

GEOLOGICAL AND GEOCHEMICAL REPORT

HOWRU MINERAL CLAIMS

Watson Lake Mining District

N.T.S. 105 F - 9, G - 12

Latitude: 61° 35' N

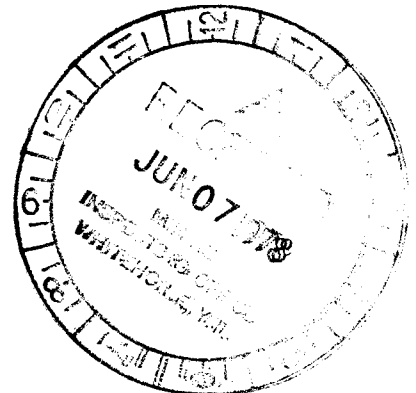
Longitude: 132° 05' W

By:

P. M. DEAN

CYPRUS ANVIL MINING CORPORATION

May 24, 1978



Field Work Done During the Period: July 12 - August 18, 1977.

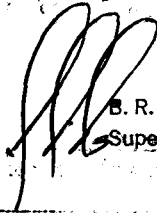
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This report has been prepared by the
Geological Survey and is recom-
mended for publication by the Director

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J. A. Main
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Considered for publication by the
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Per: Commissioner

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LIST OF CLAIMS -- HOWRU

<u>Claim No.</u>	<u>Grant No.</u>	<u>No. of Claims</u>	<u>Recording Date</u>	<u>Due Date</u>
49 - 88	YA21749-YA21788	40	August 16, 1977	August 16, 1978
1 - 40	YA21413-YA21452	40	July 22, 1977	July 22, 1978
41 - 48	YA25732-YA25739	8	September 9, 1977	September 9, 1978

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GEOLOGICAL AND GEOCHEMICAL REPORT

HOWRU MINERAL CLAIMS

INTRODUCTION

The HOWRU claim group, consisting of 88 contiguous mineral claims, is located in the headwaters of Starr Creek at approximately $61^{\circ} 35' N \times 132^{\circ} 05' W$. The claims were staked during July and August of 1977 when a regional prospecting program resulted in the discovery of showings and float occurrences of lead-zinc mineralization. Exploration work on the property, which was carried out under a joint venture agreement between Cyprus Anvil Mining Corporation and Hudson's Bay Oil and Gas, consisted of geochemical sampling and geologic mapping.

Access to the claim group is possible only by helicopter, with the nearest helicopter base being at Ross River, approximately 32 miles to the northwest. The summer road up the Ketz River Valley lies 3 miles west of the property and would be a convenient staging point from which to move camp gear or supplies in to the claim group. A branch road about 4 miles long would be required to connect the claim group to this existing road, should it ever be needed.

SUMMARY AND CONCLUSIONS

Showings and float occurrences of shale-and sandstone-hosted lead-zinc mineralization occur on the claim group. These types of mineralization typically form large, relatively low grade deposits which are suitable for large scale mining techniques. The extent of the occurrences on the HOWRU

claims is virtually unknown at this time, but the favourable economic potential of this type of deposit makes it worthwhile to explore the claim group in a very thorough manner.

In 1977, preliminary geologic mapping at a scale of 1"=1320' was carried out over the claim group and the surrounding area, and geochemical sampling was done on contour lines at the break in slope on the hillsides. Very little work was done on the showings themselves. More work is recommended for 1978, which would be directed toward developing targets for diamond drilling. This recommended work will emphasize more detailed geologic mapping as the major technique, with some minor geochemical and geophysical work.

GEOCHEMISTRY

Soil and silt samples were taken on and around the HOWRU claims on a semi-reconnaissance basis, with samples spaced 300 to 400 feet apart along contour lines following the break in slope on the hillsides. A total of 134 samples were taken as indicated in Figure 3.

Samples were taken below the "A" soil horizon, and were air dried in Kraft paper bags. The -80 mesh fraction of the sample was digested with a nitric-perchloric reagent and analysed using standard atomic absorption techniques. The nitric-perchloric reagent gives a total extraction of metals, including those bound up in silicate minerals. The analytical work was done by Acme Analytical Laboratories at their lab in Ross River, Yukon.

No attempt has been made to treat the results statistically, since it is virtually impossible to separate the samples into populations from uniform geologic environments. As well, more samples have been taken from the vicinity of showings and mineralized float, so the sampling density is biased toward the higher values. If the thresholds for lead and zinc are taken at 100ppm for lead and 200ppm for zinc, which proved to be useable threshold values on the much more widespread regional reconnaissance geochemical survey, then certain anomalous areas are clearly delineated. These anomalous areas

correlate well with known showings and float occurrences of mineralized shale or sandstones, as a comparison of Figure 3 with the geology map clearly indicates.

GEOLOGY

The HOWRU claims are underlain by sedimentary formations varying in age from Upper Cambrian to Triassic. The long span of geologic time represented by these formations can be broken down into three periods in which shallow water shelf sediments were deposited, separated by two periods in which deposition consists of pelagic shales deposited in relatively deep water in euxinic marine basins. Volcanic activity occurs at two levels within this stratigraphic column.

Structurally, the sedimentary pile has been subjected to two periods of deformation, one of which effected only the oldest rock unit on the property. The Kechika Formation has been subjected to isoclinal folding which has resulted in the formation of a strong axial plane cleavage. The Road River formation, of Upper Ordovician to Silurian age, is not folded in this manner, so this period of deformation must have taken place during the Ordovician. All the rock units on the property have been subjected to a younger period of deformation, characterized by thrust faults and open folds. This younger deformation presumably took place during the uppermost Triassic or later in the Mesozoic, since it has involved the Triassic siltstone formation.

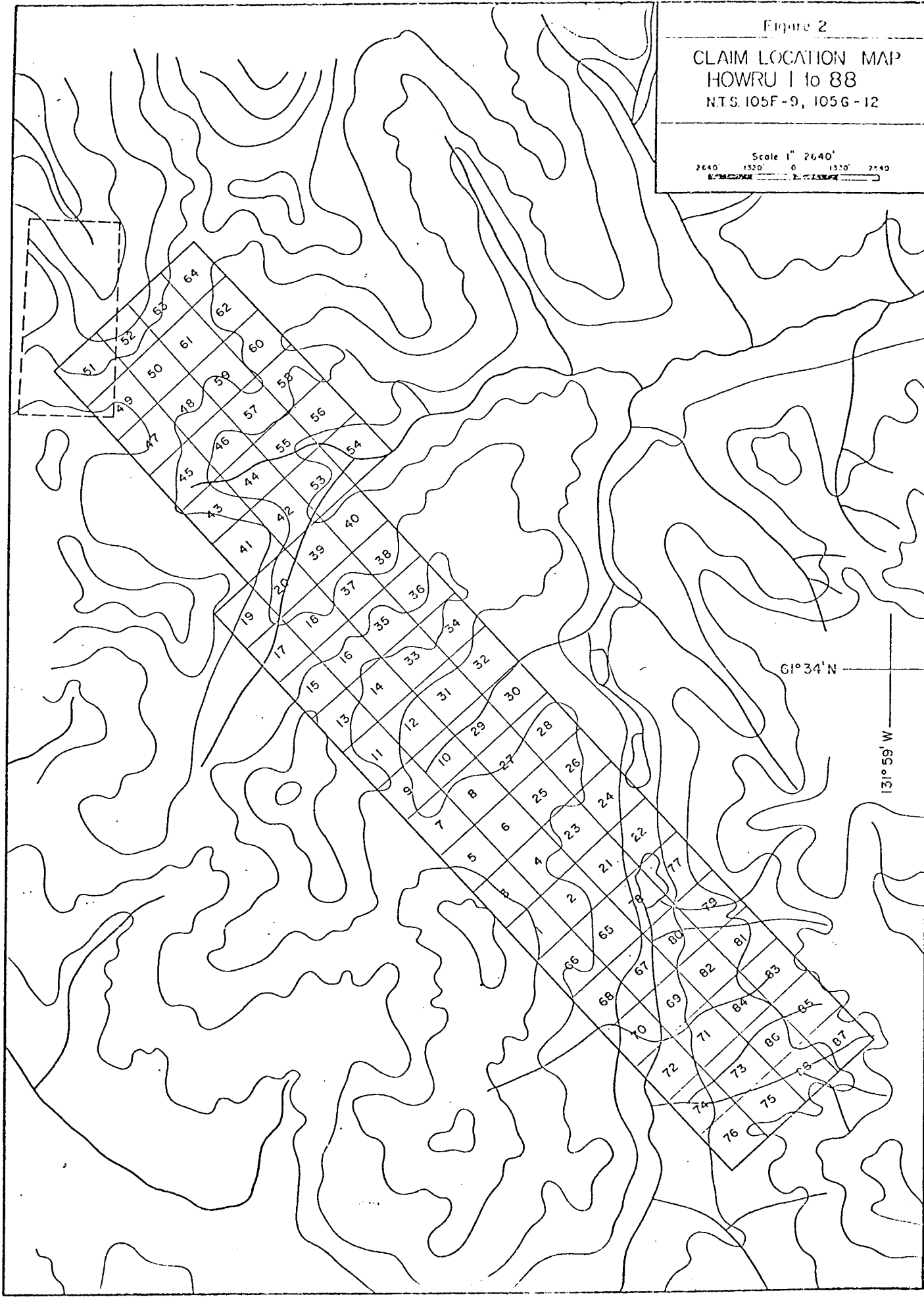
A brief discussion of the map units on the HOWRU claims follows Table 1, which summarized the stratigraphic column present on the claims, and correlates my map units with the formational designations used by the Geological Survey in their regional mapping in the Pelly Mountains.

The mapping carried out in 1977 was done on a rather broad scale, and the age and stratigraphic relationships of some of the rock units are in some doubt. In particular, three problems must be resolved before the geology on the HOWRU can be understood: To start with, the age of the various shale bands

Figure 2

CLAIM LOCATION MAP
HOWRU 1 to 88
N.T.S. 105F-9, 105G-12

Scale 1" = 2640'
2640' 1520' 0 1520' 2640'
N. 105F-9, 105G-12



which cross the property must be determined. The Ordovician Road River shales resemble very closely the Mississippian shales, and the two may not have been accurately distinguished by the 1977 mapping. Secondly, the age of the buff weathering dolomite-sandstone-siltstone formation must be determined. It is tentatively correlated with the Silurian-Devonian age Askin Group, but it may be Mississippian in age instead. Thirdly, the presence and position of thrust faults must be pinned down accurately. Shale bands assumed to be different in the 1977 mapping may prove to be the same bed repeated in successive thrust sheets. These various problems can be solved by detailed stratigraphic mapping, by identification of fossils, and by looking for sedimentary features indicative of "tops". There is sufficient outcrop on the property to resolve these questions, given enough time for the detailed mapping needed. But they are not solved now, and the 1977 geological map at 1"=1320' scale must therefore be considered an approximation.

TABLE 1

GEOLOGIC FORMATIONS

Age	Unit	G.S.C. Designation	Description
TRIASSIC	8	u ^T Rsc	brownish grey siltstone and shale; silty limestone
MISSISSIPPIAN	7	Mva	Lapilli tuffs of felsic composition, variable pyrite content
UPPER DEVONIAN- MISSISSIPPIAN	6	uDms	pyritic, variable siliceous and calcareous black graphitic shale
			<u>ASKIN GROUP</u>
SILURIAN- DEVONIAN	5	SDd Sdq etc	Grey massive dolomite dolomitic quartz sandstone and sandy dm
	4	(uDms)	black shale
			<u>ASKIN GROUP</u>
	3	Sdq etc	buff to orange weathering fine dolomitic sandstone to siltstone, silty dolomite
			<u>ROAD RIVER FORMATION</u>
ORDOVICIAN- SILURIAN	2	OSs1	black very graphitic, pyritic shale
		UNCONFORMITY	PERIOD OF DEFORMATION
			<u>KECHIKA FORMATION</u>
UPPER CAMBRIAN TO ORDOVICIAN	1	u ^{EO} s1v u ^{EO} vb u ^{EO} v	buff to silvery weathering, limy phyllites, chlorite phyllites, amygdaloidal volcanics, dark slates, cherts, and tuffs

The Kechika Formation, Unit 1, consists of a mixed assemblage of sediments and volcanics which now for the most part have been altered to phyllites and greenstones. Typical of the formation are great thicknesses of calcareous, silvery-weathering, pale grey-green phyllites. These phyllites are the metamorphosed equivalents of argillaceous limestones and limy siltstones, and represent deposits laid down on a carbonate shelf of great regional extent. Volcanic rocks make up a very minor part of the Kechika Formation generally, but in the vicinity of the HOWRU property they are abundant. The volcanics are intermediate to basic in composition, and are represented by amygdaloidal flows, breccias, tuffs, and chloritic phyllites probably derived from tuffaceous sediments. No attempt has been made to break the formation down into subunits of the HOWRU claim group.

The Kechika Formation is isoclinally folded, and the younger formations overlie it with pronounced angular unconformity. The deformation and erosion which has effected the Kechika must have occurred during middle Ordovician time, since the overlying Road River shales have been dated on the basis of good graptolite fossils as being Upper Ordovician to Silurian in age. These shales represent a change from carbonate shelf to deep basinal conditions of sedimentation. In the area of the HOWRU claims they contain abundant pyrite and carbon, indicating deposition under euxinic conditions. Elsewhere in the Pelly Mountains, turbidites have been mapped within this formation, which is consistent with deposition in a deep marine basin. Volcanics have also been mapped within the Road River Formation, indicating that volcanic activity had persisted until this time. No volcanics were seen within the formation on the HOWRU claims.

Overlying the Road River shales with apparent conformity is the Askin Group, a sequence of sandstones, siltstones, and dolomites which mark the return of carbonate shelf depositional conditions again. These shelf deposits tend to be predominantly clastics at the base, grading upward into thick bedded dolomites at the top. The Askin Group rocks are massive and competent, and have tended to move as thrust blocks which frequently are found structurally overlying younger rocks. This may be the case on the HOWRU claims, and the shale formations designated as Units 4 and 6 may be thrust slices of the same

shale bed. Units 3 and 5 differ in weathering colour and in amount of clastic material but clearly are part of the same formation. Firm identification of the internal stratigraphy and facies relationships within this unit must wait until more detailed mapping has been done.

The black shales which overlies the Askin Group closely resemble the Road River Formation shales in pyrite and carbon content. In addition, the Askin Group rocks are often found structurally overlying these shales due to thrusting, and when these two factors are complicated by the poor outcropping characteristics of black shales in general, one has many problems in mapping. Unit 6 is clearly Mississippian in age at the northwest end of the property, where it is interbedded with felsic lapilli tuffs which are distinctive and recognizable. Elsewhere, the age of the black shale beds is in some doubt and Unit 4 shales could easily be a thrust repeat of Unit 6, as has been discussed already. Bedded pyrite occurs within these shales, and is sometimes accompanied by base metals, which may also be syn-sedimentary in origin.

Unit 7 interfingers with and overlies Unit 6 toward the northwest. It consists of felsic, pyritic volcanic breccias. Great thicknesses of these volcanics occur to the west and to the southeast, but in the area of the HOWRU claims they thin and wedge out. These volcanics are mineralized elsewhere in the Pelly Mountains, and may prove to be the source of the metals within the black shales on the HOWRU claims.

Where Unit 7 volcanics are absent in the central portion of the claim group Unit 6 grades upward with increasing silt and carbonate content into Unit 8, which has been identified by the G.S.C. as being Triassic in age. Unit 8 typically consists of brownish-grey, relatively incompetent siltstones, silty shales, and grey, thin bedded limestones. These are the youngest rocks exposed on the claim group, and are the youngest sediments known to occur within the autochthonous sedimentary sequence in the Pelly Mountains. They represent once again a return to shallow water marine conditions in which silts and bioturbated, limy muds were deposited under well oxidized conditions close to a paleo-coastline.

MINERAL SHOWINGS

Three distinctively different types of mineralization occur on the HOWRU property. Of least importance are small veins of copper and of sphalerite and galena. These are widespread everywhere in the Pelly Mountains and occur at 3 or 4 locations on the HOWRU claims within the Mississippian shale unit. They will not be discussed further. The second type of mineralization encountered on the claim group is galena disseminated in quartz sandstones. Sandstone-hosted lead deposits are unusual but are not merely a geological freak: several deposits of this type are in production in Europe. The third type of mineralization which occurs on the claim group is shale hosted sedimentary pyrite with traces of galena and sphalerite. Bedded pyrite is relatively common within the Mississippian shale unit, but it very rarely contains any lead or zinc values. The presence of these traces of base metals, including a small lens of nearly pure sphalerite, may indicate the proximity of a shale hosted massive sulphide deposit. The sandstone hosted and shale hosted showings are discussed in more detail in the paragraphs that follow.

A search of the available literature reveals very few examples of sandstone hosted lead deposits. Table 2 summarizes the major characteristics of 6 known occurrences of this type of mineralization. As can be seen, the deposits span the time range from Archean through at least to the Triassic. They are characteristically stratabound within siltstones or sandstones, tend to be very extensive, and tend to be low grade. Typically galena is the only sulphide mineral present, although very minor amounts of sphalerite may occur. An exception to this is the George Lake deposit, in which zinc predominates. Several deposits of this type are being mined in France and in Scandinavia, the largest in Scandinavia being Laisvall in Sweden, with pre-mining reserves of 40 million tons grading 4.4% lead.

Various theories of genesis have been proposed:

- 1) Grip (1967) proposes that the Scandinavian examples were formed when lead was remobilized from Ordovician black shales into structurally overlying quartzites of Eocambrian to Cambrian age.

2) Karup-Moller and Brummer (1970) feel that the George Lake sulphides were precipitated syngenetically as the host sandstone was being deposited. They do not speculate on the source of the lead.

3) Samama (1976) proposes an early diagenetic genesis for the French deposits, with lead leached from Hercynian uplands being precipitated as an internal chemical sediment within the host sandstones between sedimentary cycles. Banerjee and Prakash also favour an early diagenetic age for the sandstone lead deposits at Amjhore, India, as does Willey (1970) for the occurrence in Wales.

So little is known about the HOWRU showings up to now that it would be foolish to speculate on the origin, especially since the age of the host sandstones is still in doubt. If the sandstones are Siluro-Devonian in age, then the setting would be like the Scandinavian deposits, with sandstone being thrust over metal rich Mississippian shales. If the host rocks are Mississippian in age, then the setting would more closely resemble the Indian and French deposits, and may be syngenetic or early diagenetic in origin. The silver-lead ratio in the HOWRU mineralization is the same as in the numerous polymetallic veins related to Mississippian volcanism in the Pelly Mountains; but this in itself does not support either an epigenetic or syngenetic genesis, since in either case the Mississippian shale/volcanic formations are involved as a source of metals.

With respect to the economic viability of this type of deposit, the characteristic large size is offset by the low grades. On the HOWRU most of the talus float material contains only about 1% lead, which probably won't be economic to mine for about a thousand years. However, one piece of float assaying 10.5% lead with 7.6 oz silver was found, providing hope that higher grade sections do occur. The good silver values add a great deal to the potential value of the deposit, since an ounce of silver is roughly equivalent in value to 0.75% lead at current metal prices. In other words, that sample with 10.5% lead and 7.6 oz of silver is equivalent in value to material containing 16.2% lead. Showings and float occurrences of the sandstone hosted mineralization have been found along the strike of the host sandstones for 12km, and lead anomalies occur along strike in both directions beyond that, so there is plenty

of room for a large deposit. The grade will determine whether it has economic possibilities or is just a mineralogical curiosity.

TABLE 2 EXAMPLES OF SANDSTONE LEAD DEPOSITS

DEPOSIT LOCATION and LITERATURE REFERENCE	AGE	HOST ROCK	DIMENSIONS	GRADE	MINERALOGY
South Wales. Willey; 1970	MESOZOIC	marine siltstones	thickness a few mm to 18cm, lateral extent unknown.	very low	GA only
George Lake, Sask. Karup-Moller and Brummer; 1970	ARCHEAN	biotitic quartzites	5 million tons in main body. Intermittently occurs over length of 15 miles.	3% Zn+Pb	7:1 Zn to Pb ratio
Amjhore, India. Banerjee and Prakash; 1975	PROTEROZOIC	sandstones siltstones	average thickness 81cm, intermittently underlies 150 sq km, continuously underlies 5.21 sq km.	0.44% Pb+Zn average in 7 drill holes- Range 0.1 to 5.8% Pb+Zn	Pb Zn low Ag
East border of Calidonides, Scandinavia. Grip; 1967	EOCAMBRIAN to CAMBRIAN	clean quartz arenites	scattered deposits occur over 100's of km. Largest is Laisvall with 40 million tons	Laisvall: 4.4% Pb+Zn others 6.4% and 5.6% combined	Pb Zn
Silvermines Deposit, Cape Breton Island.	PENNSYLVANIAN	terrigenous sandstones with plant debris	6900' x 1000' and open along strike and downdip. Average thickness 37'. ≈ 25 million tons.	3 to 3½ Pb	Pb only
Largentiere, France. Samama; 1976	TRIASSIC	sandstones	several deposits are scattered over a large area. Size of individual deposits is not known.	unknown	Pb Zn, Cu

The second group of mineral showings on the HOWRU occur within the black shales of Upper Devonian to Mississippian age. These shales are extremely black, incompetent, and pyritic, and represent deposition within a stagnant, euxinic marine basin. To the northwest they intertongue with felsic tuff beds related to Mississippian volcanic activity. Pyrite beds within these black shales contain traces of galena and sphalerite, including some remobilized siliceous material assaying 14% combined lead and zinc in grab samples. The shales are so extremely recessive and deeply weathered that it is almost impossible to gain any idea of the nature or extent of these pyrite/base metal sulphide occurrences. At another locality on the claim group weakly copper stained black shales proved to contain 2.2% copper when a grab sample of the shale was analysed geochemically. Similar syngenetic pyrite beds with lead and zinc values occur on Iona Silver's "C" mineral claims 6km west of the showings on HOWRU.

About the only way that these pyritic shales can be tested is through drilling. On surface the shales outcrop at only a few places, and where they do they weather into piles of black soot encrusted with iron sulphates and limonite. Detailed surface mapping may succeed in unravelling the structure so that the shale formation can be drilled in the most economical way, but no amount of surface work would succeed in exposing fresh sulphides.

PROPOSED EXPLORATION

The first and most important requirement on the HOWRU claims is for detailed geologic mapping. It is suggested that this be done over the entire property at a scale of 1:5,000, using an orthophoto at that scale for control. In addition, well exposed sections should be mapped at a much more detailed scale, for example, 1:500, so that lithologies and facies changes within important units can be detected. This detailed lithological mapping will help to reveal the relationship of the disseminated galena with the host sandstones, and may provide some clues toward determining the genesis of the deposit. It may also provide sound stratigraphic control, without which detailed lithochemical or assay work can not be done in the mineralized horizons. Fossils may prove to be important in distinguishing the Mississippian from the Ordovician shale

units and the Silurian-Devonian carbonate-sandstone formations from the Mississippian carbonate units.

Electromagnetic geophysical methods may be a useful aid to mapping the black shale beds beneath the overburden in the valley bottoms. The contrast in conductivity between the graphitic shales and the carbonates and sandstones should be extreme, so almost any type of E.M. system could be used for this work. E.M. would not be of any use for detecting sulphide bands within the black shale beds, since the method cannot distinguish between graphite and sulphides.

Geochemical methods may provide a little more information by carrying out detailed soil sampling surveys over some of the anomalous areas which are poorly defined by the 1977 work. This detailed soil sampling can be carried out on chained compass lines tied into the 1:5,000 scale orthophoto. Lithogeochemical profiles in the shales and in the sandstones may also provide useful data, if good enough stratigraphic control can be established.

Ultimately, diamond drilling will have to be done to test the base metal occurrences in the shales and the sandstones. Only through diamond drilling can accurate assay data be obtained, and only drilling can provide fresh unweathered samples of the shale for examination.

Respectfully submitted,

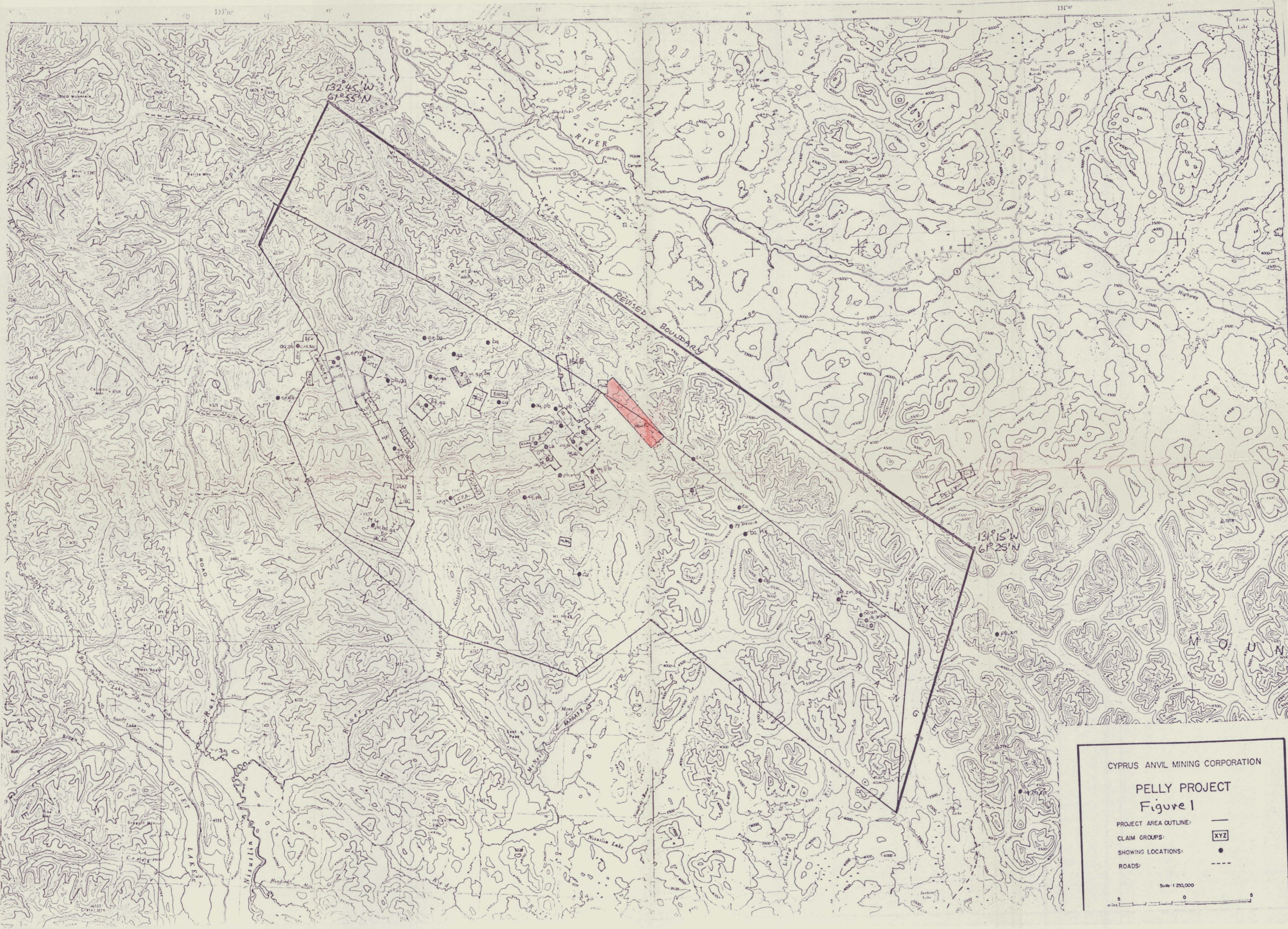


PETER DEAN.

May 24, 1978.

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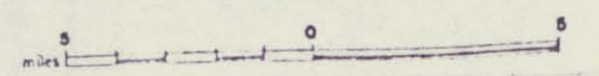


CYPRUS ANVIL MINING CORPORATION

PELLY PROJECT
Figure 1

- PROJECT AREA OUTLINE: —
- CLAIM GROUPS: [XYZ]
- SHOWING LOCATIONS: ●
- ROADS: - - -

Scale 1:250,000





CYPRUS ANVIL MINING CORPORATION

PELLY PROJECT

GEOCHEMICAL VALUES MAP
KETZA RIVER DETAIL
I05F-9, I05G-12

<p>DESIGNED BY: PETER M DEAN DATE: AUGUST 31, 1977</p> <p>SCALE: 1" = 1320 FEET DRAWN BY: CHARLES E. GORY</p>	<p>FIGURE 3</p>
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GEOLOGIC FORMATIONS		
Age	S.S.C. Designation	Description
TRIASSIC	8	8Tbc BROWNISH GREY SLTSTONE AND SHALE, SILTY LIMESTONE
MISSISSIPPIAN	7	7Mw LAMPLU TUFFS OF FELSIC COMPOSITION, PYRITIC
	6	6UWm PYRITIC, VARIABLY SILICEOUS AND CALCAREOUS BLACK GRAPHITIC SHALE
UPPER DEVONIAN - MISSISSIPPIAN	ASKIN GROUP	
	5	5Gd GREY MASSIVE CALCAREOUS DOLOMITIC QUARTZ SANDSTONE AND SANDY GR.
	4	4UWm BLACK SHALE
	3	3Sd BUFF TO ORANGE WEATHERING FINE DOLOMITIC SANDSTONE TO SLETTONE, SILTY DOLOMITIC
SILURIAN - DEVONIAN	ASKIN GROUP	
	2	2OSd BLACK VERY GRAPHITIC, PYRITIC SHALE
ORDOVICIAN - SILURIAN	ROAD RIVER FORMATION	
	1	1KCHK PERIOD OF DEFORMATION KECHIKA FORMATION
UNCONFORMITY	PERIOD OF DEFORMATION	
	KECHIKA FORMATION	
UPPER CAMBRIAN TO BROOKTON	1	1UWm BUFF TO SILVERY WEATHERING, LUMP PHYLITES, CHERT, PHYLITES, AMPHIBOLITE, WELONS, DARK SLATES, CHERT, AND TUFFS
	1	1UWm

CYPRUS ANVIL MINING CORPORATION

PELTY PROJECT

GEOLOGY HOWRU AREA
105F-9, 105G-12

SAMPLE SITE
 DATED 10/19/77
 SAMPLE NUMBERS
 SAMPLE
 DATE (SECRET) T. 977

DESIGNED BY: PETER M. DEAN
 DATE: AUGUST 21, 1977
 SCALE: 1" = 320 FEET
 DRAWN BY: CHARLES L. CORY

FIGURE 4