



# EXGALIBUR INTERNATIONAL CONSULTANTS LTD.

1522 Clearwater Drive, Mississauga, Ont., Canada L5E 3A3 • Tel. (416) 278-1545

EVALUATION OF GRAVITY DATA

HULSE LAKE AREA, YUKON TERRITORY

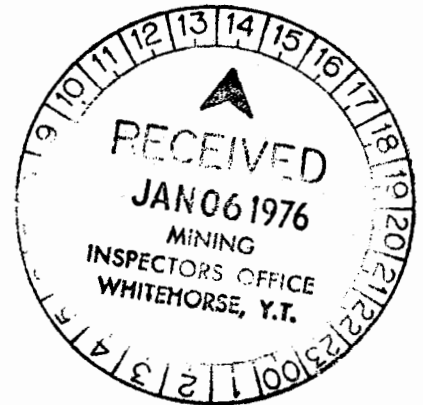
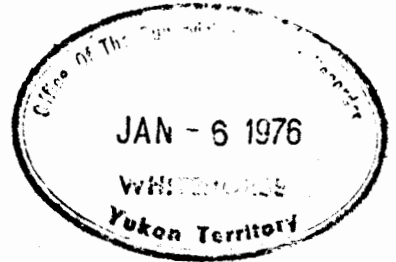
FOR

NORANDA EXPLORATION LIMITED

(Walter Sharpe, Contractor)

BY

J. B. Boniwell



EXPLORATION GEOPHYSICAL CONSULTANT

This report has been examined by the  
Exploration Unit and is recom-  
mended to the Board of Mines to be consid-  
ered as representation work in the amount of

\$ 9502.17

Resident Geophysicist or

Resident Mining Engineer

- September 1, 1975 -

Considered as representation work under  
Section 53 (4) Yukon Quartz Mining Act.

B.R. BAXTER

Supervising Mining Recorder

for Commissioner of Yukon Territory

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LIST OF DRAWINGS

<u>DWG. NO.</u>	<u>TITLE</u>	<u>SCALE</u>
EIC - 135	Stacked Bouguer Profiles	1"=400'
EIC - 136	Regional Gravity Contours	1"=400'
EIC - 137	Residual Gravity Contours	1"=400'

Instrument used:

Worden-type gravimeter, model WS 410, serial number 104,  
with a calibrated sensitivity of 0.10105 mgals/scale division. Instrument  
manufactured by W. Sodin Limited, 211 Hendon Ave., Willowdale, Ontario, M2M 1A9.

## INTRODUCTION

Renewed investigations by gravimeter have been undertaken in the Hulse Lake area, approximately 42 miles NE of Watson Lake, Yukon Territory in an endeavour to assess the wider ore-making potential of the meta-sedimentary setting there that contains the earlier discovered Macmillan sulphide deposit. The latter is a strata-bound mineralization typically represented by grades averaging 6% Pb, 9% Zn, 3.0 ozs. Ag and a tonnage amounting to 1.5 million.

The present investigation embraces the Macmillan occurrence but is not central to it; nor is this a simple repeat of any preceding survey although overlap is implicit. Based on a larger grid, the newly collected data (summer 1975) are treated for themselves and herein evaluated and reported on independent of any previous gravity coverage.

## DESCRIPTION OF DATA

The gravity field data involved in this study have been collected under contract by Walter J. Sharpe, geophysical surveyor of Toronto, Ontario. All the preliminary collation, processing and compilation of data to the Bouguer values have been undertaken by him, and the results are accepted as real and in good order.

The determined Bouguer equivalents for the observed gravity values, it has been pointed out, have been derived from an assumed environmental rock density of 2.74 gms./cc. This figure in fact is the overall average of a suite of 87 density determinations made from actual drill core specimens at the Macmillan site. Using such a figure nevertheless is probably erring a fraction on the high side, not because of sulphides or undue alteration which can be avoided, but because of the in-situ effects of fracturing and weathering in the near-surface and of overburden (which can range in thickness from virtual zero to 200' plus), none of which circumstance can be truly duplicated by hand specimen measurement. The present evidence suggests a density closer to 2.60 gms./cc. as being more representative of true near-surface conditions; however no revision of the calculated data has been made on this basis for the very good reason that the refinement involved is simply not worth the effort within the governing context of a semi-reconnaissance survey.

By appearances (Dwg. No. EIC - 135), the Bouguer gravity data contain noise, that is, they do not constitute as smooth a set of profiles as might be hoped for in the circumstances. Aside from the occasional obvious erratic, there is an incidental ripple which at most times is confined within an envelope up to 0.20 mgal. wide; but these effects are minor and quite manageable compared to what might be referred to as the general lumpiness of the gravity background, a region of change which includes most notably a number of abrupt breaks in relief, e.g. at 15E on line 16S, at 44E on 4N, 48E on 28N, 25E on 36N. These latter are not orderly gravity changes and in consequence they cast something of a shadow over the data. Their causes, and there are almost certainly several, can not

be individually sorted out, and so long as they resist identification there will always be doubt as to what is real and what is not. However while it is possible to put some of this noise down to operationally induced errors either in the actual gravimeter reading or the levelling measurement as they were collected in the field, clearly the greater proportion belongs to the environment. Indeed because of the range of environmental factors present the man-caused effects may well be minimal. Terrain influences clearly are substantial in places, and may be important in sectors not even now recognizable, particularly in the close distances about a station. There are suggestions that the near-surface condition of the bedrock is significantly affecting the gravity reading, most likely as a weathering differential but possibly on occasion by solution cavity or karsting. In addition there are the normal contributions that a changing lithology plus structure must be expected to introduce to some extent or another, and finally, and far from least is the ever-bearing overburden component as this changes with cover thickness and constituency.

With all these effects variably superimposed one on top the other, it is hardly surprising that the local background should be lumpy even to the point of including the sharp break, suspect as these must remain. It is also clear that the impressed factors operate on several scales, from the very local to the quasi-regional; and it is for this very potent reason that no filtering of the data has been attempted, except through the modest smoothing inherent to the contouring operation. In the Bouguer presentation (Dwg. No. EIC - 135), the primary data are thus shown, warts and all.

Implicit to the above of course is the fact that what follows in the way of interpretation can be no better or worse than the quality of the supplied results on which it is based. Inevitably there will be a need for some check work before it can be ascertained with some authority what subtleties in geologic information there are that can be extracted reliably from the data. For the moment, the priority is to determine where the probabilities for massive sulphides lie, and from them to assess what potential the general setting has for further exploration and discovery.

## PROCESSING OF DATA

From the Bouguer plots (Dwg, No. EIC - 135), the data have been evaluated for their regional component versus those residual effects which promise relatively local significance. This is a subjective process inherently, for it always has to be decided what should be consigned to the regional and what not, and on this score it is often the target type-signature sought that will settle the issue. In the present case, while steeply dipping massive sulphide occurrences unmistakably form the primary goal of the extraction process, the reduction to the residual is compounded by terrain effects, the other undifferentiated elements of noise, and most importantly by the lack of any strong over-riding pattern from deep or external mass contrasts. In short, it is difficult to establish a regional gravity for this area.

In consequence each traverse line of data has tended to be treated for itself, particularly as the interval between traverses varies from as low as 200' to a high of 800' across the grid. The individual regional profile so selected deliberately attempted in each case to take in as much of the obvious terrain effects along the line as it could, the end-product then being matched up as near as possible with the regional curves similarly obtained for the adjacent line neighbours. All this processing was done graphically, and to effect it conveniently all plots were brought to a scale in plan of 1"=400'. The individualistic character of the regional gravity eventually so established for the area shows up in the final contour presentation (Dwg. No. EIC - 136). The latter is in fact a pot-pourri of effects and the usual elements of lithology and structure which it is hoped will emerge here are in this instance rather lost to the competing influences of terrain.

This however is a small price to pay for the gaining of an authoritative plan of residual gravity. This it is believed has been accomplished. In it

(Dwg. No. EIC - 137), the bulk of the larger scale effects have been removed, and by omitting the zero contour and all negatives, near-surface noise and relic terrain components have either been minimized or excluded, at least visually. The discussion that follows then is based almost exclusively on this plan and the potential significance of its results.

## DISCUSSION OF RESULTS

While the solid attempt has been made to absorb most of the terrain effects into the regional as noted, it is inevitable that a certain proportion must remain outside its compass. A consequence of this circumstance is that there could exist positive residual shoulders around the more sharply resolved gravity lows brought about by terrain. The supreme example of this appropriately is provided by the highest topographic peak within the grid area, viz. at 21E on line 00 and its environs. It is to be noted that the regional low centred on this locality is surrounded by a halo of positive residual gravity comprising Anomalies A, B & C and several lesser events. All the involved features are of modest tenor, and it is unlikely therefore they hold any significance over and beyond their presently cited cause. By the same token, Anomaly G and separately, parts of D & F can be ascribed to similar derivations. This means that sub-surface geology is not being represented by these anomalies, totally in the first case, partially in the others, and that they should be discounted correspondingly.

On the other hand there is a number of quite positive features in the plan of residual gravity that deserves close consideration. The sector that manifestly is the most anomalous is that occupying the north-west quadrant of the grid area and here there appears several inter-related highs reaching in excess of 0.5 mgal. amplitude. These expressions (all identified as Anomaly H) together form the focus of much of the past drilling in the area and include the Macmillan mineralization. It is very evident from their make-up that the mass sources underlying are liable to be spotty and broken up, and this is true despite the overprint of local noise on the anomaly signatures. With some 100 drill holes completed in this vicinity however it is a somewhat futile exercise in dissecting the gravity relief therein for whatever extra detail it might be reliably induced to supply: the drilling results by all the odds must be presumed the more factual, and the one real value the gravity data retain in the circumstances is their implicit ability to determine what, if anything the drilling has missed. Obviously such reconciliation can only be made with full possession of all

recorded drill hole information and such is not here available. In any event the gravity coverage clearly is not as complete as it could be here to properly define the local bodies of excess mass present; notwithstanding it is possible to make an overall tonnage estimate if it is assumed that the material involved is made up of a typifying sulphide assemblage yielding a density of 3.92 gms./cc. (7% PbS, 13.5% ZnS, 30% FeS<sub>2</sub>). For such mineralization the gravity anomalies in this sector aggregate 9.5 million tons independent of body dimensions.

If this be the known, and presuming the gravity coverage has been applied: primarily to seek the detection of the unknown, then the anomaly that most closely approaches the Anomaly H significance to mineralization is Anomaly J. In itself the most startling anomaly of the survey, certainly the strongest, it lies in the south-west corner of the area on overt strike with the Macmillan zone but separated from it by over 6000'. On line 32S, it is a superbly resolved anomaly peaking to 1.15 mgal. in local relief. This is the kind of expression that virtually can only be due to massive sulphides in the relative near-surface. Inexplicably therefore while the intermediate line 34S was surveyed to one side in patent recognition of the anomaly's importance, no equivalent line was run to the other (north) side; indeed the nearest line in this direction is 800' away. This leaves a certain imbalance in the areal definition. Notwithstanding, and again taking the 3.92 gms./cc. density figure prescribed for the likely sulphides, a tonnage of 3.8 million can be projected directly from the excess mass displayed. A brief analysis of the premier response on line 32S indicates a substantial source width in the order of 100' lying under a shallow 25' cover. Assuming steep dips and continuity in depth, such a disposition provides a compatible amplitude in (residual) gravity with that observed but not a fit with the tonnage estimate. On-strike maintenance of these dimensions hence can not be projected; on the contrary all the evidence suggests a splintering and petering out of the mineralized zone(s) in both directions from the line 32S centre. Indeed if there is one visual aspect that characterizes this Anomaly J, it is that it is so obtrusively composed of two directional components, one bearing NNW, the other north-east; the

anomaly as outlined in fact looks something like a star-burst. While rather deleterious to its coherence, these two near-orthogonal lineaments are likely to bear strongly on the anomaly's mineral connotations. If it can be taken that the generally NNW striking element is formational and stratiform, then the north-east is transgressive and structurally controlled. This infers that the underlying mineralization is influenced by both geologic factors, it occupying favourable strata and available lines of weakness as it was introduced and possibly remobilized in the environment. Whether the mineralization is essentially syngenetic or epigenetic, multi-stage or single stage remains an enigma.

All these aspects must have a bearing on drilling. Reportedly three diamond drill holes have already been put down in this locality and some massive sections of pyrite were encountered. Reports also have it that a 9' section averaging 2% copper was likewise intersected. What is not known is the evidence the drilling was based on, the actual hole locations, and the full results of the logging undertaken. The two elements suggested by gravity and their implications to mineral distribution may well have not received an adequate testing.

Empirically however it seems important that both factors be present and where they come together, the best mineralization is liable to occur. If this so dramatically appears the case for Anomaly J, it can also be perceived on second look in the preceding Anomaly H, for the signs of a similar marriage of like components are present there also. But going beyond these two anomaly features into the rest of the grid area, the case seems to be either one or the other but not both. The two trends re-appear from place to place through the region but not clearly again in consort unless it be the two anomaly fingers designated Anomalies E and F coming together on line 36N at about 46E. If this indeed is an exception as purported, it is a major one. It offers to exploration a target feature as big as, if not bigger than the Macmillan anomaly system.

The heart of this new possibility lies in the very broad anomaly that can be construed to exist at 46E on the line 36N section; however this is so broad and gently resolved a gravity relief that it has been assigned to the regional background where normal probabilities suggest it belong. If, on the other hand it can be shown that it more properly relates to the Anomalies E and F, or even to just one of them, it should be resurrected as an active sulphide bet, which means of course revising the regional gravity projections in the vicinity. If the anomaly should be so rehabilitated, the characteristics attendant upon it imply a depth of burial in the order of 100' and an effective plunge thereby to the south for the system. It should be noted in this respect that topography alone, rising as it is to the south by roughly this amount could account for the apparent deepening involved.

For the moment however it remains for the necessary line-to-line relationship in gravity to be proven before the conceived system and Macmillan analogy becomes valid. To accomplish this, logical first attention should be given the peak centres of Anomalies E and F themselves. Both occur on line 44N. Each in their turn represent promising excess mass concentrations in the relative near-surface consistent with local massive sulphide occurrences. Substantial widths and tonnages could be inherent to them as they stand e.g. 50' - 100' widths and up to 2.0 million tons of camp grade material. Much more is possible and this ought to be quite a sufficient motivation for their individual testing; nevertheless the probabilities of the sought extensions can be readily defined by additional gravity traversing on those intervening 400' lines not yet surveyed in this general locality, and such determinations could be a definite asset to planned drilling here.

Another individual mass expression that falls into the category of probably expressing sulphides is Anomaly K resolved at the northern extremity of the grid area. It too infers a locally significant incidence in much the same order as Anomalies E and F. However as an anomaly it clearly suffers from the

incompleteness of its strike definition although its remaining open to the north does hold out the promise of an unknown size potential. To the south, this anomaly shows a disposition to tie in with a fairly extensive system of positive gravity all lumped together as Anomaly L. Whether the link is real and of mineral significance is uncertain and again some additional gravity coverage, specifically along line 48N could be most informative. Notwithstanding Anomaly L by and large is not a feature displaying much character and its several internal peakings are never really strong enough nor clean enough to rise above the interfering possibilities of being part of background. One of the more credible resolutions, viz. at 16E on line 44N also happens to be one of the weaker, for instance. In the face of the several manifestly more interesting events elsewhere in the grid area, all Anomaly L must perforce be downgraded. Still it can not be entirely ignored, and its place in the stratigraphy, and its potential for mineralization should at some time be assessed.

The two remaining anomaly systems in the region, Anomalies M and N, are difficult to warm to. The one, Anomaly M, faithfully follows the flank of a locally steep gravity trough reflecting the effect of a relative mass deficiency along a line of sharp topographic change, while the other is so mild and at the same time so without believable adjacent line support it resists classification. Anomaly M for all that is remarkable in that, unlike its seeming relatives Anomalies A, B, C, D & G also sitting on the flanks of gravity lows as earlier discussed, appears to have a cause distinctly its own. It is in the first place a very continuous and relatively narrow system; in the second, it is near-linear in its strike behaviour but hewing to neither of the regional trends already noted. Since it is following a topographic lineament, the chances are that it is symptomatic of a governing fault structure throwing different lithologies against each other. Assuming a contrast in densities, their abrupt juxtaposition is liable not to be fully compensated for by the regional gradient taken as prevailing. Interesting as this might be to the general geology of the area, there is no mineral potential directly held to be present. This however is not entirely true of Anomaly N which so long as it remains unexplained must be given an outside chance of representing sulphides. Only additional work in this sector will sort out the realities.

## CONCLUSIONS AND RECOMMENDATIONS

It can be concluded, despite the irregularities impressed on the data by terrain, by near-surface conditions, and perhaps even by untoward operational errors, that the gravity surveying undertaken in this geologic environment has been significantly effective. While it is not possible in the absence of detailed geology for the grid area and also of the large amount of information supplied by drilling to say realistically to just what degree gravity has defined the known, it can be guessed that in detecting the hitherto unknown, it has exceeded its original hopes. Clearly the method has come up with a number of new worth-while target anomalies including one outstanding gravity response that almost certainly reflects a massive sulphide body in the near-surface (Anomaly J).

It is recommended in consequence that investigations continue to be extended to the area. Obviously these should be conducted on several fronts but the weight of the recommendation is that they should in the near-future focus primarily on the gravity implications. Specifically Anomalies J, K, E and F deserve explanation as a matter of priority which includes their drilling, yet importantly at the same time it needs be recognized that by all normal standards of exploration for steeply dipping tabular sulphide bodies, not one of these four anomalies can be said to be completely defined. Thus the recommendation is broken up into two successive parts, the first concerning itself with that additional gravity surveying to fill in the gaps of knowledge requisite to an optimum test drilling, the second with the drilling itself.

At this point since the second stage is conditional upon the first, it is the required extra traversing only that is laid out:

line 28S from 15W to 15E  
line 20S from 15W to 15E  
line 8N from 36E to 56E  
line 16N from 36E to 52E

line 32N from 36E to 64E  
line 40N from 32E to 60E  
line 48N from 16E to 68E  
line 56N from BL to 52E  
line 64N from BL to 28E  
line 68N from BL to 28E

The sum total of this extra gravity traversing is roughly 6 line miles, not a large amount. Additionally some check work of past results desirably ought be undertaken and the suggested sections for this are;

line 4N from 40E to 52E  
line 36N from 16E to 28E  
line 52N from BL to 28E  
line 60N from 5E to 20E

An extra 1.2 line miles are involved thereby.

While these specifics in gravity work are designed to meet an immediate need, they should not be allowed to obscure the basic thrust of the encompassing recommendation and that is that the eventual drilling of the presently favoured gravity features is herein considered mandatory.

Finally in a look ahead to beyond the current results, it is not being unreasonable to suppose that widened applications of the gravity method in the environment could prove as powerful and as rewarding an exploration tool as it potentially has here.



JBB:sm

September 1, 1975

J. B. Boniwell

Exploration Geophysical Consultant

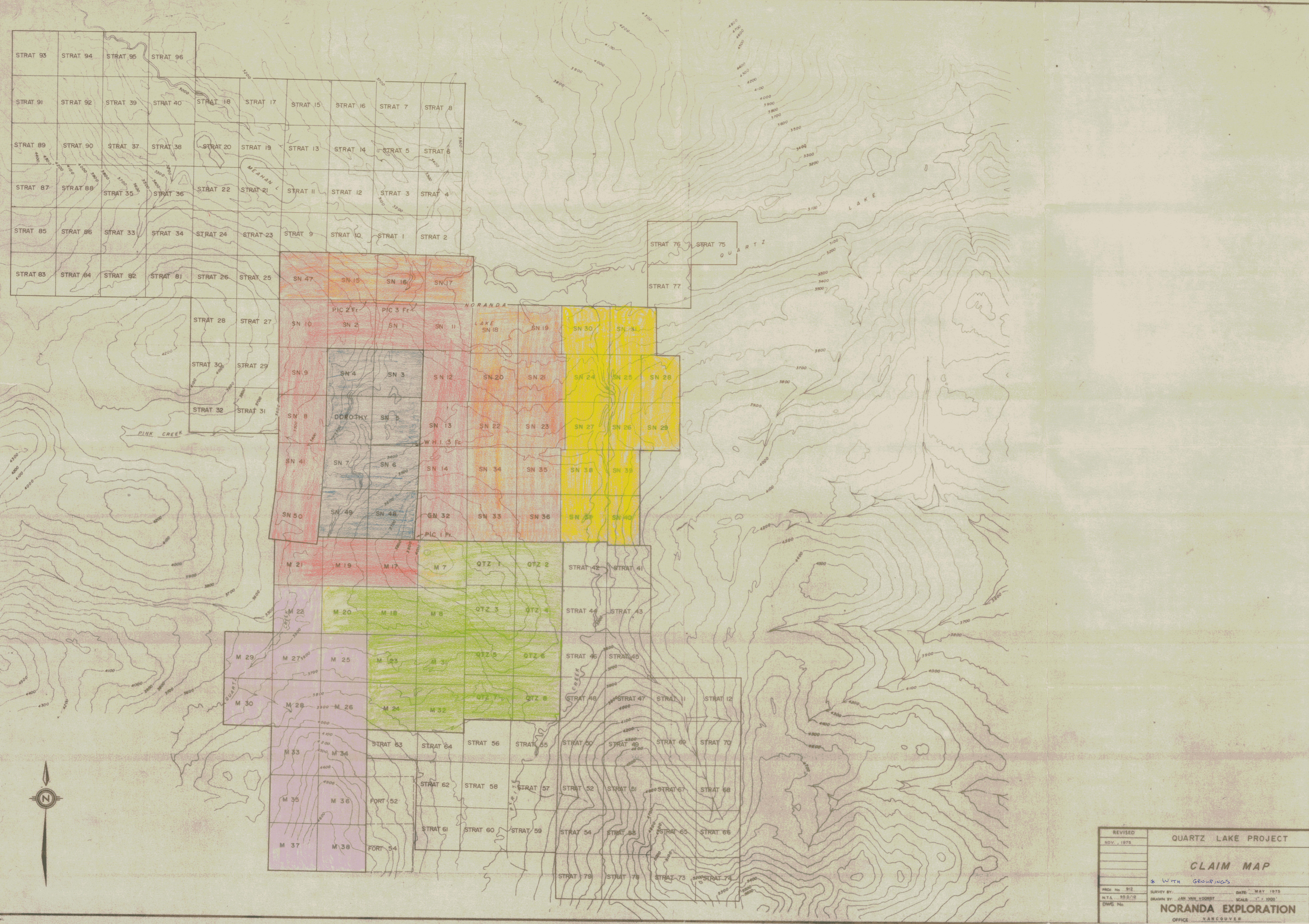
CLAIM STATISTICS

<u>Claim Name</u>	<u>Grant No.</u>	<u>Owner</u>
South Nahanni #1	57465	Liard Copper Mines Ltd.
South Nahanni #2	57466	"
South Nahanni #3	57467	"
South Nahanni #4	57468	"
South Nahanni #5	57469	"
Dorothy	57470	"
South Nahanni #6	57471	"
South Nahanni #7	57472	"
South Nahanni #8	57550	"
South Nahanni #9	57551	"
South Nahanni #10	57552	"
South Nahanni #11	57553	"
South Nahanni #12	57554	"
South Nahanni #13	57555	"
South Nahanni #14	57556	"
South Nahanni #15	57580	"
South Nahanni #16	57557	"
South Nahanni #17	57558	"
South Nahanni #18	57559	"
South Nahanni #19	57560	"
South Nahanni #20	57561	"
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South Nahanni #36	60058	"
South Nahanni #37	60059	"
South Nahanni #38	60060	"
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South Nahanni #40	60062	"
South Nahanni #41	60063	"
South Nahanni #47	60069	"
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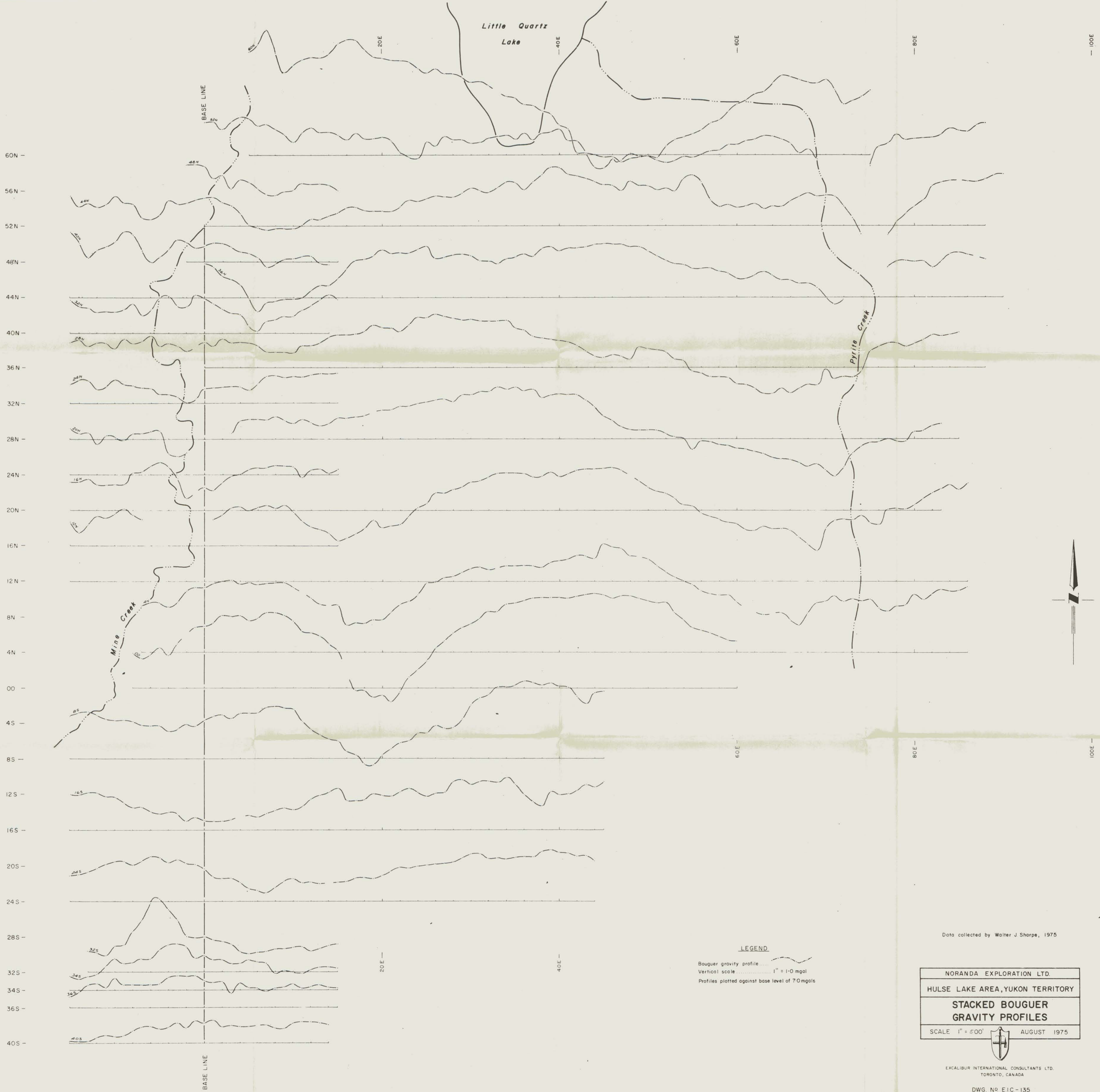
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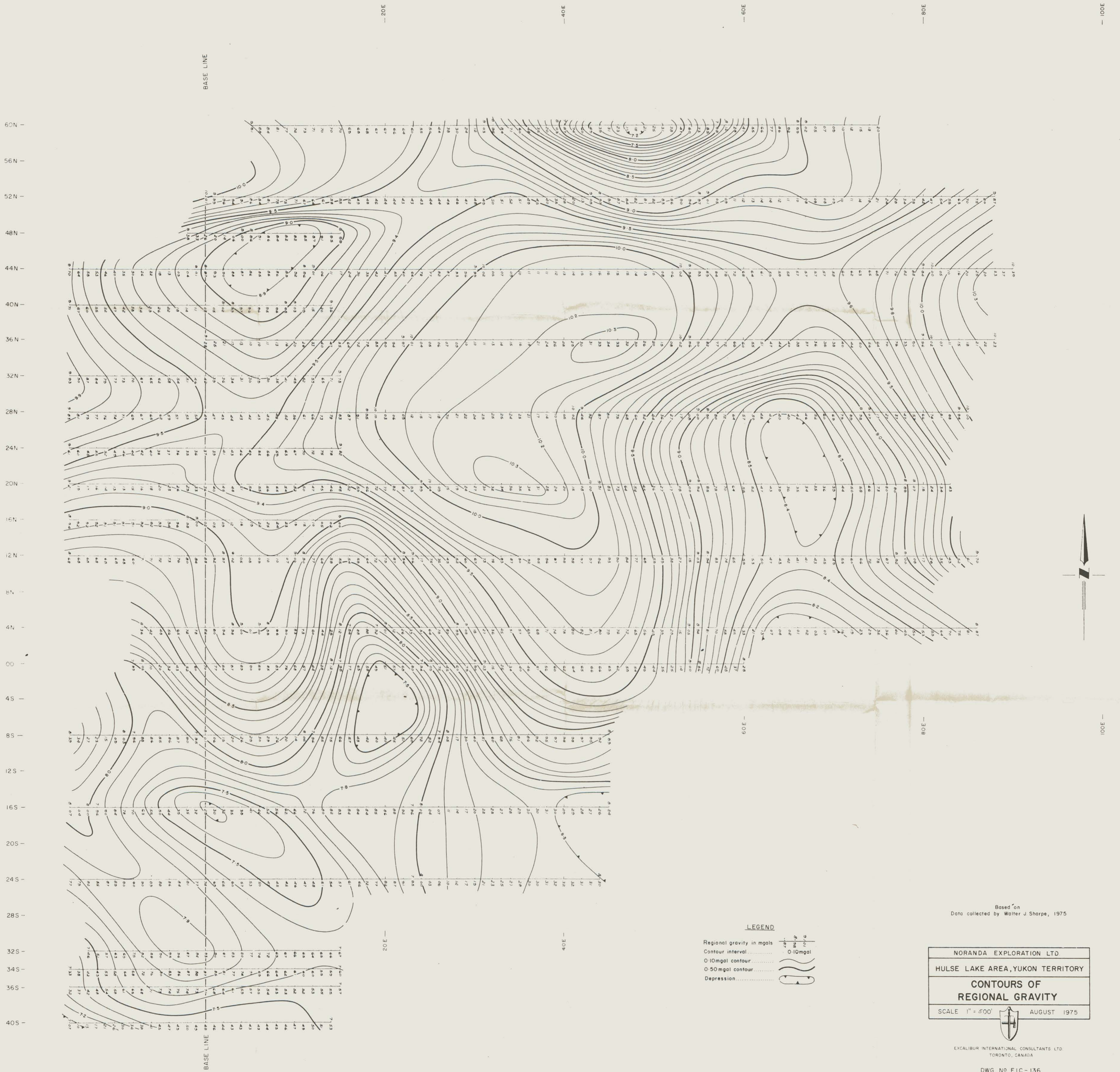
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M. #7	69450	Asarco
M. #8	69451	"
M. #17	70364	"
M. #18	70365	"
M. #19	70366	"
M. #20	70367	"
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M. #26	70460	"
M. #27	70461	"
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M. #38	70652	"
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Pic 3 Fr	Y72517	"
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QTZ #2	Y84113	"
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QTZ #5	Y84116	"
QTZ #6	Y84117	"
QTZ #7	Y84118	"
QTZ #8	Y84119	"





REVISED	QUARTZ LAKE PROJECT	
NOV., 1975		
	<b>CLAIM MAP</b>	
	* WITH GROUPINGS	
PROJ. No. 912	SURVEY BY: _____	DATE: MAY 1975
N.T.S. 85/2/12	DRAWN BY: JAN VAN VOORST	SCALE: 1" = 1000'
DWG. No.	<b>NORANDA EXPLORATION</b>	
	OFFICE VANCOUVER	





Based on  
Data collected by Walter J Sharpe, 1975

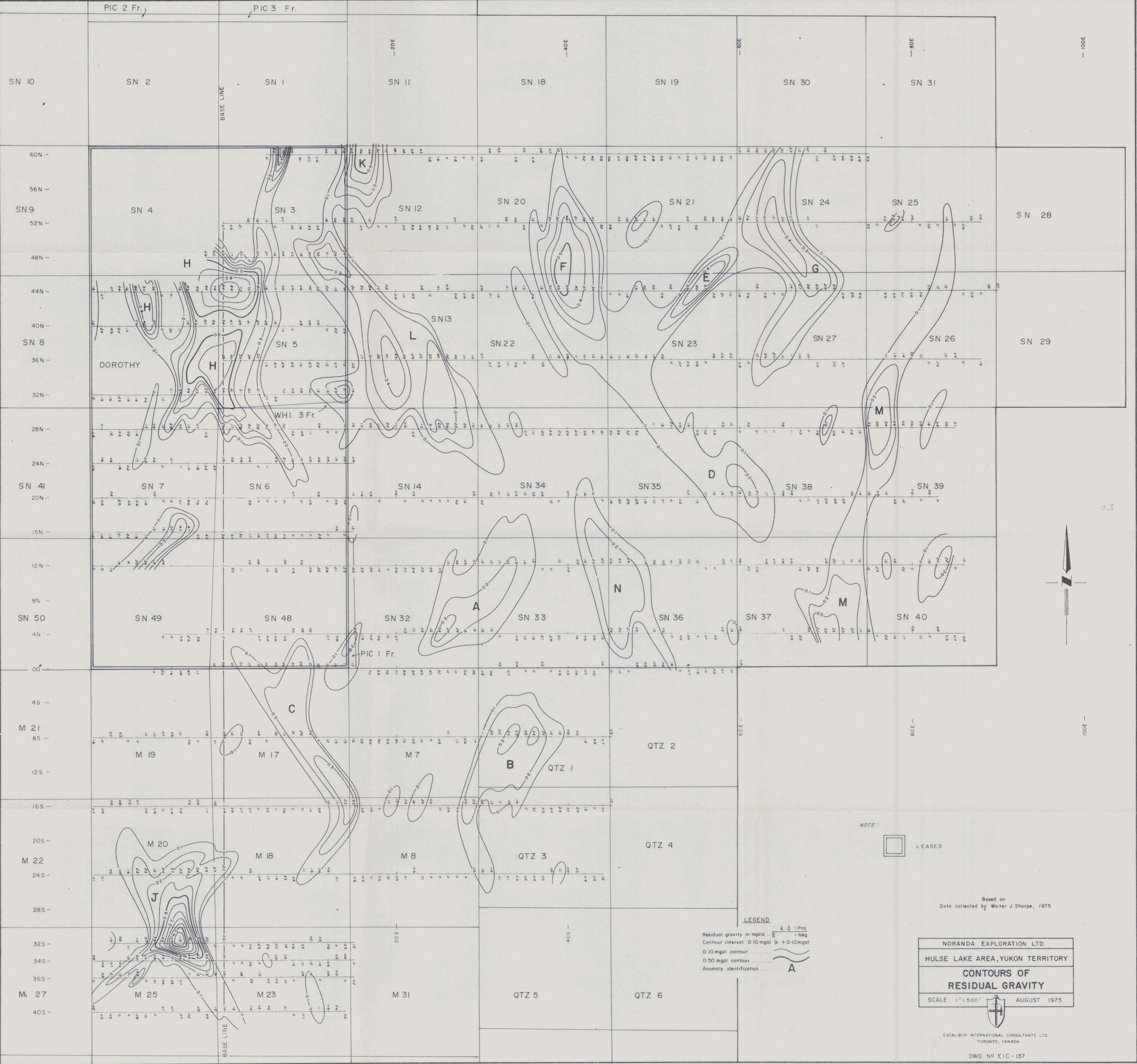
**LEGEND**

- Regional gravity in mgals
- Contour interval
- 0.10mgal contour
- 0.50mgal contour
- Depression

NORANDA EXPLORATION LTD	
HULSE LAKE AREA, YUKON TERRITORY	
<b>CONTOURS OF REGIONAL GRAVITY</b>	
SCALE 1" = 500'	AUGUST 1975

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TORONTO, CANADA

DWG. No EIC-136

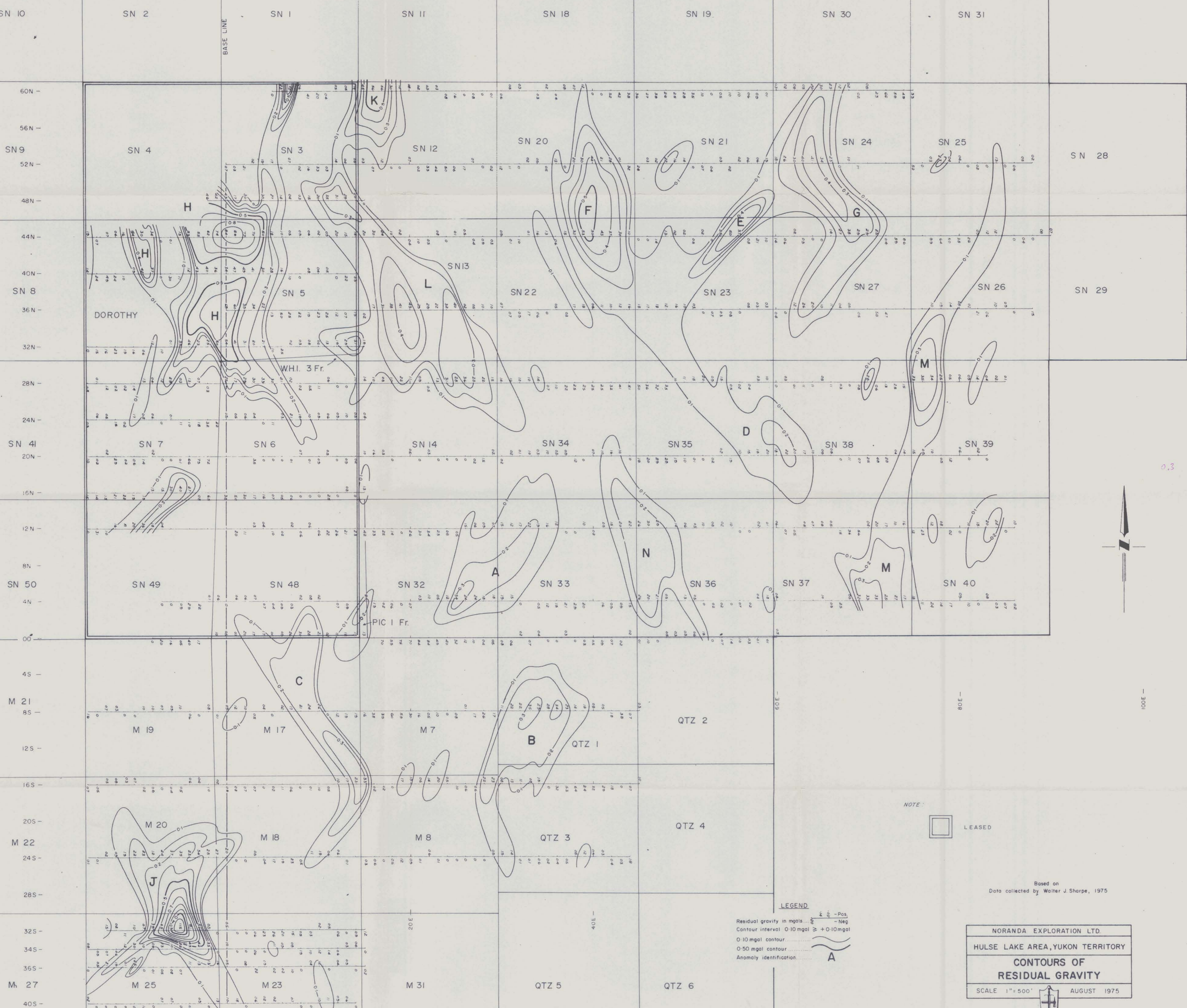


PIC 2 Fr.

PIC 3 Fr.

BASE LINE

BASE LINE



NOTE: LEASED

**LEGEND**  
 Residual gravity in mgals...  $\pm$  Pos - Neg  
 Contour interval 0.10 mgal  $\nabla$  +0.10 mgal  
 0.10 mgal contour  
 0.50 mgal contour  
 Anomaly identification **A**

Based on  
 Data collected by Walter J. Sharpe, 1975

**NORANDA EXPLORATION LTD.**  
**HULSE LAKE AREA, YUKON TERRITORY**  
**CONTOURS OF RESIDUAL GRAVITY**  
 SCALE 1"=500' AUGUST 1975

EXCALIBUR INTERNATIONAL CONSULTANTS LTD.  
 TORONTO, CANADA

DWG. NO. EIC-137