES & LENSES OF CARBONATE (LIMONITE)	43.7 / 55.7		12.0'		2796			
50															SANDY, DARK BROWN SHALE. TRACE LIT JASPER BANDS, 1" WIDE	57.7		4.0'		2797			
			TR								1/4"-1"	I			LOW-GRADE IRON THICK SHALY CLEAVAGE	61.7 / 71.7		10.0'		2798			
60			TR												LOW GRADE IRON FORMATION	74.2		2.5'					
															DARK BROWN SHALE W.S. GREEN TO DARK GREEN	75.2 / 76.2		1.0'		2935			
																77.2		6.0'		2936			
70															DARK BROWN SHALE, MAROON HEMATITE CONTENT INC AT TOP & BOTTOM	79.2		2.5'		2937			
															RESISTANT JASPER BAND	81.7		1.0'		2938			
											1/8"-1/2"	I			STREAKS OF RED & MAROON TENDING TO BECOME IRREGULAR	82.7		5.0'		2939			
80															DARK MAROON SHALE - SANDY BITS TO CONGLOMERATIC <5%	87.7		2.0'		2940			
															CONGLOMERATE AT 89.0'								
90															CONGLOMERATE (GREYISH TO GREENISH SHALE) BOX FRAGMENTS OF SHS ANGULAR TO SUB ROUND DARK BROWN & GREEN SHALE, WHITE QUARTZ, RED JASPER & WHITE & GREEN CALCAREOUS SANDSTONE. ALSO LIGHT REDDISH BROWN QUARTZ. MATRIX VERY CALCAREOUS LIGHT BROWN SHALE	89.2		7.5'		2941			
100																							
110																							
120																							
130																							
140																							
150																							
160																							
170																							
180																							
190																							
200																							
210																							
220															FRACES OF DARK BROWN SHALE MATRIX								
230																							
240																							
250															IRREG. STREAKS & PATCHES OF RED & MAROON JASPER CONTAINING "E" OF SILICEOUS WASTE	240		9		2942			
															SLICKER SIDE COMMON ALONG STRIKE								
															FAULT (?)	249		10		2943			
260																							
															FRACES OF SHALE MATRIX	257		8		2944			
270																							
280																							
290																							
300																							
310															CONGLOMERATIC BOX FRAGMENTS UP TO 1/2 DIAMETER. BROWN SHALE MATRIX								
320																							

1397

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 137-63
DESCRIBED BY GIBBINS
MEASURED BY PFAFF
AIR PHOTO No A 12148 - FL (11)" - 63
AREA Headwaters Bluebird Creek
WEATHER Rainy, windy/Cloudy, Cold

DATE STARTED July 18, 1963.
DATE COMPLETED August 15, 1963.
MEASURING RATE 10 hours for 337'
COORDINATES 114, 300N 92A00E
CLAIM A2-12

ROCK TYPES -

IRON FORMATION | SILTSTONE
ANDESITE | SHALE
CONGLOMERATE | LIMESTONE
BRECCIA | DOLOMITE
SANDSTONE | COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED ANDESITE
MAROON ANDESITE
MINERALIZATION QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FELS F
MANY M

BOUNDARIES R - REGULAR - i.e Even boundary between Jasper and Hematite
I - IRREGULAR - i.e Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES ...
FRACTURING
ACCESSORIES - Circle, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict Texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous Waste

PAGE 1 OF 2
DATE July 18, 1963

INTERVAL	FOOTAGE	% HEMATITE	% RELICT TEXTURES	BANDS AND LENSES: SIZE RANGE	BANDS AND LENSES: AMT COMP	BANDS AND LENSES: THICK RANGE	BANDS AND LENSES: AMT COMP	VEINLETS: NO/FT	VEINLETS: BANDS THICK RANGE	VEINLETS: BANDS AMT COMP	REMARKS	CRUDE ANALYSIS: ITEM	CRUDE ANALYSIS: No	CRUDE ANALYSIS: PCT	CRUDE ANALYSIS: SAMPLE No	CRUDE ANALYSIS: Fe %	CRUDE ANALYSIS: P %
0											Conglomerate : Maroon shale						
10																	
20																	
30																	

091697

GREAT EXPLORATION LIMITED
IRON ROCK LOG CHART

SECTION No. 17 (CM 40)
RECORDED BY C.Green
MEASURED BY C.Green
ALL POINTS TO N. (Lamb-N.1927) - Mercator
DATE DRILLED Discovery 1964

DATE STARTED June 17, 1968
DATE COMPLETED Nov. 14, 1968
MEASURING NOTE Top Ex./Gr.Sur.
COORDINATES 18,948 N. & 6,240 E.

ELEVATION 1,140

MATERIAL Fresh - Rock / Weathered Cover

ROCK TYPES

GNEISS		SCHIST	
SEDIMENTARY (Ore Zone)		QUARTZITE	
SEDIMENTARY (Waste)		LIMESTONE	
IGNEOUS		CLAYSTONE	
		SANDSTONE	
		CONGLOMERATE	

% HEMATITE

COLL. ORE GRADE %	
MARTITE-GOETHITE	
MAGNETITE	

SILICEOUS WASTE TYPES

RICH QUARTZ	
MARTITE-QUARTZ	
MEDIUM TO LEAN	

VEINLETS

QUARTZ	
LIMONITE	
CALCITE	
PYRITE	
MICA	

BOUNDARIES: R - REGULAR ; I - Ill-Boundary between Ocean and Martite
IRREGULAR ; U - Unsure Boundary between Ocean and Martite

TENORS:
- ORIGINAL STRIKE DIP
- MEASURED LINE
- INDICATED LINE
- VALLEY OR GULLY
- FAULT LINE
- FOLIATIONS
- SLICKENSIDES - Cache, Diamond, Tubular, etc.
- LARGE COLLECTED SAMPLES

NOTE: Percent with Micro Values measured WT% to right as percent of Total Elements
Percent Oxides, Lenses, Aligned Lenses and Bands measured WT% to left as percent of Total Siliceous Matrix

PAGE 1 OF 22

DATE Aug. 18, 1969

| DEPTHS | STRUCTURE | % TENORS | REMARKS | ORE/WASTE CONTACTS | BOUNDARIES | BANDS | | |

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No IF 139 - 63
DESCRIBED BY GIBBINS
MEASURED BY BRAY
AIR PHOTO No A 12148 - (11(8)) - 183
AREA 2 miles NE of CAMP
WEATHER 3/10 Cloud, Sunny, Windy

DATE STARTED AUG. 8, 1963
DATE COMPLETED AUG. 8, 1963
MEASURING RATE 206'/8 hr.
COORDINATES 112, 400N, 83, 800E
CLAIM L - 12

ROCK TYPES

OVOIDS : o o
UNALIGNED LENSES : ⬭
ALIGNED LENSES : ⬭⬭
BANDS : ═

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES : R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS : BEDDING STRIKE / DIP eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE AUG. 8, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER. DATA: LEN RUN	ENGINEER. DATA: No. RUNS	ENGINEER. DATA: FT REC.	ENGINEER. DATA: % REC.	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															Section Measured Down								
0															Dark Brown Shale								
0															Jasperoid Iron Formation - Irregular Streaks of Red & Maroon Jasper								
0															Some fairly large Voids Tend to become Lenses			1'		1951			
																		9.5		1952			
10															Sandstone Matrix: Fine to Coarse Grained. Dark Brown Shale Matrix			5.5		1953			
															A Few Lenses of Red Jasper. Most 2"x8" - One 2'x6".								
															16-18 = 24-26 Banded IF								
20															18-24 Nodular IF			10'		1954			
															Nodular Iron Formation								
30															12.5% Red Jasper Patches			8'		1955			
															Banded Iron Formation								
															Most 1-5mm - Green Shales, Clear Quartz & Abund of Fe			1.5'		1956			
																		7.5'		1957			
															Conglomerate with Dark Brown Shale Matrix			4'		1958			
40					Conglomerate Dark Brown Shale Fragments (¼"-10") (Ave. ~6") Angular to Rounded																			
					Some ovoids have inner rings & bands of Ex-like Hematite.													9'		1959			
50					3" of Conglomerate at 52.0' a Max of 55.0'																			
					Most of the Jasper is regular but Tending to become Irregular.													10'		1960			
60					37% Red Jasper & Quartz Patches Mostly round 1/16-3/8 Diameter.																			
					Hematite is a fine crystalline variety.													10		1961			
70					SG N MN OVOIDS have Ex maroon hematite boundary													10'		1962			
					First 6.0' is Largely Lenses to patches of Red Jasper. Many have fine white Acicular Quartz borders													12.5		1963			
80																							
90																		6.5		1964			
					Marker? Sandstone - Medium to very Coarse Grained - Brown Shale Matrix with many of the grains being light green shale - Faint suggestion of regular even bedding - Exact shown by bedding plane cleavage along certain weathered horizons													8.0		1965			
100					Most of Ex Jasper from 101.5' - 104.0																			
					Dark green sub-brown Sandstone - Medium to coarse grained - Shale Matrix													8.0		1966			
110																		6.0		1967			
					Many of the irregular Maroon Jasper bands & lenses have thin borders of red Jasper.													10'		1968			
120																		9.0'		1969			
130					IRREGULAR SUB-UNIT OF CONGLOMERATE 10-15% Clastics													5.0'		1970			
					Conglomerate Fragments (¼"-8") (¼ x ¼ - 2' x 2') Sub rounded to Rounded, Inclusions mainly Maroon Hematite & Red Jasper - Very coarse granite, Medium grained Quartz, Rarely Sandstone, Quartzite, Flakes of altered iron formation - Matrix is a Hematitic Chert & Brown Shale													5.0'		1971			
140																		10.0'		1972			
150					Quartz and/or Hematite Centers in Voids. Some very thick Maroon Hematite to Maroon Jasper bands grading to irregular patches of red & Maroon Jasper.													8.0'		1973			
160					Very Irregular bands of Jasper.																			
170																							
180					Conglomeratic (Lens) - Maroon Hematite Shale																			
					Pebbles up to 2" (Quartzite, Shale, etc.) Also Quartz - Jasper Patches ⅛ - ¾" Diameter													5.0'		1974			
190																		10.0'		1975			
																		10.0		3451			
200																							
					Shale & Jasperoid Iron Formation													4.0'		3452			
																		1.0'		3453			
210																							
220																							
230																							
240																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-147-63
DESCRIBED BY A. Gorrealt
MEASURED BY D. Pfaff
AIR PHOTO No. A 12106-(47)-315
AREA East of Discovery Creek
WEATHER Sunny

DATE STARTED August 7/63
DATE COMPLETED August 7/63
MEASURING RATE 100'/HR.
COORDINATES 111,880 N, 148,100 E
CLAIM II-12

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 2
DATE August 9 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BLND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BLND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BLND	VEINLETS	REMARKS	ENGINEER. DATA LEN RUN	ENGINEER. DATA No RUNS	ENGINEER. DATA FT REC	ENGINEER. DATA % REC	GRADE ANALYSIS SAM No	GRADE ANALYSIS Fe	GRADE ANALYSIS SiO_2	GRADE ANALYSIS P
0-10															Light brown sandy overburden (w.c.) fragments - 25% (1 cm - 5 cm) Rounded quartzite, siliceous pebbles Accessories: sandstone, etc. Hematite sandstone, calcareous			4'	1509			
															Shale (w.s.) light brown to maroon, massive and non-calcareous Sp. green shale bands, bedding (a = 1/4")								
															Poor iron. Occasional small patches of red jasper & carbonate At top of interval there is a band (2") of aligned lenses Shale is infilled jasper bands (1/4" - 1/2")			3'	1510			
											¼-½ E	½-2" E			Bands are irregular banding to patches. Bear from formation								
10															Ferruginous sandstone Blue to coarse grained Wt. gold to warm (1 to 1½ hardness to brown Calcareous & magnetic Near the top of the sandstone it seems to be quite hematitic			10'	1511			
20					Same as above, but more distinct bedding planes (≥ 1/4")													9.5	1512				
30					Hematitic conglomerate - reddish brown Fragments are coarse grained, down to a coarse grained sandstone Fragments are angular to sub-angular Matrix is hematitic vein jasper													2.0'	1224				
40					Covered interval consists of rubble basically sandstone																		
50																							
60																							
70																							
80																							
90																							
100																							
110																							
120																							
130																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-155-63 — DATE STARTED August 11/63
DESCRIBED BY A. Gorrealt — DATE COMPLETED August 11/63
MEASURED BY D. Pfaff — MEASURING RATE 150'/3 hrs.
AIR PHOTO No. A 12106-(14³)-315 — COORDINATES 115,000 N; 148,600 E
AREA West of Discovery Creek — CLAIM II-11
WEATHER Foggy later on sunny

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
- BEDDING STRIKE / DIP — eg 125°/25°W
- FAULT STRIKE / DIP — eg 125°/25°E
- BRECCIATED ZONE
- HALOS OF JASPER
- SPHERULITES
- FRACTURING
- ACCESSORIES - Calcite, Dolomite, Siderite, etc
- LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Aug. 11, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
															Quartzite is 300' above IF — Bedding strike/dip 90°/11° S								
-5															Conglomerate is light brown → gray. Fragments 30% - ¼"-4". Subangular, subrounded & well sorted. Pebbles: carbonate & quartzite. Matrix - maroon shale. Base: shale, grading to gray-maroon shale. A thin band of conglomerate								
0															Hematitic maroon shale. Large bands of red & maroon jasper (½-3") (Small bands of maroon hematite - ¼") Lenses & streaks of red jasper			5'	152[illegible]				
10															Ferruginous Conglomerate (Gray-brown → maroon) fragments (20%), ⅛-2". Angular → subrounded. Pebbles - red jasper, carbonate, sandstone, etc. Matrix - calc. sandy shale. Grades into a coarse-grained sandstone.			3'	152[illegible]				
20																							
30															Ferruginous cherty, poor IF. Waste is due to irregular patches of red jasper								
															Jaspilite hematite - with bands of shale ½-2			6'	152[illegible]				
40															Sandstone - W.S - Dark Brown → gray. Medium, coarse grained & calcareous. Bedding ½°-2°			10'	152[illegible]				
50															Sample 44-48 - Ferruginous coarse grained sandstone. Sample 48-57.5 - Calcareous & banding with bands of jasper			10'	152[illegible]				
60															Red jasper borders on maroon bands which is severe			3.5'	152[illegible]				
															Green shale - wet: light brown, F.S. green → dark green. 25% of waste in irreg. patches of jasper. Trace of carbonate			5'	152[illegible]				
																		1.5'	152[illegible]				
																		3'	153[illegible]				
70															Some carbonate			9'	153[illegible]				
80															Hematitic conglomerate - very fine, almost approaching a coarse sandstone. Fragments 50% diameter - 4 mm. Pebbles: carbonate, hematite jasper mainly. Matrix - sandstone, slightly calcareous. Base of unit is poor iron formation with one ring component being water bedded. Also a large carbonate pebble (3" by 6")			5.5'	153[illegible]				
90																							
100															25% waste in irreg streaks & patches of red & maroon jasper			3.5'	153[illegible]				
															Conglomerate - dark grey. Fragments (10%) subangular & subrounded (⅛-2"). Pebbles - green shale, red jasper, carbonate & sandstone. Matrix - grey calcareous sand stone. Also about 6' of I.F.			3.5'	155[illegible]				
110															Begins as I.F. = 6", exposed under the conglomerate (101.5-105.0)								
120															Conglomerate - dark brown. Fragments (40%) subrounded to rounded ½" & 2". Pebbles: mainly quartzite & carbonate. Matrix - dark brown, fine grained calcareous sand stone.			3.5'	155[illegible]				
															15% of waste is in irreg. patches of red & maroon jasper			10'	155[illegible]				
130																							
140															Ferruginous sandstone, grades from a coarse grained to a fine grained type. Also if present made, hematitic tends to be banded with a cherty appearance. Also poor I.F.			10'	155[illegible]				
150															Poor jasperoid iron F[illegible] 15% Waste is due to large irreg. patches of red jasper. Also 25% Carbonate & red jasper lenses (aligned)			5.5'	155[illegible]				
160															Hematitic conglomerate - Maroon → metallic. Fragments 25% (¼-6"). Angular → subrounded. Pebbles (quartzite): Pebbles are quartzite, carbonate, & Matrix: Ferruginous, calcareous, maroon shale.								
170																							
180																							
190															Conglomerate - maroon. Fragments (20%) (¼-1"). Pebbles: carbonate & green shale. Matrix - maroon shale (calcareous)								
200																							
210																							
220																							
230																							
240															Conglomeratic shale, grading into a conglomerate with a maroon shale matrix								
250																							
260																							
270																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-156-63 — DATE STARTED August 12/63

DESCRIBED BY A. Gaucrault — DATE COMPLETED August 12/63

MEASURED BY D. Platt — MEASURING RATE 140'/4 hrs.

AIR PHOTO No. A18884-(14")-315 — COORDINATES 117,200 N; 144,200 E

AREA West of Discovery Creek — CLAIM II-10

WEATHER Sunny, windy

ROCK TYPES

IRON FORMATION; JASPER; CONGLOMERATE; BRECCIA; SANDSTONE; SILTSTONE; SHALE; LIMESTONE; DOLOMITE; COVERED

% HEMATITE

STEEL GREY HEMATITE; MAROON HEMATITE; BOTH

SILICEOUS WASTE TYPES

RED JASPER; MAROON JASPER; MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S; CARBONATE C; HEMATITE H; FEW F; MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite

I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/25°W; FAULT STRIKE / DIP eg 125°/25°E; BRECCIATED ZONE; HALOS OF JASPER; SPHERULITES; FRACTURING; ACCESSORIES - Calcite, Dolomite, Siderite, etc; LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite

Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous Waste

PAGE 1 OF 3

DATE Aug. 12, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	% OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No. RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC.	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															Section Measured Down. Crumbly, ferruginous maroon shale - Grades into a hematitic, conglomeratic maroon shale - Pebbles of jasper, green shale, etc. Medium grained sandstone - Dark grey, massive & slightly calcareous iron and green shales?? N.B. Quartz vein outcrops (10' above the first iron formation. Strike/dip 90°/vert S																
10															Iron shale formation - waste due to bands (1/16"-1") of jasper and ferruginous shale.	4.5		1.5	33	1532			
															Green shale, giving to a maroon shale - Non-calcareous.	9.5							
	Breccia														Light brown conglomerate - Fragments (20%), (1/16"-3") angular to sub-rounded consisting of green shale, carbonate, red jasper, etc. Matrix is shale - green and maroon bands (non-calcareous)		12			1533			
															1/4" slightly calcareous maroon shale.								
															Conglomerate - Light brown. Fragments (1/8"-2") Sub-angular to sub-rounded consisting of Carbonate, green shale etc. Matrix - Calcareous maroon shale.	12.5							
20															Bands appear to be patchy and, coarse interval difficult to measure strat. dip. Strike 165° mag. No or near outcrops. Slight folding??								
																20							
30															Jasperoid iron formation - Bands of jasper contain small lenses (1/16"-1/8" by 1/4"-1/2"). Also interbedded sandstone.	23	5			1534			
															Grey sandstone - medium to coarse grained. Bedding plane at top (1/4"-1/2") grading into a massive sandstone - slightly calcareous.		10			1535			
40																43							
															Ferruginous sandstone - Appears as small pebble conglomerate with pebbles of hematite & jasper. This grades from the sandstone above. Has bands of red jasperite & calcareous.		10			1536			
																53							
															Same as above - grades into a maroon jaspéroid iron formation		5			1537			
60															35% of waste occurs in irregular patches of red Jasper. Also a thin band (4") of green shale. Maroon lenses have main red jasper borders.	58	10			1538			
70															Red lenses have light colored borders.	68	9			1539			
																77							
80															Conglomeratic (sandy) sandstone - Calcareous - Particles basically red jasper, some hematite and carbonate. One place pebbles up to 2" (carbonate)	81	4			1540			
															Lens of hematite (3" by 1/4") in a red jasper band. Slickensides found near 81 but not in place! Slickens occurs along strike.	83.5	2.5			1541			
90																91							
																	7.5			1542			
100															Conglomerate - Small pebbles - Fragments 25% sub-angular to rounded Matrix - ? green shale, calcareous Also jasper lenses and ?? conglomerate lenses (up to 3") Also jasper bands (3-6") carbonate weathering in the interval	98.5	2.5			1543			
																101	10.5			1544			
110																111.5							
															Ferruginous shale - Weathered surface dark brown. Fresh surface grey - Bedding (1/8"-1/4") to massive calcareous - Also thin bands Jasperoid iron formation		5			1545			
															Conglomerate (massive) Fragments (30%) Sub-rounded and a narrow (1/2"-2") conglomerate 95' Shales, carbonate & quartzite.	116.5							
															Shaly iron formation - A lot of jasper mixed waste is jasper and ferruginous shales - Also large pyroxenite Analysis at 124.5?? - Formation is badly fractured.		10			1546			
130															Conglomerate (hematitic) Maroon shale matrix - Beds are pinching and swelling	126.5	4.5			1547			
																131							
															25% of waste occurs as irregular patches of Jasper and carbonate Poor iron formation.		11.5			1548			
140																142.5							
150															Conglomerate - Ferruginous Fragments (15%) (1"-5") Sub-angular to sub-rounded. Pebbles - green shale, red jasper, carbonate, etc. Matrix - hematitic maroon shale - calcareous								
															Measuring down from Conglomerate at 142.5'								
															Conglomerate found to approximately 212' AT 212' - small band of Jasperoid iron formation. (2" exposed) - Stringer band.								
															Below Iron Formation - Large ash grey conglomerate: Fragments (15%) (1"-3") sub rounded to rounded Pebbles:- carbonate, quartzite, jasper but mostly a green shale of maroon?? Matrix - sandy, calcareous, shale.								

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-157-63 — DATE STARTED August 11/63

DESCRIBED BY G. Sutherland — DATE COMPLETED August 12/63

MEASURED BY G. Sutherland — MEASURING RATE 50'/hr.

AIR PHOTO No. A 12106 - (FL 14³) - 315 — COORDINATES 111,200 N; 138,700 E

AREA Head waters Discovery Creek — CLAIM FF-12

WEATHER 2/10 Cloud light breeze

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite

I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:

BEDDING STRIKE / DIP	eg 125°/ 25° W
FAULT STRIKE / DIP	eg 125°/ 25° E
BRECCIATED ZONE	·.·.·.·
HALOS OF JASPER	▭
SPHERULITES	• • •
FRACTURING	
ACCESSORIES - Calcite, Dolomite, Siderite, etc	
LARGE ISOLATED LENSES	

NOTE: Percent with Relict texture measured left to right as percent of total Hematite

Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Aug 12, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
Overburden 30 FT															Drift: calcareous, conglomerate, pebbles up to 2" dia. fragments are subangular to subround. 40% jasper. Bedrock: Sericite, dolomite, shale, quartzite, & some gneiss (float). Bedrock is brown shale.								
0																							
															At 5' there is a 4" band of fine. Shale. Strike 112° Dip 20° S	0							
																2.5		2.5		2954			
															Upper: grits, marl, sandstone, calcareous.			10'		2955			
10																12.5							
																		10'		2956			
20																22.5							
																		10'		2957			
30															Hematitic conglomerate, calcareous, fragments are angular to subangular. Pieces up to 1" diam. Matrix is hematite. 20% waste in dolomite & siderite. 40% hematite	32.5							
																		10'		2958			
40																							
50					<⅛"	I	<⅛"	I	<¾"	I R					At 49' there is a 2" band of fine calcareous green conglomerate. Also at 52'	42.5		5.5'		2959			
															Argillaceous green siltstone. Pebbles are angular to subangular. Fragments are shale & dolomite. Pieces up to ¼" diam. 30% waste. Matrix is green shale.	48		3'		2960			
					<⅛"	R I	<½"	R I	<1"	I R					Patches and lenses are up to 2" long.	51							
60																		10'		2961			
																61							
70															Brown conglomerate, slightly calcareous. Pebbles up to 1" in dia. Fragments are angular to subround. Pieces are shale, quartzite, dolomite & chert. 15% breccia.			4'		2962			
																71							
																		5'		2963			
																76							
					<½"	R	<½"	R	<1"	I R								12'		2964			
80																							
																88		1'		2965			
																89							
90															Maroon shale, non calcareous			6.5'		2966			
					<1"	R I	<½"	R I	<1"	R					Lenses are up to 2" long.	95.5							
																		10'		2967			
100															Lower: green massive sandstone. Calcareous.								
																105.5							
																		10'		2968			
110																							
																115.5		5.5'		2969			
120					<¼"	R	<⅜"	R	<½"	R						120							
																		10.5'		2970			
130																							
															Brown siltstone, non calcareous	130.5		1.5'		2971			
					<⅜"	R	<⅜"	R	<½"	R					At 133 there is a 4" band of non-calcareous brown conglomerate	132							
																		3.5'		2972			
140																135.5							
															Brown conglomerate, calcareous, pebbles are round to subround. Fragments up to 6" dia. 50% pieces. Pebbles are shale, dolomite, quartzite, chert & jasper. Matrix is brown shale.			10'		2973			
150																145.5							
																		5'		2974			
																150.5							
					<½"	I R	<½"	I R	<2"	I R					Strike 110°, Dip 13° S								
160															Calcareous brown conglomerate. Pebbles are angular to subangular. Pieces up to 1". Pebbles are shale and dolomite. 30% pebbles. Matrix brown shale. Sample 155 - 160.5	155.5		8'		2975			
																158.5		1'		2976			
					<⅛"	R	<½"	R	<5"	R I					Drastic zone, weathered out on surface. Traces of pebbles up to 1" long.	159.5		3'		2977			
170															Argillaceous brown conglomerate. 30% pieces. Pebbles are round to subround. Fragments are up to 6" diam. Pebbles are jasper, shale, dolomite, quartzite. Matrix maroon shale. 175' is covered								
180																							
190																							
200																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-158-63 — DATE STARTED August 12/63
DESCRIBED BY G. Sutherland — DATE COMPLETED August 13/63
MEASURED BY G. Sutherland — MEASURING RATE 50'/hr
AIR PHOTO No. A 12106-(FL 14³)-315 — COORDINATES 113,500 N; 142,800 E
AREA Headwaters Discovery Creek — CLAIM GB-12
WEATHER Clear sky Light breeze

ROCK TYPES

IRON FORMATION; JASPER; CONGLOMERATE; BRECCIA; SANDSTONE; SILTSTONE; SHALE; LIMESTONE; DOLOMITE; COVERED

% HEMATITE

STEEL GREY HEMATITE; MAROON HEMATITE; BOTH

SILICEOUS WASTE TYPES

RED JASPER; MAROON JASPER; MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S; CARBONATE C; HEMATITE H; FEW F; MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE AUGUST 12, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: BOUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: BOUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: BOUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															OVERLYING BEDS OF 50 FT PLUS - BROWN CONGLOMERATE - SUB-ANGULAR TO SUB-ROUND PEBBLES UP TO 1 FT IN DIAMETER - SEDIMENTARY FRAGMENTS ARE CHERT, SHALE, DOLOMITE, QUARTZITE - MATRIX BROWN SHALE	0							
4											L½"	R	L3"	½	STRIKE 187° DIP 19°N	4		4		2976			
6															BROWN CALCAREOUS CONGLOMERATE, PEBBLES UP TO 3" IN DIAMETER - 40% PEBBLES, FRAGMENTS ROUND TO SUB-ROUND, MATRIX BROWN SHALE, GREEN CONGLOMERATE BAND UP TO 3"	4		2		2979			
10																							
20																							
26															BROWN SHALE NON-CALCAREOUS	26		2		2980			
28															VERY POOR IRON	28							
30					L1"	R					L5"	½	R		A 5" BAND OF CALCAREOUS BROWN SANDSTONE AT 33'			6		2981			
34															GREY BANDED CALCAREOUS SANDSTONE BANDS ARE MAROON SHALE FRESH SURFACE IS GREY WHILE WEATHERED SURFACE IS BROWN			8		2982			
43															FERRUGINOUS SANDSTONE CALCAREOUS PARTICLES OF DOLOMITE AND SIDERITE ARE WEATHERED OUT	43		10		2983			
53																53		6		2984			
59																59							
63															STRIKE 150° DIP 19°N UNALIGNED LENSES AND PATCHES ARE UP TO 3" LONG	63		10		2985			
73																73							
75					L1"	R		L½"	R		L3"	R/I						11.5		2986			
84.5																84.5							
90																							
94.5					L½"	R		L½"	R		L1"	R				94.5		5		2987			
99.5																99.5							
108															MAROON SHALE CALCAREOUS - 40% PEBBLES - A JASPER LENSE UP TO 6" THICK AT 118.5'	108		1		2988			
110					L2"	R		L½"	R		L2"	R/I			GREEN CONGLOMERATE - ½" DIA. - PEBBLES, MAROON SHALE, NON-CALCAREOUS, DOLOMITE - FINE GRAY SANDSTONE - GREEN MARKER SANDSTONE	108 110		1		2989			
118.5																118.5		8.5		2990			
120																120		13.5		2991			
128																128		8.5		2992			
136.5					L1"	R		L½"	R		L1"	R/I			STRIKE 153° DIP 23°N PATCHES ARE UP TO 2" LONG	136.5							
140																							
150															- CALCAREOUS MAROON CONGLOMERATE - 40% PEBBLES - PIECES ARE UP TO 3" IN DIAMETER - FRAGMENTS ARE ROUND TO SUB-ROUND - SHALE, CHERT, QUARTZITE, DOLOMITE, JASPER PEBBLES - MATRIX BROWN SHALE								
160																							
170																							
180																							
200																							
210																							
217															IRON AND JASPER LENSING FROM 6" TO 4'								
221																							

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF - 159 - 63
DESCRIBED BY G. Sutherland
MEASURED BY H. Klaassen
AIR PHOTO No. A 12106 - (FL. 147) - 315
AREA Headwaters Discovery Creek
WEATHER 2/10 Cloud Warm Light Breeze

DATE STARTED August 14/63
DATE COMPLETED August 14/63
MEASURING RATE 60'/hr
COORDINATES 113,200 N; 137,400 E
CLAIM

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3
DATE AUGUST 14

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															330 ft FROM TOP OF IRON TO BOTTOM OF THE QUARTZITE								
0															BROWN CALCAREOUS CONGLOMERATE								
															PEBBLES ARE QUARTZITE, SHALE, JASPER, DOLOMITE, CHERT, (IGNEOUS) DIORITE FRAGMENTS UP TO 2 FT. IN DIAMETER								
															40% COBBLES								
															SUB ROUND TO SUB ANGULAR								
															MATRIX BROWN SHALE								
10															GREY CALCAREOUS SANDSTONE								
															WEATHERED SURFACE IS BROWN WHILE FRESH SURFACE IS GREY								
0																0							
2.5					¼" R						< 2" R				AT 2' THERE IS A 1" BAND OF FERROUS SHALE STRIKE 135° DIP 4°S	2.5		2.5		2993			
5																							
10																		12		2994			
															GREEN MARKER SANDSTONE	14.5							
20															CALCAREOUS			12		2995			
																26.5							
30																		10		2996			
36.5															HEMATITIC CONGLOMERATE CALCAREOUS 40% HEMATITE	36.5							
37.5															SUB ANGULAR FRAGMENTS OF CHERT AND QUARTZITE UP TO ½" IN SUB ROUND MATRIX OF IRON SHALE AND DOLOMITE AND SIDERITE	37.5		1'		2997			
40																40							
															FOREIGN CALCAREOUS CONGLOMERATE PEBBLES ARE SHALE AND DOLOMITE SUB ROUND PIECES UP TO 2" IN DIAMETER			6		2998			
54																54							
57					< ½" I			< ½" I			< ½" I				Very poor shaly iron Pellets and lenses up to ½" long.	57		3		2999			
60																							
70																							
77.5																77.5							
					< ½" I R			< ½" R			< 2" I R				Lenses upto 3" Long. Strike 135° Dip 10°S			7.5		3000			
85																85							
90															GREEN MARKER SANDSTONE			10		3376			
															CALCAREOUS	96							
100																		10		3377			
																105							
110															Brown siltstone, non-calcareous	111	5	4		1279			
															Green calcareous conglomerate, pebble, coated to sub-rounded granitic, gneissic, chert, quartzite, shale, siltstone, sometimes shale/siltstone fragments up to 2" thick and 4" long. Matrix grey shale	113	2	2		1279			
120					< ½" R			< ½" R			< ½" R					120	7	7		1280			
130																132		12.5		1281			
															Brown calcareous conglomerate, pebble, coated to sub-rounded granitic, gneissic, chert, quartzite, shale, siltstone, sometimes shale/siltstone fragments up to 2" long. Matrix calcareous brown shale	137		4.5		1282			
140					< ½" R			< ½" R			< ½" R				Pebbles are up to 3" long. calcareous around leaves and cracks	142		5.5		1283			
															Brown non-calcareous conglomerate, 40% pebble up to 6" long, shale fragments of iron formation and jasper lenses	144		2.5		1284			
					< ½" R			< ½" R			< ½" R				up to 2" lenging differences along strike	147		3		1285			
150															Maroon shale, non-calcareous	149		2.5		1286			
					< ½" R			< ½" R			< 1" R					151		4		1287			
					Green shale, slightly calcareous										conglomerate	153		1.5		1288			
					< ½" R			< ½" R			< 3" R					155		2		1289			
					Maroon calcareous conglomerate, 30% pebbles up to ½"											157		2.5		1290			
					Non-calcareous ferruginous maroon shale																		
160					Brown calcareous conglomerate											163		6		1291			
170					Lower and conglomerate from 170 on.																		

GEO - 23 - 2 - CR 16/631

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF - 160 - 63 — DATE STARTED August 21/63
DESCRIBED BY Folinsbee — DATE COMPLETED August 21/63
MEASURED BY Folinsbee — MEASURING RATE 350'/5 hrs.
AIR PHOTO No. A 12148 - (13²) - 272 — COORDINATES 119,600 N ; 124,000 E
AREA Discovery Creek — CLAIM Z - 9
WEATHER Sunny

ROCK TYPES

IRON FORMATION; SILTSTONE; JASPER; SHALE; CONGLOMERATE; LIMESTONE; BRECCIA; DOLOMITE; SANDSTONE; COVERED

% HEMATITE

STEEL GREY HEMATITE; MAROON HEMATITE; BOTH

SILICEOUS WASTE TYPES

RED JASPER; MAROON JASPER; MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S; CARBONATE C; HEMATITE H; FEW F; MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4

DATE Aug. 21, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC.	ENGINEER DATA % REC.	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0															Conglomerate: weathered surface brown, fresh surface maroon; Fragments 10% - shales, rounded (1/8" - 1/2") Matrix Poorly bedded (1/4") Maroon non-calcareous shale								
												½-5 R			very shaly maroon hematite grading to shale	0							
																43		40		1481			
10															Coarse sandstone - slightly calcareous weathered surface black fresh surface dark gray; poorly bedded - 1 foot.								
20																							
30																							
40					¼-1 R ½-3 I							½-4			3 bands of ferruginous sandstone about 8" wide	55							
															Ovoids have hematite centers.	60	10	1482	1482				
50					⅛-¼ R ¼-3				⅛-¼ R			½-½ R				62	7	1483	1483				
															Formerly have sandstone (Patchy iron formation) Slightly calcareous	78.5	8.5	1484	1484				
												½-½ R			shaly iron formation	87.5	3	1485	1485				
															Conglomerate - weathered surface brown, fresh surface maroon								
60															Fragments 30% ⅛" - 6") shape subangular to rounded.	103.5	6			1486			
															Shaly iron formation								
70																114	11			1487			
					½-1 I ½-4				½-4 I						fs Brown Jasper containing carbonate.								
80																124.5	10			1488			
					½-1 I ½-4				½-½ R			½-½ R											
90																134.5	10			1489			
															Dark grey green-maroon fine shale with grey	137.5	3			1490			
100					Tense ⅛-½ R ⅛-1				½-4 R			½-½ R			strike 145° Dip 72° SW Carbonate in upper 2½% Patchy Red Jasper	142.5	1			1491			
110															Calcareous conglomerate, W.S. Brown, Fragments 20% well rounded ⅛ - 8", occasional jasper fragments to 3ft. Matrix finely bedded maroon shale	147	8.5			1492			
120																							
130																							
140																							
150																							
160																							
170					¼-1 I ⅛-3				¼-1 R			¼-4 R			Bed is leaning.	165							
180															Chaotic calcareous sandstone leading to conglomerate with grey hematite 20% matrix and shale and maroon hematite (¼ - 2")	177	12.5			1494			
																183	4			1493			
															Conglomerate - F.S. maroon; Finely bedded(8") Fragments 5% sub-angular ⅛ - 8" 1mm to 8" Matrix non-calcareous shale.								
190																							
200															Same as sandstone from 185.5 to 200.								
210					¼-1 I ¼-5				¼-1 R			¼-1 R		S	Bed leaves from 185 to 215 ft. Shaly at the bands are broken loose bands have maroon centres and red exteriors	205							
																216	10			1494			
220																227	4			1495			
															Fairly calcareous conglomerate (Patchy iron formation) Fragments ¼ - 2"	226	4			1496			
					¼-1 R ½-4				¼-¼ R			½-3 R		S		227							
230																233	12			1497			
240															Conglomerate ⅛ - 2" Dark Grey Fragments 1% shale ¼" - ½" well rounded matrix Maroon grey shale	241	7			1498			

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-161-63 — DATE STARTED August 24/63
DESCRIBED BY R. Garrett — DATE COMPLETED August 24/63
MEASURED BY R. Bray — MEASURING RATE 40'/hr
AIR PHOTO No. A12148-(112)-211 — COORDINATES 113,200 E ; 107,400 N
AREA Headwaters of Bluff Creek — CLAIM V-14
WEATHER Warm and Sunny

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3
DATE Aug 24/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No. RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0															Overlying Grd. (-80 [illegible]) Conglomerate: Lt. brown → Jasper. Fragments 45% (¼ - 4"). Subangular to subrounded. Fragments are: quartzite, igneous, sandstone & carbonate. Matrix is sandy.								
10															Overlying Grd. (-15' to -30') Sandstone: F.S. Dark gray-brown. Medium grained, massive & calcareous.								
					¼-½"	R			¼-½"	I					Some ovoid with carbonate centres 25% of waste due to carbonate cementing. (trace of limonite)	4		2'		1908			
					½-1"	I									Last 4' of Grd. Brown sandstone/limestone. Fragments (80%) (¼" - 4") Subangular to subrounded. Pebbles: quartzite, greenstone & quartzite mainly. Matrix: marl/calcareous sandy	9		5'		1909			
					½-1"	I			¼-½"	R					Some carbonate weathering								
					½-1"	R									Shale: W.F. Brown → maroon. F.S. maroon. Bedding (¼" to massive)	14		2'		1910			
20					¼-⅝"	R		¼-1½"	R						Some ovoids are of hematite. 10% waste in irregular patches of red jasper. Also limonite patches ??	16		10'		1911			
					⅛-¼"	R										26							
30					⅛-½"	R									10% of waste occurs in patches of carbonate.			5'		1912			
					⅛-¼"	R										33							
40															Ovoids with maroon jasper centers. Flow structures on lines of FEW. 40% of waste occurs in irreg. patches & streaks	35		2½'		1913			
																40							
50																55		7.5'		1914			
60					⅛-½"	R			¼-1"	R					30% of waste occurs in large patches of carbonate, sericite etc. 10% occurs in mainly maroon jasper patches	62.5		10'		1915			
70					¼-¾"											72.5		3'		1916			
80																75.5							
90																							
100																							
110																							
120																							
130																							
140																							
150															Shale: W.F. = Dark gray, brown F.S. = Light gray to maroon. Calcareous & massive.								
160															Gray conglomerate: F.S. - Brown gray (slightly metallic) Fragments (20%), (¼" - ½") Subang. to angular. Pebbles are: quartzite, greenstone, & carbonate. Matrix: maroon shale (ferruginous) & calcareous.								
170																							
180																							
190																							
200																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-162-63
DESCRIBED BY Folinsbee
MEASURED BY Folinsbee
AIR PHOTO No. A 12148-(12²)-211
AREA Tributary Bluff Creek
WEATHER C.A.V.U.

DATE STARTED August 24/63
DATE COMPLETED August 24/63
MEASURING RATE 140'/4hrs.
COORDINATES 110,600 N; 106,900 E
CLAIM S-12 and T-12

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

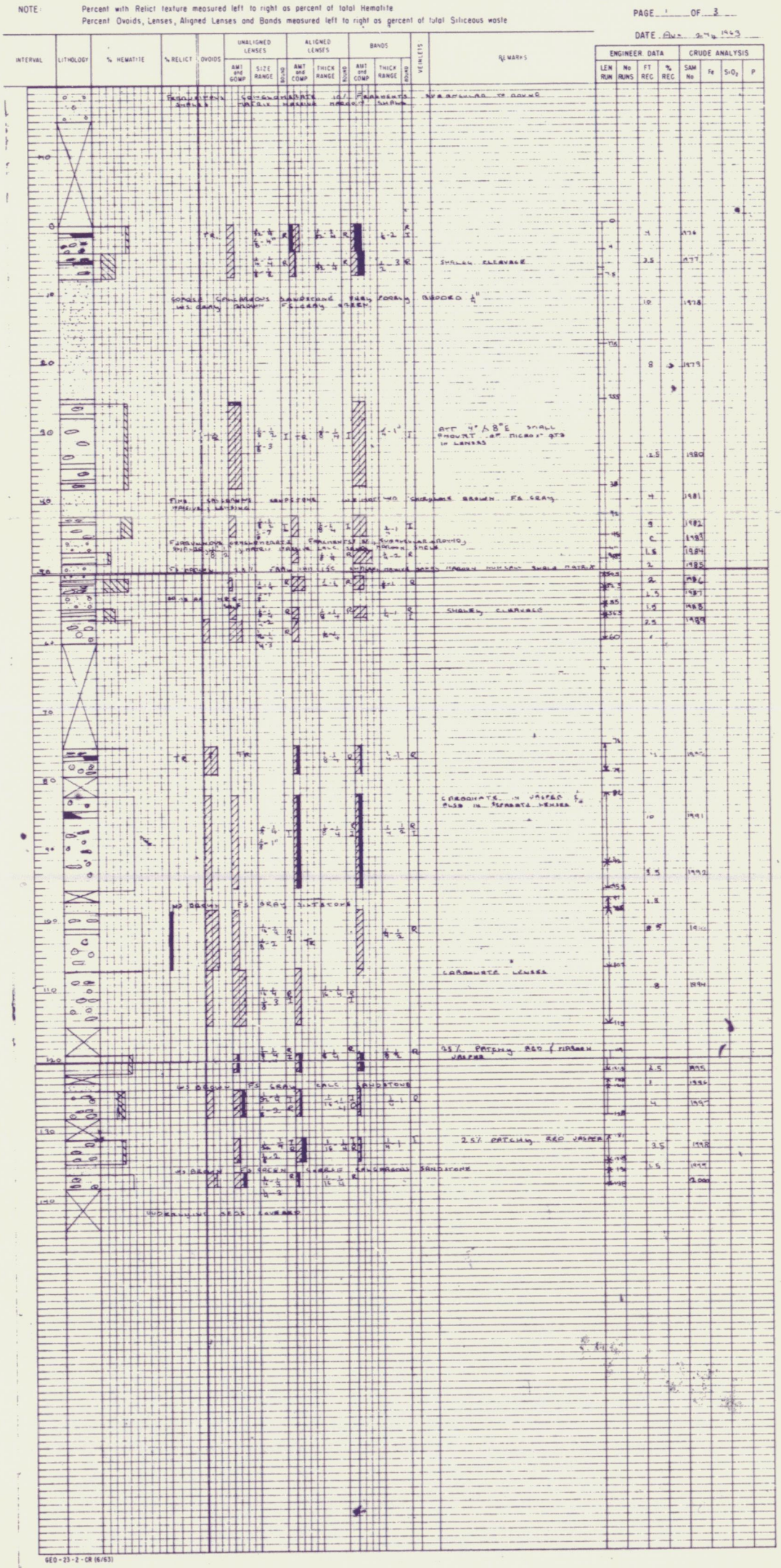
QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3
DATE Aug 24th 1963



GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-163-63 (IF-40-62) DATE STARTED August 26/63
DESCRIBED BY E. C. Gronberg (reported from notes) DATE COMPLETED August 26/63
MEASURED BY D. A. Darwin MEASURING RATE 140/5 hrs.
AIR PHOTO No. A 12148-(12")-211 COORDINATES 100, 200 N; 118, 100 E
AREA North of Iron Creek 7 miles East of Camp CLAIM X-16
WEATHER Warm Cloudy in afternoon becoming overcast

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite.

REMARKS: BEDDING STRIKE / DIP..... eg 125°/25°W
FAULT STRIKE / DIP..... eg 125°/25°E
BRECCIATED ZONE.....
HALOS OF JASPER.....
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc.
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 3 OF 3
DATE Aug 26/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT one COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT one COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT one COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC.	ENGINEER DATA: % REC.	CRUDE ANALYSIS: SAM No.	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
160															Dark brown (reason) shale interbedded with conglomerate.								
150																							
140															Undulating jasperoid iron bands (Varies from 1'-2') 5-10% hematite (½ red & ½ maroon jasper) Dark brown massive shale with a few bands of interbedded conglomerate. Occasional boulder up to 1' ϕ	141 / 139		2.0		3157			
130																							
120					conglomeratic with a few interbedded shale bands. Fragments 15-20% Calc. boundary up to 8", green shale, grain, yellow shale (limonite), Few Ca veinlets. Matrix - 2/3 maroon brown shale. Dk maroon brown non calc. shale.	122 / 120		2.0		3156			
110					Top MARKER SANDSTONE Fine grained, calcareous, grey green sandstone w/s - brown green. Fault(??) 130° (vertical dip) S.W. side. Contact between S.S. & following beds lost in fault zone.	113.5		9.5		3155			
100			Tr.		½0-½ R ¼-2" I	½-3" R I	FL								note! - 2 green shale bands (6-8" & unbroken) @ 90° 36' Very fine cleavage to massive in places. Some carbonate replacement of bands & lenses	104		7.0		3154			
90					⅛-1 R ⅛-2 I	1"-3" R I									much carbonate (limonite?) replacement, slickensides	97		7.0		3153			
80			Tr.		⅛-2" R ¼-2" I		R I								some ovoids have maroon hem. centers. Some carb. replacement Large cong. lense @ 82.5 (11½'×6' — 60-70% frags)	83.5 / 76		6.5 / 7.5		3152 / 3151			
70															Banded Jasperoid Iron Fm - tending to be shaly. Dk brown shale mixed with chlorite(?) - non calc. Poor bedding. Jasperoid iron formation. Few ovoids but mostly red & maroon jasper bands & patches. Tends to be quite shaly.	74 / 71.5 / 67		2.0 / 2.5 / 4.5		3150 / 3149 / 3148			
60			Tr.		½0-½ I ⅛-4"	¼-2	R I								Slickensides. Carbonate replacement. Some ovoids have carbonate centers	62		5.0		3147			
50			Tr.		½0-½ R ⅛-1 I	⅛-2"	R I FL								Some carbonate replacement of lenses. Birdseye.	52		10.0		3146			
40																42		10.0		3145			
30					Very coarse sandstone or maroon brown conglomerate many green & maroon shale fragments. slightly calc. Few Ca veinlets. F.S. - grey green to brown green. Bedding indistinct. Becomes fine grained sandstone to siltstone. To shale @ top of interval. (MARKER SANDSTONE ?)	33		9.0		3144			
20																23.5		9.5		3143			
10			Tr.		½-½ R ⅛-⅛ I	½0-½ R ⅛-3		¼-3	R I						Some carbonate replacement of silica wisps. large (6'×½') conglomeratic lense @ 23'	14.0 / 13.5		7.5 / 2.5		3058 / 3042			
			Tr.		¼-¼ R ⅛-1 I			½-2	R I	FQ					Some banks & lenses tending to patches. @ 15.5' a 5-6" bank of grey green S.S. which swells to 5-6' alongstrike. Slickensides.			7.5		3041			
0					Dk brown massive noncalc. shale. Few (<1%) green shale frags.	8.0																			
					⅛-¼ R ¼-1 I			1-5"	R I						Lenses grade into bands in places. Beds are drag folded producing 8-10" displacement. Trace of birdseye. Slickensides strike 122° Dip 33	6.5		1.5 / 6.5		3056 / 3055			
					Slightly hematitic dark brown conglomeratic shale F.S. brown - slickensides @ -2ft.	0 / -2		2.0		3054			
					Underlying beds are of a dark brown conglomerate.																			
					SECTION TURNED UP!																			

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF - 164 - 63 — DATE STARTED August 28/63

DESCRIBED BY Bray — DATE COMPLETED August 28/63

MEASURED BY Bray — MEASURING RATE 30'/hr.

AIR PHOTO No. A 12148 - (11²) - 181 — COORDINATES 129, 500 N, 93, 600 E

AREA Remnant between Gypsum and Bluff Ch CLAIM O - 6

WEATHER C.A.V.U.

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE

MAROON HEMATITE

BOTH

SILICEOUS WASTE TYPES

RED JASPER

MAROON JASPER

MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite

I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
- BEDDING STRIKE / DIP ... eg 125° / 25° W
- FAULT STRIKE / DIP ... eg 125° / 25° E
- BRECCIATED ZONE
- HALOS OF JASPER
- SPHERULITES
- FRACTURING
- ACCESSORIES - Calcite, Dolomite, Siderite, etc
- LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Aug. 28, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS
0															OVER BURDEN - IN. RED + BROWN SANDY DIFFUSE PHASE TILLS ON EAST LINE OF CLAIM
10															
20															
30															
40															
50															
60															
70															
80															
90															
100															
110															
120															
130															
140															
150															
160															

ENGINEER DATA RUN	No. RUNS	FT REC.	% REC.	CRUDE ANALYSIS SAM No.	Fe	SiO_2	P
0 - 4		H		17108			
4 - 5.5							
5.5 - 8		8		17111			
8 - 9.8							
9.8 - 13.5		H		17112			
13.5 - 15.5		6		17113			
15.5 - 23.5		15		17114			
23.5 - 26							
26 - 36		10		17115			
36 - 42		8		17116			
42 - 43		1.5		17117			
43 - 43.8							
43.8 - 46							
46 - 66		1		17118			
66 - 68		2		17120			
68 - 113.5		11.5		17121			
113.5 - 114							
114 - 123.5		9		17122			
123.5 - 135							
135 - 137		2.5		17123			
137 - 142.5		5		17124			
142.5 - 152		9.5		17125			
152 - 160		12		17158			

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-165-63
DESCRIBED BY A. Gorreatt
MEASURED BY A. Arthur
AIR PHOTO No. A 12148 - (12²) - 213
AREA West side Bluff Creek
WEATHER Sunny Windy

DATE STARTED August 28/63
DATE COMPLETED August 28/63
MEASURING RATE 40'/hr.
COORDINATES 125,000 N, 99,700 E
CLAIM Q - 7

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP ... eg 125° / 25° W
FAULT STRIKE / DIP ... eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Aug. 28, 1963.

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															OVERLYING FORMATIONS: Dark brown to maroon, fragments (up to 60%) (4" > 4") of conglomerate, chert, jasper, siltstone, dolomite, shale & sandstone. Matrix is dark brown to maroon, sandy (leading to a quartz calc.									
10															Approx. 30% of siliceous waste in irregular patches of maroon jasper with red halos.	0	10'			1919			
20															Ovoids with weathered-out centers. 15% of waste in red jasper patches.	10	10'			1920			
30															Weathered surface, mainly due to weathered-out ovoid centers. 10% of waste in carbonate patches & red jasper veinlets.	20	9.5			1921			
40															SANDSTONE: very fine grained (siltstone?) dark brown to medium brown, W.S. brown to light brown. Fx. Light grey to brown, red jasper patches. Bedding plane 125°-25°W, mostly AC 125	29.5	5.5			1922			
															Traces of limonite	35	5.0			1923			
															Weathered-out patches	39	7.5			1924			
50															SILTSTONE: wx - Reddish-brown, Fx - Grey to maroon. Massive (non-calcareous)	46.5	2.5			1925			
															Some slikensides! 25% of waste occurs in masses & patches of red jasper.	49	4.5			1889			
60															Light Brown, Shaly Conglomerate. Fragments (50%) (1" > 1") subangular to subrounded. Fragments are shale, red jasper, siltstone, sandstone & green stone. Matrix: Ferruginous calcareous maroon shale.	53.5							
															N.B. - Conglomerate appears to dump? as the bed approaches the fault zone.								
70															Shale and crushed but not faulted (i.e. not in place?)								
80																							
90																							
100																							
110															Conglomerate. Light brown (surface weathered reagt). An interspersing fragments (50%) (1" > 2") subangular to subrounded, consisting of red jasper, green stone, shales, and sandstones. Matrix: sandy & calcareous.								
120																							
130																							
140																							
150																							
160																							
170																							
180																							
190																							
200															Conglomeratic Shale. Maroon & slightly ferruginous. Fx: Maroon to reddish, calcareous.								
210															Conglomerate Light Brown to Grey. Fragments (10%) (1" > 4") subangular to subrounded. Pebbles are green schistose, Bolmaida dark greenstone. MATRIX: Maroon shale, very calcareous.								
220																							
230															LOWER IRON BAND	228	10'			1890			
															Weathered & pitted surface also a Carbonate lens (1" by 4" max.) 10% of waste occurs in large patches of red jasper & Carbonate.	238	10'			1891			
240															25% of waste is in weathered out bands & patches of Carbonate.	248	6.5'			1892			
250															Shale: Light Brown, Fx + Dark Br. Non-Calcareous. Also a thin band of conglomeratic shale.	254.5	1.5'			1893			
															Horizontal "pencil-like" deep striations on vertical surface from (254' - 258'). 10% waste in red jasper streaks & patches.	256	2.5'			1894			
260															SANDSTONE: Light Brown, coarse grained, massive (X stratified) CALCAREOUS	258.5							
270															Shale maroon, Conglomerate fragments (10%) (1" > 2") subrounded mainly. Matrix: ate. Shale & ferruginous mainly. MATRIX: CALCAREOUS MAROON SHALE								

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-166-63 — DATE STARTED August 29/63
DESCRIBED BY A. Bray — DATE COMPLETED August 29/63
MEASURED BY A. Fryling — MEASURING RATE 30'/hr
AIR PHOTO No. A 12148-(13")-272 — COORDINATES 117,300 N; 132,800 E
AREA Discovery Creek — CLAIM CC-19
WEATHER C.A.V.U

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP ... eg 125°/25°W
FAULT STRIKE / DIP ... eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE August 29/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0															Grey-white quartzite rubble followed by 20' of reddish hilly dolomitic and carbonates 95' covered to top of Redstone Outcrop forming sandstone / Dark grey to blank weathering coarse calcareous with a platy cleavage) sandstone (?) (N.E. Trend.								
17															Dark brown weathering, fine grained non-calcareous sandstone. F.S. dark grey								
0					½-¾ R	½-¾ R		½-1 I	½-1 I						20% jasper in patches	7.5'		1.5'		3076			
					Interbedded Huffanedric shale and maroon dematitic shale											8.5'		2.0'		3077			
					½-¾ R	½-¾ R		½-¾ I	½-¾ I						30% jasper in patches	6.5'		3.0'		3078			
20															Clastic conglomerate with fragments of red jasper, yellow jasper, yellow carbonate, chert, hematite, magnetite, martite, martite, hematite, oolitic hematite, ferruginous chert and carbonate.	16.5		5'		3079			
					¾-1 R			¾-1 R							Conglomerate:	21.5							
					Conglomerate: variegated pebbles from ½" to 3" composed of shale and quartzite. Matrix is maroon ferruginous shale.											24.5		3'		3080			
40					½-¾ R						½-¾ I					34		4.5'		3081			
					½-1											38.5							
											¾-1" I				B.J. Brown Jasper.	46.0		5.5'		3082			
					½-¾ R						2-2 I				Lower boundary pinches & swells with F.S. below	48.0		4.5'		3083			
50					DK. Gy. Brown weathering non-calc. S.S. F.S. - Grey (trace)											52.5								
					½-¾ R						¾-1" I							7.5'		3084			
60					½-¾ R											60.0							
					Conformable (30°) sub-angular fragments Shale mainly. Minor green (basalt) sandy shale																			
70																70							
					½-¾ R						¾-1" I				Minor Carbonate wisps as lenses.			5.5'		3085			
80					½-¾ R											80.0							
																82		2'		3086			
											¾-2" I					87		4'		3087			
90					DK. Gy. Black weathering platy argillaceous S.S. F.S. - Gray. Grades to a conformable with 10% pebbles 50' over the base which has a irreg. (pinch & swell) boundary. MIDDLE I MARKER SS.											91.5		1.5'		3088			
					½-¾ R	½-¾ I		¼-½ I			½-1" I					93.0		9.0'		3089			
100					½-¾ R											102							
																103							
110					½-¾ R						½-1" I					112		9.0'		3090			
					½-¾ R											112.5							
120																121							
					½-¾ R						¾-1" I				Some carbonate waste in small lenses	122.5		7.0'		3091			
130															Grey slightly calcareous or ferruginous non-calcareous ss.	129.5		6.0'		3092			
					½-¾ R						¾-2" I				Slightly banded grey calcareous sandstone separated by 1-2" bands of red jasper at 10% E	135.5		2.5'		3093			
					½-¾ R										Contact non-calcareous slightly ferruginous grey-black weathering sandstone (F.S. light grey interbedded coarse Algoma sandstone and maroon hematitic with red and grey jasper bands. There are 5 bands, one at top and 4 below and these in between.	138		4.0'		3094			
150					Conglomerate containing 10% pebbles from ½ - 3"											150								
160																							
170																							
180																							
190					Brown weathering calcareous sandstone - some evidence of cross bedding Shale stringers F.S. light grey																			
200																							
					Gradation of sandstone to conglomerate.																			
210					Conglomerate contains 10% sub-angular to rounded pebbles from ½" to 3" composed of shale, sandstone, quartzite, dolomite, limestone and cherty rock. Matrix is of calcareous gray green sandstone and shale. Unit swells along strike.																			
					Calcareous sandstone - same as that from 184'-195' grades to a sandy argill. shale with many shale stringers showing cross bedding.																			
220																							
					210'-227' is covered - conglomerate contains 10% pebbles from ½" to 4" Matrix is a crumbly calcareous brown shale - Massive and poorly bedded. (Below 270' to 305')																			

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-167-63
DESCRIBED BY E.C. Groulberg
MEASURED BY D. Pfaff
AIR PHOTO No. A 12148-(FL 13°)-272
AREA Discovery Creek
WEATHER C.A.V.U.

DATE STARTED August 29/63
DATE COMPLETED August 29/63
MEASURING RATE 330'/shrs
COORDINATES 123,100 N; 122,100 E
CLAIM Y-7

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 5
DATE Aug. 29/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ROUND	BANDS AMT and COMP	BANDS THICK RANGE	ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No. RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	GRADE ANALYSIS SAM No	GRADE ANALYSIS Fe	GRADE ANALYSIS SiO_2	GRADE ANALYSIS P
0															Section measured down dip. Overlying beds of qtzite containing red jasper & siliceous (?) maroon hematite fragments								
															Qtzite.								
												½-3"	R		35% birdseye of red jasper (& subsidiary 3" band of coarse hematite) & S.S. of beds.	5		1.5		3/176			
																7.5							
																10		2.5		3/177			
10															Conglomerate: 40-50% fragments of green shale & carbonate in dk. maroon hematitic shale matrix. Occasional band of S.F. (thin)			4.0		3/178			
													R		50% birdseye (½ red & ½ maroon) interspersed in bands.	14							
																16		3.0		3/179			
																18							
													I		25% red jasper birdseye interspersed in bands.	20		2.0		3/180			
20																							
																24		4.0		3/181			
															Jasperoid (80% maroon to 20% red) iron formation. Very coarse, ferruginous sandstone (mostly red jasper particles) 25% fine carbonate birdseye interspersed in bands.								
												¼-1"	R	FC		30							
30																							
																37		4.5		3/182			
			TR		1/16-¼		R				¼-3"		R		Some ovoids have hematite centres - some carbonate - remainder of ovoids & lenses	42.5		5.5		3/183			
													I										
			TR					TR			½-4"		R										
													I			48		6.5		3/184			
50					1/16-⅛		R								25% carbonate patches.								
					⅛-½		I									54.5		6.0		3/185			
					⅛-¼		R	TR			½-1"		R	FC	Trace of carbonate patches.								
					¼-3"		I		⅛-½					TO									
60			TR		⅛-½		R				¼-1"		R		Some carbonate replacement & patches.	62.5		4.5		3/186			
					¼-3"		I																
			TR		⅛-½		R								25% red jasper patches. Slight carbonate replacement	65		2.5		3/187			
					¼-2"		I									67.5		6.5		3/188			
					⅛-½		R		1/16-⅛						Aligned lenses in form of birdseye.								
70					¼-2"		I		⅛-3"				I			73		5.0		3/191			
			TR		⅛-½		R		1/32-¼		¼-2"		I		3-4" band of dk. green brown shale at top of interval - undulates to 2' wide. 20% red jasper birdseye. Some bed replaced.	78		4.0		3/189			
80					⅛-1"		I		⅛-1"														
															Dk. maroon, brown noncalcareous massive shale. 1-2" band of jasper at top.	82		1.0		3/190			
											½-5"		R		75% red jasper patches.								
															Conglomeratic shale. Fragments (2-5%) of green shale, sandstone & carbonate, matrix of dk. maroon brown noncalcareous shale.								
90																							
100																							
110																							
120																							
130															Conglomerate - 70% fragments of qtzite, carbonate, sandstone & shale in a dk. maroon brown shale matrix. Calcareous. Rt. 16' conglomerate becomes slightly ferruginous. Fragments are subangular to rounded.								
140																							
150																							
160																							
170															Grey green, fine grained, slightly calcareous sandstone W/S - Brown								
180																							
190																							
200																							
210																							
220																							
230															Siltstone at top grading into silty shale. Slickensides.								
240																							
250																							
260																							
270																							
280																							
290															Conglomeratic siltstone to shale becoming conglomerate with 5% fragments of qtz. sandstone, shale, and carbonate in a dk brown maroon noncalcareous shale matrix.								
300																300		2.0		3/192			
					⅛-½		R									302		5.0		3/193			
					⅛-5"		I				¼-2½"		I										
															Dk. brown maroon calcareous shale.	307		10.0		3/195			
310																							
					⅛-½		R								Some carbonate replacement. Traces of red jasper birdseye. Most of maroon jasper bands have red jasper borders.								
					⅛-3"		I				¼-3"		I			317		6.0		3/196			
320																							
					⅛-½		R									328		8.0		3/197			
					⅛-3		I				½-2"+		I		Some carbonate replacement.								
330					⅛-1		R									336							
															Conglomerate with a thin band of shale (dk. maroon brown) at the top of the interval.								

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091697

SECTION No. IF-168-63
DESCRIBED BY A. Gorveatt
MEASURED BY A. Gorveatt
AIR PHOTO No. A 12148 - (132) - 272
AREA Discovery Creek
WEATHER Sunny

DATE STARTED August 30/63
DATE COMPLETED August 30/63
MEASURING RATE 300'/6hrs
COORDINATES 125,500 N, 115,700 E
CLAIM AA-10 & AA-11

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 5
DATE Aug 30, 1963.

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No. RUNS	ENGINEER DATA FT REC.	ENGINEER DATA % REC.	CRUDE ANALYSIS SAM No.	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0															Conglomerate: Light Brown & Maroon. Shaly near top of I Fm. Fragments (25%) of jasper & mag. oxide to subrounded. Fair to well sorted. Contacts: Gradational. Etc. N.B. Some pebbles are peculiar and provide an example of dark green & has brecciated fragments (approx ½") within it. Matrix: MAROON Calc. SHALE									
															Banded SANDSTONE: Light Brown alternating to dark Gray Fine Dk. Gray Med. to Fine Gray Baked, calcareous, bedding ½" to massive near top of I Fm.									
10															Ovoids have weathered-out centers	10'		5'		1895			
															Conglomeratic shale: W.S. green with marron-tinge. Small subang fragments (<10mm).	15 16		1'		1896			
															Also a thin band (4") of green conglomeratic shale & siltstone & red jasper.			10'		1897			
20															30% of waste in irreg patches of carbonate & red jasper.	16		5.5'		1898			
															Conglomeratic ferruginous SHALE: Fragments of jasper, stromatolitic Carbonate & Chert. Matrix: Dk. Red, ferruginous shale.	22							
															Att STRIKE 300°/13° SW	23		8'		1899			
															mainly Jasperoid I Fm. 25% of waste in patches & blebs rarely veins.	24 25		1.5'		1900			
30					Conglomerate: Grading to a shaly conglomeratic SHALE. Fragments (long axis 1-2") subang to subround. Matrix: Slightly calc. MAROON SHALE.													2.5'		2657			
					Basal Member of I Fm.										Shaly I Fm. 10% of waste occurs in irreg patches & streaks of red jasper & traces of limonite? N.B. Traces of bedding along strike (approximately) Nr. marker beds.	25.5				3659			
															15% of waste occurs in carbonate patches & mainly red jasper patches.	27.5		3.5'		3660			
					Shaly I Fm - Waste is mainly in pyrite & red jasper lenses. Conglomeratic SHALE - grading into a ferruginous slightly calc. MAROON SHALE.												27.5 28		1.5'		3661			
50															Ovoids: over half are carbonate. Aligned lenses are carbonate or are jasper & lower on part of limonite is present. Approx 20% of waste is in carbonate bands & patches.			18'		3662			
															Lenses & bands are carbonate? chert or jasper. 5% of waste in carbonate patches. Also a 6.0' band of Conglomeratic SHALE.	29		10'		3663			
70					MEASURED ALONG CREEK AND HOKE I Fm outcrops at approx. 10% it was seen following strike where the I Fm. outcrops) and the line of measurement.																			
90																								
100																								
110					Siltstone: Light Brownish grey, F.S. - Iron grey, non-calc. & massive.										20% of waste in stringers & patches of red jasper. Traces of limonite.	31 32		1'		3664			
					MAROON SHALE: W.S. - Light Brown. F.S. - MAROON. Non-calcareous & massive.											32 33		3'		3665			
					Fine grained sandstone, gradeds into a coarse grained W.S. - Brownish tone F.S. - Dark grey, non-calc.											33 34		2'		3667			
130					CONGLOMERATE - Brownish Grey. Fragments: (30%) (¼" - 2") Subangular to subrounded. Types: Quartzite, shale, cherty igneous rock & sandstone. Size: mainly ½" - 1" Consistency: Soft/friable. Matrix: Calcareous MAROON SHALE. Primarily CONGLOMERATE - grades into a large pebbled conglomerate.																			
150																								
170					Ferruginous calc SHALE, with veinlets of bluish CALCITE																			
190					Ferruginous SHALE: W.S. - Dark Grey F.S. - Reddish, maroon calcareous. N.B. Most of SS's, shales etc. are outcrops and true thickness of beds was not taken.																			
210																								
230																								
250					Dark GRAY Ferruginous CONGLOMERATE																			
270					Very Ferruginous conglomeratic SHALE. F.S. - Maroon. W.S. - Reddish, Calcareous.																			
					Interbedded I Fm. & thin band of highly red jasper. This band is deformed, could be a fold 0-5 ft.																			
					MAROON FERRUGINOUS SHALE. W.S. - Maroon to Light Brown. F.S. - Reddish, maroon. (Calcareous).																			
290					SANDSTONE: Quite hematitic. Small amts of red jasper & hematite encrusted with S.S. W.S. - Grey-mottled. F.S. - greenish-brown. very calcareous & fine grained.																			
					Sandstone: Shows at 275' is similar to jasper & hematite. N.B. Beds in vicinity of ft. - ft. are followed by band and bedding of SS. at 300' is very difficult to trace. The most well defined is approximately where viewed from SS on cliff bed. Impure coarse sediment between SS & stream-bed.	35.5							
					Silicen-sites? 25% of waste occurs in irreg. patches of red jasper & thin irreg. bands & carbonate. STRIKE 108°/23° S.E.	35.5		11.5'		3668			
310					MAROON CONGLOMERATE: Fragments (20%) (¼" - 2") subang to subrounded. Pebbles are SS, greenstone, chert, red jasper, etc. Matrix: Maroon, calcareous SHALE																			

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No 1F-206-63
DESCRIBED BY WALTER GIBBINS
MEASURED BY FOLINSBEE, BRAY
AIR PHOTO No A 12148 FL(11)^2 -182
AREA 2 MILES N.E. OF BASE CAMP
WEATHER C A V U

DATE STARTED AUGUST 12 1963
DATE COMPLETED AUGUST 12 1963
MEASURING RATE 8 hrs.
COORDINATES 87200 E 110500 N
CLAIM L 13

ROCK TYPES

OVOIDS ooo
UNALIGNED LENSES
ALIGNED LENSES
BANDS

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 5
DATE AUGUST 12, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	BANDS AMT and COMP	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
292	CONGLOMERATE FROM SANDSTONE VERY JASPEROID FROM FORMATION																			
291																				
290																				
285																				
280																				
275																				
273																				
270												IRON FORMATION HIGH IN MAROON HEMATITE								
265																				
260													261		8		1633			
255	FINE GRAINED DARK BROWN SANDSTONE																			
253													253							
250												RED JASPER LENS RESEMBLE CONGLOMERATE PEBBLES AT THE TOP								
245																				
240																				
235												A FEW SHALEY HEMATITE BANDS								
229													229							
223	CONGLOMERATE (20% FRAGMENTS), (1/2"-3") PLUS BANDS 1"-4" OF RED JASPER AND HEMATITE											4ft BROWN SHALE MATRIX			6		1632			
217												6"-10" BANDS OF CONGLOMERATE (BROWN SHALE MATRIX) EX 218, 220.5 + 223			5		1631			
210												VERY IRREGULAR MAROON JASPER TO MAROON HEMATITE SOME OVOIDS HAVE HEMATITE AND/OR BROWN CARBONATE CENTERS	210							
205													205		8		1630			
200												SOME OVOIDS HAVE HEMATITE CENTERS								
195																				
190																				
186																				
180																				
175																				
170												BANDS OF WHITE QUARTZ OVOIDS 75% "JIG-SAW" PIECES OF RED AND MAROON JASPER								
167																				
160	DARK BROWN SILTSTONE (TOP) TO SANDSTONE (BOTTOM) SLIGHTLY CALCAREOUS THIN LAMIEY BEDDING PLANE CLEAVAGE (1/16-1/8") AT BOTTOM TO MASSIVE AND BLOCKY AT TOP												160		6		1629			
154													154							
150												LIGHT BROWN CARBONATE OVOIDS AND MAROON JASPER BANDS TRACE OF IRREGULAR BROWN CARBONATE AND MAROON JASPER								
144												75% OF WASTE IS PATCHES OF RED JASPER (1/2" TO 1 1/2") PLUS MORE QUARTZ								
140																				
135	MASSIVE DARK BROWN SHALE SLIGHTLY CALCAREOUS												133.5		1.5		1630			
133.5												BANDED IRON FORMATION	132							
130																				
125																				
123													123							
120	CONGLOMERATE FRAGMENTS ROUNDED, SHALE, CARBONATE OF RED JASPER ARE FRAGMENTS HEMATITIC AT TOP TO CALCAREOUS AT BOTTOM											(UP TO) (1/2"-4") SUB ANGULAR TO LARGE LENSES OF BOULDERS DARK BROWN SHALE			12		1628			
115																				
111												25% OF WASTE IS IRREGULAR PATCHES OF RED JASPER (1/2"-1 1/2")	110		1		1627			
105													104		2		1626			
100												CHARACTERISTIC MAROON JASPER BANDS.	102							
95												WASTE IS LARGELY THICK MAROON JASPER BANDS TRACE OF SHALE								
90												27% WASTE IRREGULAR QUARTZ AND RED JASPER PATCHES 1/2"-3" SOME OF THE HEMATITE IS FINELY CRYSTALLINE (LOWER 2' CONTAIN MAROON JASPER BANDS. 25% WASTE IS IRREGULAR MAROON JASPER LENSES WITH RED JASPER BORDERS								
85													84		1		1626			
83	MASSIVE DARK BROWN SHALE											BANDED IRON FORMATION	83		.5		1625			
80																				
75																				
70																				
65																				
60																				
55																				
50																				
47	SAND (5%) TO COBBLES (15% ARE HEMATITIC FRAGMENTS (1/2"-6") SUB ROUNDED, QUARTZITE, CARBONATE ETC.											DARK BROWN SHALE - LOWER 3' SUB ANGULAR TO TRACE OF SLICKENSIDES	47		9		1623			
40																				
38												SIMILAR TO ABOVE EXCEPT WASTE 75% IRREGULAR STREAKS OF RED JASPER + MAROON JASPER LENSES	38		3		1622			
35													35							
30												25% OF WASTE IS IRREGULAR STREAKS OF RED JASPER (SOME CONTAIN MAROON JASPER LENSES			10		1621			
25													25							
20																				
15												TRACE OF MAROON JASPER OVOIDS								
11																				
4												SMALL 1/16-1/4" OVOIDS OF RED JASPER 1/3 ALIGNED 1/3 RANDOM ALSO IRREGULAR MAROON JASPER BANDS AND LENSES	4							
0	INTERBEDDED MAROON HEMATITIC AND CROSS BEDDED CALCAREOUS SILTSTONE														4		1620			
-2													-2							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-207-63
DESCRIBED BY W. GIBBINS
MEASURED BY 1962
AIR PHOTO No. A-12148 (FL 11²)-182
AREA 2 MI. NE. of CAMP
WEATHER CAVU

DATE STARTED AUG 13/63
DATE COMPLETED AUG 13/63
MEASURING RATE 7 HRS
COORDINATES 110,400 N. 85,900 E.
CLAIM L-13

ROCK TYPES

Ovoids
Unaligned Lenses
Aligned Lenses
Bands

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE

SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE AUG 20-63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0						¼-¾									CONGLOMERATE FRAGMENTS 5-10% TO 4": MATRIX OF LIGHT GREEN & DARK BROWN SHALE								
5						¼-1½" R																	
10																11.6		10.0		1635			
15															MEDIUM GRAINED HEMATITIC SANDSTONE - DARK BROWN TO MAROON COLOR. TRACE OF CONGLOMERATE.								
20						⅛-¾ R						¼-2" R			ALSO SOME IRREGULAR STREAKS OF RED & MAROON JASPER	20.0							
25						¼-2"									SOME LENSES CONTAIN BROWN CARBONATE								
30						⅛-⅜ R						¼-4" I											
35						¼-3" I						¼-2" R											
40												¼-2" R			BANDED JASPEROID I.F.	39.0		2.0		1634			
															CONGLOMERATE - FRAGMENTS (15-25%) (¼-3") ANGULAR TO SUB ROUNDED INCLUDE SHALE, CARBONATE & QUARTZITE. MATRIX DARK MAROON BROWN SHALE.	41.5		1.5		1637			
45						¼-⅜ R										43.5		2.0		1639			
															CONGLOMERATE (SAMPLE A.D. 42.0-43.5)	44.0							
50															CONTINUOUS BAND OF CONGLOMERATE (3-4" WIDE) AT 50.1'								
55												⅛-2" R I				54.0		2.0		1640			
60						⅛-¼ ⅛-6" R									BANDED FORMATION (18cm) 7" OF CONGLOMERATE (62.0-62.6) & (66.4-67.0)	59.0		3.0		1641			
65															SHALE (69.5-70.0)	64.0		6.5		1642			
70							I									70.5							
75						¼-⅜ R																	
80						¼-1"																	
85						⅛-⅜ R						¼-3" I											
90						¼-1" I																	
95						⅛-⅜ R						¼-¾ I											
100						¼-1"																	
105												¼-1½ R I											
110															VERY FINE (TOP) TO VERY COARSE (CONGLOMERATIC) SANDSTONE (BOTTOM) SLIGHTLY CALCAREOUS - DARK GREY TO MAROON WITH REGULAR BEDDING - PLANE CLEAVAGE ⅛-¼	107.0		7.0		1643			
115						¼-¾ ¼-1" I						¼-1" I			LIGHT BROWN CARBONATE & REDISH - MAROON JASPER WASTE	114.0							
120												¼-5" R I				120.0		3.0		1644			
125																123.0							
130															MASSIVE LIGHT MAROON - BROWN SHALE - VARIOUSLY TO A PINKISH - EARTHY BROWN COATING	126.0		2.0		1645			
135																128.0				1646			
																130.0				TRACE OF CALCITE			
140						⅛-⅜ R ⅛-2½ I			⅛-¾ I-20'			¼-2" R			IN PLACES RED LENSES LOOK LIKE CONGLOMERATE PEBBLES	139.0		9.0		1647			
145															CONGLOMERATE FRAGMENTS (25%) (¼-4")" SUB ANGULAR = 1/3 ROUNDED INCLUDES SANDSTONE, SHALE, CARBONATE = 1/3 LARGE LENSES (30%) UP TO 2-8 OF RED JASPEROID IRON FORMATION = 1/3 - 3 M - S.C. THICK (1410-1475) = MATRIX - HEMATITE & SHALE								
150															PEAR IRON FORMATION - PEBBLES & IRREGULAR BANDS & PATCHES OF JASPER	149.0							
155															CONGLOMERATE FRAGMENTS (30%) BROWN SHALE TO SANDSTONE MATRIX	153.8		2.5		1648			
160						TR-BR			⅛-¾ ¼-5" R			⅛-3" I			OVOIDS (4-10 MM) MICROCRYSTALLINE SILICA & CARBONATE CENTERS	158.8							
165															NODULAR FORMATION IRON								
170						BE									MASSIVE BROWN SHALE	171.0		6.0		1649			
175																174.0		5.3		1650			
180															JASPEROID IRON FORMATION - WASTE IS MOSTLY LARGE IRREGULAR STREAKS OF RED JASPER & CONGLOMERATIC & HEMATITIC SHALE 50.0' NE								
185																							
190																							
195															CONGLOMERATIC & HEMATITIC SHALE - CONTAINS LARGE LENSES OF RED JASPEROID IRON FORMATION	193.8		10.8		1651			
200																204.6		4.0		1652			
205															CONGLOMERATE FRAGMENTS (50-75%) (¼-3") MASSIVE SHALE	209.2							
210																							
215															NODULAR IRON FORMATION TRACES OF CARBONATE								
220						⅛-¾ R ¼-1½ I						¼-1½ R I											
225																							
230																							

GEO-23-2-CR (6/63)

091697

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-209-63 (IF-9-62)
DESCRIBED BY Gibbins + Sutherland
MEASURED BY 1962
AIR PHOTO No A/12148-(11")-183
AREA Headwaters of Bluff Creek
WEATHER C.A.V.U

DATE STARTED August 27/63
DATE COMPLETED August 27/63
MEASURING RATE 6 hrs.
COORDINATES 113,700 N.; 98,600 E
CLAIM P-12

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 8
DATE August 27, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC.	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
500															Conglomeratic Iron Sandstone Matrix is coarse grained hematite and red jasper	526							
520																618		8.0'		2334			
540																609		9.0'		2336			
560																491		5.5		2338			
580															Large, irregular bands and lenses from 2" to 3"	485							
600															Upper eroded sandstone Quartz, calcite up to 1/2" in maximum size in sub-rounded grains, shaly cleavage 1/8" to 1/2"	731		2.0'		2332			
620															-100% bands and lenses 2"-6" -A few bands of conglomerate	711		2.0'					
					1/2-2" I 1-10" R			1/2-5" R							- Trace of relict texture - Minor beds of shale	692.5		8.5		2333			
640																682.5		10'		2331			
660																672.5 662.5		10'		2337			
680					Interbedded conglomeratic and hematitic maroon shale			1/4-1 1/2" R vc 1/4-1 1/2" I								652		10'		2338			
700					1/8-1/4 R 1/4-1"										- A 6" shale band at 429' & 426.5 - At 428.5' a band of brown conglomerate - Banded iron formation	630		2.0'		2340			
720					1/2-1" I 1-2" R			1-4" R							Some ovoids have metallic and maroon jasper centers Trace of relict structure	610		2.0'		2342			
					Mafic maroon shale with 5% fine shale and chlorite pebbles			1/4-1/2" I							At 410-410.5' there is a band of brown shale, calcite ovoids	590		4.0'		2339			
740					1/8-1/2 1/4-4"			1/4-1/2" R							Trace of red ovoids Trace of red BE (Birds Eye)	580							
760					1/8-1/2" R 1/4-1 1/2" I			1/8-1 1/2" R							Ovoids have maroon jasper & hematite centers - 10% relict BE - with lenses are BE								
780					1/8-1/2" I 1/4-3" R			1/4-2" R							- At 325' there is a 3" band of shale - 10% shredded dolomitic	525		2.0'		2341			
800					Dark brown 3% slightly calcareous sandstone Quartz, maroon & green jasper, hematite up to 1/8" in maximum size in sub-rounded grains, calcite veinlets & vugs Shaly cleavage 1/8" to 1/2"			1/4-3" I								505		4.0'		2342			
820																485		4.0'		2343			
																465							
840																452		10.0'		2344			
860					1/4-1/2" I 1/4-1 1/2" R			1/8-1/4" R 1-2"							Nodular iron formation 5% very weakly developed quartz Trace of red jasper BE (Birds eye)	432							
880					1/8-1/4" R 1/2-1 1/2" R			1/2-2" I							Maroon lenses 1/2-1" thick 1-10" long								
900					+60% fragments 1/8" to 1 1/2" in size (1/4" to 3/4" in majority) sub-rounded to sub-angular in quartz, calcite and jasper, greenstone, dolomite, limestone, quartzite, shale Matrix is brown shale chemically											385		10.0'		2345			
920																365		10.0'		2346			
					Distorted - iron formation - bands of jasper			1/8-2" R															
940					1/8-1/4" R 1/2-1"			1/8-2" R								346.5		5.0'		2347			
					1/8-1/4" R 1/4-1"			1/4-1/2" R 3/4-6"							A lense of conglomerate at 302'-308' Type of channel filling	306.5							
960					Interval 1/8-1/4"			1/4-1/2" R 1/2-10" long			1/4-3/4" R				FAULT	300.5							
					1/8-1/2" R 1/2-2"						1/8-2" R				- 4" to 8" bands of conglomerate - 95% large irregular streaks of red jasper - 10% Stained of quartz & carbonate	288		8.5'		2348			
980											1/4-2" I				- Some ovoids have Fe_2O_3 centers - Slicken sides from 279'-282'	279.5							
											1/8-1" R				- 80% waste is conglomerate - A trace of lenses	272		2.0'		2350			
Bands											1/2-1 1/2" I				Banded iron formation Other 20% waste is 2" to 4" bands of conglomerate	265							
1000					1/8-1/4" R 1/4-1 1/2" I						1/2" R				- Trace of relict texture - Red jasper borders maroon bands	260 259		1.0		2349			
1020					1/4-1/2" I 1/4-8" R						1/8-2" I				A few silicate veins								
1040					1/4-1/2" R 1/4-4"						1/8-1 1/2" I				- 233-234' there a bands of brecciated carbonate & red jasper and conglomerate 2" to 4" thick - Ovoids are angular and form into bands - Lenses are carbonate								
1060					1/8-1/2" R 1/4-8"			1/8-1/2" R 5/8"			1/4-1/2" R				- At 225' there is a band of brown shale - Ovoids have maroon jasper & hematite centers - A trace of relict texture and patches								
1080					1/4-1/2" R 1/4-8"						1/8-1 1/2" R				- Unaligned lenses 1/8 to 1/2" long - Some have hematite in centers	240		60'		2353			
					- Breccia matrix bands like with calcareous matrix at top, coarse and crumble at bottom											225		60'		2354			
1100					1/8-1/4" R 1/4-1/2" I										Nodular iron formation Waste is mostly irregular zones of small irregular lenses	165							
					Shaly iron formation containing bands of siltstone up to 3"										Nodular iron formation Ovoids are mostly dull orange maroon jasper and BE.								
1120					1/4-1/2" I 1/4-1" R																		
					Medium brown massive shale (same as 148-148)						1/2-2" R				30% irregular streaks of jasper	105		25'		2355			
1140					TR TR B.E.						1/2-2" R				50% irregular streaks of jasper	80							
1160					Conglomeratic, dark brown shale - (slightly hematitic) fragments up to 1" (1/8" to 1") angular to sub-rounded quartz, carbonate & red jasper, hematite pebbles													6.0'		2356			
											1/8-1/4" I 1/4-1"				Also irregular streaks & blebs of jasper								
1180											1/8-1/4" R 1/4-1 1/2" R	TR			2.5% quartz & carbonate patches								
											1/8-1/4" R 1/4-1/2" I	TR?	TR	TR	Nodular iron formation Waste average zoning & lenses with bands of nodular hematite & maroon jasper centers								
1200												TR	BE		Red jasper occurs mostly as borders of maroon bands in brown shale	193.5		5.5		2357			
					Massive non-calcareous (except for a few stony veinlets) dark brown shale with hematite cement, 5" bed of bleached (acid type) jasper & hematite shale) Broken (40-45°) at 1200' (at 1218') subangular & coated w/ carbonate & graphite & consists of carbonate & quartz in a calcite matrix											poorly sorted gravel	180							
1220																							
1240																							
1260																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091609

SECTION No. IF 213-63 (or 13-62)
DESCRIBED BY W. (GIBBIE) GIBBINS
MEASURED BY 1962
AIR PHOTO No
AREA 3 MILES UPSTREAM FROM CAMP ON IRON CREEK
WEATHER CAVU

DATE STARTED Aug 9/63
DATE COMPLETED Aug 9/63
MEASURING RATE 7 hrs
COORDINATES 102,200 N, 95,200 E
CLAIM

ROCK TYPES

OVOIDS
UNALIGNED LENSES
ALIGNED LENSES
BANDS
IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg. 125°/25°W
FAULT STRIKE / DIP eg. 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands, measured left to right as percent of total Siliceous waste

PAGE 1 OF 5
DATE Aug 9/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: ANT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: BOUND	ALIGNED LENSES: ANT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: BOUND	BANDS: ANT and COMP	BANDS: THICK RANGE	BANDS: BOUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0															HARD, DARK BROWN SHALE. TRACE OF CHERTY FRAGMENTS - ½ - 4 mm. diam. ? RUBBLE ?								
10															BANDY (15%) & CONGLOMERATIC (UP TO 4") (2%) HARD HEMATITIC SHALE								
20															DISSEMINATED LOW GRADE IRON.								
					Vbx 7/8 R M										TRACE OF CHERTY FRAGMENTS								
30															IRON SANDSTONE - COARSE GRAINED. SANDY IRON FORMATION. IRON FORMATION WITH IRREGULARLY ORIENTED LENSES &/or PEBBLES.								
															SANDY IRON FORMATION. CONGLOMERATE WITH & MAROON HEMATITIC SANDSTONE MATRIX. FRAGMENTS (2%) (½" - 2") ANGULAR TO SUB ANGULAR SHALE, QUARTZITE, CARBONATE, SANDSTONE, ETC.								
40																							
50																							
60																							
					Vbx 7/8 R						Vbx - 2"	I											
70															LIME TO MEDIUM GRAINED CALCAREOUS SANDSTONE W.S. DARK GREENISH BROWN F.S. DARK GREYISH BROWN.								
					Vbx 7/8 VS F R						Vbx - 1"	I			MINOR AMT OF OVOIDS & LENSES ARE PARTIALLY TO COMPLETELY ALTERED TO HEMATITE.								
80					Vbx 7/8 VS F R						Vbx - ½"	I			FRACTURED LENS OF CONGLOMERATE WITH CALCAREOUS LIGHT GREEN MATRIX WITH ANGULAR FRAGS (10-15%) OF LIGHT GREEN HEMA (1/8 - 1/2") A BRANCH OF CALCITE VEINLETS ½ - 1½" WIDE OF FLANKS CALCITE IRON FORMATION TO EAST OF FAULT. ALSO A FEW BEDS OF SHALE.								
					Vbx 7/8 VS F R						Vbx - 1"	I											
90					Vbx 7/8 VS F R						Vbx - 1"	I			TRACE OF HEMATITE IN OVOIDS & LENSES								
					Vbx 7/8 VS F R						Vbx - 1"	I											
100					Vbx 7/8 VS F R						Vbx - 1"	I			TRACE OF HEMATITE IN OVOIDS & LENSES.								
					Vbx 7/8 VS F R						Vbx - 1"	I											
110					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
120					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
130					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
140					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
150					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
160					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
170					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
180					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
190					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
200					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
210					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
220					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
230					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
240					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
250					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
260					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
270					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
280					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
290					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
300					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											
310					Vbx 7/8 VS F R						Vbx - 1"	I											
					Vbx 7/8 VS F R						Vbx - 1"	I											

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-214-63 (IF-14-62)
DESCRIBED BY G. Sutherland
MEASURED BY H. Klaassen
AIR PHOTO No. A 12106 - (PL.14) - 315
AREA Headwaters Discovery Creek
WEATHER Clear, sky, sunny and warm

DATE STARTED August 15/63
DATE COMPLETED August 15/63
MEASURING RATE 60 ft./hr.
COORDINATES 116, 300N; 134, 400E
CLAIM EE-11

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP ..... eg 125°/ 25°W
FAULT STRIKE / DIP ..... eg 125°/ 25°E
BRECCIATED ZONE .....
HALOS OF JASPER .....
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc.
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

DATE Aug. 15/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: BOUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: BOUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: BOUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No. RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	GRADE ANALYSIS: SAM No	GRADE ANALYSIS: Fe	GRADE ANALYSIS: SiO_2	GRADE ANALYSIS: P
232															Unconformity underlain by brown calcareous conglomerate with pebbles of chert, jasper, quartzite, dolomite and rare to sub-rounded pebbles up to 1" in diameter. Matrix is a brown shale.								
230					<¼" R			<¼" R			<1½" R				Top of bed is leaning up to 2° discordant in thinnings.								
220																							
210																							
200															Slightly calcareous grey conglomerate contains 80% pebbles <¼" R <¼" R <¼" R FC								
															Green marker sandstone calcareous 197.5 to 199 v.f. to fine sandstone	199							
190																1975	1.5			1394			
																1973	1.0			1393			
180																1972.5	1.0			1396			
170																1971.5	1.0			1395			
160																1970	1.0			1394			
150																1969	1.0			1393			
140																1968	2.5			1397			
130					<½" R			<½" R			<8" 5/R				Irregular patches up to 1" long.								
					<½" 5/R			<¼" R			<½" R												
120																							
110																							
100																96							
															Fine green non-calcareous sandstone (marker)	92	4			1400			
90					<½" R			<2½" R							Brown non-calcareous sandstone	91	1			1381			
					<½" 5/R			<½" R			≤½" R												
80					<¾" R			<¼" R			≤1" R 3/MC												
70					<1" 5/R			¾" R			<1" R				Oxides and Jasper are scattered on the surface.	87							
																85	2			1368			
60																83							
																80	3			1383			
50					Brown Siltstone - non-Calcareous																		
					<½"			<½"			<1" 7/R					77							
40					Fine dark brown sandstone - non-calcareous											76							
					<1" R			½" R			<1" R				Patches and lenses are up to 2" long. At 28 ft there is a ½" band of greenish brown shale.	40	3			1394			
30																							
					<1" R 5/R			½"			<1" R												
20																							
10																							
					Ferruginous and calcareous band at sandstone											4							
0					<1" I						<2" I				one sandstone band 4" thick at 4"	15		2.5		1356			

Underlying Beds - Calcareous maroon conglomerate. 60% round to sub-rounded pebbles up to 1" diameter composed of quartzite, shale, dolomite and igneous rocks. Matrix is brown shale.

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-216-63 (IF-16-62)
DESCRIBED BY W. Gibbons + A. Felinbee
MEASURED BY [illegible]
AIR PHOTO No. A 12051 - (10²) - 284
AREA South Iron Creek 1½ miles South of CampCLAIM I - 18
WEATHER Warm, Clear, Slight to Breeze to Calm

DATE STARTED August 22/63
DATE COMPLETED August 22/63
MEASURING RATE 330 / 5½ hrs.
COORDINATES 94,500 N; 88,800 E

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP ● eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE ^^^^^
HALOS OF JASPER
SPHERULITES ***
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 5
DATE AUG. 22, 1963

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES ROUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES ROUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS ROUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No. RUNS	ENGINEER DATA FT REC.	ENGINEER DATA % REC.	CRUDE ANALYSIS SAM. No.	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
															Section Measured By A	295							
330																295.6		2.6		2225			
															Jasperoid iron formation Birds Eye occur in zones	298.5		10		2226			
																335		3'		2227			
320	Sandstone - Thinly laminated - Green & Brown Fine grained (bottom) To silty dark brown shale (Top)														Banded iron formation	305							
310																							
300																295							
	Conglomerate Fragments (30-25%), (1/32 - 4") (rounded to subrounded with size) consisting largely of Light Buff Limestone; Matrix is a dark brown shale (slightly sandy)														Angular to rounded of light green shale & Low grade iron 4"-8" bands of conglomerate	298.5		6.5		2228			
290																298		5.5		2229			
280															Nodular iron formation Some ovoids have hematite centers								
															Banded iron formation. Narrow	276		1		2230			
	Andesite fine med. brown shale Breccia Conglomerate Fragments (30%) (1/8 - 4") subrounded														Jasper Bands have thin (1/16") and Jasper borders. To sub-rounded, mostly of light colored shale & carbonate types of Quartzite. Matrix is green shale								
260															Iron formation characterized by maroon & brilliant red jasper aligned lenses. Some of each type of ovoids have hematite centers irregular lenses which may contain spherulites.								
250																							
240															Nodular iron formation Most ovoids occur in zones of red jasper or carb. waste. Nodular iron formation similar to 233.5-237 but zones of jasper & carbonate waste. Nodular iron formation - Most of the ovoids are light brown carbonates. Unusual very nodular iron formation								
230																247		6		2231			
220	Murky Sandstone very fine to medium grained, very slightly calcareous weathered surface dark brown & indicates thin bedding. Fresh Surface dark grey, maroon & green-																						
															Conglomerate fragments (50%) (1/32 x 1/16) (4x2") angular to sub-rounded, mostly light colored carbonates								
210															Nodular iron formation Many ovoids have hematite centers. A few red jasper "Birds eye" carbonate bands & veinlets are concentrated between 193' to 200'.								
																198.0		2		2232			
200																200							
	Conglomerate Fragments (30%) (1/16 - 4") Sub-angular to rounded Characteristic Lenses and Laminated Jasper. Matrix is slightly Hematite stained Shale.																	10		2233			
190																190							
	Bands of Conglomerate (Coal 20%). Weathered surface - Light brown Fresh surface medium brown.																						
180															Nodular iron formation	180.5		25		2234			
	Conglomerate & Shale similar to 169 - 180, but even finer Fragments.																	9		2235			
170																171		2		2236			
	Strongly Conglomeratic iron formation (2-5% rounded fragments)															169							
160	Conglomeratic Shale:- Fragments (Coal 5%), (1/8 x 1/16 to 3x5"), Sub-rounded to rounded. Matrix is Maroon - Brown shaly Shale.														Lower grade than 132-162 due to increase in shaly components & irregular streaks of red jasper			8.5		2236			
															Ca = Calcium.	161.5							
150																							
140																							
130																							
120															Shaly iron formation 1-3" bands of conglomerate. Some maroon jasper ovoids with light brown carbonate centers & red jasper borders. Also red jasper ovoids some having hematite centers. 12.5% irregular red jasper.								
110																							
100																							
90																							
80																							
	Conglomerate Fragments (vary 15-25%) (1/32 x 1/4 - 4" x 2"), Sub-angular to rounded, includes Quartzite (4"x2"), Shale, carbonate & diabase? Matrix is dark brown to dark maroon brown shale.															74.5		10		2236			
70																64.5							
60																54.5		10		2237			
																		10		2238			
50																44.5							
40																		11.5		2239			
30															Similar to below without lenses of jasper & bands of conglomerate. Irregular nodular iron formation - 50% composed of 4-8" bands of conglomerate & lenses of red jasper especially 16.0 - 19.0	33							
20																18		3		2240			
10															Banded iron formation: Trace of pebbles.	15							
0																							

GEO - 23 - 2 - CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IE - 819 - 63 (IE - 19 - 63) — DATE STARTED August 24/63

DESCRIBED BY Keibler, Hahn, Brandberg — DATE COMPLETED August 24/63

MEASURED BY [illegible] — MEASURING RATE 7 hrs

AIR PHOTO No. A 21479 (11A) - 183 — COORDINATES 100 N, 85 E 500 E

AREA Iron Creek 1/2 mile East of Camp — CLAIM L - 19

WEATHER C.A.V.U.

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE — SILICEOUS WASTE TYPES — VEINLETS

STEEL GREY HEMATITE		RED JASPER		QUARTZ	S
MAROON HEMATITE		MAROON JASPER		CARBONATE	C
BOTH		MICROCRYSTALLINE QUARTZ		HEMATITE	H
				FEW	F
				MANY	M

BOUNDARIES : R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite.

REMARKS : BEDDING STRIKE / DIP ..... @ 125°/ 25°W
FAULT STRIKE / DIP ..... @ 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc.
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	DISSOLVED LENSES SIZE RANGE	DISSOLVED LENSES SHAPE	DISSOLVED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES SHAPE	ALIGNED LENSES AMT and COMP	BANDS THICK RANGE	BANDS SHAPE	BANDS AMT and COMP	VEINLETS	REMARKS	LEN RUN	LEN No.	LEN RUNS	CRUDE ANALYSIS FT REC	CRUDE ANALYSIS % REC	CRUDE ANALYSIS SAM No.	Fe	SiO2	P
340															Banded Jasper Hematite Shale (aerial photo)								
360															Iron Creek Gabbro (aerial photo)								
380															Camp Limestone (aerial photo)								
400															Iron Creek Fault Zone (aerial photo)								
420															Basal Quartzite (aerial photo)								
440															Footwall Gneiss (aerial photo)								

DATE August 24/63

PAGE 1 OF 6

091697

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF 221-63 (IF-21-62)
DESCRIBED BY A. Barrett (replotted [illegible] Nov'63)
MEASURED BY 1962
AIR PHOTO No. A12106 - (FL 143) - 315
AREA Creek between Discovery creek and Boundary
WEATHER Sunny

DATE STARTED August 14/62
DATE COMPLETED August 14/62
MEASURING RATE 250/4 hrs.
COORDINATES 109,900 N, 150,600 E
CLAIM JJ-12

ROCK TYPES

IRON FORMATION	SILTSTONE
JASPER	SHALE
CONGLOMERATE	LIMESTONE
BRECCIA	DOLOMITE
SANDSTONE	COVERED

% HEMATITE	SILICEOUS WASTE TYPES	VEINLETS	
STEEL GREY HEMATITE	RED JASPER	QUARTZ	S
MAROON HEMATITE	MAROON JASPER	CARBONATE	C
BOTH	MICROCRYSTALLINE QUARTZ	HEMATITE	H
		FEW	F
		MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite.

REMARKS: BEDDING STRIKE / DIP....... eg 125°/ 25° W
FAULT STRIKE / DIP.......... eg 125°/ 25° E
BRECCIATED ZONE ....
HALOS OF JASPER ....
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc.
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 4

DATE Aug 14/63

INTERVAL	LENSES / BANDS	REMARKS	FT. REC.	SAM. No.
0		Poor Iron Formation (jasperoid), maroon - interbedded ferruginous sandstone. One quartzite boulder (1 ft x 6") @ 4.5 ft.	2.0	427
			3.0	426
			2.0	1556
10		CONGLOMERATE (Dark brown to maroon) Fragments 20% (1mm to 2") Some up to 8" Sub-angular to sub-rounded composed of shale, greenstone and quartzite. Matrix is calcareous maroon shale, Bed pinches and swells.	4.0	1557
20		Maroon shale interbedded with conglomerate. 10% sub-rounded to rounded fragments (1mm - 2") Pebbles of Greenstone, shale, carbonate. Also a 2" band of Sandstone.	10.0	1558
			8.0	1559
30	1/16-1/8 R; 1/4-1/2 I		3.0	325
		SANDSTONE: WS - grey green F.S. light grey - fine grained calcareous & massive.		
40		SANDSTONE: Blebby, coarse grained with hematite and jasper. W.S. light brown F.S. metallic	10.0	1560
			.0	1561
50		SANDSTONE W.S. maroon to metallic F.S. grey, medium to coarse grained, high in hematite and jasper content	4.0	1562
60		Covered interval measured this year as 12 ft and not 6 ft.		
	1/2-1" I		2.0	324
		SANDSTONE: WS light brown to maroon F.S. green to grey fine to coarse grained, calcareous	2.0	1563
70	1/2-1" R	25% waste in irregular patches of red jasper.	3.0	323
	1/2-1" R	25% waste in irregular patches of red jasper	3.0	322
	Trace; 1/8-1/2 R, 1/2-3/4; 1/2-4" R	Some lenses are weathered out. 25% in irregular jasper & siderite nodules.	3.0	321
80		Also about a 6" band of shale (bedding 1/4-1/2")	3.0	320
			4.0	319
90		SANDSTONE:- W.S. Dark brown to grey F.S. Dark green, fine grained, massive, hard non calcareous. Also a thin band 6" of jasper	10.0	1565
100			10.0	1566
110		25% made up of waste is a brown carbonate (limonite ?) Interval becomes crumbly towards the bottom.	3.0	318
			3.0	317
			3.0	316
120			4.0	315
		SHALE	2.0	1564
		Waste is in red jasp bands (1/4-1/2 ft) & jasp streaks	2.0	314
		Conglomerate ss	1.0	1567
	1/6-1/8 I; 1/3-1/4 R		1.0	313
130		Conglomerate frags 65% subangular to subrounded (1/8-3") of qtzite, grnstn & carb - Pinches & swells.	3.0	1568
		Waste occurs in blotchy red jasper patches and a 1/4-1/2" band of maroon jasp.	2.0	312
	1/8-1/4 I; 1/4-3/4	Ovoids also occur as	2.0	311
		siderite (?) or carbonate	2.0	310
		Quite shaley @ Top	3.0	309
140	1/8-1/4 I; 1/4-3/4		3.0	308
			3.0	307
		Conglomerate - reddish to metallic, very ferruginous. 45% frags (1/8-1/4) subrounded to rounded. Pebbles are green shale, carbonate (dol), and qtzite, matrix calcareous and sandy. Also a 1 foot band of grey siltstn.		
150	1/4-1/2 I	Shaly and crumbly. 50% of waste occurs as irregular red jasper patches and brown carbonate nodules.	3.0	306
			3.0	305
	1/8-1/4 R; 1/4-3/4; 1/4-1/2 I	25% of waste in carbonate patches and irreg red jasper patches	2.0	304
160			3.0	303
	1/8-1/2 I; 1/2-1 1/2; 1/2-1" R	15% waste in carbonate nodules and lenses	2.0	302
			2.5	301
			3.5	200
170		Poor iron formation - conglomeratic sandstone and I.Fm are interbedded. IFm mostly banded with red jasper, Conglomerate - fine grained matrix with small pebbles of mostly greenstone (1mm - 1/2")	3.5	199
			3.5	198
180		CONGLOMERATE: W.S. dark brown to grey. Frags (60%) (1/2-8") Some larger, sub-rounded to rounded, pebbles are greenstone, carbonate, and qtzite matrix calcareous sandy and maroon shale		
190				
200				
210				
220				
230				
240		Thin 2" band of congl. Waste occurs in thin bands of jasper showing "flow structure" irregular jasper patches	2.5	197
			3.0	196
250			3.0	195
		CONGLOMERATE: W.S. - metallic green brown. Fragments angular to rounded - Matrix sandy and ferruginous		
260				

GEO - 23 - 2 - CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091697

SECTION No. IF-229-63 (IF-27-62)
DESCRIBED BY A. Gracieatt
MEASURED BY Nixon and Steele
AIR PHOTO No. A-12956-(104)-283
AREA South Iron Creek - Southernmost exposure on East side
WEATHER Sunny / Hot

DATE STARTED Aug. 26/63
DATE COMPLETED Aug. 26/63
MEASURING RATE 50'/hr
COORDINATES 83,800N; 22,000 E
CLAIM I-23

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125° / 25° W
FAULT STRIKE / DIP eg 125° / 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Aug. 26/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	BANDS AMT and COMP	BANDS THICK RANGE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
140												Maroon conglomerate. Fragments (20%) sub-angular to sub-rounded (1 mm. to 1") Pebbles are jasper, greenstone, dolomite and quartzite. Matrix is non-calcareous maroon shale.								
130																				
120												Sandstone VF. dark grey (banded) F.S. light green grey calcareous, medium grained. Conglomerate at upper and lower contact.								
					½-¾" R				½-2" R			At 111'-4" band of grey calcareous sandstone. 10% of waste in irregular patches of red jasper and carbonate (weathered out) Also a thin conglomeratic siltstone band at 91'	113							
					¾-2"								110	3			2266			
110																				
													104							
100													100	1.5			2267			
90					½-¾" R		½-¾" R					Banded Sandstone, maroon to light green. F.S. grey green Calcareous and tuffaceous in parts graded	93.7							
					¾-2½"		¾-2½"					10% waste in streaks of red and maroon jasper.	93	3			2268			
					½-¾" R		½-¾" R		¼-3" R			15% waste in irregular patches of red and maroon jasper and light carbonate								
80													76.5							
					½-1" R				½-1" R			Very ferruginous conglomerate, 75% fragments, slightly calcareous	74	3.5			2269			
					¼-2"							15% of waste occurs in irregular streak showing flow structure								
70													69.5							
												Conglomerate, dark maroon FS maroon slightly hematitic Fragments (¼" to 7") (4-7%) sub-angular to rounded. Pebbles are dolomite, green stone and sandstone. Matrix is ferruginous calcareous maroon shale.	52	1.5			2270			
					½-¾" R							FS 25% irregular patches of red jasper.	50							
60					½-¾" R				½-¾" I			Brown conglomerate interbedded with iron formation.	48	5			2271			
	Trace				¼-¾"							9 1" band of jasperoid iron formation at 45.5'								
												15% of carbonate areas have weathered surface								
50																				
40																				
									½-2" R			10% waste occurs in carbonate bands and irregular patches and streaks of jasper.								
30																				
					½-¾ R		½-¾ R		½-1½" R			A jasperoid iron formation								
					¼-1"		¼-½"													
20																				
10																				
0												Minor calcareous maroon shale. Bedded ¼", Friably	15	1.5			2272			
													0							
												Underlying Beds - Maroon calcareous conglomerate. Fragments - Sub-rounded to sub-angular (¼" to 6") pebbles of chert, jasper, quartzite, dolomite and shale. Matrix maroon shale.								

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091697

SECTION No. IF-232-63 (IF-32-62)
DESCRIBED BY G. Sutherland
MEASURED BY A. Gorrcatt
AIR PHOTO No. A-12086-(42)-352
AREA South Iron Creek - West Side
WEATHER Sunny and Warm, light breeze

DATE STARTED Aug. 26/63
DATE COMPLETED Aug. 26/63
MEASURING RATE 50'/hr
COORDINATES 82, 200 N, 75, 600 E
CLAIM H-21

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite.
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite.
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 2
DATE Aug. 26/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BRUNT	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BRUNT	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BRUNT	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
100				Calcareous				Brown							Conglomerate. Fragments sub-round to sub-angular of quartzite, jasper, shale and dolomite up to ½" diameter. Soft fragments grading to 35%. fragments and the bottom. Matrix is brown shale.									
90																							
80																13							
																94	3			2275			
															A few carbonate nodules.								
70																							
																62							
60				Brecciated	Slightly	calcareous								FS	Patches to 1"	60	2			2274			
														FS	Twisted iron formation.								
50																							
40																46							
															Matrix calcareous, fragments slightly hematitic, rounded and coloured calcite crystals, diameter, rock fragments of shale, hematite, jasper, some pieces of fly chert, Matrix is maroon shale.	39	5			1917			
														FS	Structure is very twisted.								
																39							
															Calcareous maroon conglomerate of ¼ pebbles of shale and jasper and quartzite up to ½" diameter. Matrix maroon shale.	31	3			1918			
30														FS	Patches to 2" long.								
															Patches up to 1"								
20																							
10																							
0																							
															Underlying beds: Calcareous maroon conglomerate and over 20% fragments of shale, dolomite and quartzite (<4") sub-round to sub-angular. Matrix is maroon shale								

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-23-63 (IF-33-62)
DESCRIBED BY Folinsbee
MEASURED BY Nixon
AIR PHOTO No A 12148-(FL 13)-272
AREA Discovery Creek
WEATHER 5/10 high cloud Windy and Warm

DATE STARTED August 26/63
DATE COMPLETED August 26/63
MEASURING RATE 180'/shift
COORDINATES
CLAIM BB 10

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES — REGULAR - i.e. Even boundary between Jasper and Hematite
IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3
DATE Aug. 26/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES DIRN	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES DIRN	BANDS AMT and COMP	BANDS THICK RANGE	BANDS DIRN	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC.	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
0															Overlying debris, conglomerate, W.S. dark grey, F.S. grey, 40% fragments, rounded, well bedded, 1 cm - 2" shales. Matrix is ~~sandy~~ calcareous sandy dark shale. Very poorly bedded.								
															Very steep cleavage sandstone - calcareous								
50					½-3 ⊥ ½-5	½-2"									Shaly cleavage in places sandstone lenses 1" x 3"								
70					½-1 R ½-2 ⊥			½-½ R			½-½				Round sandy lenses ½"-3" Conglomerate lenses (½-1) (5" - 1ft.)								
60															Iron sandstone W.S. maroon, F.S. Maroon grey - calcareous	5'9"							
															Conglomerate 5-7% fragments 1mm - 2" Matrix calcareous sandstone	5'10"		4.5		1877			
															Thickened iron formation.								
															Conglomerate - 20% fragments of reed shales and quartzites. Matrix is calcareous sandy maroon shale.	5'10"		4		1880			
50					½-½ ⊥ ½-1			½-½ R			½-1" R												
40					Clear soil ½-2 ⊥ ½-2" ⊥			W.S. ½-½ R			F.S. brown ½-½ R				F.S. maroon	5'9"		1		1878			
					Grey calcareous sandstone											5'10"		2.5		1879			
30					½-¾ R ½-2 ⊥			½-2" R			½-1" R				Considerable amount of siliceous waste is brown.								
					Clear soil ½-2 ⊥ ½-2" ⊥			W.S. ½-½ R			F.S. brown ½-½ R				F.S. grey	5'9"		1		1881			
20					Clear soil ½-2 ⊥ ½-2" ⊥			W.S. ½-½ R			F.S. brown ½-½ R				F.S. grey	5'9"		1		1882			
																5'10"		1		1883			
					Slightly calcareous sandstone - W.S. brown grey F.S. brown grey. Cherty lenses (¼"-6" x ½"-1ft)												5'9"							
90					½-½ R ½-1 ⊥			½-½ I			½-½ I				W.S. grey F.S. maroon; fragments 1mm - 4ft. ~~so~~ - rounded well rounded shales, limestone & quartzite. Matrix is sandy calcareous maroon shale. Poorly bedded and leaning	5'9"		6		1885			
																5'10"		8		1889			
70					½-½ ⊥ ½-3" ⊥			½-½ R			½-1" I				F.S.								
60					½-1 R ½-3" ⊥			½-½ R			½-3"				F.S.								
50					½-½ R ½-2			½-½ R			½-2 R				Carbonate leaders								
40					½-2 R ½-2 ⊥			½-5 R			½-2 R				Maroon bands contain red jasper reeds.								
					½-½ R ½-1" ⊥			½-½ R			½-1 R				25% patchy red jasper Shaly cleavage in places								
30					Brown sandstone ½-½ ⊥			F.S. maroon ½-½ R			25% fragments of shale Matrix calcareous maroon shale.					5'10"		9		1887			
					Brown conglomerate - 5% shale ½-3" well rounded																		
20					½-½ ⊥ ½-4" ⊥			½-½ R			½-3" R				F.S. sandstone band from 3.5' to 4'	5'10"		10		1888			
																5'11"		¾		1888			
0					Chocolate brown sandstone, calcareous F.S. grey																		

1401

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-237-C3 (IF-37-62) **DATE STARTED** Aug 12/63

DESCRIBED BY W. Gibbins **DATE COMPLETED** Aug 22/63

MEASURED BY 1962 **MEASURING RATE** 9 hrs.

AIR PHOTO No. A13478-(FA 117)-182 **COORDINATES** 108,600 N; 71400 E

AREA Wabush Lake Extension Creek **CLAIM** N-13

WEATHER Cloudy - Occasional light rain

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE — SILICEOUS WASTE TYPES — VEINLETS

STEEL GREY HEMATITE		RED JASPER		QUARTZ	S
				CARBONATE	C
MAROON HEMATITE		MAROON JASPER		HEMATITE	H
				FELDSPAR	F
BOTH		MICROCRYSTALLINE QUARTZ		MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS: BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Reliet texture measured left to right as percent of total Hemotite
Percent Voids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 7

DATE Aug. 12/63

MATERIAL	LITHOLOGY	% HEMATITE	% RELICT	VOIDS	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: AMT and COMP	BANDS: THICK RANGE	BANDS: AMT and COMP	VEINLETS	REMARKS
Overburden: Sand, gravel, boulders.												
Sandy Clay: Brown, soft, plastic.												
Clay: Grey, soft, plastic.												
Sand: Brown, fine to medium grained, loose

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-238-63 (IF-38-62)
DESCRIBED BY Gorveatt
MEASURED BY 1962
AIR PHOTO No. A-12148-(FL 12°)-210
AREA Iron Creek 5 miles West of camp
WEATHER CAVU

DATE STARTED August 23/63
DATE COMPLETED August 23/63
MEASURING RATE 4 hrs
COORDINATES 99, 500 N, 100, 200 E
CLAIM S-17

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

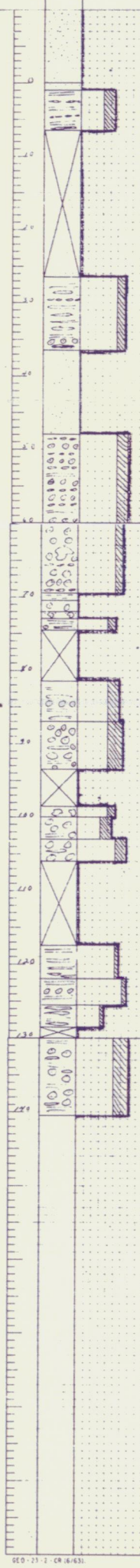
QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF
DATE Aug 23/63



INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES BOUND	ALIGNED LENSES AMT and COMP	ALIGNED LENSES THICK RANGE	ALIGNED LENSES BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARK	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO2	CRUDE ANALYSIS P
															Sandstone. W.S. dark grey brown. Massive, medium grained, highly calcareous. Also a red jasper lense.								
0				Trace		1/4-1/2" R 1/2-3/4"			1/4-1/2 R			1/2-2" R I		FS	20% waste in carbonate lenses and bands.								
10																							
20																							
30						1/8-3/4 R 1/2-2"			1/8-1/4 R			1/4-1 1/2" R			15% waste due to carbonate and red jasper streaks.								
40															Sandstone. W.S. light to dark brown (buff) F.S. iron grey (metallic luster). medium to fine grained, calcareous and ferruginous. Bedding is massive (2½ ft) to fine (1/4-3/4")	16.5							
50									1/8-1/2 R I			1/4-3/4 R			Thin band of weathered carbonate	48		115		1905			
60									1/4-1/2 I						25% waste in irregular patches and streaks of red jasper.								
70															Poor iron formation. waste mainly jasper ovoids + streaks conglomerate fragments 40% Dark brown to maroon	72 73				1906			
80						1/4-3/4 R 1/2-4"			1/32-1/16 R			1/8-1/4 R		FS									
90						1/4-1/2" I 1/2-3/4"						1/16-1/8" R			Trace of limonite. 10% waste in irregular red jasper patches.								
100												1/4-1/2" I			Waste occurs in irregular patches of red jasper. Also 6" of shale. 25% of waste occurs in irregular patches of red jasper.	98.5 100		15		1907			
						1/16-1/8									25% waste in carbonate patches. (Nodular surface)								
110																							
120						1/8-1/4" R 1/4-1/2"						1/4-2" R I		Trace S	10% waste occurs in carbonate patches and irregular red jasper patches								
												1/16-1/8		Very I	25% waste occurs in irregular jasper patches.								
				Trace		1/8-1/4 R 1/4-1/2"						1/4-1/2" I			Large weathered out carbonate patches.								
130						1/8-1/4 R 1/4-1/2						1/8-1/2" R			Carbonate and red jasper streaks.								
140																							

GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-239-63 (IF-39-62)
DESCRIBED BY Gibbins
MEASURED BY 1962
AIR PHOTO No. 12148-(FL 12³)-210
AREA N. side Iron Creek 5 miles upstream from camp
WEATHER Scattered showers

DATE STARTED July 21/63
DATE COMPLETED July 21/63
MEASURING RATE 7 hrs.
COORDINATES 99,300 N; 102,700 E
CLAIM R-17

091697

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

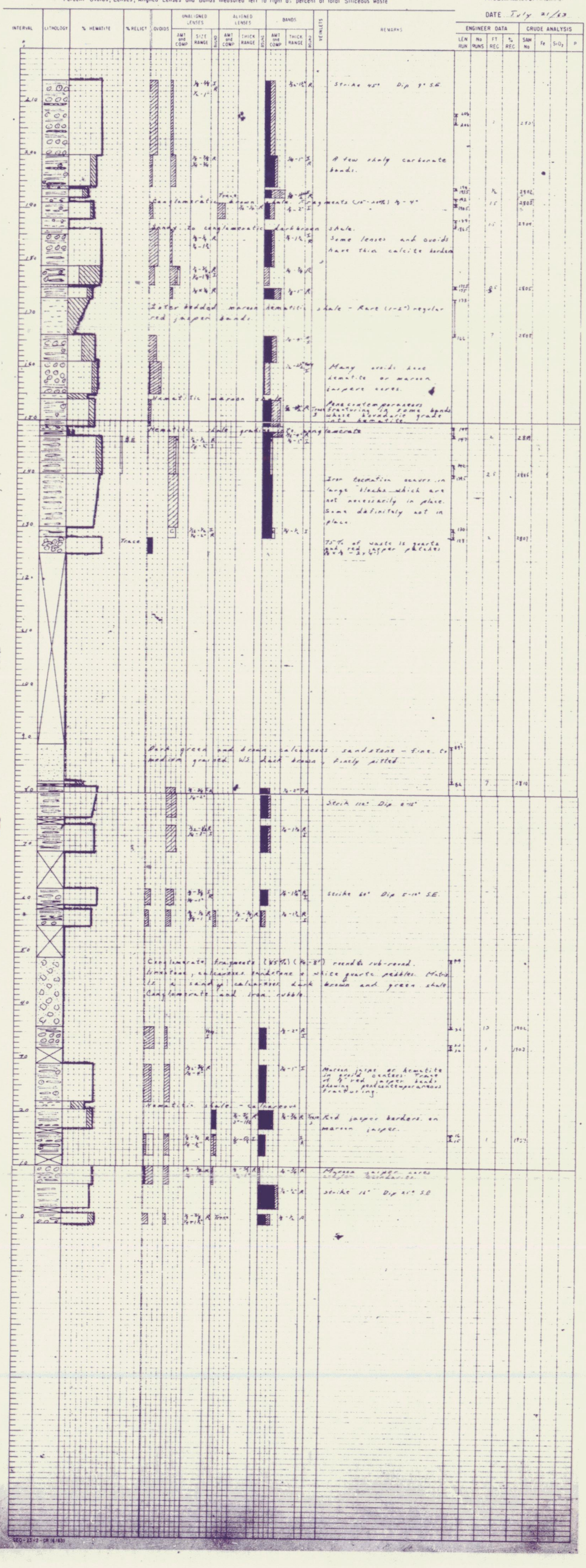
QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/25° W
FAULT STRIKE / DIP eg 125°/25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE July 21/63



GEO-23-2-CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

SECTION No. IF-243-63 (IF-43-62) — DATE STARTED August 23/63
DESCRIBED BY. Folinsbee — DATE COMPLETED August 27/63
MEASURED BY 1962 — MEASURING RATE 200'/5Acc
AIR PHOTO No. A-12056-(9")-351 — COORDINATES 97,800N ; 45,900 E
AREA 3 miles S.W. of Camp — CLAIM D-17
WEATHER Sunny, cool

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict Texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4
DATE Aug 23/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: ROUND	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: ROUND	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: ROUND	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT REC	ENGINEER DATA: % REC	CRUDE ANALYSIS: SAM No.	Fe	SiO_2	P
210															Conglomerate massive 10% fragments ave - 4" W.F. brown RS. matrix.								
															Leading band of jasperoid iron formation containing in leading band of conglomerate.	213 216	1			1479			
					¼-½ R ¼-1" I			½-¾ R I			½-½ R												
															Jasperoid iron formation: Patchy red and maroon jasper.	206.5 209	1.5			1478			
200					¾-1¼ R 1-3"			¾-1 R			¼-1" I				Loose of conglomerate 1ft W 37° at 199'								
190															Conglomerate W.S. brown F.S. maroon fragments 20% sub-angular cobbles (½" - 2½") Matrix maroon shale. Massive.	189							
					Trace ½-1½ R ¾-2 I			½-1½ R I			¾-1½ R					195	5			1477			
180																180 178	2			1476			
			Trace		½-1½ R ¾-1" I			½-1½ R I							Much slickensiding.	172 174	1			1475			
170					¾-1 I ½-3"			¾-1½ I			¾-1 R												
160															1ft I Patchy red jasper band leaning	157.5 158	1.5			1474			
															W.S. green brown F.S. green red, slightly calcareous, massive	150	6			1473			
150																							
			Trace		½-1½ R ¾-2" I			½-1½ R			¼-1" R												
140					¼-1" R			¼-¾ R			¼-1" R				brown non-calcareous sandstone.	135 137	1			1472			
			W.S. and Trace		¼-1" R ¾-4" I			¼-¾ R			¼-1" R				W.S. grey green conchoidal chert 30% conglomerate fragments in matrix.	134	2			1471			
130					¼-¾ R ¾-4" I			¼-¾ R			¼-1" R												
			Trace		¼-¾ R ¾-4" I			¼-¾ R			¼-1" R					129 131							
			Grey		quartz ¼-¾ R ¾-2" I			¼-¾ R I			¼-1" R I				W.S. absolute brown.		1.5			1470			
120																							
					¾-1¼ R ¾-5" I			¾-1 R			¼-2" R												
110																							
															Conglomerate W.S. brown grey F.S. brown grey fragments 80% 1mm - 8" sub-angular to round shales, jasper pebbles and broken bands. Bed is leaning (Thickness is 25 ft.) and may pinch out. Matrix is ferruginous shale.								
100											½-3" R				15% patchy red jasper.								
90																							
																76 77	1			1469			
80																							
			Trace		¼-¾ R ½-1" I			¼-¾ R I								69 66	2			1468			
			W.S. brown F.S. maroon grey		¼-¾ R ¾-4" I			¼-¾ R							Fragments 1mm - ½" angular to sub-angular Matrix ferruginous shale. 20% patchy red jasper.								
70			Trace		¼-¾ R ¾-4" I			¼-¾ R															
															Hosts of waste is patchy red jasper bands (¼"-½")								
60																							
					¼-¾ R ¾-4" I			¼-¾ R I			½-1" R I				Ovoids have maroon centres.								
50															Evidence not exist (Strike) Workings are covered								
					¼-½ R ¾-4" I			¼-½ R I			½-3" R I				30% patchy red jasper.								
40																							
					¼-½ R ¾-4" I			¼-½ R							Slickensiding 28.5 - 26'								
30					¼-½ R ½-½			¼-½ R															
					¼-½ R ¾-5"			½-¾ R							Slickensiding, shaly calcareous - Lenses 2"x2ft Carbonate in some lenses.								
20																							
					½-¾ R ¾-4"			½-¾ R							Considerable carbonate in fractures.								
10					½-¾ R ¼-½			½-¾ R							Strike 135° Dip 42° SW								
					¼-½ R ½-1"			¼-½ R															
0															Conglomerate - W.S. brown maroon F.S. brown Jasper fragments 2ft - massive Contact on some surfaces.								
-140			Trace		¼-½ R ½-1"			½-¾ R			½-¾ R					140							
-145																							
-150															Dolomitic F.S. grey W.S. brown	Fault at -150 ft.	150	10		1480			
-160																							

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091607

SECTION No IF-244-63 (IF-44-62)
DESCRIBED BY W Gibbon and E Greenberg
MEASURED BY 1962
AIR PHOTO No A 12056-(FL 10²)-284
AREA East side Sawtl Iron Creek
WEATHER Calm, Sunny, Warm

DATE STARTED August 23/63
DATE COMPLETED August 23/63
MEASURING RATE 200'/5 hrs
COORDINATES 44,400 N; 81,000 E
CLAIM I-19

ROCK TYPES

IRON FORMATION
JASPER
CONGLOMERATE
BRECCIA
SANDSTONE
SILTSTONE
SHALE
LIMESTONE
DOLOMITE
COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FER F
MAG M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/25°W
FAULT STRIKE / DIP eg 125°/25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 3
DATE Aug. 23/63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	% OVOIDS	UNALIGNED LENSES: AMT and COMP	UNALIGNED LENSES: SIZE RANGE	UNALIGNED LENSES: SHAPE	ALIGNED LENSES: AMT and COMP	ALIGNED LENSES: THICK RANGE	ALIGNED LENSES: SHAPE	BANDS: AMT and COMP	BANDS: THICK RANGE	BANDS: SHAPE	VEINLETS	REMARKS	ENGINEER DATA: LEN RUN	ENGINEER DATA: No RUNS	ENGINEER DATA: FT RES	ENGINEER DATA: % REC	GRADE ANALYSIS: SAM No	GRADE ANALYSIS: Fe	GRADE ANALYSIS: SiO_2	GRADE ANALYSIS: P
200															Dark maroon to green silty shale + siliceous to shaly maroon hematite, a few irregular bands of maroon hematite. Carbonate ovoids with red jasper borders. A few calcite veinlets at 135° and irregular jasper patches	2065							
																204		2.5		2241			
																141		4		2242			
																137		1		2243			
190																136							
																132		2.5		2244			
															Bedding to very thin bedding plane cleavage (1/2 - 1/4") R3. medium to dark brown. Banded iron formation. Trace of conglomerate leases. 25% irregular small nodules. (1/2 - 3/4")	127							
180																122		5		2245			
															A few ovoids have hematite centres. 50% red jasper veins as bird eye in bands. Trace of pebbles (155-167)	162							
															Conglomerate - Fragments (1/16" - 1/4") (1/4" - 2") Angular to sub-rounded, mostly carbonate and shale. Traces of red jasper. Matrix is carbonate shale with thin bands of banded red jasper and maroon hematite.	145		6		2246			
170															Poor banded maroon hematite centres 3-4" bands as conglomerate	151		5		2247			
															Ovoids have carbonate and hematite centres.								
															Birds eye in bands Some ovoids have metallic centres.	145		1		2248			
															Banded iron formation.	144							
160															Conglomerate bands 138'-139.4' - 136.8'-137.5' 135.7'-136' - 30% fragments (1/8 - 6")								
															Medium brown shale to siltstone.	132		1		2249			
															20 - 25% waste "shreded" dolomite. 75% regular to irregular ovoids.	126		1		2250			
															Fairly large ovoids.	124		3.5		2251			
150															Regular to irregular gradits and ledges of shreaded dolomite.								
															Light brown carbonate waste predominates. Highly concentrated ovoids in C bands.								
		Trace		C																			
140																							
		Trace													Many ovoids have hematite centres.	94		1		2252			
															Dark green/grey brown sandstone coarse at base shale. 25% irregular patches of jasper, carbonate and quartz.	93		2		2253			
		Trace																					
130															Birdseye leases. Some carbonate centres. Nodular in places.								
															Hematitic dark brown calcareous shale								
		Trace	Trace												Calcite replacement of semi leases.	57.5							
															Conglomerate fragments (1/8 - 12") (40%) quartz, quartzite, sandstone, carbonate. Jasper leases (1" - 4" x 1/8" - 1") Matrix - hematitic shale.								
120															Aligned leases tend to bands Some carbonate leases and ovoids.	57.5		8		2254			
																45		6.5		2255			
															Conglomerate fragments (30%) (1/8 - 8") sub-angular to sub-rounded. Leases and fragments of jasperoid iron formation up to 1" x 4". Matrix is hematitic shale. Stromatolites								
															Trace of clastic pebbles	29							
110															Conglomerate fragments (10 - 15%) (1/8 - 8") mostly sub-rounded soft carbonates. Leases of red jasper. Hard hematitic maroon shale matrix.	30		4		2256			
																20		10		2257			
				C											Nodular iron formation ovoids tend to be in bands.								
100															Low grade iron form.								

GEO-23-2-CR (6/63)

091697

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

DDH
~~SECTION~~ No. Y-1-62 — DATE STARTED Nov. 18-19'63

DESCRIBED BY R.M. Williams — DATE COMPLETED

MEASURED BY — MEASURING RATE

AIR PHOTO No. — COORDINATES

AREA Iron Creek Y.T. — CLAIM

WEATHER

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE

MAROON HEMATITE

BOTH

SILICEOUS WASTE TYPES

RED JASPER

MAROON JASPER

MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE Nov 20 '63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	PATCHES ~~AND ALIGNED LENSES~~ BOUND	BANDS AMT and COMP	BANDS THICK RANGE	BANDS BOUND	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	GRADE ANALYSIS SAM No	GRADE ANALYSIS Fe	GRADE ANALYSIS SiO_2	GRADE ANALYSIS P
10		overburden																		
		conglomerate sandstone :- lt brn grey - med to fine grnd - sl wkly limy & sub angular grains, occasional grey is, silt ss, ow up to 2"													1.8	81.7				
							C	⅛-¼"	1	⅛ ol	1	trace pyrite			3.3	84.6				
40		conglomeratic mudstone :- lt brn grey to maroon - poorly sorted - frags up to 1" of sst, stone, qtz, ms, carbonate, grnstone - angular to rounded													3.2	94.2				
		mudstone :- lt grey - grading into S.S. at bottom - limy													2.9	90.6				
50		conglomerate :- lt grey green :- size up to ¼" - rounded to sub rounded, limy													0.6	100				
		mudstone :- with bands of cong. mudstone - lt grey to pale maroon													8.7	68.6				
70							N		1			¼" qz			0.8	80.0				
		mudstone :- med maroon brown with calcite veinlets occasional ¼" band sandy material - lt grey green to maroon with frags upto 1" (carb, siltst, grnstn)													19.0	93.4				
90																				
								⅛-¼"	C			difficult to distng. from jasp			1.1	78.6				
			tr					⅛-1"	R			halos red jasp on patches			3.8	95.0				
110		sandstone :- med brownish green, med to fine grnd - some coarse grains mgtz, rounded to sub rounded - maroon matrix										flat bedding			6.4	79.0				
			tr						1						1.5	88.4				
		sandstone absolute - trace pyrite - limy in matrix - occassional halos around some grains													12.0	96.8				
130		sandstone :-													12.0	96.8				
								¼	1	¼-1"	I	carbonate halos			5.0	89.2				
		siltstone - drk brown grey - soft, hematite, brown streak													1.0	100.0				
			tr		⅛-¼	I		¼	1		FC	Jasper halos & some carb halos - trace pyrite			4.7	94.0				
150				FC	⅛-⅜	I				¼-½	I	Sand streaks, Jasp ▭ concentrated laminae			1.8	90.0				
			tr		¼	I	FC			⅛-1	R	FC ovoids ⅛-¼ ∈ carb halos - rounded			3.8	95.0				
												some carb in bands								
			tr					⅛-½	I			▭, some carb patches seem like minor brecciated zones			3.0	85.6				
170			tr				FC	⅛-½							2.9	93.6				
		siltstone										C - some elongated ovoids					3	100%		
		cong ss	tr					1mm	R			drk maroon brn - frgs to 1"ϕ			1.6	82.9				
		cong ss						1mm	R			drk maroon brn - cobble @ 108'			1.6	88.1				
190								½	I	¼-1	I	C & ▭ - some rounded hem ovoids & irreg ovoids with maroon irreg patches			4.0	83.4				
		mudstone - drk maroon brn													1.0	100				
				FC	⅛	R									0	0				
				FC	¼	I		¼-½	I	⅛-¼	R	chert bands			3.2	86.6				
		cong ss													1.0	100				
		mudstone with Jasper bands								2"	R				1.3	65.0				
															0	0				
		mudstone - drk maroon brn						¼-1	I			▭ - some carb			1.3	100				
210					½-1	I				¼-1	R	C on ovoids intergrown patches with carb, red J & MJ.			1.0	100				
								¼+1	I	¼+1	I FC				11.0	90.9				
															0	0				
			tr	tr						¼-1	I	¢ carb bands			1.8	90.0				
				C				¼-½	I	½-1	I	ovoids & carb centres & fabrics			4.1	85.4				
230		mudstone										Patches also ∈ C			0.5	50.0				
								1"	S	½-1	R FC	▭ of red J			1.6	69.5				
										¼+1	R FC	3" carb band; cherty			2.4	82.8				
		mudstone - drk maroon brn													1.7	85.0				
250												many patches of carb plus silica - fine grained with fine xline hem replacements (?).								
				C								many C & ▭								
			tr	C				⅛+1	I	¼+1	R FC	some bands completely replaced by carb.			28.6	85.9				
				C								Intergrown nodules								
270				C								some bands very high grade hem.								
															0	0				
				C	¼	I	tr			¼+1	I	∈ & ▭ 3" chert band @ 196 Intergrown carb ovoids - elongated.			7.5	85.2				
290		sandstone: drk maroon brown + fine grnd - limy matrix, poorly sorted rounded to sub angular, chlorite grains, qtz, felds, tuff													3.6	56.5				
				C				¼-1"	I			∈ - very high carb zone ovoids & patches intergrown			3.4	87.8				
								¼-1	I			carb stringers (replacement) in bands			4.5	91.9				
				FC			C			¼-1	I									
			tr		⅛-¼	I	C	¼-1		¼-½	I	Red ▭, Patches ∈ carb & red J & fine xline hem			4.1	87.2				
310			tr					¼+½	I	¼-½	I	red ▭ some carb			2.8	84.9				
		mudstone - drk maroon brn - cherty bds													1.8	90.0				
					¼	I		¼-½	I	¼-½	R FC	carb in some patches & ovoids - also ∈ & ⊡ - some carb in bx.			4.7	94.0				
330		sandstone										drk brn - typical			1.0	100.0				
			tr					½-½	I			red ▭, carb in patches & ovoids			4.1	87.2				
										⅛-1"	R	1' of very low grade material ∈ silica - fine grnd - laminae			3.3	97.1				
350					¼+1	R	C	¼+1	I	tr		Red ▭, some carb ghosts Some carb ghosts bands Some wisps ∈ red ▭			7.2	80.9				
				C								Red ▭ on some patches mixture of xline carb & hem, silica, & finely disem. Jasp (patches from above) Common oolite lathing								
			tr	C				¼-1	I	⅛-½	R				12.4	88.6				
370				C								Carb ovoids irreg carb bx & lenses.								
				C				1/16+1	I	⅛-1	I	some bx (1") of diss carb & jasp red ▭ - wavy tex to some carb bx; Some ∈ on ovoids			5.5	90.1				
		sandstone													1.0	90.9				
				C				⅛-1	I	⅛-1	I	red ▭ on ovoids & patches carb ▭ on bands & patches Some large pat of silt carb Narrow carb rich bands common.			7.3	91.4				
390		Interbedded mudstone & Iron Formation													2.0	26.4				
		Interbedded mudstone & Iron Formation.													2.0	26.4				
		mudstone :- drk maroon brown - scattered grains from sand size to pebble size - qtz, siltstone, Jasper, chlorite) - rounded to sub angular, occassional CALCITE VEINLET.													22.7	67.7				
430																				
		siltstone :- red maroon brown - material										seems similar to S.S. of maroon type.			6.4	75.3				
															0	0				
450		siltstone :- as above													2.0	100.0				
								¼-1	I	⅛-½	I FC	Carb ▭ - red ovoids with dark centres & often brown centres			3.7	80.6				
										⅛-1	I I	"CHOPPED" red ▭ on ovoids & bands Very little carb.			2.5	46.3				
470												CHOPPED IRON FORMATION			0	0				
490	T.D.																			

091697

CREST EXPLORATION LIMITED

D.D.H. No. Y-243

Logged by: [illegible]

Area: [illegible] Creek Y.T.

Claim: ______ Coordinates: 97,300 ; 100,700 (approx.)

Elevation: ______ Total Depth: 401.5 Date Started: MAY 12 Completed: MAY 20

Inclination: 90°

ROCK TYPES	MODIFIERS AND ACCESSORIES
Iron Formation	Nodules (Relict)
Jasper	Lenses (Relict)
Limestone	Bands (Relict)
Dolomite	Birdseye
Shale	Spherulites
Siltstone	Halo
Sandstone	Maroon (M)
Conglomerate	Hematitic (H)
Breccia	Jasperoid (J)
	Siliceous (S)
No Sample	Carbonitic (C)
Cavings	Calcitic
	Dolomitic

STRUCTURES

- Strong Fault, Showing Dip
- Weak Fault, Showing Dip
- Fracture, Showing Dip
- Veinlet, Showing Dip
- Brecciated Zone

Depth Elev.	Description (Note feature dimensions, bedding dip, etc.)	Len Run	No Runs	Ft. Rec	% Rec	Sam. No.	Fe	SiO2	P
20									
	SANDY CLASTIC - BROWN SHALE MATRIX	2'		2.0	100.0				
	CLASTIC SANDSTONE (GREEN) / IRON FORMATION - JASPER & CARBONATE NODULES (2 TO 5 mm)	2.0				996			
	IRON FORMATION - (5 TO 15 mm) NODULES OF JASPER	1.0		0.5	50.0				
	IRON FORMATION - (10-15 mm) NODULES OF PINK CARBONATE	1.5		0	0				
40	IRON FORMATION - RELICT BIRDS-EYE + IRREGULAR LENSES & NODULES OF PINK & LIGHT BROWN CARBONATE.	4.2		1.2	28.6	997			
		2.3		0	0				
	IRON FORMATION - IRREGULAR BANDS & (10-15mm) NODULES OF PINK-BROWN CARBONATE	2.0		1.4	70.0	998			
	IRON FORMATION - LARGE (1/2") NODULES OF PINK CARBONATE (SEPTARIAN CARBONATE VEINLETS) GREEN CALCAREOUS SANDSTONE	2.0		1.9	95.0				
	IRON FORMATION (NODULES WITH SEPTARIAN	1.5		0.3	20.0				
	IRON FORMATION (LENS WITH QUARTZ SPHERULITES.	1.5		0.5	33.3	999			
	IRON FORMATION (NODULAR METALLIC & CALCITE STOCKWORKS IN MAROON)	2.0		0.4	20.0				
	I.F. - IRREGULAR PATCHES OF MAROON & BROWN CARBONATE QUARTZ & CALCITE VEINLETS WITH OFFSETS	1.4		1.1	78.5				
60	I.F. - IRREGULAR BANDS OF JASPER / GREY CARBONITIC SHALE	5.6		4.2	75.0	1000			
	I.F. / I.F. - FEW JASPER NODULES	2.0		1.8	85.6	1001			
	I.F. - MAROON IN (1-2") BANDS - ELONGATED GHOSTS - DIP 20°	1.5		0.8	53.4				
	I.F. BANDED (1/4 - 3/4") + LIGHT BROWN CARBONATE VEINLETS DIP 15-20°	1.0		1.0	100.0				
	I.F. - IRREGULAR STREAKS OF JASPER & CARBONATE VEINS / I.F. - GHOST BIRDS-EYE & JASPER NODULES	4.0		3.5	87.5				
	I.F. - JASPER NODULES & LENSES	1.0		1.0	100.0				
		1.0		0.9	90.0	1002			
		4.0		1.9	47.5				
80	I.F. - PINK NODULES OF QUARTZ-HEMATITE CARBONATE	2.0		1.1	55.0				
	I.F. BANDED (1/2") / I.F. - CARBONATE NODULES & BANDS - CUT BY CALCITE VEINLETS WITH OFFSETS / I.F. - BANDS OF CLASTICS	3.0		3.0	100.0				
	I.F. - CARBONATE NODULES (2-5 mm)	4.5		3.0	66.7	1003			
90	I.F. - JASPER BIRDS-EYE - DIP 10-15° / I.F. - BANDED (1/2" BANDS OF MAROON)	5.5		4.8	87.3				
	I.F. JASPEROID NODULES. / I.F. - BROWN CARBONATE NODULES / I.F. - RELICT NODULES - FAULT PLANE DIPS AT 80° & SLICKENSIDES - DIP AT 10°	4.0		3.7	92.5	1004			
100	I.F. - NUMEROUS (2-6 mm) NODULES OF HARD CARBONATE & QUARTZ - DIP 10°	5.0		4.1	82.0				
	I.F. BANDED / I.F. - (2-20 mm) LIGHT GREEN BROWN CARBONATE NODULES & LENSES	5.0		2.9	58.0	1005			
	MAROON - WITH 1/2" BANDS OF CLASTICS / I.F. - HARD CARBONATE NODULES	2.4		1.0	41.7				
110	BANDED I.F. (1/4 - 3/4") - VERTICAL FAULT PLANE WITH HORIZONTAL STRIAE.	1.0		1.0	100.0				
		1.4		0.5	35.7				
	I.F. - MAROON BANDS & JASPER NODULES / I.F. - CARBONATIZED NODULES / CLASTIC (CALCAREOUS-SANDSTONE) - HEMATITE BANDS	4.0		3.7	92.5				
	I.F. - BANDS OF CARBONATE NODULES & (IN CLASTICS)					1006			
120	CLASTIC WITH METASTITE HEMATITE-MATRIX / I.F. - LARGE (5-30 mm) JASPER NODULES WHICH ARE PARTIALLY CARBONATIZED / GREEN CONGLOMERATIC SANDSTONE	5.0		4.4	88.0				
	JASPEROID I.F. - NODULES OF CARBONATES MAROON SILICEOUS HEMATITE / BROWN CLASTIC WITH SUB-METALLIC MATRIX / I.F. - HIGHLY JASPEROID MAROON SILICEOUS HEMATITE - JASPER GHOSTS IN JASPER & HEMATITE GHOSTS IN HEMATITE (2-10 mm)	5.0		4.1	82.0	1007			
130	MASSIVE BROWN SHALE - DARKER & MORE CLASTICS AT TOP & BOTTOM OF SECTION	5.0		4.4	88.0	1008			
		2.4		1.0	41.7				
	I.F. / JASPEROID I.F. - PINK NODULES	3.6		0.8	22.2	1009			
140	LIGHT GREY SHALE - LACED WITH CARBONATE VEINLETS	2.0		2.0	100.0				
	SANDY BANDED I.F. - JASPER NODULES / BANDED IF - WITH NODULES OF JASPER	1.4		1.3	92.9				
		4.6		3.4	73.9				
	NODULAR I.F. - COMMON (2-8 mm) NODULES OF JASPER, PARTIALLY ALTERED TO QUARTZ & CARBONATE.	3.0		2.3	76.7	1010			
150	BANDED I.F. - CALCITE "METACRYSTS" IN MAROON BANDS	2.4		2.1	87.5				
	COARSE CONGLOMERATE - RED SHALE MATRIX - PARTICLES ANGULAR TO WELL ROUNDED & MICROSCOPIC TO 3"	5.0		5.0	100.0	1011			
160		10.0		10.0	100.0				
		10.0		10.0	100.0	1012			
		2.5		2.5	92.0				
170	BECOMES BROWN SHALE MATRIX	4.0		2.8	70.0	1013			
		8.5		8.3	97.7				
180	JASPER & SILICEOUS HEMATITE	1.5		0.7	46.6				
	CONGLOMERATE (DARK BROWN SHALE MATRIX) / JASPER & SILICEOUS HEMATITE / CONGLOMERATE (BROWN SHALE MATRIX)	3.5		3.1	88.6	1014			
		3.0		3.0	100.0				
190	JASPER & SILICEOUS HEMATITE / CONGLOMERATE (BROWN SHALE MATRIX 1/8" TO 2" WELL ROUNDED PARTICLES)					1015			
		10.0		8.6	86.0				
200	I.F. / DARK BROWN SHALE	5.0		4.3	86.0	1016			
	I.F. / I.F. - BANDED (1/4 to 1" WIDE) MAROON WITH CALCITE METACRYSTS & BANDS (1/4" - 1/2") OF LIGHT BROWN CARBONATE.	2.0		1.8	90.0				
210		4.6		3.9	84.7	1017			
		4.4		1.7	38.8				
	MEDIUM BROWN SHALE (DIP 15-20°)								
220	GREEN CONGLOMERATIC SANDSTONE	10.6		10.2	96.2	1018			
	DARK CHOCOLATE BROWN SHALE	7.0		6.2	88.5	1019			
230	THIN BEDDED GREEN - BROWN SHALE / BROWN SHALE WITH (1-2 mm) CLASTICS								
	THIN BEDDED GREEN-BROWN SHALE-SILTSTONE	10.4		10.3	99.0				
240						1020			
	LIGHT GREEN WELL ROUNDED CONGLOMERATE (1/4" to 2") FRAGMENTS & CALCAREOUS SANDSTONE MATRIX.	10.0		10.0	100.0	1021			
260		11.0		10.3	93.7	1022			
		12.5		13.1	104.8	1023			
	BANDED JASPEROID IRON FORMATION - BANDS 1/2" WIDE OF MAROON SILICEOUS HEMATITE.	1.0		0.9	90.0				
280	BANDED IRON FORMATION (1/8 to 1/2") BANDS OF MAROON HEMATITE & JASPER	4.0		3.3	82.5	1024			
	IRON FORMATION	3.0		2.4	80.0				
	LIGHT GREENISH - BROWN SANDSTONE / IRON FORMATION - JASPEROID.	3.1		2.5	80.6				
	MAROON SILICEOUS HEMATITE / VERY DARK BROWN SHALE / MAROON SILICEOUS HEMATITE	5.4		4.1	76.0	1025			
	BLACK CLASTIC SHALE.	2.0		1.4	70.0	1026			
300	IRON FORMATION BANDED (1/2" WIDE) / IRON FORMATION - QUARTZ-JASPER LENSES & BANDS	6.0		4.8	80.0	1027			
		4.0		3.3	82.6				
	CONGLOMERATE WITH BROWN SHALE MATRIX - ROUNDNESS INCREASES WITH SIZE OF FRAGMENTS	3.5	3	3.2	91.5				
		7.5		7.0	93.4				
320		5.5		4.9	89.1				
		10.5		9.8	93.4				
		9.5		8.2	86.4				
340	IRON FORMATION / CONGLOMERATE WITH CALCAREOUS SANDSTONE MATRIX.	2.1		2.0	95.2				
		2.4		2.1	87.5				
		3.0		2.0	66.7				
		6.6		4.7	71.3				
360		1.4		0.9	64.3				
		3.6		1.6	44.5				
		6.4		6.4	100.0				
	BROWN SHALE - WITH SOME CLASTICS	2.0		1.6	80.0				
	DARK GREEN CALCAREOUS SANDSTONE	10.0		8.3	83.0				
	DARK CHOCOLATE BROWN SHALE								
380	CONGLOMERATIC RED SHALE / IRON FORMATION (15% JASPER)	4.0		2.2	55.0				
	CONGLOMERATIC DARK BROWN SHALE	2.6		2.0	76.9				
		3.4		3.5	103.0				
		4.5		4.5	100.0				
		1.1		0.8	72.8				
	GREEN CALCAREOUS CONGLOMERATE	6.5		6.3	98.5				
400	CONGLOMERATIC BROWN SHALE								
	401.5' END OF HOLE								

1402

091697

CREST EXPLORATION LIMITED

D.D.H. No. [illegible]

Logged by: [illegible]

Area: [illegible] Claim: _____ Coordinates: 98,800 ; 101,600 (approx)

Elevation: _____ Total Depth: 275.2 Date Started: MAY 13 Completed: MAY 20

Inclination: 90°

ROCK TYPES

Iron Formation	
Jasper	
Limestone	
Dolomite	
Shale	
Siltstone	
Sandstone	
Conglomerate	
Breccia	
No Sample	
Cavings	

MODIFIERS AND ACCESSORIES

Nodules (Relict)	
Lenses (Relict)	
Bands (Relict)	
Birdseye	
Spherulites	
Halo	
Maroon	M
Hematitic	H
Jasperoid	J
Siliceous	S
Carbonitic	C
Calcitic	
Dolomitic	

STRUCTURES

Strong Fault, Showing Dip	30°
Weak Fault, Showing Dip	30°
Fracture, Showing Dip	30°
Veinlet, Showing Dip	30°
Brecciated Zone	

Depth Elev.	Lithology	Hem.% Est. (with types)	Str	Description (Note feature dimensions, bedding dip, etc.)	Engineer. Data: Len Run	No Runs	Ft. Rec	% Rec	Crude Analysis: Sam. No.	Fe	SiO2	P
				GREEN TO DIRTY BROWN SANDSTONE PLUS PIECES OF IRON FORMATION								
	J	MJ		JASPEROID IRON FORMATION	2.0	—	1.7	85.0				
		MJ		DARK GREY SHALE	2.0	—	2.0	100.0				
				IRON FORMATION + SAND SIZED CLASTICS	2.0	—	2.0	100.0				
				DEEP MAROON SHALE, CONGLOMERITIC IN PART	2.0	—	1.9	95.0				
					2.0	—	2.0	100.0				
				FISSILE	2.0		1.4	70.0				
					3.0	—	2.9	96.8				
					10.4	—	9.8	94.2				
					11.0	—	9.6	87.2				
	J	MJ		IRON FORMATION + JASPER								
				IRON FORMATION + PINK NODULES & RELICT BIRDS EYE	5.5	—	6.0	109.0	1867			
				IRON FORMATION	4.7	—	4.0	85.2				
		MJ		IRON FORMATION - PINK NODULES (2-10 mm)	5.0	—	4.6	92.0	1868			
		MJ		IRON FORMATION - BANDS OF MAROON HEMATITE & SILICEOUS NODULES	3.6	—	2.5	73.6				
		MJ		IRON FORMATION - MAROON BANDS & SILICEOUS NODULES	6.2	—	4.1	66.2	1869			
		MJ		PINK DOLOMITIC LIMESTONE								
		MJ		IRON FORMATION - ½" BANDS OF PINK DOLOMITE & SILICEOUS & JASPER NODULES & LENSES (2-15 mm)	1.6		0.9	62.5				
		MJ			0.8		0.8	100.0				
		MJ		IRON FORMATION - LIGHT BROWN CARBONATE NODULES (2-10 mm)	8.3		6.9	83.2	1865			
		MJ		IRON FORMATION - 1/2" BANDS OF LIGHT BROWN ANKERITE								
		MJ		IRON FORMATION - IRREGULAR BANDS OF MASSIVE SILICEOUS HEMATITE - MORE 2-4 mm NODULES								
		MJ		IRON FORMATION - WHITE CARBONATE NODULES IN CHOCOLATE MATRIX (2-10 mm)								
		MJ		IRON FORMATION - MAROON BANDS & JASPER NODULES	6.1		4.9	80.2	1866			
		MJ		IRON FORMATION - (1-5 mm) JASPER NODULES								
		MJ		IRON FORMATION - BANDS OF SILICEOUS HEMATITE								
	J	MJ		IRON FORMATION - (SANDSTONE-SCALE CLASTS)	1.4		0.9	64.3				
				IRON FORMATION - BANDS OF SILICEOUS HEMATITE & JASPER	3.4	—	2.1	61.7	1867			
				DARK CHOCOLATE BROWN SHALE								
				GREEN SANDSTONE								
				HARD GREEN-BROWN SHALE								
				MEDIUM BROWN SHALE					1868			
				DARK CHOCOLATE BROWN SHALE WITH CLASTIC MATERIAL - CONGLOMERATE	9.2		9.4	102.0				
					0.8		0.8	95.5	1869			
				DARK BROWN SILICEOUS SHALE								
					10.2		9.5	93.1				
				CHOCOLATE BROWN CONGLOMERATIC SHALE					1870			
				LIGHT GREEN CONGLOMERATE WITH A CALCAREOUS SANDSTONE MATRIX	3.4	—	2.6	76.6				
				GREEN-BROWN SHALE					1871			
				FRAGMENTAL CHOCOLATE BROWN SHALE	2.7		8.2	84.5				
				JASPEROID IRON FORMATION - IRREGULAR BANDS OF JASPER & CARBONATE								
				IRON FORMATION - INTER BEDDED MAROON & METALIC HEMATITE					1872			
				DOLOMITE IRON FORMATION SIDERITE	5.8		4.6	79.2				
				IRON FORMATION - INTER BANDED (¼" to 1") & ½" BANDS OF LIGHT BROWN CARBONATE	5.3	—	4.7	88.6	1873			
				IRON FORMATION - A FEW CALCITE NODULES	1.6		0.9	56.2				
					4.0	—	2.0	50.0				
		MJ		SILICEOUS HEMATITE BRECCIATED BY CALCITE VEINLETS.	4.9	—	4.8	98.0	1874			
	J	MJ		JASPEROID IRON FORMATION								
		MJ		DARK BROWN SHALE	2.4	—	1.7	70.8	1875			
				JASPEROID IRON FORMATION								
				IRON FORMATION - FINE BANDS ½ to ¾" OF MAROON & CARBONATE	2.5		0.7	28.0				
					4.9	—	4.5	91.8	40001			
				DARK CHOCOLATE BROWN SHALE								
					10.3	—	9.6	93.2	40002			
									40003			
				IRON FORMATION - 4" BANDS OF JASPER & CARBONATE	8.9	—	8.2	92.2	40004			
				CONGLOMERATIC BROWN SHALE					40005			
	J	MJ		IRON FORMATION - ABUNDANT CALCITE & JASPER	1.8		0.9	50.0	40006			
				CONGLOMERATIC BROWN SHALE	9.9	—	9.1	91.9				
					10.4	—	9.7	93.2				
				BROWN SHALE	9.7	—	8.6	88.7				
				JASPER & VEIN QUARTZ								
				GREEN-RED CALCAREOUS CONGLOMERATE	9.9	—	9.1	91.9				
				GREEN CALCAREOUS SHALE - MATRIX & PARTICLES								
					10.1	—	9.5	94.0				
					8.9		6.1	69.5				
		MJ		IRON FORMATION - (2-5 mm) JASPER & CARBONATE NODULES								
				BROWN CONGLOMERATIC SHALE (FINE SAND TO PEBBLE SIZED FRAGMENTS)	9.6	—	8.6	89.6				
					8.0	—	8.4	84.0				
				END OF HOLE								

091697

CREST EXPLORATION LIMITED

D.D.H. No. Y-4-B

Logged by: W Gibbins

Area: Yellow Creek Y.T. Claim: _____ Coordinates: approx. 98,900 ; 96,900

Elevation: _____ Total Depth: 500.5' Date Started: MAY 9 Completed: MAY 29

Inclination: 90° Bp of beds - 10°

ROCK TYPES

- Iron Formation
- Jasper
- Limestone
- Dolomite
- Shale
- Siltstone
- Sandstone
- Conglomerate
- Breccia
- No Sample
- Cavings

MODIFIERS AND ACCESSORIES

- Nodules (Relict)
- Lenses (Relict)
- Bands (Relict)
- Birdseye
- Spherulites
- Halo
- Maroon — M
- Hematitic — H
- Jasperoid — J
- Siliceous — S
- Carbonitic — C
- Calcitic
- Dolomitic

STRUCTURES

- Strong Fault, Showing Dip
- Weak Fault, Showing Dip
- Fracture, Showing Dip
- Veinlet, Showing Dip
- Brecciated Zone

Depth Elev.	Lithology	Hem.% Est. (with types)	Str	Description (Note feature dimensions, bedding dip, etc.)	Engineer. Data: Len Run	No Runs	Ft. Rec	% Rec	Crude Analysis: Sam. No.	Fe	SiO_2	P
				LIGHT GREEN CALCAREOUS SANDSTONE	2.0		1.9	95.0				
		MJ		IRON FORMATION - SILICEOUS BANDS	2.5		0.6	24.0				
				IRON FORMATION	1.6		1.0	62.5	40026			
		MJ		BANDED IRON FORMATION	1.9		0.9	47.3				
					1.9		1.3	68.5				
		MJ		IRON FORMATION	3.1		2.7	87.1				
				IRON FORMATION - BANDED	2.0		1.5	75.0	40027			
				GREENISH-BROWN CALCAREOUS SANDSTONE	5.0		5.0	100.0				
				IRON FORMATION					40028			
		MJ		IRON FORMATION - RELICT BIRDS-EYE + JASPER & CARBONATE NODULES	5.0		4.7	94.0				
		MJ		IRON FORMATION - BANDED	3.0		2.7	90.0	40029			
				IRON FORMATION - QUARTZ-JASPER NODULES								
		MJ		MAROON - GREY SHALE	4.0		4.0	100.0				
				IRON FORMATION - MAROON BANDS & LENSES								
		MJ		IRON FORMATION - CARBONATE NODULES (2-3")								
				BANDED IRON FORMATION	5.0		5.0	100.0	40030			
		MJ		MAROON BAND	3.0		2.5	83.4				
				BANDED IRON FORMATION (bit 2.5")	1.0		1.0	100.0	40031			
		MJ		CLASTIC BLACK SHALE	2.7		2.2	129.0				
				BANDED IRON FORMATION - 3" WIDE	2.6		2.5	96.4				
		MJ		BANDED IRON FORMATION + JASPER & MNR CARBONATE NODULES (2-15 MM)	4.7		4.7	100.0	40032			
		MJ		IRON FORMATION - BANDED (2" to 1" WIDE)	2.5		2.5	100.0	40033			
				IRON FORMATION + PINK NODULES 1 x 2 MM								
				GREEN CALCAREOUS SANDSTONE								
		MJ		MASSIVE DARK BROWN SHALE	4.7		4.7	100.0	40034			
				IRON FORMATION (1-5 MM PINK NODULES)								
		MJ		DARK BROWN SHALE								
				BANDED IRON FORMATION + 3" BEDS OF GREEN SANDSTONE	5.0		4.6	92.0	40035			
		MJ		CONGLOMERATE - BROWN SHALE MATRIX	5.0		4.5	90.0	40036			
				30% METALLIC HEMATITE + FINE CLASTICS								
		MJ		CONGLOMERATE - BROWN SHALE MATRIX								
				IRON FORMATION								
		MJ		CONGLOMERATE - BROWN SHALE MATRIX	5.2		4.8	92.4	40037			
				IRON FORMATION, IRREGULAR BANDING					40038			
		MJ		CONGLOMERATE - BROWN SHALE MATRIX					40039			
				BANDED IRON FORMATION (2" WIDE)	3.3		3.3	100.0				
		MJ		IRON FORMATION WITH IRREGULAR BANDING & JASPER NODULES (1-12.5 MM DIAMETER)	3.9		3.9	100.0	40040			
		MJ		BANDED IRON FORMATION (2 to 1")	4.5		4.0	87.5	40041			
				IRON FORMATION					40042			
		MJ		DARK GREEN SANDSTONE								
				JASPEROID IRON FORMATION	6.8		7.2	106.0				
		MJ		DARK BROWN SHALE					40043			
				IRON FORMATION								
		MJ		DARK BROWN SHALE								
				HARD BROWN SHALE	5.9		5.8	98.5	40044			
		MJ		JASPEROID IRON FORMATION								
				BANDED IRON FORMATION (1-3" WIDE)								
		MJ		IRON FORMATION WITH IRREGULAR BANDING & CARBONATE + JASPER NODULES (1-12 mm)	4.5		4.7	104.5	40045			
				DARK BROWN SHALE								
		MJ		BANDED IRON FORMATION + PINK (2-7 mm) JASPER & CARBONATE NODULES	4.2		3.7	88.0				
					2.0		2.0	100.0	40046			
		MJ		HARD GREENISH-BROWN SHALE	5.3		5.3	100.0	40047			
				BANDED IRON FORMATION (¼ - 1") + LENSES & NODULES (1-8 mm) OF PINK CARBONATE + RELICT BIRDS EYE STRUCTURE.	3.2		2.9	90.6	40048			
		MJ			4.6		4.5	97.8	40049			
					9.6		9.3	97.0	40050			
		MJ		BANDED IRON FORMATION AS ABOVE BUT ONLY HAS A SMALL AMOUNT OF SHREDDED PINK DOLOMITE.					40051			
		MJ		IRON FORMATION WITH SHREDDED PINK DOLOMITE (10%)	9.4		9.2	98.0	40052			
				IRON FORMATION + JASPER NODULES (2-8 mm) & DOLOMITE LEASERS (1%)	8.2		7.7	94.0	40053			
		MJ		MAROON SILICEOUS HEMATITE BRECCIATED BY CARBONATE VEINLETS					40054			
		MJ		IRON FORMATION, BANDS & LENSES OF MAROON HEMATITE (¼ - 3"), JASPER NODULES, SHREDDED DOLOMITE & RELICT BIRDS-EYE	6.8		6.8	100.0	40055			
		MJ		JASPEROID IRON FORMATION								
				MASSIVE GREEN SANDSTONE	9.9		9.9	100.0	40056			
		MJ		IRON FORMATION								
				IRON FORMATION - IRREGULAR BANDING NODULES & LEAVES OF JASPER, MAROON CARBONATE, & BIRDS-EYE GHOSTS					40057			
		MJ		IRON FORMATION, CARBONATE BIRDS-EYE								
				IRON FORMATION - BANDED ¼ TO ½" THICK + CARBONATE NODULES 3-6MM THICK	15.8		15.7	99.4	40058			
		MJ		IRON FORMATION - JASPEROID BIRDS-EYE								
				JASPEROID IRON FORMATION					40059			
		MJ		IRON FORMATION - IRREGULAR BANDS OF MAROON SILICEOUS HEMATITE & CARBONATE NODULES & BIRDS-EYES								
		MJ		IRON FORMATION, IRREGULARLY BANDED					40060			
					10.0		9.9	99.0				
		MJ		THIN BEDDED GREEN BROWN SHALE					40061			
				BANDED IRON FORMATION								
		MJ		SANDSTONE					40062			
				IRON FORMATION								
		MJ		IRON FORMATION WITH LENSES, NODULES & BANDS OF MAROON SILICEOUS HEMATITE AS BRECCIATE & JASPER (5-20 mm)	6.8		6.6	97.0	40063			
				CONGLOMERATE WITH DARK BROWN SHALE MATRIX								
		MJ		IRON FORMATION WITH LIGHT PINK TO LIGHT BROWN CARBONATE NODULES	9.6		9.4	97.8	40064			
				IRON FORMATION 3 to 6" BANDS OF CONGLOMERATIC PINK CARBONATE HEMATITE BANDED IRON FORMATION (¼" to ½") & FEW MAROON JASPER NODULES (5-8 mm)								
		MJ		LAMINATED MAROON HEMATITE & FEW (1-5 mm) PINK CARBONATE NODULES	5.6		5.3	94.5	40065			
				IRON FORMATION BANDED								
		MJ		BANDED IRON FORMATION - PINK NODULES & GHOST BIRDS-EYES	4.0		4.0	100.0	40066			
		MJ		NODULAR IRON FORMATION - BANDS OF LIGHT BROWN CARBONATE NODULES (2-10 mm)	6.6		6.5	98.6	40067			
				OOLITIC CARBONATE								
		MJ		IRON FORMATION - NUMEROUS JASPER & METALLIC NODULES (1-10 mm) & BIRDS-EYE								
		MJ		BANDED HEMATITE (¼ TO 1") + ¼ TO 2" BANDS OF CARBONATE	8.4		8.4	100.0	40068			
					2.0		1.8	90.0	40069			
		MJ		IRON FORMATION WITH THIN LAMINAE OF CALCITIC CARBONATE	5.5		5.3	96.4				
		MJ		IRON FORMATION - IRREGULARLY BANDED HEMATITE & CARBONATE					40070			
				IRON FORMATION - CALCITIC & JASPER NODULES + METALLIC GHOSTS	4.0		3.6	90.0				
		MJ		BANDED IRON FORMATION - MINOR JASPER					40071			
					7.7		6.9	89.7				
		MJ		GREENISH-RED SANDY CLASTIC					40072			
				BANDED IRON FORMATION (¼ TO ½" WIDE)	2.3		2.1	91.4	40073			
		MJ		IRON FORMATION	3.5		3.3	94.3	40074			
				IRON FORMATION - METALLIC HEMATITE								
		MJ		DARK BROWN CLASTIC								
				IRON FORMATION	6.0		5.5	91.6	40075			
		MJ		RED CONGLOMERATE								
				DARK GREEN CALCAREOUS SANDSTONE								
		MJ		RED TO DARK BROWN CONGLOMERATE	8.0		8.0	100.0	40076			
				BROWN - GREEN CONGLOMERATE (Ca)	7.4		6.4	86.4	40077			
		MJ		JASPEROID IRON FORMATION					40078			
				CONGLOMERATE (DARK BROWN MATRIX)	10.0		9.9	99.0				
		MJ							40079			
									40080			
		MJ			8.6		7.5	87.1				
					5.6		5.6	100.0	40081			
		MJ		INTER BEDDED SHALE & IRON FORMATION					40082			
					7.4		6.8	92.0	40083			
		MJ		BANDED JASPEROID IRON FORMATION					40084			
				DARK BROWN SHALE (CLASTIC)	7.2		6.0	83.4	40085			
		MJ		DARK BROWN SHALE								
					7.0		5.9	84.4	40086			
		MJ		GREEN-BROWN SHALE (CALCAREOUS)								
				DARK BROWN SHALE					40087			
		MJ		GREEN BROWN SHALE	9.5		8.9	93.8				
				DARK BROWN SHALE					40088			
		MJ		GREEN-BROWN SILTSTONE - CALCAREOUS - CROSS BEDDED	7.5		6.2	82.6	40089			
		MJ		DARK BROWN SHALE								
					5.8		5.1	87.9	40090			
		MJ		GREEN SILTSTONE WITH IRREGULARLY SHAPED FRAGMENTS OF BROWN SHALE								
				DARK BROWN SHALE					40091			
		MJ		CLASTIC IRON FORMATION	7.0		6.8	97.2	40092			
		MJ		IRON FORMATION - CARBONATE NODULES (1-15 mm) + GHOST NODULES & BIRDS-EYE UP TO 20 MM LONG								
		MJ		IRON FORMATION - BANDS & NODULES OF SIDERITE.	8.0		5.0	62.5	40093			
		MJ		IRON FORMATION - JASPER NODULES & LENSES	4.0		2.7	67.5	40094			
		MJ		BLACK SHALE - MASSIVE	5.0		2.8	56.0				
		MJ		BANDED IRON FORMATION - MAROON BANDS (¼ TO 1" THICK) & MINOR CLASTIC BANDS	2.0		1.5	75.0	40095			
					0.5		0.15	30.0				
		MJ			1.3		0.4	30.8				
					2.2		1.7	77.3	40096			
		MJ		IRON FORMATION - BANDS OF MAROON SILICEOUS HEMATITE UP TO 3" THICK - NODULES & LENSES OF JASPER (1-15 mm)	3.1		1.8	58.1				
					2.9		1.6	55.2	40097			
		MJ			2.6		0.2	7.7				
				GREEN & BROWN SILTSTONE	1.9		1.4	73.6	40098			
		MJ		IRON FORMATION - THIN BANDS OF PINK JASPER & CARBONATE (¼" to ½" WIDE)	3.7		1.0	27.1				
					1.8		1.2	66.7	40099			
		MJ			3.5		3.4	97.2				
					2.5		0.5	20.0	40100			
		MJ		IRON FORMATION CAVINGS ?	2.0		0.5	25.0				
					2.0		0.1	5.0				
		MJ			4.2		0.3	7.2	40101			
				DARK CHOCOLATE BROWN SHALE								
		MJ			7.8		3.5	50.6				
				CONGLOMERATE - DARK BROWN SHALE MATRIX - PARTICLES & MATRIX - MAX. PARTICLE DIAMETER: ½ TO 2"	4.0		3.4	85.0				
		MJ		CONGLOMERATIC BROWN SHALE - PARTICLES OF LIGHT GREENISH CARBONATE (0.5 TO 15 mm) - ROUNDNESS INCREASES WITH SIZE.	10.0		9.6	96.0				
					10.0		9.4	94.0				
		MJ			10.0		3.4	34.0				
					2.0		1.6	80.0				
		MJ			4.0		3.2	80.0				
					10.0		8.3	83.0				
		MJ		BROWN SHALE	5.8		1.6	15.3				
				END OF HOLE								

1403

CREST EXPLORATION LIMITED

091697

D.D.H. No. Y-5-63

Logged by: W. Gibbins

Area: Iron Creek Y.T. Claim: ______ Coordinates: 98,600 N ; 105,400 E (approx.)

Elevation: ______ Total Depth: 632.5 Date Started: May 24 Completed: June 4

Inclination: 90°

ROCK TYPES

- Iron Formation
- Jasper
- Limestone
- Dolomite
- Shale
- Siltstone
- Sandstone
- Conglomerate
- Breccia
- No Sample
- Cavings

MODIFIERS AND ACCESSORIES

- Nodules (Relict)
- Lenses (Relict)
- Bands (Relict)
- Birdseye
- Spherulites
- Halo
- Maroon (M)
- Hematitic (H)
- Jasperoid (J)
- Siliceous (S)
- Carbonitic (C)
- Calcitic
- Dolomitic

STRUCTURES

- Strong Fault, Showing Dip
- Weak Fault, Showing Dip
- Fracture, Showing Dip
- Veinlet, Showing Dip
- Brecciated Zone

Description (Note feature dimensions, bedding dip, etc.)	Len Run	No Runs	Ft. Rec	% Rec	Sam. No.	Fe	SiO2	P
Conglomeratic brown shale. Particles (1-6 mm), green, calcareous	3.1		3.3	106.5				
Green & brown siltstone - thin bedded								
Dark brown shale - massive - few small (.5-5 mm) clastic particles	5.5		[illegible]	[illegible]				
	7.6		8.0	105.3				
	6.5		6.2	95.4				
Green & brown siltstone								
Dark brown clastic shale	3.7		3.2	86.8				
Brown shale with bands of dark green calcareous sandstone & pink calcite marble	9.9		9.8	99.0				
Dark brown massive shale	3.3		2.8	84.8				
	3.6		3.5	97.2				
	7.7		8.0	104.0				
Grades into siltstone; fine sandstone; medium; coarse	1.2		1.0	83.3				
Dark brown shale - clastic matrix >> clastic - particles 1 mm angular to 1" & rounded	10.2		8.7	85.3				
Green & brown siltstone - irregular & wavy laminations								
Conglomeratic brown shale - shaley matrix > clastic - microscopic to 3" diameter	7.8		7.0	89.8				
Sandy brown shale - disseminated carbonate sand								
Light green calcareous sandstone - contains streaks & bands of brown shale	10.1		9.8	97.1				
	10.1		9.7	96.0				
	10.1		9.7	96.0				
Grades into green & brown shaley siltstone								
Light green calcareous sandstone - massive	4.6		4.5	97.8				
Dark chocolate brown shale - carbonate veinlets - silty lenses in the first four feet	9.3		8.9	95.7				
	2.1		1.4	66.7				
Thin bedded green & brown siltstone to sandstone (top to bottom)	1.2		0.8	66.7				
Shaley maroon siliceous hematite - massive	3.3		2.3	69.7				
Brown shaley clastic sandstone	3.0		2.8	93.4				
Very dark brown shale - massive								
	10.1	5.1	9.9	98.0				
Green & brown shale								
Black hematitic shale								
Iron formation (30% metallic & 10% carbonate)	6.9		5.7	82.6				
Dark brown shale - massive	9.9		9.2	92.9				
Green & brown siltstone - thin bedded								
Dark brown shale - carbonate veinlets - high hematite content	4.5		2.7	60.0				
	3.4		2.5	73.6				
Iron formation (40% metallic & 50% maroon) - jasper, iron carbonate & relicts, birdseye to nodules (1 to 8 mm)	6.5		4.8	73.9				
Brown shale								
Brown shale to light green shale - conglomeratic to non clastic	2.5		2.2	88.0				
	1.9		1.9	100.0				
	10.0		10.0	100.0				
Iron formation (45% metallic, 25% maroon, 20% jasper) - banded & jasperoid								
Brown shale								
Conglomerate - brown shale matrix	8.6		7.9	91.9				
Brown shale								
Light green shale 60% - brown shale 40% + 35% conglomerate	8.1		7.7	95.1				
Sandstone - coarse to very coarse - green - calcareous								
Iron formation (65% metallic & 25% maroon) - lenses & bands of maroon siliceous hematite & pink carbonaceous jasper (1/4" to 1" wide)	7.0		5.0	71.4	946			
Dark green & brown siltstone	9.6		9.5	98.9	947			
Iron formation - irreg. maroon bands - pink to red jasper nodules (2 to 8 mm)					948			
Green & brown siltstone - thin bed. bedding								
Dark green-brown medium grained sandstone - massive & slightly calcareous	10.0		9.8	98.0	949			
					950			
Iron formation	10.2		9.9	97.1				
Banded iron formation - maroon bands (1/4 to 1" wide)					951			
Brown shale - iron hematite								
Nodular iron formation - pink to red jasper nodules (2 to 8 mm) diameter	1.0		0.8	80.0				
Carbonate nodules - lenses - patches	5.9		6.0	101.8				
Banded iron formation - (1/4 to 1") bands of maroon siliceous hematite					952			
Iron formation - irregular bands & patches - generally light to dark purple bands of siliceous hematite (maroon) & pink jasper nodules - spherulitic patches of quartz-carbonate-hematite	10.1		9.9	96.0				
Jasperoid banded iron formation - bands of jasper & maroon siliceous hematite & clastic shale	3.2		3.0	93.8	953			
Conglomeratic brown siltstone	4.8		4.8	100.0	954			
Iron formation								
Clastic brown shale								
Banded iron formation - maroon	5.2		5.0	96.2	955			
Nodular iron formation - pink to red jasper nodules (1 to 8 mm) diameter								
Iron formation - jasperoid nodules (1 to 5 mm) - maroon bands & lenses (1/4 to 1/2" wide)								
IF - maroon bands up to 1" thick - jasper nodules 1 to 15 mm	9.0		8.0	88.9	956			
					957			
Clastic brown shale	1.9		1.7	89.5	958			
Jasperoid iron formation								
Dark brown shale - massive	2.3		1.7	73.9	959			
IF - 15% jasper								
Dark brown shale								
IF - 20% jasper								
Medium brown shale	10.0		9.8	98.0	960			
IF - irregular bands of purple siliceous hematite with small (1 mm) metacrysts of calcite - few pink jasper nodules								
IF - nodules (1 to 3 mm) are numerous - ghosts of hematite, red jasper & pink to brown carbonate - jasper - bands of maroon hematite & pink carbonate	10.0		9.7	97.0				
					961			
Brown shale								
Jasperoid iron formation - streaky irregular bands of maroon & jasper.					962			
Dark brown shale - massive	8.6	8.2		95.3				
					963			
Light green siltstone - sand sized dark green angular fragments								
Iron formation - relict to near relict birdseye & nodules (0.5 to 5 mm) - "shredded" pink carbonate, jasper & metallic hematite - pink jasper nodules at base (~30 mm)	7.3		7.3	100.0	964			
IF - banded - 1/4 to 3/4" bands of dark maroon siliceous hematite - few pink jasper nodules & lenses (1-5 mm)	10.0		10.0	100.0	965			
IF - relict birds-eye structure								
Jasperoid - 85% jasper & dolomite breccia								
IF - patches of pink quartz - jasper up to 3" thick & can be vuggy - pea-sized siderite nodules								
Iron formation - bands of maroon hematite (1/4 to 4" wide) - pink jasperoid patches (1 to 20 mm diameter)	5.2		5.0	96.0	966			
Iron formation - maroon bands (1/4 to 3/4") - orange jasper lenses - pink jasper patches to nodules - spherulitic patches at 364.0	5.9		5.9	100.0				
	2.8		2.7	96.4	967			
Iron formation - irregular bands of maroon hematite								
Chocolate brown hard argillaceous hematite								
IF - relict birds-eye & irregular patches of maroon	9.1		8.5	93.5	968			
IF - many 1/4" maroon bands & red jasper nodules (1 to 10 mm)								
Dark brown shale								
Jasperoid iron formation								
Dark brown shale								
Dark greenish brown siltstone								
Dark greenish brown sandstone	10.0		9.7	97.0	969			
Conglomerate with green calcareous sandstone matrix								
Iron formation - irregular & numerous patches of jasper & maroon - some relict birdseye.								
IF - maroon & jasper bands (1/4 to 1/2")	5.8		5.8	100.0	970			
IF - purplish-maroon bands to nodules - light grey quartz-carbonate nodules.	5.2		5.1	98.0				
IF - irregular to regular maroon bands (1/8" to 1/2") - patches of pink jasper (to 1 1/2") may have veinlets of calcite - jasper lenses with euhedral cubes of pyrite (1 to 3 mm)	3.7		3.2	86.5	971			
	4.1		4.4	107.2	972			
Hard silty shale - brown					973			
Iron formation - maroon with jasper - birdseye	10.1		9.3	92.1				
Iron formation - maroon bands (1/4" to 1") - relict birds-eye texture (1 to 8 mm) - pink to red jasper nodules & patches & lenses, cores with borders partially altered.					974			
	1.4		1.4	100.0				
Dark green-brown calcareous conglomeratic sandstone					975			
IF - streaks of maroon hematite								
Iron formation - irregular maroon jasper bands - smaller & fewer carbonate bands	9.5		8.3	87.4				
					976			
	2.8		2.8	100.0				
Iron formation - (1/4 to 1") bands of maroon jasper - white carbonate nodules (1 to 15 mm)	5.4		4.1	76.0				
					977			
	3.6		3.6	100.0				
Iron formation - orange jasper nodules (1 to 15 mm)	[illegible]		[illegible]	[illegible]				
Iron formation - bands of numerous birds-eye to ovoid nodules	4.7		4.4	93.6				
Banded iron formation - regular to irregular bands of maroon jasper					978			
Iron formation - irregular maroon & red jasper patches & streaks - jasper nodules - banded iron formation (55% hematite) (1/4 to 1") bands of maroon jasper	5.4		4.9	90.8				
	4.8		4.9	102.0	979			
Inter-bedded iron formation & clastic carbonate								
Dark chocolate brown shale	9.2		9.9	107.5				
					980			
Clastic brown shale - clastics sand sized to 1/2" - brown shale matrix becomes darker towards the bottom.	10.0		9.4	94.0				
					981			
	9.9		9.7	98.0				
					982			
Iron formation - patches of pink to red jasper & carbonate (1/2 to 2") - irregular streaks of red jasper	8.7		7.8	89.6	983			
Coarse green sandstone & brown shale								
Iron formation - ovual nodules of maroon & red jasper (1 to 12 mm) diam. - lenses & bands of pink jasper broken into sharp fragments by penecontemporaneous fracturing	10.4		9.5	91.4	984			
Iron formation - maroon jasper - with red jasper halos								
Iron formation - jasperoid - wide (up to 0.8 feet) bands of red & maroon jasper	5.3		3.8	71.7	985			
	7.5		6.8	90.7				
Nodular iron formation - numerous nodules (2 to 10 mm) of maroon, red, & pink jasper - 27% angular fragments in the nodules - bands of carbonate clastics	3.2		2.7	84.4	986			
	10.4		10.1	97.1				
					987			
Iron formation - irregular maroon bands (1/4 to 1.5" wide)								
Iron formation - 60% white carbonate patches & nodules (5 to 8 mm)								
Iron formation - scattered carbonate patches, red jasper nodules & fragments of penecontemporaneous fractured beds.								
Iron formation - 85% carbonate nodules								
Iron formation - red jasper nodules (2 to 9 mm) - red & maroon irregular bands	10.0		10.0	100.0	988			
Nodular IF - 60% hard white silica nodules & red jasper matrix	9.9		9.5	96				
Iron formation - a few maroon jasper bands & patches - & altered pink jasper nodules					989			
IF - many nodules: red jasp. & pink silica/carbonate								
Iron formation - maroon bands (1/4 to 1") & nodules (1 to 2 mm) - with thin halos of red jasper	10.0		9.8	98.0	990			
Conglomeratic brown shale								
Greenish brown calcareous sandstone - grades to brown sandy shale to light green calcareous cong. & massive shale					991			
Dark brown shale - massive	10.0		9.1	91.0				
					992			
Thin bedded green & brown siltstone to sandstone - calcareous	10.0		9.4	94.0				
Massive dark brown shale.								
Light green calcareous rounded pebble conglomerate - pebbles exceed sandstone matrix.					993			
	9.9		6.5	65.7				
Brittle jasperoid & clastic iron formation - unit is largely composed of hard maroon & red jasper & dark brown clastic shale.	1.6		1.2	75.0				
	6.5	5.8		89.3	994			
					995			
Conglomeratic brown shale - sand sized to 2" pebbles - light green calcareous clastics	7.0	5.9		84.3				
	10.6	9.8		92.5				
	10.0	10.0		100.0				
Coarse greenish-brown sandstone - clastic sand grains of brown shale & light green calcite								
Conglomeratic to sandy dark brown shale								
Coarse to fine grained green & brown sandstone	9.9		9.7	98.0				
End of hole Y-5-63 at 632.5 feet.								

1404

CREST EXPLORATION LIMITED

091697

D.D.H. No. Y-6-63
LOGGED BY W. Gibbins
AREA IRON CREEK Y.T. CLAIM ____ COORDINATES 22,500 N; 92,500 E approx.
ELEVATION ____ TOTAL DEPTH 636' DATE STARTED May 21/63 COMPLETED June 13/63
INCLINATION 90° Dip of beds ≈ 15°

ROCK TYPES

- IRON FORMATION
- JASPER
- LIMESTONE
- DOLOMITE
- SHALE
- SILTSTONE
- SANDSTONE
- CONGLOMERATE
- BRECCIA
- NO SAMPLE
- CAVINGS

MODIFIERS AND ACCESSORIES

- NODULES (RELICT)
- LENSES (RELICT)
- BANDS (RELICT)
- BIRDSEYE
- SPHERULITES
- HALO
- MAROON (M)
- HEMATITIC (H)
- JASPEROID (J)
- SILICEOUS (S)
- CARBONITIC (C)
- CALCITIC
- DOLOMITIC

STRUCTURES

- STRONG FAULT, SHOWING DIP
- WEAK FAULT, SHOWING DIP
- FRACTURE, SHOWING DIP
- VEINLET, SHOWING DIP
- BRECCIATED

GEO-26-CH (6/63)

Log column headings: Depth Elev. | Lithology | Hem.% Est. (with types) | Str | Description (Note feature dimensions, bedding dip, etc.) | Engineer. Data: Len Run, No Runs, Ft. Rec, % Rec | Crude Analysis: Sam. No., Fe, SiO2, P

Depth marks: 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500, 520, 540, 560, 580, 600, 620

Descriptions

- CONGLOMERATE – BROWN SHALE MATRIX – LIGHT GREEN SUB-ANGULAR TO SUB-ROUNDED PARTICLES (1/8" TO 2" DIAMETER)
- LIMESTONE DIKE IN FAULT ZONE ?
- CAVINGS: BROWN CONGLOMERATE, MARBLE, GREEN ARKOSE & SHALE
- CONGLOMERATIC BROWN SHALE – SCATTERED SUB-ROUNDED PARTICLES UP TO 2" ACROSS & SMALLER SUB-ANGULAR PARTICLES – LIGHT GREEN TO WHITE IN COLOR.
- GREEN & BROWN SILTSTONE – THIN IRREGULAR BEDDING
- CONGLOMERATIC BROWN SHALE – CARBONATE VEINLETS (0.5 TO 4 MM WIDE)
- CONGLOMERATE WITH A LIGHT GREEN CALCAREOUS MATRIX
- CONGLOMERATIC BROWN SHALE
- GREEN & BROWN SILTSTONE – IREG. BEDDED
- CONGLOMERATIC BROWN SHALE.
- GREEN & BROWN SILTSTONE
- BROWN TO GREEN SHALE
- GREEN & BROWN SILTSTONE
- BROWN SHALE
- GREEN & BROWN SILTSTONE
- BROWN SHALE – CONGLOMERATIC TO SANDY – CALCAREOUS PARTICLES.
- SILTY BROWN SHALE
- GREEN & BROWN SILTSTONE
- GREEN & BROWN SILTSTONE
- SILTY BROWN SHALE
- GREEN & BROWN SILTSTONE – THIN BEDDED
- DARK GREENISH BROWN SILTSTONE TO SANDSTONE – MASSIVE
- GREEN & BROWN SILTSTONE – THIN BEDDED & CROSS BEDDED.
- BROWN SHALE – MASSIVE
- GREEN & BROWN THIN CROSS-BEDDED SILTSTONE.
- CONGLOMERATIC TO SANDY BROWN SHALE – FEW WHITE CALCITE VEINLETS
- FINE GRAINED CALCAREOUS SANDSTONE – LIGHT GREEN TO BROWN
- CONGLOMERATIC BROWN SHALE
- ARGILLACEOUS IRON FORMATION OR HEMATITIC ARGILLITE
- THIN BEDDED DARK GREEN & BROWN SILTSTONE
- HEMATITIC ARGILLITE
- DARK BROWN SHALE – MASSIVE – CALCITE VEINLETS
- IRON FORMATION – COARSE SAND SIZED GRAINS OF HEMATITE – IN A MAROON JASPER MATRIX.
- DARK BROWN SHALE – MASSIVE
- SANDY IRON FORMATION
- DARK BROWN SHALE – MASSIVE
- THIN BEDDED GREEN & BROWN SILTSTONE TO FINE SANDSTONE – CALCAREOUS
- IRON FORMATION – COARSE SAND SIZED HEMATITE TOWARDS BOTTOM
- GREEN & BROWN CALCITIC SILTSTONE TO SANDSTONE
- INTER-BEDDED CONGLOMERATIC ARGILLACEOUS HEMATITE & IF, 95% METALLIC
- NO RECOVERY
- IRON SANDSTONE – COARSE, SUB ROUNDED TO ANGULAR GRAINS OF METALLIC HEMATITE, SOME HEMATITE & JASPER
- IRON FORMATION – PURE SUB-METALLIC HEMATITE & MAROON JASPER
- IF – SUB-METALLIC HEMATITE ≈ 50% IS CLASTIC DARK GREEN CALCAREOUS SANDSTONE
- LIGHT GREY QUARTZITE (? BOULDER) BROWN TO GREEN & BROWN SILTSTONE
- DARK BROWN SHALE – SOME LIGHT GREEN
- SHALEY IRON SANDSTONE
- CONGLOMERATIC LIGHT GREEN-BROWN CALCAREOUS SANDSTONE
- DARK BROWN TO LIGHT GREEN SHALE ON THIN LAMINAE
- CONGLOMERATIC BROWN SHALE – LIGHT GREEN FRAGS.
- BROWN TO LIGHT GREEN SHALE
- CONGLOMERATIC BROWN SHALE
- JASPEROID IRON FORMATION – RED & MAROON JASPER BANDS (1/8" to 2") WIDE – MOST WITH REGULAR BOUNDARIES – FEW RED JASPER NODULES
- GREEN & BROWN THIN BEDDED CALCAREOUS SANDSTONE – GRADES INTO IRON SANDSTONE & OUT AGAIN
- DIP 15-20° IF – IRREGULAR STREAKS & PATCHES OF ORANGE-RED JASPER – RED-ORANGE JASPER NODULES (1-5mm) – LIGHT MAROON JASPER BANDS (1/8 – 1/4")
- IF – MAROON JASPER BANDS (1/2 – 1/4")
- IF – WIDE BANDS OF PALE MAROON JASPER (UP TO 6" WIDE) – NODULES & LENSES OF RED JASPER (7 TO 10 mm).
- IF – IRREGULAR BANDS OF MAROON JASPER.
- IF – MANY THIN (1/16 – 1/4") BANDS OF WHITE MICROCRYSTALLINE QUARTZ, MCR JASPER
- IF – IRREGULAR BANDS OF MICRO JASPER
- GREENISH BROWN CONGLOMERATE WITH A SANDSTONE MATRIX.
- IF – IRREGULAR BANDS & PATCHES OF MAROON JASPER – A FEW FINE BANDS & LENSES OF RED JASPER.
- CONGLOMERATE – CLASTS "ANGULAR & ROUNDED"
- IF – IRREGULAR BANDS OF MAROON JASPER (1/8 – 1") WIDE – NODULES: RED JASPER, MICROCRYSTALLINE QUARTZ, & RELICT
- INTERBEDDED JASPEROID (RED), MAROON HEMATITE & DARK BROWN CLASTIC SHALE.
- DARK BROWN SHALE
- JASPEROID IF – (1/8 – 3/8") BANDS OF RED & MAROON JASPER.
- DARK BROWN SHALE TO SILTSTONE
- DIP 10-15° IF – BRECCIATED OR "SHREDDED" RED JASPER & DOLOMITE – RELICT BIRDSEYE – MAROON JASPER NODULES & LENSES (1/2 – 1/4 mm) – QUARTZ-HEMATITE PATCHES – TRACE OF CARBONATE VEINLETS & PYRITE
- IF – NODULES (1-5mm) & LENSES (1-10mm) OF RED & MAROON JASPER – PINK QUARTZ-HEMATITE PATCHES
- DIP 10° IF – BANDS OF MAROON JASPER (1/2 – 1") – TRACE OF LIGHT BROWN SHREDDED CARBONATE
- IF – RELICT BIRDS-EYE (50% OF METALLIC HEMATITE) – IRREGULAR PATCHES (1/8 – 1") DIAM. OF PINK QUARTZ-HEMATITE & LIGHT BROWN CALCITIC CARBONATE.
- IF – NODULES & LENSES (1/8 – 1/4") OF LIGHT BROWN CARBONATE & RED JASPER (MAROON CORES)
- IF – BRECCIATED OR SHREDDED RED JASPER & DOLOMITE.
- IF – (30% OF METALLIC HEMATITE) – BIRDS-EYE – IRREGULAR PATCHES OF PINK QUARTZ-HEMATITE & A FEW NODULES OF RED JASPER.
- IF – RED JASPER NODULES (1-5 MM) & IRREGULAR MAROON JASPER BANDS.
- SHALEY IF – SHALE & MAROON JASPER WASTE
- DIP ≈15° IF – (50% OF METALLIC CARBONATE) – IRREGULAR MAROON JASPER LENSES (1/8 – 1/2" THICK) – 6" OF SHREDDED OR BRECCIATED DOLOMITE & RED JASPER.
- JASPEROID IRON FORMATION – DARK BROWNISH GREEN CALCAREOUS SANDSTONE
- IF – IRREGULAR BANDS & LENSES OF MAROON JASPER – (520.0-522.0: SHREDDED METALLIC HEMATITE, RED JASPER & CARBONATE) – (525.5-526.5: NUMEROUS WHITE DOLOMITE NODULES.)
- IF – RELICT BIRDS-EYE – IRREGULAR MAROON JASPER BANDS UP TO 2" WIDE – (1/2 – 1") BEDS OF FINE CLASTIC.
- IF – RED JASPER NODULES & LENSES (2-10mm) – SMALL NODULES & IRREGULAR BANDS OF MAROON JASPER.
- HARD DARK BROWN HEMATITIC SHALE
- IF – VERY IRREGULAR BANDS & STREAKS OF RED & MAROON JASPER
- JASPEROID IF – IRREGULAR STREAKS, BANDS & PATCHES OF RED & MAROON JASPER – (560-565: PEA SIZED SUBANGULAR CONGLOMERATE ? BOULDER)
- HARD DARK BROWN SHALE
- JASPEROID IRON FORMATION – SANDY TO CONGLOMERATIC DARK BROWN SHALE.
- SANDY TO CONGLOMERATIC MAROON HEMATITE
- HARD BROWN SHALE
- JASPEROID IRON FORMATION – HARD BROWN SHALE
- JASPEROID IRON FORMATION.
- HARD BROWN SHALE
- IF – RED JASPER BIRDS-EYES
- SANDY TO CONGLOMERATIC DARK BROWN SHALE
- END OF HOLE Y-6-63 636.0 FEET.

Engineer. Data / Sample Nos. (in order down the log)

Len Run	Ft. Rec	% Rec	Sam. No.
2.5	2.6	104.0	
6.5	4.9	75.5	
3.0	1.5	50.0	
3.0	3.3	110.0	
1.5	1.2	80.0	
6.0	4.9	81.7	
5.0	4.7	96.0	
7.0	6.0	85.7	
3.0	3.4	113.4	
3.0	2.5	83.5	
4.5	3.9	86.7	
1.5	1.2	80.0	
3.5	2.9	82.9	
5.0	4.7	94.0	
5.0	5.0	100.0	
5.0	4.6	92.0	
4.7	4.6	97.8	
2.8	2.4	85.8	
5.0	4.5	90.0	
5.0	4.7	96.0	
2.5	1.3	52.0	
4.0	3.2	80.0	
1.0	1.0	100.0	
1.6	1.3	81.3	
1.4	1.0	71.5	
3.0	2.5	83.3	
2.0	1.7	85.0	
8.0	7.8	97.5	
3.5	2.9	82.9	
3.5	3.4	97.2	
3.5	3.1	101.2	
3.0	2.4	80.0	
3.0	1.0	33.3	
2.0	1.6	80.0	
2.0	1.6	80.0	
2.0	1.5	75.0	
2.0	1.5	75.0	
3.0	2.5	83.4	
1.5	1.1	73.4	
1.5	0.5	33.3	
1.0	0.5	50.0	
2.0	1.0	50.0	
2.0	1.4	70.0	
3.0	3.0	100.0	
3.0	2.2	73.4	
5.0	4.6	92.0	
2.0	1.3	65.0	
3.0	2.1	70.0	
3.0	3.3	110.0	
5.0	5.0	100.0	
2.5	1.9	76.0	
4.0	4.1	102.5	
2.0	1.2	60	
10.0	9.3	93.0	
7.0	7.0	100.0	
3.0	1.5	50.0	
8.0	6.2	77.5	
10.0	9.6	96.0	
10.0	9.7	97.0	
4.0	3.8	95.0	
4.0	3.1	77.5	40104
3.5	2.2	62.9	40105
3.6	2.8		
2.0	2.0	100.0	40106
1.0	0.9	90.0	
3.4	4.1	120.5	40107
5.0	4.3	86.0	
4.6	4.2	91.3	40108
9.0	5.9	65.6	40109
7.5	5.5	73.5	40110
6.5	4.4	67.7	40111
6.5	6.1	93.9	40112, 40113
4.0	2.1	52.5	40114
3.0	0.8	26.6	
1.5	–	–	40115
3.0	0.8	26.6	
4.0	2.0	50.0	40116
1.5	0.9	60.0	40117
2.2	1.6	[illegible]	
4.5	3.2	71.0	40118
2.0	2.1	105.0	
3.0	2.1	70.0	40119
5.0	3.6	72.0	
2.9	0.4	13.8	
3.0	2.0	66.7	
3.6	3.2	89.0	40120
5.0	2.8	56.0	40121
2.0	–		
3.5	0.5	14.3	40122
1.5	0.1	6.7	
1.0	0.7	70.0	
1.0	0.8	80.0	
1.2	0.2	16.7	
1.3	0.8	61.5	
1.0	0.7	70	40123
6.0	4.8	80.0	
5.0	4.8	96.0	40124
4.0	3.5	87.5	40125
4.4	3.7	84.1	
3.6	3.6	100.0	
5.5	4.5	81.8	40126
4.4	3.9	88.6	
1.5	1.2	80.0	40127
2.5	2.5	100.0	
2.0	1.6	80.0	
2.0	1.7	85.0	40128
4.0	2.3	57.5	
1.5	0.5	33.3	40129
4.5	4.1	91.1	
3.0	3.0	100.0	40130
5.9	5.2	88.1	
1.1	0.8	72.7	40131
1.6	1.3	81.2	
3.0	1.5	50.0	
2.0	1.5	75.0	40132
2.0	2.0	100.0	40133
2.4	1.6	66.7	40134
5.6	4.7	84.0	
3.9	3.7	94.8	40135
6.0	5.7	95.0	
6.0	5.6	93.4	40136
3.0	3.0	100.0	40137
6.5	4.7	72.4	
1.8	1.8	100.0	
2.6	2.6	100.0	40138
4.5	4.0	88.9	
7.5	5.5	73.3	40139
5.0	4.9	98.0	40140
7.0	6.9	98.6	40141
7.0	6.3	90.0	
2.0	2.0	100.0	40142
5.0	4.3	86.0	40143
1.0	0.5	50.0	
3.2	1.9	59.4	40144
5.3	4.8	90.6	
5.1	1.2	23.5	40145
1.0	0.7	70.0	
5.9	4.9	83.1	
			40146
10.0	7.3	73.0	
			40147
3.6	9.2	83.2	
4.0	3.4	85.0	40148
4.4	3.4	77.2	40149
1.6	0.4	25.0	40150
7.4	7.4	100.0	40151
			40152
			40153
10.0	7.2	72.0	40154
			40155
2.0	1.5	75.0	40156
7.0	4.7	67.3	
3.0	1.3	43.3	
9.0	7.7	85.6	
5.0	2.1	42.0	
1.6	0.4	40.0	

GEO-26-CH (6/63)

1405

091697

CREST EXPLORATION LIMITED

D.D.H. No. Y-7-63

Logged by: W Gibbins

Area: Iron Creek Y.T. Claim: _____ Coordinates: 100,200N ; 88,800E approx.

Elevation: _____ Total Depth: 443.8' Date Started: May 30/63 Completed: June 7/63

Inclination: -90° Dip of beds ≈ 25°/30°

ROCK TYPES

- Iron Formation
- Jasper
- Limestone
- Dolomite
- Shale
- Siltstone
- Sandstone
- Conglomerate
- Breccia
- No Sample
- Cavings

MODIFIERS AND ACCESSORIES

- Nodules (Relict)
- Lenses (Relict)
- Bands (Relict)
- Birdseye
- Spherulites
- Halo
- Maroon — M
- Hematitic — H
- Jasperoid — J
- Siliceous — S
- Carbonitic — C
- Calcitic
- Dolomitic

STRUCTURES

- Strong Fault, Showing Dip
- Weak Fault, Showing Dip
- Fracture, Showing Dip
- Veinlet, Showing Dip
- Brecciated Zone

Depth Elev.	Lithology	Hem.% Est. (with types)	Str	Description (Note feature dimensions, bedding dip, etc.)	Engineer.Data Len Run	No Runs	Ft. Rec	% Rec	Crude Analysis Sam. No.	Fe	SiO2	P
20				CLASTIC BROWN SHALE - CLASTICS (½ to 2") DIAMETER	3.0		1.7	56.7				
				LIGHT GREEN & BROWN FINE CALCAREOUS SILTSTONE	1.0		1.0	100.0				
				CLASTIC BROWN SHALE	5.0		2.6	52.0				
				COARSE IRON SANDSTONE (MAROON MATRIX & HEMATITIC CALCITE SAND GRAINS) CLASTIC BROWN SHALE	2.0		1.5	75.0				
40					5.0		4.5	90.0				
					4.0		4.3	107.5				
					5.0		5.0	100.0				
		MJ		IRON FORMATION - MAROON SILICEOUS TO SUB-METALLIC + BROWN SHALE	2.8		2.5	89.4				
				GREEN & BROWN SILT STONE - DARKER TOWARDS THE BOTTOM	10.2		9.8	96.1				
60					6.0		5.7	95.0				
	H			IRON SANDSTONE - COARSE HEMATITE CALCITE GRAINS IN A SHALEY JASPEROID MATRIX					907			
				CROSS-BEDDED GREEN & BROWN SILTSTONE	12.0		12.1	93.0				
	RJ MJ	H M		CONGLOMERATE - BROWN SHALE MATRIX JASPEROID IRON FORMATION - RED to MAROON					903			
	RJ PJ	MH M		NODULAR IRON FORMATION	2.6		1.4	54.5				
80	H	M		CLASTIC IRON FORMATION (IRON SANDSTONE WITH BANDS OF CONGLOMERATIC TO NON CLASTIC MAROON HEMATITE.	5.0		5.0	100.0	904			
	H	MH			1.9		1.6	84.3				
		MH		CONGLOMERATIC GREEN-BROWN SILTSTONE JASPEROID IRON FORMATION	4.5		4.0	88.9	905			
				ALTERNATE LIGHT GREEN & DARK BROWN BANDS OF MASSIVE SHALE.	6.5		5.5	84.6	930			
100				CONGLOMERATIC GREEN & BROWN SHALE	3.9		3.4	87.2				
				MASSIVE DARK BROWN SHALE	6.1		4.6	75.5	944			
				LIGHT GREEN SHALE - MASSIVE - ALTERNATING CLASTIC & NON-CLASTIC	8.2		7.7	93.9	945			
		M		IRON FORMATION - RED & MAROON JASPER BANDS (¼ TO 2") THICK + A FEW IRREGULAR TO PATCHY NODULES OF PINK JASPER	6.8		5.6	82.4	906			
120		M		BANDED IRON FORMATION - NUMEROUS RED & MAROON JASPER BANDS (½ to 2") THICK	3.2		2.1	65.6				
					2.3		0.6	26.0	907			
					3.5		2.1	60.0				
			30° DIP	DARK GREENISH BROWN SILTSTONE - MASSIVE TO 30° DIP IN THE BEDDING	5.6		5.0	89.3	938			
140					5.0		4.9	98.0				
		M		IRON FORMATION - IRREGULAR RED & MAROON JASPER STREAKS & PATCHES	4.4		4.6	104.5				
		M	30° DIP	IRON FORMATION - LIGHT CALCAREOUS MAROON JASPER BANDS. - NODULAR TO IRREGULAR PATCHES OF ORANGE-RED JASPER	5.0		5.0	100.0	908			
				CLASTIC DARK BROWN SHALE	2.0		2.2	110.0				
		M		BANDED IRON FORMATION - REGULAR TO IRREGULAR BANDS OF LIGHT (CALCAREOUS) & DARK MAROON JASPER + A FEW RED JASPER NODULES WITH THIN WHITE BORDERS OF FIBROUS OR ASICCULAR CALCITE.	3.5		3.5	100.0	909			
160					2.5		2.6	104.0				
		H		IRON FORMATION - MASSIVE - EXCEPT FOR CLASTIC & SHALY ZONE	7.1		6.7	89.1	910			
		H M	30° DIP	BANDED IRON FORMATION - MAROON & RED JASPER	1.5	1	1.7	113.3				
				CLASTIC BROWN SHALE - WITH A SMALL AMOUNT OF SOOTY HEMATITE WATER BEDDED.								
		H M		BANDED JASPEROID IRON FORMATION (¼ to ½") BANDS OF MAROON & RED JASPER. CLASTIC DARK BROWN SHALE (¼ to ½")	10.0		9.9	99.0	911			
180		H		IRON FORMATION - IRREGULAR BANDS & LENSES OF LIGHT MAROON JASPER - RED JASPER NODULES (1 TO 15 mm) - IRREGULAR PINK JASPER PATCHES	4.5		4.5	100.0	912			
					7.5		7.6	101.3				
									914			
	RJ	H M		INTER BEDDED BROWN SHALE & RED JASPER	2.3		2.1	91.4				
					5.7		4.7	83.5				
200												
	RJ	H MH		IRON FORMATION - IRREGULAR MARKN JASPER NODULES WITH RED HALOS - IRREGULAR CARBONATE PATCHES - MANY RELICT BIRDS-EYES.	12.6		12.8	101.5	915			
		M		IRON FORMATION - SHREDDED PINK DOLOMITE PINK JASPER PATCHES WITH WHITE CRUSTS NODULAR IF - MANY GHOST TO SUB-GHOST BIRDS-EYES - OVAL RED JASPER NODULES								
		H	30° DIP	IRON FORMATION - MAROON JASPER BANDS (¼ to ½") - PATCHES OF LIGHT COLORED JASPER								
		H		IRON FORMATION - METALIC HEMATITE & MARON JASPER LIGHT COLOR DUE TO HIGH MICROCRISTALLINE SILICA CONTENTS	6.9		6.5	94.2	916			
220		M		IRON FORMATION - PATCHES OF PINK JASPER (1 to 30mm) & WHITE SILICA (½ to 6 mm) ACROSS - MAROON BANDS - RED JASPER NODULES & LENSES - RELICT BIRDS-EYE - & A FEW SMALL VUGS (1 to 5 mm) WIDE	6.5		6.3	97.2	917			
			30-35° DIP									
		M			6.0		5.6	93.3				
					7.0		6.8	97.1	918			
240												
		M		IRON FORMATION - WIDE MAROON & RED JASPER BANDS - AS WELL AS NUMEROUS PINK TO RED JASPER NODULES (1 TO 5mm), LENSES, (3 TO 15 mm), & PATCHES (1 TO 10 mm).	9.1		8.7	95.7	919			
		H M			10.0		9.8	98.0	920			
				FINE GRAINED GREEN-BROWN CALCAREOUS SANDSTONE.					921			
260				NODULAR IRON FORMATION - NUMEROUS WHITE SILICEOUS NODULES (1 to 15 mm) & PINK JASPER PATCHES (1 to 10 mm)	9.4		9.0	96.7	922			
		M	30-35° DIP	IRON FORMATION - MAROON JASPER BANDS (¼ TO 3") WIDE	1.7		2.5	147.0				
					4.9		3.5	71.5				
		M		IRON FORMATION - 3 TO 5" BANDS OF RED JASPER WITH NUMEROUS MARON JASPER NODULES (1 to 9 mm) - RELICT BIRDS-EYE	1.5		1.4	93.4	923			
				IRON FORMATION - VERY IRREGULAR MAROON JASPER BANDS & PATCHES	7.0		6.6	94.3				
280									924			
				LIGHT BROWN CARBONATEOUS SHALE					925			
	H H	M		IRON FORMATION - CANMAW RELICT BIRDS-EYE - ALSO SOME RED & MARON JASPER	5.0		5.0	100.0				
				IRON FORMATION - CHARACTERISTIC BANDS & OVAL PATCHES OF ORANGE JASPER, WHICH MAY OR MAY NOT HAVE CORES OF WHITE FIBROUS CRISTALS - MAROON BANDS (¼ TO 3")	6.6		6.0	91.0	926			
				CLASTIC IRON FORMATION - ANGULAR TO SUB ANGULAR CARBONATE CHIPPINGS					927			
		MH		IRON FORMATION - RED JASPER NODULES (1 to 6 mm) - RELICT BIRDS-EYE - PINK & MAROON JASPER	2.2		2.2	100.0	929			
300				CONGLOMERATIC - CARBONATE FRAGMENTS IF - ABUNDANT PINK TO RED JASPER PATCHES & SHREDS - RELICT BIRDS-EYE.	10.0		9.8	98.0	931			
					3.7		3.2	86.5	932			
			DIP 35°	BANDED IF - (¼ to 2") BANDS OF MAROON JASPER.	7.1		6.4	90.0				
		MH		IRON FORMATION - RED JASPER PATCHES & NODULES - BANDS OF MAROON JASPER LENSES - RELICT BIRDS-EYE.	5.0		4.1	82.0	933			
320		M			9.5		9.2	95.5	934			
				HARD MEDIUM BROWN SHALE								
	MJ RJ			INTER-BEDDED RED & MAROON JASPER CONGLOMERATIC DARK BROWN SHALE	10.0		8.9	89.0	935			
340					4.4		4.2	95.5				
									936			
					4.6		3.7	80.5				
					3.7		3.6	34.6				
									937			
360		M		IRON FORMATION - 35% RED & 35% MAROON JASPER IN THICK & IRREGULAR BANDS	6.4		6.2	96.9				
				REGULAR IRON FORMATION - VERY ABUNDANT: RED JASPER NODULES (1 to 8mm) PINK JASPER PATCHES (1 to 12 mm), IRREGULAR STREAKS OF PALE MAROON JASPER, RELICT TO SUB-RELICT BIRDS-EYE	8.3		8.3	100.0	938			
380					10.0		9.6	96.0	939			
		H		BANDED IRON FORMATION - (¼ to ½") BANDS OF MAROON JASPER - LAST 0.5 CONTAINS WELL BANDED CLASTIC POLMITE	4.7		3.9	83.0	940			
			DIP 35°	IRON FORMATION - RED JASPER NODULES (¼ to ½") WITH MAROON JASPER CORES - A FEW PINK JASPER BANDS OR LENSES (¼ - ½" THICK	4.3		3.5	76.5				
400		M			7.0		6.8	97.2	941			
					10.8		9.5	87.8	942			
		M		IRON FORMATION - NUMEROUS & REGULAR RED JASPER NODULES (1 - 5 mm), LENSES, (½ - 2" x ¼ - 1") & IRREGULAR BANDS	4.7		3.6	76.6	943			
					2.9		2.0	69.0				
				CONGLOMERATE - CALCAREOUS (LIGHT GREEN WELL ROUNDED (¼ - 3" DIAM.) FRAGMENTS (± 75.% - BROWN SHALE MATRIX	9.0		8.5	94.5				
420				CONGLOMERATIC TO SANDY DARK BROWN SHALE - SUB ANGULAR FRAGMENTS UP TO 2" LONG - TRACE OF THIN (1-2 mm) CARBONATE VEINLETS.	4.0		1.0	25.0				
					4.6		2.1	45.6				
					10.0		9.7	97.0				
440					9.9		3.6	38.0				
			443.8	EOH	= END OF HOLE # Y-7-63							

1406

CREST EXPLORATION LIMITED

D.D.H. No. Y-8-63

LOGGED BY W. Sibbick

AREA IRON CREEK CLAIM COORDINATES 108,400 N : 82,300 E

ELEVATION TOTAL DEPTH 310.0 DATE STARTED JUNE 11 COMPLETED JUNE 26

INCLINATION VERTICAL

ROCK TYPES

IRON FORMATION
JASPER
LIMESTONE
DOLOMITE
SHALE
SILTSTONE
SANDSTONE
CONGLOMERATE
BRECCIA
NO SAMPLE
CAVINGS

MODIFIERS AND ACCESSORIES

NODULES (RELICT)
LENSES (RELICT)
BANDS (RELICT)
BIRDSEYE
SPHERULITES
HALO
MAROON M
HEMATITIC H
JASPEROID J
SILICEOUS S
CARBONITIC C
CALCITIC
DOLOMITIC

STRUCTURES

STRONG FAULT, SHOWING DIP
WEAK FAULT, SHOWING DIP
FRACTURE, SHOWING DIP
VEINLET, SHOWING DIP
BRECCIATED

DEPTH ELEV	LITHOLOGY	HEM % EST. (with types)	STR	DESCRIPTION (Note feature dimensions, bedding dip, etc.)	ENGINEER DATA: LEN RUN	No RUNS	FT REC	% REC	CRUDE ANALYSIS: SAM No	Fe	SiO_2	P
				- OVERBURDEN								
			DIP 30°	- IRON FORMATION - RELICT NODULES: OVOIDS (3-8 MM) - REGULAR TO IRREGULAR BANDS OF MAROON JASPER - MICROCRYSTALLINE QUARTZ - HEMATITE PATCHES, LENSES, & VERY IRREGULAR BANDS	3.0		2.1	70.0				
					3.0		2.7	94.0	1072			
					2.3		1.4	60.8				
					2.3		2.0	—				
					1.8		0.2	12.0				
					0.9		0.4	44.5	1073			
					2.2		1.1	50.0				
					1.3		1.1	84.6				
					1.8		0.8	—				
					0.8		0.2	12.5				
					(6.0)		(2.0)	(33.3)				
20				- FINE GRAINED, CALCAREOUS, BROWN & GREEN SANDSTONE								
					4.3		4.3	100.0	1074			
				- I.F. - BANDS ARE MOSTLY VERY IRREGULAR MAROON JASPER AS WELL AS SOME PINK QUARTZ-HEMATITE BANDS - NODULES & LENSES OF PINK QUARTZ-HEMATITE & RED JASPER	4.4		3.5	79.5				
					4.0		3.9	97.5	1075			
				- JASPEROID IRON FORMATION - RED BROWN TO DARK MAROON JASPEROID WITH IRREGULAR PATCHES (¼-½") OF PINK QUARTZ-JASPER & IRREGULAR BANDS OF MAROON JASPER & BROWN CALCITIC CARBONATE	4.0		3.1	77.6				
					1.0		0.6	60.0				
40			DIP 15°		3.0		2.0	66.0	1076			
					1.8		1.8	100.0				
					2.0		1.9	95.0				
				- SANDY DARK BROWN SHALE	1.7		1.6	88.3				
				- I.F. - IRREGULAR BANDS OF JASPER & RELICT LENSES								
				- IRON SANDSTONE - RED JASPER/HEMATITE SAND								
				- BANDED IRON FORMATION - (¼ TO ½") REGULAR TO IRREGULAR BANDS OF RED & MAROON JASPER - TRACE OF INTERBEDDED SHALE	3.1		2.5	80.6	1077			
			DIP 16°									
				- CONGLOMERATE - DARK BROWN SHALE MATRIX - FRAGMENTS (1/2 TO 1½") DIAMETER, SHALE & CARBONATE, ANGULAR TO ROUNDED	9.2		8.2	89.2	1078			
			60° DIP	- IRREGULAR BANDS OF JASPER & CARBONATE (¼-½")								
60		FG SS	VARIES	- IRON SANDSTONE - SAME INTERBEDDED CONSISTENCY								
				- BANDED IRON FORMATION - RED JASPER BANDS (¼-½") - SLICKENSIDES PARALLEL BEDDING	5.5		5.5	100.0	1079			
			DIP 20°	- IRON FORMATION - REGULAR BANDS OF JASPER (½-¾") WIDE								
					6.7		5.0	74.6				
				- CONGLOMERATE: DARK BROWN SHALE MATRIX - FRAGMENTS OF LIGHT GREEN SHALE & WHITE TO YELLOW CARBONATES, ANGULAR TO 3" DIAMETERS - ANGULAR TO SUB-ROUNDED					1080			
					4.6		3.2	69.5				
				- IRON FORMATION - (½-3") BANDS OF LIGHT BROWN CARBONATE & (¼-½") BANDS OF MAROON JASPER	5.2		3.8	73.1	1081			
80				- IRON FORMATION - STREAKY TO WASTE BANDS OF MAROON JASPER & CARBONATE, CHERTEXES (½-2")								
					4.0		4.0	100.0				
			DIP 15-20°		5.0		4.7	94.0				
				- LOW GRADE IRON FORMATION - STREAKY BANDS OF RED & MAROON JASPER, CARBONATE & CLASTICS (⅛-2")	5.0		4.6	92.0	1082			
				- CONGLOMERATE - BROWN SHALE MATRIX - FRAGMENTS UP TO 4" LONG.	5.0		3.9	78.0	1083			
100				- LOW GRADE IRON FORMATION - BANDS UP TO 2" WIDE OF RARE DARK BROWN SHALE - RED & MAROON JASPER BANDS (⅛-½")	3.0		2.8	93.3				
				- IRON FORMATION - RED JASPER-QUARTZ PATCHES & LENSES (⅛-½") - PALE PURPLE MAROON JASPER CALCITE LENSES - SHREDDED DOLOMITE	3.0		3.0	100.0	1084			
					4.0		3.1	77.5				
			DIP 30°	- BANDED IRON FORMATION - MAROON & RED JASPER BANDS (⅛-½")								
					6.3		6.3	100.0	1085			
				- IRON FORMATION: IRREGULARLY DISTRIBUTED WASTE CONSISTING OF SHREDDED DOLOMITE & RED JASPER ZONES, PINK PATCHES & LENSES OF HEMATITE-QUARTZ-IRON & IRREGULAR BANDS OF MAROON JASPER & CARBONATE	1.8		1.8	100.0				
120					3.8		3.5	92.1				
					3.5		3.5	100.0	1086			
					1.7		1.7	100.0				
					2.8		2.2					
					4.0		3.9	97.5				
									1087			
					6.0		4.7	94.0				
					4.0		3.5	87.5	1088			
140												
				- HARD BROWN SHALE	5.0		4.9	98.0				
				- JASPEROID IRON FORMATION								
				- BROWNISH GREEN MEDIUM SIZED SANDSTONE					1089			
					6.5		6.5	100.0				
			DIP 20-25°	- LOW GRADE IRON FORMATION: BANDS (¼-1½") OF IRREGULAR RED & MAROON JASPER & PATCHES (⅛-1") OF PINK QUARTZ-HEMATITE, BANDS OF CLASTICS	8.5		8.5	100.0	1090			
160												
					7.0		6.8	97.1				
				- BANDED IRON FORMATION: (¼-1") BANDS OF MAROON JASPER & (¼-½") PATCHES OF RED JASPER	5.1		2.7	74.0	1091			
				- HARD BROWN SHALE - TRACE OF VERY ANGULAR SOFT DARK GREEN FRAGMENTS	7.0		5.8	83.0	1092			
				- IRON FORMATION: REGULAR TO IRREGULAR PATCHES (⅛-1/2) & BANDS (⅛-1") OF MAROON JASPER & LIGHT BROWN CARBONATE - RELICT BIRDS-EYE	1.8		1.8	100.0				
180					2.3		2.2	95.6	1093			
					1.8		1.8	100.0				
					(6.1)		(5.8)	(95.0)				
				- CONGLOMERATIC IRON FORMATION: IRREGULAR FRAGMENTS OF BROWN CARBONATE & RED JASPER ETC. - MAROON - STEEL GREY HEMATITE MATRIX.	8.0		7.3	89.0	1094			
				- LOW GRADE BANDED IRON FORMATION (¼-1") BANDS OF MAROON & RED JASPER - ½" BAND OF DARK SHALE.								
				- BANDED IRON FORMATION: BANDS (⅛-2") ARE MOSTLY MAROON JASPER, SOME PALE PUR TO CARBONATE & LIGHT BROWN CARBONATE BANDS.	5.6		4.5	80.6				
200			DIP 20°		2.1		2.0	95.3	1095			
					3.7		3.3	89.2				
				- IRON FORMATION, WHICH CONTAINS SANDY BANDS OF LIGHT BROWN CARBONATE & IRREGULAR STREAKS OF RED JASPER.								
				- NODULAR IRON FORMATION: ROUNDED LENSES & PATCHES OF RED JASPER & CARBONATE (½-1½") - RELICT BIRDS-EYE STRUCTURE IN CENTRE OF HEMATITE.	10.0		9.5	95.0	1096			
					2.0		2.0	100.0	1097			
				- IRON FORMATION, CONTAINS A FEW IRREGULAR BANDS & PATCHES, MOSTLY LIGHT BROWN CARBONATE.	(6.1)		(6.1)	(100.0)				
220				- MEDIUM BROWN HARD SHALE - CONTAINS IRREGULAR 6" STREAKS OF RED JASPER (INCLUDING CALCITE VEINLETS)	8.1		7.5	65.5				
				- SANDY DARK BROWN SHALE	2.3		0.6	26.1	1098			
				- ROCK WITH LARGE & ABUNDANT CARBONATE PATCHES, WITH A SMALL AMOUNT OF HEMATITE MATRIX	9.0		7.7	85.5	1099			
				- SANDY TO CONGLOMERATIC DARK BROWN SHALE	2.0		0.9	45.0	1100			
240					2.6		1.1	42.3				
					3.9		2.8	74.4	1101			
					2.7		2.7	100.0				
		MJ		- JASPER								
				- IRON FORMATION WITH NUMEROUS PATCHES OF LIGHT BROWN CARBONATE (¼-½")	5.3		4.4	83.0	1102			
					4.7		4.7	100.0				
					5.3		4.6	86.9	1103			
260				- IRON FORMATION: RED JASPER & CARBONATE BANDS (½-1") & LENSES (¼-½") - MOST OF THE LENSES ARE BETWEEN 267.0 & 271.0 - LIMONITE PSEUDOMORPHS AFTER PYRITE AT 267.2	5.5		5.4	98.2	1104			
					4.0		3.5	87.5				
			DIP 20°	- IRON FORMATION: CARBONATE PATCHES & LENSES (¼-3/4") & CARBONATE & MAROON JASPER BANDS (⅛-½")	7.0		6.5	93.8	1105			
280					5.0		4.0	80.0	1106			
					5.0		5.0	100.0				
				- DARK BROWN SHALE - SLIGHTLY SANDY TO CONGLOMERATIC	7.6		7.6	100.0				
300					7.4		4.7	63.5				
				- DARK GREEN CALCAREOUS SANDSTONE ? BOULDER	7.0		3.2	45.7				
				END OF DDH # Y-8-63 AT 310.0'								
318												

GEO - 25 - CR (6/63)

CREST EXPLORATION LIMITED

0s 1697

D.D.H. No. Y-9-63

LOGGED BY W. Gibbins

AREA IRON CREEK CLAIM COORDINATES 198,300 N ; 94,100 E

ELEVATION TOTAL DEPTH 420.0 DATE STARTED JUNE 14 COMPLETED JUNE 26

INCLINATION 90°

ROCK TYPES

- IRON FORMATION
- JASPER
- LIMESTONE
- DOLOMITE
- SHALE
- SILTSTONE
- SANDSTONE
- CONGLOMERATE
- BRECCIA
- NO SAMPLE
- CAVINGS

MODIFIERS AND ACCESSORIES

- NODULES (RELICT)
- LENSES (RELICT)
- BANDS (RELICT)
- BIRDSEYE
- SPHERULITES
- HALO
- MAROON (M)
- HEMATITIC (H)
- JASPEROID (J)
- SILICEOUS (S)
- CARBONITIC (C)
- CALCITIC
- DOLOMITIC

STRUCTURES

- STRONG FAULT, SHOWING DIP
- WEAK FAULT, SHOWING DIP
- FRACTURE, SHOWING DIP
- VEINLET, SHOWING DIP
- BRECCIATED

DEPTH ELEV	LITHOLOGY	HEM % EST. (with types)	STR	DESCRIPTION (Note feature dimensions, bedding dip, etc.)	ENGINEER DATA: LEN RUN	No RUNS	FT REC	% REC	CRUDE ANALYSIS: SAM No	Fe	SiO_2	P
				- OVERBURDEN								
30												
				- HARD HEMATITIC SHALE & IRON SANDSTONE	4.0		1.7	42.5				
				- VERY FINE GREEN & BROWN SANDSTONE	5.0		3.5	70.0				
40				- DARK BROWN SHALE	3.0		1.5	50.0				
					2.6		0.7	26.9				
					1.4		1.3	92.8				
				- IRON SANDSTONE - COARSE RED JASPER & METALLIC HEMATITE SAND. SANDY BROWN SHALE TO BROWNISH GREEN SANDSTONE.	4.0		3.6	90.0				
					3.0		2.5	83.4				
					1.6		0.7	43.9				
					1.4		1.0	71.5				
60					2.0		0.4	20.0				
					3.0		-	-				
					1.8		-	-				
					5.0		0.4	8.0				
		MH		- IRON FORMATION - JASPEROID & APPEARS TO CONTAIN SAND GRAINS OF QUARTZ & JASPER	2.5		0.1	4.0				
					3.0		0.5	16.7	1028			
					1.0		-	-				
					5.0		0.3	10.0				
80					1.6		0.3	18.7				
		MH			2.4		0.2	8.3	1029			
					5.0		1.5	30.0				
				- DARK BROWN SHALE - BANDS OF GREENISH CONGLOMERATE & TRACES OF LIGHT GREEN SHALE	2.5		1.7	68.0				
				DIP ~20°	1.5		0.8	53.3	1030			
					2.0		0.7	35.0				
					6.0		5.1	85.0				
100					4.0		3.0	75.0	1031			
					5.0		3.7	74.0				
		RH		- IRON FORMATION - 75% OF WASTE IS RED & MAROON JASPER BANDS, REGULAR TO IRREGULAR & 1/2" THICK	1.6		0.6	37.7				
				DIP ~30°	3.4		1.5	36.3	1032			
					1.0		0.6	60.0				
		MH			1.0		0.9	90.0				
					2.0		-	-				
					1.0		0.3	30.0				
120					1.8		0.8	44.3				
					2.5		0.5	20.0				
					2.0		1.4	70.0	1033			
					3.0		1.8	60.0				
				- PINK GREEN & BROWN SANDSTONE - LAMINATED & CALCAREOUS.	2.0		1.3	65.0	1034			
					5.0		2.7	54.0				
				- IRON FORMATION - IRREGULAR TO REGULAR BANDS OF JASPER & CARBONATE DIP 24-30°	1.5		1.1	73.4				
					1.0		0.3	30.0				
					1.0		0.6	60.0	1035			
140					1.0		0.3	30.0				
					3.0		2.5	83.4				
					1.8		0.8	60.8				
					4.0		3.5	87.5				
					1.0		1.0	100.0	1036			
					2.5		2.3	92.0				
					2.5		2.3					
					4.0		4.0	100.0	1037			
					2.0		2.0	100.0				
160												
				- CONGLOMERATE: BROWN SHALE MATRIX - FRAGMENTS (35 - 40%), (0.3 mm TO 5" DIAM.) LIGHT GREEN & YELLOW CARBONATES, ANGULAR TO SUB-ROUNDED - SMALL BANDS OF JASPEROID MAROON HEMATITE	4.0		2.2	55.0				
					3.1		0.0	-	1038			
					1.4		0.0	-				
					5.0		3.4	68.0	1039			
					4.0		3.5	87.5				
180				- NODULAR IRON FORMATION: 50% OF OVOIDS (50% OF WASTE + RED JASPER RINDS HAVE CRUSTS OF ASSOCIATED CALCITE - PATCHES (25% OF WASTE) CONTAIN BROWN CARBONATE - DIP 20°	3.0		2.7	90.0				
				DIP 20°	2.0		0.0	-	1040			
					3.0		3.0	100.0				
		MH		- BANDED JASPEROID IRON FORMATION - 10 - 25% REGULAR BANDS OF MAROON & RED JASPER. - TRACE OF SANDY SHALE	3.5		1.7	48.6	1041			
				DIP 10-15°	2.0		1.5	75.0				
		MH+MH		- INTERBEDDED DARK BROWN SHALE & JASPEROID IRON FORMATION, (25-75% REGULAR TO IRREGULAR BANDS OF RED & MAROON JASPER	2.5		1.2	48.0				
					2.0		1.7	85.0	1042			
		MH+MH			2.5		2.1	84.6				
200				- IRON FORMATION: MOST OF THE HEMATITE IS NEAR THE STEEL GREY - MOMENT BRADLEY. - THIN BANDS OF BROWN SHALE.	4.0		3.3	82.5	1043			
		MH			2.0		1.7	85.0				
				- HARD MEDIUM GREY DOLOMITIC SHALE					1044			
				- IRON FORMATION: IRREGULAR PATCHES & BANDS OF JASPER & LIGHT BROWN CARBONATE	4.5		4.2	93.3				
					4.1		4.0	97.6	1045			
				- IRON FORMATION: PATCHES OF PINK QUARTZ-HEMATITE, SHREDDED DOLOMITE & JASPER, SMALL LENSES TO BANDS-EYE OF WHITE MICROCRYSTALLINE QUARTZ - TRACE OF SANDY SHALE - MAROON JASPER BANDS (1/8-1")								
				DIP 5°	4.4		4.3	97.8				
220					5.0		5.0	100.0	1046			
					5.0		4.8	96.0				
					5.0		4.9	98.0	1047			
					5.0		5.0	100.0				
240												
				- IRON FORMATION: SIMILAR TO ABOVE BUT ONLY A TRACE OF DOLOMITE	2.0		1.9	96.0				
					5.0		5.0	100.0	1048			
					7.0		6.9	98.6	1049			
					4.0		4.0	100.0				
				- VERY FINE DARK GREEN CALCAREOUS SANDSTONE.	10.0		10.0	100.0	1050			
260												
				- IRON FORMATION: REGULAR & IRREGULAR BANDS (1/2") & LENSES (2" x 3") OF RED & MAROON JASPER. - TRACE OF CHALCOPYRITE.	4.6		4.1	89.2	1051			
					7.0		7.0	100.0	1052			
									1053			
280		MH		- INTER-BEDDED SHALE & LEAN GRADE MAROON HEMATITE.	6.7		6.5	97.0	1054			
				- IRON FORMATION: NUMEROUS LENSES (1/2" - 2" x 1/2" - 2") OF RED JASPER & CARBONATE (SOME HAVE BORDERS OF RADIOLARIAN CALCITE.								
				- IRON FORMATION: IRREGULAR BANDS OF MAROON JASPER (1/8 - 1/2") THICK. SOME HAVE RED JASPER IN BANDS & THIN MICROSCOPIC VEINLETS OF CALCITE.	4.7		4.7	100.0	1055			
					3.0		2.5	83.3				
				- HARD DARK BROWN HEMATITIC SHALE					1056			
				- IRON FORMATION: REGULAR MAROON JASPER BANDS (1/2 - 2") - TRACE OF CHALCOPYRITE.	8.0		7.8	97.6				
300				DIP ~5°					1057			
				- COARSE CALCAREOUS SANDSTONE: ANGULAR GRAINS (0.5-3 mm) OF BROWN SHALE & LIMESTONE	6.0		5.8	96.7	1058			
				- IRON FORMATION: BANDS (1/2-1") & LENSES (1/2-1") OF MAROON & RED JASPER					1059			
				- DARK BROWN CONGLOMERATIC SHALE - SAND TO 1" ANGULAR PARTICLES OF CARBONATE	9.0		8.3	92.3	1060			
				- JASPEROID CONGLOMERATE: MATRIX OF HIGHLY HEMATITIC SHALE WHICH IS INTERSECTED BY LARGE STREAKS OF RED JASPER								
320					6.6		6.6	100.0	1061			
				- IRON FORMATION: IRREGULAR BANDS (1/2-1") OF MAROON JASPER & PATCHES (1/2-2") OF PINK-WHITE CARBONATE - TRACE OF CHALCOPYRITE.	6.4		6.0	93.8				
					1.0		1.0	100.0	1062			
				- FAIRLY HARD CARBONATEOUS LIGHT BROWN SHALE - BRECCIATED BY CALCITE VEINLETS	10.0		10.0	100.0				
				- SANDY DARK BROWN SHALE					1063			
340				- LIGHT BROWN CARBONATEOUS SHALE								
				- SANDY DARK BROWN SHALE: SMALL (0.5-3 mm) ANGULAR FRAGMENTS OF WHITE CARBONATE & DARK GREEN CHLORITE	10.0		9.7	97.0	1064			
					10.0		9.7	97.0	1065			
360												
				- IRON FORMATION WITH VERY IRREGULAR BANDS & PATCHES OF CARBONATE & PINK QUARTZ-HEMATITE	2.0		1.6	82.0				
					9.6		9.6	100.0	1066			
					2.2		2.2	100.0	1067			
				- CALCAREOUS CONGLOMERATE: ROUNDED TO SUB-ROUNDED FRAGMENTS (1/2" - 6") OF SHALE, LS., JASPER, ETC. (85%); MATRIX IS PURE WHITE CALCITE.	5.2		5.1	98.1	1068			
380				- IRON FORMATION WITH REGULAR TO IRREGULAR LENSES & BANDS OF CARBONATE (CALCITE)	6.0		5.2	86.7				
				DIP ~15°					1069			
					4.0		3.3	82.5				
					5.0		4.4	88.0				
					2.6		2.6	100.0	1070			
400					5.0		4.7	94.0				
				- IRON FORMATION: HEMATITE IS STEEL GREY, BUT APPROACHING MAROON - BANDS OF CARBONATE UP TO 4" WIDE, MAY BE "SHREDDED".	1.4		1.2	85.7	1071			
					6.0		5.6	93.4				
				- LIGHT GREEN CALCAREOUS CONGLOMERATE: FRAGMENTS UP TO 8" (30%), MOSTLY LIGHT GREEN CALCAREOUS SANDSTONE, ALSO SHALE, QUARTZITE, ETC., ROUNDNESS INTERMEDIATE WITH PARTICLE SIZE. MATRIX IS DARK BROWN SHALE.	5.0		4.1	82.0				
420				END OF DDH # Y-9-63 AT 420'	5.0		4.0	80.0				
440												

GEO - 25 - CR (6/63)

1407

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

091697

DDH ~~SECTION~~ No. Y-10-63 — DATE STARTED JUNE 30

DESCRIBED BY W. GIBBINS — DATE COMPLETED JULY 6

MEASURED BY — MEASURING RATE

AIR PHOTO No. — COORDINATES 39,600 N ; 88,900 E

AREA — CLAIM

WEATHER

ROCK TYPES

IRON FORMATION — SILTSTONE

JASPER — SHALE

CONGLOMERATE — LIMESTONE

BRECCIA — DOLOMITE

SANDSTONE — COVERED

% HEMATITE

STEEL GREY HEMATITE

MAROON HEMATITE

BOTH

SILICEOUS WASTE TYPES

RED JASPER

MAROON JASPER

MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4

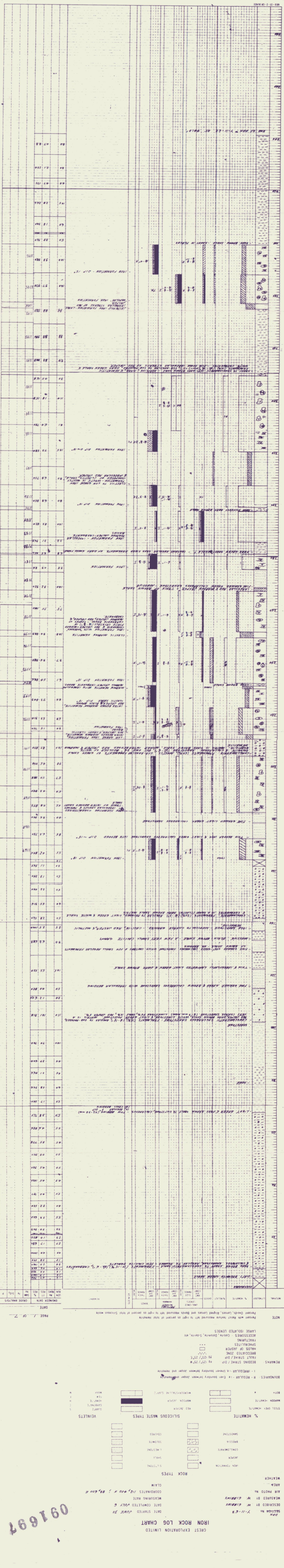
DATE

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	UNALIGNED LENSES SHAPE	PATCHES ~~ALIGNED LENSES~~ AMT and COMP	PATCHES ~~ALIGNED LENSES~~ THICK RANGE	PATCHES ~~ALIGNED LENSES~~ SHAPE	BANDS AMT and COMP	BANDS THICK RANGE	BANDS SHAPE	VEINLETS	REMARKS	ENGINEER DATA LEN RUN	ENGINEER DATA No RUNS	ENGINEER DATA FT REC	ENGINEER DATA % REC	CRUDE ANALYSIS SAM No	CRUDE ANALYSIS Fe	CRUDE ANALYSIS SiO_2	CRUDE ANALYSIS P
															- OVERBURDEN								
20																							
					C	½-4 / ½-2	A	TR			X	½-16	TR		- IRON FORMATION 15° DIP	1.5	1.4	93.4					
																4.5	3.9	86.8		1107			
40															- IRON SANDSTONE: MEDIUM GRAINED HEMATITE, RED JASPER, & CALCITE. - BANDED IRON FORMATION						1108			
			TR								X	½-1	I			5.6	3.7	67.4		1109			
																2.0	1.9	95.0					
															- CONGLOMERATE: FRAGMENTS (40%) (¼-1½") ROUNDED TO SUB-ROUNDED, WHITE & LIGHT GREEN CARBONATE MATRIX IS MAROON-BROWN SHALE	2.0	1.8	90.0					
																5.0	2.3	46.0		1110			
															- "NODULAR" IRON FORMATION - VERY IRREGULAR MAROON JASPER CARBONATE BANDS - TINY FISSURES & CALCITE VEINLETS PROVIDE TINY OFFSETS IN FEATURES. DIP 5°W	2.0	1.9	95.0					
60																3.5	1.2	34.3		1111			
																1.8	0.8	44.4					
																4.5	4.2	93.3					
																				1112			
																5.0	3.1	62.0					
															- BANDED IRON FORMATION - DIP 18°	2.0	2.0	100.0		1113			
											X	½-2	I		- INTERBEDDED, DARK BROWN SHALE & FINE ANGULAR CONGLOMERATE (BRECCIA) OF LIGHT GREEN SHALE FRAGMENTS (IN A DARK BROWN SHALE TO DOLOMITIC MATRIX.	2.6	2.5	96.1		1114			
																1.4	0.7	50.0					
											X	½-1½	I		- BANDED IRON FORMATION * STEEL GREY HEMATITE.	3.0	2.2	73.3		1115			
80															- IRON FORMATION - ZONES UP TO 1" WIDE OF "SHREDDED" CARBONATE & RED JASPER - IRREGULAR BANDS OF RUSTY CARBONATE & PINK QUARTZ-HEMATITE PATCHES. RELICT BIRDS-EYE.	3.0	2.5	83.4					
																3.9	3.9	100.0		1116			
																5.0	4.6	92.0					
											X	½-2	I			2.6	2.3	88.5					
																4.4	3.4	77.3		1117			
100																5.0	5.0	100.0					
															- IRON FORMATION - RED JASPER BANDS SHOW PENECONTEMPORANEOUS FRACTURING	1.0	1.0	100.0					
					C	½-¾ / ½-4	A	¼-½	I			¼-½	R			4.0	3.9	97.5		1118			
																XX	XX	XXX					
																1.4	1.4	100.0					
															- IRON FORMATION - ZONES OF "SHREDDED" DOLOMITE & RED JASPER (UP TO 6")	3.0	3.0	100.0					
																2.0	2.0	100.0					
120																5.0	4.8	96.0		1119			
															- INTERBEDDED HARD BLACK SHALE & JASPEROID MAROON HEMATITE.	5.0	5.0	100.0					
															- FINE GRAINED DARK GREEN/GREY-BROWN CALCAREOUS SANDSTONE								
																5.0	4.5	90.0		1120			
															- IRON FORMATION - CHARACTERIZED BY MANY IRREGULAR PATCHES OF RED JASPER, QUARTZ-HEMATITE & MAROON JASPER-CARBONATE.	9.0	8.9	99.0		1121			
															- IRON FORMATION - MOSTLY MASSIVE HEMATITE + IRREGULAR BANDS OF JASPER & CLASTIC CARBONATE	4.0	3.9	97.5		1122			
															- IRON FORMATION WITH VERY IRREGULAR BANDS TO PATCHES OF MAROON JASPER	3.0	3.0	100.0					
			TR									¼/C	½-¾	½		3.5	2.6	74.3		1123			
															- HARD DARK BROWN SHALE - TRACE OF SMALL ANGULAR FRAGMENTS OF SHALE					1124			
															- IRON FORMATION DIP 10°	4.5	4.4	97.8					
						¾-1 / ¾-2	R	¾-1	I			½-2	R / I			5.0	5.0	100.0		1125			
140															- CONGLOMERATIC SHALE & MAROON HEMATITE (10-15%), LARGELY COMPOSED OF THICK (1-4") BANDS OF JASPER, CARBONATE, & COARSE SANDY SHALE.								
															- CONGLOMERATE: FRAGMENTS (35%) (¼-2"), WELL ROUNDED TO SUB-ROUNDED, INCLUDE: RED JASPER, BROWN SHALE, GREEN SANDSTONE & WHITE LIMESTONE. WHOLE UNIT IS VERY CALCAREOUS.	7.0	6.7	95.7		1126			
															- SANDY TO CONGLOMERATIC BLACK SHALE								
																8.0	7.6	94.8		1127			
					C	¼-½ / ¾-¾	I					±-1	R/I		- "NODULAR" TO "SHREDDED" IRON FORMATION - IRREGULAR PATCHES TO LENSES OF WHITE CARBONATE & ZONES OF SHREDDED CARBONATE.	6.6	6.2	94.0		1128			
160															- BANDED IRON FORMATION - DIP 10°	5.0	5.0	100.0					
												¾-¾	I							1129			
															- SANDY MAROON HEMATITE WITH IRREGULAR PATCHES & STREAKS OF RED & MAROON JASPER - IRON FORMATION	7.4	7.4	100.0					
																4.0	3.3	82.5		1130			
																1.8	0.3	16.6					
180															- INTERBEDDED DARK BROWN SHALE & MAROON RED JASPER								
															- SANDY TO CONGLOMERATIC DARK BROWN SHALE. FRAGMENTS (15-20%) (¼-2"), LIGHT COLORED CHERT & CARBONATE, SUB-ANGULAR TO SUB-ROUNDED.	8.0	7.4	92.5		1131			
																4.0	2.7	67.6					
															- SANDY MAROON HEMATITE - SHALE & CONGLOMERATE AS ABOVE UP TO ¾" DIAMETER.	5.0	4.3	86.0					
200																5.4	3.3	61.1		1132			
															- IRON FORMATION - DIP 20°	2.2	2.2	100.0					
																1.6	1.3	81.3					
						¼-¾ / ¾-1	R	¼-¾	I			½-¾	¼ / ½			3.0	3.0	100.0		1133			
															- NODULAR IRON FORMATION - SOME OVOIDS & LENSES HAVE CARBONATE CORES 1/8" BANDS.	4.4	4.3	96.6					
						½-2"	R	TR							- IRON FORMATION - DIP 10-20°	1.0	1.0	100.0					
																2.0	2.0	100.0					
																3.5	2.6	74.4		1134			
220																1.5	1.4	93.3					
																5.5	5.3	96.4					
																1.0	1.0	100.0					
																2.0	1.7	85.0		1135			
															- RELATIVELY LOW GRADE IRON FORMATION	7.5	6.8	90.7					
															- INTRA-WACKE CALCAREOUS, BROWN & WHITE SILTSTONE WITH MINOR HEMATITIC SHALE & RED JASPER								
240																3.8	2.9	76.0					
															- CONGLOMERATIC TO SANDY DARK BROWN SHALE: FRAGMENTS (15%), (¼-2"), ROUNDED, MOSTLY LIGHT GREY OR GREEN DOLOMITE.	9.0	7.5	83.0					
																4.0	3.6	90.0					
																10.0	9.4	94.0					
260																							

END OF BORE @ Y-10-63 AT 994.0'

1409

660-23-2-CM (6/83)


END OF BOH @ Y-11-63 AT 1440'
DARK BROWN SHALE - SANDY IN PLACES
IRON FORMATION - DIP 15°
IRON FORMATION DIP 10°
IRON FORMATION DIP 10°
IRON FORMATION DIP 10°
IRON FORMATION
DARK GREY SAND/SHALE - CALCAREOUS ARGILLACEOUS SILTSTONE
IRON FORMATION - INTREGULAR
MARROON ARGILLITE - CALCAREOUS
CHERT FORMATION - VARIABLE
CHERT FORMATION - VARIABLE
IRON FORMATION DIP 15°
CLASTICS TO LOW GRADE IRON FORMATION - WASTE IS MOSTLY COMPOSED OF CLASTICS, SHALE, & IRREGULAR RED JASPER

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

DDH No. Y-12-63 — DATE STARTED July 8 — DATE COMPLETED July 15

DESCRIBED BY E. C. CARNBERG — MEASURED BY

AIR PHOTO No. — COORDINATES 112,800 N / 94,700 E

AREA — CLAIM

WEATHER

ROCK TYPES

IRON FORMATION — SILTSTONE

JASPER — SHALE

CONGLOMERATE — COAL/LIGNITE

BRECCIA — DOLOMITE

SANDSTONE — GOUGE

% HEMATITE — SILICEOUS WASTE TYPES — VEINLETS

STEEL GREY HEMATITE — RED JASPER — QUARTZ

MAROON HEMATITE — MAROON JASPER — CARBONATE

BOTH — MICROCRYSTALLINE QUARTZ — HEMATITE

WAXY — CHERT — WAXY

BOUNDARIES 'R' - REGULAR - i.e Even boundary between Jasper and Hematite

I - IRREGULAR - i.e Uneven boundary between Jasper and Hematite

REMARKS
- BEDDING STRIKE / DIP — eg 125°/ 25°W
- FAULT STRIKE / DIP — eg 125°/ 25°E
- BRECCIATED ZONE
- HALOS OF JASPER
- SPHERULITES
- FRACTURING
- ACCESSORIES - Calcite, Dolomite, Siderite, etc
- LARGE ISOLATED LENSES

NOTE Percent with Relict Texture measured left to right as percent of total Hematite. Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste.

PAGE 1 OF 8 — DATE July 63

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES: AMT per COMP	SIZE RANGE	ALIGNED LENSES: AMT per COMP	THICK RANGE	BANDS: AMT per COMP	THICK RANGE	VEINLETS	% VAR.	ENGINEER DATA: LEN RUN	REC No	RQMS	FT REC	% REC	SAM No	CRUDE ANALYSIS: Fe	SiO2	P
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091697

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

DRN
SECTION No Y-13-63

DESCRIBED BY W. GIBBINS
DATE STARTED July 3
DATE COMPLETED July 15

MEASURED BY
MEASURING RATE

AIR PHOTO No
COORDINATES 105,250 N & 105,100 E

AREA
CLAIM

WEATHER

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		COAL	
BRECCIA		DOLOMITE	
SANDSTONE		CHERT	

% HEMATITE	SILICEOUS WASTE TYPES	VEINLETS
STEEL GREY HEMATITE	RED JASPER	QUARTZ S
MAROON HEMATITE	MAROON JASPER	CARBONATE C
BOTH	MICROCRYSTALLINE QUARTZ	HEMATITE H
		CLAY I
		MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e Uneven boundary between Jasper, and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LINSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Voids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 2 OF 6

DATE

ENGINEER DATA				CRUDE ANALYSIS			
CLN RUN	No RUNS	FT REC	% REC	SAM No	Fe	SiO_2	P

REMARKS

STRATA

BANDS: THICK RANGE; AMT and COMP

INTERBANDED LENSES: AMT and COMP; SIZE RANGE

% RELICT TEXTURES

% HEMATITE

LITHOLOGY

INTERVAL

Overburden

Very fine grained hematitic, very dark brown chert to 5 % medium grained calcite. Some brown shale.

Light green, calcareous siltstone, white sandstone, dark brown shale interbedded with minor brown shale

Hard siliceous brown shale

Interbedded green calcareous siltstone to very fine sandstone & dark brown shale. Grades to hard brown shale

Very fine dark brown hematitic shale

Fine grained hematitic shale, dark red/brown, medium hard

Maroon shale & dark brown hematite, occasional green calcareous shale

Dark brown shale, occasional green calcareous shale

Dk brown shale, grey mm-calcareous hematitic 15-25% fragm. pyrite, green shale.

Dk brown shale grey mm-calcareous hematitic 15-25% fragm. pyrite, green shale. Some calc. fragmental green shale

Dk brown shale band near base

Brown shale, 25% dolomitic sandstone. Some fine grained hematitic matrix. Occasional dark brown shale

Dip 20-25°, some calcite bands & pockets. Band of coarse brown (dark) shale

Fine grained hematitic matrix. Occasional dark brown shale

Fine grained hematitic matrix. Occasional dark brown shale

Fine grained hematitic matrix. Occasional dark brown

091894

CRETE EXPLORATION LIMITED

IRON ROCK LOG CHART

AREA
DRILLER No. P.P.M. #3
DRILLED BY: M. MARKS
MECHANICS BY
ASSISTANT No.
ART. No.
WEATHER

DATE STARTED 1957.12.
DATE COMPLETED 1958.2.20
MEASURING RATE
COORDINATES: Original E. / Original N.
ELEVATION

ROCK TYPES

TUFA CONGLOMERATE		FELSTONE	
GRITSTONE		SHALE	
LIMESTONE		LIMESTONE	
SANDSTONE		GRANITE	
CONGLOMERATE		STONEWORK	

% MINERALS

LIMONITE		HEMATITE	
MAGNETITE		MARCASITE	
PYRITE			

SOLUBLE WASTE TYPES

IRON SALTS		SULPHATE OF IRON	
MANGANESE SALTS		MANGANESE SULPHATE	
MANGANESE OXIDES			
OXIDES			

MINERALS

CHALCOPYRITE	C
COVELLITE	V
PYRITE	P
GOLD	G

DESCRIPTION OF INTERLAYER: Core Recovery between diamond and formation

REMARKS: Core Recovery 100%
Casing Shoe 1.20 to 1.20 = 0.0
Water Level 1.20
Installation Date
Installed by
Installation
Location
ACCESSORIES, Locks, Shrouds, Cable, Etc.
Other Valuable Comments

NOTE: Values and Rock Types measured are to right of centre of hole measured.
Values Rock Types Mineral Grades and Depths measured are to left of centre of hole measured.

PAGE 1 OF 10

| DEPTH | DESCRIPTION | CORE RECOVERY | | |

GREST EXPLORATION LIMITED

091697

D.D.H. No. 91-07-4

LOGGED BY Mr. ANDREW

AREA Mine GREEN

GRID COORDINATES 4624m E, 9124m N

ELEVATION TOTAL DEPTH 700m DATE STARTED 1991.7.10 DATE COMPLETED 1991.8.7

INCLINATION -90°

ROCK TYPES

IRON FORMATION	
JASPER	
LIMESTONE	
DOLOMITE	
SHALE	
GLUTENITE	
SANDSTONE	
CONGLOMERATE	
BRECCIA	
NO SAMPLE	
CASINGS	

MODIFIERS AND ACCESSORIES

MAGNETIC (WEAK/STR.)	O
LIMONITE (WEAK/STR.)	
HARDS (WEAK/STR.)	
SILICIFIED	QUARTZ
SPHERULITES	S
VUGS	V
MARCASITE	M
HEMATITIC	H
JASPEROID	J
SILICEOUS	Si
CARBONATIC	C
CALCITIC	CCO
DOLOMITIC	DOL

STRUCTURES

STRONG FAULT, SHOWING DIP	
WEAK FAULT, SHOWING DIP	
FRACTURE, SHOWING DIP	
VEINLET, SHOWING DIP	
BRECCIATED	

IRON ROCK LOG CHART

Office No. 91-07-4

RECORDED BY M. GREEN

MEASURED BY

AIR PHOTO No.

AREA Mine GREEN

WEATHER

DATE STARTED 1991.7.10

DATE COMPLETED 1991.8.7

MEASURING RATE

COORDINATES 4624m E, 9124m N

CLAIM

ROCK TYPES

IRON FORMATION		GLUTENITE	
JASPER		SHALE	
LIMESTONE		MARLSTONE	
DOLOMITE		CONGLOMERATE	
BRECCIA		SANDSTONE	

% HEMATITE

STRONG (>50%)	
MODERATE (20-50%)	
WEAK (<20%)	

SILICEOUS WASTE TYPES

SILICIFIED	
JASPEROID	
SILICEOUS	
CHERT	

HEMALTERS

MAGNETIC	M
LIMONITIC	L
MARTITIC	MT
CLAY	C
MICA	MIC

DRILLHOLE(S): # MINERALIZED - a 3-cm boundary between ironstone and meta-wacke

UNMINERALIZED - a 3-meter boundary between ironstone and meta-wacke

MEMBERS: BEDDING STRIKE / DIP ... 270°/20°W

FOLIATION STRIKE / DIP ... 270°/20°W

ASSOCIATED ZONE

FOLDS IN JASPER

FOLDS IN CHERT

FRACTURES

ASSESSORIES Calcite, Dolomite, Siderite, Iron Oxide Veinlets, Quartz

NOTE Percent Weight Recovery based on 10 cm core or percent of total recovered

Percent Weight Content, Original Content, and Density measured with % used as percent of Total Ironstone Recovered

PAGE 1 OF 11

DATE

FOOTAGE	SAMPLE No.	% CONTENT	% WEIGHT RECOVERY	% WEIGHT CONTENT	% WEIGHT ORIGINAL CONTENT	DENSITY g/cm³	DESCRIPTION	ASSAYED DATA Fe	SiO₂	P	S	Mn	Al₂O₃	CaO	MgO	Na₂O	K₂O	LOI	TiO₂	CHEMICAL ANALYSIS Fe	SiO₂
0.00							OVERBURDEN														
1.00							OVERBURDEN: Brown, loose, fine to medium grained, angular to rounded, medium sorted, dry, quartz sand with minor amounts of weathered, medium grained, angular to rounded, poorly sorted, dry, quartz sand.												
2.00																					
3.00																					
4.00																					

091097

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

~~DDH~~ ~~SECTION~~ No. Y-16-63

DESCRIBED BY W. GIBBINS

MEASURED BY

AIR PHOTO No.

AREA

WEATHER

DATE STARTED AUGUST 1

DATE COMPLETED AUGUST 11

MEASURING RATE 95,500 N ; 110,400 E

COORDINATES

CLAIM

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FEW	F
MANY	M

BOUNDARIES: R - REGULAR - i.e. Even boundary between Jasper and Hematite

I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS:
- BEDDING STRIKE / DIP — eg 125°/ 25°W
- FAULT STRIKE / DIP — eg 125°/ 25°E
- BRECCIATED ZONE
- HALOS OF JASPER
- SPHERULITES
- FRACTURING
- ACCESSORIES - Calcite, Dolomite, Siderite, etc
- LARGE ISOLATED LENSES

NOTE: Percent with Relict texture measured left to right as percent of total Hematite

Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

DATE

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	UNALIGNED LENSES AMT and COMP	UNALIGNED LENSES SIZE RANGE	PATTERNED LENSES BOUND	PATTERNED LENSES AMT and COMP	PATTERNED LENSES THICK RANGE	BANDS BOUND	BANDS AMT and COMP	BANDS THICK RANGE	VEINLETS BOUND	REMARKS
0		+ OVERBURDEN												
10		- CONGLOMERATIC (15%) DARK BROWN SHALE. FRAGMENTS (10%) (¼ - 4"), SUB ANGULAR TO SUB ROUNDED, INCLUDE WHITE CARBONATES & LIGHT TO DARK GREEN SHALE. TRACE OF CARBONATE VEINLETS.												
20														
30														
40		- CONGLOMERATIC FRAGMENTS (75%) (¼ - 1") ANGULAR TO SUB-ROUNDED, INCLUDE WHITE CARBONATE & LIGHT GREEN & DARK BROWN SHALE. THE MATRIX IS A CARBONATE SANDSTONE WHICH IS COMPARABLE TO THE SHALE FRAGMENTS.												
50		- CONGLOMERATIC & SANDY DARK BROWN SHALE												
60		- CONGLOMERATIC (15%) (¼ - 4") INTER-BEDDED WITH IRREGULAR BANDS OF DARK BROWN SHALE & MAROON GRAINED LIGHT GREEN CALCAREOUS SANDSTONE.												
70		- SANDY TO CONGLOMERATIC DARK BROWN CALCAREOUS SHALE, FRAGMENTS ANGULAR TO SUB-ROUNDED & UP TO ¾" DIAMETER - MOSTLY SHALE & CARBONATES.												
80														
90														
100														

CREST EXPLORATION LIMITED
IRON ROCK LOG CHART

~~SECTION~~ DDH No Y-17-63
DESCRIBED BY W. GIBBINS
MEASURED BY
AIR PHOTO No
AREA IRON CREEK
WEATHER

DATE STARTED AUGUST 6
DATE COMPLETED AUGUST 17
MEASURING RATE
COORDINATES 96,300 N ; 105,100 E
CLAIM

ROCK TYPES

IRON FORMATION — SILTSTONE
JASPER — SHALE
CONGLOMERATE — LIMESTONE
BRECCIA — DOLOMITE
SANDSTONE — COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
MAROON JASPER
MICROCRYSTALLINE QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
HEMATITE H
FEW F
MANY M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS BEDDING STRIKE / DIP° eg 125°/ 25° W
FAULT STRIKE / DIP eg 125°/ 25° E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 8
DATE

Column headings: INTERVAL | LITHOLOGY | % HEMATITE | % RELICT | OVOIDS | UNALIGNED LENSES (AMT and COMP, SIZE RANGE, B) | PATCHES (~~ALIGNED LENSES~~) (AMT and COMP, THICK RANGE, B) | BANDS (AMT and COMP, THICK RANGE, B) | VEINLETS | REMARKS | ENGINEER DATA (LEN RUN, No RUNS, FT REC, % REC) | CRUDE ANALYSIS (SAM No, Fe, SiO_2, P)

Log descriptions (in order of depth)

- 0–20: OVERBURDEN
- CONGLOMERATIC (1-2%) & SANDY (20%) DARK BROWN SHALE. FRAGMENTS (1/2 - 2"), SUB-ANGULAR, SHALE, CARBONATES, ETC.
- LIGHT GREEN & DARK BROWN CALCAREOUS SILTSTONE
- CONGLOMERATIC (5-10%) & SANDY (15-20%) DARK BROWN SHALE
- MEDIUM GRAINED CALCAREOUS SANDSTONE - MASSIVE - WHITE TO GREEN.
- LIGHT GREEN SANDSTONE INTERBEDDED WITH DARK BROWN SHALE - CROSS-BEDDED DIPS 0-10°
- DARK BROWN SHALE MASSIVE - A FEW CALCITE VEINLETS.
- MEDIUM TO COARSE GRAINED LIGHT GREEN SANDSTONE - CALCAREOUS - TRACE OF BROWN SHALE. AIR 1/4"
- SILTY DARK BROWN SHALE
- VERY DARK BROWN HEMATITIC SHALE
- CROSS BEDDED LIGHT GREEN SILTSTONE & DARK BROWN SHALE
- DARK BROWN SHALE WITH A TRACE OF SILT, SAND, & CALCITE VEINLETS
- INTERBEDDED LIGHT GREEN SILT & DARK BROWN SHALE - PENECONTEMPORANEOUS BRECCIATION & CROSS BEDDING
- SHALEY IRON SANDSTONE - BROWN SHALE MATRIX
- 3/4 DARK BROWN SHALE & 1/4 CROSS BEDDED LIGHT GREEN SILTSTONE
- 140: MASSIVE DARK BROWN SHALE - TRACE OF CALCITE VEINLETS
- HARD SHALEY IRON FORMATION — Remarks: 1-2% VUGGY POROSITY
- IRON SANDSTONE, VERY COARSE GRAINED. GRAINS OF HEMATITE, CALCITE & JASPER
- IRON FORMATION & DARK BROWN SHALE - TRACE OF PEA SIZED CONGLOMERATE
- VERY COARSE IRON SANDSTONE
- CONGLOMERATE. FRAGMENTS (4-20%) (1/8 - 1/2"), ANGULAR TO SUB-ROUNDED, INCLUDE LIGHT & DARK GREEN SHALE & CARBONATES. MATRIX IS PURPLE MAROON SHALE & LIGHT GREEN SHALE
- VERY DARK BROWN SHALE; FINE GRAINED LIGHT GREEN CALCAREOUS SANDSTONE; SHALE
- MASSIVE DARK BROWN SHALE - WITH A TRACE OF SILT
- CONGLOMERATE. FRAGMENTS (50%) (1/8 - 2"), ANGULAR TO SUB-ANGULAR, SHALE & CARBONATES. MATRIX - DARK BROWN SHALE; MASSIVE VERY DARK BROWN SHALE; CONGLOMERATE
- MASSIVE DARK BROWN SHALE - TRACE OF LIGHT GREEN SILT
- CONGLOMERATIC (5-10%) & SANDY (25%) LIGHT GREEN & DARK BROWN SHALE.
- Remarks: BANDED IRON FORMATION DIPS 5-10°
- 200: DARK GREEN SILTSTONE & DARK BROWN SHALE - CROSS - BEDDED — Remarks: A FEW VERY IRREGULAR BANDS OF HARD CARBONATE & PATCHES OF RED JASPER & QUARTZ
- HARDER SANDSTONE - MEDIUM GRAINED, & CALCAREOUS - FAINT REGULAR BEDDING DIPPING AT 10°
- 210: Remarks: IRON FORMATION. SPHERULITIC PATCHES AT 232.5. SOME OVOIDS ARE IN VARIOUS STAGES OF REPLACEMENT BY GHOST HEMATITE, WHILE OTHERS HAVE CENTERS OF MAROON JASPER, & SOME OVOIDS OCCUR WITHIN MAROON JASPER BANDS. LENSES OF RED JASPER HAVE ACICULAR WHITE CALCITE CRYSTAL BORDERS, & MAROON JASPER LENSES HAVE RED JASPER BORDERS.
- Remarks: IRON FORMATION - SIMILAR TO ABOVE, BUT CONTAINS 3-6" BANDS OF SHALE & CONGLOMERATE (25% OF WASTE). DIP ~10°
- MEDIUM GRAINED GREY SANDSTONE, GRAINS OF WHITE CARBONATE & BROWN SHALE
- CONGLOMERATE. FRAGMENTS (60%) (1/8 - 1"), ANGULAR TO SUB ANGULAR, INCLUDE CARBONATES, LIGHT & DARK BROWN SHALE & SANDSTONE. MATRIX IS BROWN SHALE. — Remarks: 10% SMALL 1-2 mm. CRYSTALS OF CARBONATE IN IRREGULAR MAROON JASPER BANDS, WHICH ALSO HAVE BORDERS OF RED JASPER. MOST OF THE OVOIDS HAVE THIN BORDERS OF ACICULAR WHITE CARBONATE. TRACE OF CLASTICS DIPS UP TO 20°
- INTERBEDDED CONGLOMERATE & IRON FORMATION.
- VERY DARK BROWN SHALE. TRACE OF IRON FORMATION.
- 280: Remarks: SOME OF THE OVOIDS HAVE HEMATITE CENTERS
- DARK BROWN TO LIGHT GREEN SHALE — Remarks: LOW GRADE SHALEY IRON FORMATION
- CONGLOMERATE, FRAGMENTS (5-10%), ANGULAR TO SUB-ROUNDED, INCLUDE SHALE & CARBONATES. MATRIX IS CALCAREOUS
- SLIGHTLY CALCAREOUS MAROON BROWN SHALE CONTAINS (1%) (1-2 mm) ANGULAR CLASTIC GRAINS OF VERY DARK GREEN SHALE.
- IRON FORMATION. WASTE CONSISTS OF A FEW JASPER & CARBONATE PATCHES & A FEW SMALL STREAKS OF MAROON JASPER
- "SHREDDED" DOLOMITE WITH A TRACE OF HEMATITE JASPER
- IRON FORMATION. CONTAINS A FEW SMALL PATCHES OF JASPER & CARBONATE, & A SMALL AMOUNT OF "SHREDDED" DOLOMITE.
- 0.6' OF SHREDDED DOLOMITE
- BANDED ZONES OF SHREDDED DOLOMITE & MICROCRYSTALLINE QUARTZ
- Remarks: BANDS OF MAROON HEMATITE (1/8 - 1/4") PATCHES & "SHREDDED" PINK QUARTZ - HEMATITE
- FAIRLY HARD MASSIVE MEDIUM BROWN SHALE. FEW CALCITE VEINLETS.
- 350: DARK GREEN COARSE GRAINED SANDSTONE; JASPEROID IRON FORMATION; LOWER DARKER SANDSTONE - LIGHT TO MEDIUM GREEN - SILTY (TOP) TO VERY COARSE (BOTTOM) - CALCAREOUS. — Remarks: PYRITE CRYSTALS & CALCITE IN FRACTURE AT 350.0
- Remarks: IRON FORMATION. TRACE OF SULFIDE. RED JASPER OCCURS AS BORDERS ON MAROON JASPER.
- HARD MEDIUM TO LIGHT BROWN SHALE — Remarks: DIP ~ 15°
- SANDY DARK GREEN TO BROWN SHALE
- Remarks: IRON FORMATION. TRACE OF BANDS OF "SHREDDED DOLOMITE & RED JASPER. PATCHES HAVE SHRINKAGE VEINLETS OF CALCITE.
- Remarks: WASTE INCLUDES: PATCHES OF RED JASPER WHICH CONTAIN CALCITE VEINLETS, QUARTZ - CALCITE OVOIDS, SMALL STREAKS OF RED JASPER, & TRACES OF SHALEY IRON FORMATION.
- Remarks: DOLOMITE? & RED JASPER OVOIDS. TRACE OF SULFIDES
- Remarks: BANDS OF SHALE, CARBONATE & RED JASPER. BIRDS-EYE TO OVOIDS IN MAROON JASPER. TRACE OF SULFIDES.
- 420: Remarks: RED JASPER - CARBONATE PATCHES.
- SHALEY MAROON HEMATITE
- SANDY (10%) & CONGLOMERATIC (2%) DARK MAROON BROWN SHALE. FRAGMENTS (1/16 - 3/8"), SUB-ANGULAR TO SUB-ROUNDED, INCLUDE GREEN SHALE & CARBONATES. A FEW CALCITE VEINLETS.
- Remarks: ALSO TRACE OF RED JASPER BANDS. MAROON HEMATITE INCREASES DOWNWARDS.
- POOR JASPEROID IRON FORMATION
- COARSE VERY DARK GREEN SANDSTONE
- JASPEROID MAROON HEMATITE
- FAIRLY HARD BLACK TO VERY DARK BROWN SHALE WHICH CONTAINS A TRACE OF CLASTICS.
- LARGE IRREGULAR STREAKS OF RED JASPER, BRECCIATED BY MANY QUARTZ - CARBONATE VEINLETS (QUARTZ, CALCITE)
- SIMILAR TO ABOVE BUT NO VEINLETS.
- LARGE IRREGULAR STREAKS OF RED JASPER & CARBONATE. RED JASPER IS BRECCIATED BY QUARTZ CARBONATE VEINLETS.
- Remarks: IRON FORMATION. DIP 5-10°
- LARGE IRREGULAR STREAKS OF RED JASPER & CARBONATE. RED JASPER IS BRECCIATED BY QUARTZ-CALCITE VEINLETS.
- CONGLOMERATE. FRAGMENTS (90%) (1/8 - 2"), ANGULAR TO ROUND (ROUNDNESS INCREASES WITH SIZE) INCLUDE LIGHT COLORED LIMESTONE, SANDSTONE, SHALE, ETC. MATRIX IS DARK BROWN SHALE.
- MASSIVE DARK BROWN SHALE.
- END OF DDH # Y-17-63 AT 545.0'

Engineer data (in order of depth)

LEN RUN	FT REC	% REC
4.0	4.0	100.0
5.0	2.0	40.0
2.0	2.0	100.0
3.0	3.0	100.0
4.0	2.7	67.5
4.0	4.0	100.0
3.0	3.0	100.0
2.0	2.0	100.0
5.0	4.4	88.0
3.0	2.9	96.6
5.0	4.7	94.0
5.0	4.5	90.0
5.0	5.0	100.0
3.0	3.0	100.0
5.0	4.7	94.0
5.0	4.6	92.0
5.0	5.0	100.0
5.0	4.8	96.0
5.0	3.9	78.0
5.0	1.8	36.0
5.0	4.9	98.0
5.0	5.0	100.0
5.0	5.0	100.0
2.0	1.8	90.0
2.0	1.6	80.0
8.0	7.5	93.8
5.0	5.0	100.0
5.0	4.8	96.0
5.0	3.4	68.0
2.0	1.5	75.0
5.0	3.9	78.1
2.0	1.2	60.0
3.6	2.7	76.0
5.0	4.7	94.0
2.6	2.3	88.8
5.0	4.7	94.0
5.0	5.0	100.0
5.0	4.9	98.0
[illegible]	[illegible]	[illegible]
4.5	3.9	86.9
3.0	2.5	83.3
4.0	2.5	62.5
3.5	2.4	68.5
4.8	3.9	81.5
5.0	5.0	100.0
3.6	3.3	91.6
5.0	3.5	70.0
1.6	0.9	56.3
2.0	0.9	45.0
3.4	1.9	55.8
3.0	2.4	80.0
5.0	5.0	100.0
3.0	3.0	100.0
3.6	2.7	75.0
8.4	7.5	89.3
5.0	4.2	84.0
5.0	4.5	90.0
4.5	4.2	93.4
4.0	3.5	87.5
4.5	3.4	75.6
5.0	3.2	64.0
3.0	2.1	70.0
3.0	1.3	43.4
3.6	2.7	75.0
5.4	4.9	90.8
3.0	2.8	93.4
1.0	0.4	40.0
3.6	3.0	83.4
2.4	2.2	91.6
5.0	3.9	78.0
2.5	2.1	84.0
2.6	2.1	84.0
2.0	1.3	65.0
2.0	0.4	20.0
2.0	0.2	10.0
3.6	2.3	63.9
1.4	1.1	78.6
3.0	1.4	46.7
2.6	1.4	53.9
1.4	1.3	92.8
3.0	1.6	53.4
[illegible]	[illegible]	[illegible]
2.0	1.0	50.0
1.5	1.4	93.4
1.0	0.2	20.0
1.0	0.8	80.0
2.0	1.6	80.0
1.0	1.0	100.0
3.0	2.5	83.4
[illegible]	[illegible]	[illegible]
1.1	1.1	[illegible]
1.7	1.3	76.5
0.8	0.8	100.0
2.2	1.3	59.1
1.3	1.1	84.6
3.1	2.9	93.6
5.0	4.9	98.0
5.0	4.7	94.0
2.5	2.5	100.0
4.5	4.2	93.4
2.0	2.0	100.0
3.5	3.3	94.4
4.9	4.9	100.0
5.0	4.9	98.0
4.4	4.4	100.0
1.0	0.9	90.0
2.0	1.7	85.0
1.9	1.6	84.1
5.7	5.7	100.0
5.0	4.9	98.0
1.9	1.6	84.3
4.0	3.7	92.5
5.0	4.8	96.0
4.6	3.9	85.0
1.5	—	—
2.0	0.7	35.0
1.0	0.4	40.0
1.6	1.3	81.1
2.4	2.0	83.4
[illegible]	[illegible]	[illegible]
1.5	0.7	46.6
1.5	0.5	33.3
3.5	1.8	51.4
[illegible]	[illegible]	[illegible]
4.5	4.5	100.0
5.0	4.9	98.0
5.0	4.8	96.0
5.0	4.8	96.0
5.0	5.0	100.0
5.0	4.1	82.0
4.0	2.8	70.0
4.5	3.1	68.9
2.0	2.0	100.0
4.0	3.0	75.0
3.5	1.8	51.5
5.0	3.2	64.0
2.5	1.7	68.0
2.5	2.3	92.0
1.0	0.6	60.0
3.0	2.5	83.3
5.0	2.2	44.0
5.0	5.0	100.0
4.0	3.2	80.0
5.0	4.9	98.0
5.0	3.9	78.0
2.0	1.6	80.0
1.0	0.6	60.0
2.0	1.5	75.0
1.0	0.8	80.0
2.0	1.8	90.0
5.0	5.0	100.0
5.0	3.8	76.0

GEO - 23 - 2 - CR (6/63)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

DDH
~~SECTION~~ No Y-18-63

DESCRIBED BY W. GIBBINS & R. WILLIAMS

MEASURED BY

AIR PHOTO No.

AREA

WEATHER

DATE STARTED AUGUST 8

DATE COMPLETED AUGUST 11

MEASURING RATE

COORDINATES 102,800 N ; 30,400 E

CLAIM

ROCK TYPES

IRON FORMATION		SILTSTONE	
JASPER		SHALE	
CONGLOMERATE		LIMESTONE	
BRECCIA		DOLOMITE	
SANDSTONE		COVERED	

% HEMATITE

STEEL GREY HEMATITE	
MAROON HEMATITE	
BOTH	

SILICEOUS WASTE TYPES

RED JASPER	
MAROON JASPER	
MICROCRYSTALLINE QUARTZ	

VEINLETS

QUARTZ	S
CARBONATE	C
HEMATITE	H
FE#	I
MAG'Y	M

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS
BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite, etc
LARGE ISOLATED LENSES

NOTE Percent with Relict Texture measured left to right as percent of total Hematite
Percent Ovoids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4

DATE

INTERVAL	LITHOLOGY	% HEMATITE	% RELICT	OVOIDS	ALIGNED LENSES: AMT PER COMP	ALIGNED LENSES: SIZE RANGE	PATCHES: AMT PER COMP	PATCHES: THICK RANGE	BANDS: AMT PER COMP	BANDS: THICK RANGE	VEINLETS	REMARKS	ENGINEER. DATA: LEN RUN	ENGINEER. DATA: No RUNS	ENGINEER. DATA: FT REC.	ENGINEER. DATA: % REC.	CRUDE ANALYSIS: SAM No	CRUDE ANALYSIS: Fe	CRUDE ANALYSIS: SiO_2	CRUDE ANALYSIS: P
0												OVERBURDEN								
50																				
60												SANDY LT-TO-DK BROWN SAND... ANGULAR TO SUB-ANGULAR FRAGMENTS OF LIGHT GREEN CALCAREOUS RUBBLE. TRACE OF CONGLOMERATIC FRAGMENTS.	4.0		1.3	32.5				
													5.0		4.8	96.0				
70													5.0		4.7	94.0				
80													5.0		5.0	100				
													5.3		4.8	90.5				
													5.0		3.6	72.0				
90													2.2		1.1	50.0				
												VERY IRREGULARLY THIN BEDDED LIGHT GREEN SILTSTONE TO SANDSTONE & DARK BROWN SHALE. DIPS ARE IRREGULAR.	5.0		4.8	96.0				
100													5.0		5.0	100				
													5.0		4.7	94.0				
													5.0		3.5	70.0				
110												- CURRIE LIGHT GREEN CALCAREOUS SANDSTONE - 15% DARK BROWN SHALE. DIP 0-15°.	5.3		4.8	90.5				
												- SANDY DARK BROWN SHALE (CONGLOMERATIC) SUB-ANGULAR TO SUB-ROUNDED GRAINS UP TO 1" DIAMETER. 40% SILTSTONE & CARBONATE MATRIX IS CALCAREOUS.	5.2		5.0	96.1				
													5.0		5.0	100				
120													5.0		4.7	94.0				
													5.0		2.6	52.0				
130													5.0		4.9	98.0				
													5.0		4.8	96.0				
140													10.0		9.7	97.0				
150																				
160													10.0		9.4	94.0				
170													10.0		9.6	96.0				
180												6" BOULDER OF LIMESTONE.	10.0		9.5	95.0				
												- AS ABOVE, BUT JASPER FRAGMENTS ARE QUITE COMMON AS ARE SMALL JASPER LENSES. ALSO OCCASIONAL JASPER OVOIDS								
190													10.0		9.5	95.0				
200													10.0		9.5	95.0				
210													10.0		9.6	96.0				
												- AS ABOVE, BUT NO JASPER FRAGMENTS.								
220													10.0		9.5	95.0				
												END OF DDH # Y-18-63 AT 224'.								
230																				

SEC-23-2-CR(6/31)

CREST EXPLORATION LIMITED

IRON ROCK LOG CHART

PDH DESCRIPTION No Y-19-C3 | DATE STARTED AUGUST 12
DESCRIBED BY W. GIBBINS | DATE COMPLETED AUGUST 16
MEASURED BY | MEASURING RATE
AIR PHOTO No | COORDINATES 100,200 N ; 98,000 E
AREA IRON CREEK | CLAIM
WEATHER

ROCK TYPES

IRON FORMATION | SILTSTONE
JASPER | SHALE
CONGLOMERATE | LIMESTONE
BRECCIA | DOLOMITE
SANDSTONE | COVERED

% HEMATITE

STEEL GREY HEMATITE
MAROON HEMATITE
BOTH

SILICEOUS WASTE TYPES

RED JASPER
YARROW JASPER
MICACEOUS QUARTZ

VEINLETS

QUARTZ S
CARBONATE C
ITEM I
MANY V

BOUNDARIES R - REGULAR - i.e. Even boundary between Jasper and Hematite
I - IRREGULAR - i.e. Uneven boundary between Jasper and Hematite

REMARKS BEDDING STRIKE / DIP eg 125°/ 25°W
FAULT STRIKE / DIP eg 125°/ 25°E
BRECCIATED ZONE
HALOS OF JASPER
SPHERULITES
FRACTURING
ACCESSORIES - Calcite, Dolomite, Siderite etc
LARGE ISOLATED LENSES

NOTE Percent with Relict texture measured left to right as percent of total Hematite
Percent Voids, Lenses, Aligned Lenses and Bands measured left to right as percent of total Siliceous waste

PAGE 1 OF 4

DATE

ENGINEER DATA					CRUDE ANALYSIS			
LEN RUN	RUNS No	REC %	FT REC	SAM No	Fe	SiO_2	P
10	1.5	15	1.5				
10	1.0	10	1.0				
10	1.0	10	1.0				
10	1.0	10	1.0

TOPOGRAPHIC MAP

SNAKE RIVER AREA

YUKON AND NORTHWEST TERRITORIES

PREPARED FOR

CREST EXPLORATION LTD.

091697

GEOPHOTO

CONTOUR INTERVAL 100 FEET

SCALE 1:31,680

1 0 1/2 1 MILE

2000 1000 0 2000 4000 6000 FEET

LEGEND

- △ 2830 — Biometric elevation (Crest Exploration Ltd.)
- x 3620 — Multiplex spot elevation
- + 349 — Depositive center
- Edge of shadow or no stereoscopic coverage, contour position indefinite
- Intermediate 50 foot contour
- Creek
- Sand wash

MAGNETIC DECLINATION 36°27' E 1962

North, Moss North

NOTE

This map was photogrammetrically prepared using a multiplex plotter.

INDEX MAP

WEST SHEET

EAST SHEET

REVISIONS

CREST EXPLORATION LIMITED

SNAKE RIVER AREA (EAST SHEET)

1419

SCALE	DATE	DRAWN
1 : 31,680	DEC. 1962	GEOPHOTO

65° 00'

25' 30' 35' 40' 45' 50' 132°52'30"

132° 15'

05'

10'

65°15'

20'

25'

65°30'

132°15'

20' 25' 30' 35' 40' 45' 50' 132°52'30"

Roll No. A12264 (17)

High Level Roll No. A14405 Roll No. A12106 (16)

Roll No. 12106 (15)

Roll No. A 12106 (14)

Roll No. A12148 (13)

TOPOGRAPHIC MAP
SNAKE RIVER AREA
YUKON AND NORTHWEST TERRITORIES

PREPARED FOR
CREST EXPLORATION LTD.

1962

CONTOUR INTERVAL 100 FEET

SCALE 1:31,680

MAGNETIC DECLINATION 36°27' E 1962

LEGEND

- Barometric elevation (Crest Exploration Ltd.)
- Multiplex spot elevation
- Dip/strike center
- Area of shadow or no stereoscopic coverage, Contour position indefinite Intermediate 50 foot contour
- Streams
- Sand wash

NOTE
This map was photogrammetrically prepared using a multiplex plotter.

INDEX MAP
WEST SHEET
EAST SHEET

REVISIONS	SCALE	DATE	DRAWN
	1 : 31,680	DEC 1962	GEOPHOTO

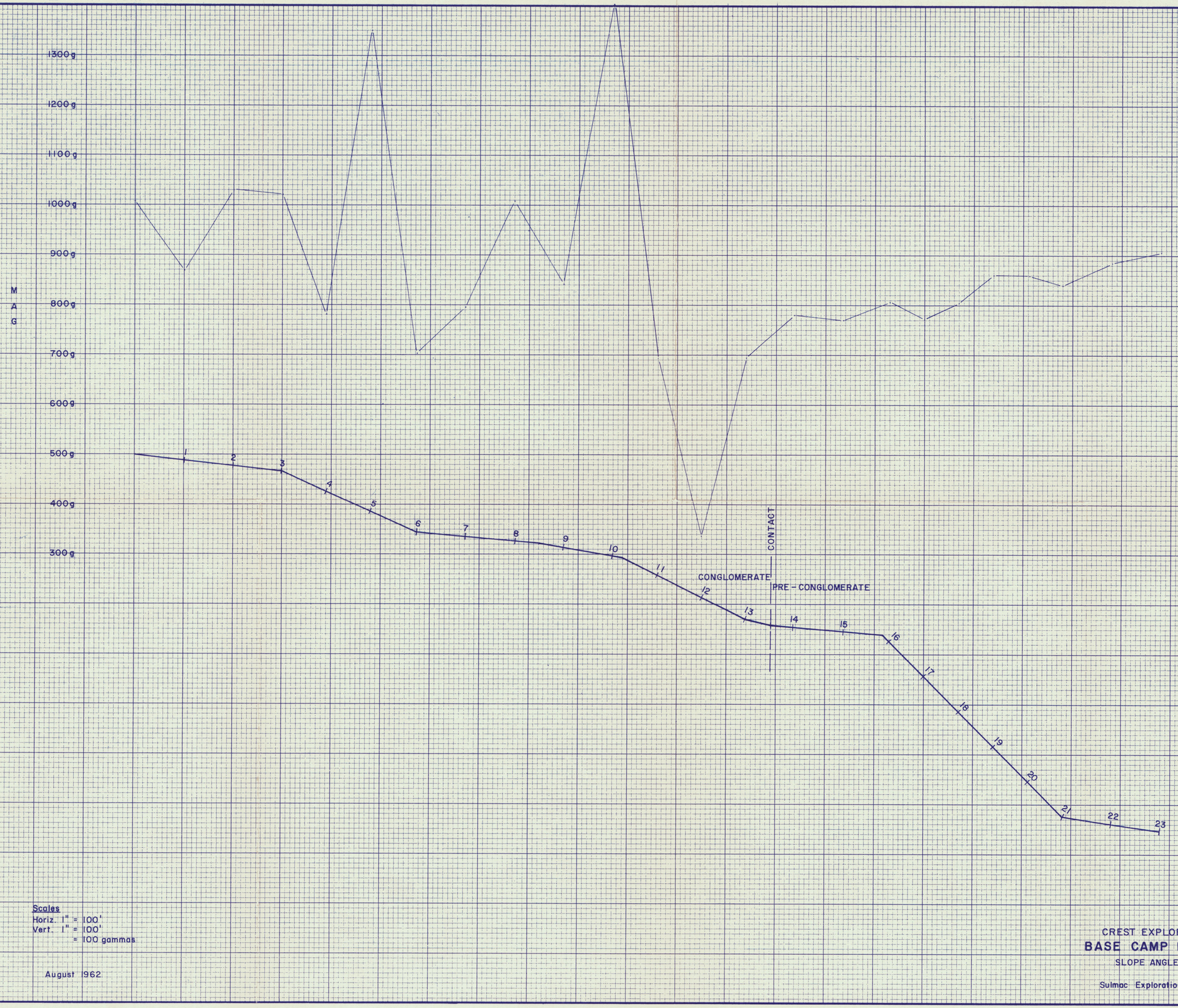
CREST EXPLORATION LIMITED

SNAKE RIVER AREA
(WEST SHEET)

169697

WEST SHEET

133°30' 133°00' 132°52' 30" 65°30' 65°15'



091691

Scales
Horiz. 1" = 100'
Vert. 1" = 100'
= 100 gammas

August 1962

CREST EXPLORATION CO. LTD.

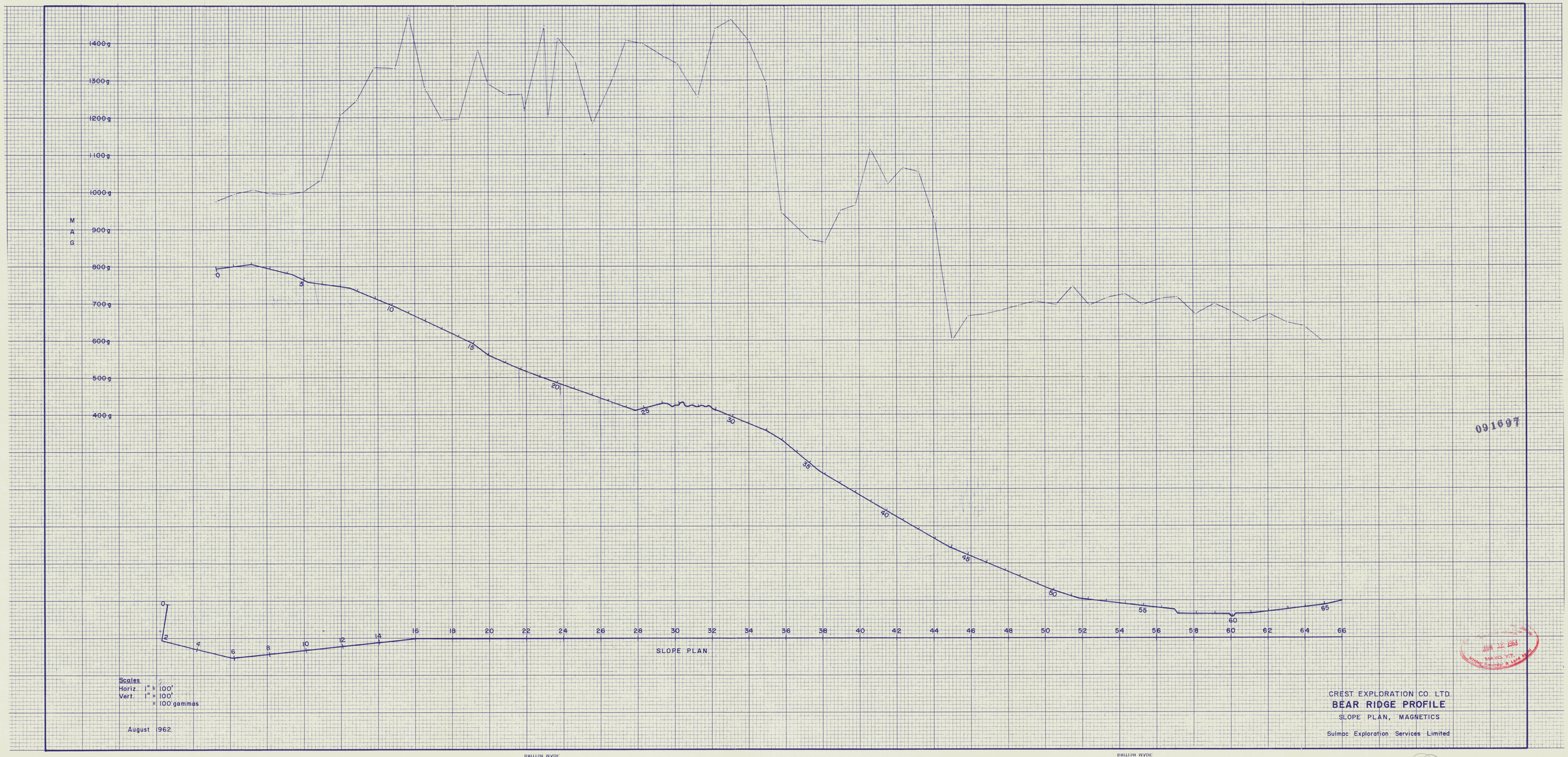
BASE CAMP RIDGE PROFILE

SLOPE ANGLES, MAGNETICS

Sulmac Exploration Services Limited

BRITISH MADE
BRITISH MADE

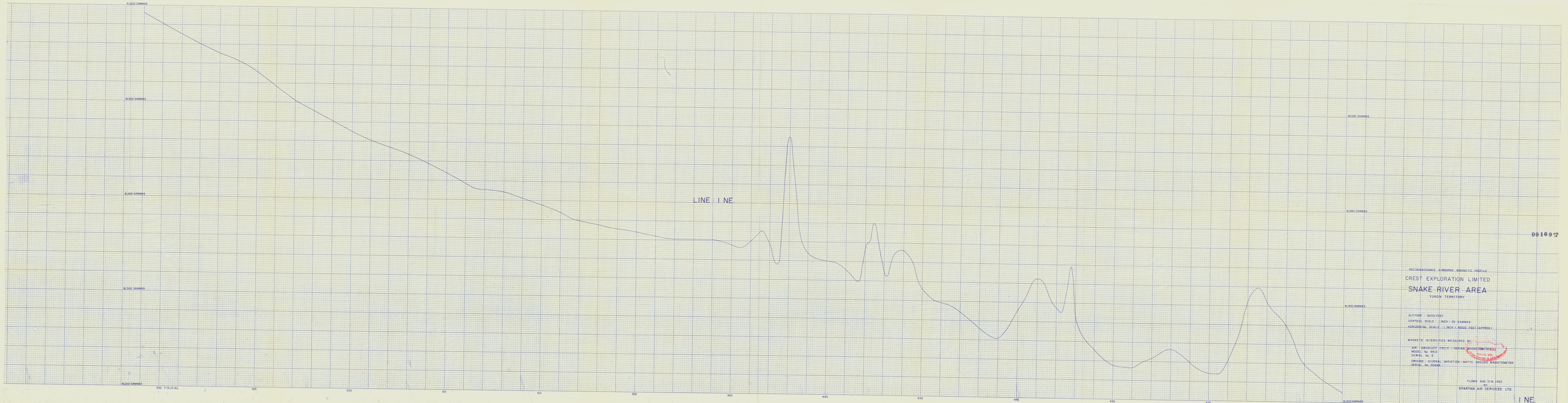
1436

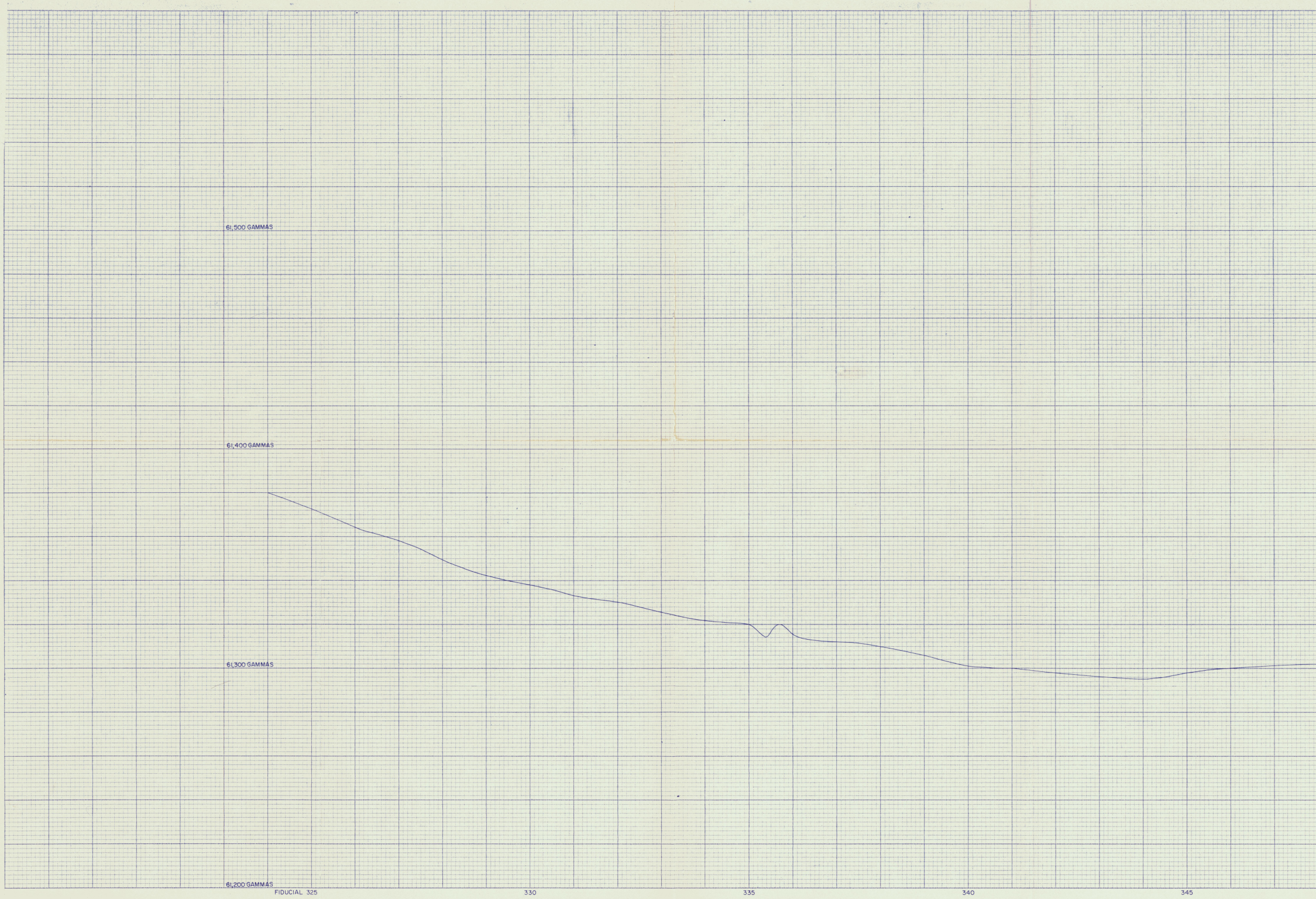


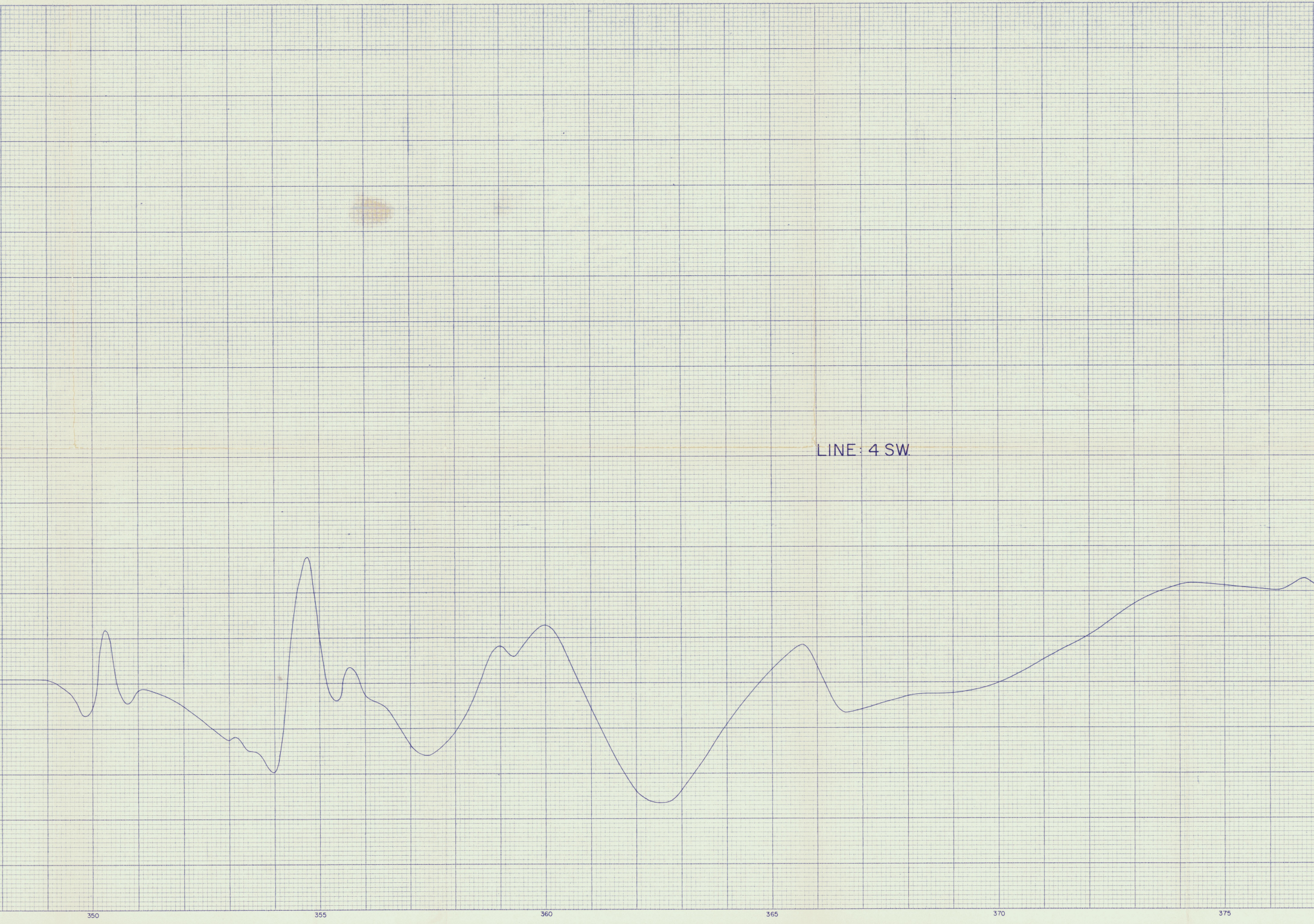
091697

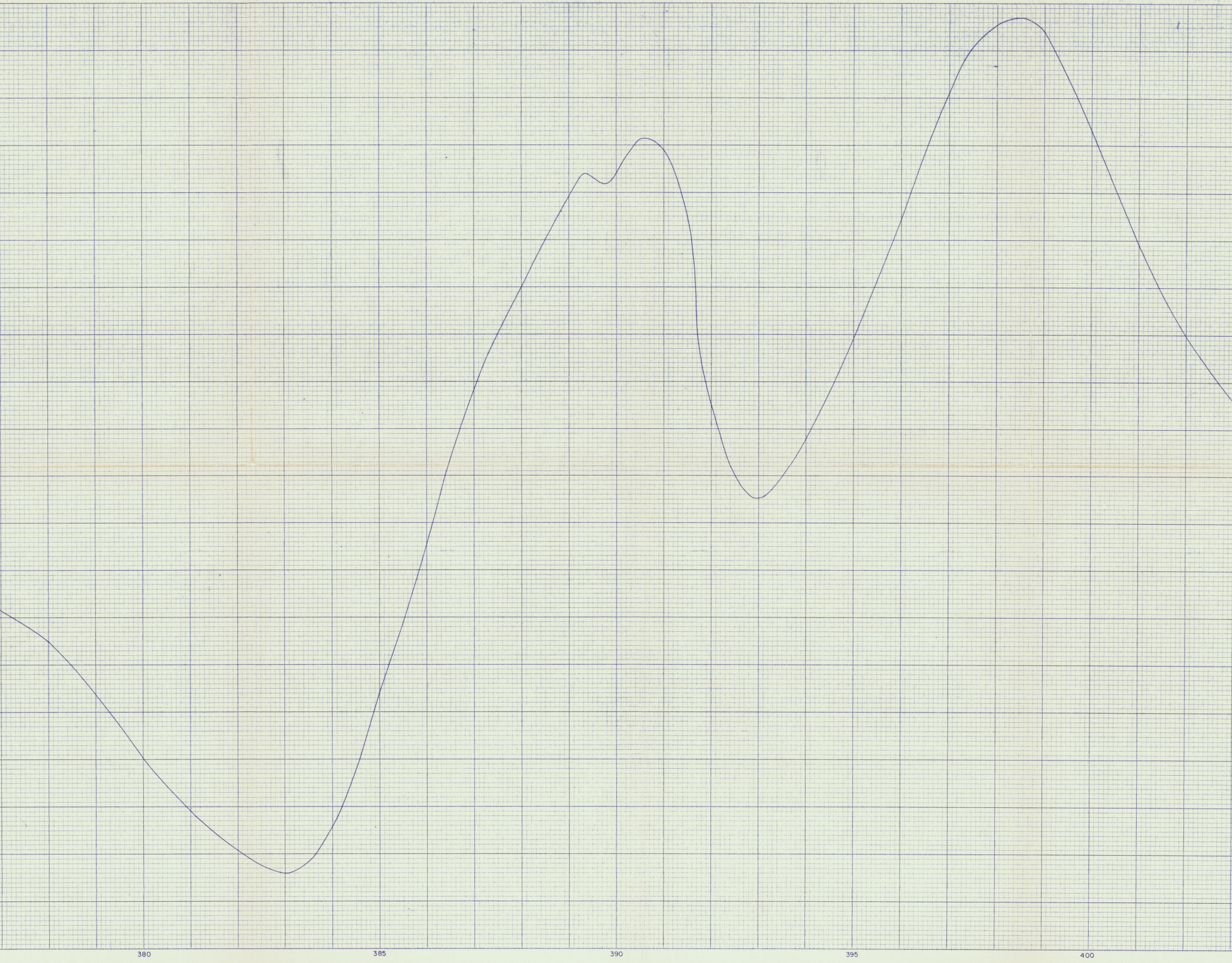
JUN 12 1963
MAYO, Y.T.
Mining Division & Land Agent

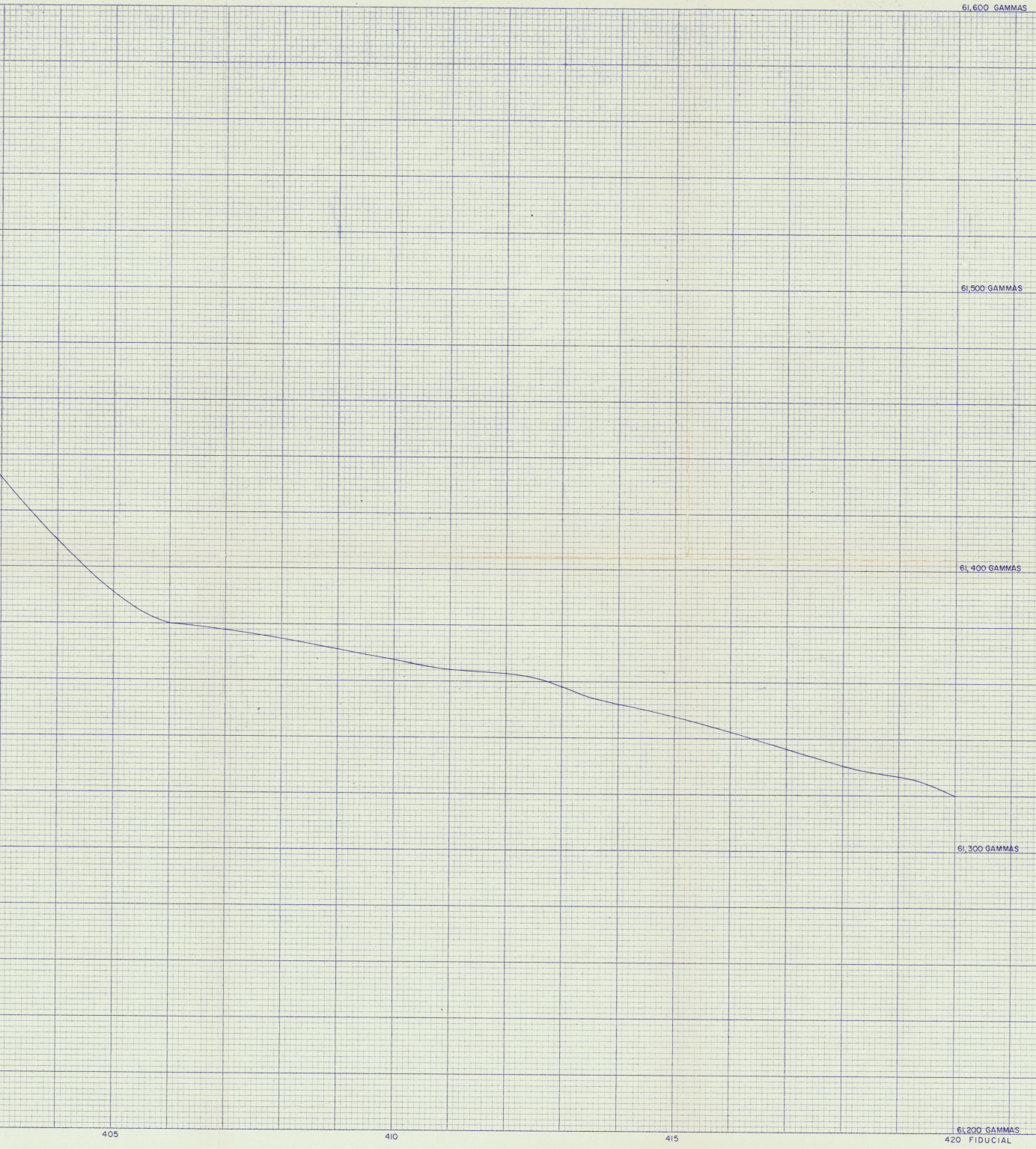
1422


6,600 GAMMAS
6,500 GAMMAS
6,400 GAMMAS
6,300 GAMMAS
6,200 GAMMAS
530 FIDUCIAL
525
520
515
510
505
500
495
490
485
480
475
470
468 FIDUCIAL
LINE : I NE.
6,500 GAMMAS
6,400 GAMMAS
6,300 GAMMAS
6,200 GAMMAS
091697
RECONNAISSANCE AIRBORNE MAGNETIC PROFILE
CREST EXPLORATION LIMITED
SNAKE RIVER AREA
YUKON TERRITORY
ALTITUDE : 8000 FEET
VERTICAL SCALE : 1 INCH = 20 GAMMAS
HORIZONTAL SCALE : 1 INCH = 8000 FEET (APPROX.)
MAGNETIC INTENSITIES MEASURED BY:
AIR : ABSOLUTE FIELD - VARIAN MAGNETOMETER
MODEL No. V-80
SERIAL No. 5
GROUND : DIURNAL VARIATION - WATTS GROUND MAGNETOMETER
SERIAL No. 30648
FLOWN AUG. 12 th. 1962
BY
SPARTAN AIR SERVICES LTD.
I NE.
091697









091697

RECONNAISSANCE AIRBORNE MAGNETIC PROFILE

CREST EXPLORATION LIMITED

SNAKE RIVER AREA

YUKON TERRITORY

ALTITUDE 6000 FEET
VERTICAL SCALE : 1 INCH = 20 GAMMAS
HORIZONTAL SCALE : 1 INCH = 4000 FEET (APPROX.)

MAGNETIC INTENSITIES MEASURED BY

AIR - ABSOLUTE FIELD - VARIAN MAGNETOMETER
MODEL No. 4912
SERIAL No. 5

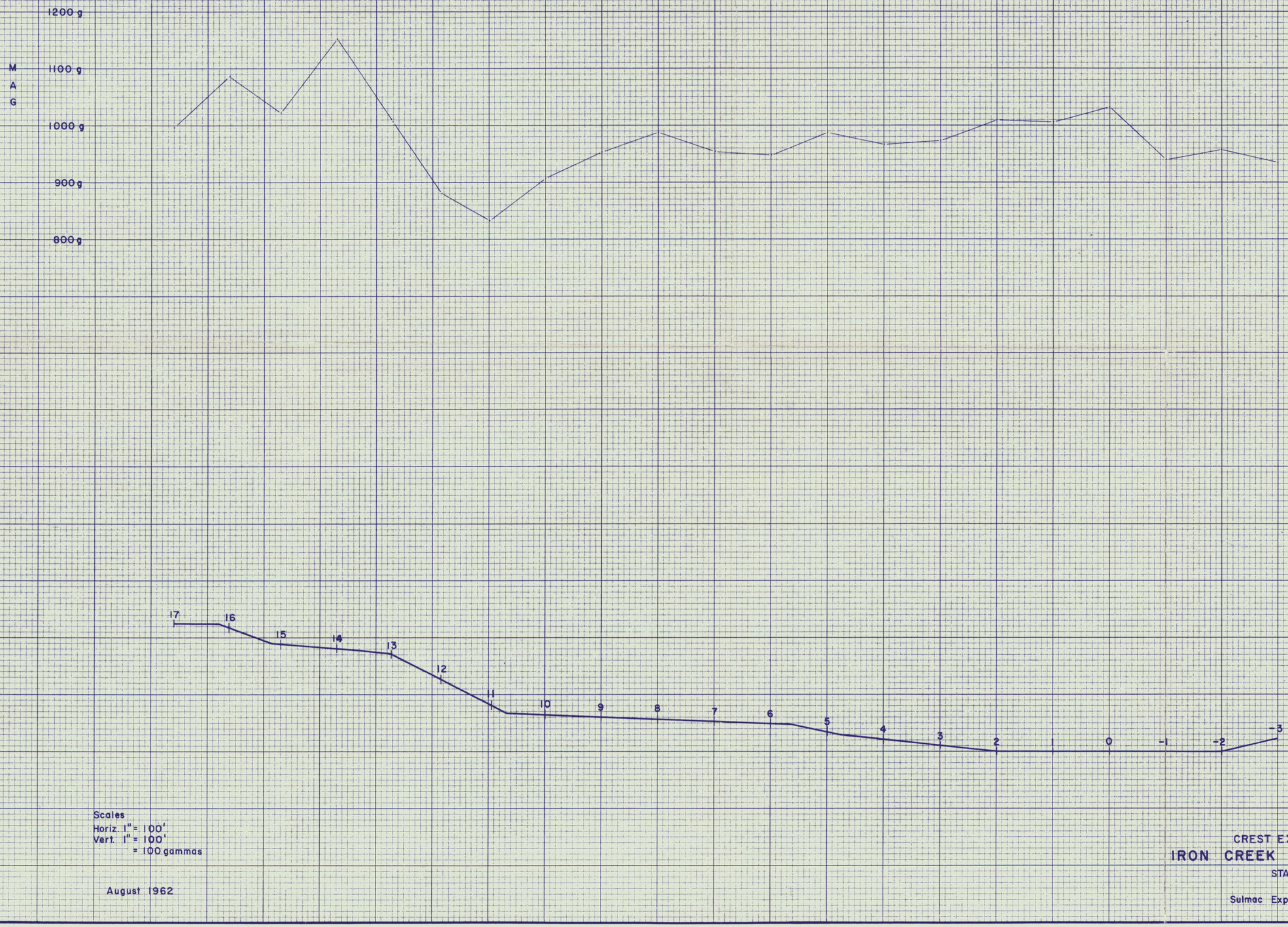
GROUND - DIURNAL VARIATION - WATTS GROUND MAGNETOMETER
SERIAL No. 50448

RESOURCES DIVISION
JUN 12 1963
MAYO, Y.T.
Mining Recorder & Land Agent

FLOWN AUG. 12 th. 1962
BY
SPARTAN AIR SERVICES LTD.

4 SW.

1417



Scales
Horiz. 1" = 100'
Vert. 1" = 100'
= 100 gammas

August 1962

091697

JUN 12 1963

CREST EXPLORATION CO. LTD.

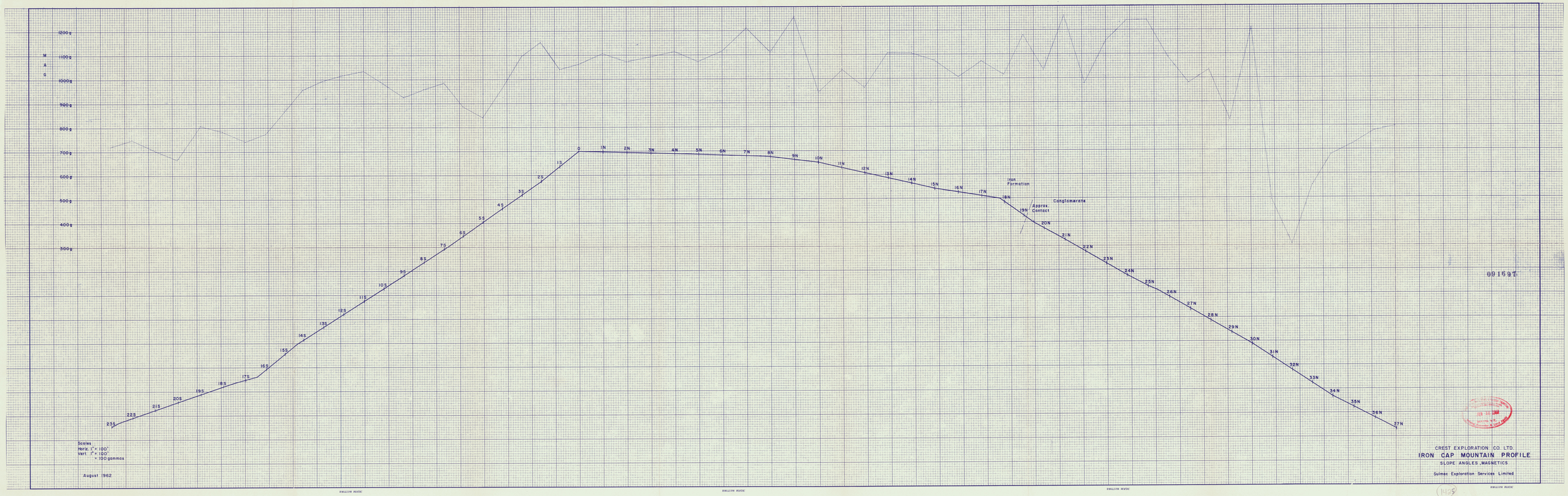
IRON CREEK TRANSVERSE PROFILE

STADIA, MAGNETICS

Sulmac Exploration Services Limited

BRITISH MADE

(1427)


MAG
1200g
1100g
1000g
900g
800g
700g
600g
500g
400g
300g
0
1N
2N
3N
4N
5N
6N
7N
8N
9N
10N
11N
12N
13N
14N
15N
16N
17N
18N
19N
20N
21N
22N
23N
24N
25N
26N
27N
28N
29N
30N
31N
32N
33N
34N
35N
36N
37N
1S
2S
3S
4S
5S
6S
7S
8S
9S
10S
11S
12S
13S
14S
15S
16S
17S
18S
19S
20S
21S
22S
23S
Iron Formation
Conglomerate
Approx. Contact
Scales
Horiz. 1" = 100'
Vert. 1" = 100
= 100 gammas
August 1962
091697
CREST EXPLORATION CO. LTD.
IRON CAP MOUNTAIN PROFILE
SLOPE ANGLES, MAGNETICS
Sulmac Exploration Services Limited

BRITISH MADE

MILLIGALS

D = 2·5	D = 5·0
69·00	
68·50	
68·00	
67·50	
67·00	64·00
66·50	63·50
66·00	63·00
65·50	62·50
65·00	62·00
64·50	61·50
64·00	

D = 5·0

D = 2·5

091697

ELEV.

2500'

2400'

Post

Tie No.1

22

2 4 6 8 10 12 14 16 18 20

COMMON ZERO

Southwest →

NO. 2 LINE

Scales
Horiz. 1"= 200'
Vert. 1"= 100'
= 0·5 Mg.

August 1962

JUN 12 1963
MAYO, Y.T.

CREST EXPLORATION CO. LTD.

SOUTH IRON CREEK Nº 1 (SOUTH LINE)

STADIA, GRAVITY

Sulmac Exploration Services Limited

(420)

MILLIGALS

D = 2·5 D = 5·0

69·00

68·50

68·00

67·50

67·00 64·50

66·50 64·00

66·00 63·50

65·50 63·00

65·00

64·50

64·00

D = 5·0

D = 2·5

091697

2500'

ELEV.

2400'

2300'

LINE No. 1.

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

JUN 12 1963
MAYO, Y.T.
Mining Recorder & Land Agent

Scales
Horiz. 1" = 200'
Vert. 1" = 100'
= 0·5 Mg.
= 100 gammas

August 1962

CREST EXPLORATION CO. LTD.

SOUTH IRON CREEK Nº2 (NORTH LINE)

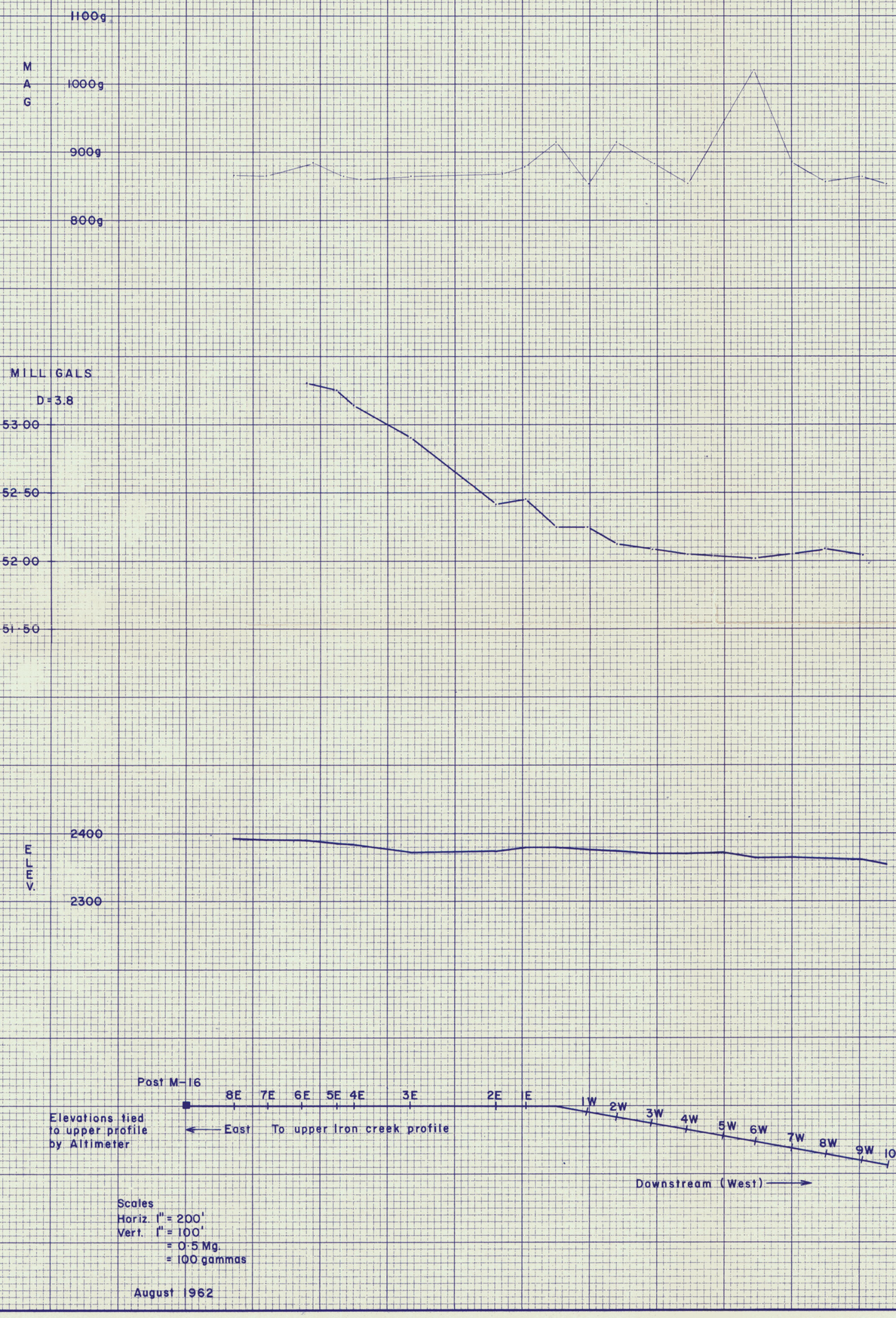
STADIA, GRAVITY

Sulmac Exploration Services Limited

BRITISH MADE

BRITISH MADE

1421



Scales
Horiz. 1" = 200'
Vert. 1" = 100'
= 0·5 Mg.
= 100 gammas

August 1962

091697

CREST EXPLORATION CO. LTD.

LOWER IRON CREEK PROFILE

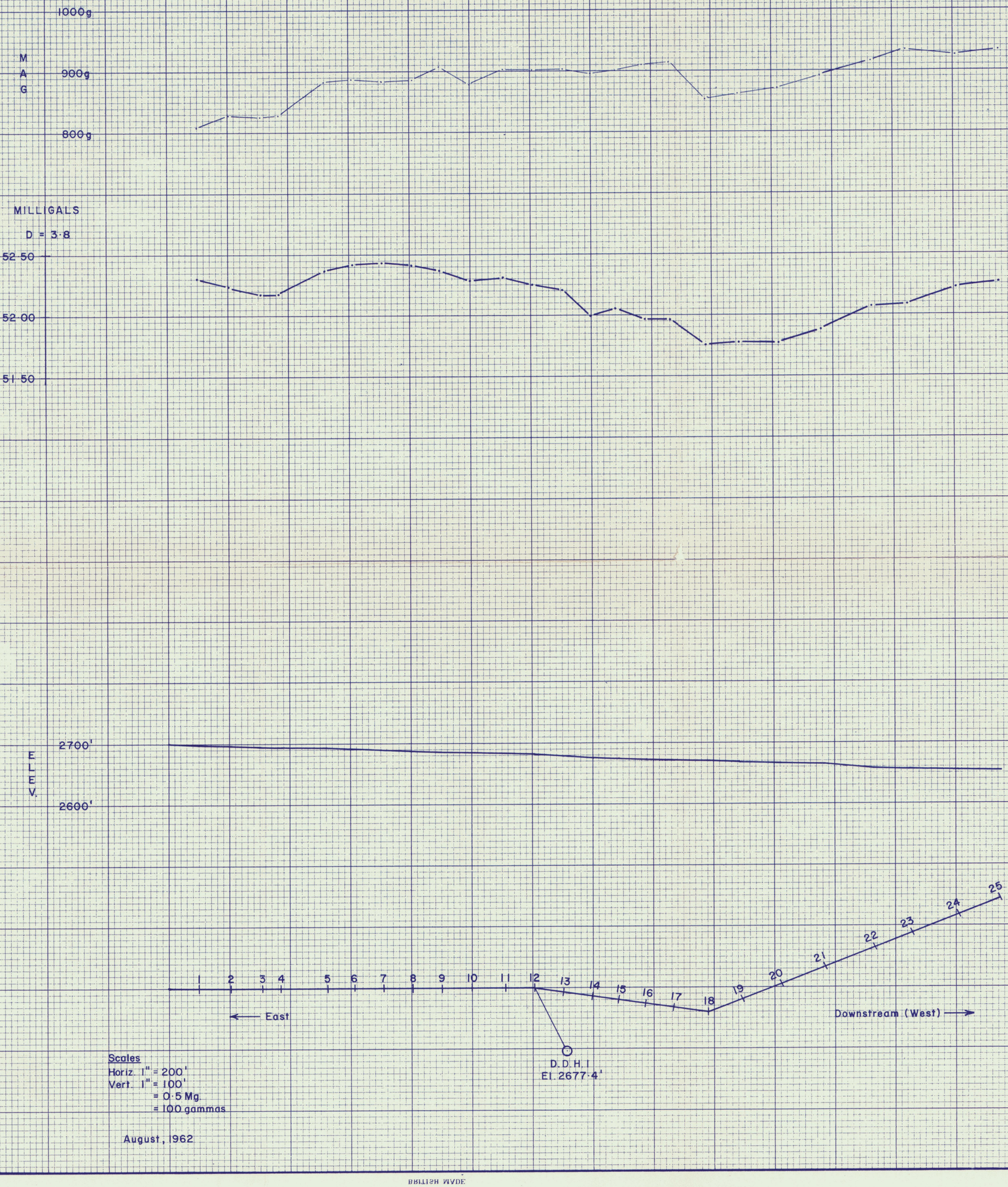
STADIA, GRAVITY, MAGNETICS

Sulmac Exploration Services Limited

JUN 12 1963

BRITISH MADE

1424



Scales
Horiz. 1" = 200'
Vert. 1" = 100'
= 0·5 Mg.
= 100 gammas

August, 1962

091697

JUN 12 1963
MAYO, Y.T.

CREST EXPLORATION CO. LTD.

UPPER IRON CREEK PROFILE

STADIA, GRAVITY, MAGNETICS

Sulmac Exploration Services Limited

BRITISH MADE

(1423)

WEST SHEET

TOPOGRAPHIC MAP
SNAKE RIVER AREA
YUKON AND NORTHWEST TERRITORIES

PREPARED FOR
CREST EXPLORATION LTD.

1962

CONTOUR INTERVAL 100 FEET

SCALE 1:31,680

2000 1000 0 2000 4000 6000 ft
1/2 1/4 0 1/2 1 mile

65°00'
133°30'
25'
20'
15'
10'
05'
133°00'
65° 00'

LEGEND

- △ 2630 Barometric elevation (Crest Exploration Ltd.)
- x 3620 Multiplex spot elevation
- + 369 Diopsylitye center
- Area of shadow or no stereoscopic coverage
- Contour position indefinite
- Intermediate 50 foot contour
- Streams
- Sand wash

MAGNETIC DECLINATION 36°27' E 1962

NORTH
Mag North

NOTE
This map was photogrammetrically prepared using a multiplex plotter

INDEX MAP
WEST SHEET
EAST SHEET
69°30'
132°30'
132°00'
69°00'

PLATE I - (West Sheet)

REVISIONS

CREST EXPLORATION LIMITED

SNAKE RIVER AREA
(WEST SHEET)

TRAVERSE POINT LOCATIONS

SCALE	DATE	DRAWN
1 : 31,680	DEC 1962	GEOPHOTO

LEGEND

- POLAROID PHOTO
- FIELD TRAVERSE
- H-1-62 UI8 TRAVERSE POINT CLAIM NUMBER WITH POLAROID PHOTO

65°15'
65°30'
132°52' 30"
55'
05'
10'
15'
20'
25'

Roll No. A12148 (6)
Roll No. A12148 (7)
Roll No. A12148 (8)
Roll No. 12056 (9)
Roll No. 12056 (10)
Roll No. A12148 (11)
Roll No. 13614 (High Level)
Roll No. A12148 (12)

TOPOGRAPHIC MAP

SNAKE RIVER AREA

YUKON AND NORTHWEST TERRITORIES

PREPARED FOR

CREST EXPLORATION LTD.

SCALE 1:31,680

CONTOUR INTERVAL 100 FEET

SCALE	DATE	DRAWN
1 : 31,680	DEC. 1962	GEOPHOTO

REVISIONS

CREST EXPLORATION LIMITED

SNAKE RIVER AREA
(EAST SHEET)

TRAVERSE POINT LOCATIONS

PLATE I - (East Sheet)

GEOPHOTO

LEGEND

- Barometric elevation (Crest Exploration Ltd.)
- Multiplex spot elevation
- Diggositive center
- Area of shadow or no stereoscopic coverage, contour position undefined
- Intermediate 50 foot contour
- Streams
- Sand wash

MAGNETIC DECLINATION 36°27' E 1962

North / Mag Norm

NOTE

This map was photogrammetrically prepared using a multiplex plotter.

INDEX MAP

WEST SHEET

EAST SHEET

LEGEND

- POLAROID PHOTO
- TRAVERSE POINT / CLAIM NUMBER WITH POLAROID PHOTO

FIELD TRAVERSE

H-I-62 / UIB

Roll No. A12148 (13)

Roll No. A 12106 (14)

Roll No. 12106 (15)

High Level Roll No. A14405 Roll No. A 12106 (16)

Roll No. 12264 (17)

YUKON TERRITORY / NORTHWEST TERRITORIES

65°30'
65°15'
132°52'30"
132°15'
50'
45'
40'
35'
30'
25'
20'

133°30' 25' 20' 15' 10' 05' 133°00' 55' 132°52' 30"

65°30'

Roll No. A12145 (6) | Roll No. A12148 (7) | Roll No. A12148 (8) | Roll No. 12056 (9) | Roll No. 12056 (10) | Roll No. A12148 (11) | Roll No. 13614 (High Level) | Roll No. A12148 (12)

25'

20'

Gypsum

65°15'

10'

05'

LEGEND

PROBABLE AGE	DESIGNATION AND PROBABLE ROCK TYPE	PROBABLE CORRELATION
MIDDLE DEVONIAN		
10	DARK GREY CARBONATE	HUME
SILURO-DEVONIAN		
9	UPPER BUFF (Not always seperable)	LONE MOUNTAIN - BEAR ROCK
8	LIGHT GREY CARBONATE	
7	LOWER BUFF (Not always seperable)	
SILURO-ORDOVICIAN		
6	UPPER BLOCKY CARBONATE (m. grey)	RONNING
ORDOVICIAN		
5	SHALY CARBONATE	
CAMBRO-ORDOVICIAN		
4	LOWER BLOCKY CARBONATE (lt grey)	
CAMBRIAN		
3	DARK SHALE (S.W. corner only)	
2	CONGLOMERATE WITH IRON (truncated to north)	
1	C UNDIFFERENTIATED INCL. GYPSUM	

NOTE:- GEOLOGICAL CONTACTS, FAULTS ETC., WERE TRANSFERRED FROM PHOTOS BY SKETCH-MASTER AND ARE SUBJECT TO ERRORS INHERENT IN THIS METHOD. GEOLOGY IS FROM FIELD WORK BY STUART AND CHERNOFF TO 1962 AND PHOTO INTERPRETATION BY STUART AND HARRIS. IRON FORMATION WITHIN THE CONGLOMERATE CANNOT BE FOLLOWED READILY ON PHOTOS AND WAS TRACED FROM FIELD SKETCHES ON PHOTOS.

RC-23-61 MEASURED SECTIONS

ATTITUDES

FIELD OBSERVATION

CALCULATED FROM PHOTOS

TOPOGRAPHIC MAP

SNAKE RIVER AREA

YUKON AND NORTHWEST TERRITORIES

PREPARED FOR

CREST EXPLORATION LTD.

GEOPHOTO SERVICES LTD. CALGARY, ALBERTA, CANADA

1962

CONTOUR INTERVAL 100 FEET

SCALE 1:31,680

2000 1000 0 2000 4000 6000 ft.

1/2 1/4 0 1/2 1 mile

LEGEND

△ 2830 Barometric elevation (Crest Exploration Ltd.)

x 5620 Multiplex spot elevation

+ 369 Diapositive center

Area of shadow or no stereoscopic coverage, contour position indefinite

Intermediate 50 foot contour

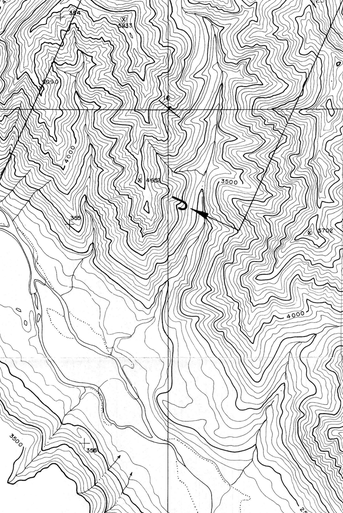
Streams

Sand wash

MAGNETIC DECLINATION 36°27' E. 1962

North Mag. North

INDEX MAP



NOTE

This map was photogrammetrically prepared using a multiplex plotter.

Roll No. A12148

55' 132°52' 30"

65°00'

133°30' 25' 20' 15' 10' 05' 133°00'

65° 00'

WEST SHEET

PLATE II - (West Sheet)

REVISIONS	CREST EXPLORATION LIMITED
Geol April 2/63	SNAKE RIVER AREA (WEST SHEET)
	SURFACE GEOLOGY

SCALE	DATE	DRAWN
1 : 31,680	DEC. 1962	GEOPHOTO

091697

TOPOGRAPHIC MAP

SNAKE RIVER AREA

YUKON AND NORTHWEST TERRITORIES

PREPARED FOR

CREST EXPLORATION LTD.

GEOPHOTO

PLATE II - (East Sheet)

SNAKE RIVER AREA

(EAST SHEET)

SURFACE GEOLOGY

REVISIONS
dd/mm/yy

CREST EXPLORATION LIMITED

SCALE	DATE	DRAWN
1 : 31,680	DEC. 1962	GEOPHOTO

091617

CONTOUR INTERVAL 100 FEET

SCALE 1:31,680

2000 0 2000 4000 6000 ft.

1/2 0 1/2 1 mile

LEGEND

- Barometric elevation (Crest Exploration Ltd.)
- Multiplex spot elevation
- Dip/strike center
- Area of shadow or no stereoscopic coverage, contour position indefinite
- Intermediate 50 foot contour
- Streams
- Sand wash

MAGNETIC DECLINATION 36°27' E 1962

North / Mag North

NOTE

This map was photogrammetrically prepared using a multiplex plotter

INDEX MAP

WEST SHEET / EAST SHEET

65°00' 132°52'30" 132°45' 65°00'

LEGEND

PROBABLE AGE	DESIGNATION AND PROBABLE ROCK TYPE		PROBABLE CORRELATION
MIDDLE DEVONIAN	10 DARK GREY CARBONATE	HUME	
SILURO-DEVONIAN	9 UPPER BUFF (Not always separable)	LONE MOUNTAIN – BEAR ROCK	
	8 LIGHT GREY CARBONATE		
	7 LOWER BUFF (Not always separable)		
SILURO-ORDOVICIAN	6 UPPER BLOCKY CARBONATE (m grey)	RONNING	
ORDOVICIAN	5 SHALY CARBONATE		
CAMBRO-ORDOVICIAN	4 LOWER BLOCKY CARBONATE (lt grey)		
CAMBRIAN	3 DARK SHALE (S.W corner only)		
	2 CONGLOMERATE WITH IRON (Truncated to north)		
	1 ± UNDIFFERENTIATED INCL. GYPSUM		

NOTE:- GEOLOGICAL CONTACTS, FAULTS ETC. WERE TRANSFERRED FROM PHOTOS BY SKETCH-MASTER AND ARE SUBJECT TO ERRORS INHERENT IN THIS METHOD. GEOLOGY IS FROM FIELD WORK BY STUART AND CHERNOFF TO 1962 AND PHOTO INTERPRETATION BY STUART AND HARRIS. IRON FORMATION WITHIN THE CONGLOMERATE CANNOT BE FOLLOWED READILY ON PHOTOS AND WAS TRACED FROM FIELD SKETCHES ON PHOTOS.

RC-23-61 MEASURED SECTIONS

ATTITUDES

FIELD OBSERVATION

CALCULATED FROM PHOTOS

65°00' 132°52'30" 50' 45' 40' 35' 30' 25' 20' 15'

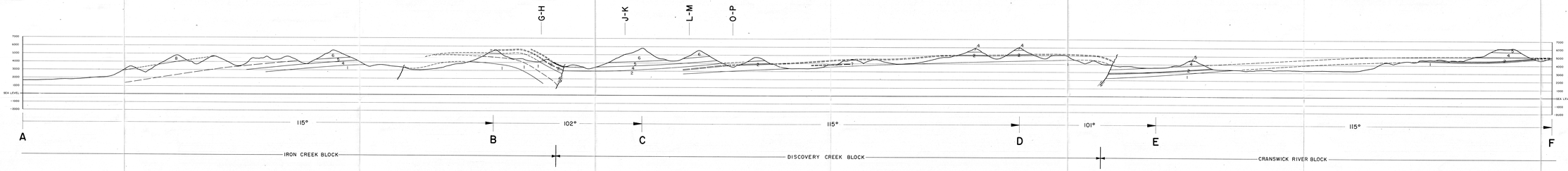
Roll No. A12248 (13) | Roll No. A 12106 (14) | Roll No. 12106 (15) | High Level Roll No. A14405 Roll No. A 12106 (16) | Roll No. 12264 (17)

LOWER IRON BAND

LS DYKE

Gypsum

YUKON NORTHWEST TERRITORY TERRITOIRES



LEGEND

PROBABLE AGE	DESIGNATION AND PROBABLE ROCK TYPE	PROBABLE CORRELATION
SILURO-DEVONIAN		
9	UPPER BUFF (Not always separable)	LONE MOUNTAIN - BEAR ROCK
8	LIGHT GREY CARBONATE	
7	LOWER BUFF (Not always separable)	
SILURO-ORDOVICIAN		
6	UPPER BLOCKY CARBONATE (in gray)	ROWNING
ORDOVICIAN		
5	SHALY CARBONATE	
CAMBRO-ORDOVICIAN		
4	LOWER BLOCKY CARBONATE (in gray)	
CAMBRIAN		
3	DARK SHALE (S.W. corner only)	
2	CONGLOMERATE WITH IRON (Occupied to north)	
1	¢ UNDIFFERENTIATED INCL. GYPSUM	

PLATE II A

REVISIONS

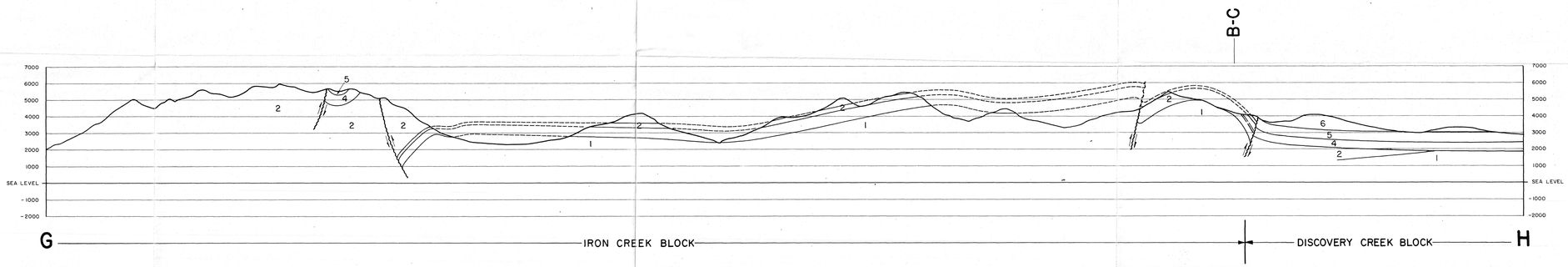
CREST EXPLORATION LIMITED

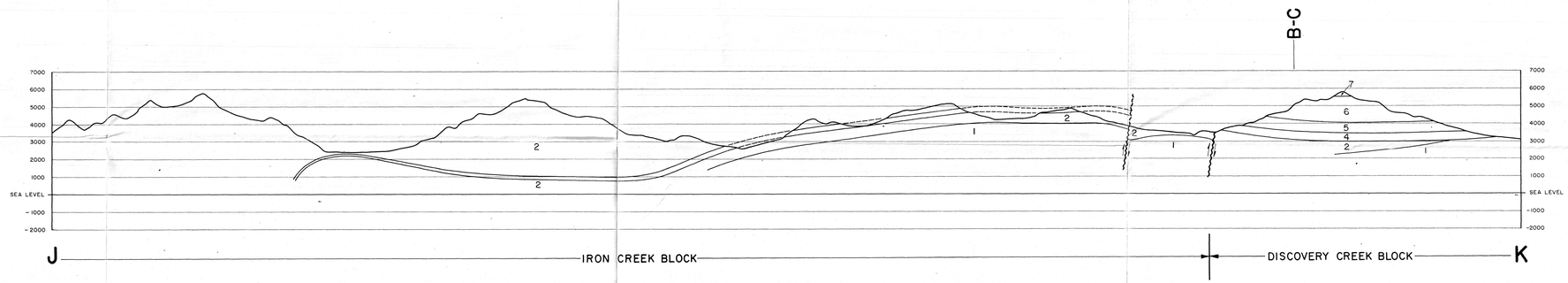
SNAKE RIVER AREA

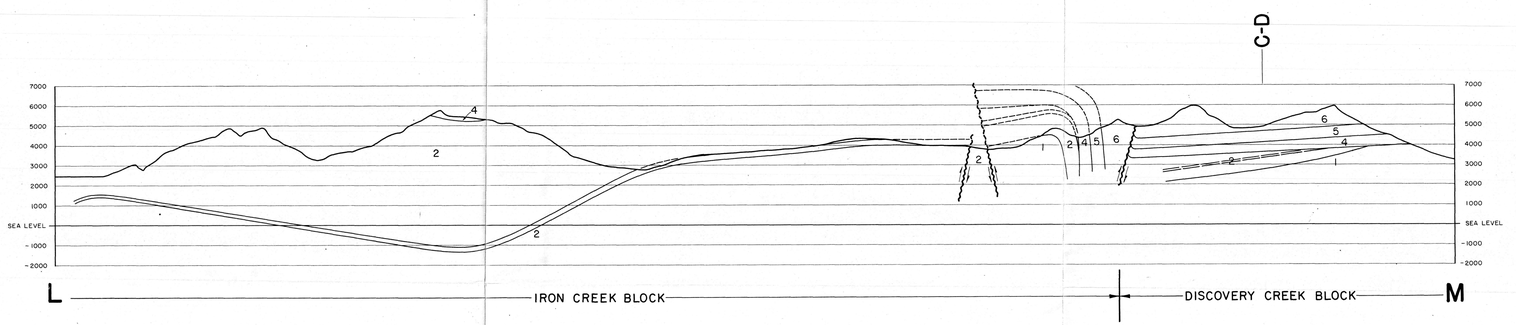
CROSS SECTION E-F

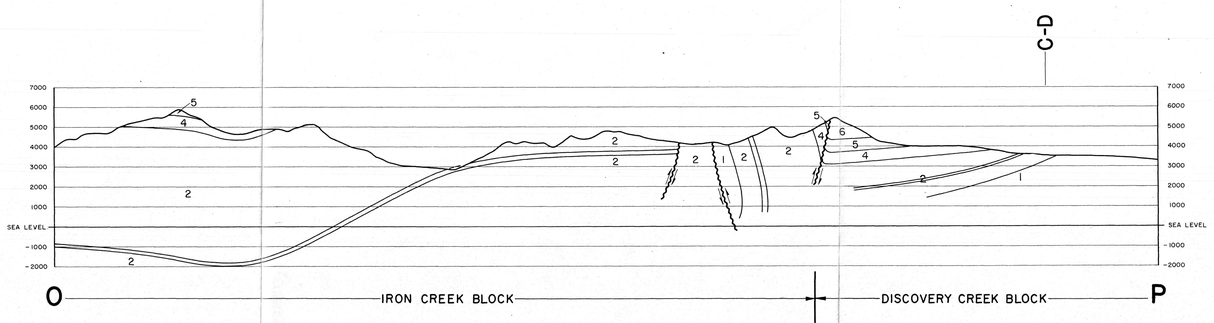
By K.A. HARRIS

SCALE	DATE	DRAWN
1 INCH = 2640 FEET	APRIL 5, 1963	L. P. L.









LEGEND

PROBABLE AGE		DESIGNATION AND PROBABLE ROCK TYPE	PROBABLE CORRELATION
SILURO-DEVONIAN	9	UPPER BUFF (Not always separable)	LONE MOUNTAIN - BEAR ROCK
	8	LIGHT GREY CARBONATE	
	7	LOWER BUFF (Not always separable)	
SILURO-ORDOVICIAN	6	UPPER BLOCKY CARBONATE (m. grey)	RONNING
ORDOVICIAN	5	SHALY CARBONATE	
CAMBRO-ORDOVICIAN	4	LOWER BLOCKY CARBONATE (lt grey)	
CAMBRIAN	3	DARK SHALE (S.W. corner only)	
	2	CONGLOMERATE WITH IRON (truncated to north)	
	1	€ UNDIFFERENTIATED INCL GYPSUM	

PLATE II B

REVISIONS	CREST EXPLORATION LIMITED

SNAKE RIVER AREA

CROSS SECTIONS

G-H
J-K
L-M
O-P

By K.A. HARRIS

SCALE	DATE	DRAWN
1 INCH = 2640 FEET	APRIL 3, 1963	W. E. D.

021627

15' 10' 05' 133°00' 55' 132°52'30"

20'

65°15'

10'

GYPSUM CREEK

BLUFF CREEK

SOUTH IRON CREEK

IRON CREEK

SNAKE RIVER

6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500

EROSIONAL EDGE

OUTLINE OF CLAIM BLOCKS

— — — ERODED
——— PRESENT

PLATE III

091697

REVISIONS

CREST EXPLORATION LIMITED

IRON CREEK AREA

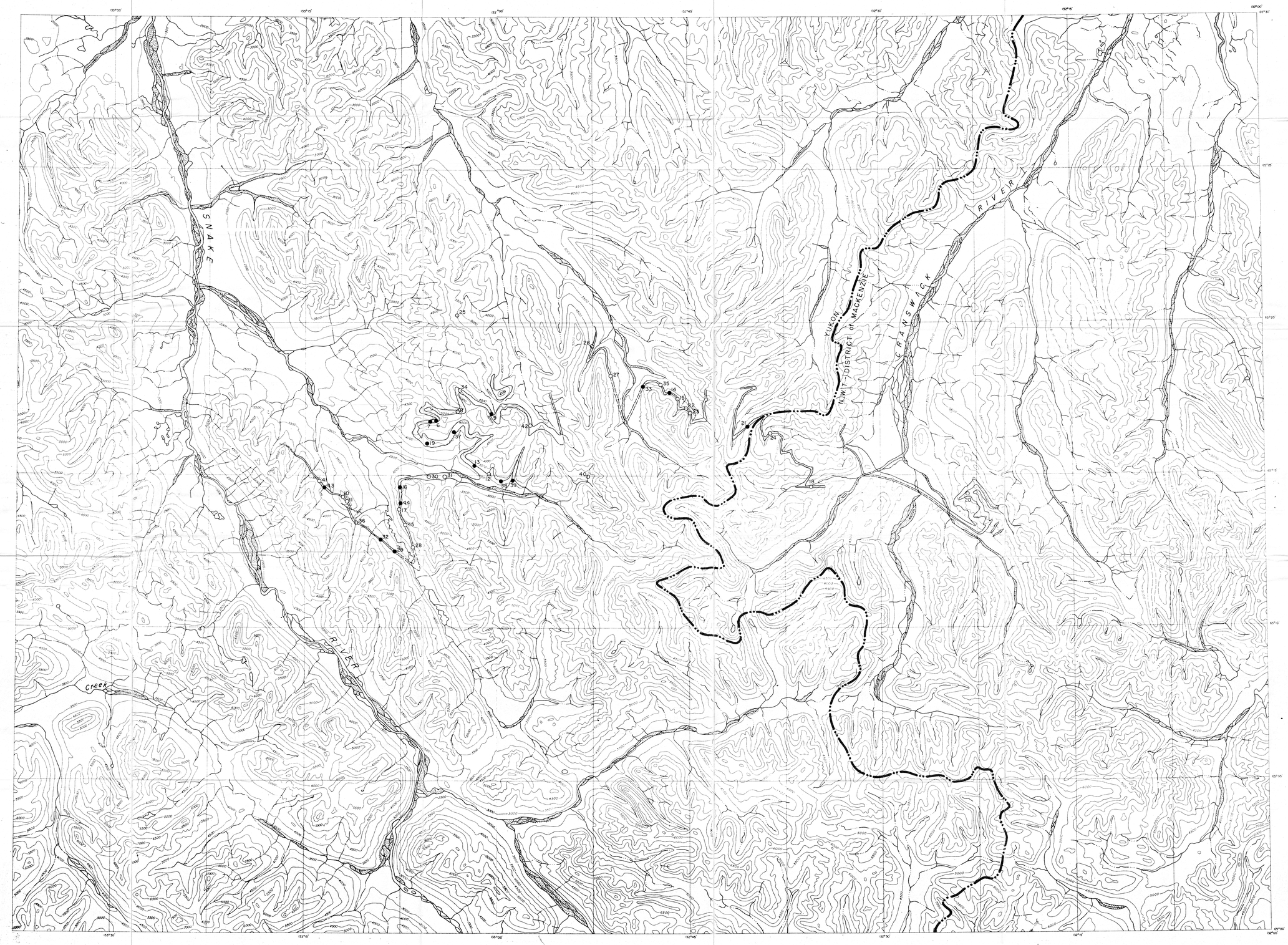
STRUCTURE CONTOURS
(RECONSTRUCTED)
ON TOP OF
IRON FORMATION

By K. A. Harris

C.I. = 100'

APRIL 19, 1963

SCALE	DATE	DRAWN	
1 : 31,680	APRIL 1963		



LEGEND

○ MEASURED 1962
● SAMPLED 1962

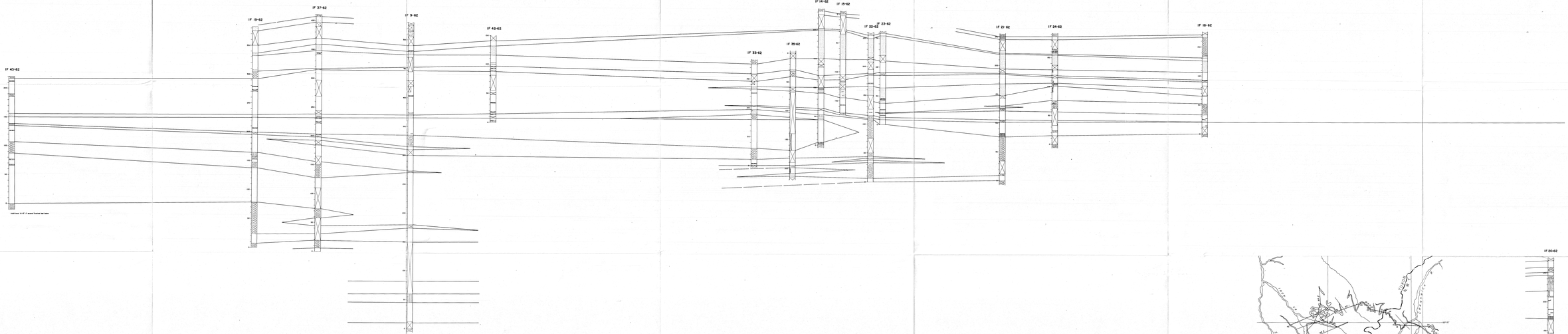
PLATE IV 07/497

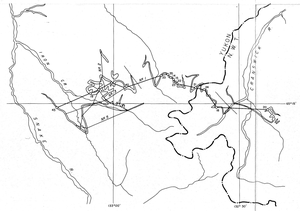
CREST EXPLORATION LIMITED

SNAKE RIVER AREA

OUTCROP OF IRON FORMATION
LOCATION OF SECTIONS

SCALE	DATE	DRAWN	
1 INCH = 1 MILE	JULY 26-1963		





LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE X-1 09167

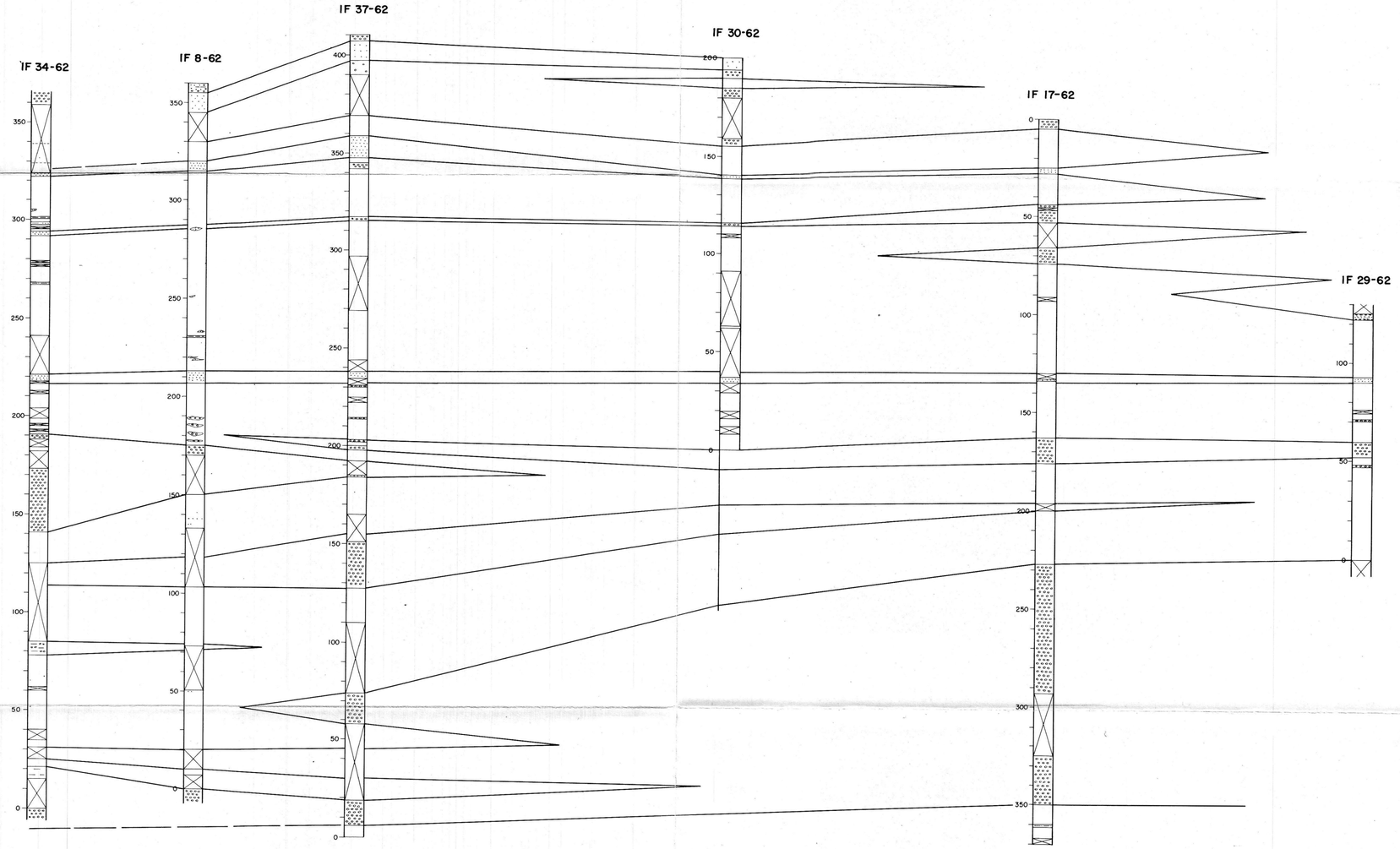
CREST EXPLORATION LIMITED

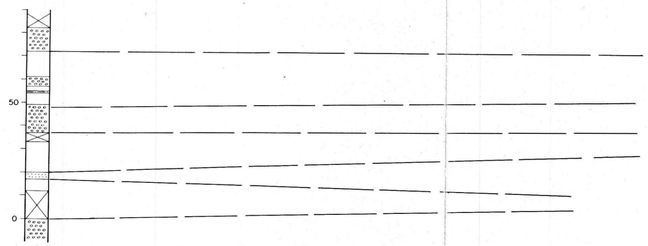
SNAKE RIVER IRON DEPOSIT

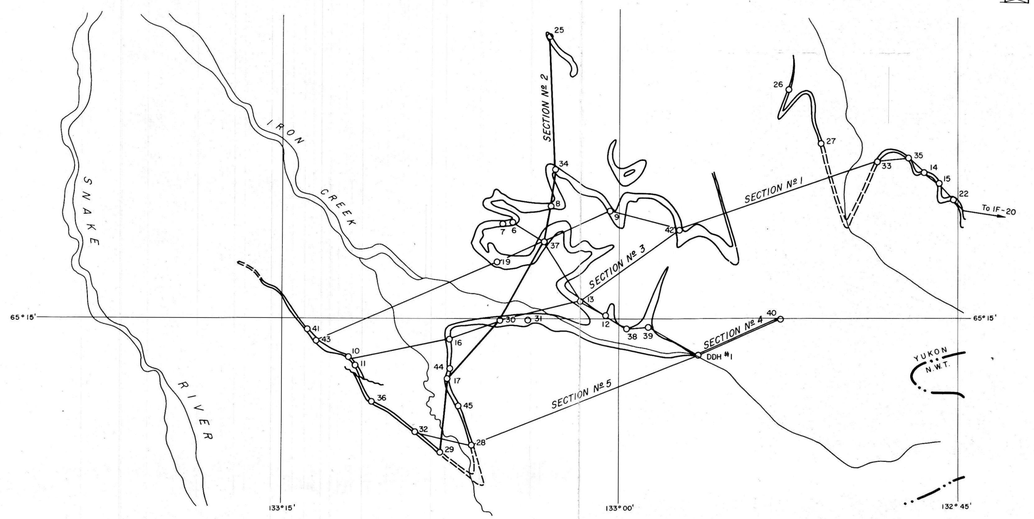
STRATIGRAPHIC CROSS SECTION
NUMBER 1

BY R. A. STUART

DATE OF ISSUE	SCALE	
DATE DRAWN	DRN. BY	R. A. S.







LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE V -2

CREST EXPLORATION LIMITED

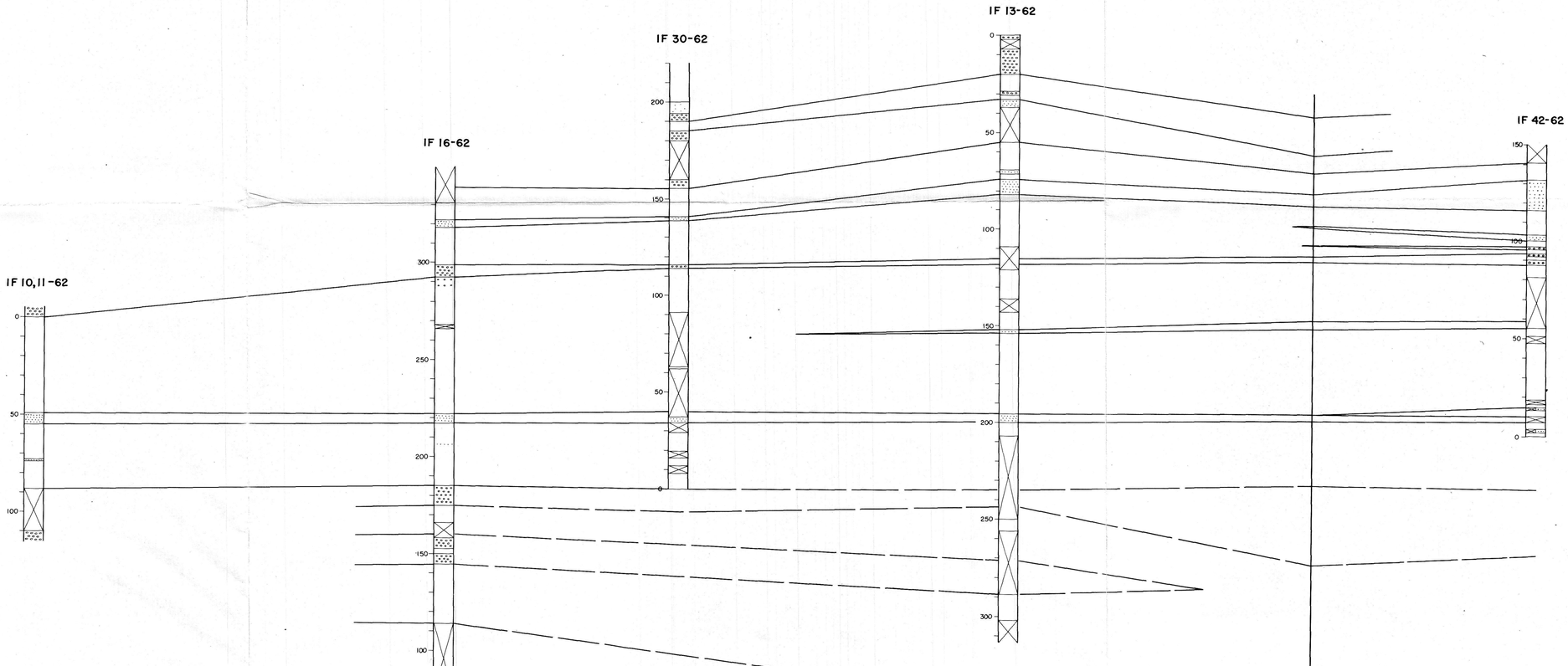
SNAKE RIVER IRON DEPOSIT

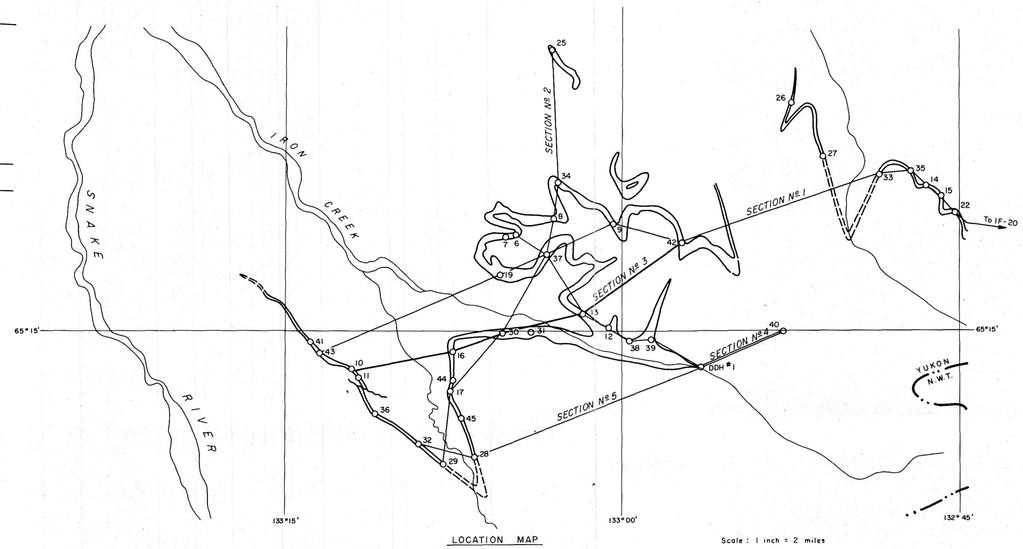
STRATIGRAPHIC CROSS SECTION NUMBER 2

BY R. A. STUART

091697

SCALE	DATE	DRAWN
Vert. 1" = 40' Horiz. 2.5" = 1mi.	JUNE, 1963	B. A. F.





LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE V -3

CREST EXPLORATION LIMITED

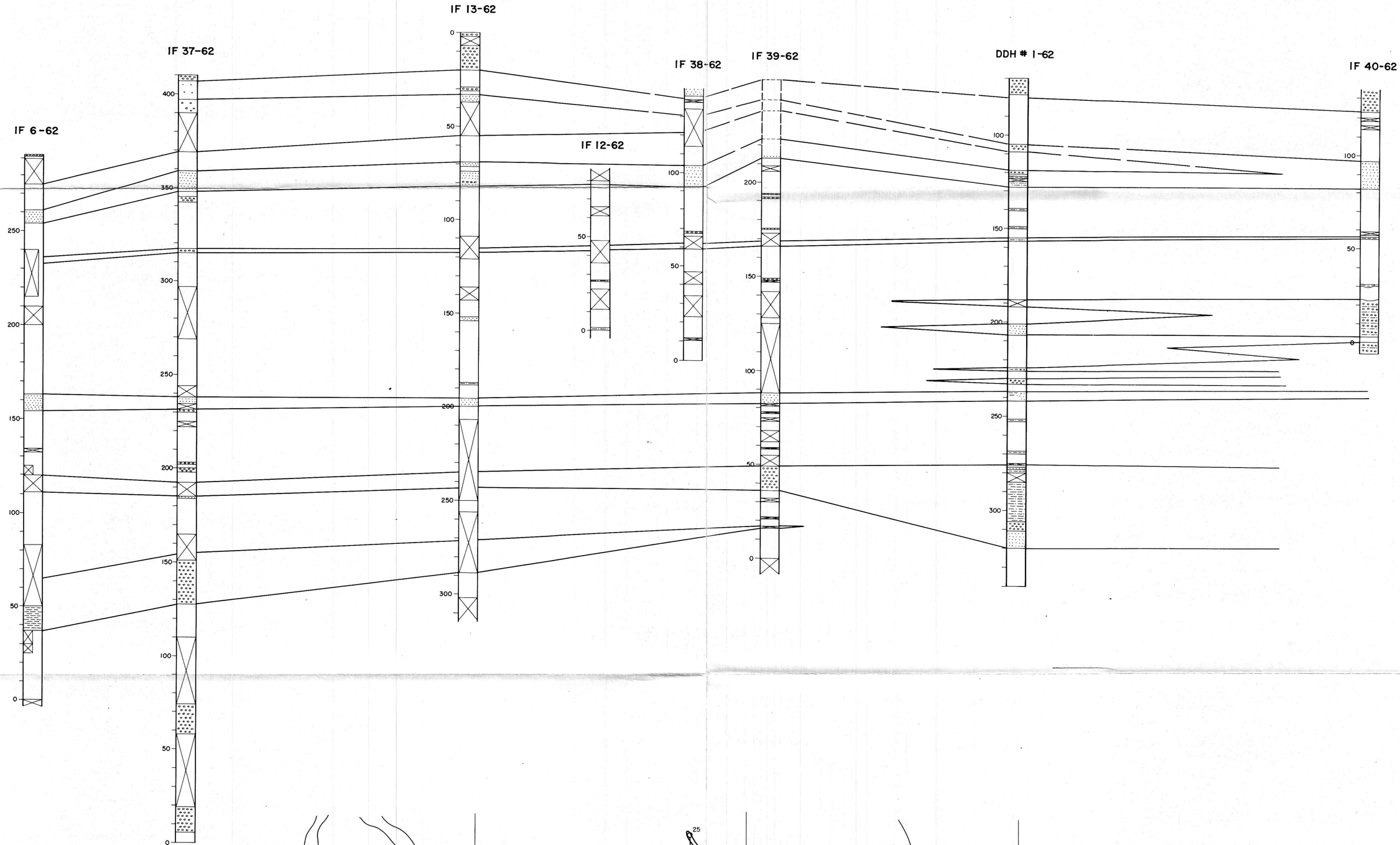
SNAKE RIVER IRON DEPOSIT

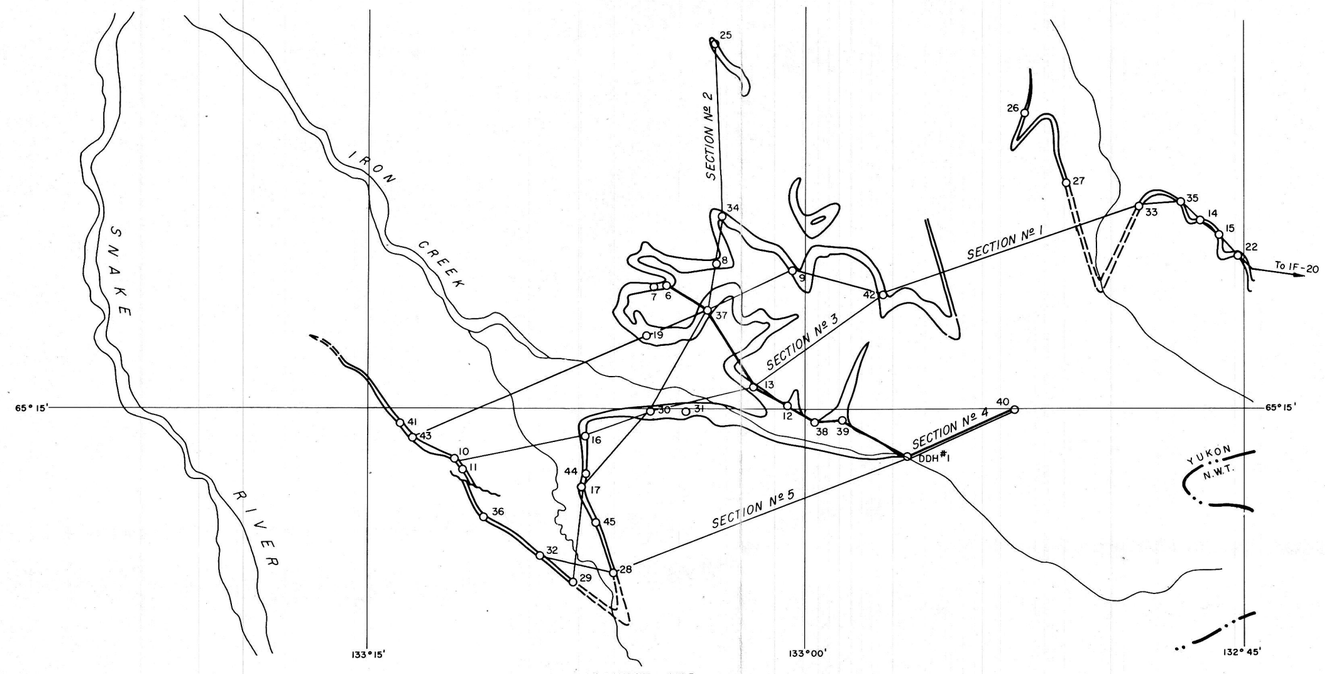
STRATIGRAPHIC CROSS SECTION NUMBER 3

BY R. A. STUART

091697

SCALE	DATE	DRAWN
Vert. 1"=40' Horiz. 2.5"=1mi.	JUNE, 1963	B. A. F.





LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE V - 4

CREST EXPLORATION LIMITED

SNAKE RIVER IRON DEPOSIT

STRATIGRAPHIC CROSS SECTION NUMBER 4

BY R. A. STUART

091697

SCALE	DATE	DRAWN	
Vert. 1"=40' Horiz. 2.5"=1mi.	JUNE, 1963	B. A. F.	

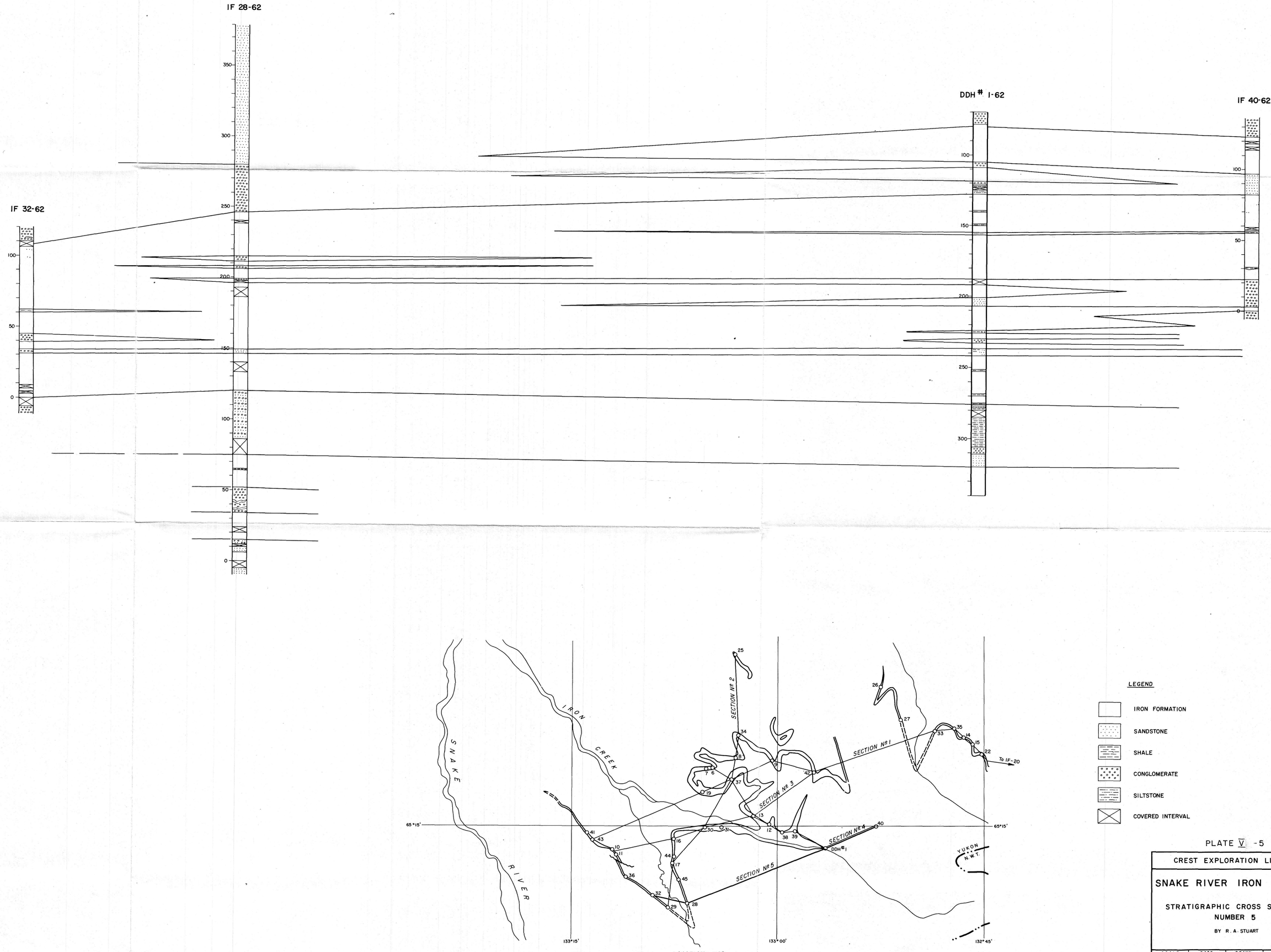


PLATE V -5

CREST EXPLORATION LIMITED

SNAKE RIVER IRON DEPOSIT

STRATIGRAPHIC CROSS SECTION NUMBER 5

BY R. A. STUART

091697

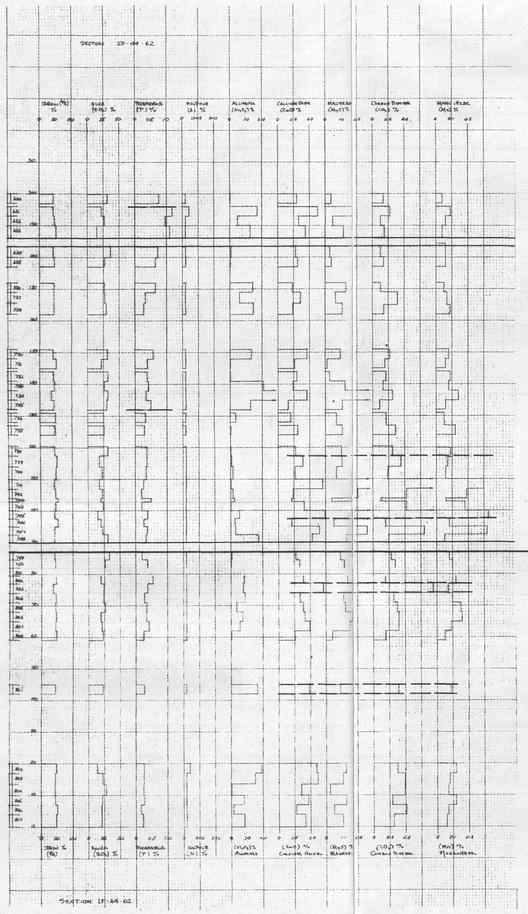
SCALE	DATE	DRAWN
Vert. 1" = 40' Horiz. 2.5" = 1mi	JUNE, 1963	B. A. F.

PLATE VI

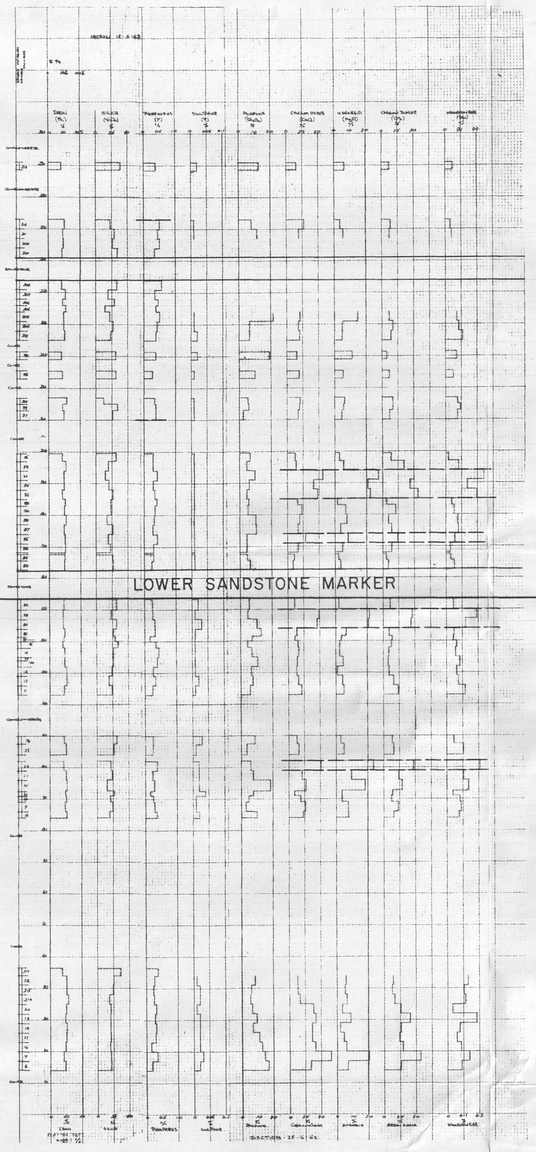
SNAKE RIVER IRON DEPOSIT

CHEMICAL ANALYSES OF SAMPLED SECTIONS SHOWING CORRELATION BETWEEN CHEMICAL COMPOSITION AND STRATIGRAPHY

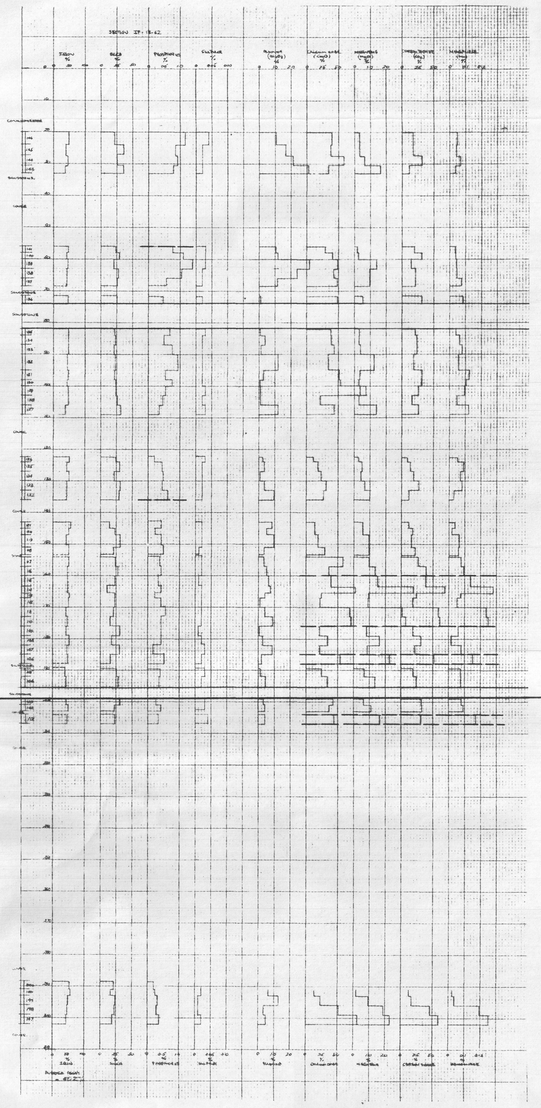
IF 44-62



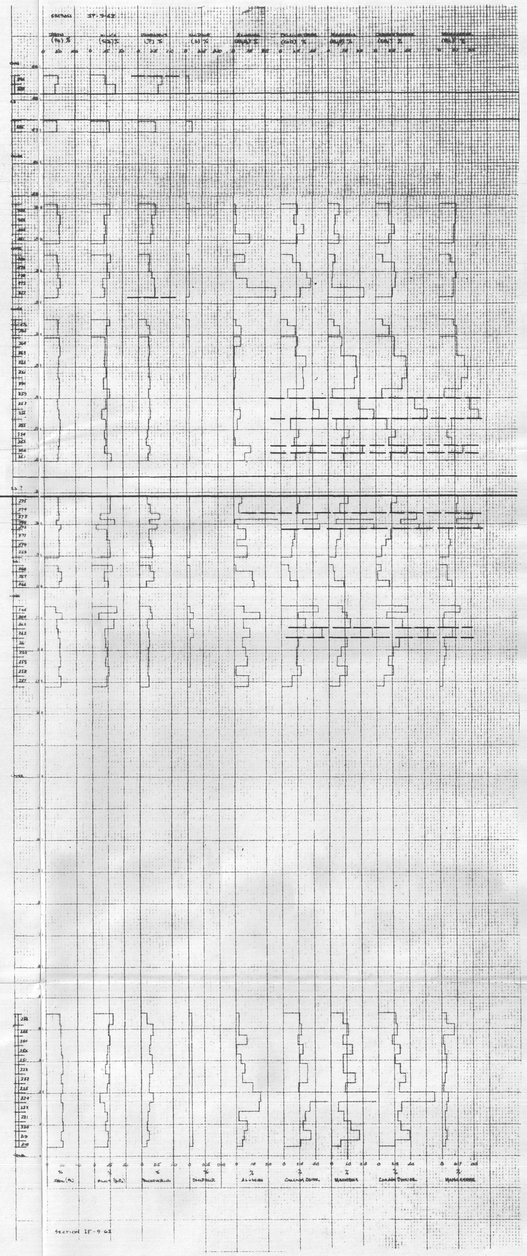
IF 6-62

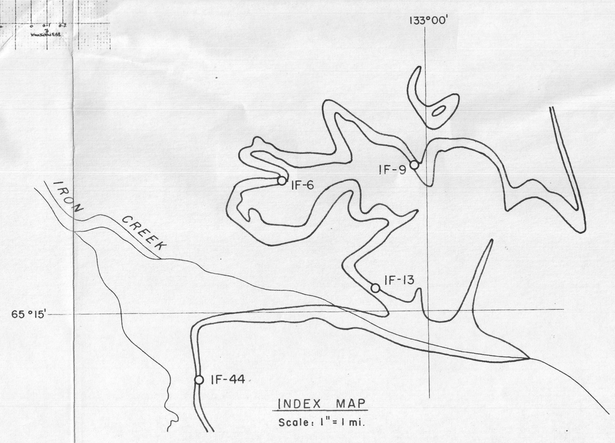


IF 13-62



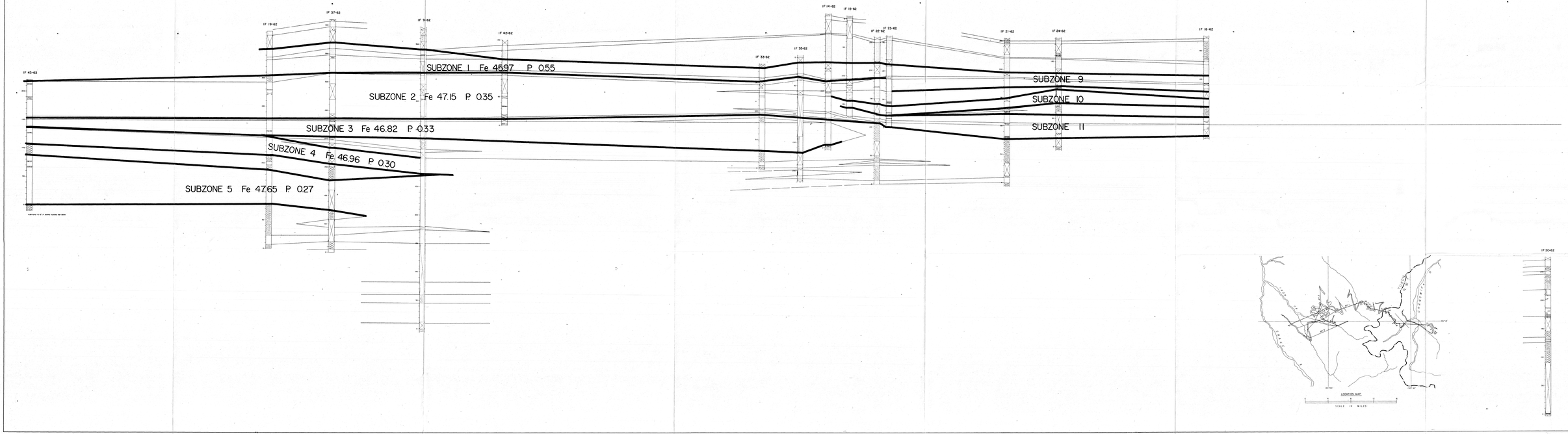
IF 9-62



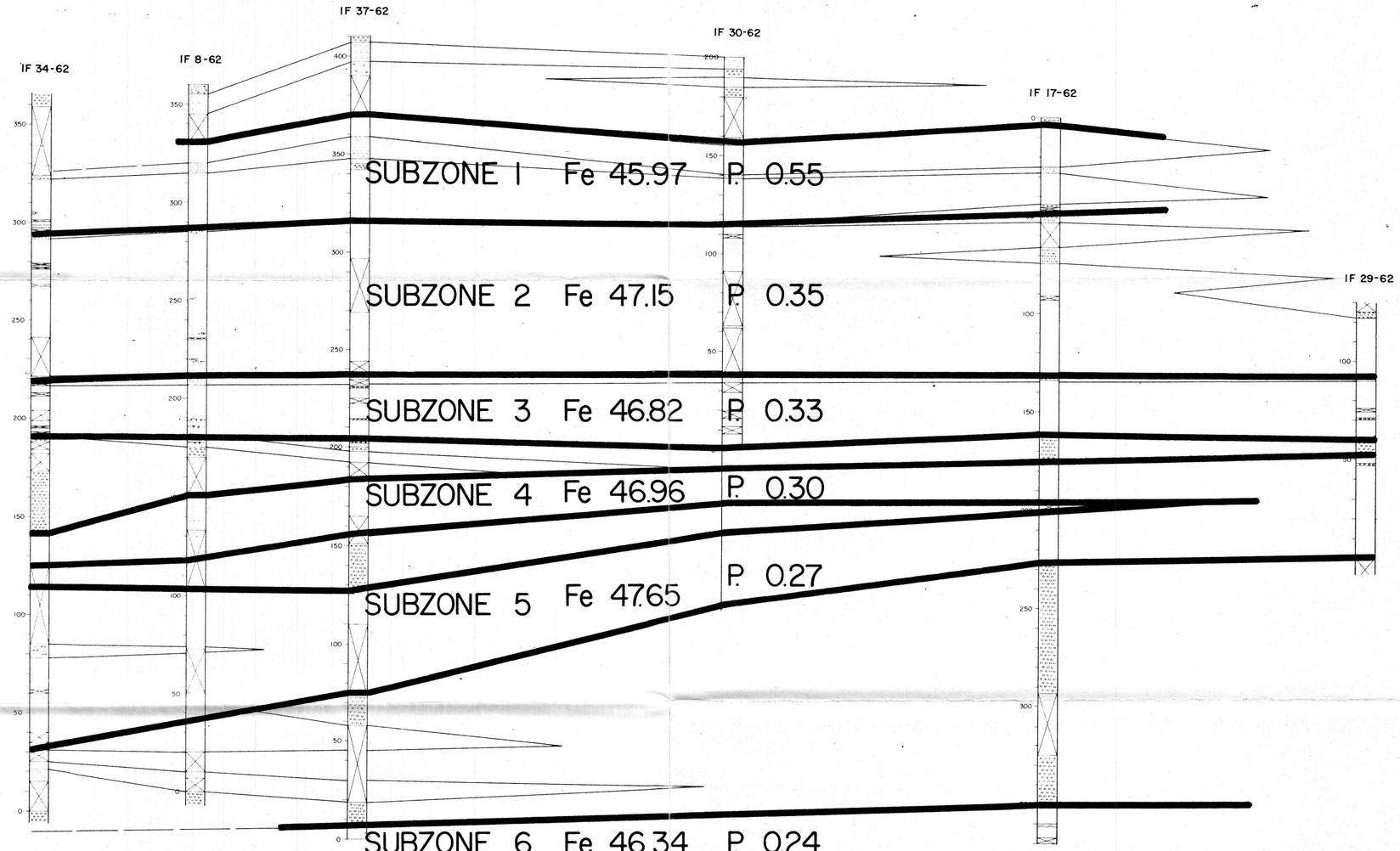


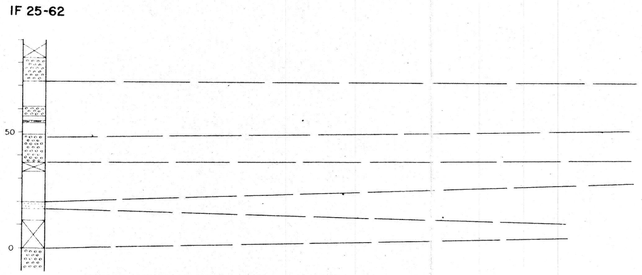
INDEX MAP
Scale: 1" = 1 mi.

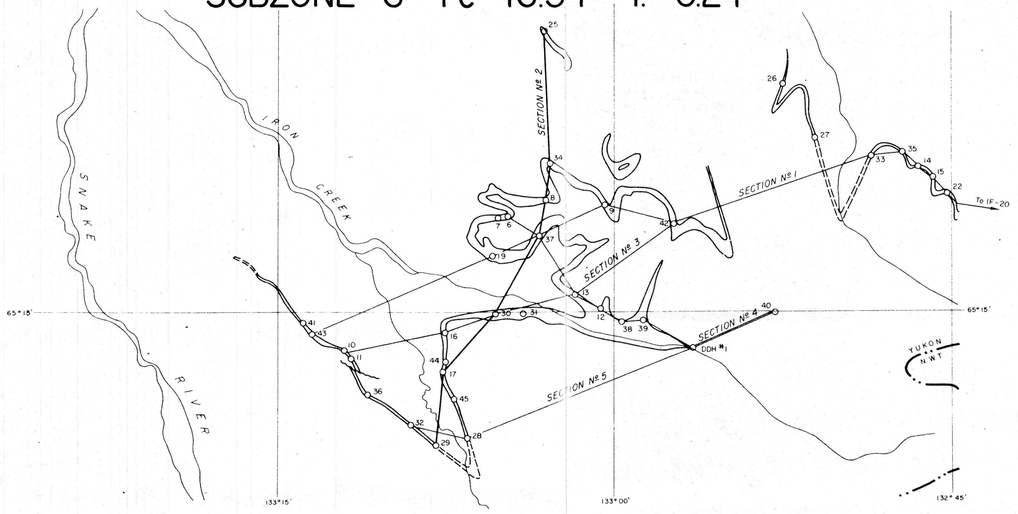
091697



IF 43-62
IF 19-62
IF 37-62
IF 9-62
IF 42-62
IF 33-62
IF 35-62
IF 14-62
IF 15-62
IF 22-62
IF 23-62
IF 21-62
IF 24-62
IF 18-62
IF 20-62
SUBZONE 1 Fe 45.97 P. 0.55
SUBZONE 2 Fe 47.15 P. 0.35
SUBZONE 3 Fe 46.82 P. 0.33
SUBZONE 4 Fe 46.96 P. 0.30
SUBZONE 5 Fe 47.65 P. 0.27
SUBZONE 9
SUBZONE 10
SUBZONE 11
LOCATION MAP
SCALE IN MILES
LEGEND
IRON FORMATION
SANDSTONE
SHALE
CONGLOMERATE
SILTSTONE
COVERED INTERVAL
PLATE VII-1
CREST EXPLORATION LIMITED
SNAKE RIVER IRON DEPOSIT
STRATIGRAPHIC CROSS SECTION
NUMBER 1
SUBZONES OF IRON FORMATION







LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE VII-2

CREST EXPLORATION LIMITED

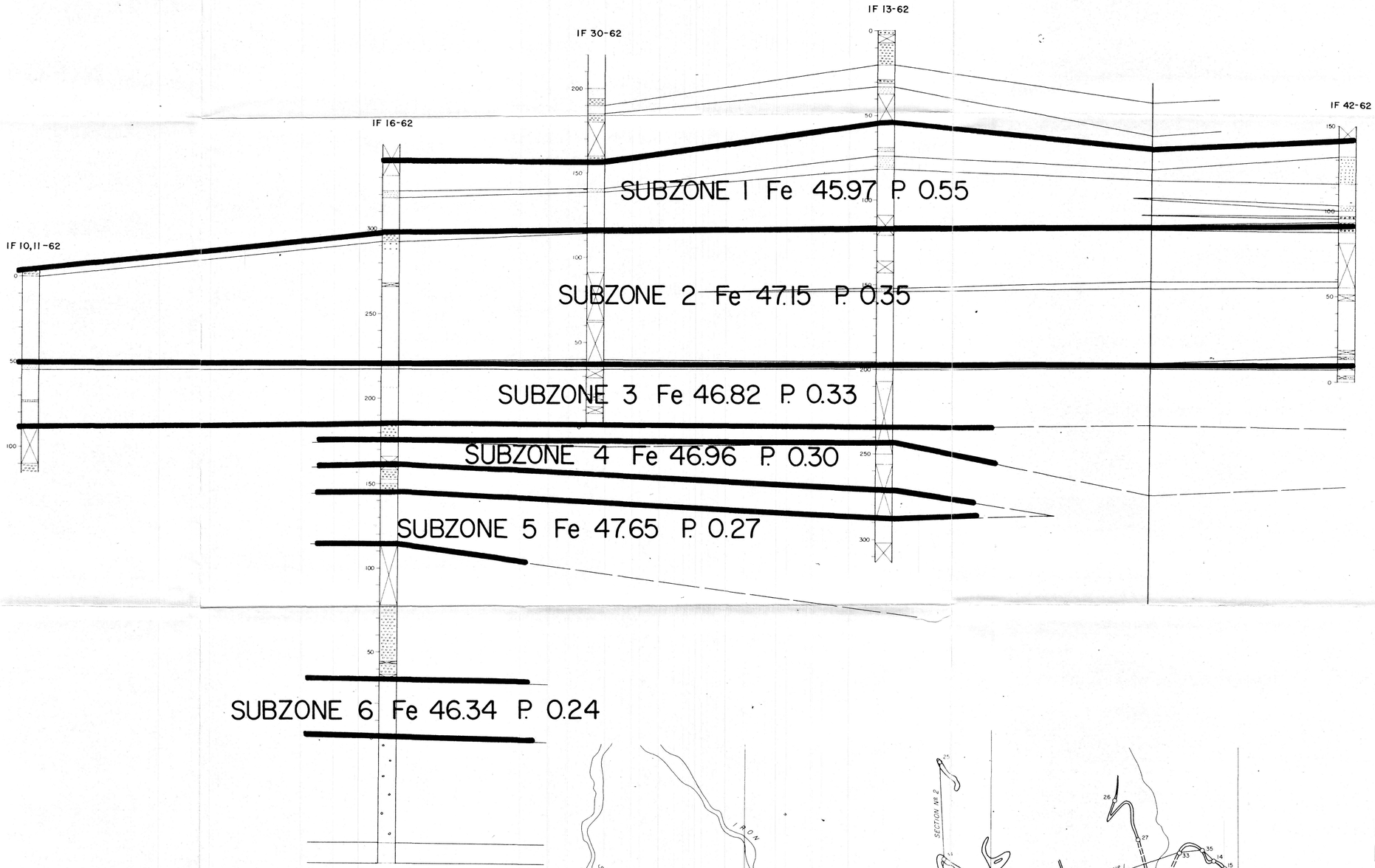
SNAKE RIVER IRON DEPOSIT

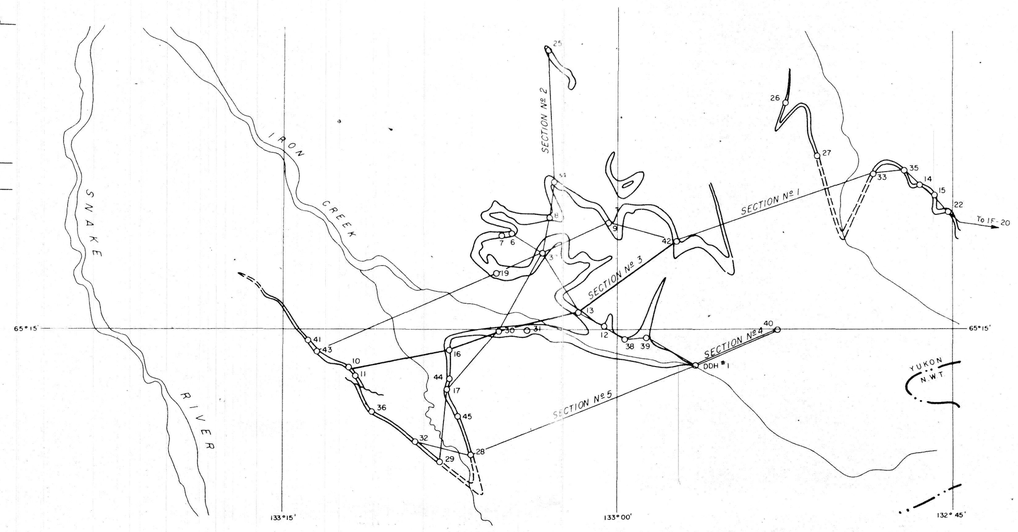
STRATIGRAPHIC CROSS SECTION NUMBER 2 SHOWING SUBZONES OF IRON FORMATION

BY R. A. STUART

091697

SCALE	DATE	DRAWN
Vert. 1" = 40' Horiz. 2.5" = 1mi.	JUNE, 1963	B. A. F.





LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE VII-3

CREST EXPLORATION LIMITED

SNAKE RIVER IRON DEPOSIT

STRATIGRAPHIC CROSS SECTION
NUMBER 3
SHOWING
SUBZONES OF IRON FORMATION

BY R.A. STUART

091697

SCALE	DATE	DRAWN
Vert. 1"=40' Horiz. 2.5"=1mi.	JUNE, 1963	B. A. F.

IF 13-62

IF 37-62

IF 38-62

IF 39-62

DDH # 1-62

IF 40-62

IF 6-62

IF 12-62

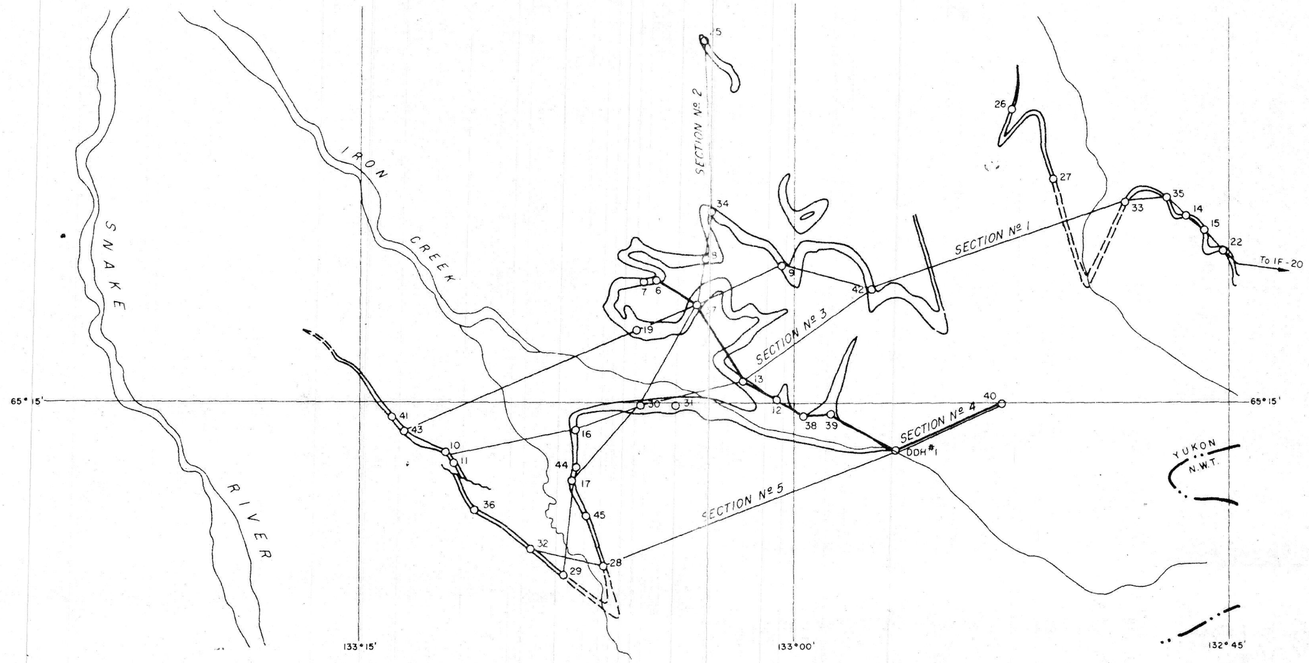
SUBZONE 1 Fe 45.97 P. 0.55

SUBZONE 2 Fe 47.15 P. 0.35

SUBZONE 3 Fe 46.82 P. 0.33

SUBZONE 4 Fe 46.96 P. 0.30

SUBZONE 5 Fe 47.65 P. 0.27



LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

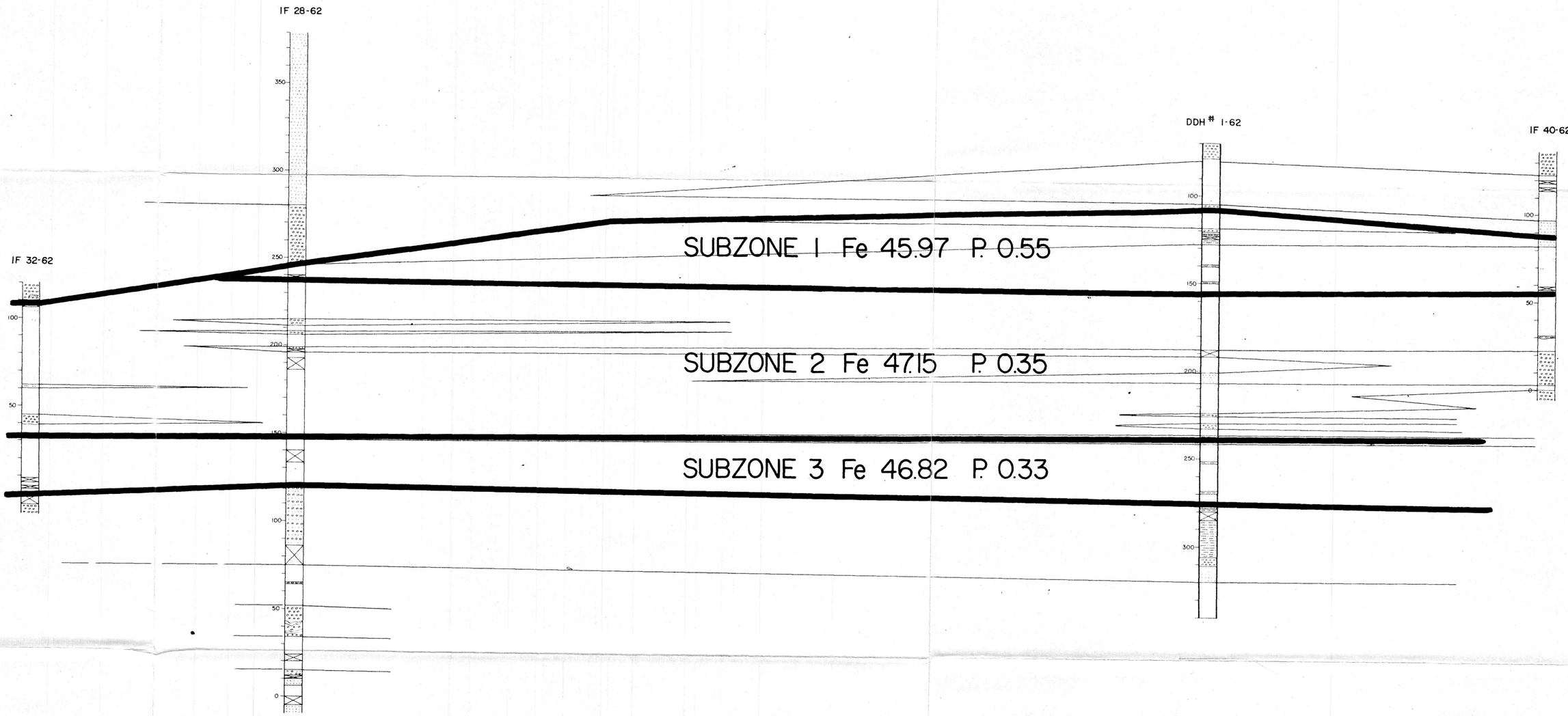
PLATE VII-4

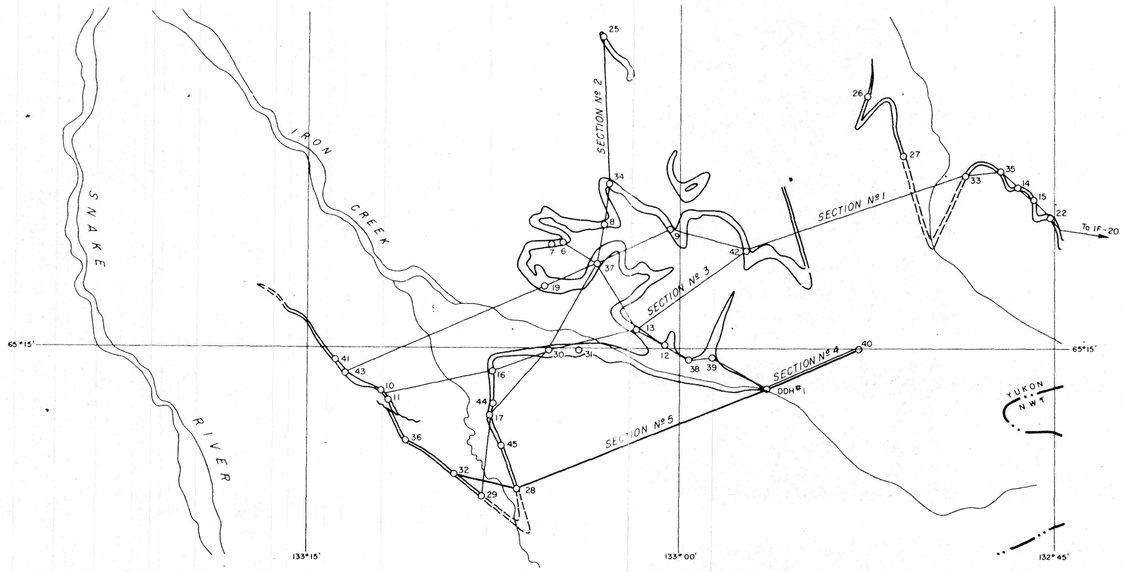
CREST EXPLORATION LIMITED

SNAKE RIVER IRON DEPOSIT

STRATIGRAPHIC CROSS SECTION
NUMBER 4
SHOWING
SUBZONES OF IRON FORMATION
BY R.A. STUART 091697

SCALE	DATE	DRAWN
Vert. 1"=40' Horiz. 2.5"=1mi.	JUNE, 1963	B & F





LOCATION MAP

Scale : 1 inch = 2 miles

LEGEND

- IRON FORMATION
- SANDSTONE
- SHALE
- CONGLOMERATE
- SILTSTONE
- COVERED INTERVAL

PLATE VII-5

CREST EXPLORATION LIMITED

SNAKE RIVER IRON DEPOSIT

STRATIGRAPHIC CROSS SECTION
NUMBER 5
SHOWING
SUBZONES OF IRON FORMATION
BY R.A. STUART 091697

SCALE	DATE	DRAWN
Vert. 1" = 40' Horiz. 2.5" = 1mi.	JUNE, 1963	B A F

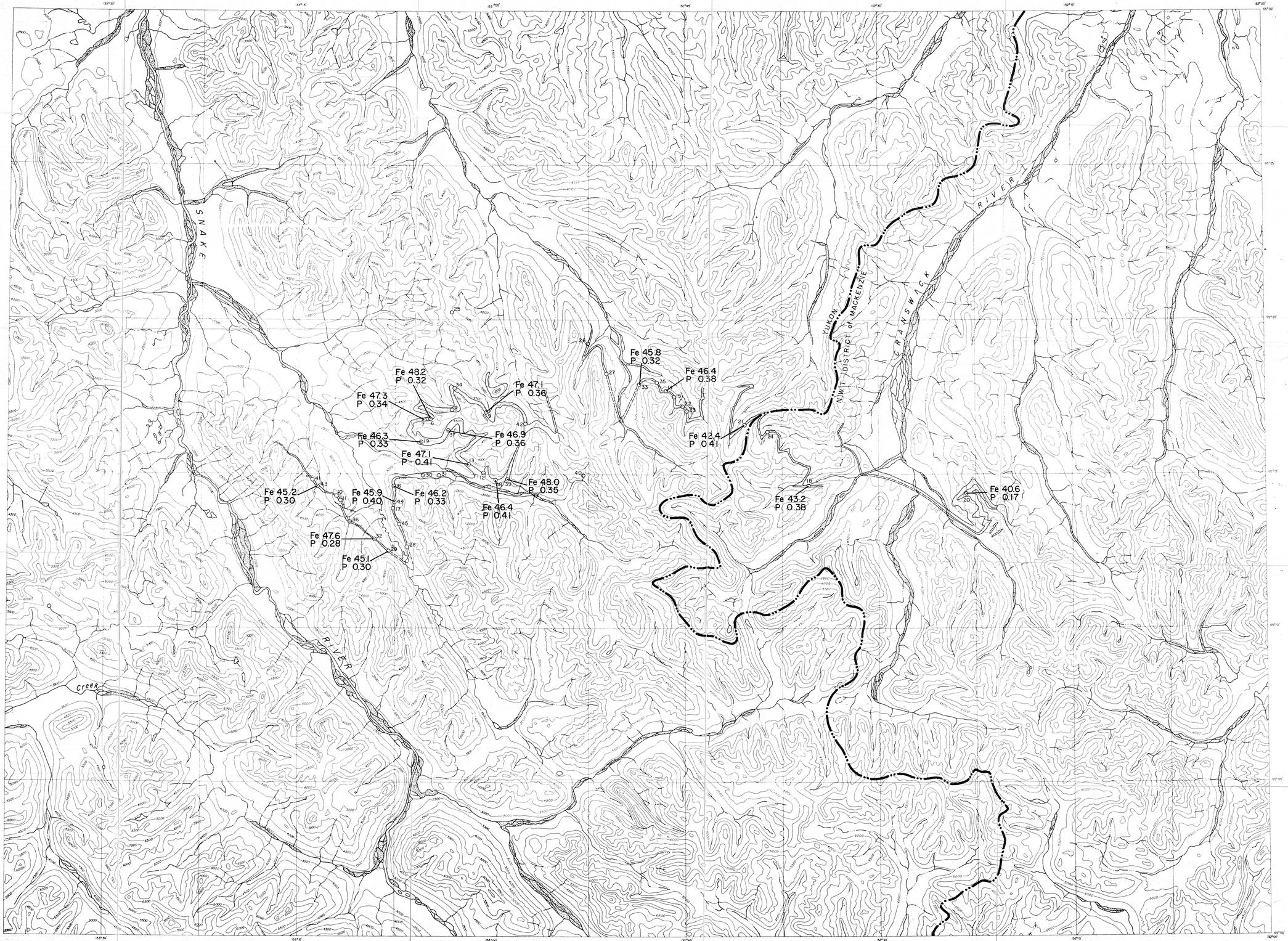


PLATE VIII

CREST. EXPLORATION LIMITED

SNAKE RIVER AREA

AVERAGE IRON AND PHOSPHOROUS VALUES AT SAMPLED SECTIONS

01697

SCALE	DATE	DRAWN
1 INCH = 1 MILE	JULY 26, 1963	