LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
600E	1	-838	330	2	-825	208	3	-813	103	4	-800	49	5	-788	43
600E	1	-863	413	2	-850	210	3	-838	128	4	-825	94	5	-813	46
600E	1	-888	402	2	-875	312	3	-863	140	4	-850	111	5	-838	58
600E	1	-913	533	2	-900	340	3	-888	191	4	-875	72	5	-863	31
600E	1	-938	632	2	-925	478	3	-913	278	4	-900	188	5	-888	99
600E	1	-963	490	2	-950	509	3	-938	349	4	-925	198	5	-913	165
600E	1	-988	482	2	-975	353	3	-963	325	4	-950	206	5	-938	117
600E	1	-1013	460	2	-1000	414	3	-988	247	4	-975	220	5	-963	139
600E	1	-1038	447	2	-1025	402	3	-1013	408	4	-1000	314	5	-988	157
600E	1	-1063	539	2	-1050	431	3	-1038	333	4	-1025	224	5	-1013	124

APPENDIX D

TESTWORK REPORT OF F.W.A. SUTTON

THE LANG BAY KAOLIN DEPOSIT – BRITISH COLUMBIA

This report concerns work performed on four selected mineral samples. These samples arose from drilling operations ('reverse circulation') mounted on this previously identified kaolin deposit.

The work was confined and devoted to the tasks:-

(i) of separating kaolin-rich particle-size fractions from the whole-rock samples,

(ii) of the measurements of various aspects of these refined kaolin samples to elucidate the likely values and useability of these kaolins in the two major market areas for this industrial mineral viz. Paper Manufacture and Ceramics, which in aggregate account for over 90% of the global usage of china-clay.

This work was performed personally by the writer using the facilities of a china-clay testing laboratory in U.K. and drawing upon his 30 years' experience with its world's largest china-clay producer in which he held senior positions concerned with Research, Quality Control, Production and the evaluation of kaolin projects world-wide.

Subsidiary remarks are also made herein touching upon the peculiar nature of this ore deposit, the types of mining and processing operations best fitted to the deposit, and some feasibility aspects which require early attention.

F. V. A. SUTTON
St. Austell,
Cornwall,
England

14th January 1988

1. THE FOUR SAMPLES

The choice was made from the examination of bore-hole drilling logs and from visual appraisal of the stored mineral samples arising from the drilling operation.

It appeared that there were four main strata which were capable of reasonable discrimination and which seemed worthy of consideration.

A composite sample was made up from each of four drill holes as follows:

TABLE I

Code	Hole No.	Depth Increment-Feet
Grey White (GW)	87-20	100-132
Grey Green (GG)	87-34	258-260
Light Brown (LB)	87-26	257-267
Grey Brown (GB)	87-27	252-264

2. MANUFACTURE OF FRACTIONS

This was achieved by *"static"* sedimention in two stages, one cutting at approximately 60 mesh (250 microns) the oversize being referred to as *"Sand"*.

The undersize slurry was deflocculated and given a sedimention depth-time calculated to cut at 20 microns. This oversize is referred to as *"Slimes"* and the undersize was considered to be *"Clay"*.

In fact, the two *"oversizes"* were given two further resuspensions. This ensures that the yield values of the three fractions for each borehole refers to what would be achieved in a good, full-scale refining operation.

TABLE II Yields from whole-rock (dry weights percentage)

Code	Sand	Slimes	Clay
GW	66.17	13.37	20.46
GG	69.73	8.81	21.46
LB	-	29.21	70.79
GB	40.36	19.24	40.40

In the case of LB there was very little mass in the Sand category and a single +20 microns fraction was collected.

The clay fractions were submitted to particle-size analysis by the "Sedigraph" technique and the curves are given in Appendix. It can be seen that the target cut of 20 microns was fairly well achieved in all four cases. Significant parameters taken from the curves are:-

TABLE III

Code	+20	+10	-2	-1 microns
GW	1%	6%	50%	38%
GG	1%	8%	57%	42%
LB	NIL%	4%	49%	35%
GB	1%	5%	60%	46%

3. THE NATURE OF THE DEPOSIT

This section can be considered as a parenthesis in the report but it is convenient to consider it at this point.

The writer admits that he finds these particular materials quite intriguing; they are unique in his own experience. He has seen at least eleven china-clay deposits taken to thorough evaluation and many more given cursory treatment. Two of the eleven were secondary (sedimentary) deposits. The other nine were primary (in situ kaolinisation) deposits arising from the kaolinisation of acid igneous parents i.e. granites and in one case a volcanic rock.

Two features of the Lang Bay materials, discovered en passant in the above reported work were:-

(i) The high alkalinity of the slurries when the whole-rock samples were suspended in deionised water, i.e.

TABLE IV

Code	pH. of slurry
GV	8.7
GG	9.7
LB	8.9
GB	8.7

'Normal' granitic matrix gives a pH of about 5.0.

(ii) The large amount of magnetic materials which are so magnetic that they are removable from the sands and slimes by means of a hand magnet. See Appendix.

The writer has seen other data (provided by Brenda Mines Limited - Tables V and VI - of a report by Professor A. C. D. Chaklader) which indicates unusually high iron (magnetite) and calcium (calcite) contents by means of both X R D and chemical analysis. The magnesium analysis is also high. From these features, the writer is of the opinion that the Lang Bay materials arise not from the alteration of a 'normal' acid granite but from a much less acidic i.e. more basic parent rock in which the altered felspathic material contained much iron. In other words the parent might be considered as intermediate between a granite and a basalt.

From Table II we see that GV and GG give low yields of "clay" which is a normal feature of primary deposits. LB is distinct in showing a yield normally associated with a secondary deposit; the absence of "sand" is also a secondary deposit characteristic. A general distinction between primary kaolins and secondary kaolins (the latter category typified by the ball clays of S.W. England and the kaolins of Georgia U.S.A.) lies in particle size. Secondary clays usually exhibit relative "fineness". The transportation separates the finer clay material from the coarser sands of the parent rock but goes even further in producing a classification of the clay material. Thus if the two distinct matrix types are similarly cut at 20 microns, the secondary clay will show a larger mass of material finer than 2 microns. This feature is absent from LB (see Table III). One might hypothesise that this material arises from the same general area as GV such that the small amount of movement has separated the clay from the sands without any further classification of the clay.

GB is the odd-one-out; the clay yield is intermediate and this clay is finer than the others.

4. THE GREY WHITE CLAY AS A PAPER FILLER

The other three clays are very highly coloured and are unworthy of consideration as clays to be aimed at the paper industry. This section deals with the GW clay fraction considered as a paper filler.

(i) Particle Size

This clay, arising from a normal filler cut-point of 20 microns, has a particle size distribution intermediate between English and Georgian filler clays but is perhaps nearer to the English type. In this respect the clay is 'wholesome' as a filler.

(ii) Abrasivity

Abrasiveness of clays is mainly due to the inclusion of minerals other than kaolinite such as quartz, feldspar, tourmaline, topaz etc.; quartz (sometimes crystobalite) is the major offender. Apart from the silica-alumina ratio arising from chemical analysis, a low "loss-on-ignition" will usually indicate the presence of much non-kaolinite mineral in the clay. The L.O.I. of this clay, at 13.9%, is an indication that it should not be overly abrasive.

A test, using the Einlehner Abrasion Tester, was performed and it gave the result of 11 m.g. loss. (In this test, a clay slurry at a specified concentration is rubbed against a disc of wire mesh in a standardised manner and the loss in weight of the mesh is used as the index of abrasion).

This is a satisfactory result, again intermediate betweeen results generally applicable to English and U.S.A. fillers, the latter being the less abrasive. This is a crucially important feature and can often damn an otherwise acceptable clay.

(iii) Brightness

Here the I.S.O. system was employed. (The G.E. system, commonly used in N. America tends to give numerical results about 1.5 units higher than I.S.O.).

In this test an Elrepho meter is used. It reports % Reflectance of light having a wavelength of 457 nm. This is known as "Brightness". The reflectance, using a wavelength of 570 nm can also be measured. The arithmetical difference between these two reflectances is reported as "Yellowness".

The clay gave the results:-

Brightness 69.4; Yellowness 5.1

which are disappointing and unusual. For example, most of the kaolin fillers used in Europe have values ranging between 78.8/6.9 and 83.5/4.9. (There is one specially coarse filler, with restricted use, with a value as low as 75.5/8.0). Fillers arising from Georgia, U.S.A. are generally similar, the water-washed being brighter than the air-floated category.

The result for GV is unusual in the relationship between Brightness and Yellowness. It can be seen from the above ranges that depression of Brightness is normally accompanied by increased Yellowness, and low Brightness and high Yellowness are each separately disadvantageous. Other factors being equal, each reduces the value of the filler. For GV the low Brightness is accompanied by relatively low Yellowness. This is the reason for the visual "Greyness" of the GV clay. This is a mitigating factor; the low Brightness, although not desirable, is less excruciating than the numerical value might suggest, simply because the Yellowness factor is also low.

To the writer's knowledge, two experts skilled in the paper-making arts each agree that a clay with a value of 70/5 need not be considered unuseable as a filler in newsprint paper. Within limits, possible rather than probable, it might find some application in finer papers. This is because there are methods for overcoming the Brightness deficiency which are available to the paper manufacturer. These are not inexpensive but might be afforded within the transport cost differential; a dull, local clay might be competitive with a bright clay imported over a great distance. This will be truer, the more bright the dull clay can be made.

4A BRIGHTNESS BENEFICIATION

(i) Preamble

No kaolin is white. Perfect whiteness implies 100% reflectance of all visible wavelengths. "Colour" or departure from whiteness can have various causes.

The kaolinite crystallites themselves can be absorptive of some wavelengths and probably always are. It is thought that replacement of aluminium by iron in the crystal lattice (which is the case in natural kaolinite) is a chromophoric feature. It has been well demonstrated that a brown or green beer bottle will appear "white" when ground up sufficiently fine, at least as white as good "white" kaolin, but not perfectly white.

A major cause of colour in kaolins is due to a surface coating of adherent hydrated iron oxides (e.g. limonite).

Another cause is the presence of discrete particles of minerals other than kaolinite, such as haematite, biotite, muscovite and iron-titania complexes.

Organic compounds arising from decomposition of vegetation (peat) confer yellow and brown tints.

(ii) The most commonly used beneficiation is reductive acid leaching (The Hydros Bleaching Process) which dissolves the yellow hydrated iron oxide from the clay surface. With greater difficulty it can even bring discrete particles of haematite into solution.

Oxidative bleaching is sometimes used to decolourise organic contaminants. This is achieved by treatments with oxidising agents such as ozone or active chlorine.

Removal of non-kaolinite minerals can be achieved by two processes. One is flotation which has been used to remove micas, tourmaline and iron-titania complexes. Over the last decade this has tended to be replaced by high intensity magnetic separation. All these minerals are (weakly) magnetic.

(iii) The following attempts were made to improve the brightness of GV clay. Please see Appendix for details of treatments. Iron analysis was performed on some treated clays (XRF).

TABLE V

Treatment	Brightness I.S.O.	Fe_2O_3 %
NIL	69.4 - 5.1	2.78
Hydros Bleach	70.5 - 4.8	2.54
Ditto x 2	70.5 - 4.7	
Chlorinated	71.9 - 5.9	
Ditto plus Hydros Bleach	72.5 - 4.9	
Hydrochloric Acid I	76.1 - 4.0	1.32
Ditto II	76.5 - 3.8	1.22
Magnetic Separation - Product	73.7 - 4.3	1.55
Ditto - Magnetic Fraction	51.4 - 7.6	

Some brightness gains have been achieved but no treatment succeeded in eradicating the grey tint from the clay although the brighter products were slightly less grey.

The best results were achieved by boiling the clay with hydrocholoric acid and it is interesting to note that this treatment removed more than half of the iron (Fe_2O_3). This process seems hardly viable in practice; the costs would be very high.

The effect of chlorination is surprising as the gain of 2.5 units is rather higher than one might expect. The improvement of clays lying just under a peat bed is normally about 1.0 to 1.5 units. The increase in Yellowness is unusual; this process normally reduces Yellowness ('browness'). Perhaps this increase in Yellowness is due to the oxidation of ferrous to ferric iron at the surface of some particles. This seems likely because subsequent reduction with Hydros decreases the Yellowness.

Magnetic Separation is one process for which there remains some hope. The system used in the laboratory employs very small fields compared with the modern superconducting magnetic separators which generate enormous fields of 3 to 5 Tesla. (It takes about 5 hours to get 20 grams of clay through the matrix in the small laboratory rig employing permanent magnets). This inefficient laboratory test can do no more than indicate that the clay contains particles which can be removed magnetically and so gives confidence that a magnetic separation process is worth considering. In this case, the gain of 3.4 units of Brightness is quite encouraging but it is not possible to predict from this result what a High Gradient Magnetic Separator might achieve. It is interesting to note that the laboratory process removed 44% of the Iron (Fe_2O_3) present in the clay.

The Hydros process gives disappointing results and it appears that it cannot remove very much iron from the clay. This small lift in Brightness would not repay the cost of the process at this lower end of the Brightness scale.

It was imagined that the material causing the grey tint and low Brightness might be discrete non-kaolinite particles. It was further imagined that these particles might reside at the coarse end of the particle-size distribution. If this were so it might be possible to remove them, by a fractionation process, along with the coarser kaolinite. This would give rise to a fine clay without the grey tint and with good Brightness which could fetch a high price as a paper-coating clay.

Some GV clay (-20 microns) was slurried and deflocculated and submitted to a static sedimentation regime. The particle-size distributions of the coarse and fine fractions (Sedigraph) are included in Appendix. It will be seen that the fine fraction has a distribution typical of a paper-coating clay.

The two fractions were tested for Brightness and Iron

TABLE VI

	Brightness	Fe_2O_3 %
Fine Fraction	72.1 - 4.3	2.15
Coarse Fraction	63.1 - 5.7	3.91

Clearly there is an improvement in Brightness and a reduction of Fe_2O_3 as a result of removing the coarse material from the whole clay, but the Brightness achieved is unsuitable for paper-coating application. The grey tint, although concentrated at the coarse end, nevertheless extends into the finer particle-sizes.

5. THE FOUR CLAYS AS CERAMIC MATERIALS

The clays were measured for Fired Brightness and Fired Contraction from a standard firing schedule to 1180°C. Iron and Potash contents were also measured (XRF)

TABLE VII

Code	Fired Brightness	Contraction %	K_2O%	Fe_2O_3%
GV	57.8	8.9	1.01	2.78
GG	7.9	11.9	6.38	7.04
LB	45.1	8.6	1.65	3.80
GB	56.1	8.5	1.85	2.43

The GG clay is clearly unuseable due to the very low fired colour - the trial was dark brown in colour, similar to plain chocolate. It might possibly be used as a component for building-bricks. However, such materials are low priced and normally used "as dug" without any refining process. This GG had suffered the cost of a refining process.

It is interesting to see that GB gave a colour similar to GV, despite it being very coloured in the raw state. It is also interesting to see that it actually has a lower iron content than GV and the fact that it does not fire whiter than GV can be explained by its higher potash content. (Potash acts as a flux and enhances the lowering effect that iron has on fired colour).

The visual colours of GW, GB and LB fired trials are Light Grey Cream, Cream and Dark Cream respectively and there is absence of specking or mottling (usually caused by large particles rich in iron and coarse Biotite or Muscovite).

There is an unusual feature in the potash to iron ratio in these clays. The iron is higher than the potash whereas the opposite is the case for English china-clays.

Some typical values for English ceramic clays follow:

TABLE VIII

	K_2O	Fe_2O_3	Fired Brightness
Porcelain Clay	2.3	0.6	84+
Table-Ware Clay	2.5	0.67	82
Sanitary-Ware Clay	3.0	0.85	70+

Note the very much lower iron content of these clays arising from acid granites.

It is however possible to visualise ceramic uses for the Lang Bay clays. In sanitary-ware manufacture, fired brightness is of less importance because the colour of the finished ware is supplied by thick, opaque and often highly coloured glazes.

It has been noticed when handling dried filter-cakes of these clays, and particularly so for L.B., that they have high strength (Modulus of Rupture) i.e. the cakes are quite difficult to break and grind in a pestle and mortar. This feature is quite unusual in clays with these particle size distributions. However caused, this feature is beneficial. When cast ware is removed from the casts it has to be handled into drying ovens and then into firing kilns. This gives rise to breakage, lost production and a cost in recycling the cracked ware. Increasing the green strength of the pottery body, therefore, reduces these losses. Strength is usually increased by including strong fine sedimentary (ball) clays in the body. I do not know if these are available from Canadian sources; perhaps the nearest source is Tennessee/Kentucky U.S.A. Thus, although Fired Brightness is rather low, a compensating factor would be the strength of these clays. (A formal M.O.R. test could not be applied - it requires about 1.5 kg of clay and only small amounts of these clays were available).

Two other important ceramic clay tests were performed on a mixture of G.B. and L.B. (ratio 2 to 1). The first is known as "Casting Concentration". This is the determination of the percentage of solids in a slurry having a viscosity of 5 poises when adjusted to minimum viscosity with sodium silicate. The mixture gave a result of 60% solids.

This slurry is then used to determine the rate at which a cast builds up with time in a plaster mould. The result for this mixture was 0.42 mm^2 per minute at 20°C. Both these results are rather low and just creep into the ranges normally seen i.e. 58 to 67 and 0.2 to 6.0 respectively, but do not necessarily preclude their application as a body component. As we have seen, GB is rather finer than LB, which on its own might give better results but at the expense of some Fired Brightness loss.

It would appear quite likely that magnetic separation could improve Fired Brightness of these clays to some unknown extent. This process is used in Cornwall for exactly that purpose.

Another outlet for these clays would be in the manufacture of wall and floor tiles although this is a large volume, low price market. At even lower price the clays could be consumed in the manufacture of glazed ceramic pipes (cloamware) used for sewerage and drainage systems.

6. CONCLUSIONS

(i) The clay typified by GW would seem suitable for newsprint paper filling. There would be a lower Brightness limit that would have to be observed and reached by a system of matrix selection.

Clays which failed might be brought into line by use of High Gradient Magnetic Separation. This process might also convert some of the better clays into Brightness ranges applicable to the filling of finer papers.

Pilot work with a 5 Tesla system might be arrangeable in a U.K. University but would require upwards of 10 kg. of refined clay.

(ii) Clays typified by GW, GB and LB would seem suitable as lower grade ceramic materials i.e. for sanitary ware production at best.

Here again magnetic separation is a beneficiation process worth piloting.

If there is a reasonably local ceramic market it should be explored as a potential consumer. Serving two industries rather than just one gives added security.

Indicative U.K. ex works prices per bulk tonne are:

Paper fillers	High Brightness	£54
	Low Brightness	£46
Sanitary Ware Clays		£42 to £47
Tile Clays		£25 to £30 (very approximately)

(iii) The deposit is unusual and problematical. The writer is of the opinion that such a deposit situated in Europe would be unlikely to be exploited. Its being where it is, near markets and remote from other clay deposits in production, might well provide the feature which makes exploitation feasible.

One adverse feature which must require continuing attention is the high overburden to refined clay ratio. From existing drilling logs this does seem unusually high. The deposit is very non-uniform regarding clay quality and a dry-mining, selective stock-piling operation seems essential.

Clays are normally sold as 10% moist lump which assumes filtration and evaporative drying. With very local paper-filling markets the idea of selling concentrated slurries (65-70% solids) should be explored. This is accomplished in U.S.A. and UK. It has the advantage of obviating the need for drying, with its high capital and running costs.

(iv) In any feasibility study a variety of features can indicate that the project is not viable. Clay quality is one of these. The writer is of the opinion that in this case clay quality leaves something to be desired but it does not, per se, render the project obviously unviable.

A P P E N D I X

C O N T E N T S

* * * *

PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION LANG BAY -20µ CODE GW

DATE

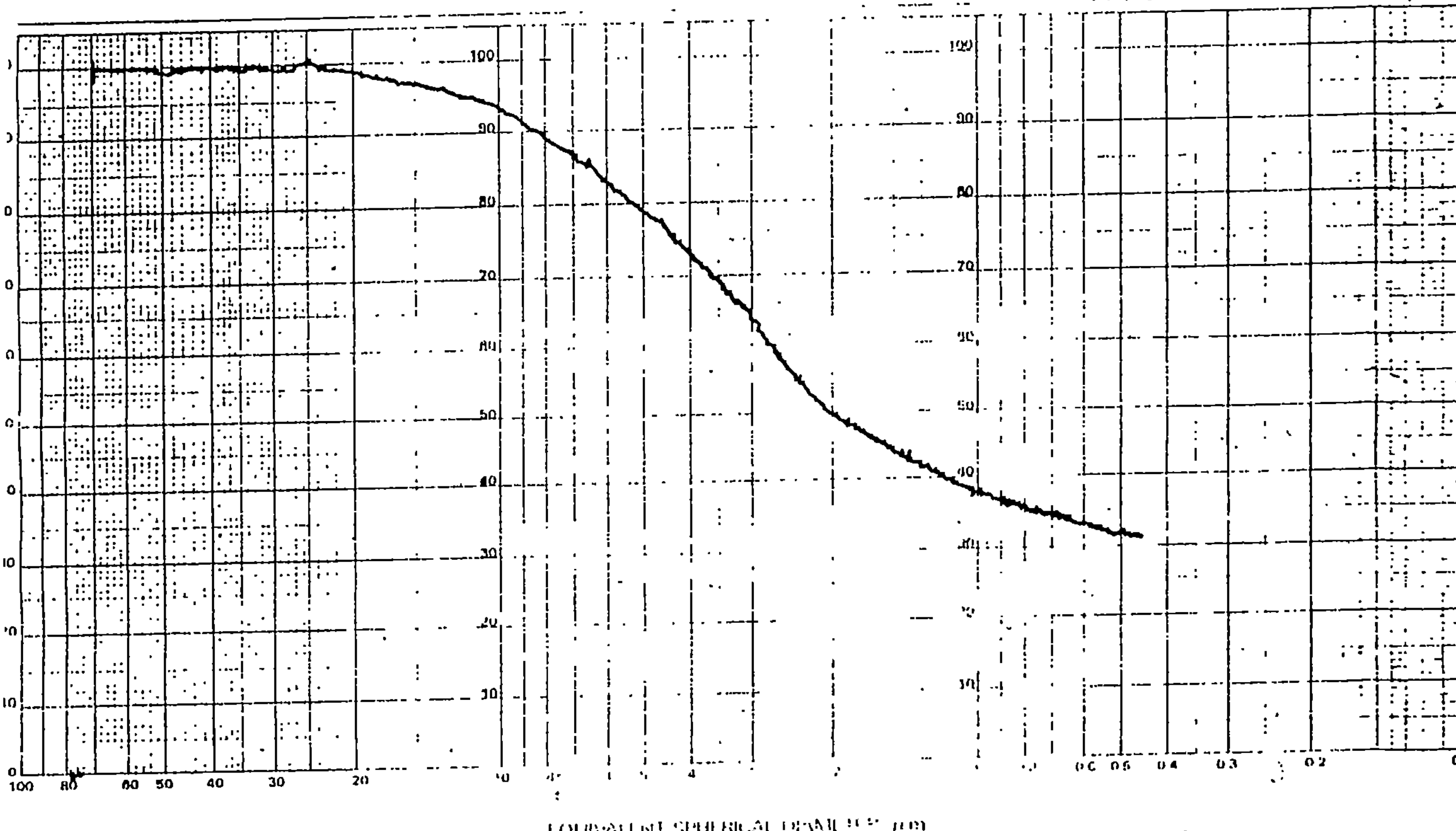
BY

Density ______ g/cc LIQUID

TEMPERATURE ______ °C

Preparation

RATE ______ START DIA 70 µm



micromeritics instrument corporation

COULTER ELECTRONICS LIMITED

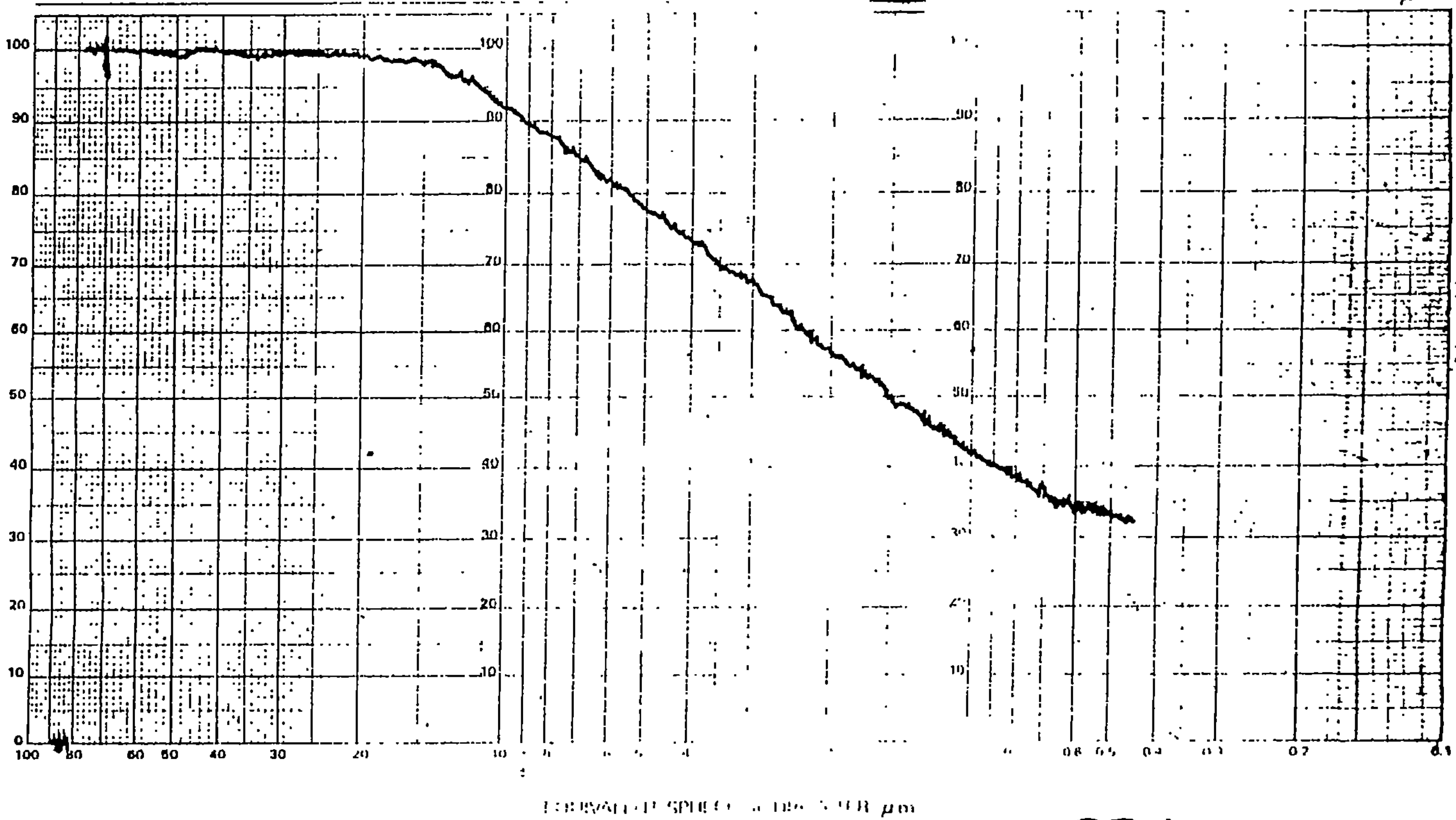
PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION LANGBAY -20μ CODE GG DATE ______

Density ______ g/cc LIQUID ______ Density ______ Viscosity ______ cp BY [signature]

Preparation ______ TEMPERATURE ______ °C

RATE ______ START DIA 70 μm



micromeritics instrument corporation

COULTER ELECTRONICS LIMITED

PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION LB -20μ BROWN CLAY CODE LB

DATE 24 NOV 87

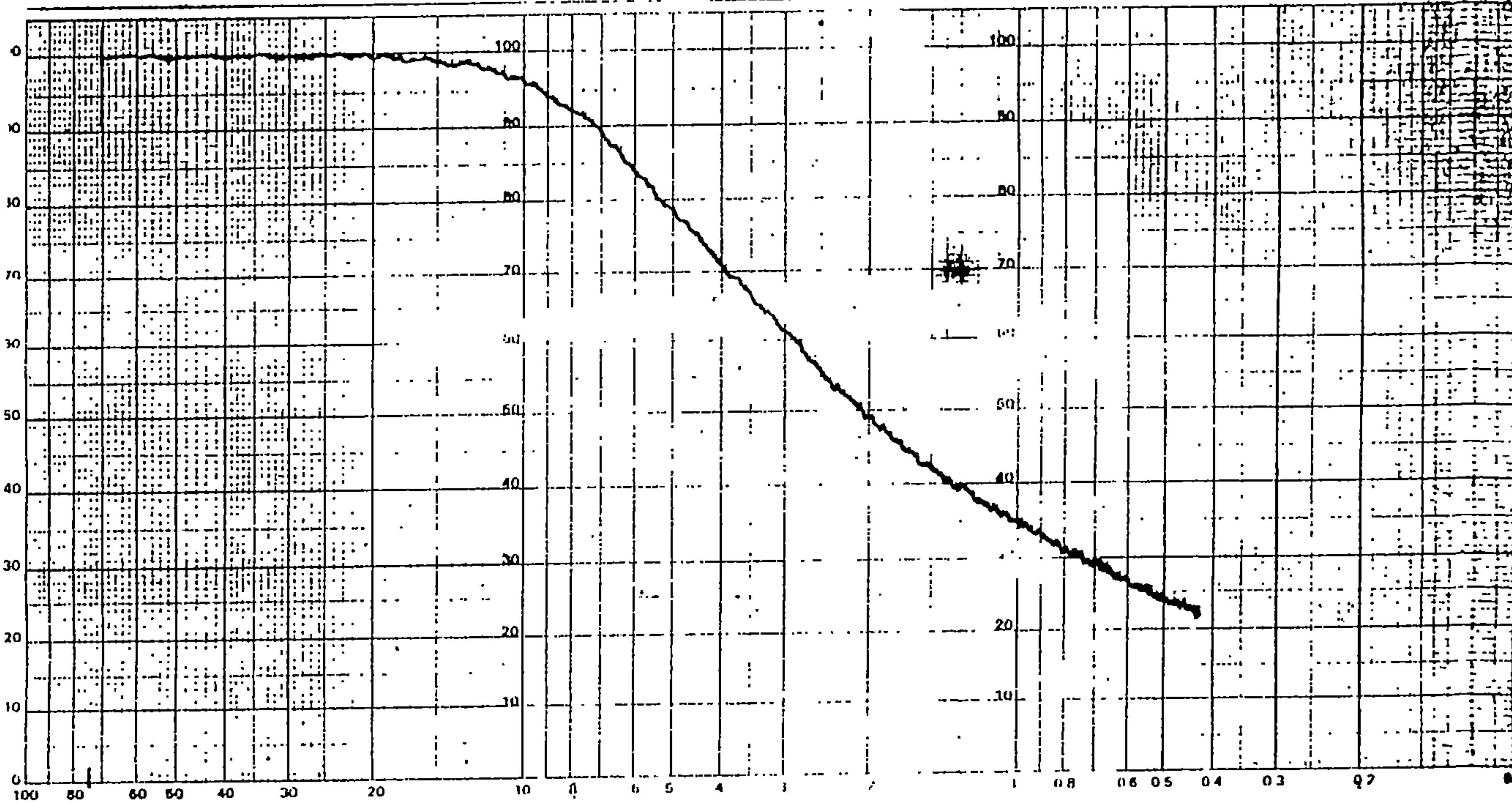
Density ______ g/cc LIQUID ______ Density ______ g/cc Viscosity ______ cp

BY [signature]

Preparation ______

TEMPERATURE ______ °C

RATE ______ START DIA. 10 μm



EQUIVALENT SPHERICAL DIAMETER, μm

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COULTER ELECTRONICS LIMITED

PARTICLE SIZE DISTRIBUTION

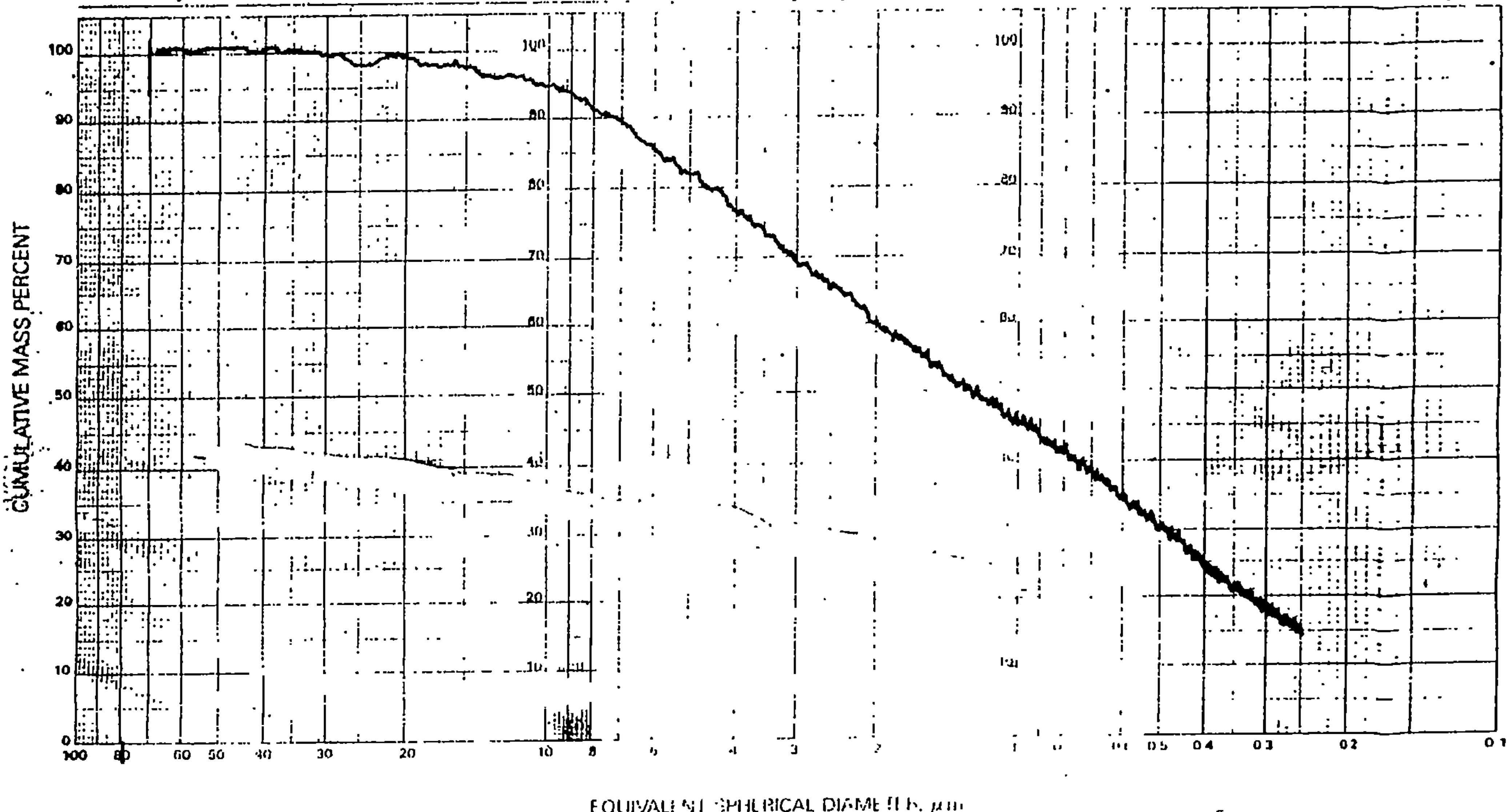
SAMPLE IDENTIFICATION LB -20μ BROWNISH GREY CLAY CODE GB DATE 24NOV'87

Density ____ g/cc LIQUID ____ BY MAP

Preparation ____

TEMPERATURE ____ °C

RATE ____ START DIA. 70 μm



micromeritics

COULTER ELECTRONICS LIMITED

PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION LANGBAY CODE G.W.

DATE

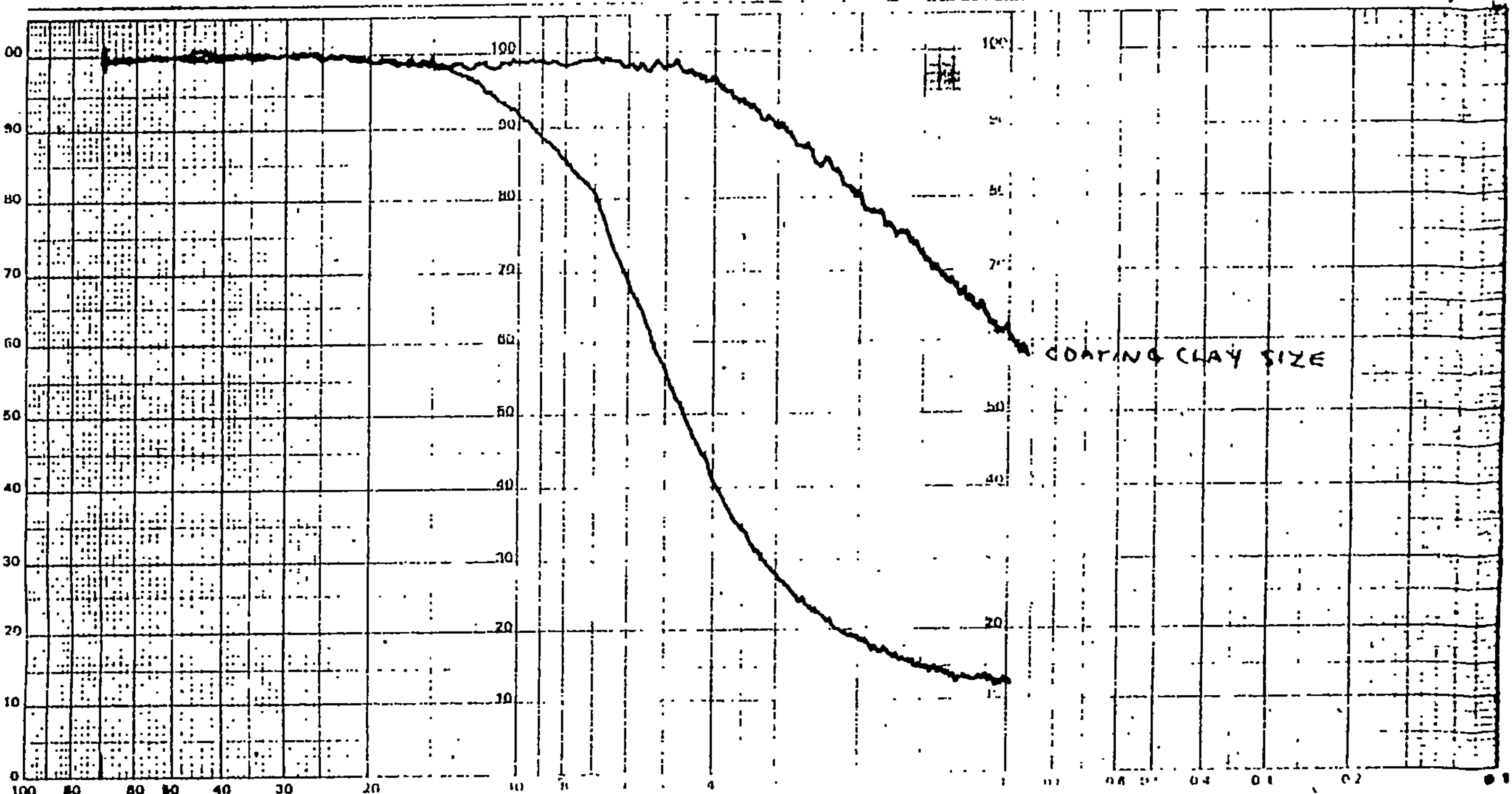
Density ____ g/cc LIQUID ____ Density ____ Viscosity ____

BY [signature]

Preparation FRACTIONATED TO COATING CLAY AND RESIDUE CLAY

TEMPERATURE ____ °C

RATE ____ START DIA 70 µm



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COULTER ELECTRONICS LIMITED

2. HYDROS BLEACH

A clay slurry (about 10% solids) is brought to pH3.0 with sulphuric acid. Sodium Hydrosulphite is added with stirring. The amount is 0.5% based on clay solids. The pH is again reduced to 3.0 and the slurry is aged for 18 hours. The slurry is filtered (Buchner) and the filter cake is washed free of salts on the filter with hot water. The cake is dried at 80° for Brightness testing.

"X2" means that the Hydros dose is raised to 1.0%.

CHLORINATION

10 grams of clay is slurried with 100 ml. of water; 2 ml. of concentrated sodium hypochlorite solution is added and mixed. The pH is reduced to 3.0 with sulphuric acid and the slurry is aged for 18 hours. The treatment is then as for Hydros Bleach regarding washing etc.

HYDROCHLORIC ACID I

10 grams of clay is slurried with 100 ml. of water and treated with 2 ml. of concentrated hydrochloric acid. The liquid is brought to the boil, cooled and filtered (Buchner) and the cake washed with hot water.

HYDROCHLORIC ACID II

This increases the amount of acid and its concentration. 10 grams of clay are boiled with a mixture of 50 ml. of water and 50 ml. of concentrated acid.

MAGNETIC SEPARATION

A matrix is made up by forming a plug of fine iron wire wool in a glass tube. This plug is brought into a field provided by permanent magnets. A dilute, deflocculated clay slurry is passed slowly through the matrix. After the passage of about 2 ml. of slurry, the clay feed is replaced by a water feed to remove clay from the matrix.

The magnets are then removed and the collected magnetic material is washed out with water into a separate container. The process is then repeated until all the clay slurry has passed through the matrix. The magnetic and non-magnetic fractions are floculated with acid, filtered and dried at 80°C for testing.

3. IRON

It was found possible to remove magnetic minerals from the sand and slimes fractions by means of a hand magnet.

Samples of the materials were repeatedly explored until the yield of magnetics was almost complete.

WEIGHT % OF REMOVABLE MAGNETICS IN FRACTIONS

	SAND	SLIMES
GV	0.65	4.58
GG	10.30	38.30
LB		Trace
GB	1.81	4.80

It seems that the GG stratum is very ferruginous and this condition extends into the clay fraction with its analysis of 7.04% Fe_2O_3.

It was found that two magnetic species existed. The most magnetic was black in colour and the less magnetic was green and tended to be more finely divided. When a sample of GG Slimes was treated with strong acid, there was marked effervescence and the liquour was dark green; on standing the liquour became yellower.

A reasonable hypothesis seems to be that the black material is magnetite and the green material is siderite (ferrous carbonate). The latter would account for the effervescence and being more basic it would be more quickly attacked by acid to give the green liquour. Subsequent slower dissolution of the magnetite would give rise to the yellow development. The filtered liquour was diluted and titrated with caustic soda solution. The first precipitate was blue in colour (ferrous hydroxide?) and the second was yellow brown and gelatinous - ferric hydroxide. This highly ferruginous condition is unseen in the usual china-clay deposits arising from alteration of acid granites and supports the theory that the Lang Bay parent rock is more basic in nature which in turn means that the feldspathic content was high in iron content.

APPENDIX E

GEOLOGICAL REPORT OF
COLIN C. HARVEY

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GEOLOGY OF THE LANG BAY KAOLIN PROSPECT
BRITISH COLUMBIA, CANADA

====================================

PREPARED for the OWNERS and OPERATORS

FARGO RESOURCES LIMITED
and
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P8071 CCH:mt
March 1988

C O N T E N T S

* * * *

EXECUTIVE SUMMARY

The Resource

1. The Lang Bay prospect is contained within a small sedimentary basin on the western edge of the Coast Plutonic Complex of British Columbia.

Basement granitoid rocks, which in places are altered to kaolin, are overlain by a sedimentary sequence containing kaolin clays. The whole prospect is overlain by glacial till overburden up to 40m thick.

2. Two distinctly different kaolin clay types have been recognised within the prospect:

   a. A primary kaolin derived from the insitu weathering of granitoid basement rocks.
   b. A secondary kaolin, part of the "so-called" Brown Beds Formation, a cyclothemic sequence within the Lang Bay sedimentary basin.

3. Several drilling programmes and geophysical surveys have been undertaken in the northeastern sector of the prospect. These studies have shown that the primary kaolins are restricted to a relatively narrow band, approximately 200m wide located close to the edge of the basin, but they extend along the perimeter of the basin for at least 2.5km.

In certain boreholes, the weathering profile in the basement rocks is up to 30 metres thick but with progressive distance into the basin, the weathering profile becomes less. Boreholes drilled to intersect basement rocks towards the centre of the basin show little evidence of weathering or alteration of the basement rocks.

The secondary kaolins (Brown Beds Formation) are extensively distributed throughout the basin and in places they are up to 100m thick.

4. Preliminary laboratory studies on the primary kaolins confirm that the kaolin content decreases with increasing depth within the weathered profile. However, little systematic work has been carried out on all the borehole samples.

5. Preliminary benefication studies have indicated that the primary kaolin may be beneficiated to achieve a white filler clay specification. The secondary kaolin is too discoloured for general application as a filler clay but may be acceptable for certain ceramic or refractory usages. Because of the large tonnage potential for white filler clays, attention has been focussed on the primary kaolin in this report.

6. The calculation of resource volumes and tonnages has been constrained by the absence of a defined drilling grid, the methods of drilling, and the absence of systematic detailed testing. Nevertheless an inferred resource calculation for the primary kaolin indicates 5 million cubic metres of raw material. At an average bulk density of 2.2 gms/cc this equates to 11 million tonnes of raw material.

If a recovery of 15% can be achieved from the raw material, this equates to 1.65 million tonnes of recoverable kaolin. However more detailed testing is required to confirm this.

No resource calculation has been attempted for the secondary clay, but it is estimated that many tens of million of tonnes of secondary kaolins are present within the sedimentary basin.

Recommendations for Further Work

1. Testing Programme

Insufficient testing has been carried out on the borehole samples collected during the 1987 and 1988 programmes. A detailed testing programme is necessary on the primary kaolin to assess:

a) the variability in kaolin content with depth within the weathering profile;

b) the optimal percent recovery from the primary kaolin to achieve the required market specification;

c) the optimal particle size distribution of a marketable product.

Samples for these tests should be drawn from boreholes listed in Table 4.1 of this report.

A more detailed testing programme is also required to assess the potential of the secondary clays, from within the Brown Beds Formation.

2. Further Exploration

Additional exploration, geophysics and drilling should be delayed until this testing programme has been considerably advanced.

1.0 INTRODUCTION

1.1 Location

The Lang Bay Kaolin Prospect is contained within a group of mineral claims 15 kilometres southeast of the town of Powell River, British Columbia, at approximate coordinates 49°48' N, 124°25' W (Figure 1). The prospect consists of a connected series of claims approximately six kilometres by six kilometres in area.

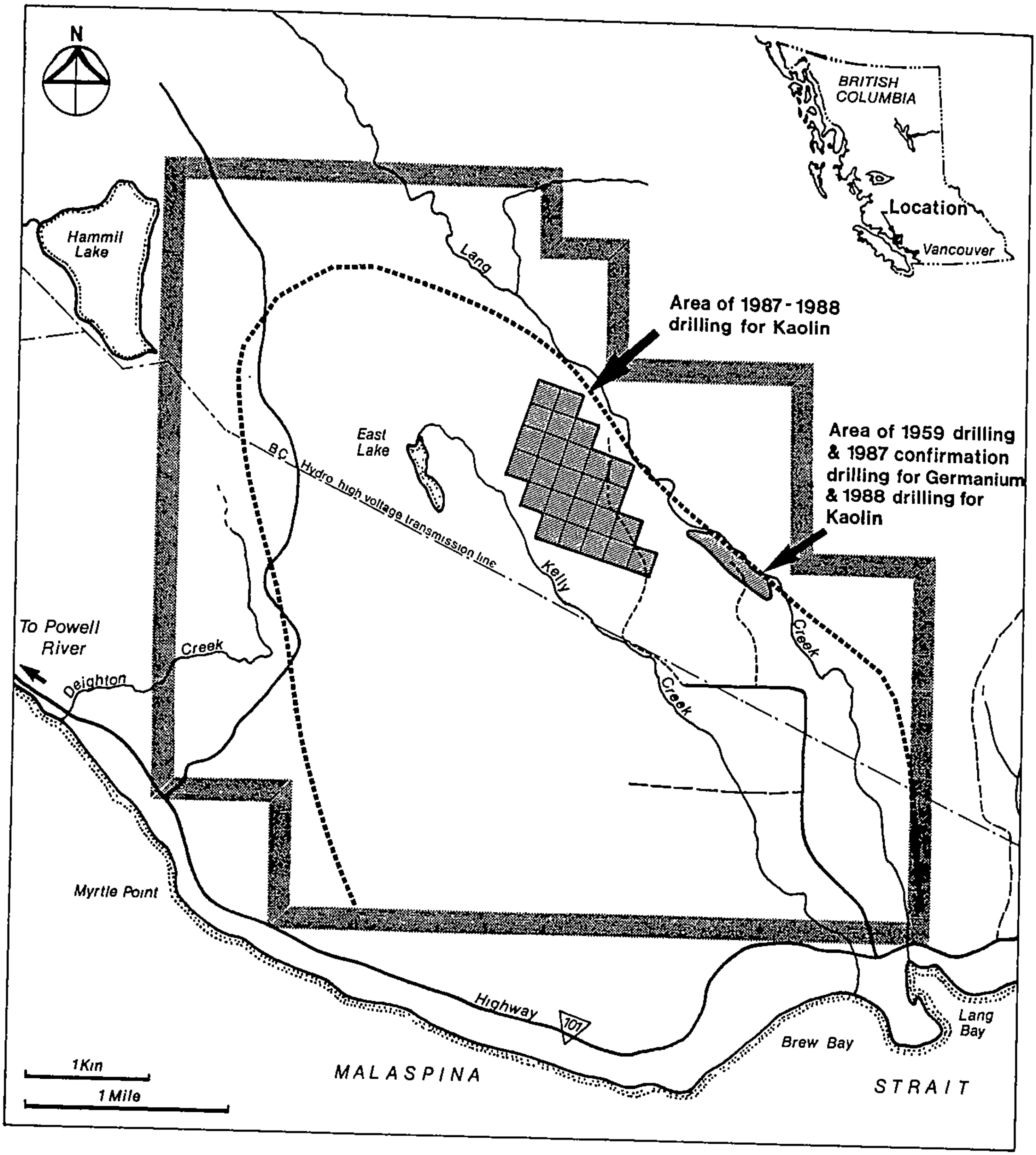
1.2 Access

Access to the project is from the main coastal highway from Powell River (Highway 101). Sealed roads from Highway 101 give access to the western and eastern margins of the claim area while a British Columbia Hydro powerline transects the area northwest - southeast. Several unsealed roads, constructed for previous drilling, forestry activity and for recreation, provide limited access to other parts of the prospect.

1.3 Project History

In 1948 anomalous germanium values were found in carbonaceous sediments in the Lang Creek area. Mineral claims were acquired by Taiga Mines in 1957 who carried out trench and diamond drilling during 1958 and 1959. The mining rights were subsequently obtained by Fargo Resources Ltd who carried out drilling, trenching and testing programmes on the germanium-bearing horizons between 1981 and 1985.

In 1986 drilling by Fargo Resources Ltd indicated the presence of kaolin clays in the southeast sector of the claims area, which were considered to have potential as industrial clays. In asssociation with Brenda Mines, reverse circulation drilling and various geophysical surveys were undertaken during 1987 which have been the subject of reports by Pilon (1987) and Foundex Geophysics (1987a, 1987b).



KEY

Claim boundary

Paved highway

Inferred boundary of Sedimentary Basin

LOCATION MAP
LANG BAY KAOLIN PROSPECT
Fig 1

2.0 GEOLOGICAL SETTING

General Geology

The Lang Bay prospect is contained within a small sedimentary basin on the western edge of the Coast Plutonic Complex of British Columbia.

The geological sequence consists of basement granitoid rocks of the Coast Plutonic Complex of Jurassic-Cretaceous age which are unconformably overlain by the Brown Beds Formation a cyclothemic sequence of carbonaceous clays, indurated mudstones, siltstones, shales, conglomerates and minor lignitic coal lenses. Palynomorphic studies reported by White (1986) suggest that these sediments are late Cretaceous in age. They are confined to a sedimentary basin approximately five kilometres across whose depth has not been determined.

The whole prospect is covered by glacial till, except along Lang Creek where erosion has exposed a considerable part of the sequence over 1.6 kilometres of outcrop, north of the British Columbia Hydro powerline.

The Kaolin Clays

Two distinctly different kaolin clay types are recognised within the Lang Bay prospect.

(1) A primary kaolin, derived from previous insitu weathering of the granitoid basement rocks.

(2) A secondary kaolin, part of the cyclothemic sequence within the sedimentary basin (The Brown Beds Formation).

Drilling carried out to date indicates that the primary kaolin is confined to the margins of the sedimentary basin, whereas the secondary kaolin is extensively distributed throughout the basin interbedded with the coarser lithologic units of the cyclothemic sequence.

The 1987 Programme

The 1987 drilling programme confirmed the presence of a significant thickness of kaolin clay within the prospect. However the reverse circulation drilling method destroyed the texture of the insitu clay structure and confused any distinction between:

(a) primary kaolins derived from insitu alteration (weathering) or the basement granitoid rocks; or
(b) secondary kaolins within the basin sediments.

The geophysical surveys included seismic profiling, ground magnetic surveys, dipole-dipole resistivity surveys and Schlumberger vertical electric soundings. The seismic surveys were undertaken to define the profile of the basement rocks across the basin. The magnetic surveys were carried out to locate near surface basement rocks which were found to have strong magnetic signatures. The electrical resistivity surveys were used to locate conductive clay horizons in the subsurface.

The magnetic surveys successfully modelled the shallowing of the basement rocks towards the edge of the basin, although significant 'geologic noise' was encountered due to the presence of large altered granitic boulders in the glacial till. Interpretation of the seismic profiling was constrained by the complexity of the sedimentary units in the basin and the lack of contrast in seismic velocity between certain of these units and the basement. The electrical resistivity surveys successfully delineated conductive clay horizons although it was not possible to distinguish between the primary and secondary kaolins.

Beneficiation studies and laboratory testing of selected samples from the 1987 reverse circulation drilling were carried out by Sutton (1987) who confirmed that certain of the clay horizons were suitable for processing to paper filler clay specifications. Mineralogical investigations of borehole samples from the 1987 drilling by Mak (1987) demonstrated that the kaolin content of the primary kaolin (weathered granitoid rocks) decreases with increasing depth below the surface. These trends are discussed in greater detail under Chapter 5.

Preliminary testing and examination of cores of the secondary kaolin indicates that the quality and composition of these clays may be highly variable.

All of these exploration activities were carried out in the northeastern sector of the claims area, close to Lang Creek.

3.0 THE FEBRUARY 1988 DRILLING PROGRAMME

3.1 Introduction

On the basis of the encouraging test results obtained on certain samples from the 1987 programme, the decision was made to proceed with a 7 to 9 hole drilling programme early in 1988.

3.2 Objectives

The objectives of the February 1988 programme were:

i) To clarify the stratigraphic and lithologic relationships of the clay horizons encountered during the 1987 programme. To achieve this, core drilling was used in contrast to reverse circulation (1987) drilling.

ii) To test the geophysical anomalies and confirm the geophysical interpretations which were obtained from the 1987 surveys. To achieve this, boreholes were drilled at various locations within the southeastern sector of the basin covered by the geophysical surveys.

iii) To delineate the zones, or horizons of kaolin clays sufficiently well to justify calculations of inferred resources of potentially exploitable clays. This involved the review and integration of all previous borehole data (including the 1959 data) which resulted in the drilling of boreholes designed to:

- prove continuity between explored areas
- extend the resource further to the northwest of the explored area.

3.3 Drilling Programme

Nine boreholes were drilled in the period February 5th to February 27th, 1988. Their locations are given in Figure 2 and Map 1 in the map jacket. Drill logs are given in Appendix 1 of this report, and in a separate drilling report by Lobdell (1988).

A summary of relevant data from these boreholes is given in Table 3.1 while a general section running northwest-southeast is presented in Figure 3.

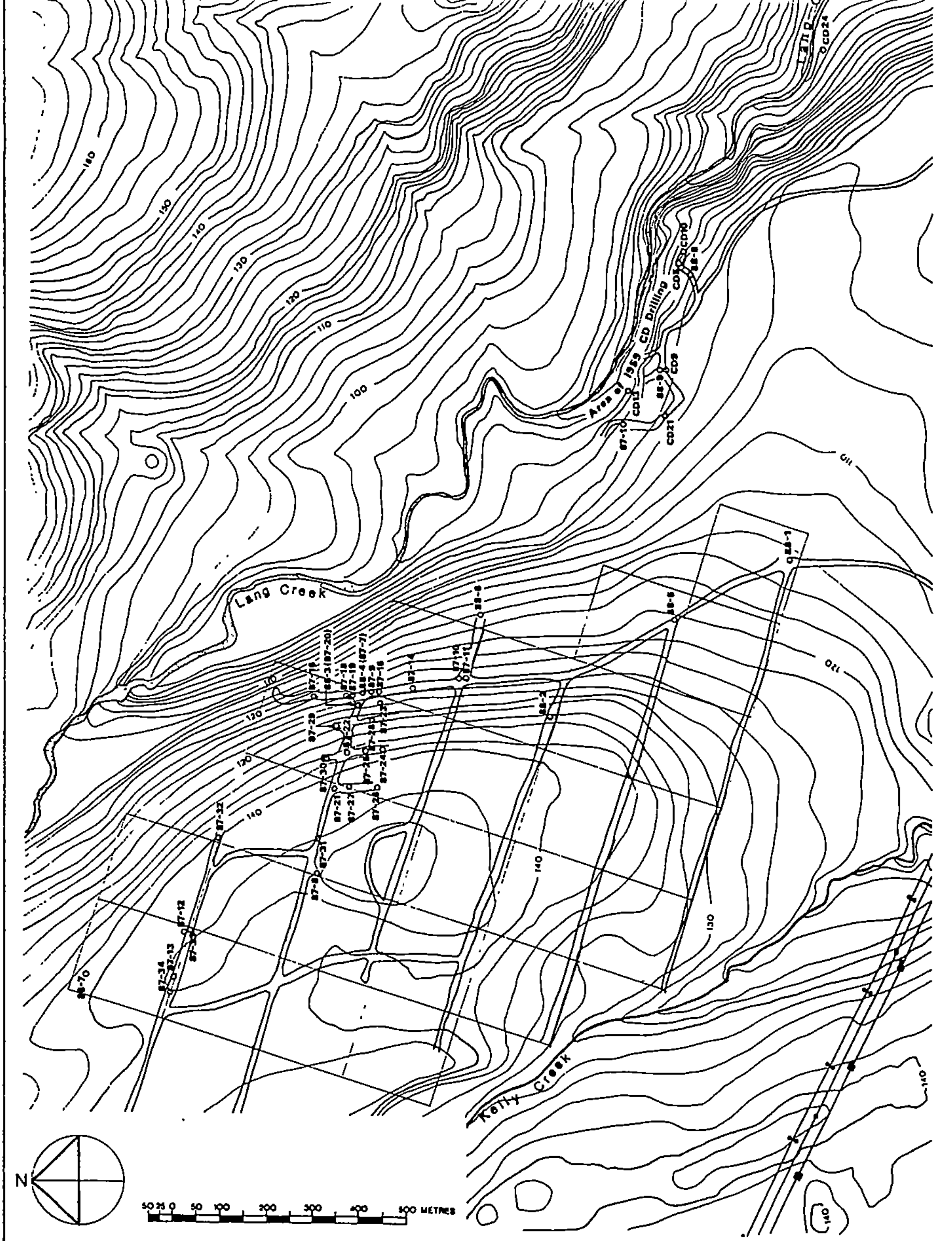
Borehole 88-1 (Location: 8+00S, 6+00E)

This borehole was drilled approximately 1200 yards (1100m) in from the edge of the sedimentary basin to test a low resistivity anomaly identified during the 1987 geophysical surveys (Foundex 1987b). The low resistivity was considered to be responding to clays at relatively shallow depth (less than approximately 250ft depth).

The borehole encountered glacial till overburden to 80ft underlain by the Brown Beds cyclothemic sequence of conglomerates, sandstones, clays and shales with occasional narrow lignitic layers. The borehole was abandoned at 300ft, in grey sandstone. Consideration was given to extending the depth of the borehole to reach basement, but seismic data (Foundex 1987a) suggested it could be as deep at 500ft in this part of the basin.

The clays were highly carbonaceous and varied in colour from grey to brown. The clay content in some bands was visually estimated at 30-40% clay content.

In this part of the basin the low resistivity is considered to be responding to the discoloured secondary kaolin clays within the sedimentary sequence.



Key

- OBS-1 Boreholes
- Contours at 2m intervals
- Road
- Power line on pole
- " " " tower

LOCATION OF BOREHOLE SITES

Fig 2

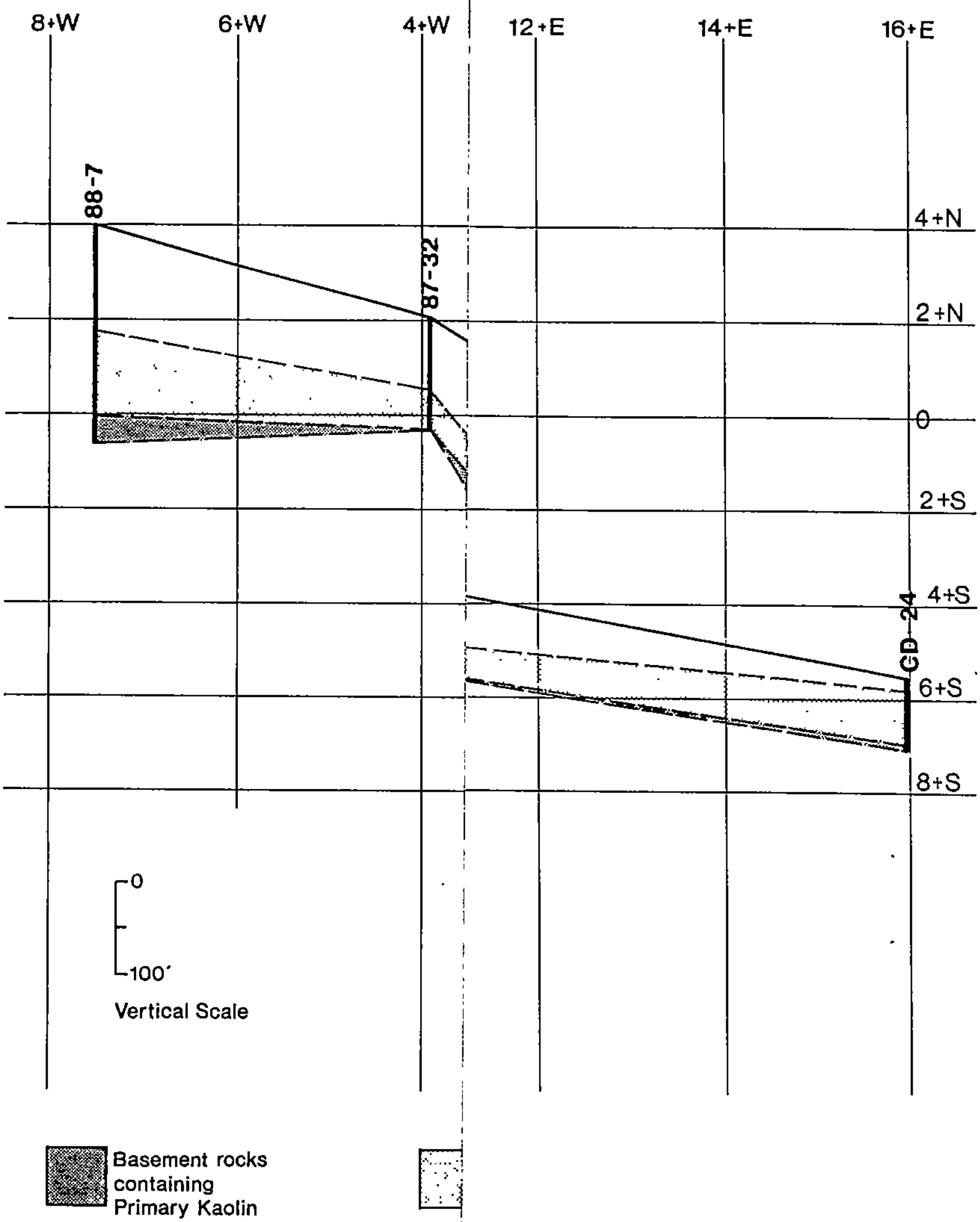

8+W
6+W
4+W
12+E
14+E
16+E
88-7
87-32
GD-24
4+N
2+N
0
2+S
4+S
6+S
8+S
0
100'
Vertical Scale
Basement rocks containing Primary Kaolin

Fig 3

TABLE 3.1: SUMMARY TABLE OF DATA FROM 1988 DRILLING PROGRAMME

BOREHOLE	DRILLED DEPTH ft	DEPTH INTERVAL GLACIAL TILL OVERBURDEN	DEPTH INERVAL SECONDARY KAOLIN SEDIMENTS	DEPTH INTERVAL WEATHERED BASEMENT ROCKS	COMMENT ON PRIMARY KAOLIN (WEATHERED BASEMENT ROCKS)
88-1	300	0-80'	80-300'	NOT ENCOUNTERED	NONE
88-2	384	0-123'	123-368'	368-384'	16ft OF RELATIVELY UNALTERED ROCK
88-3	158	0-92'	NONE	92-158'	66ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH
88-4	141	0-50'	50-51'	51-141'	90ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH
88-5	316	0-62'	62-305'	305-316'	11ft OF RELATIVELY UNALTERED ROCK
88-6	190	0-130'	130-156'	156-190'	34ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH
88-7	230	0-110'	110-202'	202-230'	28ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH
88-8	144	0-74'	74-130'	130-144'	14ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH
88-9	135	0-52'	52-95'	95-135'	40ft OF WEATHERED ROCK BECOMING PROGRESSIVELY LESS ALTERED WITH INCREASING DEPTH

Borehole 88-2 (Location: 4+00S, 0+80E)

This borehole was drilled approximately 900 yards (800m) in from the edge of the sedimentary basin to test data from the 1987 geophysical surveys (Foundex, 1987 a,b):

i) a moderately low resistivity anomaly
ii) modelling of seismic profiling data which indicated basement at approximately 300ft depth.

The borehole ecountered glacial till overburden to 123ft and a cyclothemic sequence of conglomerates, sandstones, clays and shales with occasional narrow lignitic bands to 358ft. At this depth there was a sharp contact with slightly weathered coarse grained biotite granodiorite(?). Occasional fracture zones were more extensively kaolinised but overall, the basement rocks were relatively unaltered.

Borehole 88-3 (Location: 0+00, 0+80W)

This borehole sited close to the edge of the sedimentary basin was core drilled alongside borehole 87-20 which had been drilled using the reverse circulation technique. The reverse circulation technique had finely ground the borehole material making it very difficult to distinguish between primary kaolin (weathered basement rocks) and arkosic sandstone. Further, it was suspected that the reverse circulation method was producing a lower brightness due to possible contamination from other horizons in the drillhole.

The borehole encountered glacial till to 92ft and then a weathered granodiorite which became progressively less altered with increasing depth. The borehole was abandoned at 158ft in relatively unweathered granodiorite.

Borehole 88-4 (Location: 0+00, 0+00)

This borehole was drilled close to the edge of the basin alongside borehole 87-7, the so-called 'discovery borehole' in which grey-white kaolin was first encountered in this sector of the prospect. The objective was to obtain good samples of the kaolin and to confirm that it was primary in origin.

The borehole encountered glacial till to 51ft where a thin basal conglomerate passed sharply to weathered (kaolinised) granodiorite which became progressively less altered with increasing depth, although within the sequence some small sections of relatively unaltered basement rocks were encountered. The borehole was abandoned at 141ft in only slightly weathered granodiorite.

Borehole 88-5 (Location: 6+00S, 2+150E)

This borehole was drilled approximately 1000 yards (900m) in from the edge of the basin to:

i) test a low resistivity anomaly identified during the 1987 geophysical surveys (Foundex, 1987b)
ii) obtain information on the continuity of the sedimentary units within the basin
iii) confirm the depth to basement
iv) determine the degree of weathering of basement rocks towards the centre of the basin.

The borehole ecountered glacial till overburden to 62ft and a cyclothemic sequence of clay, shales, sandstones and conglomerates similar to that encounted in boreholes 88-1 and 88-2. A basal conglomerate at 282ft passed to slightly weathered diorite (granodiorite?) at 305ft. The hole was abandoned at 316ft.

Borehole 88-6 (Location: 2+00S, 2+40E)

A review of borehole data from the 1959 drilling programme showed that the majority of the churn drilled holes (CD series) encountered weathered granite in the area close to Lang Creek about 1000 yards (900m) southeast of the gridded area (Figure 1).

Borehole 88-6 was sited in the sector between these two areas to prove continuity between them.

The borehole encountered glacial till overburden to 130ft depth, the cyclothemic sedimentary sequence (ref. boreholes 88-1, 88-2, 88-5) to 156ft and below this weathered diorite/granodiorite which became progressively less altered with increasing depth. The hole was abandoned at 190ft depth in relatively unaltered diorite/ granodiorite.

Borehole 88-7 (Location: 2+180N, 6+160W)

This borehole was sited approximately 220 yards (200m) from the edge of the sedimentary basin in the north west corner of the gridded area. The objective of the borehole was a step-out drillhole to test an extension of the primary kaolin (weathered basement) to the north west.

The borehole encountered glacial till overburden to 110ft depth and the cyclothemic sedimentary sequence (ref. boreholes 881-1, 88-2, 88-5, 88-6) to 202ft. Beneath a basal conglomerate kaolinised (weathered) diorite was encountered which was of variable hardness between 202 and 220ft depth, becoming progressively less weathered below 220ft. The hole was abandoned at 230ft.

Boreholes 88-8, 88-9

These boreholes were sited in the area of 1959 churn drilling (ref. Figures 1 and 2), approximately 1km south east of borehole 88-6, within 110 yards (100m) of the edge of the sedimentary basin. The objectives were to confirm the presence of kaolinised granite in this sector and to obtain core samples for investigation.

Borehole 88-8 (Location: 4+00S, 10+70E)

Borehole 88-8 encountered glacial till to 74ft depth and the cyclothemic sedimentary sequence to 130ft before entering weathered quartz diorite. Pyrite is recorded from altered diorite between 130ft and 144ft depth where the hole was abandoned.

Borehole 88-9 (Location: 4+00S, 8+50E)

Borehole 88-9 encountered glacial till to 52ft depth and the cyclothemic sedimentary sequence to 94.5ft before entering weathered diorite which become progressively less altered to 135ft where the hole was abandoned.

4.0 DEVELOPMENT OF A GEOLOGICAL MODEL

4.1 The Primary Kaolin

Data from the 1959, 1987 and 1988 drilling programme are summarised in Table 4.1

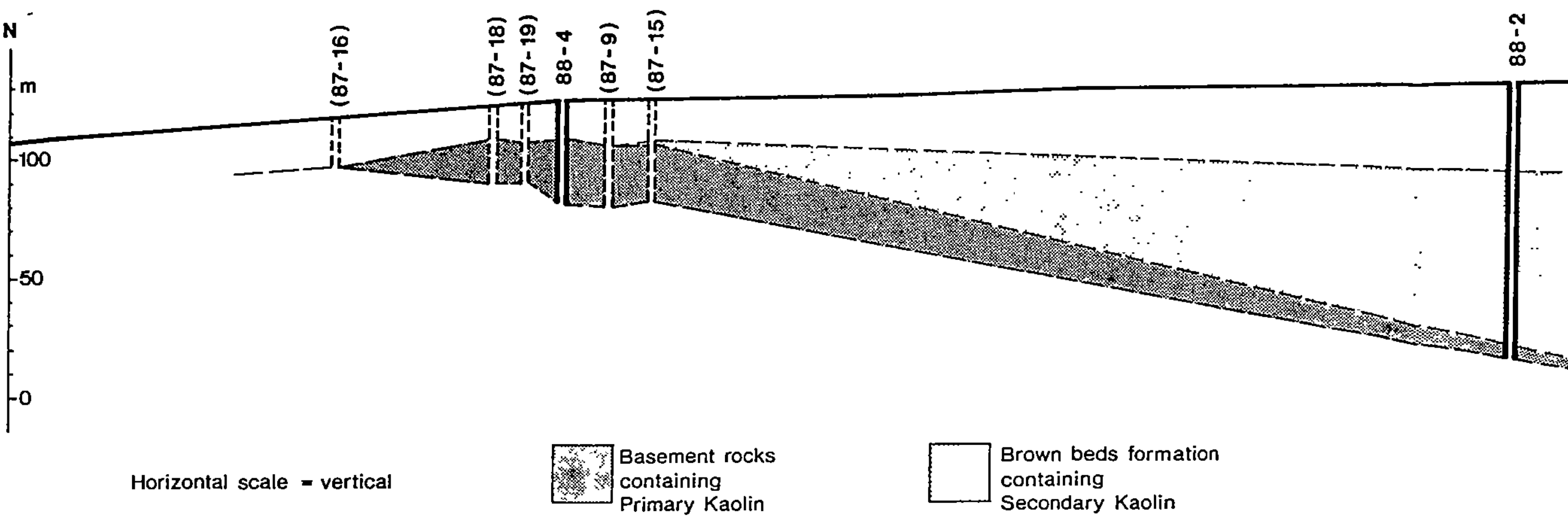
These data confirm that the primary kaolin extends in a northwest-southeast direction in the southeastern sector of the basin, for at least 2700 yards (2.5 km) extending from borehole 88-7 to CD 24. The thickness of the primary kaolin not well known since in the CD drill holes and certain of the 1987 bore holes, little effort was made to determine this. Nevertheless the data from boreholes 87-7 and 88-4 indicate that the alteration extends for at least 90ft thickness (27m) in places in the prospect. A line of section into the basin through several of these boreholes is shown in Figure 4.

There are only limited borehole data within the centre of the basin and of these, few have been drilled to basement. Data from boreholes 88-2 and 88-5 show little evidence of an extensive weathered basement profile towards the centre of the basin.

Overall these data indicate that a weathered mantle of basement granitoid rocks which contains the primary kaolin is restricted to the outer margins of the sedimentary basin at Lang Creek. Moving into the basin the weathered zone becomes progressively thinner and is not evident in the deeper parts of the basin.

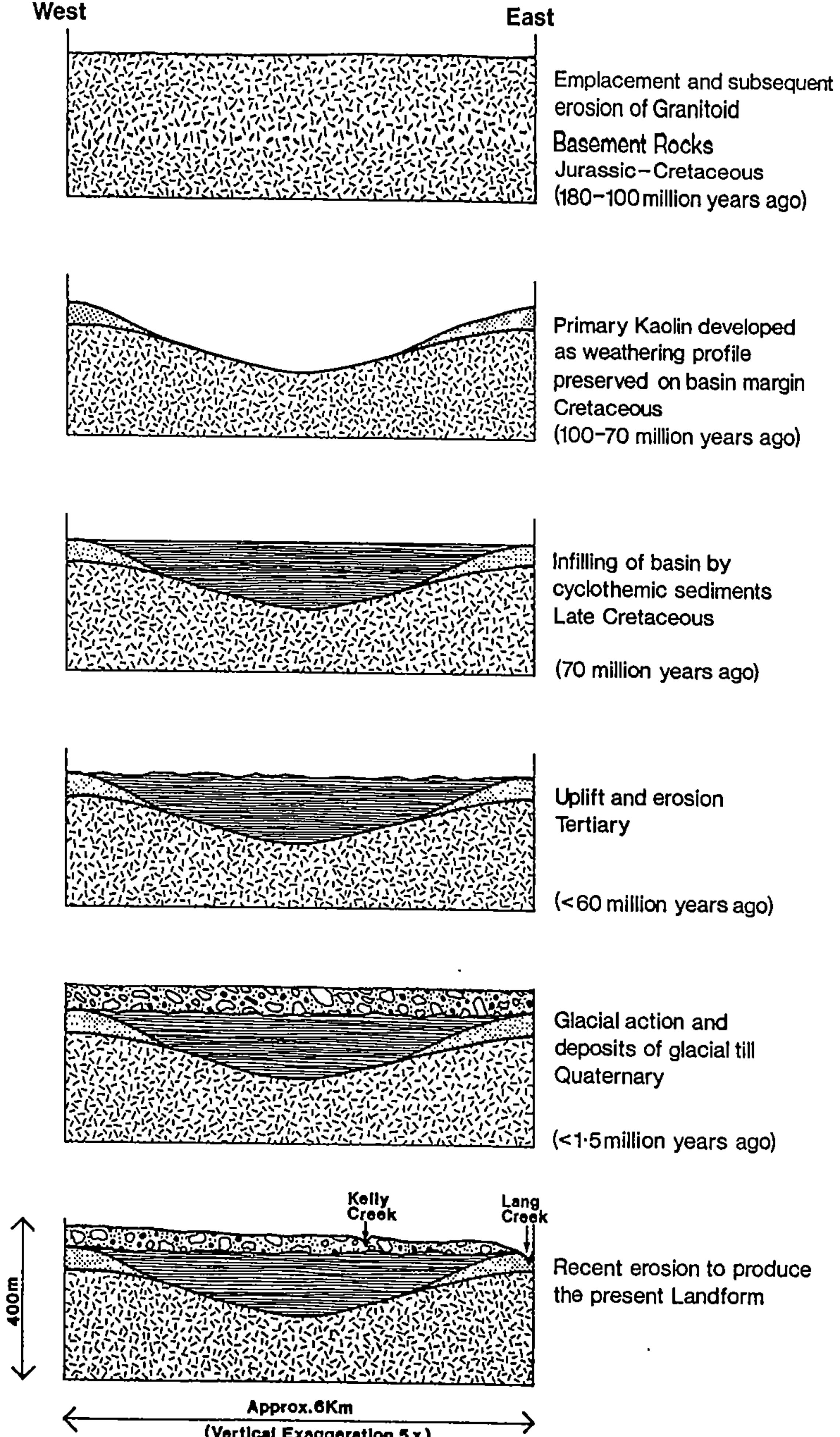
4.2 The Secondary Kaolin

The secondary kaolin is part of the Brown Beds Formations, a cyclothemic sequence of clays, shales, sandstones, conglomerates and minor lignitic layers which were laid down in a sedimentary basin eroded in the basement complex.



CROSS SECTION THROUGH BOREHOLES

Fig 4



GEOLOGICAL MODEL

Fig 5

TABLE 4.1 OCCURRENCE OF PRIMARY KAOLIN

BOREHOLE	DEPTH TO PRIMARY KAOLIN (ft)	DRILLED THICKNESS OF PRIMARY KAOLIN (ft)	COMMENT
1959 DATA			
CD 3	152	20	The purpose of drilling these holes was to explore for germanium rather than kaolin. The thickness of kaolin drilled gives no indication of actual thickness of the weathering zone.
5	72	25	
9	97	38	
10	89	3	
11	97	4	
12	139	5	
13	67	7	
14	165	6	
16	162	6	
17	82	24	
18	47	5	
19	82	2	
20	75	10	
23	122	7	
24	72	4	
1987 DATA			
87-1	81	9	Reverse circulation drilling confuses any distinction between primary and secondary kaolins. However, based on understanding developed from 1988 core drilling these depth intervals in the 1987 programme are considered likely to be part of the weathered basement profile.
5	79	3	
6	78	4	
7	56	72	
9	60	90	
14	170	30	
15	65	75	
17	75	74	
18	48	62	
19	50	60	
20	100	85	
21	220	80	
22	160	70	
23	100	40	
24	230	20	
25	200	41	
26	280	65	
27	270	45	
28	120	60	
29	120	36	
30	160	58	
33	140	43	
1988 DATA			
88-2	368	16	These boreholes located towards the centre of the basin showed little evidence of weathered basement rocks.
5	305	11	
88-3	92	66	These boreholes located close to the edge of the basin showed variable thicknesses of weathered basement rocks.
4	51	90	
6	156	34	
7	202	28	
8	74	56	
9	95	40	

The sedimentary sequence is at least 300ft (270m) thick in the centre of the basin and thins towards the margins. Within the sequence, high clay-content layers are interbedded with the coarser lithologic units.

4.3 The Glacial Till

The whole basin is overlain by a variable thickness of glacial till which varies from 13ft thick in borehole CD 24 to 130ft thick in borehole 88-6.

4.4 Composite Geological Model

On the basis of the data available to date a hypothetical geological model is proposed (Figure 5).

i) Basement granitoid rocks of the coastal complex were emplaced during the Jurassic-Cretaceous period (180 to 100 million years ago).

ii) Weathering and erosion took place during the Cretaceous which produced a weathered mantle and a basin structure in the vicinity of Lang Creek.

iii) Subsequent sea-level fluctuations resulted in the deposition in the basin of a cyclothemic sequence of coal-measure-type clays, sandstones and conglomerates in the late Cretaceous. These sediments assisted in the preservation of the weathered granitoid rocks on the margins of the basin.

iv) Emergence during the Tertiary produced an irregular erosion surface which was covered by glacial till during the late Tertiary-Quaternary period.

v) Recent erosion has produced the present land form with significant erosion to the granitoid basement along Lang Creek.

5.0 THE WEATHERING PROFILE - KAOLIN CONTENT

5.1 The Basement Granitoid Rocks

The basement rocks in the project area have been previously described as red granites (Pilon, 1987), quartz diorites, diorite and granodiorites (Lobdell, 1988). A single sample of surface outcropping basement just east of Lang Creek thin section examination was classified as a hornblende biotite quartz diorite.

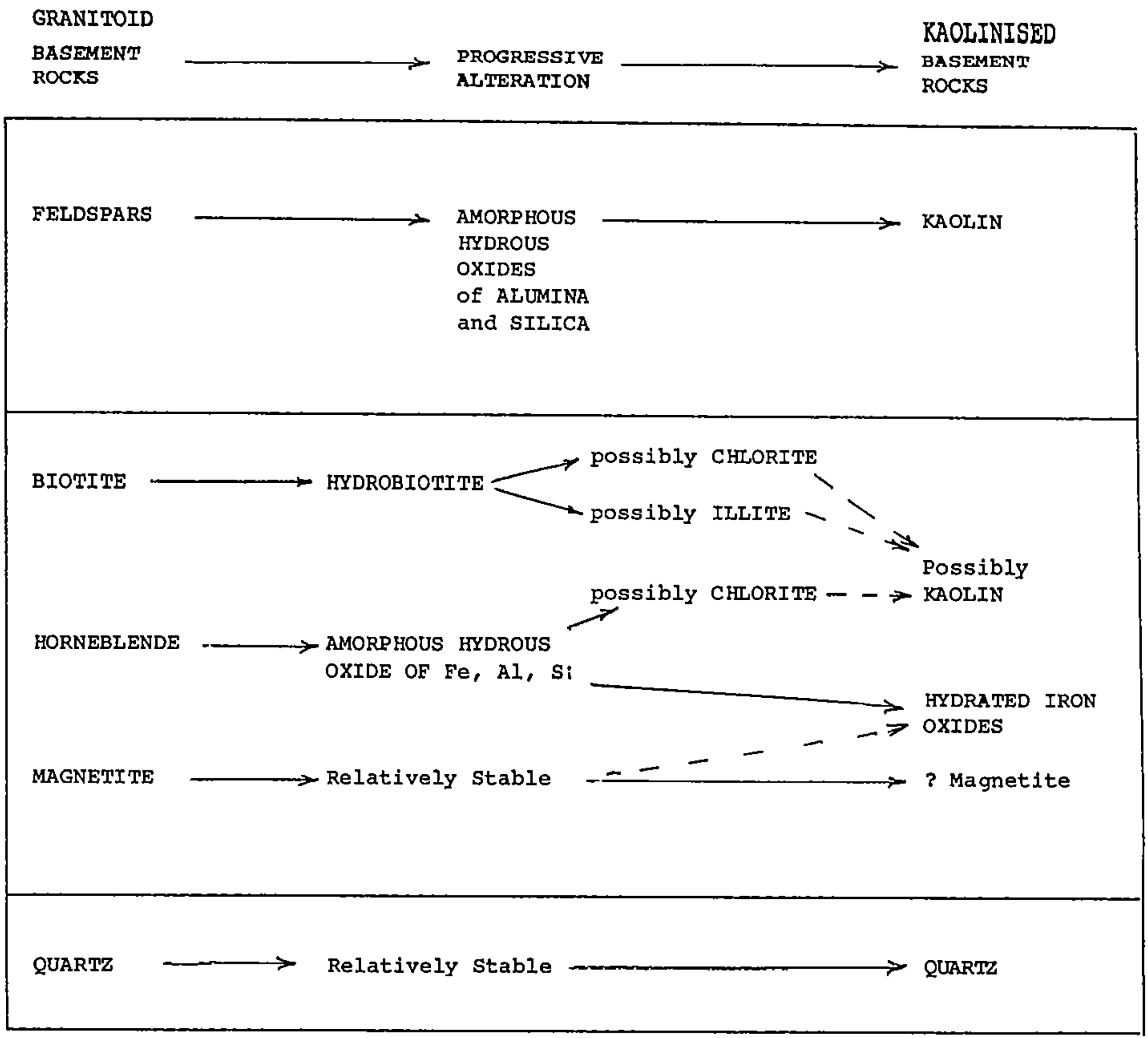
The sample was coarsely crystalline, with large (up to 6mm) crystals of zoned plagioclase feldspar, anhedral quartz, and minor orthoclase, green hornblende, brown biotite and magnetite. Accessory minerals included apatite and zircon, and rare allanite.

On the basis of the various descriptions, the basement rocks may well be quite variable in composition. Nevertheless, for the purposes of proposing a model of the kaolin genesis, they may be considered as granitoid rocks with feldspar and quartz as major components but with significant mafic minerals, biotite, hornblende and magnetite.

5.2 The Kaolinisation Process

At Lang Bay certain preliminary chemical studies of the basement weathering profile have been undertaken by Mak (1987). However, to date, no systematic mineralogical studies have been done to trace the breakdown of the primary minerals in the basement rocks to the kaolins and the hydrous minerals.

A typical kaolinisation process, based on studies carried out elsewhere is shown in schematic form in Figure 6. The Lang Bay kaolinisation process is likely to follow the trends illustrated in this diagram.



<u>Note:</u>

Proportions not to scale but drawn to indicate major Feldspar and Quartz, minor Biotite, Hornblende, and Magnetite

SCHEMATIC DIAGRAM SHOWING MINERAL CHANGES WITH KAOLINISATION

Fig 6

Systematic mineralogical studies should be undertaken to confirm these processes.

5.3 Kaolin Content in the Kaolinised Basement Rocks

Preliminary chemical studies have been undertaken by Mak (1987) who examined every two foot interval of core from borehole 87-7 in the depth interval 58-132ft, using x-ray diffraction and bulk chemical analysis.

By x-ray diffraction the kaolin content in the borehole profile was found to be 55% kaolin at 66ft depth and steadily dropped to about 10% kaolin at about 130ft depth. This is reasonably consistent with observation of the cores, and the trends indicated in Figure 6.

Using chemical analysis however it was suggested that the kaolin content down to 88ft depth averaged 59% and below this (down to 132ft depth) the kaolin content remained at 35% kaolin.

From a preliminary re-evaluation of these data, it would appear that the rational analysis used for interpretation of the chemical data, is not entirely relevant to rocks of the Lang Bay composition. For example, the calcium oxide (CaO) would best be allocated to a feldspar composition rather than calcite.

It is recommended that the chemical data be reinterpreted in conjunction with more detailed mineralogical examinations of the core material at various depths.

6.0 RESOURCE ESTIMATION OF THE PRIMARY KAOLIN

6.1 Constraints

The calculation of the primary kaolin resource has been constrained by certain aspects of the drilling and testing programme. The constraints are:

- the distribution of the boreholes
- the depth of drilling into the weathered granitoid rocks
- the method of drilling
- the testing programme.

i) <u>Borehole Distribution</u>

In the 1959 churn drilling programme and the 1987 reverse circulation drilling programme, boreholes were drilled at very close spacings (often less than 20m apart), in restricted parts of the prospect. In the exploration drilling for a large tonnage industrial mineral resource, a typical grid pattern would be 200m spacing. The selection of such a closely spaced drilling programme has meant that only limited information on the uniformity and extent of the resource has been obtained to date.

ii) <u>Depth of Drilling into the Weathered Basement Profile</u>

In the 1959 and 1987 drilling, boreholes were frequently abandoned once the weathered basement was encountered. This was primarily because there was a lack of appreciation of the significance of the weathered material as a primary kaolin resource. Ideally, these boreholes should have been drilled deeper to determine the thickness of the weathered mantle.

iii) Drilling Method

The reverse circulation technique used in 1987 is cost effective and produces large samples of finely ground materials. However it destroys the texture of the insitu rock and because of this, it is difficult to distinguish between primary weathered basement rocks and secondary weathered sandstones or shales.

Uncertainties in the logging of much of the 1987 core has constrained the interpretation of these data. Core drilling is therefore to be preferred until a better appreciation of the basin-basement profile is developed. At this time, for subsequent infill drilling, it may be appropriate to use the reverse circulation technique.

iv) Testing Programme

Only very limited testing has been carried out on the primary kaolin. Mak (1987) has confirmed a trend of decreasing alteration with increasing depth in borehole 88-7 and this trend is apparent in several of the 1988 drillholes.

Laboratory evaluations of the primary kaolin in terms of recovery and brightness as a paper filler have been restricted to preliminary tests on only a few boreholes and again, this has constrained any detailed calculation of recoverable or marketable reserves.

6.2 Calculation of Inferred Resources

Because of the constraints listed above, the Lang Bay kaolin resource can only be classified as "Inferred Resources".

Basis of Calculation

Lateral extent: Along the basin margin in a northwest-southeast zone weathered basement rocks were encountered between BH 88-7 and CD 24, 2500m extent (Figure 7).

For this calculation a lateral extent of 2500m was used.

Width of resource: In the area of the 1959 CD drilling the width in a northeast-southwest direction was at least 200m.

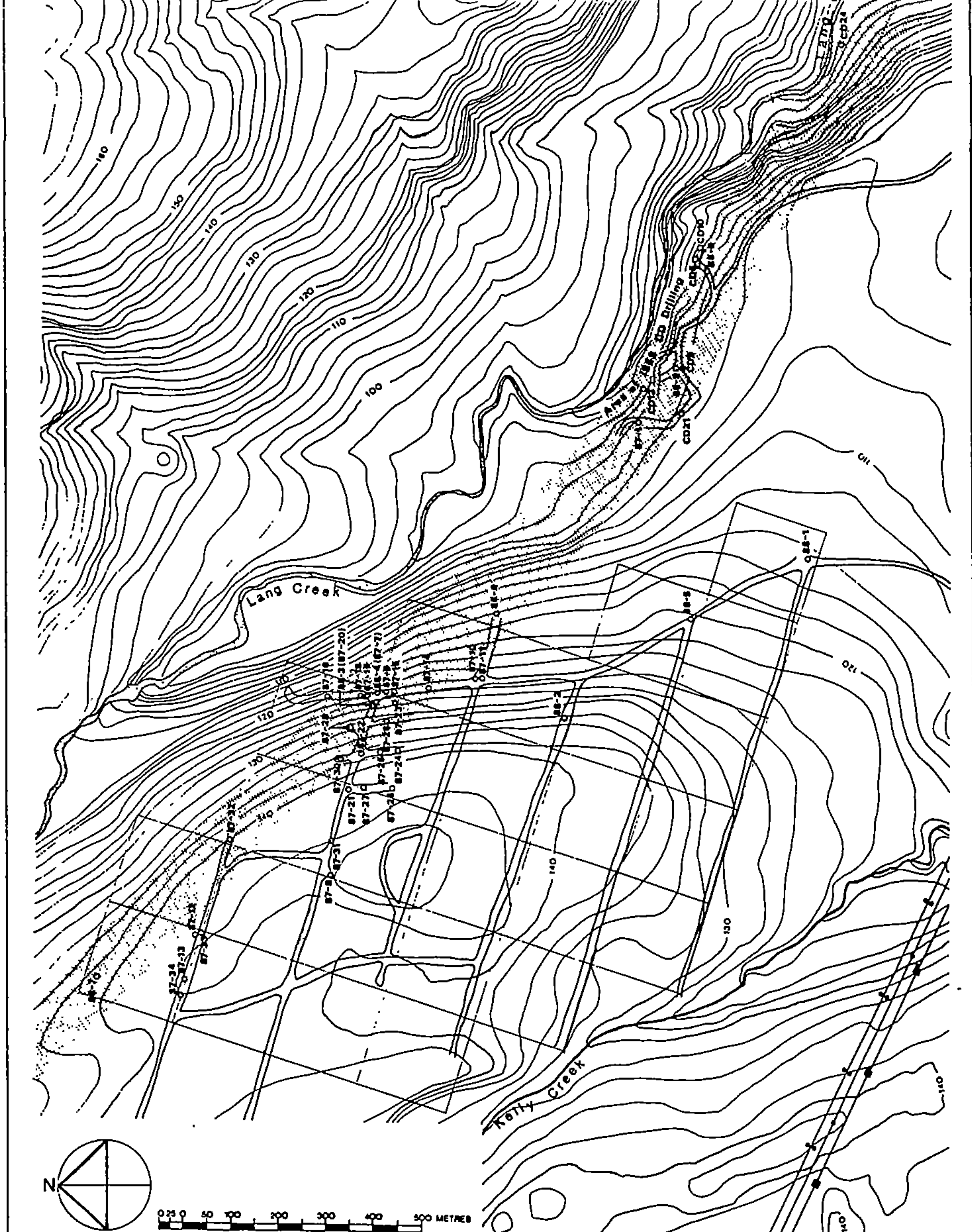
In the area of the 1987 drilling the width in a northeast-southeast direction was at least 200m.

For this calculation a width of 200m was used.

Depth-thickness: In the area of the 1959 CD drilling borehole 88-9 encountered 40ft (12m) of weathered basement rocks. In the areas of the 1987 drilling boreholes 87-7 (and 88-4) drilled through 90ft (27m) of this material, while other boreholes (88-3, 88-6, 88-7) only encountered approximately 10m thickness of weathered basement rocks.

For this calculation, a thickness of 10m has been used.

Recovery: Preliminary laboratory studies by Sutton (1987) on material from borehole 87-20 (100-130ft) obtained a recovery at 20 microns size of about 20%. Subsequent work by KRTA



o Borehole locations

Area of primary kaolin resource

DISTRIBUTION OF THE PRIMARY KAOLIN

Fig 7

(1988) from boreholes 88-3 (100-130ft) and 88-4 (56-100ft) obtained recoveries of about 10% at 20 microns size. It is essential that a detailed testing programme be carried out as soon as possible to confirm a realistic percentage recovery figure. However, for the purpose of this calculation an average recovery of 15% was used.

Bulk density: No measurements have been made to date but it is predicted that the bulk density will vary between 1.6 and 2.6.

For this calculation a bulk density of 2.2 was used (4000 lbs/cubic metre).

Calculation

Inferred Resource of Raw Material = 2500 x 200 x 10 cubic metres
= 5 million cubic metres
At bulk density of 2.2 = 11 million tonnes
(12 million short tons)

Recoverable resources based on 15% recovery =
1.65 million tonnes
(1.8 million short tons)

7.0 RESOURCE ESTIMATION OF THE SECONDARY KAOLIN

Within the Brown Beds Formation a considerable quantity of secondary clays are evident, occurring as clay layers or mixed with sandstones, conglomerates and lignitic lenses.

Boreholes drilled to date towards the centre of the basin (88-1, 88-2, 88-5) have encountered up to 100m (300ft) of Brown Beds Formation. Clay bearing horizons constitute approximately 50% of parts of drilled sections but to date no systematic testing programme has been undertaken on these materials.

Preliminary laboratory investigations of Brown Beds Formation clays from close to the basin margin by Sutton (1987) indicate that these clays have no potential as filler clays for paper manufacture. They may however have potential in ceramics or refractory applications.

Because of the limited drillhole data and lack of testing, no detailed resource calculation is justified at this time. It is likely however that many tens of millions of tonnes of secondary kaolins are present within the total Lang Bay sedimentary basin.

8.0 SPECIFIC COMMENT RELATING TO EXPLORATION TECHNIQUES AND TESTING

8.1 The Testing Programme

Exploration and drilling in the northeast section of the Lang Bay kaolin prospect has delineated a reasonably large resource of primary kaolin.

Detailed testing of these materials should be carried out before any further exploration is planned.

These tests should include:

i) detailed mineralogical analysis of the alteration profile: the kaolinisation of the basement rocks;
ii) detailed applied testing on the borehole samples to beneficiate the primary kaolin to a filler clay specification;
iii) preliminary evaluation of the filler clay in potential market areas.

8.2 Priorities in Exploration of the Lang Bay Basin

When the testing has proceeded to a satisfactory stage, the following aspects should be considered in regard to future exploration.

<u>Location</u>

At present only approximately 20% of the basin has been explored by drilling and geophysics. Certain parts of the basin are on developed farmland, marginal to the coast or adjacent to environmentally-sensitive fishery areas. A decision will have to be made regarding which parts of the basin could be developed into a large scale open cast mining operation. At this time, the northern sector appears most remote from these developed activities.

Further Geophysics

Based on the review of the 1987 geophysical survey data in conjunction with 1987 and 1988 borehole data, it was concluded that no further geophysical surveys are warranted to guide further exploration in the northeast sector.

Aerial magnetics versus ground magnetics:

The relative merits of these two techniques have been the subject of some discussion between Foundex Geophysics and KRTA Ltd. It is acknowledged that if the objective is to locate the boundary of the basin in the north of the project, then several widely spaced ground magnetic profiles may be sufficient to guide exploration drilling. If however the objective is to delineate the margin of the whole basin and to explore for near-surface basement rocks within the basin, then an aerial magnetic survey of the whole basin may be justified.

In regard to shallowing of basement rocks within the basin, a magnetic anomaly in the south of the gridded area identified during the 1987 survey has yet to be tested.

8.3 Exploration of Other Areas

A review of the geological history of British Columbia reveals that in the late Cretaceous-Early Tertiary there was a period of quiessence when coal measures were deposited and where the climate and geological stability were conducive to the formation of weathering profiles on basement rocks. Kaolin clays have recently been reported in Saskatchewan, while in British Columbia weathered granites have been recorded beneath coal measure clays in the Fraser Basin (Hora pers. comm.).

Because of the very active erosion history in British Columbia most of this weathered mantle has been removed. However, at Lang Bay there is evidence that remnants of this profile have been preserved on the flanks of the Lang Bay Basin.

A preliminary review of the geological literature relating to Late Cretaceous-Tertiary basins indicates that a significant number of shallow sedimentary basins exist along the east coast of Vancouver Island - the socalled coastal belt (B.C. Hydro, 1975). Other basins are recorded from the interior of British Columbia but because of their isolation they are of less immediate interest. If further exploration beyond the Lang Bay prospect is contemplated, these sedimentary basins of the Coastal Belt should be investigated.

8.4 Occurrence of Pyrite in Basement Rocks

In most boreholes in which core drilling has encountered basement rocks there has been no evidence of hydrothermal alteration. The progressive decrease in alteration with increasing depth has been supportive evidence for a weathering profile. However in borehole 88-8 pyrite is reported from fractures in basement granitoid rocks, (Appendix 1). Petrological studies should be carried out to determine whether or not this is evidence of hydrothermal alteration in this part of the prospect.

REFERENCES

B.C. HYDRO, (1975); Coal resources of British Columbia, Dolmage, Campbell & Assoc.

Foundex Geophysics (1987a); Seismic refraction investigation, Lang Bay Kaolin Propsect, October 1987.

Foundex Geophysics (1987b); Report on an electrical resistivity and magnetometer survey, Lang Bay Kaolin Prospect, December 1987.

Lobdell, D. (1988); Report on February 1988 core drilling-Lang Bay Kaolin Prospect (In preparation).

Mak, S.; Investigation on the kaolin at the Lang Bay prospect, Department of Metals and Material Engineering, University of British Columbia (NRC sponsored study).

Pilon, C.G. (1987); Drilling report on the Lang Bay kaolin prospect (November 1987).

White, G.V. (1986); Preliminary report. Lang Bay germanium prospect (92F/1610). Paper 1986-1, Geological Field Work (1985), Ministry EMPR of British Columbia.

A P P E N D I C E S

DRILLING METHODS

TR = TRICONE
H = HAMMER
W/L = WIRELINE
C = CORE DRILLING WITH CONVENTIONAL DOUBLE BARREL

FLUIDS

A = AIR
M = MUD
W = WATER

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 7-9.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL: HARVEY

BOREHOLE No 88-1 SHEET No 1 OF 1

ELEVATION .... DATUM ....

GRID REF 8+00S, 6+00E

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH feet	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
HAMMER	AIR						20	Brown (oxidised) Till underlain by grey sands		
								with occasional granite.		
							40	(Bedrock) boulders		
TRICONE	MUD/WATER						60			
							80	Becoming consolidated and minor grey clay particles.		
CORE								GREY CONSOL. PEBBLE CONGLOM. & ARKOSIC SANDSTONE	CORE	85-90'
TRICONE	MUD / WATER						100	Consolidated grey sandstone with occasional		
								boulders		
							120	and conglomerate bands		
								occasional clay lumps (grey/brown) in		
							140	drill returns.		
							160			
CORE								GREY CONSOL. SANDSTONE, OCCASIONAL PEBBLES, CLAY < 5%.	CORE	159-167'
TRICONE	WATER						180	Consolidated sandstone grey sandstone with		
								occasional clay		
							200	Lumps (grey/brown) in drill returns.		
CORE							220	ALTERNATING GREY SANDSTONE AND BROWN CLAYS UP TO 6" THICK (10% OF CORE)		211-218'
TRICONE	WATER						240	Consolidated grey sandstone with increasing		
								quantity of clay lumps in		
							260	drill returns.		
CORE								Alternating layers of grey sandstone and grey-	CORE	259-269'
CORE							280	brown clays (35% clay, 65% sandstone) Flat lying	CORE	269-279'
CORE								occasional lignite fragments.	CORE	279-289'
TRI	W							GREY SANDSTONE AND CLAY LUMPS IN DRILL RETURNS		
							300	EOH.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 11.02.88

CONTRACTOR CORA LYNN LOGGER HARVEY : LOBDELL

BOREHOLE Nº 88-2 SHEET Nº 1 OF 3

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING							DEPTH	DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY				COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
TR	M						0	OVERBURDEN - TILL		
W/L	W			90			123	SANDSTONE, green conglomeritic cobbles to 2", minor green clay, friable, RQD 3-6", green is due to greenstone source material, thin lignite parting at 139' and 153'.		
W/L	W			0			156	No recovery.		
TR	W			0			159	SANDSTONE and conglomerate, as above.		
W/L	W			100			199	CLAYSTONE (FIRE CLAY): grey brown, occasional lignite partings, becoming sandier/siltier with depth.		
W/L	W			100			202	SANDSTONE, clayey coarse grained, salt & pepper cross-bedded, thin coal partings, feldspathic/ark with pepper being greenstone (quartz minor).		
W/L	W			100			206	SILTSTONE/CLAYSTONE : grey.		
W/L	W			100			207	SANDSTONE: very coarse to medium grained, dark green becoming coarser with depth and more salt and peppery.		
W/L	W			100			212	CLAYSTONE: grey, grading to.		
W/L	W			100			213.5	SANDSTONE: salt and pepper, arkosic with chert and greenstone chips.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 14.2.88

CONTRACTOR CORA LYNN LOGGER HARVEY

BOREHOLE Nº 88-2 SHEET Nº 2 OF 3

ELEVATION DATUM

GRID REF. 4+00S, 0+00E

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING							DEPTH	DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY*				COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
W/L	W			100			216	CLAYSTONE: silty, grey/brown some sandy sections.		
W/L	W			100			222.5	SANDSTONE: grey, very coarse grained, friable cross-bedded, thin coal partings.		
W/L	W			100			227	CLAYSTONE: dark grey-brown, plastic, some sandy/ silty sections (CVS SS at 235'-237', 239.5'-241' and 249'-250') coal fragments common.		
W/L	W			50			253	CLAYSTONE, as above, except poor recovery and sandstone at 264'-265'.		
W/L	W			100			274	CLAYSTONE: as above, except dark olive green, very coarse sandstone 278-279', some silty sections.		
W/L	W						298	SANDSTONE: greenish, salt and pepper with coal fragments and partings.		
W/L	W			100			300.5	CLAYSTONE: dark green, interbeds to sandstone at bottom.		
W/L	W			100			305	CONGLOMERATE: dark green to salt and pepper pebbles to 1", (very coarse sandstone 315'-319.5') calcite cement(?).		
W/L	W			80			319.5	CONGLOMERATE: very coarse pebbles to 2" dark green (almost all greenstone, including punky matrix) some calcite filled fractures.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE ....

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº 88-2 SHEET Nº 3 OF 3

ELEVATION .... DATUM ....

GRID REF. ....

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING							DEPTH	DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY				COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
TR	W			O			334	CONGLOMERATE INTERBEDDED WITH SANDSTONE: (thought to be as above, from chips).		
							359	SANDSTONE: arkosic, very coarse grained, greenish salt and pepper. sharp contact with		
							368	Biotite GRANODIORITE: coarse grained, with occasional fractures which are weathered, otherwise relatively unaltered.		
							384	EOH		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 15.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº BH 88-3 SHEET Nº 1 OF 1

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING								DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
H	A			O			0	GLACIAL TILL: boulder/clay, probably underlain by BASAL CONGLOMERATE. Greenstone cobbles to 1".		
				O			92	GRANODIORITE: weathered-mafics to chlorite, feldspars to kaolin, weathering decreases with depth, coarse grained, foliated (weakly).		
C/C	W						96	GRANODIORITE: as above; non calcareous; talc layer at 107'; augen structures/xenoliths observed.		
C/L	W						126	GRANODIORITE: as above, except fresher appearance, but upon closer inspection, kaolinised and punky (friable); biotite major mafic mineral (~20%); quartz may be less than 10%.		
							154	GRANODIORITE: relatively unweathered, otherwise as above; drill rate at 157'-158' 15 minutes; increased kaolinisation at fractures.		
							158	EOH		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 16.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No. BH 88-4 SHEET No. 1 OF 1

ELEVATION DATUM

GRID REF.

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
T R	M						0	GLACIAL TILL: boulder clay; underlain by BASAL CONGLOMERATE; greenstone cobbles to ½".		
		to 51								
							51	GRANODIORITE: weathered-mafics to chlorite, feldspars to kaolin.		
							54	GRANODIORITE: as above; weakly foliated; crushed different zone (100-62'); more mafic; very coarse grained.		
							76	GRANODIORITE: as above, but less weathered, biotite becoming fresher in appearance with depth, but rock still kaolinised and punky, especially along fractures; biotite- 20%; harder drilling, but still kaolinised at 141 (EOH); less mafics after 92' (15%).		
							141	EOH.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 20.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº 88-5 SHEET Nº 1 OF 3

ELEVATION DATUM

GRID REF.

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
TRI	M			0			0	OVERBURDEN		
W/L	W			20%			62	SANDSTONE: 20% pebbles to 1½"; salt and pepper; feldspathic (partly weathered to kaolin); covered only to 68' and from 95 to 98'.		
TRI	W						125	SANDSTONE: as above, but no pebbles, covered to 128'; medium grained, cross-bedded.		
TRI	W									
W/L	W						150	SANDSTONE: as above, but very coarse grained.		
W/L	W						153	MUDSTONE: sandy, clayey; grey-brown; covered only to 156'.		
TRI	W									
W/L	W			95%			158.5	SANDSTONE: feldspathic (weathered); very coarse grained; cross-bedded; sharp contact below.		
				95%			162	CLAY SHALE: some silty sections; grey except red brown from 166-174'; thin parting (bedding) planes to case; 6" sandstone bed at 188'		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 20.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No. 88-5 SHEET No. 2 OF 3

ELEVATION DATUM

GRID REF.

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
				100			189½	SANDSTONE: fine grained grading downward to very coarse-grained; salt and pepper; cross-bedded.		
				100			194	CLAY SHALE: grey, silty sections; sharp contact below and above.		
				100			200	SANDSTONE: very coarse-grained, salt and pepper, grading to clay shale below.		
				100			204	CLAY SHALE: grey/brown fissile.		
				100			216	SANDSTONE: clayey, silty; grey, coarse-grained; gradational contacts above and below.		
				95			219	CLAY SHALE: silty sections; grey; carbonaceous fragments.		
				100			220½	SANDSTONE: dark grey; becoming coarser downwards; fine becoming coarse-grained.		
				100			222	CLAY SHALE: grey; silty, sandy; some high organic sections; slightly fissile in space, more clayey sections; 1ft sandstone at 226' and 228'; red brown from 234'-236'.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 20.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº 88-5 SHEET Nº 3 OF 3

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
							238	SANDSTONE: very coarse grained, arkosic; salt and pepper, cross-bedded to massive.		
							242	CLAY SHALE: grey becoming red/brown fissile; sharp contact above and below.		
							247½	SANDSTONE: very coarse-grained, arkosic, largely greenstone and weathered granite fragments; grading finer downward (to some extent); 3" silty black clay at base.		
							257	Stopped coring - as above.		
							279	Started coring - lithology as above.		
W/L				95			282½	CONGLOMERATE: many pebbles weathered granite; pebbles to 3" diameter.		
TR				0				No core 289-310'.		
TR				0			305	DIORITE (no core).		
W/L				100			310	(Slightly weathered) DIORITE (30% mafics) Dark green coloured.		
							316	EOH.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 22.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº BH 88-6 SHEET Nº 1 OF 2

ELEVATION DATUM

GRID REF.

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING								DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
TR	M			0			0	Overburden of sand, boulders and till.		
W/L	W			30%			130	CLAY SHALE: silty, red/grey, nuggetty structure, fractured, (RQD 2-4").		
W/L	W			100			133	CLAY SHALE: siltier, grey, massive, (RQD 4-9").		
W/L	W			100			135	SANDSTONE: very coarse-grained, salt & pepper, cross bedded (2-3"), (RQD 4-11"), sharp contact above and below.		
W/L	W			100			139	CLAY SHALE: silty, grey, massive to faint bedding (RQD 4-10").		
W/L	W			100			140	MUDSTONE: sandy, clayey; sandy structure, hematite staining; massive structure otherwise (possibly a weathered feldspathic sandstone?).		
W/L	W			100			151	SANDSTONE: fine-grained grading downwards to very coarse-grained; much of feldspar weathered to kaolin; rests unconformably on weathered granite with granite boulder one foot above contact; would appear contact dips steeper than cross-beds.		

LANG BAY KAOLIN PROJECT - LOGGING SHEET

krta

DATE 22.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No BH 88-6 SHEET No 2 OF 2

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING							DEPTH	DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY				COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
W/L	W			50%			156	DIORITE: originally 20% mafics which have partly weathered to chlorite; feldspars incompletely weathered to kaolin.		
W/L	W			100%			164	As above, becoming less weathered with depth; fractures more altered; not as weathered as much of material in previous holes; mafics much less weathered with depth to where unaltered.		
							190	EOH - becomes relatively unaltered.		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 24.02.88

CONTRACTOR CORA LYNN   LOGGER LOBDELL

BOREHOLE No 88-7   SHEET No 1 OF 1

ELEVATION   DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
							0	GLACIAL TILL : overburden		
				98			110	CLAY SHALE: grey and red/brown well indurated silty section from 123-124'; plastic; massive with shiny partings (RQD to 12").		
				100			126½	SANDSTONE: bedded with carbonaceous partings and wispy cross-beds (RQD to 6").		
				98			129	CLAY SHALE: grey browning hematite, red/brown slight fissile; (RQD to 3').		
				100			147	SANDSTONE: medium grained grading downward to very coarse-grained (two cycles); cross-bedded; salt and pepper; (RQD to 18").		
				100			171	INTERBEDDED WISPY FINE to MEDIUM GRAINED SANDSTONE AND PEBBLE CONGLOMERATE: (2 cycles); wispy sections are black clay shale, which occur in conglomerate as fragments near top (RQD to 16"),		
							178	INTERBEDDED CONGLOMERATE AND COARSE-GRAINED SANDSTONE: pebbles to 1" (3 cycles); contacts tend to be gradational probably a significant amount of kaolin in weathered pebbles (RQD to 2')		
							202	DIORITE: 25% mafics; relatively fresh to 210' but very mushy to 220' then becoming less weathered (RQD to 2').		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 26.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No 88-8 SHEET No 1 OF 1

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
							0	GLACIAL TILL: overburden.		
							74	MUDSTONE: sandy silty; sandy section from 79-81' grey (RQD to 30")		
							85	SANDSTONE: fine-grained becoming very coarse-grained downward; salt and pepper lower contact sharp, upper gradational feldspars weathered; wispy black bedding 85-86' massive to weakly cross-bedded; arkosic.		
							91	CLAY SHALE: grey; silty.		
							95	SANDSTONE: becoming coarse-grained downward; fine to very coarse-grained; salt and pepper, with greenish hue.; feldspars weathered; RQD to 2')., arkosic.		
							106	CONGLOMERITIC SANDSTONE: pebble to ; feldspars weathered; (RQD to 2') greenish hue; green shales and diorite clasts; cross-bedded to massive.		
							130	DIORITE to QUARTZ DIORITE: pyrite cubes to ¼"; moderately weathered; foliated, coarse grained; mafics about 25%; fine-grained diorite dikes along fractures (on possibly zenoliths), sharp irregular contact (RQD to 3')		
							144	EOH		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 27.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No. 88-9 SHEET No 1 OF 3

ELEVATION .... DATUM ....

GRID REF ....

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
							0	OVERBURDEN		
							52	MUDSTONE; grey; (1mm) bedded carbonaceous, (RDQ - 16")		
							53.5	SANDSTONE: very coarse grained: salt and pepper, cross-bedded with hematite partings to bedding; arkosic (partial alteration of feldspars to kaolin) (RQD - 8")		
							55	MUDSTONE: grey; thin bedded (mm);)RQD-12")		
							56	SANDSTONE: very coarse grained; salt and pepper; cross-bedded with hematite partings; carbonaecous matter (RQD - 8", fractured).		
							58	MUDSTONE: grey; massive carbonaceous matter (RQD-12")		
							60	SANDSTONE: greenish, salt and pepper cross-bedded ; thin bedded (1-10cm); fine grading downward to coarse grained; (RQD-2ft).		
							61.5	CLAY SHALE: grey, silty; carbonaceous; (RQD -16")		

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LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 27.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE No 88-9 SHEET No 2 OF 3

ELEVATION DATUM

GRID REF

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING: METHOD	FLUID	HOLE DIA	CASING	RECOVERY			DEPTH	DESCRIPTION: COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	SAMPLING: METHOD	NUMBER
							63	SANDSTONE: salt and pepper; grading downward to very coarse grained. (RQD - 12")		
							69	CLAY SHALE: grading downwards to MUDSTONE; sharp contact with sandstone below (RQD to 10") coal parting (à) 6:1		
							68'	SANDSTONE: coarse grained; salt and pepper; carbonaceous partings and fragments; some wispy bedding; last 8" very fine grained (RQD to 14"); sharp contact dipping at 3-4°.		
							71.5	CLAY SHALE: grey/brown; carbonaceous (RQD to 12"		
							72.5	SANDSTONE: pinkish salt and pepper; carbonaceous ½-1" bedding (RQD to 8").		
							73.8	CLAY SHALE: grey and grey/brown; (RQD to 30") gradational contact below.		
							77	SANDSTONE: very coarse grained; reddish salt and pepper cross bedded; hematitic and mafic partings; sharp contact with diorite; hematite filled fractures; (RQD to 205'); 93.5-94 - Diorite boulder.		
							94.5	DIORITE: 20% mafics; contact dips at 10-15%, sharp contact coarser grained; friable but becoming .... with depth; less altered at depth; alteration-feldspar to kaolin, mafics to chlorite; fractures hematite rich growing oxide red contrast; fractures at 131-134' red		

krta

LANG BAY KAOLIN PROJECT - LOGGING SHEET

DATE 27.02.88

CONTRACTOR CORA LYNN LOGGER LOBDELL

BOREHOLE Nº 88-9 SHEET Nº 3 OF 3

ELEVATION DATUM

GRID REF.

WATER LEVELS			
Time			
Water depth			
Bore depth			

DRILLING							DEPTH	DESCRIPTION	SAMPLING	
METHOD	FLUID	HOLE DIA	CASING	RECOVERY				COLOR/TEXT/GRAIN SZ/CEMENT/WEATHER/MINERALS/NAME	METHOD	NUMBER
							94.5	contd...		
								with white calcite (siderite?) and 135',		
								zenoliths to 1".		
							135	EOH.		

LOG OF CHURN DRILL HOLE * CD #1 - Logs of holes drill in 1959 closer to Long Creek

Location: On road-allowance @ N.E. cor. Lot 5143
Elevation: 153 ft. (aneroid)
Claim: G.E. No. 34

0-6	Brown silty sand and loam.
6-14	Blue clay with gravel, water table at 14'.
14-27	Silty clay.
27-30	Till.
30-32	Gravel.
32-70	Medium to coarse grained green graywacke with abundant grains of green volcanic rock. Some pebble beds. Fairly hard. Hole making water at 35 to 44 feet.
70 -76	Soft, very dark shale with beds of graywacke. Shale decreasing towards 76!.
76-90	Medium-grained graywacke, becoming coarser towards 90'. Static level of water +6" at 78 feet.
90-101.5	Medium-grained coarse graywacke with pebble beds.
101.5-102	Soft, shaly graywacke.
102-108	Soft graywacke with beds of dark sandy shale.
108-115	Soft, fine-grained shaly graywacke and dark greenish silty shale.
115-125	Dark greenish-gray shale, silty and sandy shale.
125-128	Lighter colored greenish-gray shale and silty shale, trace of coal.
128-131.5	Dark gray silty shale with medium to dark-brown sandy shale increasing toward 131.5 (brown-bed). Coal lenses - mostly in brown sandy shale. Samples Nos. 3, 4, and 5
131.5-137	Fairly light gray medium-grained sandstone.
137-145	Sandy to silty shale and shale.
145-152	Graywacke with shale beds.
152-156	Dark gray-green shale.
156-158	Soft, sandy shale with traces of coal.
158-166	Greenish-gray medium grained arkose with beds of dark gray and greenish-gray shale.
166-190	Gray arkosic sandstone with beds of shale, some graywacke
190-219	Medium to dark gray shale and silty shale, a few thin sandy beds.
219-259	Greenish arkosic graywacke, medium soft, some pebble beds some thin beds of shale. Hard graywacke from 237-239. Some soft brown shale from 253-259.

259-271	Medium to fine-grained, light to medium gray arkose.
271-301	Medium to dark gray shale, silty shale, some beds of arkose, alittle soft, brown shale. Traces of coal.

END OF HOLE

NOTE: Sampler (3'-6" of "N"-casing) lost in bottom of hole. Top is approximately at 299'.

LOG OF CHURN DRILL HOLE - CD #2

Location: Rear of house on east side L.5259 (used for well)
Elevation: 240 ft. (aneroid)
Claim: G.E. No. 11

0-8	Topsoil and gravel
8-14	Till
14-22	Greenish-gray, coarse-grained graywacke and grit composec mostly of volcanic rock grains, a few pebble beds.
22-24	Fine-grained gray sandstone, some volcanic grains, littl feldspar.
24 -44	Greenish gray arkosic graywacke, few pebble beds, like 1
44-46	Med. to fine-grained gray graywacke,alittle soft brown shale. A thin lens of coal. Sample No.6
46-48	Medium to fine-grained graywacke, a fewpebbles.
48-91	Greenish-gray shale with beds of medium to fine-grained gray arkosic sandstone. Much less volcanic material.
91-102	Gray shale with thin beds of fine-grained sandstone. A little coal, increasing slightly towards 102.
102-110	Brownish sandy and silty shale, alittle coal.
110-120	Gray sandy shale with beds of med. to fine-grained arkose increasing towards 120.
120-126	Beds of brownish shale and sandy shale with a little coa gray shale and medium to fine-grained arkose.
126-144	Grayish and greenish shale and sandy shale. Alittle coal 136-138 and elsewhere. Mica (?) conspicuous in fines from
144-154	Medium to fine-grained light gray arkosic sandstone, a fe beds of dark gray and brownish sandy shale, trace of coal
154-163	Greenish and gray shale, sandy shale and fine-grained sandstone, alittle coarser towards 163. Traces of coal.
163-172	Fairly light gray arkosic sandstone, some shale, a littl brownish sandstone, traces of coal. Sample No.13 from 164
172-178	Dark gray and greenish gray shale and sandy shale.
178-182	Brownish sandstone, brownish, gray and greenish shales.
182-196	Light gray sandstone with beds of dark gray shale and silty shale. Some specks of red iron oxides in sandy m't'
196-206	Darker gray fine-grained sandstone with shale beds.
206-230	Greenish gray and gray shale -beds of fine-grained arkose Some light gray sandy shale, some with specks of iron oxi
230-234	Brownish sandstone, brownish and some gray and green shal coal lenses. (Brown-bed) Sample No. 12 from 230-232.
234-242	Fairly dark gray sandstone, sandy shale and shale. Grain of volcanic rock and light-yellowish, unidentified grains

LOG OF HOLE CD #2 (cont'd)

242-246	Dark gray shale, silty shale. Magnetite grains from 244.
246-274	Grit, graywacke and some shale beds with prominent yellow grains. Conspicuous magnetite from 250-252, less below. Generally becoming finer-grained toward bottom of hole. Alittle brownish shale from 266, traces of coal.

END OF HOLE

NOTES: Bailer lost in bottom of hole.

This hole is now being used for domestic water supply. The static level is about four feet below ground level. The hole started making water at about 46-48 feet.

LOG OF DRILL HOLE R-2 (CD-3)

LOCATION:	On old logging road on south side of Lang Creek near east boundary of claim G.E. No. 55. 0+00 N, 0+00E.
ELEVATION:	315 ft. (aneroid)
DATE:	12 May 59 - 20 May 59 CLAIM: GE NO. 55
	This hole is a deepening of CD #3 which bottomed at 51'. Churn-drilled to 61', rotary-drilled with tricone bit to 65', and cored with N-equipment below 61'. 65
51-58	Tight boulder-clay.
58-61	Sandstone, soft, light-colored, with pebble beds.
61-65	As above, drilled with tricone bit.
65-70.5	Arkose, medium to very coarse-grained, light gray, with red iron stains on bedding planes. 1/32" lens of coal at 70'.
70.5-73	Shale, medium to dark gray, soft, with flecks of coal.
73-74	Sandstone, medium to coarse-grained, medium gray.
74-76	Shale, medium to dark gray, becoming silty towards 76.
76-76.5	Arkose, medium to coarse-grained, medium gray, 1/8" coal seam at 76.5.
76.5-78	Shale, medium to dark gray.
78-80	Shaly arkose grading downward into very coarse-grained gray arkose with streaks of red iron oxide, a little pyrite.
80-82	Shale, dark gray, becoming silty towards 82 ft., flecks of coal.
82-83	Arkosic sandstone, medium to coarse grained, medium to light gray. 1/8" coal seam at 82.5.
83-85	Siltstone, fine-grained sandstone, dark gray.
85-87	Shale; 85-86 dark gray; 86-87 dark brownish gray.
87-87.7	Siltstone, dark gray.
87.7-88.2	Shale, very dark gray, flecks of coal at 88.
88.2-88.9	Sandstone, fine-grained, dark gray.
88.9-91	Shale, dark gray to slightly brownish, a few sand grains
91-99.7	Lost core. Steel in the hole. No reason to suspect any significant change in the formation.

<u>LOG OF DRILL HOLE R-2 (CD-3)</u> <u>continued</u>:

99.7-100	Shale, dark gray and sandstone.
100-102	Lost core.
102-103	Shale, very soft, medium gray, a little red iron stain at 103.
103-103.5	Arkosic sandstone, very coarse-grained, medium gray, with flecks of coal.
103.5-104.5	Silty shale, medium gray with flecks of coal, a little grit at 104.5.
104.5-106	Shale, medium to dark gray.
106-106.5	Siltstone, clayey sandstone, thin bedded.
106.5-115	Arkose, medium to very coarse-grained. 0.1 ft. clayey sandstone at 108. A few short reddish sections. Greenish gray below 113. A few pebbles at 114.
115-120	Conglomerate and grit, pebbles to 3/4". A thin bed of red iron oxide at 115.2.
120-124	Lost core, steel in the hole. No reason to suspect any significant change in the formation.
124-142	Arkosic sandstone, pebble conglomerate. Pyrite at 140.
142-142.7	Vug. Lost water.
142.7-146	"Red-bed". Sandstone, medium-grained, dark reddish brown. <u>Sample No. 17.</u>
146-146.5	Arkosic sandstone, coarse-grained, gray.
146.5-151.8	Conglomerate. Pebbles mostly shale up to 3" across. Arkosic matrix, medium gray.
151.8-172	Biotite granite. Soft owing to decomposition of the feldspars.

END OF HOLE

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LOG OF CHURN DRILL HOLE - CD #3

Location:	On old logging road on south side of Lang creek near east boundary of Claim GE No. 55
Elevation:	315 ft. (aneroid)
Claim:	G.E. No. 55

0-2	Brown, sandy topsoil.
2-14	Blue-gray clay.
14-35	Hard boulder clay.
35-47	Fine to medium-grained water-bearing silty sand with some gravel and boulders.
47-51	Large granite boulders.

END OF HOLE

This hole was subsequently deepened — see log of R-2.

LOG OF CHURN DRILL HOLE - CD #4

Location:	On logging road 1000 ft. southeast of CD #3
Elevation:	330 ft. (aneroid)
Claim:	G.E. No. 54

0-2	Brown sandy soil with boulders.
2-40	Hard boulder clay.
40-48	Water-bearing sand and gravel.
48-51	Boulder clay
51-56	Boulders
56-56.5	Large granite boulder.

END OF HOLE

LOG OF CHURN DRILL HOLE - CD #5

Location: On bench, south side of Lang creek near westside of Claim GE-56.
Elevation: 305 ft. (aneroid)
Claim: GE No. 56

0-3	Gravelly topsoil.
3-8	Loose, heavy gravel.
8-46	Very tight boulder-clay.
46-50	Soft, lightgray, medium to fine-grained, thin-bedded sandstone and light gray shale. Some fine black rock grains and some grains of volcanic rock. Cased to 48'.
50-60	Medium to fine-grained, light gray sandstone and gray shale, including a few thin layers of brownish shale and silty shale. A trace of coal.
60-65	Brownish sandy shale with a few beds of light gray sandstone and shale. Considerably more coal. Sample No.16 from 63-64.
65-69	Dark brown sandy shale, some fragments almost black. Abundant lenses of coal. Samples Nos. 11, 14, and 15.
69-72	Gray, sandy shale. Making less than ½ gallon of water per minute from this horizon.
72-97	Weatherd mica-granite with green ferro-magnesians.

END OF HOLE

LOG OF CHURN DRILL HOLE CD - No. 6

LOCATION: Kelly Creek School (east side of building)

ELEVATION: 120 ft. (aneroid)

DATE: 28 Apr. 59 - 5 May 59 CLAIM: GE No. 7

0-17	Boulder clay.
17-25	Light hardpan.
25-26	Silty sand and gravel, water-bearing.
26-33	Shale, dark greenish, a little greenstone grit.
33-40	Shale, dark gray, trace of coal from 33-35.
40-107	Graywacke, medium-grained becoming coarser grained with pebble beds towards 107. A few shale streaks above 43 ft. Medium hard, harder below 51 ft. Mostly derive from green volcanic rocks. One or two thin beds of shale from 98-100 and 102-104. Making 1/2 gpm @ 98 ft.
107-116	Graywacke, soft, dark gray, medium to fine-grained. Some shale beds, a little grit. Trace of coal between 114 and 116. Making 2 gpm @ 111, 1/2 gpm @ 116.
116-142	Arkosic sandstone, medium to fine-grained, medium to light colored. A few thin beds of shale. Occasional trace of coal. Making 1 gpm @ 124 and 1 gpm @ 142.

END OF HOLE

NOTE:

This hole began to flow about five days after completion.

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LOG OF DRILL HOLE R-1 (CD - 7)

LOCATION: North of house on Marko Place (Lot 5260)
182 ft. S 86°E of C.D.-2

ELEVATION: 240 ft. (aneroid)

DATE: 11 May 59 - 15 May 59 CLAIM: GE No. 11

0-15	Tight boulder-clay
15-17	Pebble conglomerate, graywacke, soft.
	END OF 6" CHURN DRILL HOLE START OF N-CORING
17-18.5	Pebble conglomerate, greenstone pebbles to 1" in a medium-grained graywacke matrix.
18.5-22	Graywacke, coarse-grained, medium gray to greenish gray with pebble beds. (15% core recovery)
22-38	Graywacke(?) unconsolidated to poorly consolidated. No core recovery. A thin coal seam at 36 ft.

END OF HOLE

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LOG OF DRILL HOLE R-3 (CD-8)

LOCATION: On west side of Lot 5260 at south end of orchard.

ELEVATION: 235′ (aneroid)

DATE: 20 May 59 - 26 May 59. CLAIM: GE No. 11

Churn drilled to 20′. Rotary drilled with 3-7/8″ tricone bit to 27 ft. Cored with N-equipment from 27′

0-5	Boulders, some silt.
5-10	Boulder clay.
10-20	Conglomerate and graywacke, coarse-grained, greenish.
20-27	As above.
27-32	Lost core, probably unconsolidated graywacke.
32-41	Graywacke, unconsolidated to slightly consolidated, medium to coarse-grained, gray-green, a few thin pebble beds.
41-43.5	Graywacke, well-consolidated, medium to coarse-grainec gray-green, a few thin pebble beds.
43.5-48	Graywacke, like 32-41.
48-53.7	Graywacke, somewhat consolidated, medium to coarse-grained, gray-green.
53.7-58.5	Shale to silty shale, dark gray.
58.5-60	Shaly sandstone, becoming coarser towards 60, dark gra
60-64	Graywacke, medium to light gray, medium grained, fleck of coal.
64-65.2	Sandstone, medium grained, light to dark gray, banded, very thin seams of coal (aggregate thickness about 1/1 or less).
65.2-69	Lost core. Driller considers this material similar tc 69-69.7.
69-69.7	Graywacke, unconsolidated, olive-colored.
69.7-71	Shale and silty shale, fairly dark gray.
71-72.5	Sandstone and shaly sandstone, light to dark gray, medium to fine-grained, flecks of coal.
72.5-74	Shale, soft, dark brownish gray.
74-77	Shaly sandstone, mottled dark, greenish and pinkish gr
77-77.5	Shale, dark gray with flecks of coal.
77.5-80.5	Shaly sandstone, medium to dark gray, flecks of coal.
80.5-81.5	Shale, dark gray.

(End of shift, May 25/59, still drilling).

Log of Drill Hole R-3 (CD-8) cont'd.

81.5-83.5	Dark grey shale.
83.5-85.5	Fine-grained greywaeke.
85.5-86.5	Fine-grained sandstone - many very thin seams of coal.
86.5-88	Coarse-grained sandstone - some coal.
88-92	Coarse-grained, unconsolidated to slightly consolidated sandstone.
92-93	Medium-grained sandstone, a few seams of coal.
93-95	Medium to dark grey shale.
95-96	Fine to medium-grained sandstone, cross-bedded.
96-97	Dark grey shale, a few flecks of coal.
97-100	Medium-grained to coarse-grained, well consolidated san stone.
100-101.5	Dark grey shale.
101.5-103.5	Medium to light grey thin-bedded sandy shale, some coal in fine streaks.
103.5-104.5	Shaly sandstone.
104.5-105	Medium-grained sandstone, coal fragments.
105-109.8	Arkose, grit, very coarse-grained, medium to light grey
109.8-110.5	Medium grey sandy shale.

LOG OF DRILL HOLE CD-9 (R-4)

LOCATION:	0+15 N, 5+93 W
ELEVATION:	310.7
DATE:	May 23 - June 1, 1959 CLAIM: GE NO. 55
	Churn-drilled to 53 ft. Rotary drilled with 3-7/8" tricone bit to 115 ft. and ~~en~~N-cored 115 ft. to 135 ft.
0-7	Silty clay, soft.
7-16	Boulder clay.
16-25	Sand-gravel, some boulders, making water, static level 2 f
25-34	Boulder clay.
34-38	Coarse water-bearing gravel, some sand and boulders, very tight.
38-42	Boulders.
42-50	Boulder-clay, tight.
50-53	Arkose, light-colored, some shale.
53-57½	Arkose, coarse-grained, gray.
57.5-57.7	Reddish sandstone.
57.7-61	Shale, gray, some sandy shale.
61-65.5	Arkose, coarse-grained, gray, reddish from 61½-62.
65.5-68	Shale, sandy shale, gray.
68-69	Arkose, thin lens of coal.
69-75.5	Shale, gray.
75.5-77.5	Arkose, gray, coal lens at 76.
77.5-79	Shale, gray, sandy shale.
79-79.5	Arkose, shaly sandstone, brownish, considerable coal.
79.5-83	Sandy, shale, shaly sandstone, gray, thin bedded, a thin lens of coal at 83.
83.5-85.5	Shale, brownish.
85.5-89	Arkose, gray, medium to coarse-grained.
89-90.5	Shale, sandy shale, arkose, brownish.

Log of Drill Hole CD-9 (R-4) - cont'd.

90.5-93	Shale, some arkose. Pink color at 90.5, coal.
93-96	Arkose.
96-97	Shale.
97-135	Granite.

END OF HOLE

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LOG OF DRILL HOLE CD-10 (R-6)

LOCATION:	2+28 N, 2+23 E	
ELEVATION:	305.5	
DATE:	June 6-10, 1959	CLAIM: GE No. 56

Churn-drilled to 58 feet and core-drilled with N-equipment from 58 feet to 92 feet.

0-6	Topsoil and gravel, brown, sandy.
6-28	Boulder clay, soft, gray.
28-32	Boulder clay, tight, blue-gray.
32-36	Boulders, boulder clay.
36-40	Sand, water-bearing.
40-50	Boulder clay, very tight.
50-52	Coarse gravel, loose, silty, making water.
52-55	Gravel, tight, silty.
55-58	Sandstone, arkosic, soft, light-colored.
58-61.8	Arkosic sandstone and pebble conglomerate, friable, coarse-grained, feldspars weathered, light gray. Fragments of brown-bed at 60 feet.
61.8-63.1	Shale, soft, medium gray, traces of coal.
63.1-64.6	Arkosic sandstone, very coarse grained to coarse grain medium to light gray, weathered feldspars.
64.6-65.5	Shale, medium to dark gray, flecks of coal.
65.5-68.7	Arkose, med. to light gray, becoming coarser towards 68.7 with pebble beds, thin shale beds near 65.5. A little coal, small lenses vicinity 67 feet up to 1/8" thick with pyrite.
68.7-69.7	Lost core (probably friable arkose).
69.7-73.5	Brown-bed. Shaly to sandy, dark brown to black with abundant thin coal seams mostly 1/64" or less. (Sample 10-1 to 10-8).
73.5-88.8	Arkose, coarse-grained to very coarse-grained, with some pebble beds. (2" shale at 76.0 and 79.5), light gray, feldspars weathered, a little scattered pyrite.
88.8-92	Granite, medium to light greenish gray, weathered feldspars, green ferro-magnesians.

END OF HOLE

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LOG OF DRILL HOLE CD-11 (R-7)

LOCATION:	1+85 N, 1+20 E
ELEVATION:	311.8
DATE:	June 9-13, 1959 — CLAIM: GE No. 56

Churn-drilled to 56.5 feet and core-drilled with N-equipment from 56.5 feet to 101 feet.

0-6	Silty sand and gravel, loose.
6-24	Boulder-clay, soft, gray.
24-32	Boulder-clay, tight.
32-36	Gravel, tight, water-bearing.
36-50	Boulder-clay, soft.
50-55	Sand and gravel, loose, water-bearing.
55-56.5	Sandstone, arkosic, with some granite (weathered).
56.5-64.5	Granite with weathered feldspars (same as basement), unconsolidated sand- probably basal part of drift.
64.5-70.5	Shale, soft, may include some drift.
70.5-72.2	Arkose, very coarse-grained, light gray.
72.2-75.3	Shale and silty shale, becoming sandy towards 75.3, mec gray, lenses of coal towards base (one lens 1/8" thick
75.3-83	Arkose, very coarse-grained with grit, med. to light gr
83-85	Brown-bed, dark brown to black, shaly to sandy, coarser at base. (Sample No. 11-1 to 11-6)
85-89.4	Sandstone, med.-grained, brownish at 85, becoming white at 86, a fairly clean hard quartz sandstone.
89.4-96.7	Arkose, coarse-grained to very coarse-grained, grit, pebble conglomerate. Some pyrite at 90 feet.
96.7-101	Granite, typical light grayish green with weathered feldspars.

END OF HOLE

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LOG OF DRILL HOLE CD-12 (RC8)

LOCATION: 0+44 N, 0+27 E

ELEVATION: 313.0

DATE: June 11-18, 1959 CLAIM: GE No. 55

Churn-drilled to 56 feet and core-drilled with N-equipment from 56 feet to 144 feet.

0-4	Silty clay, brown.
4-26	Boulder-clay, gray.
26-35	Gravel, coarse, tight, silty, with lenses of clay, some water.
35-44	Clay, tight, with layers of silty sand.
44-46	Clay, black, organic.
46-50	Boulder-clay, tight.
50-53	Tight boulder-clay, brown.
53-56	Sandstone, arkosic, soft, light-colored, with thin beds of shale.
56-61	Overburden (?) in part. Clay.
61-62	Shale, soft, medium to dark gray.
62-62.3	Sandy shale, poorly consolidated.
62.3-64	Shale, silty shale, dark gray.
64-64.8	Arkose, med. to coarse-grained, med. to dark gray, some shaly sandstone.
64.8-65.9	Shale, dark gray to slightly brownish, a few thin lenses of coal.
65.9-78.5	Shale and sandy shale, medium to dark gray, rather soft.
78.5-80	Arkose, very coarse-grained, light gray.
80-86	Shale, med. to dark gray, locally somewhat brownish or greenish. Becoming a little sandy near 86 feet.
86-87.8	Arkose, fine-grained, med. to light greenish gray. Traces of coal near 87.
87.8-92.4	Arkose, coarse-grained to very coarse-grained. Med. to light gray. 2" shale at 89.5 feet.
n92.4-99.7	Shale, med. to dark gray, brownish and greenish gray. Sandy beds at 93 and 94 feet.

LOG OF DRILL HOLE CD-12 (R-8) continued:

99.7-121	Arkose, med. to very coarse-grained, grit, med. to light gray with thin smears of red iron oxide. Pebble beds at 105.5, 108.5, 111-112, 114, 115, 117.
121-122.1	Shale, sandy shale.
121.1-131.8	Arkose, grit, with pebble beds, med. to light gray. Some greenish and brownish pebbles.
131.8-139.2	Conglomerate, quite large boulders (>2') towards 139. Includes weathered granite boulders.
139.2-144	Granite, typical weathered.

END OF HOLE

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LOG OF DRILL HOLE CD-13 (R-9)

LOCATION: 1405 N, 8421 W
ELEVATION: 307.0
DATE: June 15-24, 1959

CLAIM: GE No. 55

Churn-drilled to 47 feet and core-drilled with N-equipment from 47 feet to 74.5 feet.

0-18	Sandy clay, soft, brown.
18-20	Silty clay, making some water.
20-43	Boulder clay.
43-47	Arkosic sandstone, soft, light-colored with streaks of s
47-49.1	Shale, silty shale, med. gray.
49.1-49.5	Sandy shale, med. gray.
49.5-50.1	Arkose, coarse-grained, yellowish with streaks of red iron oxide, conspicuous mica flakes.
50.1-51.2	Shale, med. to dark gray, thin-bedded with bedding almos at right angles to core axis.
51.2-51.9	Arkosic sandstone, fine-grained, med. to dark gray, thin bedded at right angles to the core.
51.9-53.1	Shale, dark gray, becoming sandy towards 53.1. Flecks o coal (1-2% coal).
53.1-55	Arkosic sandstone, coarse-grained to very coarse-grained medium to light gray.
55-57.3	Arkosic sandstone, ~~xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx~~ shaly sandstone, dark gray. Bedding at right angles to core, traces of coal.
57.3-58.8	Shale and sandy shale, dark gray.
58.8-59.9	Arkose, med. grained, med. to light gray.
59.9-62.0	Shale and sandy shale, med. to dark gray, flecks of coal
62.0-67.1	Brown-bed. shaly to sandy. Samples 13-5 to 1301. Approx. 1-foot lost core.
67.1-71.5	Clayey arkose, med. to coarse-grained. Bedding very indistinct. Gradational contacts.
71.5-74.5	Granite, soft, med. to light gray, weathered.

END OF HOLE

- - - - -

LOG OF DRILL HOLE CD-14 (P-10)

LOCATION:	1+06 S, 3+02 E
ELEVATION:	318.1
DATE:	June 18 to July 6, 1959 CLAIM: GE No. 56

0-2	Sandy topsoil.
2-18	Boulder-clay, brown.
18-31	Silty gravel, tight.
31-48	Boulder-clay, tight.
48-78	Gravel, med. coarse, with lenses of silt and fine sand. Making a considerable amount of water.
78-85	Boulder-clay, tight, with large boulders.
85-90	Arkosic sandstone, soft, light-colored with streaks of shale.
90-94	Clay, sand, sandstone, pebbles, etc. - DRIFT.
94-96.4	Clay, silty and sandy clay, med. gray, traces of coal. May be drift - largely or in part.
96.4-97.8	Clayey arkose, med. to dark gray.
97.8-107.4	Clay, some sandy and silty clay, med. gray - light brownish gray from 105-106. Occasional traces of coal.
107.4-113.8	Arkose and grit, med. to very coarse-grained, becoming coarser towards base. Med. to light gray, traces of coal.
113.8-119	Shale, grading into sandy shale from 117-119, med. to dark gray, traces of coal.
119-126.6	Arkose and grit, very coarse-grained, some beds stained reddish or pinkish by iron oxide.
126.6-126.8	Shale, med. gray.
126.8-127.8	Graywacke, med. to fine-grained, med. to dark gray. Bed has an 8^{o} dip.
127.8-129.1	Arkosic grit, pinkish.
129.1-130	Graywacke, med. to fine-grained.
130-140	Arkose, very coarse-grained, grit, pebble beds at 134.5-135, 138-139.5. 0.1' of very dark shale at 130.8.
140-141.4	Shale, mottled brownish and greenish gray.

LOG OF DRILL HOLE CD-14 (R-10) continued:

141.4-159	Grit and pebble conglomerate. Shale 149-149.5. Med. to fine-grained graywacke 155-155.8, 156-156.3.
159-165.5	Conglomerate, coarse, brown, green. Very similar to basal conglomerate in CD-3 (R02).
165.5-171	Granite, green ferromagnesians, weathered feldspars, typical.

END OF HOLE

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NOTE: This hole was churn-drilled to 90 feet and core-drilled with N-equipment to 171 feet.

LOG OF DRILL HOLE CD-15 (R-11)

LOCATION: 5+56 S, 11+26 E

ELEVATION: 320.0

DATE: July 1-11, 1959 CLAIM: GE No. 54

Churn-drilled to 88 feet and core-drilled with N-equipment from 88 feet to 134 feet.

0-54	Overburden
54-64	Slightly consolidated sand and gravel.
64-70	Med. to coarse brown sand, clean and uniform, water-bearing.
70-78	Silty sand and gravel.
78-83	"Blue" silty clay - hardpan.
83-103.5	Sand, silt, and clay with large chunks of the sandstone-shale bedrock formation.
103.5-104	Shale, dark gray.
104-105	Shaly sandstone, dark gray.
105-108	Shale and sandy shale, dark gray.
108-110	Arkose, coarse-grained to very coarse-grained. slightly brown and greenish beds
110-113	Shale to silty shale, dark gray, trace of coal.
113-115	Arkose, med. grained, med. to light gray, trace of coal.
115-116	Unconsolidated sand, med. grained, med. gray.
116-117	Arkose, med. to fine grained, med. to dark gray, trace of coal.
117-118	Shale and silty shale, med. to dark gray.
118-120	Arkose, light gray, med. grained, hard.
120-128.7	Shale, sandy shale and shaly sandstone, med. to dark gray.
128.7-131	Shale, dark gray, trace of coal.
131-134	Shale, med. to dark brown.

END OF HOLE

Hole abandoned due to caving at 103.

LOG OF CHURN DRILL HOLE CD-16

LOCATION: 8+32 E, 2+26 S
ELEVATION: 319.0
DATE: July 8-17, 1959 CLAIM: GE No. 54

Churn-drilled throughout.

0-11	Boulder-clay, sandy clay. A little silty gravel at surface.
11-43	Sandy gravel, well compacted.
43-58	Silty sand and gravel
58-75	Tight boulder-clay, some water-bearing sand below 60 f
75-83	Sand and gravel, water-bearing. Some clay below 80 ft.
83-86	Arkosic sandstone. From 83 to 90 plus feet may be a large chunk of bedrock in the glacial drift.
86-90	Shale with thin beds of sandstone.
90-106	Shale, dark gray. This may be base of overburden.
106-115	Shale, shaly sandstone.
115-120	Sandstone, fine-grained, with silt and shale.
120-128	Arkosic sandstone, coarse, with coal lenses.
128-130	Shale, gray.
130-143	Shale, brownish with some thin lenses of coal.
143-152	Pebble conglomerate, sandstone, reddish shale binder.
152-154	Sandstone, fine-grained, reddish.
154-162	Pebble conglomerate, some arkose, light colored.
162-168	Arkosic sandstone, Granite at 168?????

END OF HOLE

LOG OF DRILL HOLE CD-17

LOCATION: Lot 5260 on West Side of Lang Creek about 50 ft. E. of #2 Post of M.C. GE #10.

ELEVATION: -

DATE: July 20th - 23rd, 1959 **CLAIM:** GE NO. 37 Frac.

Churn-drilled throughout.

0-9	Fine brown sand.
9-20	Blue sandy clay.
20-33	Med. to fine-grained water-bearing sand.
33-34	Coarse-gravel.
34-54	Light hardpan.
54-56	Shale, medium gray.
56-70	Arkosic sandstone, fine-grained becoming coarser towards 70 ft.
70-82	Graywacke, arkose, containing a conspicuous amount of greenstone grains.
82-106	Granite, considerable mica.

END OF HOLE

- - - - - -

LOG OF CHURN DRILL HOLE CD-18

LOCATION: 0+91 N, 6+96 W.

ELEVATION: 309.2

DATE: August 19-21, 1959 CLAIM: GE No. 55

0-14	Clay, light gray.
14-33	Boulder clay.
33-43	Arkose with thin beds of shale.
43-47	Brownish shale, arkose, coal lenses.
47-52	Graywacke, conspicuous mica flakes. Hole is losing water.

END OF HOLE

~~Sample No.~~	~~Footage~~	~~% Ge~~
18/43-44	43 - 44	Trace
18/44-45	44 - 45	Trace
18/45-46	45 - 46	Trace
18/46-47	46 - 47	0.005

LOG OF CHURN DRILL HOLE CD-19

LOCATION: 0+96 N, 9+07W.

ELEVATION: 301.0

DATE: August 22-27, 1959 CLAIM: GE No. 55

0-5	Clay and topsoil.
5-11	Hard sandy clay
11-18	Boulder clay
18-24	Coarse water-bearing sand.
24-26	Tight hard clay.
26-28	Water-bearing sand.
28-39	Boulder clay.
39-45	Arkose, a few specks of coal/
45-51	Shale, gray.
51-54	Shale, brown, with coal lenses.
54-57	Shale, brownish, with thin beds of arkose and lenses of coal.
57-59	Arkose, gray. Coal - slough in part?
59-64	Shale, reddish brown, with thin beds of arkose,coal.
64-70	Arkose, with lenses of coal.
70-74	Shale, grayish brown with some coal lenses.
74-76	Shale, brown, thin lenses of arkose, coal.
76-78	Arkose, thin beds of shale, some coal.
78-82	Graywacke, abundant mica flakes. Very little coal -slough?
82-84	Granite, soft weathered.

END OF HOLE

SAMPLE NO.	FOOTAGE	% Ge	SAMPLE No.	FOOTAGE	% Ge
19/66-67	66-67	Trace	19/72-73	72-73	Trace
19/67-68	67-68	Trace	19/73-74	73-74	0.007
19/68-69	68-69	0.005	19/74-75	74-75	0.012
19/69-70	69-70	0.005	19/75-76	75-76	0.007
19/70-71	70-71	Trace	19/76-77	76-77	0.007
19/71-72	71-72	Trace			

LOG OF CHURN DRILL HOLE CD-20

LOCATION: 0+96 N, 11+01 W.
ELEVATION: 312.2
DATE: August 28 – Sept. 2, 1959 CLAIM: GE No. 55

0-5	Yellow clay
5-9	Blue clay
9-27	Tight boulder clay
27-29	Water-bearing sand.
29-50	Boulder clay.
50-54	Pinkish sandstone, arkose, a little brownish shale, traces of coal.
54-71	Arkose, gray, a little shale. Trace of coal.
71-75	Graywacke. Hole made ½ gpm of water at 72 feet.
75-87	Granite, soft, weathered.

END OF HOLE

SAMPLE No.	FOOTAGE	% Ge
20/53-55	53-55	Trace
20/55-57	55-57	Trace
20/57-59	57-59	Trace
20/59-61	59-61	Trace
20/61-63	61-63	0.005
20/63-65	63-65	Trace
20/65-67	65-67	Trace
20/67-69	67-69	0.005
20/69-71	69-71	0.006

LOG OF DRILL HOLE CD-21

LOCATION: 1+04 S, 8+99 W

ELEVATION: 309.7

DATE: September 2-8, 1959 CLAIM: GE No. 55

Churn-drilled throughout.

0-2	Road bed.
2-28	Boulder clay
28-33	Sand, medium coarse, water-bearing.
33-50	Tight sand and gravel with boulders. Hole flowing about 5-6 allons per minute at the collar.
50-52	Tight boulder-clay.
52-5[illegible]	Sand and boulders.

END OF HOLE

LOG OF CHURN DRILL HOLE CD-22

LOCATION: 1+04 S, 7+97 W.

ELEVATION: 304.9

DATE: September 10-15, 1959 CLAIM: GE No. 55

0-12	Soft boulder clay, silty clay.
12-27	Tight boulder clay.
27-32	Tight sand and gravel with boulders. Hole flowing about 5-6 g.p.m. at the collar.

END OF HOLE

LOG OF CHURN DRILL HOLE CD-23

LOCATION: 1+18 S, 10+94 W.

ELEVATION: 314.3

DATE: September 16-26, 1959 CLAIM No: GE 55

0 - 2	Boulder clay
2 -10	Light brown clay, a few boulders.
10 -20	Hardpan, gray, clayey.
20 -34	Boulder clay.
34 -38	Sandy hardpan.
38 -76	Coarse tight water-bearing gravel. Water flowing over top of casing.
76 -87	Light sandy hardpan.
87 -122	Arkose, grit, pebble conglomerate. Some gray to brown shale - especially below 100 ft. A few thin coal lenses from 113 to 117 feet.
122-129	Granite, soft, weathered.

Till

END OF HOLE

LOG OF CHURN DRILL HOLE CD-24

LOCATION: 3+05 S, 16+13 E.

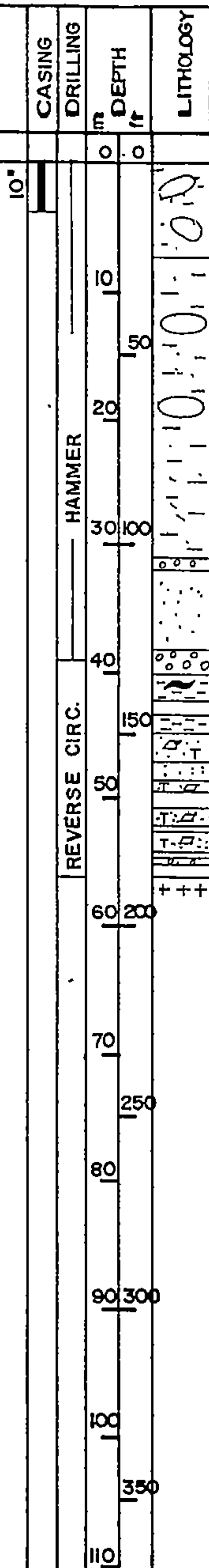
ELEVATION: 269.8

DATE: September 26-29, 1959 CLAIM: GE No. 54

0-13	Sandy clay.
13-18	Arkose, light gray, with a few thin reddish streaks.
18-36	Shaly sandstone, shale, brownish with thin lenses of coal.
36-39	Arkose, shale, very red.
39-49	Arkose and grit, a few thin beds of shale, a little coal.
49-56	Shale, with beds of arkose, a little coal.
56-60	Arkose, grit, somewhat reddish.
60-70	Red arkose and grit.
70-72	Arkose.
72-76	Granite, soft, weathered.

END OF HOLE

SAMPLE No.	FOOTAGE	% Ge	
24/26-27	26-27	Trace	
24/27-28	27-28	Trace	
24/28-29	28-29	Trace	
24/29-30	29-30	Trace	
24/30-31	30-31	0.005	
24/31-32	31-32	Trace	
24/32-33	32-33	Trace	
24/33-34	33-34	0.004	
24/34-35	34-35	Trace	
24/35-37	35-37	Trace	
24/37-38	37-38	0.004	
24/60-62	60-62	0.007	
24/62-64	62-64	Trace	
24/64-66	64-66	0.005	
24/66-68	66-68	0.007	
24/68-70	68-70	Trace	
24/60-64	60-64	0.008	Water containing reddish material in suspension (dry basis)
24/64-70	64-70	Trace	Water containing reddish material in suspension (dry basis)



DESCRIPTION

BROWN OXIDIZED TILL & BOULDERS

4" BOULDER

BLUE SANDY CLAY

1' BOULDER

PEBBLE 1' TO 2" WATER

COARSE SAND & WATER

CONGLOMERATES

PURPLE GREY SHALE & COAL SEAM

WHITE KAOLIN

GREY CLAY / SHALE

ARKOSIC SANDSTONE

CLEAN SAND & BROKEN ROCK - WATER

ARKOSIC SANDSTONE

DIRTY WHITE CLAY

ARKOSIC SANDSTONE/CLAY ALTERNATE

HARD TO DRILL

END OF HOLE 183'

FARGO RESOURCES LTD.	ELEVATION: 140.4 m	HOLE # 87 - 33
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
6 3/4"	HAMMER	0	0		OXIDIZED TILL & BOULDERS
		10	50		GREY SAND
		20			
		30	100		BLUE SANDY CLAY
		40			BROWN BEDS – COAL SEAM GREY & BROWN SHALES
			150		RED SHALES
		50			GREY SHALES SANDSTONES
	REVERSE CIRC.				LT. GREY TO BEIGE SHALE
		60	200		RED BROWN CLAY
					GREY CLAY / SHALE
					RED BROWN CLAY
					BEIGE CLAY
					RED BROWN CLAY
		70			BEIGE CLAY
			250		
		80			DEEP GREEN – GREEN SANDSTONES & CLAY ARKOSIC
		90	300		HARD TO DRILL END OF HOLE AT 296'
		100			
			350		
		110			

FARGO RESOURCES LTD.	ELEVATION: 136.4 m	HOLE # 87 – 34
LANG BAY PROJECT	NOVEMBER, 1987	

APPENDIX B

SEISMIC SURVEY REPORT
OF FOUNDEX GEOPHYSICS INC.

FARGO RESOURCES LIMITED

REPORT ON

SEISMIC REFRACTION INVESTIGATION

LANG BAY KAOLIN PROSPECT

LANG CREEK AREA

VANCOUVER, M.D.

NTS 92F/16W

49°43'N, 124°25'W

OWNER AND OPERATOR

FARGO RESOURCES LIMITED

900 - 850 WEST HASTINGS STREET

VANCOUVER, B.C. V6C 1E1

by

Russell A. Hillman, P.Eng.

October, 1987

FGI-024-3

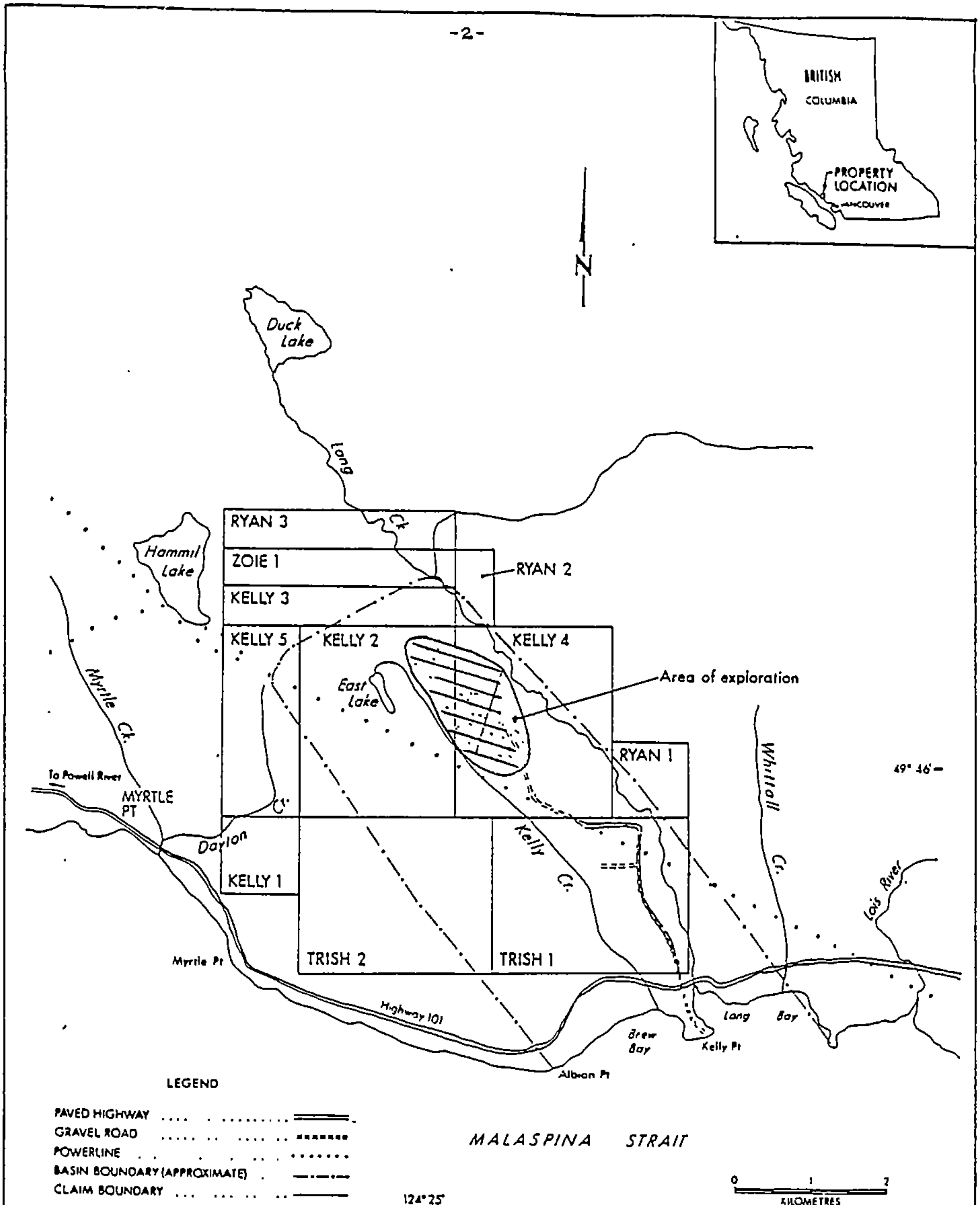
CONTENTS

Figures

1. INTRODUCTION

In the period September 10 to September 19, 1987, Foundex Geophysics Inc. carried out a seismic refraction investigation for Fargo Resources Limited at their property at Lang Bay near Powell River, B.C. The investigation was carried out along seven separate parallel lines on claims staked to cover the postulated extent of a kaolin clay deposit in the area. The purpose of the survey was to determine the thickness and general composition of oberburden soils overlying sedimentary beds and the overall thickness of materials overlying the basement granitic bedrock.

A site plan is presented in Figure 1. In total, 22,000' (6.7 km) of seismic refraction survey work was carried out at the site.



FARGO RESOURCES LTD. LANG BAY PROJECT	OCTOBER, 1987
SITE PLAN	FIGURE 1

2. LOCATION AND ACCESS

The claim group lies 9.3 miles (15 km) southeast of the town of Powell River, B.C., and in close proximity to Lang Bay. The property is bounded by Lang Creek to the east and north, by Hammil Lake to the west and Malaspina Strait to the south.

Highway 101 follows the coast from Saltery Bay to Powell River and passes very near to the southern limit of the property. Zilinsky Road extends north and then west from Highway 101 to the B.C. Hydro power line where a tote road gives access to the exploration area.

3. HISTORY

Interest in the Lang Bay property dates from 1948, when a spectrographic research study on the coals of British Columbia discovered high values of germanium in the carbonaceous sandstone material found in the sedimentary basin located there. A trenching and churn drilling program was carried out by Taiga Mines Ltd. in 1958 and 1959.

In 1977, the property was staked by Ultrabasic Minerals Ltd. who treated samples in a high temperature furnace. These results did not warrant further work and the claims were allowed to lapse.

In 1981, the claims were acquired by Fargo Resources Limited who carried out an extensive sampling program on the Kelly group in 1981 and 1982. In 1986, a drill program was completed in the Kelly claim group.

In May, 1987, Foundex Geophysics Inc. carried out a 610 m north-south seismic refraction survey line on the Kelly 4 claim. Drillhole 87-7 was put down on the seismic line and extensively sampled between 58' (17.4 m) and 132' (39.6 m). The samples were analyzed at the University of British Columbia and proved to be a kaolinitic clay with kaolin concentrations varying from 35% to 60%.

In September, 1987, more extensive seismic refraction and drilling programs were initiated in an area encompassed by the access road to the east, Kelly Creek to the west, and the power line to the south.

4. GEOLOGY

The property is underlain by a basin of thin-bedded Eocene sedimentary rock composed of poorly to well consolidated shales, sandstones, arkose and conglomerates. The basin is surrounded and underlain by granitic intrusives of the Coast Plutonic complex of Jurassic-Cretaceous age. Glacial overburden covers all of the claim area, except along Lang Creek.

The recent drilling program, summarized in "Drilling Report on the Lang Bay Kaolin Prospect" by C. G. Pilon, November, 1987, outlined the following:

4.1 Overburden

The overall overburden thickness ranges from 50' (15 m) to 170' (50 m). A surficial layer composed of oxidized till with numerous boulders is from 15' (4.5 m) to 25' (7.5 m) in thickness. This unit is underlain by a glacial deposit of grey sand, blue clay/clayey sand, and coarse grey washed sand which is usually saturated.

4.2 Brown Beds Formation

The Brown Beds Formation is formed by a succession of thin bedded shales, sandstones, clays and conglomerates. Coal cuttings and organic fragments are present in shale/clay horizons. The dip trend is south-westerly with a dip angle of up to 20 .

4.3 Kaolin and Arkosic Formation

The formation encompasses feldspar alteration of the granitic rock in situ, arkosic sandstones interbedded with kaolinitic clay, kaolin residual of primary deposit found above the arkosic sandstones and kaolinitic clays of secondary origin in the upper part of the formation. Secondary kaolinitic clays are also found on the Brown Beds Formation.

The kaolin deposit trend is along a structural feature oriented south-east to north-west and trending through drillholes 87-9, 87-20, 87-30, and 87-33 (Figure 2). The thicknesses and whiteness of the kaolin found along this line suggests weathering of the underlying granitic rock by hydrothermal processes.

The Arkosic Formation lies above the granitic bedrock with an average thickness of 47.5' (14.5 m).

5. THE SEISMIC REFRACTION SURVEY METHOD

5,1 Equipment

The seismic refraction investigation was carried out using a Geometrics Model ES-1225, 12 Channel, signal enhancement seismograph and Mark Products Ltd. 14 Hz geophones. A 1000' (305 m) cable was used for all seismic lines with geophone spacings of either 50' (15.2 m) or 100' (30.5 m). Explosive charges ranging from one to eight sticks of 75% Forcite dynamite were detonated electrically using a Geometrics HVB-1 high voltage, capacitor-type blaster.

5.2 Survey Procedure

For each spread, the seismic cable was stretched out in a straight line and the geophones implanted. Six different shot-holes were then excavated; one at either end of the spread, two intermediate locations within the line, and one off each end of the line for coverage of the basal layer. Shots were detonated individually and arrival times for each geophone were automatically recorded in the seismograph. Hard copy records were made on electrically sensitive recording film. Data recorded during field surveying operations was generally of good to excellent quality.

Topographic surveying was carried out at the site by R. J. Durling & Associates of Powell River, B.C.

6. SEISMIC REFRACTION DATA ANALYSIS

6.1 Interpretation

Interpreted geological conditions at the site indicate shallow to deep basement overlain by up to five separate layers. In general, the velocity contrast between refractive layers was distinct, however, the contrast between the Brown Beds Formation with the underlying Arkose Formation and in some instances, the overlying glacial overburden, was small requiring careful application of the standard interpretive methods to arrive at final profiles. Interpreted boundaries between layers with different velocities are indicated by dashed lines in the profiles. The basal dashed line in all cases represents the interpreted competent granitic basement surface.

6.2 Interpretive Methods

The interpretation of the seismic data was arrived at using the method of differences technique. This method utilizes the time taken to travel to a geophone from shotpoints located to either side of the geophone. Using the total time, a small vertical time is computed which represents the time taken to travel from the refractor up to the ground surface. This time is then multiplied by the velocity of each overlying layer to obtain the thickness of each layer at that point.

6.3 Limitations

The interpreted depths to subsurface boundaries derived from seismic refraction surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries. In some cases, unusual geological conditions may produce false or misleading seismic arrivals with the result that computed depths to subsurface refractors may be less accurate.

In this survey, the large depths to bedrock in some areas coupled with the thickness and high approximate 3000 m.p.s. velocity of the overlying layer resulted in incomplete two-way coverage of the basal granitic basement surface. This difficulty was partially overcome by "picking" of second arrivals on seismic records which were interpreted as the basement refractor and extrapolation of calculated basement velocities into areas of incomplete coverage. In addition, the small velocity contrast between the Brown Beds Formation with the underlying Arkose Formation and in some instances with the overlying glacial till overburden, give rise to partial definition of hidden layers which will result in some additional inaccuracies.

Interpretation errors may be large in areas of thick nominal 3000 m.p.s. velocity layer presence which is essentially to the west and south. With additional drillhole information, seismic refraction interpretation may require revision in order to better define layer boundaries and thicknesses.

7. GEOPHYSICAL RESULTS

7.1 General

Seismic refraction profiles at a natural scale of 1:2000 are shown in Appendix A. Seismic Line 1 was carried out in May, 1987, but is included here for completeness.

7.2 Overburden

The seismic refraction interpretation has identified three distinct overburden velocities. The thin surficial layer ranging in velocity from 645 m.p.s. to 1045 m.p.s. has been directly correlated with loose sand, gravels and cobbles, cemented sands and gravels, and loose, wet silt and sand in swampy areas. This unit appreciably thickens at station 3+00W on Line 2+00N coincident with an interpreted fault.

The second grouping ranges in velocity from 1210 m.p.s. to 1600 m.p.s. These velocities have been directly correlated with dry, loose clay, sand and gravels and occasional boulders. These materials pinch out against higher or lower velocity materials in the vicinity of inferred faults located at 3+00W on Line 2+00N, and 2+70W and 6+00W on Line 0+00.

The third distinct group ranges in velocity from 1770 m.p.s. to 2510 m.p.s. and averages 2100 m.p.s. Drillhole intersections indicate these velocities represent glacial till and sand and clay with some boulders. Velocities within this layer are high for overburden materials due either to numerous boulder inclusions or saturated conditions. The 2440 m.p.s. and 2510 m.p.s. velocities encountered at station 7+50W to 12+00W on Line 2+00N, seem anomalously high and may indiate either shallow Brown Beds Formation or extremely dense overburden.

7.3 Intermediate Layers

There are two distinct velocity layers intermediate between the interpreted overburden layers and the basement granitic rock. The upper thinner unit with velocities of 2320 m.p.s. to 2670 m.p.s. and average velocity of 2510 m.p.s. has been correlated with the Brown Beds Formation. This unit, due to its depth of burial, thickness and velocity behaves in some instances, as a "hidden" layer in that it is not consistently detected throughout the survey area.

The major intermediate layer has a velocity range of 2680 m.p.s. to 3410 m.p.s. and an average velocity of 3060 m.p.s. This unit which may contain some "hidden" Brown Beds Formation at near surface, has been sampled by limited drilling and is correlated with the Arkose Formation. This layer thickens substantially to the west and south reaching a maximum interpreted thickness of 160 m on Line 6+00S. The composition of this layer to the west and south is believed to be arkosic sandstones with or without a layer of more competent overlying Brown Beds Formation. At depth, this layer may also be composed in part of altered granitic rock in situ.

7.4 Basal Layer

The basal layer, having velocities ranging from 4120 m.p.s. to 7925 m.p.s. is interpreted as the competent granitic bedrock surface. Computed basement velocities indicate a weak trend of higher velocities in areas of shallow overall depths to basement, to lower velocities in areas of greatest interpreted depths to basement. The basement surface dips generally west and south although data from the east section of Line 2+00S, Line 4+00S and Line 10+00S, indicate an easterly dip to the bedrock surface. There is a significant drop in bedrock elevation between Lines 4+00S and 6+00S suggesting the presence of faulting between these lines.

8. SUMMARY AND RECOMMENDATIONS

A total of 22,000' (6705 m) of seismic refraction work has been completed on Fargo Resources Ltd.'s kaolin clay prospect at Lang Bay near Powell River, B.C.

The seismic work was able to identify distinct velocities for overburden units, the Brown Beds Formation, Arkose Formation and the basement granitic bedrock. Faulting was detected by the seismic refraction survey.

The Brown Beds Formation, due to its velocity, thickness and depth of burial, is believed to be a "hidden" layer in the interpretation of some profiles. The granitic basement surface dips generally to the west and south and is overlain in areas of greatest thickness by the interpreted "Arkose Formation" which is interpreted to be up to 160 m thick on Line 6+00S. The depths to bedrock and the thicknesses of the "Arkose Formation" in deep areas is reliant in some instanes on incomplete two-way coverage of the basal granitic surface and may be in error.

Future work should consist of drilling and geophysical surveying. Priorities of the drilling program should be the sampling of the thick "Arkose Formation" to the west and south of the present detailed drilling area and an investigation of bedrock depths especially the discrepancy between Lines 4+00S and 6+00S.

Given that primary kaolin contains significant magnetite and is associated with faulting, high resolution magnetometer surveying should be carried out. Results of surveying on the present grid should be evaluated to detemine if the technique is effective in structural mapping and determining kaolin concentrations.

Resistivity surveying should be carried out on the present grid to determine its effectiveness in delineating overburden, Brown Beds Formation, kaolin and structural anomalies.

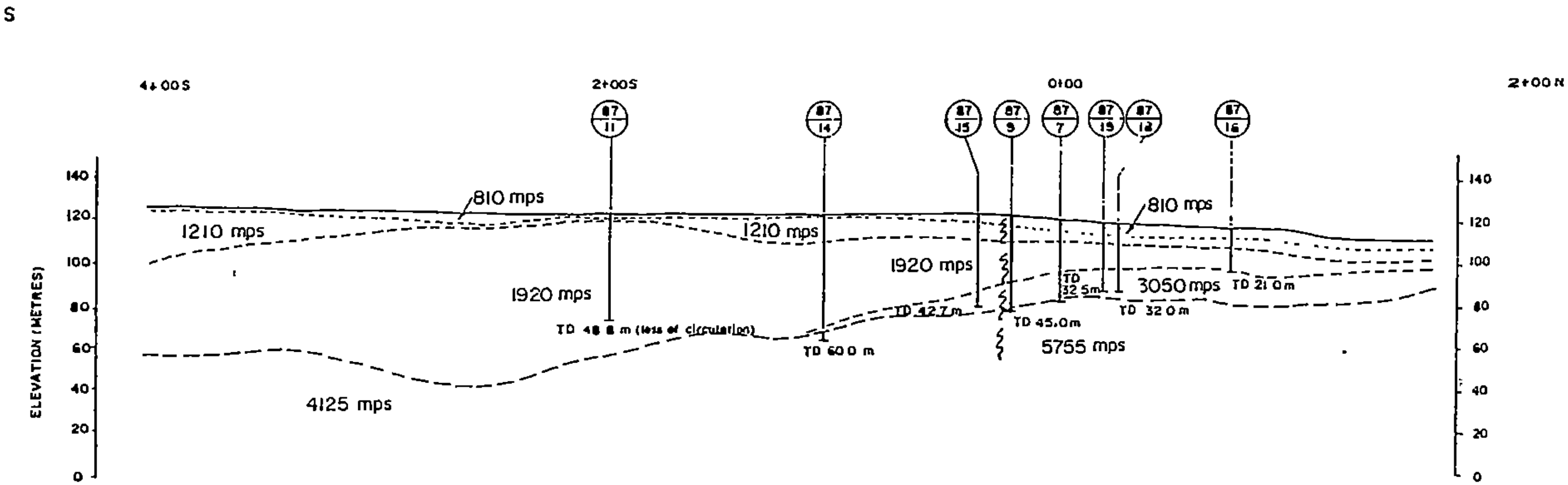
Seismic refraction surveying is effective in mapping the major geological units at the site and in identifying major faults. Future seismic refraction work should be carried out with tighter geophone spacings and wider offset shooting. This will result in improved intermediate layer and basement definition and a more thorough understanding of site geology.

for

FOUNDEX GEOPHYSICS INC.

Russell A. Hillman, P.Eng.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA Russell A. Hillman



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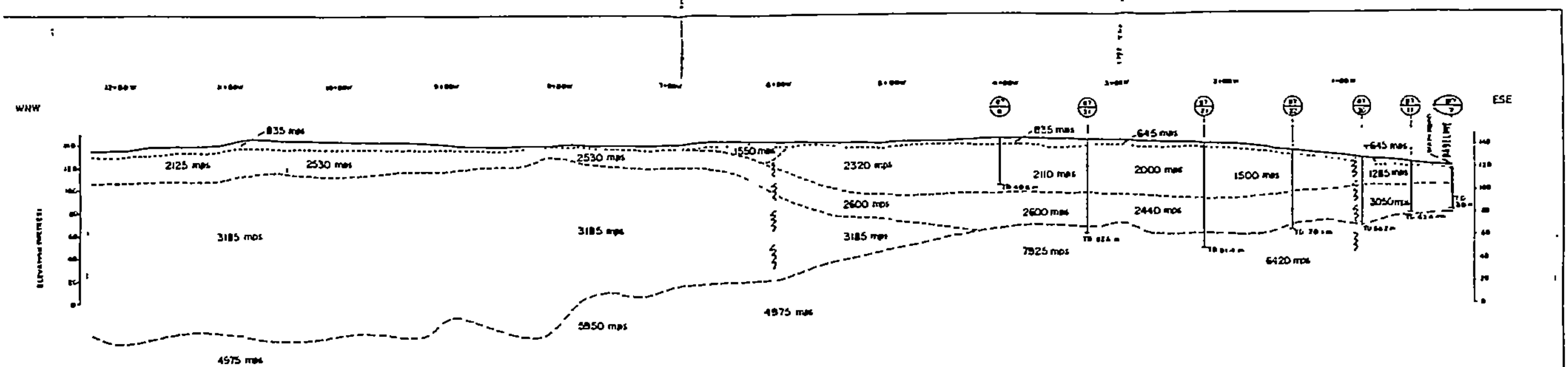
SEISMIC REFRACTION SURVEY INTERPRETED SECTION SL-1	OCTOBER, 1987 FGI-024-3



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FARGO RESOURCES LTD LANG BAY PROJECT	FOUNDEX GEOPHYSICS INC
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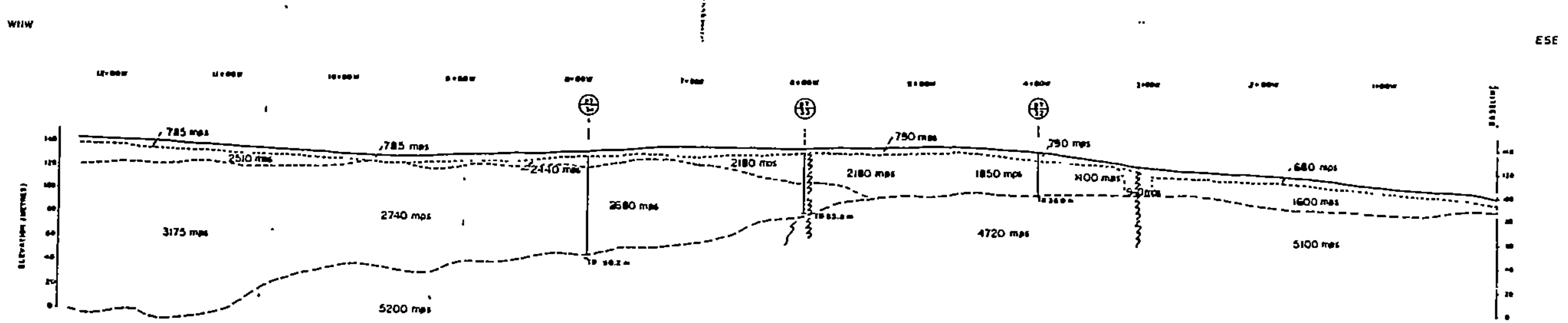

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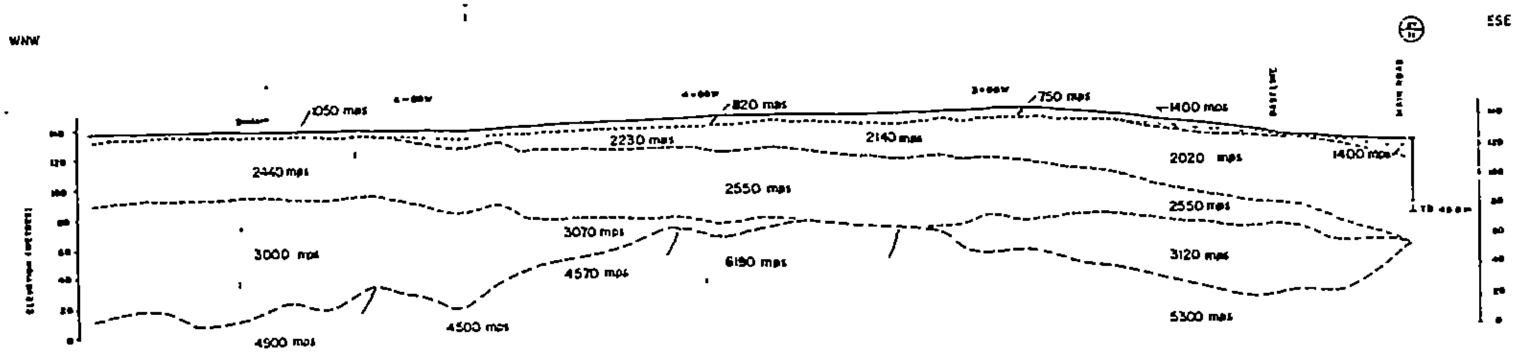

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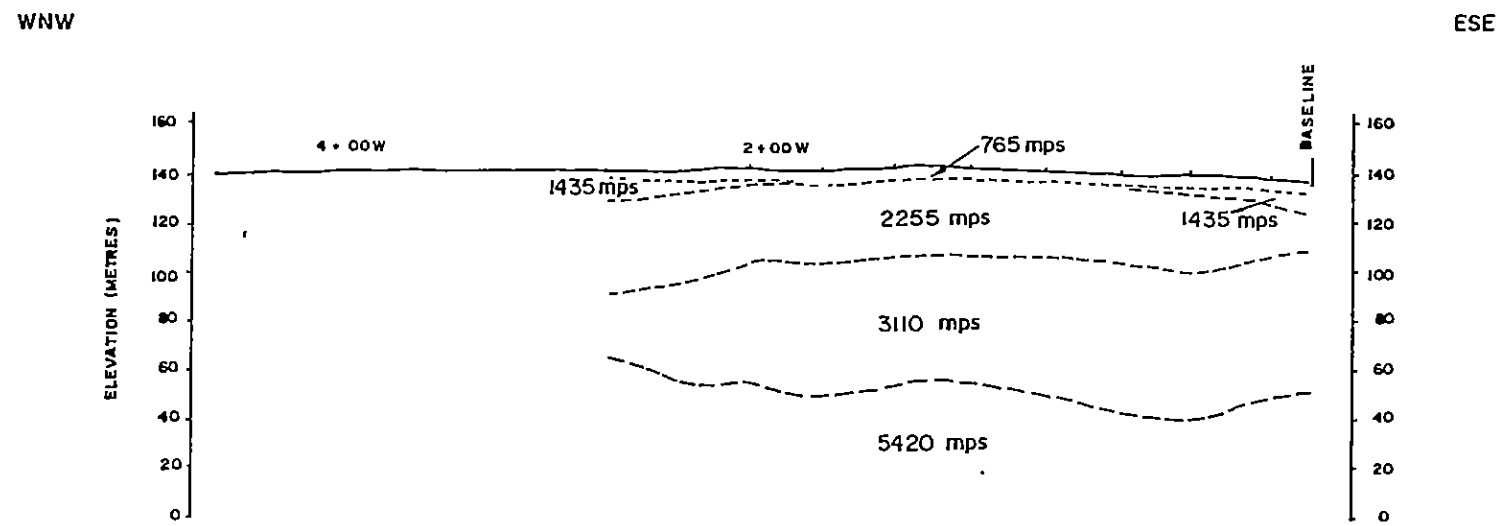
SEISMIC REFRACTION SURVEY INTERPRETED SECTION LINE 2+00S	OCTOBER, 1987 FGI-024-3



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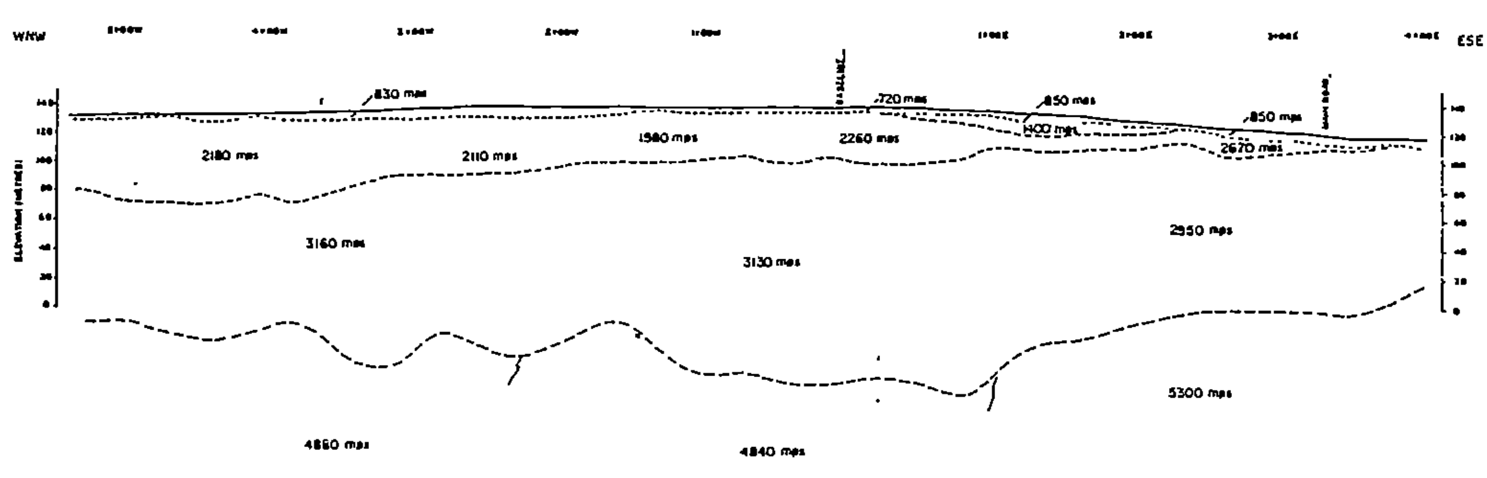
FARGO RESOURCES LTD LANG BAY PROJECT	FOUNDEX GEOPHYSICS INC
SEISMIC REFRACTION SURVEY	OCTOBER, 1987
INTERPRETED SECTION LINE 4+00S	FGI-024-3



SCALE 1 2000

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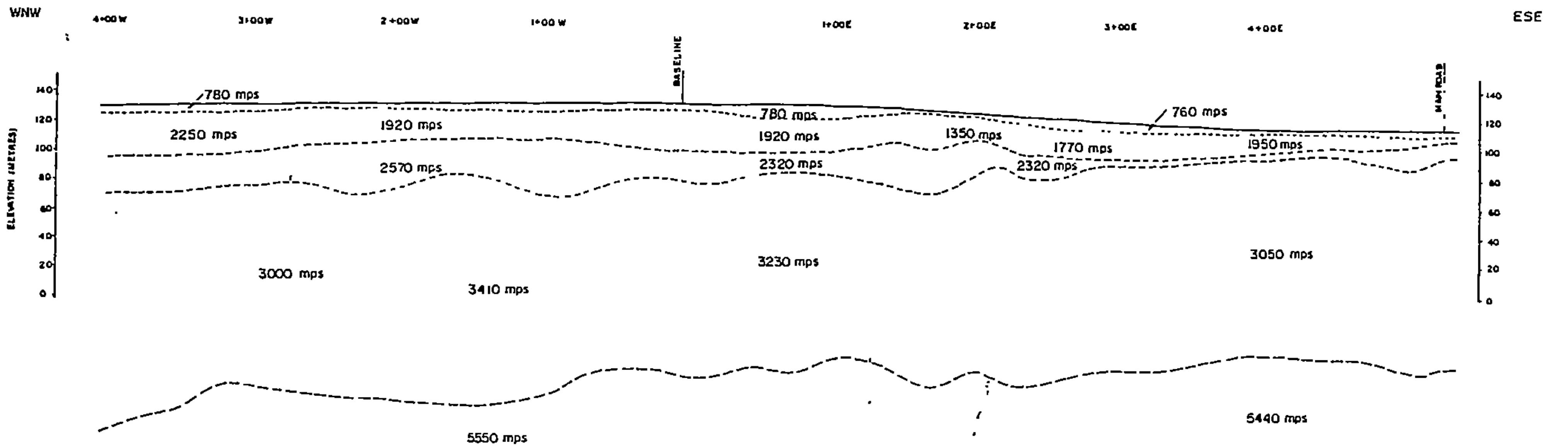
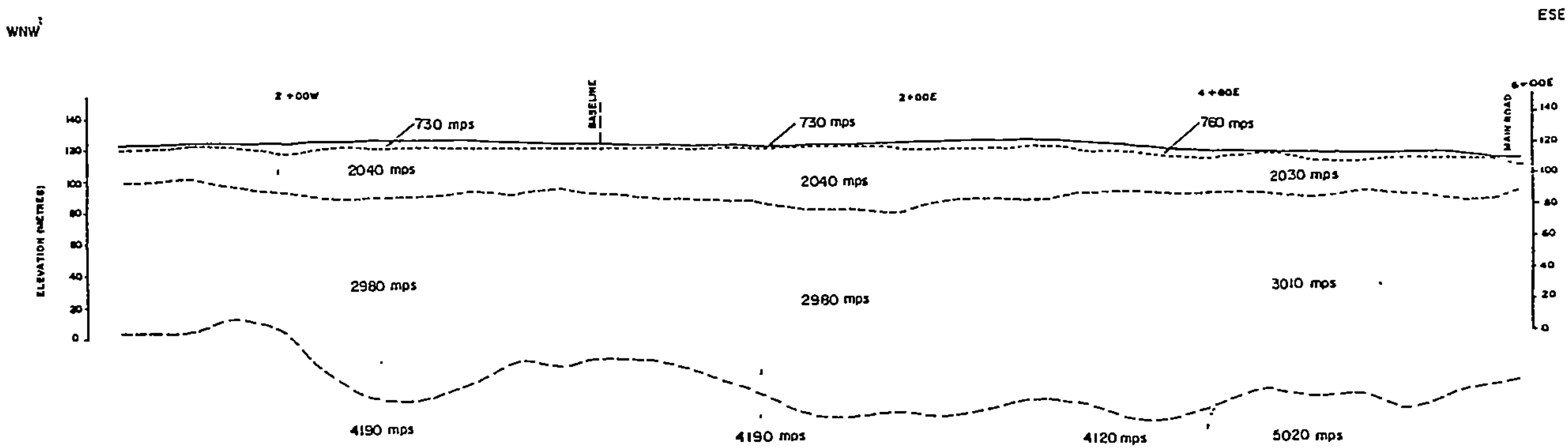
SEISMIC REFRACTION SURVEY INTERPRETED SECTION LINE 8+00 S	OCTOBER, 1987 FGI-024-3



SCALE 1 2000

FARGO RESOURCES LTD LANG BAY PROJECT	FOUNDEX GEOPHYSICS INC
SEISMIC REFRACTION SURVEY INTERPRETED SECTION LINE 8+00S	OCTOBER, 1987 FGI-024-3



SCALE 1:2000

FARGO RESOURCES LTD LANG BAY PROJECT	FOUNDEX GEOPHYSICS INC
SEISMIC REFRACTION SURVEY INTERPRETED SECTION LINE 10+00S	OCTOBER, 1987 FGI-024-3

APPENDIX C

MAGNETOMETER AND RESISTIVITY REPORT OF FOUNDEX GEOPHYSICS INC.

FARGO RESOURCES LIMITED

REPORT ON AN ELECTRICAL RESISTIVITY AND MAGNETOMETER SURVEY LANG BAY KAOLIN PROSPECT

LANG CREEK AREA

VANCOUVER, M.D.

NTS 92F/16W

49°48′N, 124°25′W

OWNER AND OPERATOR

FARGO RESOURCES LIMITED

900 - 850 WEST HASTINGS STREET

VANCOUVER, B.C. V6C 1E1

by

Clifford E. Candy, Senior Geophysicist

Russell A. Hillman, P.Eng.

December, 1987

FGI-024-5

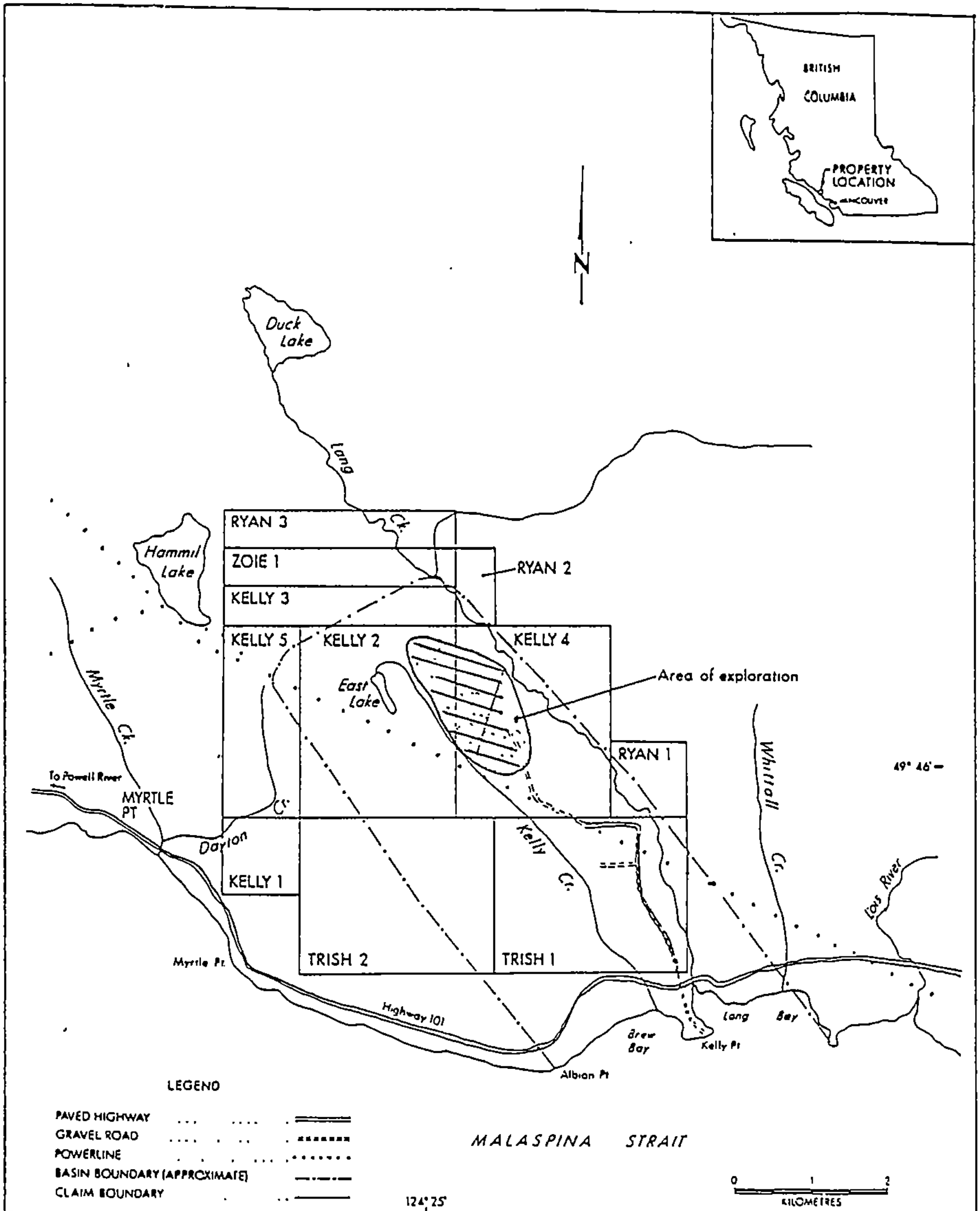
CONTENTS

ILLUSTRATIONS

1. INTRODUCTION

During December of 1987, a program of dipole-dipole apparent resistivity surveying and proton precession magnetometer surveying was undertaken on the Lang Bay Kaolin Prospect. The resistivity survey consisted of approximately ten kilometres of five separation coverage as well as four Schlumberger electrical resistivity soundings. The magnetometer survey was carried out over approximately 10.5 kilometres of line with 12.5 metre station intervals.

The objective of the resistivity surveys was to determine whether sufficient resistivity contrasts existed to delineate the kaolin-bearing formation, and within the scope of the limited program layed out, determine the extent and distribution of the Kaolin. The magnetometer survey had as its objective the detection of structural features, such as faulting which might have both controlling and disruptive attributes with respect to the kaolin-bearing formation. As well, the possibility exists that direct detection of the kaolin may be possible due to the high magnetite content of the clay-bearing formation given sufficient magnetic susceptibility contrasts exist against the basement rocks and other units.



FARGO RESOURCES LTD. LANG BAY PROJECT	DECEMBER, 1987
SITE PLAN	FIGURE 1

2. LOCATION AND ACCESS

The claim group lies 9.3 miles (15 km) southeast of the town of Powell River, B.C., and in close proximity to Lang Bay. The property is bounded by Lang Creek to the east and north, by Hammil Lake to the west and Malaspina Strait to the south.

Highway 101 follows the coast from Saltery Bay to Powell River and passes very near to the southern limit of the property. Zilinsky Road extends north and then west from Highway 101 to the B.C. Hydro power line where a tote road gives access to the exploration area.

3. GEOLOGY

The property is underlain by a basin of thin-bedded Eocene sedimentary rock composed of poorly to well consolidated shales, sandstones, arkose and conglomerates. The basin is surrounded and underlain by granitic intrusives of the Coast Plutonic complex of Jurassic-Cretaceous age. Glacial overburden covers all of the claim area, except along Lang Creek.

The recent drilling program, summarized in "Drilling Report on the Lang Bay Kaolin Prospect" by C. G. Pilon, November, 1987, outlined the following:

3.1 Overburden

The overall overburden thickness ranges from 50' (15 m) to 170' (50 m). A surficial layer composed of oxidized till with numerous boulders is from 15' (4.5 m) to 25' (7.5 m) in thickness. This unit is underlain by a glacial deposit of grey sand, blue clay/clayey sand, and coarse grey washed sand which is usually saturated.

3.2 Brown Beds Formation

The Brown Beds Formation is formed by a succession of thin bedded shales, sandstones, clays and conglomerates. Coal cuttings and organic fragments are present in shale/clay horizons. The dip trend is south-westerly with a dip angle of up to 20^{o}.

3.3 Kaolin and Arkosic Formation

The formation encompasses feldspar alteration of the granitic rock in situ, arkosic sandstones interbedded with kaolinitic clay, kaolin residual of primary deposit found above the arkosic sandstones and kaolinitic clays of secondary origin in the upper part of the formation. Secondary kaolinitic clays are also found on the Brown Beds Formation.

The kaolin deposit trend as defined by the drilling program is along a structural feature oriented south-east to north-west. The thicknesses and whiteness of the kaolin found along this line suggests weathering of the underlying granitic rock by hydrothermal processes.

The Arkosic Formation lies above the granitic bedrock with an average thickness of 47.5' (14.5 m).

4. INSTRUMENTATION AND SURVEY PROCEDURE

4.1 Resistivity Surveys

The dipole-dipole resistivity survey was undertaken using an ABEM SAS 300B resistivity meter. An "a" spacing of 25 metres was employed with "n" values ranging from one to five in the shallower basement areas and two through six in the deeper south and west grid areas. Porous pot electrodes were used to sense potential information and self-potential data was recorded to monitor contact integrity.

The Schlumberger soundings were undertaken using the 300B resistivity meter. The potential "mn" separation expansion points were read twice to ensure accuracy. Geometric "k" factors were computed and results plotted ongoing with survey operations in order to maintain data quality and monitor for lateral inhomogeneity effects.

4.2 Magnetometer Survey

The magnetometer survey was carried out using a Gem Systems Lamontagne GSM-18 instrument. A GSM-18 with extended memory was used as a base station. Operator demagnetization precautions were observed and base station to roving magnetometer synchronization was maintained to within one second per day. Diurnal variation removal was accomplished using software internal to the GSM-18 and the resulting data downloaded to field computer.

5. DATA PROCESSING AND INTERPRETATION

5.1 Resistivity Surveys

The dipole-dipole data was gridded utilizing an elliptical window consistent with the "n" and "a" parameters and the resulting gridded data assigned colours in a logarithmic distribution. This information is displayed in false colour pseudo-section format in Figures 6 - 9. It should be noted that the vertical scale is exaggerated by a factor of two to enhance the clarity of vertical detail.

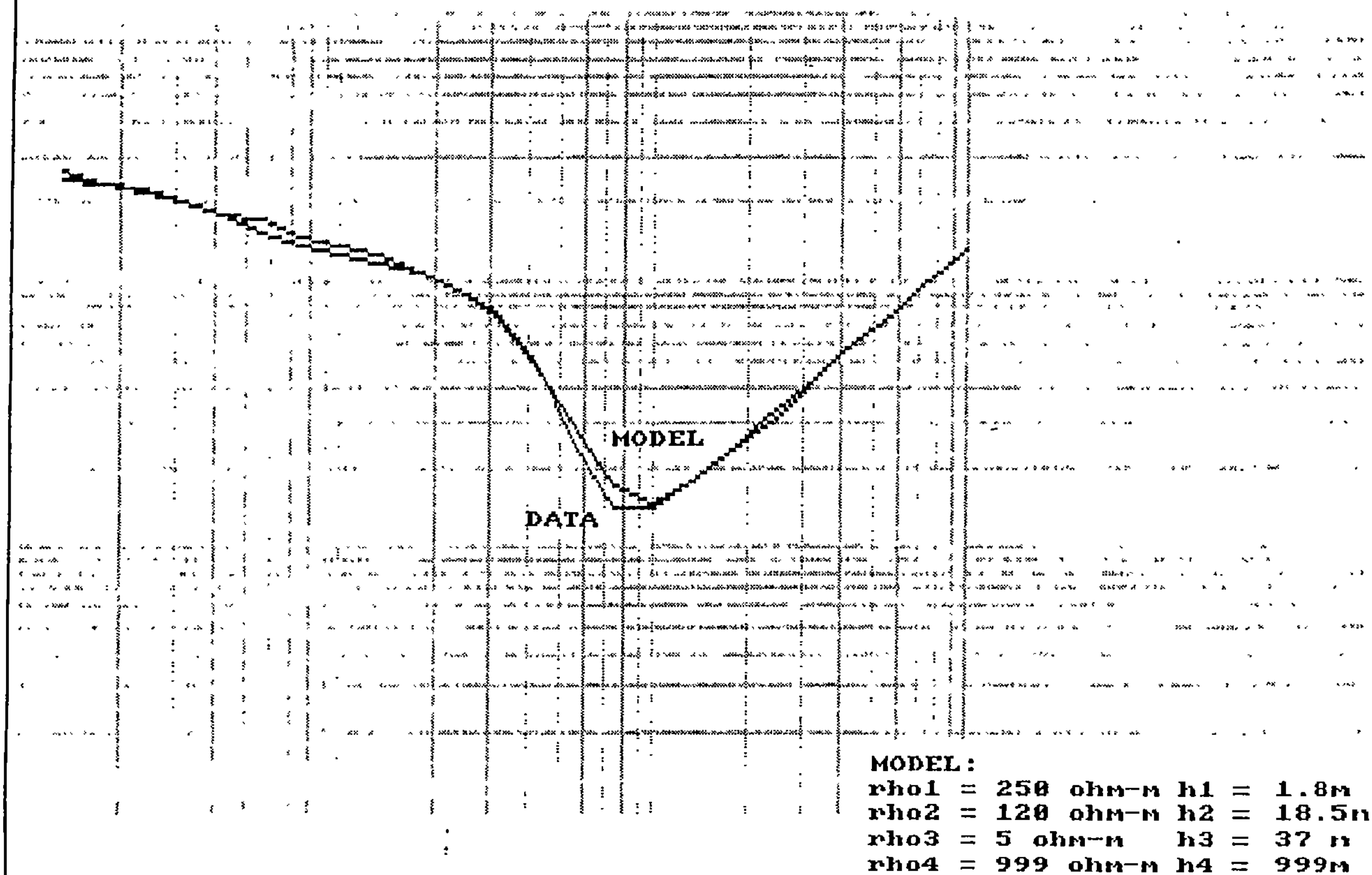
The n=5 data was gridded in plan and plotted at a scale of 1:10000 in Figure 3. This provides an overview of the plan distribution of apparent resistivities at this separation.

At appropriate intervals apparent resistivity data was selected and modelled using a digital linear filter method forward case (Ref. 1, 2). These data form partial sounding curves, spanning a small interval of less than a decade. However, the models provide a useful estimate of true resistivities and a rough estimate of layer thicknesses. These data have been plotted on interpretation sections in Figures 8 - 17. The data on lines 2+00N and 0+00N overlay the detailed seismic interpretation for these lines (Ref. 3). Where the extent of the seismic lines permits, the north-south apparent resistivity traverses intersect the seismic lines at approximately 200 metre intervals. These data are plotted on the interpretation sections for comparison with the apparent resistivity data. The dashed lines connecting the various velocity layers are for correlation purposes only and do not form a detailed estimate of horizon topography.

The Schlumberger resistivity sounding data and the corresponding model curves are plotted in Figures 18 - 21. The locations of the soundings are noted in Figure 2 and the derived models on Figures 9, 14 and 16. The Schlumberger sounding method requires little movement of the potential pot electrodes during the course of the soundings as compared to other methods. As potential sensing is much more subject to local resistivity effects as compared to the current introduction points this method provides some immunity against the presence of lateral inhomogeneities. In some areas of the property however, strong lateral resistivity contrasts are present and interference with the sounding results is apparent.

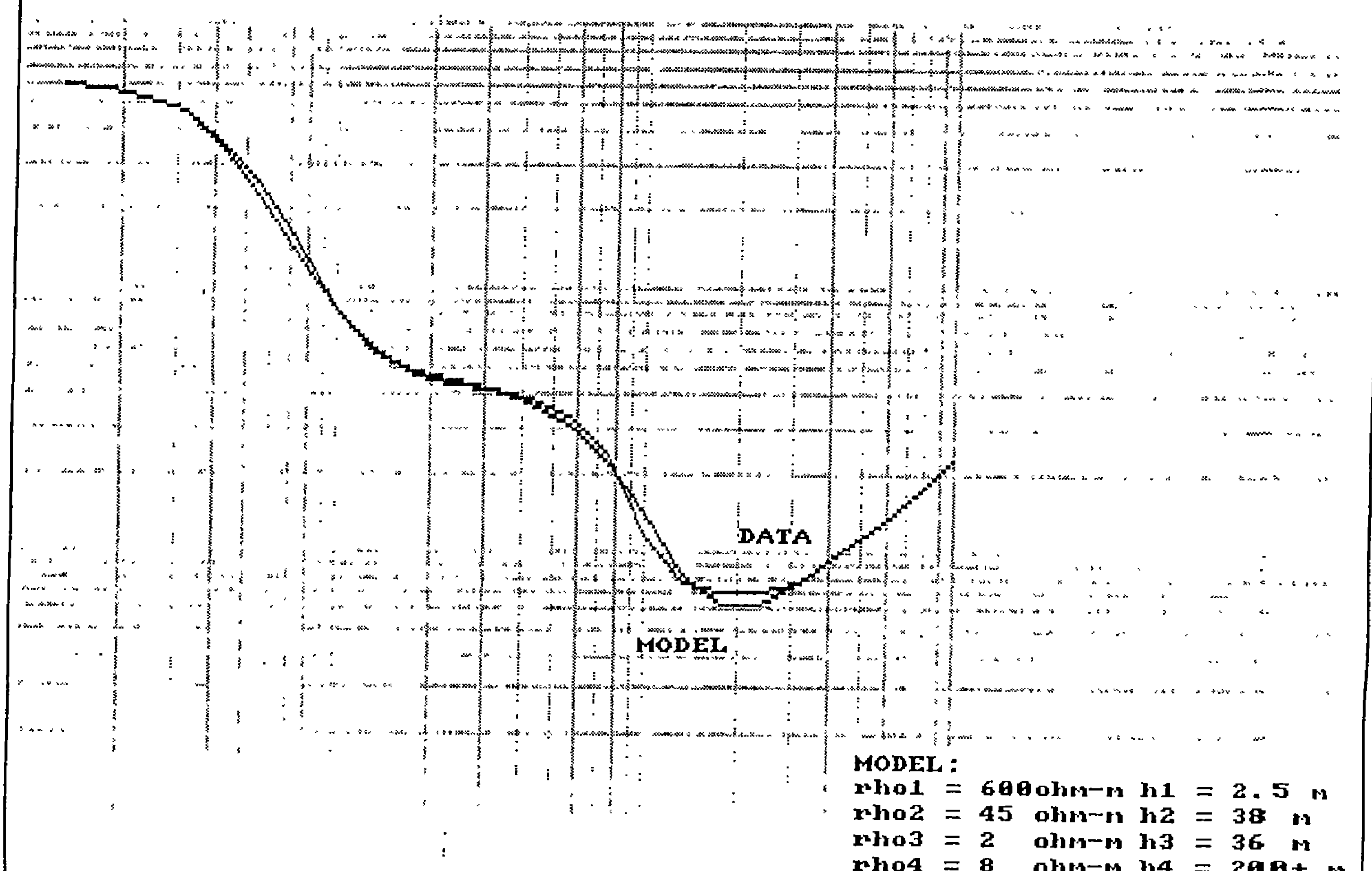
5.2 Magnetometer Survey

The diurnal-corrected, unfiltered magnetometer data is plotted in stacked profile form in Figure 22. An overview of the data at 1:10000 scale is provided in Figures 23 and 24. Figure 23 shows the data is gridded with a weighting ellipse which reflects the 12.5 metre by 200 metre sampling of the data. Figure 24 conforms to the clearly established trends oriented at azimuth 330° and emphasizes features possessing this strike.



SCHLUMBERGER ELECTRICAL RESISTIVITY SOUNDING ES-1

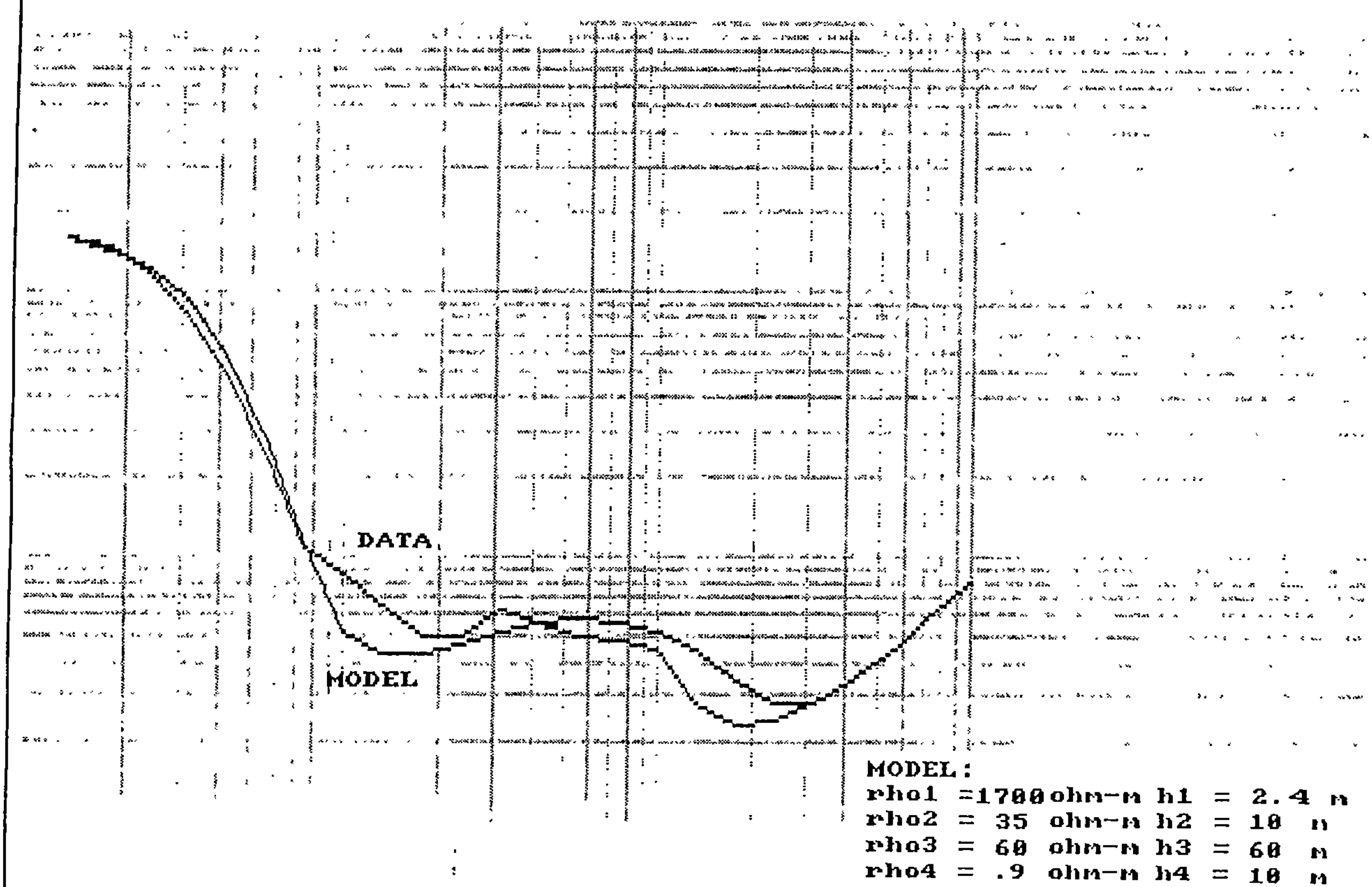
SURVEY DATE: DEC/87 FIG: 18



SCHLUMBERGER ELECTRICAL RESISTIVITY SOUNDING ES-2

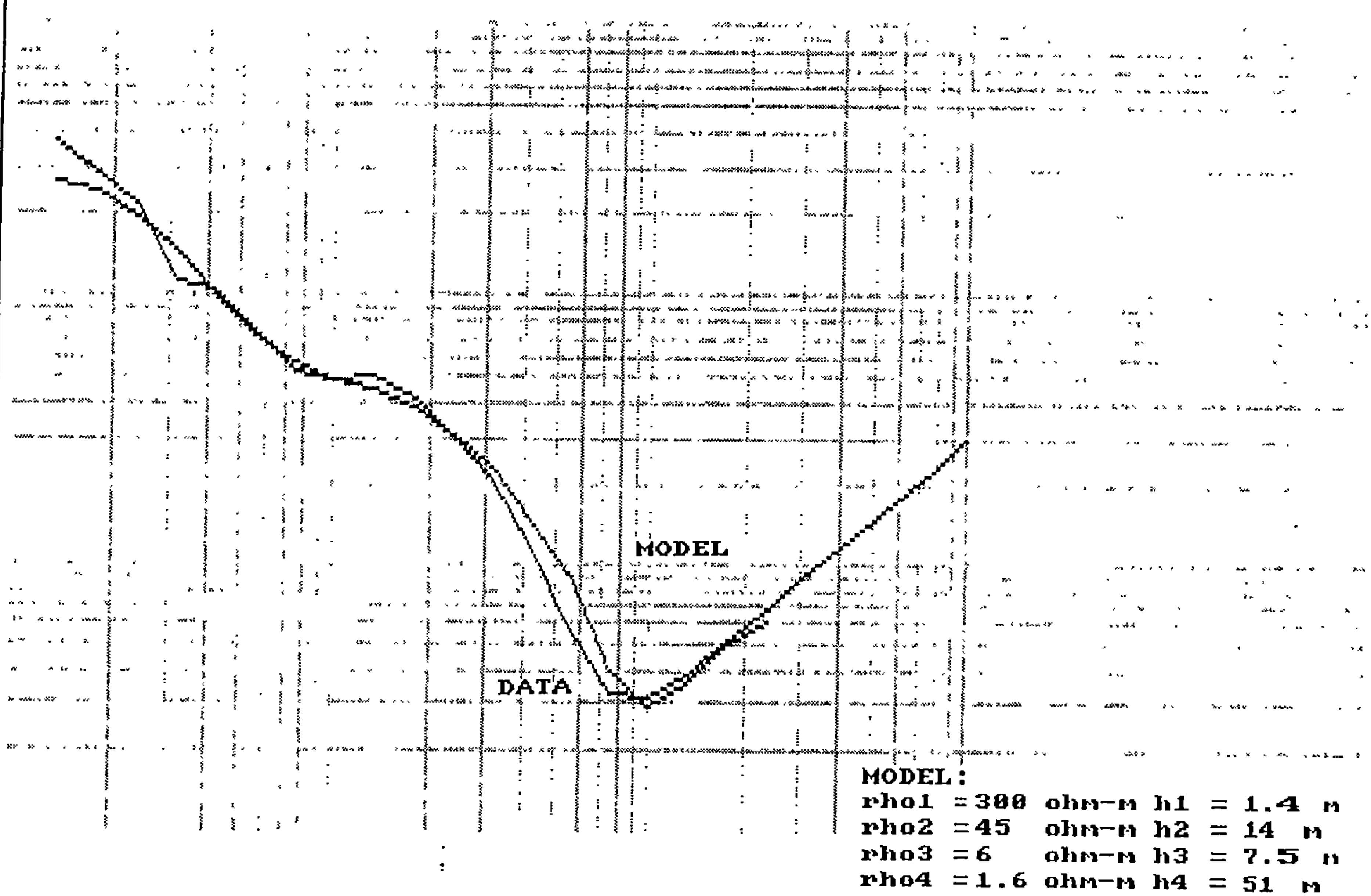
SURVEY DATE: DEC/87

FIG: 19



SCHLUMBERGER ELECTRICAL RESISTIVITY SOUNDING ES-3

SURVEY DATE: DEC/87 FIG: 20



SCHLUMBERGER ELECTRICAL RESISTIVITY SOUNDING ES-4

SURVEY DATE: DEC/87 FIG: 21

6.0 DISCUSSION OF RESULTS

6.1 Resistivity Surveys

The apparent resistivity profile of line 0+00W in Figure 6 shows the low apparent resistivities correlated with the kaolin formation found in the 0+00N, 0+00W, "Discovery" and other nearby holes. This pseudo-section may be compared with Figure 3 of C. Pilon's report (Ref. 4). Schlumberger sounding ES-1, illustrated in Figure 14, shows the conductive properties of the clay. A resistivity value of 5 ohm-m is fairly representative of the kaolin formation in this area. An additional contributing conductive source could be well interconnected carboniferous material in the Brown Beds Formation. These layers however, are generally of low grade and thin and are often not present in the strata. A sounding generated from the dipole-dipole data is shown for comparison at station 0+50N.

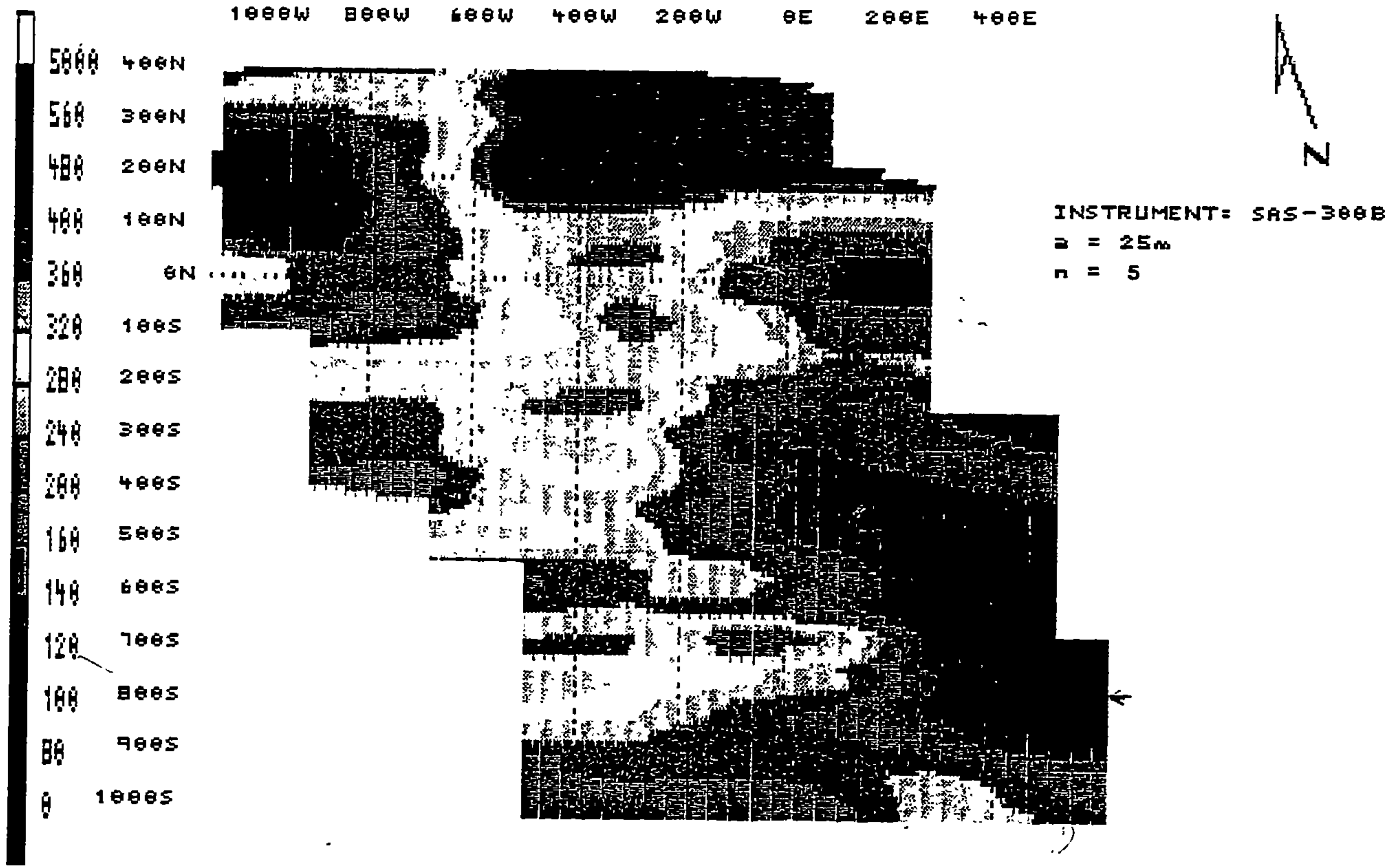
This strong resistivity low persists to grid north to approximately 1+50N where a transition into the high apparent resistivities of 500 - 800 ohm-m, characteristic of the basement rock is seen. To the south of ES-1, the seismic data (Ref. 3) shows an increase in overburden depths as an increase in the 2000 m.p.s. layer. This is well correlated with an increase in apparent resistivities associated with a resistive glacial and/or alluvial overburden. A thinning of this resistive layer occurs near 4+00S, again well correlated with the thinning of the 2000 m.p.s. zone. Schlumberger sounding ES-2 at 3+67S shows the presence of the conductive zone as does the n=5 separation of the dipole-dipole data (Fig. 6).

A disruptive feature, likely an east-west fault between 4+00S and 6+00S, is evidenced as a sharp change in bedrock elevations in the seismic data. This correlates with the thickest accumulation of resistive material generally thinning to the south. The surface of the 3060 m.p.s. zone is relatively shallow on line 6+00S suggesting a resistive component of the sedimentary formation may be present rather than mere thickening of the glacial overburden. At 8+00S, the conductive zone is located at depth within the 3060 m.p.s. velocity layer, inferring the presence of the kaolin formation.

Line 2+00E shows a continuation of the conductive zone to the east, with the strongest conductive feature centred on 4+00S. On Line 4+00E, the conductive zone is very well established at relatively shallow depths between stations 5+00S and 6+00S. Schlumberger sounding ES-4 documents the extremely conductive nature of the zone. The modelling of this zone provides a "best fit" with approximately 50 metres of 1.6 ohm-m material. Line 6+00E provides a window on the southward extent of the conductive zone and shows very precise line-to-line correlation with the south end of 4+00E.

Line 0+00N, Fig. 4, shows the east-west behaviour of the formation near the "Discovery" hole and may be compared with Figure 8 of C. Pilon's report (Ref. 4). The apparent resistivity profile shows the plunge of the zone under the resistive glacial/alluvial material to the west. Continuation of the zone to the east is strongly indicated. Schlumberger sounding ES-3 shows an erroneously low overburden layer resistivity. This is probably due to the fact that the current array expands into very conductive material as little as 125 metres from the sounding point. As well, a number of offsets were noted characteristic of the expanding array traversing fault zones. However, it is feasible that the conductive material is present at depth under this deep overburden area. Thinning of the resistive overburden to the west is observed, well correlated with a thinning of the 2500 m.p.s. velocity layer (Fig. 9).

Lines 2+00W and 4+00W show the presence of deeper resistive overburden. North of approximately 1+00N on 2+00W and 2+00N on 4+00W the strongly resistive feature is likely due to resistive basement rocks. The conductive zone is evident at a number of points on these lines in the n=6 data (Fig. 6).



FGI:-024-5
SURVEY DATE: DEC/87
SCALE: 1:10000

GeoSci Data Analysis Ltd.

FARGO RESOURCES LTD.
LANG BAY PROJECT
APPARENT RESITIVITY (ohm-m)
FALSE COLOUR CONTOUR MAP

FIG: 3

Line 8+00W , and Seismic Refraction Line 2+00N show the presence of a well expressed conductive zone. The most easterly extreme of this zone was tested by drillhole 87-34 (Ref. 4), and a clay zone was intersected at depth. Some carboniferous material was also intersected in this hole and may form a contributing conductive source.

6.2 Magnetometer Survey

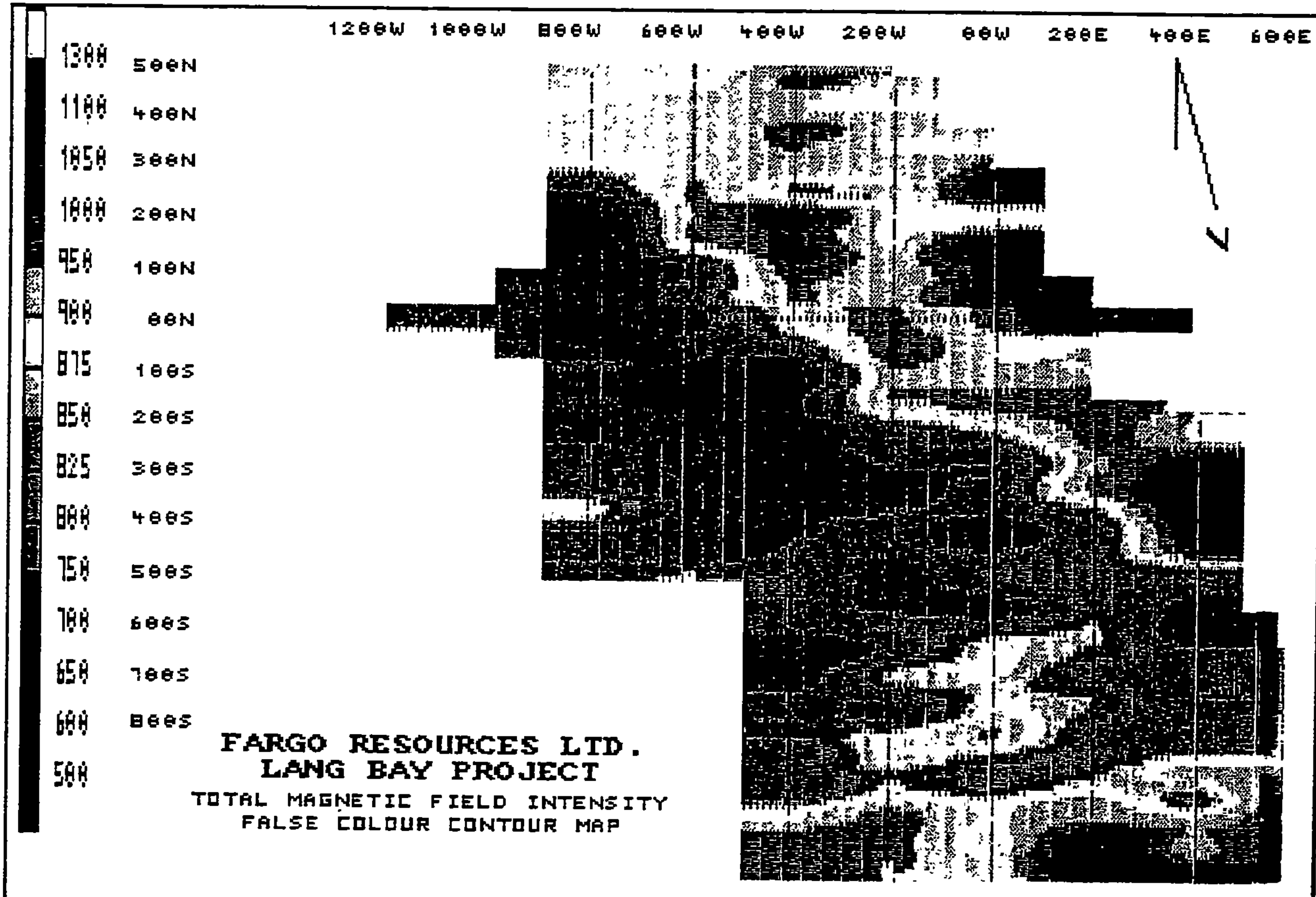
The proton precession magnetometer survey data is displayed in Figures 22, 23 and 24. The stacked profile map (Fig. 22) shows an abundance of shallow sourced high spatial frequency variations. These are believed to be due to the presence of magnetic mineral rich rock fragments within the glacial overburden. In some areas, the overburden materials are quite coarse, consisting of very large boulders. This contributes a "geologic noise" which remains under sampled even at 12.5 metre intervals.

At longer spatial wave lengths however, a number of deeper sourced features are evident. The most pronounced feature is a strong north westerly striking lineament separating high magnetic susceptibility material to the northeast from low susceptibility to the southwest. This break trends from

2+50N on 8+00W to 5+00S on 4+00E. The trend is likely a basement effect and may represent a fault zone. The false colour contour map, Fig. 24, best represents this trend. It may be noted that this trend is, in turn, offset by an interpreted north-south trending fault passing between 0+00W and 2+00W. This north-south inferred fault acts to terminate a series of magnetic highs to the north. Within the general magnetic low, the strike of individual lows continues to display a 330° strike.

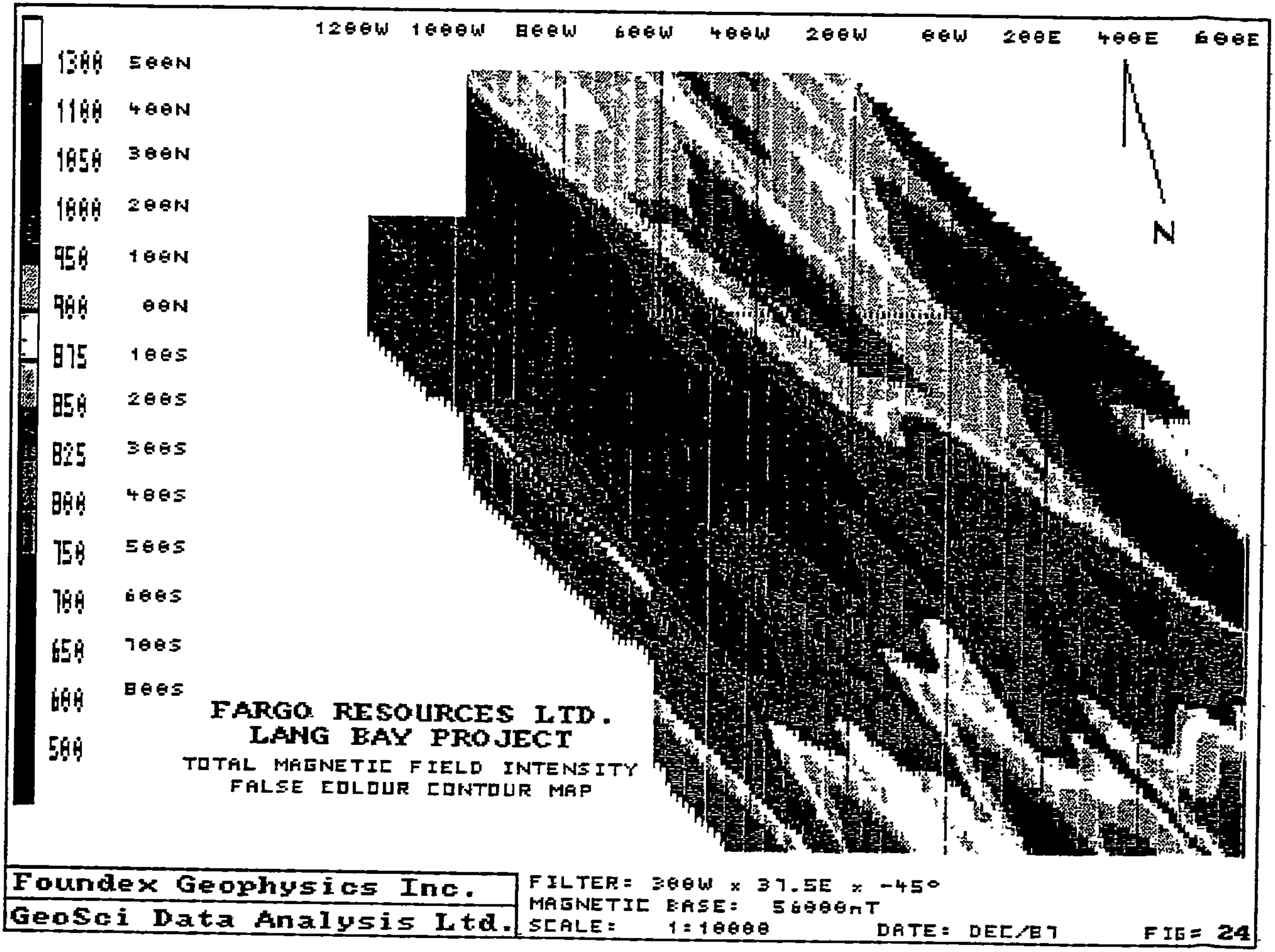
The unbiased colour contour map, Fig. 23, best displays the alignment of the magnetic high at the southern extent of survey coverage.

The kaolin zone in the area of present drilling shows a rough correlation with a magnetic high, however, the northwestern and southeastern anomalies appear to be correlated with magnetic lows. Thus, it seems that the magnetic activity is largely basement controlled. The general trend towards magnetic lows in the western area of the grid may, in part, be due to a general increase in basement depth.



FARGO RESOURCES LTD.
LANG BAY PROJECT
TOTAL MAGNETIC FIELD INTENSITY
FALSE COLOUR CONTOUR MAP

Foundex Geophysics Inc.	FILTER: 225W x 37.5E x 0°
GeoSci Data Analysis Ltd.	MAGNETIC BASE: 56000nT
	SCALE: 1:10000 DATE: DEC/87 FIG: 23


1200W 1000W 800W 600W 400W 200W 00W 200E 400E 600E
500N
400N
300N
200N
100N
00N
100S
200S
300S
400S
500S
600S
700S
800S
1300
1100
1050
1000
950
900
875
850
825
800
750
700
650
600
500
N
FARGO RESOURCES LTD.
LANG BAY PROJECT
TOTAL MAGNETIC FIELD INTENSITY
FALSE COLOUR CONTOUR MAP
Foundex Geophysics Inc.
GeoSci Data Analysis Ltd.
FILTER: 300W x 37.5E x -45°
MAGNETIC BASE: 56000nT
SCALE: 1:10000
DATE: DEC/87
FIG: 24

7. SUMMARY AND RECOMMENDATIONS

The dipole-dipole resistivity survey method proved to be effective in delineating conductive anomalies due to the strong apparent resistivity contrasts between geological units on the property. In two areas, these conductive features are correlated with kaolin rich formation. In addition, the resistive overburden and resistive basement rocks are distinguishable in the pseudo-sections. The Schlumberger electrical resistivity sounding method appears to be effective as a complementary tool to the lateral search method, except in areas where very large lateral inhomogeneities exist.

The magnetometer survey was effective in delineating several large-scale effects such as faulting. Some detail will be lost, however, due to the near-surface geologic noise prevalent in the grid area.

Further exploration work at the property should consist of drilling and geophysical surveying. Drilling should be concentrated on the conductive anomalous areas identified by the dipole-dipole resistivity survey. The resistivity data indicates a conductive zone extending east from the detailed drilling area located at stations 0+00W to 2+00W on Line 0+00N. A large target area south of this zone is roughly bounded by grid lines 2+00S, 9+00S and 0+00E, with an open extension further to the east.

The third target area is roughly centred on Line 2+00N and is bounded to the east by Line 8+00W. This zone is open to the west.

Future geophysical work should consist of 25 metre, dipole-dipole resistivity surveying with "n" values of 1 to 6 in areas of shallow overburden and 1 to 7 in areas of deeper overburden. This work should be supported by detailed resistivity soundings at appropriate intervals. Magnetometer work should be carried out with station intervals of 12.5 metres in areas of shallow overburden, and 25 metres in areas of deeper overburden. Detailed seismic refraction work should be undertaken to supplement the resistivity and magnetometer surveying. Line interval frequency should remain at 200 metres for dipole-dipole resistivity and magnetometer surveying with 400 metre line intervals for seismic refraction surveying.

for FOUNDEX GEOPHYSICS INC.

Clifford E. Candy, Senior Geophysicist

PROFESSIONAL PROVINCE OF Russell A. Hillman BRITISH COLUMBIA ENGINEER

Russell A. Hillman, P.Eng.

REFERENCES

1) Hillman, R.A., Oct. 1987, Report on Seismic Refraction Investigation, Lang Bay Kaolin Prospect, for Fargo Resources Ltd.

2) Koefoed, O., 1979, Geosounding Principles 1, Resistivity Sounding Measurements, Elsevier, Amsterdam

3) Kumar, R., Das, U.C., 1976, Transformation of Schlumberger Apparent Resistivity to Dipole Apparent Resistivity With Digital Linear Filters, Gèophysical Prospecting Vol. 26

4) Pilon, C.G., November, 1987, Drilling Report on the Lang Bay Kaolin Prospect, for Fargo Resources Ltd.

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
200N	2	-300	339	3	-313	309	4	-325	342	5	-338	626	6	-350	137
200N	2	-325	400	3	-338	412	4	-350	509	5	-363	743	6	-375	771
200N	2	-350	423	3	-363	451	4	-375	582	5	-388	629	6	-400	1108
200N	2	-375	451	3	-388	528	4	-400	527	5	-413	772	6	-425	528
200N	2	-400	594	3	-413	638	4	-425	1143	5	-438	572	6	-450	467
200N	2	-425	472	3	-438	236	4	-450	474	5	-463	421	6	-475	269
200N	2	-450	686	3	-463	414	4	-475	339	5	-488	1019	6	-500	607
200N	2	-475	517	3	-488	349	4	-500	546	5	-513	345	6	-525	422
200N	2	-500	459	3	-513	240	4	-525	198	5	-538	394	6	-550	79
200N	2	-525	427	3	-538	330	4	-550	396	5	-563	107	6	-575	100
200N	2	-550	404	3	-563	436	4	-575	408	5	-588	315	6	-600	235
200N	2	-575	462	3	-588	506	4	-600	493	5	-613	449	6	-625	618
200N	2	-600	494	3	-613	442	4	-625	342	5	-638	210	6	-650	169
200N	2	-625	498	3	-638	456	4	-650	455	5	-663	250	6	-675	238
200N	2	-650	602	3	-663	662	4	-675	505	5	-688	348	6	-700	193
200N	2	-675	746	3	-688	666	4	-700	430	5	-713	288	6	-725	285
200N	2	-700	615	3	-713	593	4	-725	352	5	-738	322	6	-750	164
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200N	2	-800	425	3	-813	202	4	-825	96	5	-838	56	6	-850	77
200N	2	-825	282	3	-838	124	4	-850	64	5	-863	43	6	-875	29
200N	2	-850	207	3	-863	94	4	-875	57	5	-888	53	6	-900	71
200N	2	-875	179	3	-888	85	4	-900	55	5	-913	46	6	-925	45
200N	2	-900	149	3	-913	100	4	-925	84	5	-938	58	6	-950	58
200N	2	-925	138	3	-938	112	4	-950	73	5	-963	46	6	-975	53
200N	2	-950	137	3	-963	76	4	-975	61	5	-988	76	6	-1000	84
200N	2	-975	85	3	-988	59	4	-1000	49	5	-1013	67	6	-1025	84
200N	2	-1000	74	3	-1013	83	4	-1025	86	5	-1038	110	6	-1050	84
200N	2	-1025	153	3	-1038	128	4	-1050	181	5	-1063	136	6	-1075	84
200N	2	-1050	174	3	-1063	106	4	-1075	78	5	-1088	82	6	-1100	82

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
00N	2	-1150	189	3	-1138	298	4	-1125	563	5	-1113	383	6	-1100	356
00N	2	-1125	240	3	-1113	256	4	-1100	394	5	-1088	422	6	-1075	372
00N	2	-1100	152	3	-1088	197	4	-1075	386	5	-1063	46	6	-1050	63
00N	2	-1075	221	3	-1063	371	4	-1050	301	5	-1038	92	6	-1025	29
00N	2	-1050	451	3	-1038	466	4	-1025	273	5	-1013	462	6	-1000	84
00N	2	-1025	487	3	-1013	499	4	-1000	190	5	-988	450	6	-975	195
00N	2	-1000	449	3	-988	-396	4	-975	184	5	-963	693	6	-950	106
00N	2	-975	393	3	-963	238	4	-950	141	5	-938	148	6	-925	158
00N	2	-950	387	3	-938	273	4	-925	94	5	-913	176	6	-900	53
00N	2	-925	376	3	-913	292	4	-900	245	5	-888	165	6	-875	66
00N	2	-900	404	3	-888	259	4	-875	160	5	-863	115	6	-850	238

00N	2	-875	560	3	-863	299	4	-850	153	5	-838	102	6	-825	71
00N	2	-850	457	3	-838	218	4	-825	176	5	-813	125	6	-800	124
00N	2	-825	494	3	-813	236	4	-800	198	5	-788	185	6	-775	211
00N	2	-800	400	3	-788	292	4	-775	248	5	-763	244	6	-750	29
00N	2	-775	384	3	-763	354	4	-750	393	5	-738	257	6	-725	135
00N	2	-750	483	3	-738	578	4	-725	287	5	-713	155	6	-700	198
00N	2	-725	810	3	-713	438	4	-700	262	5	-688	191	6	-675	462
00N	2	-700	446	3	-688	294	4	-675	216	5	-663	287	6	-650	45
00N	2	-675	429	3	-663	342	4	-650	284	5	-638	160	6	-625	113
00N	2	-650	844	3	-638	719	4	-625	408	5	-613	234	6	-600	454
00N	2	-625	592	3	-613	461	4	-600	246	5	-588	430	6	-575	214
00N	2	-600	526	3	-588	306	4	-575	479	5	-563	561	6	-550	140
00N	2	-575	506	3	-563	419	4	-550	443	5	-538	247	6	-525	238
00N	2	-550	543	3	-538	259	4	-525	424	5	-513	313	6	-500	264
00N	2	-525	479	3	-513	448	4	-500	391	5	-488	229	6	-475	201
00N	2	-500	375	3	-488	357	4	-475	480	5	-463	327	6	-450	203
00N	2	-475	662	3	-463	541	4	-450	530	5	-438	368	6	-425	267
00N	2	-450	494	3	-438	453	4	-425	360	5	-413	221	6	-400	198
00N	2	-425	553	3	-413	607	4	-400	396	5	-388	409	6	-375	512
00N	2	-400	585	3	-388	574	4	-375	447	5	-363	582	6	-350	377
00N	2	-375	662	3	-363	598	4	-350	537	5	-338	462	6	-325	475
00N	2	-350	613	3	-338	551	4	-325	301	5	-313	412	6	-300	557
00N	2	-325	519	3	-313	560	4	-300	452	5	-288	396	6	-275	317
00N	2	-300	613	3	-288	662	4	-275	509	5	-263	363	6	-250	322
00N	2	-275	699	3	-263	617	4	-250	495	5	-238	381	6	-225	533
00N	2	-250	564	3	-238	462	4	-225	584	5	-213	247	6	-200	528
00N	2	-225	421	3	-213	306	4	-200	301	5	-188	264	6	-175	132
00N	2	-200	466	3	-188	380	4	-175	284	5	-163	208	6	-150	211
00N	2	-175	466	3	-163	388	4	-150	307	5	-138	231	6	-125	158
00N	2	-150	449	3	-138	367	4	-125	254	5	-113	165	6	-100	166
00N	2	-125	434	3	-113	287	4	-100	301	5	-88	200	6	-75	219
00N	2	-100	297	3	-88	207	4	-75	150	5	-63	114	6	-50	161
00N	2	-75	327	3	-63	195	4	-50	148	5	-38	175	6	-25	187
00N	2	-50	218	3	-38	126	4	-25	145	5	-13	135	6	0	182
00N	2	-25	165	3	-13	141	4	0	122	5	13	171	6	25	190
00N	2	0	165	3	13	102	4	25	132	5	38	147	6	50	153
00N	2	25	89	3	38	96	4	50	110	5	63	114	6	75	129
00N	2	50	82	3	63	85	4	75	89	5	88	132	6	100	129
00N	2	75	103	3	88	97	4	100	112	5	113	130	6	125	124
00N	2	100	77	3	113	83	4	125	97	5	138	96	6	150	103
00N	2	125	76	3	138	86	4	150	84	5	163	86	6	175	108
00N	2	150	62	3	163	57	4	175	58	5	188	106	6	200	140

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
800W	2	-400	297	3	-388	278	4	-375	271	5	-363	162	6	-350	124
800W	2	-375	534	3	-363	524	4	-350	396	5	-338	272	6	-325	443
800W	2	-350	564	3	-338	377	4	-325	252	5	-313	226	6	-300	259
800W	2	-325	142	3	-313	237	4	-300	238	5	-288	196	6	-275	230
800W	2	-300	318	3	-288	320	4	-275	245	5	-263	214	6	-250	132
800W	2	-275	509	3	-263	430	4	-250	485	5	-238	239	6	-225	232
800W	2	-250	538	3	-238	626	4	-225	300	5	-213	237	6	-200	185

800W	2	-225	949	3	-213	394	4	-200	414	5	-188	482	6	-175	187
800W	2	-200	415	3	-188	367	4	-175	243	5	-163	228	6	-150	150
800W	2	-175	487	3	-163	437	4	-150	324	5	-138	282	6	-125	156
800W	2	-150	632	3	-138	566	4	-125	386	5	-113	214	6	-100	119
800W	2	-125	635	3	-113	447	4	-100	253	5	-88	143	6	-75	145
800W	2	-100	635	3	-88	382	4	-75	222	5	-63	158	6	-50	108
800W	2	-75	526	3	-63	318	4	-50	245	5	-38	135	6	-25	84
800W	2	-50	485	3	-38	387	4	-25	216	5	-13	135	6	0	74
800W	2	-25	645	3	-13	374	4	0	233	5	13	175	6	25	203
800W	2	0	451	3	13	290	4	25	170	5	38	82	6	50	11
800W	2	25	339	3	38	210	4	50	155	5	63	211	6	75	235
800W	2	50	486	3	63	209	4	75	138	5	88	68	6	100	74
800W	2	75	305	3	88	241	4	100	138	5	113	87	6	125	48
800W	2	100	331	3	113	150	4	125	110	5	138	74	6	150	45
800W	2	125	269	3	138	191	4	150	102	5	163	45	6	175	45
800W	2	150	318	3	163	164	4	175	89	5	188	18	6	200	21
800W	2	175	346	3	188	122	4	200	75	5	213	40	6	225	13
800W	2	200	159	3	213	80	4	225	50	5	238	40	6	250	87
800W	2	225	175	3	238	109	4	250	86	5	263	114	6	275	74
800W	2	250	289	3	263	204	4	275	284	5	288	148	6	300	16
800W	2	275	393	3	288	428	4	300	192	5	313	145	6	325	61
800W	2	300	878	3	313	416	4	325	154	5	338	247	6	350	185
800W	2	325	681	3	338	685	4	350	437	5	363	335	6	375	182
800W	2	350	566	3	363	476	4	375	398	5	388	201	6	400	127

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
600W	2	450	619	3	438	406	4	425	299	5	413	226	6	400	509
600W	2	425	677	3	413	480	4	400	297	5	388	246	6	375	259
600W	2	400	575	3	388	430	4	375	282	5	363	348	6	350	216
600W	2	375	637	3	363	415	4	350	351	5	338	300	6	325	211
600W	2	350	590	3	338	561	4	325	331	5	313	279	6	300	261
600W	2	325	771	3	313	497	4	300	332	5	288	348	6	275	383
600W	2	300	598	3	288	409	4	275	356	5	263	368	6	250	343
600W	2	275	423	3	263	480	4	250	397	5	238	327	6	225	335
600W	2	250	620	3	238	603	4	225	518	5	213	452	6	200	325
600W	2	225	664	3	213	615	4	200	548	5	188	404	6	175	293
600W	2	200	677	3	188	650	4	175	480	5	163	358	6	150	259
600W	2	175	620	3	163	539	4	150	419	5	138	336	6	125	311
600W	2	150	598	3	138	521	4	125	423	5	113	331	6	100	240
600W	2	125	579	3	113	511	4	100	373	5	88	257	6	75	140
600W	2	100	656	3	88	515	4	75	362	5	63	237	6	50	143
600W	2	75	669	3	63	494	4	50	365	5	38	204	6	25	185
600W	2	50	615	3	38	439	4	25	261	5	13	228	6	0	143
600W	2	25	705	3	13	431	4	0	469	5	-13	204	6	-25	208
600W	2	0	652	3	-13	675	4	-25	423	5	-38	218	6	-50	140
600W	2	-25	773	3	-38	545	4	-50	310	5	-63	203	6	-75	179
600W	2	-50	765	3	-63	442	4	-75	307	5	-88	246	6	-100	222
600W	2	-75	444	3	-88	420	4	-100	334	5	-113	176	6	-125	193
600W	2	-100	626	3	-113	529	4	-125	477	5	-138	373	6	-150	259
600W	2	-125	946	3	-138	810	4	-150	538	5	-163	394	6	-175	301
600W	2	-150	500	3	-163	439	4	-175	347	5	-188	269	6	-200	193

600W	2	-175	389	3	-188	348	4	-200	283	5	-213	204	6	-225	145
600W	2	-200	351	3	-213	316	4	-225	243	5	-238	214	6	-250	166
600W	2	-225	494	3	-238	308	4	-250	245	5	-263	228	6	-275	203
600W	2	-250	382	3	-263	271	4	-275	268	5	-288	257	6	-300	208
600W	2	-275	299	3	-288	318	4	-300	318	5	-313	247	6	-325	153
600W	2	-300	378	3	-313	420	4	-325	322	5	-338	191	6	-350	282
600W	2	-325	356	3	-338	300	4	-350	159	5	-363	153	6	-375	140
600W	2	-350	417	3	-363	288	4	-375	252	5	-388	198	6	-400	277

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
400W	2	-1050	799	3	-1038	724	4	-1025	423	5	-1013	274	6	-1000	185
400W	2	-1025	840	3	-1013	429	4	-1000	318	5	-988	170	6	-975	166
400W	2	-1000	462	3	-988	394	4	-975	262	5	-963	170	6	-950	143
400W	2	-975	504	3	-963	382	4	-950	247	5	-938	186	6	-925	127
400W	2	-950	585	3	-938	422	4	-925	336	5	-913	200	6	-900	156
400W	2	-925	455	3	-913	360	4	-900	265	5	-888	188	6	-875	409
400W	2	-900	538	3	-888	447	4	-875	284	5	-863	327	6	-850	235
400W	2	-875	498	3	-863	293	4	-850	186	5	-838	214	6	-825	224
400W	2	-850	380	3	-838	348	4	-825	341	5	-813	376	6	-800	309
400W	2	-825	309	3	-813	350	4	-800	413	5	-788	331	6	-775	327
400W	2	-800	300	3	-788	430	4	-775	389	5	-763	381	6	-750	303
400W	2	-775	364	3	-763	371	4	-750	390	5	-738	327	6	-725	259
400W	2	-750	229	3	-738	283	4	-725	271	5	-713	187	6	-700	181
400W	2	-725	307	3	-713	310	4	-700	244	5	-688	231	6	-675	106
400W	2	-700	408	3	-688	344	4	-675	329	5	-663	312	6	-650	161
400W	2	-675	356	3	-663	392	4	-650	268	5	-638	221	6	-625	153
400W	2	-650	481	3	-638	446	4	-625	283	5	-613	208	6	-600	135
400W	2	-625	483	3	-613	320	4	-600	236	5	-588	206	6	-575	121
400W	2	-600	357	3	-588	301	4	-575	216	5	-563	153	6	-550	129
400W	2	-575	468	3	-563	339	4	-550	298	5	-538	244	6	-525	193
400W	2	-550	502	3	-538	472	4	-525	405	5	-513	297	6	-500	240
400W	2	-525	620	3	-513	567	4	-500	430	5	-488	340	6	-475	317
400W	2	-500	598	3	-488	489	4	-475	350	5	-463	361	6	-450	367
400W	2	-475	449	3	-463	414	4	-450	370	5	-438	167	6	-425	216
400W	2	-450	474	3	-438	502	4	-425	485	5	-413	325	6	-400	333
400W	2	-425	541	3	-413	472	4	-400	360	5	-388	307	6	-375	343
400W	2	-400	476	3	-388	400	4	-375	375	5	-363	409	6	-350	322
400W	2	-375	399	3	-363	421	4	-350	527	5	-338	546	6	-325	296
400W	2	-350	438	3	-338	578	4	-325	419	5	-313	409	6	-300	214
400W	2	-325	476	3	-313	578	4	-300	409	5	-288	373	6	-275	198
400W	2	-300	517	3	-288	578	4	-275	491	5	-263	379	6	-250	227
400W	2	-275	556	3	-263	541	4	-250	452	5	-238	726	6	-225	267
400W	2	-250	722	3	-238	617	4	-225	603	5	-213	383	6	-200	269
400W	2	-225	583	3	-213	564	4	-200	430	5	-188	300	6	-175	256
400W	2	-200	564	3	-188	451	4	-175	341	5	-163	318	6	-150	243
400W	2	-175	479	3	-163	397	4	-150	418	5	-138	305	6	-125	296
400W	2	-150	408	3	-138	461	4	-125	369	5	-113	289	6	-100	214
400W	2	-125	481	3	-113	434	4	-100	367	5	-88	351	6	-75	401
400W	2	-100	466	3	-88	429	4	-75	428	5	-63	430	6	-50	309
400W	2	-75	329	3	-63	365	4	-50	268	5	-38	272	6	-25	208
400W	2	-50	493	3	-38	456	4	-25	441	5	-13	353	6	0	269

400W	2	-25	509	3	-13	529	4	0	446	5	13	356	6	25	654
400W	2	0	622	3	13	566	4	25	464	5	38	427	6	50	406
400W	2	25	750	3	38	667	4	50	540	5	63	455	6	75	335
400W	2	50	596	3	63	530	4	75	383	5	88	295	6	100	319
400W	2	75	696	3	88	539	4	100	396	5	113	379	6	125	317
400W	2	100	594	3	113	562	4	125	402	5	138	356	6	150	462
400W	2	125	579	3	138	455	4	150	359	5	163	460	6	175	388
400W	2	150	504	3	163	277	4	175	468	5	188	496	6	200	607
400W	2	175	493	3	188	546	4	200	528	5	213	627	6	225	581
400W	2	200	573	3	213	537	4	225	622	5	238	792	6	250	396
400W	2	225	549	3	238	598	4	250	744	5	263	610	6	275	554
400W	2	250	440	3	263	560	4	275	499	5	288	495	6	300	1029
400W	2	275	476	3	288	433	4	300	650	5	313	495	6	325	818
400W	2	300	528	3	313	504	4	325	707	5	338	549	6	350	530
400W	2	325	585	3	338	777	4	350	641	5	363	577	6	375	789
400W	2	350	628	3	363	598	4	375	479	5	388	740	6	400	866

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
200W.	2	-250	461	3	-263	315	4	-275	216	5	-288	183	6	-275	121
200W.	2	-275	336	3	-288	254	4	-300	215	5	-313	178	6	-300	143
200W.	2	-300	342	3	-313	302	4	-325	261	5	-338	195	6	-325	124
200W.	2	-325	382	3	-338	339	4	-350	272	5	-363	229	6	-350	132
200W.	2	-350	432	3	-363	395	4	-375	526	5	-388	292	6	-375	216
200W.	2	-375	425	3	-388	372	4	-400	350	5	-413	204	6	-400	298
200W.	2	-400	449	3	-413	369	4	-425	302	5	-438	213	6	-425	251
200W.	2	-425	449	3	-438	417	4	-450	277	5	-463	239	6	-450	129
200W.	2	-450	397	3	-463	309	4	-475	247	5	-488	186	6	-475	158
200W.	2	-475	415	3	-488	352	4	-500	284	5	-513	265	6	-500	169
200W.	2	-500	343	3	-513	309	4	-525	271	5	-538	239	6	-525	216
200W.	2	-525	351	3	-538	369	4	-550	332	5	-563	274	6	-550	132
200W.	2	-550	330	3	-563	337	4	-575	309	5	-588	287	6	-575	261
200W.	2	-575	294	3	-588	312	4	-600	307	5	-613	265	6	-600	208
200W.	2	-600	320	3	-613	351	4	-625	297	5	-638	259	6	-625	211
200W.	2	-625	300	3	-638	261	4	-650	287	5	-663	254	6	-650	161
200W.	2	-650	317	3	-663	281	4	-675	341	5	-688	190	6	-675	193
200W.	2	-675	355	3	-688	387	4	-700	223	5	-713	190	6	-700	343
200W.	2	-700	464	3	-713	321	4	-725	306	5	-738	411	6	-725	111
200W.	2	-725	316	3	-738	344	4	-750	328	5	-763	261	6	-750	145
200W.	2	-750	397	3	-763	407	4	-775	349	5	-788	241	6	-775	145
200W.	2	-775	641	3	-788	589	4	-800	441	5	-813	308	6	-800	108
200W.	2	-800	429	3	-813	366	4	-825	220	5	-838	214	6	-825	290
200W.	2	-825	457	3	-838	329	4	-850	349	5	-863	335	6	-850	121
200W.	2	-850	343	3	-863	355	4	-875	222	5	-888	162	6	-875	203
200W.	2	-875	596	3	-888	536	4	-900	285	5	-913	241	6	-900	150
200W.	2	-900	389	3	-913	324	4	-925	288	5	-938	277	6	-925	240

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
200W	1	413	387	2	400	594	3	388	707	4	375	885	5	363	760
200W	1	388	478	2	375	669	3	363	889	4	350	832	5	338	673
200W	1	363	463	2	350	737	3	338	791	4	325	810	5	313	846
200W	1	338	623	2	325	701	3	313	813	4	300	890	5	288	963
200W	1	313	401	2	300	491	3	288	541	4	275	668	5	263	765
200W	1	288	456	2	275	468	3	263	556	4	250	687	5	238	836
200W	1	263	328	2	250	340	3	238	415	4	225	514	5	213	465
200W	1	238	302	2	225	344	3	213	442	4	200	571	5	188	407
200W	1	213	252	2	200	335	3	188	311	4	175	301	5	163	327
200W	1	188	302	2	175	271	3	163	286	4	150	414	5	138	369
200W	1	163	289	2	150	267	3	138	277	4	125	235	5	113	262
200W	1	138	324	2	125	368	3	113	306	4	100	318	5	88	302
200W	1	113	501	2	100	417	3	88	432	4	75	339	5	63	457
200W	1	88	404	2	75	447	3	63	345	4	50	367	5	38	455
200W	1	63	422	2	50	380	3	38	360	4	25	333	5	13	295
200W	1	38	428	2	25	494	3	13	424	4	0	396	5	-13	298
200W	1	13	522	2	0	485	3	-13	502	4	-25	363	5	-38	327
200W	1	-13	442	2	-25	479	3	-38	528	4	-50	433	5	-63	511
200W	1	-38	596	2	-50	556	3	-63	656	4	-75	547	5	-88	379
200W	1	-63	563	2	-75	628	3	-88	646	4	-100	463	5	-113	397
200W	1	-88	746	2	-100	823	3	-113	622	4	-125	530	5	-138	473
200W	1	-113	615	2	-125	573	3	-138	513	4	-150	491	5	-163	320
200W	1	-138	575	2	-150	588	3	-163	551	4	-175	409	5	-188	340
200W	1	-163	563	2	-175	607	3	-188	505	4	-200	414	5	-213	270
200W	1	-188	525	2	-200	526	3	-213	497	4	-225	356	5	-238	236
200W	1	-213	464	2	-225	537	3	-238	406	4	-250	290	5	-263	214

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
00W	1	238	321	2	225	438	3	213	481	4	200	470	5	188	435
00W	1	213	215	2	200	277	3	188	306	4	175	285	5	163	290
00W	1	188	268	2	175	294	3	163	256	4	150	262	5	138	289
00W	1	163	347	2	150	186	3	138	188	4	125	178	5	113	254
00W	1	138	182	2	125	113	3	113	120	4	100	150	5	88	155
00W	1	113	142	2	100	92	3	88	97	4	75	113	5	63	143
00W	1	88	138	2	75	95	3	63	87	4	50	97	5	38	114
00W	1	63	162	2	50	98	3	38	86	4	25	115	5	13	132
00W	1	38	167	2	25	96	3	13	88	4	0	110	5	-13	129
00W	1	13	204	2	0	120	3	-13	118	4	-25	142	5	-38	140
00W	1	-13	176	2	-25	158	3	-38	153	4	-50	139	5	-63	157
00W	1	-38	215	2	-50	195	3	-63	228	4	-75	271	5	-88	211
00W	1	-63	210	2	-75	232	3	-88	254	4	-100	222	5	-113	198
00W	1	-88	331	2	-100	372	3	-113	341	4	-125	317	5	-138	211
00W	1	-113	378	2	-125	373	3	-138	381	4	-150	263	5	-163	330
00W	1	-138	390	2	-150	395	3	-163	280	4	-175	210	5	-188	92

00W	1	-163	488	2	-175	352	3	-188	302	4	-200	192	5	-213	106
00W	1	-188	414	2	-200	361	3	-213	245	4	-225	124	5	-238	214
00W	1	-213	554	2	-225	389	3	-238	205	4	-250	155	5	-263	132
00W	1	-238	461	2	-250	289	3	-263	210	4	-275	171	5	-288	109
00W	1	-263	440	2	-275	316	3	-288	223	4	-300	152	5	-313	104
00W	1	-288	418	2	-300	333	3	-313	234	4	-325	162	5	-338	110
00W	1	-313	679	2	-325	406	3	-338	276	4	-350	192	5	-363	91
00W	1	-338	483	2	-350	446	3	-363	290	4	-375	169	5	-388	134
00W	1	-363	491	2	-375	385	3	-388	221	4	-400	185	5	-413	148
00W	1	-388	436	2	-400	257	3	-413	223	4	-425	144	5	-438	104
00W	1	-413	311	2	-425	399	3	-438	207	4	-450	230	5	-463	107
00W	1	-438	366	2	-450	287	3	-463	215	4	-475	137	5	-488	102
00W	1	-463	349	2	-475	299	3	-488	218	4	-500	152	5	-513	150
00W	1	-488	485	2	-500	378	3	-513	279	4	-525	298	5	-538	254
00W	1	-513	374	2	-525	340	3	-538	390	4	-550	353	5	-563	287
00W	1	-538	329	2	-550	489	3	-563	385	4	-575	333	5	-588	298
00W	1	-563	392	2	-575	357	3	-588	355	4	-600	284	5	-613	115
00W	1	-588	415	2	-600	404	3	-613	385	4	-625	287	5	-638	175
00W	1	-613	520	2	-625	470	3	-638	406	4	-650	283	5	-663	366
00W	1	-638	538	2	-650	566	3	-663	616	4	-675	452	5	-688	1047
00W	1	-663	378	2	-675	293	3	-688	356	4	-700	319	5	-713	226
00W	1	-688	443	2	-700	526	3	-713	388	4	-725	334	5	-738	280
00W	1	-713	680	2	-725	540	3	-738	447	4	-750	366	5	-763	315
00W	1	-738	501	2	-750	349	3	-763	267	4	-775	353	5	-788	249
00W	1	-763	539	2	-775	438	3	-788	349	4	-800	306	5	-813	208
00W	1	-788	547	2	-800	470	3	-813	390	4	-825	301	5	-838	162
00W	1	-813	523	2	-825	449	3	-838	361	4	-850	192	5	-863	193
00W	1	-838	481	2	-850	444	3	-863	270	4	-875	283	5	-888	158
00W	1	-863	396	2	-875	283	3	-888	317	4	-900	161	5	-913	241
00W	1	-888	302	2	-900	385	3	-913	209	4	-925	241	5	-938	143
00W	1	-913	585	2	-925	320	3	-938	352	4	-950	226	5	-963	160
00W	1	-938	478	2	-950	560	3	-963	338	4	-975	217	5	-988	150
00W	1	-963	499	2	-975	380	3	-988	304	4	-1000	198	5	-1013	153

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
200E	1	-1063	384	2	-1050	252	3	-1038	328	4	-1025	181	5	-1013	190
200E	1	-1038	400	2	-1025	322	3	-1013	246	4	-1000	253	5	-988	252
200E	1	-1013	490	2	-1000	320	3	-988	338	4	-975	340	5	-963	269
200E	1	-988	428	2	-975	378	3	-963	400	4	-950	490	5	-938	300
200E	1	-963	427	2	-950	368	3	-938	295	4	-925	307	5	-913	231
200E	1	-938	446	2	-925	417	3	-913	340	4	-900	261	5	-888	252
200E	1	-913	472	2	-900	385	3	-888	325	4	-875	304	5	-863	259
200E	1	-888	517	2	-875	462	3	-863	361	4	-850	253	5	-838	142
200E	1	-863	556	2	-850	474	3	-838	337	4	-825	181	5	-813	186
200E	1	-838	707	2	-825	489	3	-813	265	4	-800	272	5	-788	213
200E	1	-813	593	2	-800	312	3	-788	315	4	-775	259	5	-763	181
200E	1	-788	460	2	-775	525	3	-763	466	4	-750	782	5	-738	297
200E	1	-763	618	2	-750	447	3	-738	184	4	-725	226	5	-713	82
200E	1	-738	425	2	-725	321	3	-713	268	4	-700	155	5	-688	109
200E	1	-713	484	2	-700	459	3	-688	273	4	-675	181	5	-663	160
200E	1	-688	500	2	-675	321	3	-663	235	4	-650	183	5	-638	132

200E	1	-663	485	2	-650	343	3	-638	235	4	-625	109	5	-613	107
200E	1	-638	431	2	-625	378	3	-613	230	4	-600	151	5	-588	129
200E	1	-613	487	2	-600	325	3	-588	199	4	-575	137	5	-563	94
200E	1	-588	517	2	-575	309	3	-563	226	4	-550	149	5	-538	87
200E	1	-563	468	2	-550	340	3	-538	258	4	-525	164	5	-513	94
200E	1	-538	411	2	-525	338	3	-513	242	4	-500	139	5	-488	150
200E	1	-513	402	2	-500	352	3	-488	263	4	-475	171	5	-463	110
200E	1	-488	328	2	-475	307	3	-463	187	4	-450	104	5	-438	86
200E	1	-463	486	2	-450	314	3	-438	170	4	-425	115	5	-413	74
200E	1	-438	415	2	-425	248	3	-413	120	4	-400	76	5	-388	74
200E	1	-413	496	2	-400	275	3	-388	133	4	-375	151	5	-363	176
200E	1	-388	464	2	-375	193	3	-363	191	4	-350	148	5	-338	140
200E	1	-363	574	2	-350	362	3	-338	266	4	-325	263	5	-313	229
200E	1	-338	368	2	-325	256	3	-313	270	4	-300	245	5	-288	191

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

LINE	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho	n	STATION	rho
400E	1	-238	233	2	-250	122	3	-263	112	4	-275	117	5	-288	94
400E	1	-263	280	2	-275	199	3	-288	221	4	-300	156	5	-313	125
400E	1	-288	445	2	-300	328	3	-313	222	4	-325	195	5	-338	162
400E	1	-313	434	2	-325	277	3	-338	247	4	-350	226	5	-363	200
400E	1	-338	335	2	-350	313	3	-363	285	4	-375	272	5	-388	145
400E	1	-363	345	2	-375	321	3	-388	315	4	-400	190	5	-413	165
400E	1	-388	382	2	-400	329	3	-413	209	4	-425	206	5	-438	135
400E	1	-413	415	2	-425	248	3	-438	246	4	-450	154	5	-463	59
400E	1	-438	233	2	-450	237	3	-463	209	4	-475	58	5	-488	46
400E	1	-463	465	2	-475	192	3	-488	109	4	-500	88	5	-513	59
400E	1	-488	341	2	-500	68	3	-513	48	4	-525	46	5	-538	28
400E	1	-513	155	2	-525	70	3	-538	52	4	-550	40	5	-563	48
400E	1	-538	225	2	-550	98	3	-563	59	4	-575	56	5	-588	56
400E	1	-563	239	2	-575	66	3	-588	52	4	-600	51	5	-613	43
400E	1	-588	150	2	-600	83	3	-613	64	4	-625	42	5	-638	38
400E	1	-613	272	2	-625	128	3	-638	76	4	-650	57	5	-663	53
400E	1	-638	309	2	-650	139	3	-663	70	4	-675	49	5	-688	59
400E	1	-663	325	2	-675	149	3	-688	93	4	-700	65	5	-713	59
400E	1	-688	473	2	-700	157	3	-713	110	4	-725	75	5	-738	66
400E	1	-713	448	2	-725	127	3	-738	151	4	-750	73	5	-763	54
400E	1	-738	291	2	-750	185	3	-763	114	4	-775	69	5	-788	53
400E	1	-763	364	2	-775	243	3	-788	154	4	-800	97	5	-813	81
400E	1	-788	433	2	-800	267	3	-813	152	4	-825	115	5	-838	82
400E	1	-813	363	2	-825	258	3	-838	211	4	-850	136	5	-863	86
400E	1	-838	550	2	-850	459	3	-863	282	4	-875	137	5	-888	104
400E	1	-863	621	2	-875	425	3	-888	251	4	-900	152	5	-913	132
400E	1	-888	564	2	-900	347	3	-913	214	4	-925	198	5	-938	331
400E	1	-913	498	2	-925	329	3	-938	349	4	-950	167	5	-963	183
400E	1	-938	510	2	-950	372	3	-963	528	4	-975	325	5	-988	331
400E	1	-963	499	2	-975	399	3	-988	381	4	-1000	384	5	-1013	346

FARGO RESOURCES LTD. LANG BAY PROPERTY

DIPOLE DIPOLE RESISTIVITY SURVEY

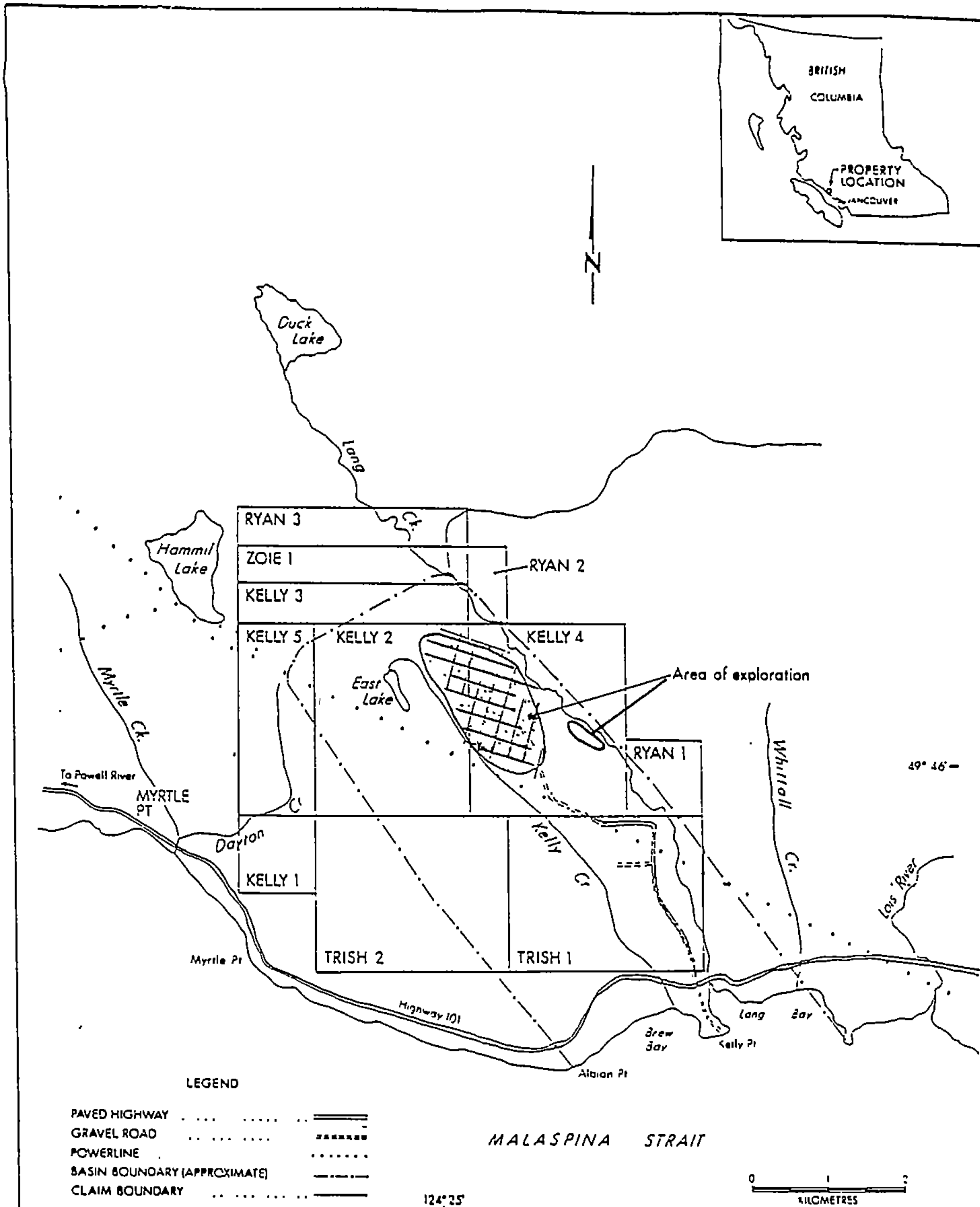
1. INTRODUCTION

In 1981, Fargo Resources Limited staked 11 mineral claims covering some 300 hectares at Lang Bay, near Powell River, British Columbia. These claims cover a sedimentary basin which contains a large inferred resource of kaolin. Additionally, the property is known to contain highly anomalous values of germanium and gallium in some of the more carbonaceous horizons of the deposit.

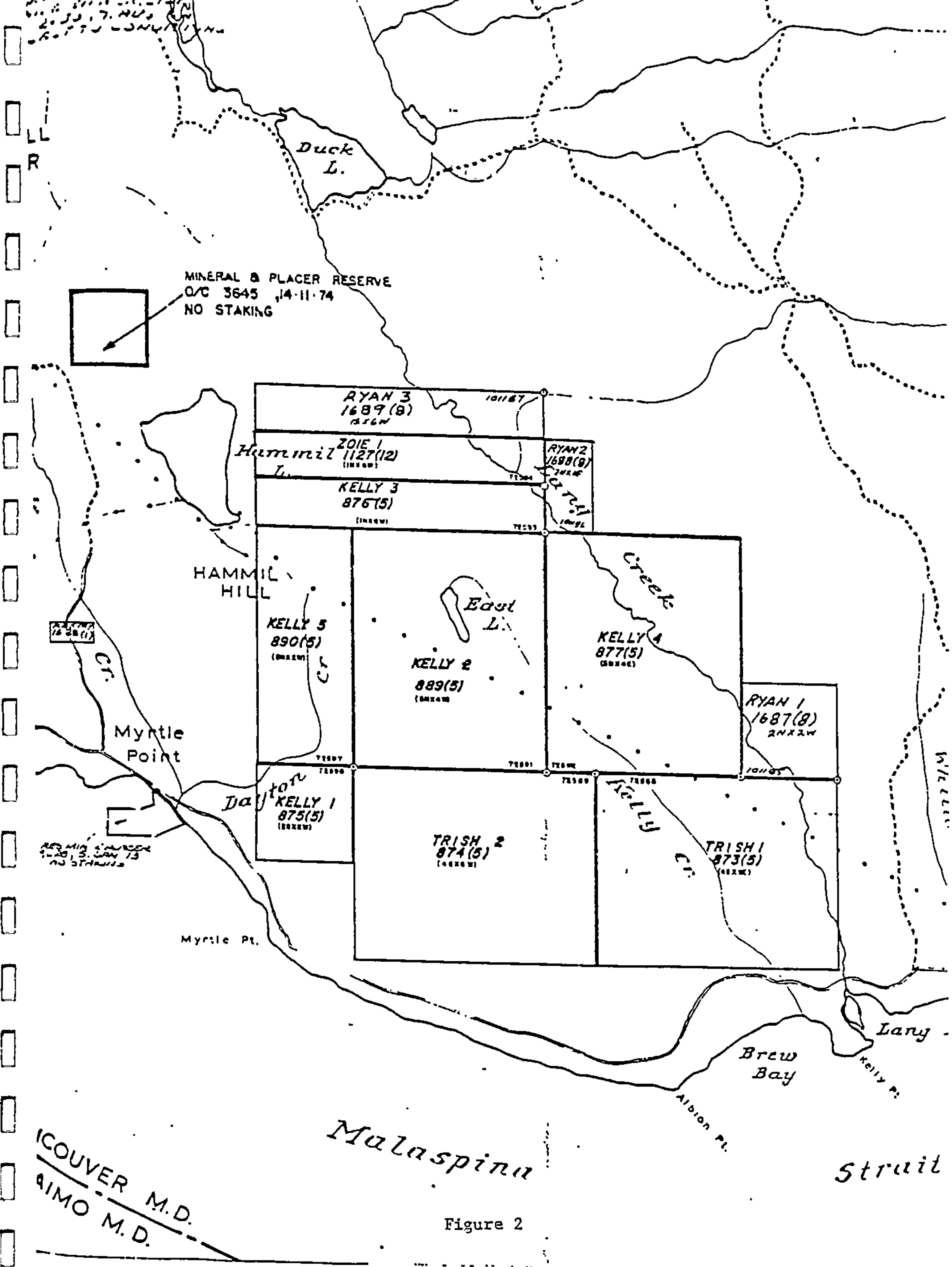
Fargo entered into a joint-venture agreement with Brenda Mines Ltd., a Noranda Group company, in September 1987. Brenda can earn a 50% interest in the Lang Bay property by providing 100% of the exploration costs through production. Further to this, an extensive exploration program was initiated in September 1987 which continued until February 1988. Work completed during that time consisted of the following:

- 6,700 meters of seismic refraction survey,
- 10,500 meters of magnetomer survey,
- 11,000 meters of Dipole-Dipole resistivity survey,
- 4 Schlumberger electrical soundings,
- 2,100 meters of reverse circulation drilling.

Preliminary beneficiation tests have been undertaken at kaolin laboratories in Cornwall, U.K. and at Indiana University in the United States. Thus far, these tests have been successful in producing a good filler-grade product for use in the paper industry.



FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
SITE PLAN	FIGURE 1



MINERAL & PLACER RESERVE
O/C 3645 14-11-74
NO STAKING
Duck L.
RYAN 3
1689(8)
ZOIE 1
1127(12)
RYAN 2
1688(9)
Haminil L.
KELLY 3
876(5)
HAMMIL HILL
KELLY 5
890(5)
East L.
KELLY 2
889(5)
Creek
KELLY 4
877(5)
RYAN 1
1687(8)
2NX2W
Myrtle Point
Cr.
Dayton
KELLY 1
875(5)
TRISH 2
874(5)
Kelly Cr.
TRISH 1
873(5)
Myrtle Pt.
Lang
Brew Bay
Kelly Pt.
Albion Pt.
Malaspina
Strait
COUVER M.D.
AIMO M.D.

Figure 2

2. CLAIMS

Fargo Resources Limited, 900 - 850 West Hastings Street, Vancouver, B.C. V6C 1E1, is the registered holder of the following mineral claims at Lang Bay:

Claim Name	Record Number	Number of Units	Record Date
Trish 1	873	20	May 4, 1993
Trish 2	874	20	May 4, 1993
Kelly 1	875	4	May 4, 1994
Kelly 2	889	20	May 8, 1994
Kelly 3	876	6	May 4, 1994
Kelly 4	877	20	May 4, 1994
Kelly 5	890	10	May 8, 1994
		100	
Zoie 1	1127	6	Dec. 15, 1988
Ryan 2	1688	2	Aug. 20, 1988
Ryan 3	1689	6	Aug. 20, 1988
		14	
Ryan 1	1687	4	Aug. 20, 1988
		118	

This report pertains to the Trish 1-2 and Kelly 1-5 mineral claims, known as the Kelly group.

3. LOCATION

The claim group lies 15 km southeast of the town of Powell River, British Columbia, and centered on Lang Creek. General physiographic boundaries are Malaspina Strait between Lang Bay and Myrtle Point to the south, Myrtle Creek and Hammil Lake to the west and northwest, Lang Creek to the north and Whittall Creek to the east. The approximate coordinates are 49° 48' N and 124° 25' W. The NTS map reference for the area is 92F/16W.

4. ACCESS

Highway 101 follows the coast from Saltery Bay to Powell River and passes very near to the southern border of the Kelly claim group. A good paved secondary road connecting to Highway 101 between Lang Creek and Kelly Creek extends north and then west where a tote road in useable condition, gives access to the area where the drilling was undertaken.

5. CLIMATE, TOPOGRAPHY AND LOCAL RESOURCES

The moderately undulating terrain has a maximum elevation of approximately two hundred and fifty meters above sea level near the northeast corner of the property. The ground slopes gently to the southeast. Lang Creek has cut its valley about fifteen to thirty meters below the general level of the surrounding area.

The area is covered with a mixed second growth forest consisting mainly of fir, hemlock, cedar and alder.

The water supply is plentiful due to the many streams and creeks on the property, the main ones being centrally located Lang creek and Kelly creek, both flowing southeasterly and to the west, Deighton Creek flowing southerly into Malaspina strait.

The climate is mild with an annual rainfall from 40 to 50 inches (100 - 125 mm) and minimal snowfall in the winter.

Dissecting the property in a northwest to southeast line is a high voltage power line.

6. HISTORY

In 1948 a spectrographic research study on the coals of British Columbia discovered high values of germanium in the carbonaceous shales and sandstones found in the Lang Creek area. In 1957 the mineral rights to the area were acquired by the now defunct Taiga Mines Ltd. who carried out a bulldozer trenching and a churn and diamond drilling program throughout 1958 and 1959.

In 1981 the property was acquired by the current owner, Fargo Resources Limited, who conducted a number of trenching and sampling programs between August 1981 and April 1984. Work in 1985 consisted of research on methods of recovering germanium from the arkosic sandstone formation.

In 1986-1987, a drilling program of 9 holes was carried out for a more detailed exploration of germanium bearing brown beds. Tests on clay/shale horizons contained within the brown beds determined that they contain a high quality kaolin.

In May 1987, a hole drilled a distance of 1 Km to the northwest of the previous area of sampling also contained kaolin, indicating a potentially large resource of this commodity at Lang Bay.

Since May 1987, most of the work at Lang Bay has centered on evaluating the property as a kaolin deposit. It is envisaged that if a mine were to ever come into production, the primary product would be kaolin clay with germanium and gallium being valuable by-products.

7. GEOLOGY

The Lang Bay prospect is contained within a small sedimentary basin on the western edge of the Coast Plutonic Complex of British Columbia.

The geological sequence consists of basement granitoid rocks of the Coast Plutonic Complex of Jurassic-Cretaceous age which are uncomformably underlain by the Brown Beds Formation a cyclothemic sequence of carbonaceous clays, indurated mudstones, siltstones, shales, sandstones, conglomerates and minor lignitic coal lenses. Palynomorphic studies suggest that these sediments are late Cretaceous in age. They are confined to a sedimentary basin approximately five kilometres across whose depth has not been determined.

The whole prospect is covered by glacial till, except along Lang Creek where erosion has exposed a considerable part of the sequence over 1.6 kilometres of outcrop, north of the British Columbia Hydro powerline.

The Kaolin Clays

Two distinctly different kaolin clay types are recognised within the Lang Bay prospect.

(1) A primary kaolin, derived from previous insitu weathering of the granitoid basement rocks.

(2) A secondary kaolin, part of the cyclothemic sequence of the granitoid basement rocks.

Drilling carried out to date indicates that the primary kaolin is confined to the margins of the sedimentary basin, whereas the secondary kaolin is extensively distributed throughout the basin interbedded with the coarser lithologic units of the cyclothemic sequence.

8. WORK PROGRAM - SEPTEMBER 1987 - FEBRUARY 1988

Various geophysical methods were employed to see if they might be successful in locating areas of the whiter, primary kaolin in close proximity to the surface. Anomalies located by geophysics were then drilled in an attempt to determine whether such a correlation could be made.

8.1 Seismic Refraction Survey

In September 1987, approximately 6,700 m (22,000') of seismic refraction survey was carried out by Foundex Geophysics Inc., over seven East-West oriented parallel lines, between Lang Creek and Kelly Creek. A 12 channel instrument was used, with 30 m (100') spacing between geophones. The results are presented in their report dated October 1987, and attached hereto as Appendix B.

While the seismic refraction could distinguish between the till and secondary kaolin, it was imposible to differentiate between the secondary kaolin and primary kaolin. Therefore, it is not anticipated that any further seismic refraction studies will be undertaken at Lang Bay.

8.2 Magnetometer and Electrical Resistivity Surveys

During December 1987, resistivity and magnetometer surveys were carried out by Foundex Geophysics Inc. of Vancouver. The results presented in their report dated December 1987, are attached hereto as Appendix C.

Approximately 10.5 km of line were surveyed at 12.5 m intervals using a Gem Systems Lamontagne GSM - 18 rowing magnetometer and a GSM-18 with extended memory as a base station.

An ABEM SAS 300B resistivity meter was used to profile 11 km of line by Dipole-Dipole resistivity with a "a" spacing of 25 meters over 5 separations with "n" values ranging from 1 to 5 in shallower basement areas and 2 to 6 in the deeper south west grid areas.

Resistivity was successful in delineating areas of high kaolin content close to surface, however, was not successful in distinguishing between the secondary and primary kaolin.

The magnetometer was not able to distinguish between the secondary and primary kaolins. However it was successful in outlining areas where unweathered basement rocks are close to surface. If there does seem to be a relationship between the depth to the unweathered basement and the primary kaolin, this method will be used to map the remainder of the basin.

8.3 Drilling

Two drilling programs were undertaken from September 27 - November 11, 1987 and from February 6 - 27, 1988. Both programs were conducted by Cora-Lynn Drilling of Strathmore, Alberta and consisted of 2100 meters of drilling in reverse-circulation and core holes.

This drilling has been successful in:

- delineating 11 million tonnes of material containing primary kaolin as well as several tens of millions of tonnes of secondary kaolin.

- providing a better understanding of the geology at Lang Bay.

- determining that magnetometer surveys appear to be the best geophysical tool for finding primary kaolin.

Results of the two drill programs are detailed in the report by C. Pilon in Appendix A and by C. Harvey of KRTA in Appendix E..

9. TOPOGRAPHIC SURVEY

The topographic survey over the exploration area has been conducted by R.J. Durling and Associates, 4775 Joyce Avenue, Powell River, B.C. who established a survey map and provided elevation profiles for the seismic lines.

The drill holes were tied to the exploration grid and surveyed for their elevations.

10. BENEFICATION TESTING

Over the past six months, testwork has been undertaken at kaolin laboratories in Cornwall, England and Indiana University in the United States.

Thus far, this testwork has shown:

- that it is possible to upgrade all of the primary kaolins, regardless of raw brightness (I.S.O) to a brightness of between 72 and 78.
- the primary kaolin has suitable qualities to be used in both paper and ceramic applications.
- that yields of the Lang Bay kaolin are substantially higher than primary deposits located in the U.K.

11. CONCLUSIONS

Results of the exploration and testing program have been very positive thus far. During 1988, considerable process testwork will be carried out to assess the optimal percent recovery from the primary kaolin to achieve the required market specification. Pending positive results from this testwork, delineation drilling will be performed with a view to taking the Lang Bay project to a full feasibility study by early-1989.

J. Currie

James A. Currie, P.Eng.

July 1988

STATEMENT OF COST

Drilling:		
Western Hydro Air Drilling	164,737.42	
Thiessen Equipment - drill mud	985.00	
		165,722.42
Geophysical Survey:		
Foundex Geophysics Inc.:		
- Seismic Refraction Survey		
- Field Program	14,821.44	
- Interpretation	10,208.98	
- Borehole Geophysical Investigation	6,364.68	
- Resistivity/Magnetometer Survey	16,600.00	
- Report Preparation/Supplies	307.12	
		48,302.22
Geological Supervision:		
Christian Pilon - fees & expenses	15,929.08	
Gordon R. Hilchey - fees & expenses	11,204.63	
Ragnar Bruaset - fees & expenses	4,013.00	
		31,146.71
Geological Consulting:		
Colin Harvey - KRTA Limited	26,175.10	
Kresho Galovich	1,126.08	
		27,301.18
Road Construction - Permanent Access Road:		
Granet Lake Logging Ltd.	23,287.50	
Numan Enterprises Ltd.	2,252.50	
		25,540.00
Land Survey:		
R.J. Durling & Associates		12,188.28
Beneficiation:		
F.W. Sutton	8,190.51	
MacMillan Bloedel Research	2,802.50	
Indiana University	559.83	
		11,552.84
Accommodation & Meals		10,554.56

Salaries & Wages:		
John Maithus	5,392.45	
Bill Gardener	718.18	
		6,110.63
Other Supplies:		
E.G. Whalley Ltd. - core boxes	3,264.55	
Western Concord Manufacturing - sample bags	1,163.24	
Shipping	914.53	
Supplies & Expenses	280.30	
Safety Supplies	151.80	
		5,774.42
Line Cutting:		
Bill Chase & Associates Ltd.		4,237.14
Truck Rental		2,514.06
Air Fare		263.00
	TOTAL	$351,207.46

APPENDIX A

1987 DRILLING REPORT OF CHRISTIAN G. PILON

FARGO RESOURCES LIMITED

DRILLING REPORT

ON THE

LANG BAY KAOLIN PROSPECT

Lang Creek Area
Vancouver. M.D
NTS 92F/16W
49° 48' N, 124° 25' W

Owner and Operator
FARGO RESOURCES LIMITED
900-850 West Hastings Street
Vancouver, B.C.
V6C 1E1

---

by

Christian G. Pilon, P. Geoph.

November 1987

TABLE OF CONTENTS

FIGURES

APPENDIX "A"

APPENDIX "B"

1. INTRODUCTION

Since 1981, Fargo Resources Limited is the holder of a group of mineral claims near Lang Bay, British Columbia. The claims cover a sedimentary basin known to contain high values of gallium and germanium.

Previous exploration programs on the property show presence of white kaolin and kaolinitic clays.

An exploration program of twenty five (25) reverse circulation rotary holes and two (2) cored holes was completed on Kelly 2 and Kelly 4 claims during the period from September 27 to November 11, 1987.

The purpose of this work was to test the continuity, lateral extend and grade of the white kaolin formation encountered by drill hole 87-7.

Field work was supervised by Gordon R. Hilchey, P. Eng. until October 7th and by the writer after this date.

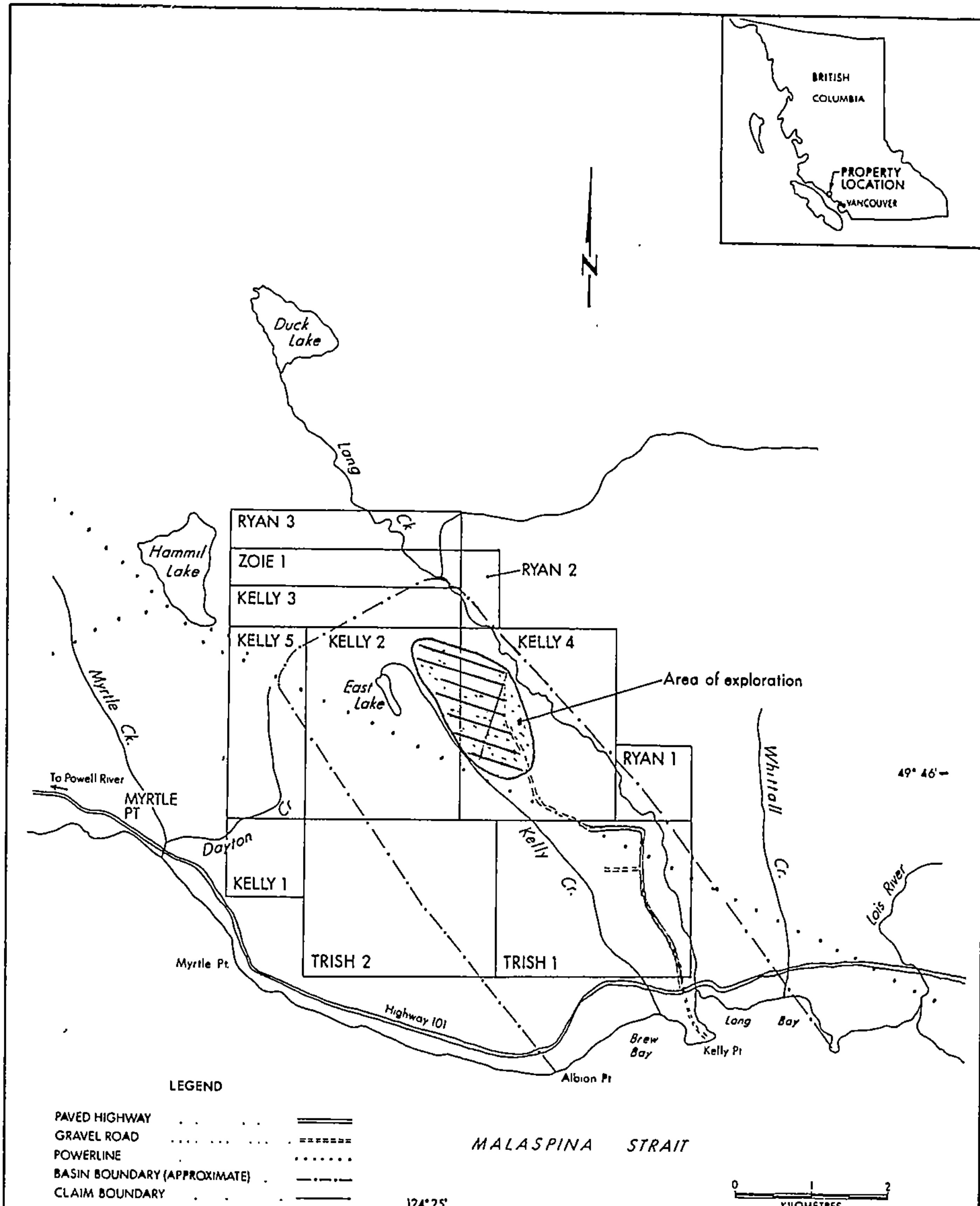
In September 1987, a seismic refraction survey was carried out over seven (7) parallel East-West lines, between Lang Creek and Kelly Creek.

2. LOCATION

The claim group lies 15 km southeast of the town of Powell River, B.C., centered on Lang Creek. General physiographic boundaries are Malespina Strait between Lang Bay and Myrtle Point to the south, Myrtle Creek and Hammil Lake to the west and northwest, Lang Creek to the north and Whittall Creek to the east. The approximate co-ordinates are 49° 48' N 124° 25' W. The NTS map reference for the area is 92F/16W.

3. ACCESS

Highway 101 follows the coast from Saltery Bay to Powell River and passes very near the southern border of the Kelly claim group. A good paved secondary road connecting to Highway 101 between Lang Creek and Kelly Creek extends north and then west where a tote road in fairly good condition gives access to the exploration area.



FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
SITE PLAN	FIGURE 1

4. HISTORY

In 1948 a spectrographic research study on coals of British Columbia discovered high values of germanium in carbonaceous material found in the Lang Creek area. In 1957 the mineral rights to the area were acquired by the now defunct Taiga Mines Ltd. who carried out a bulldozer trenching and a churn and diamond drilling program throughout 1958 and 1959.

In 1981 the property was acquired by current owner, Fargo Resources Limited, who have conducted a total of 11 trenching and sampling programs between August 1981 and April 1984. The 1985 work consisted of research on methods of recovering germanium for the arkosic sandstone formation.

In 1986-1987, a drilling program of 9 holes was carried out for a more detailed exploration of germanium bearing brown beds. Tests on clay/shale horizons overlying the brown beds have shown that they contain high quality kaolin. A large hole drilling program supported by a seismic refraction was recommended by G. R. Hilchey in his May 1, 1987 report.

On May 1987, Foundex Geophysics Inc. carried out a limited seismic refraction survey along one 610m north-south trending line, on the Kelly 4 claim. Hole No. 87-7 was drilled on the seismic line by air reverse circulation and sampled every 2' (0.6m) between 58' (17.4m) and 132' (39.6m). The samples were analysed at U.B.C. and proven to be a kolinitic clay with a kaolin concentration varying from 35% to 60%.

In September 1987 a seismic refraction survey was carried out by Foundex Geophysics Inc. on seven (7) parallel lines oriented East-West, spaced every 200m and covering an area limited by the access road to the east, Kelly Creek to the west and the power line to the south.

On September 27, 1987, a drilling program was initiated, with the objective of determining the extend of the kaolin deposit encountered by hole 87-7, as well as obtaining some clays samples from the different formations for a more complete analysis.

5. GEOLOGY

The property is underlain by a basin of thin bedded Eocene sedimentary rocks composed of poorly to well consolidated shales, sandstones, arkose and conglomerates. The basin in surrounded and underlain by granitoid intrusives of the Coast Plutonic Complex of the Jurassic-Cretaceous age. A glacial overburden covers all of the claim area, except along Lang Creek.

The drilling program undertaken around the discovery hole (87-7) delineated the following:

5.1 Overburden

The overburden thickness encountered ranges between 50' (15m) with hole 87-18 and 170' (50m) with hole 87-27. The superficial layer, 15' (4.5m) to 25' (7.5m) thick is composed of oxidized till with numerous boulders. This is underlain by a glacial deposit of grey sand, blue clay/clayey sand and a deposit of coarse grey washed sand usually water saturated.

A fair amount of gravels and pebbles was present at the contact of glacial overburden deposit with the underlaying brown beds formation.

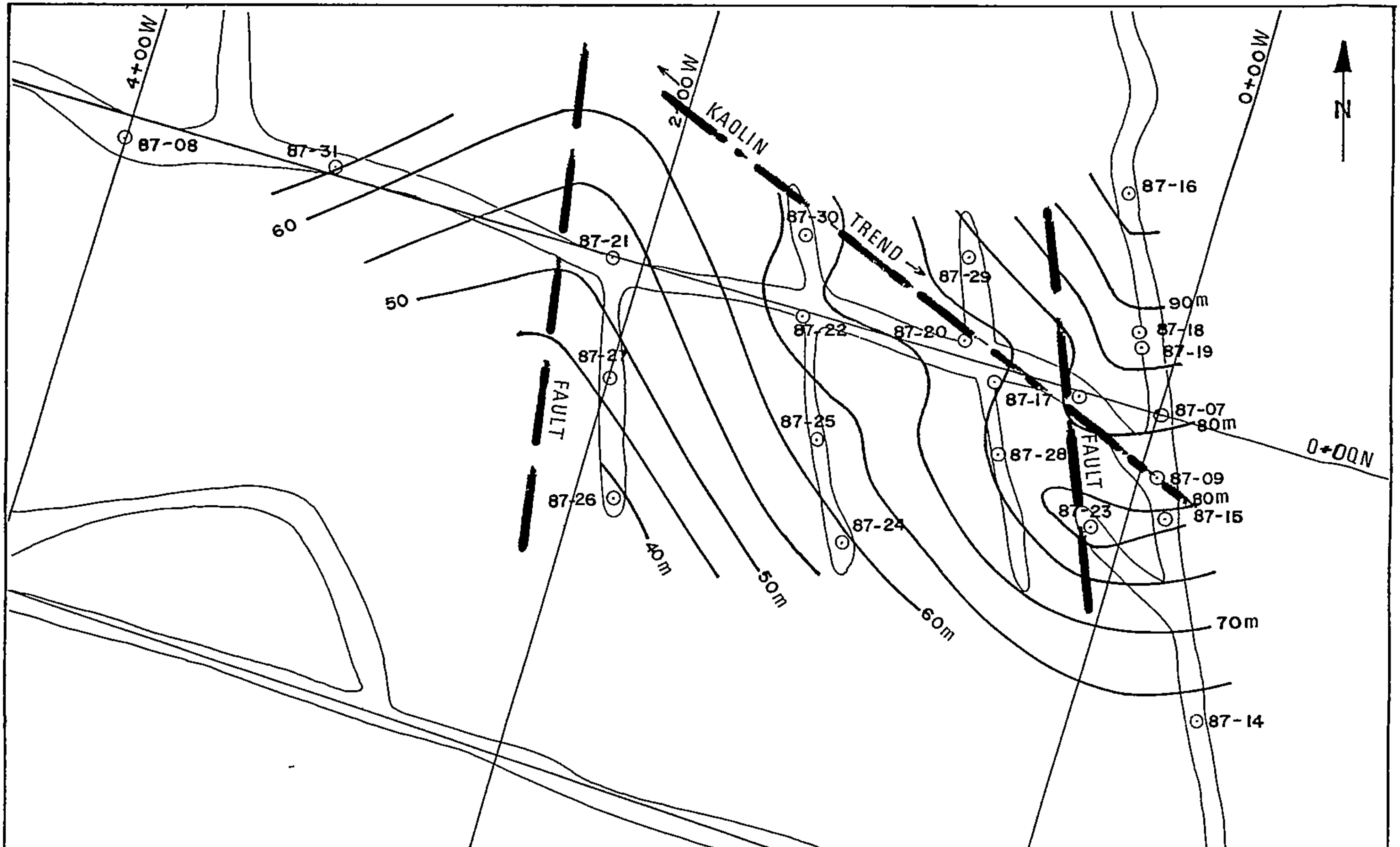
5.2 Brown Beds Formation

The formation contains dark brown horizons with germanium carrying coal lenses locally called brown beds.

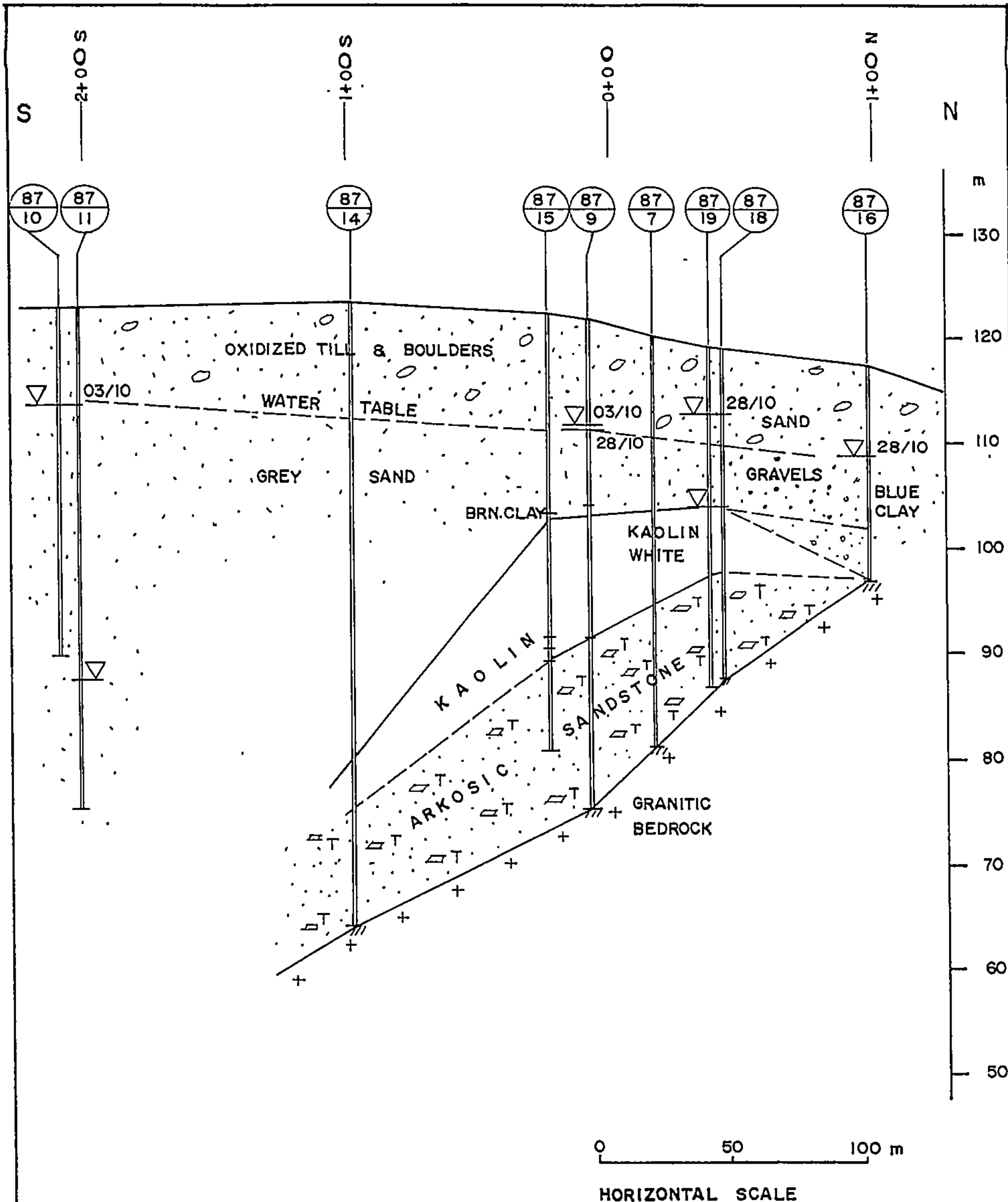
The brown beds formation is formed by a succession of thin bedded from 6" (0.15m) to 30' (9m) thick, shales, sandstones, clays and conglomerates with colours ranging from black, grey and purple grey for shales; grey, beige, white, brown and red for clays; to grey for sandstones and conglomerates.

Coal cuttings and organic fragments are present in brown, beige and black shale/clay horizons.

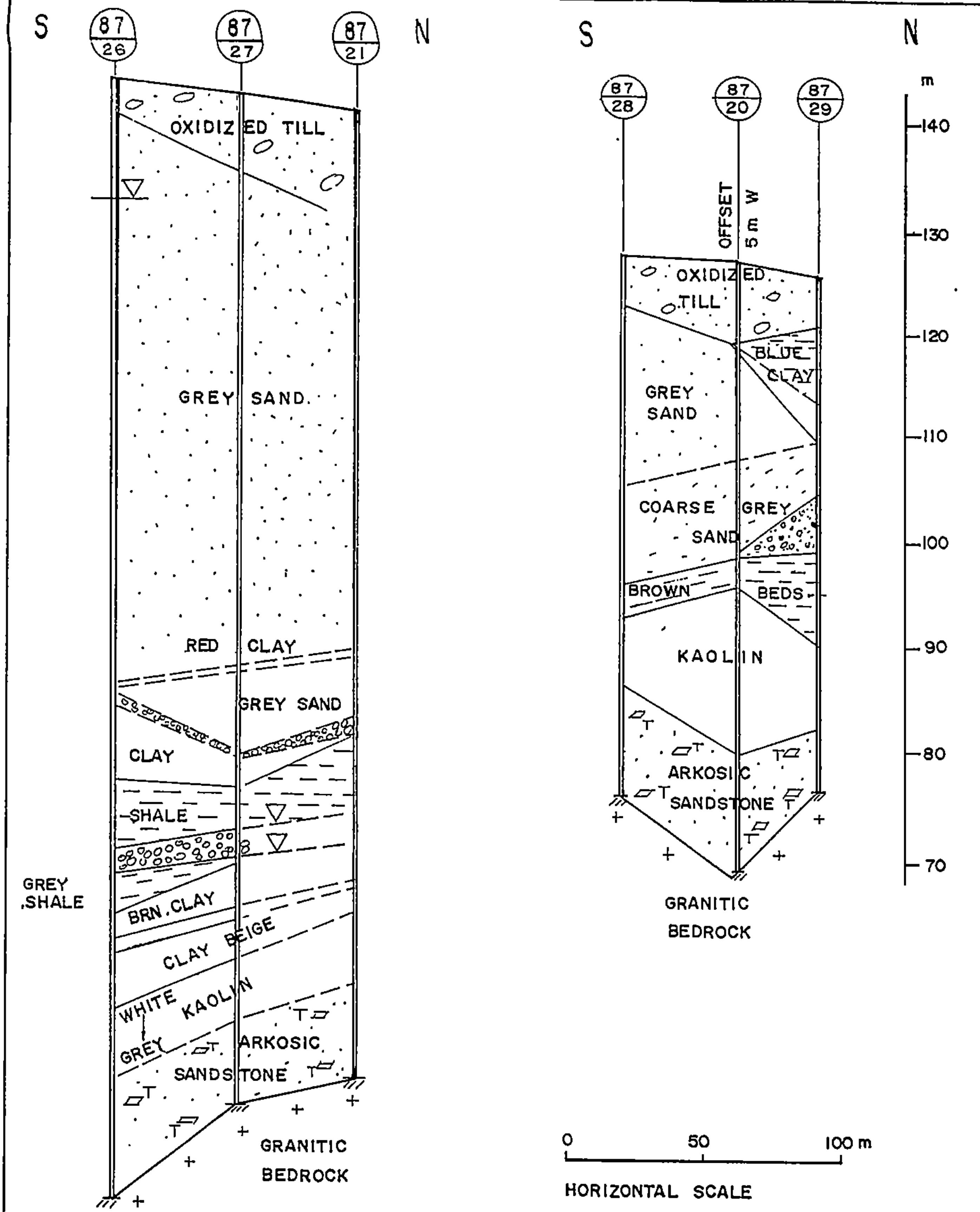
The dip trend is south westerly with a dip angle up to 20°.



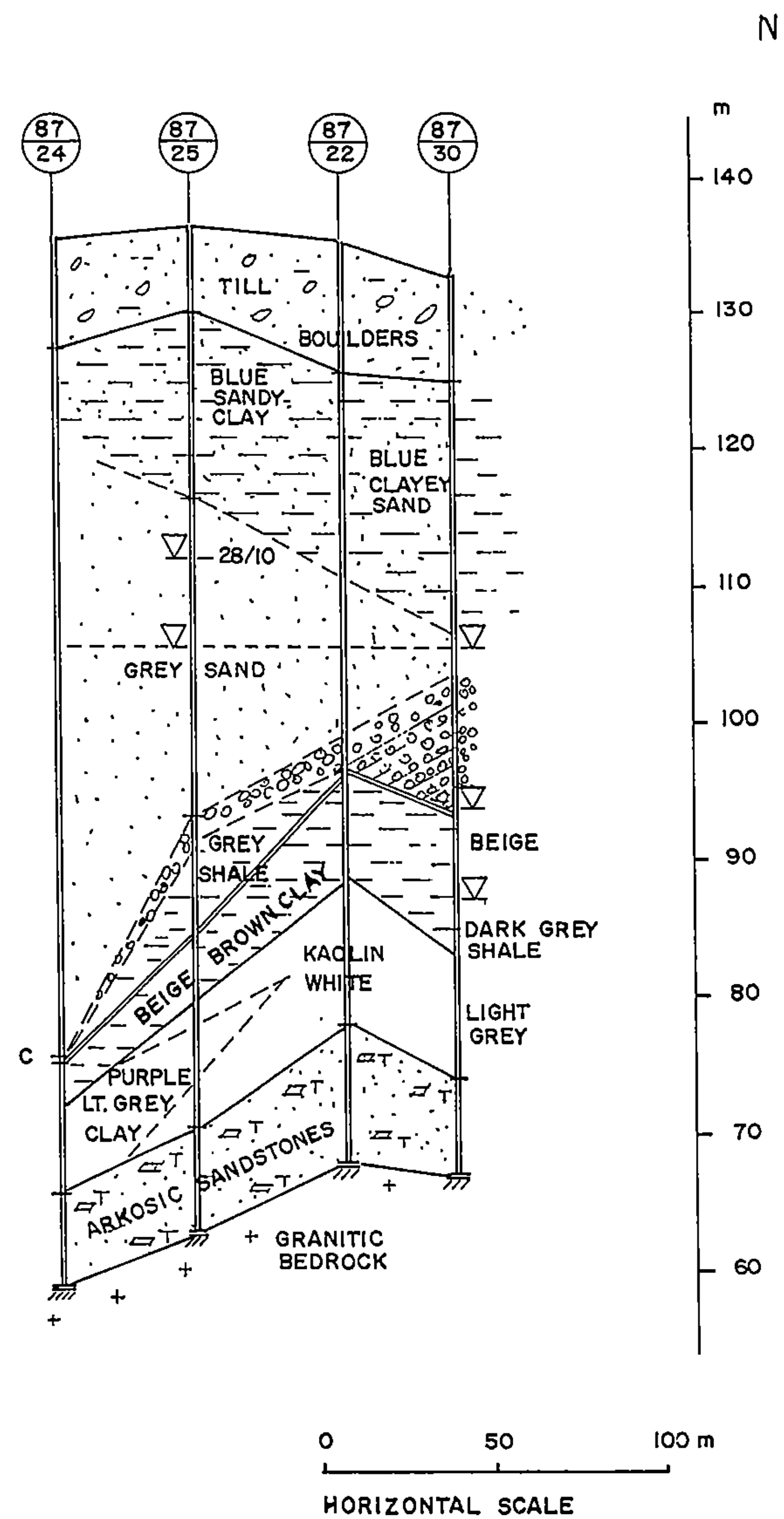
FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
BASEMENT ELEVATION CONTOURS FROM DRILLING	FIGURE 2



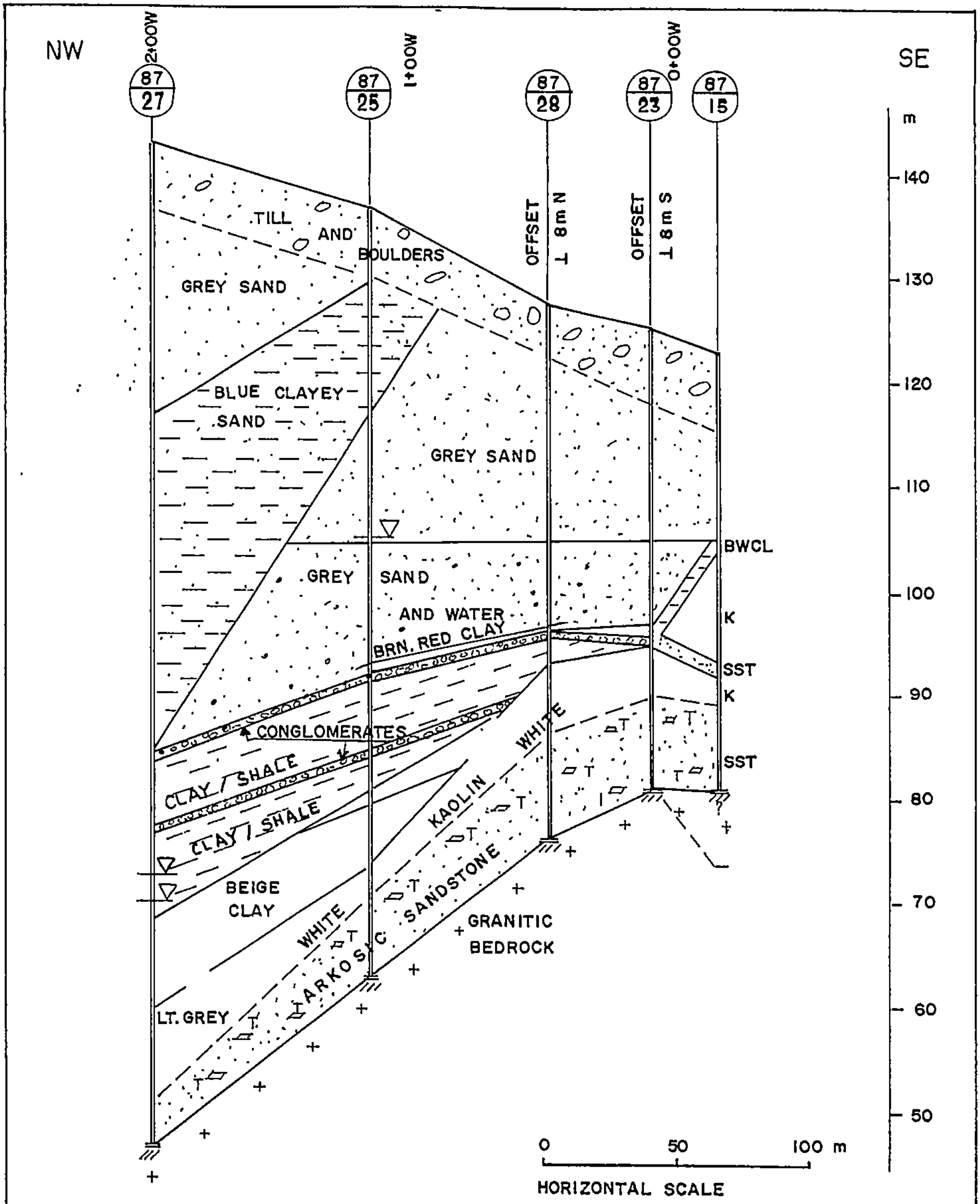
FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
CROSS SECTION - ACCESS ROAD	FIGURE 3



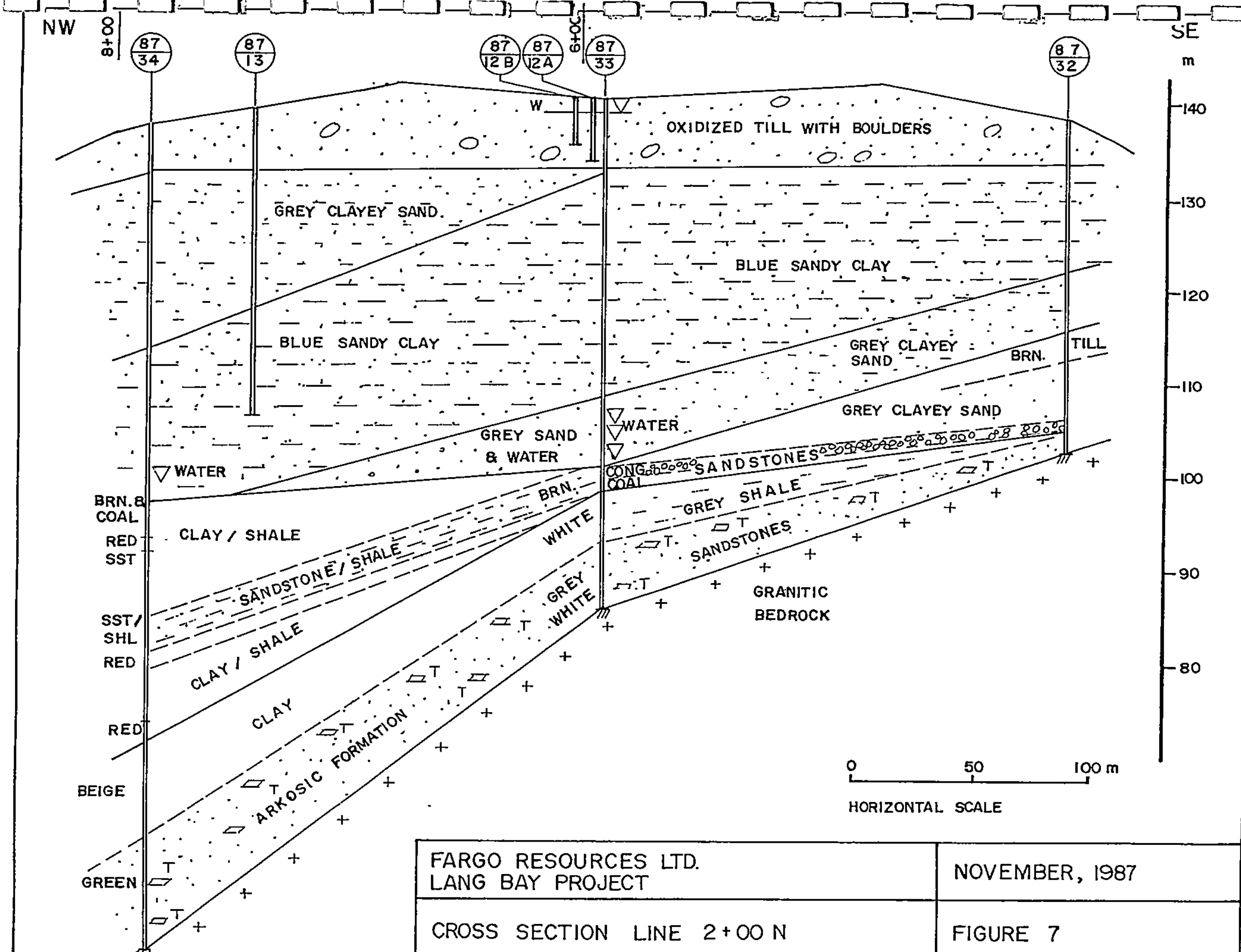
FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
CROSS SECTIONS - LINES 0+70W & 2+10W	FIGURE 4



FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
CROSS SECTION LINE 1+40 W	FIGURE 5



FARGO RESOURCES LTD. LANG BAY PROJECT	NOVEMBER, 1987
CROSS SECTION LINE 0+50 S	FIGURE 6

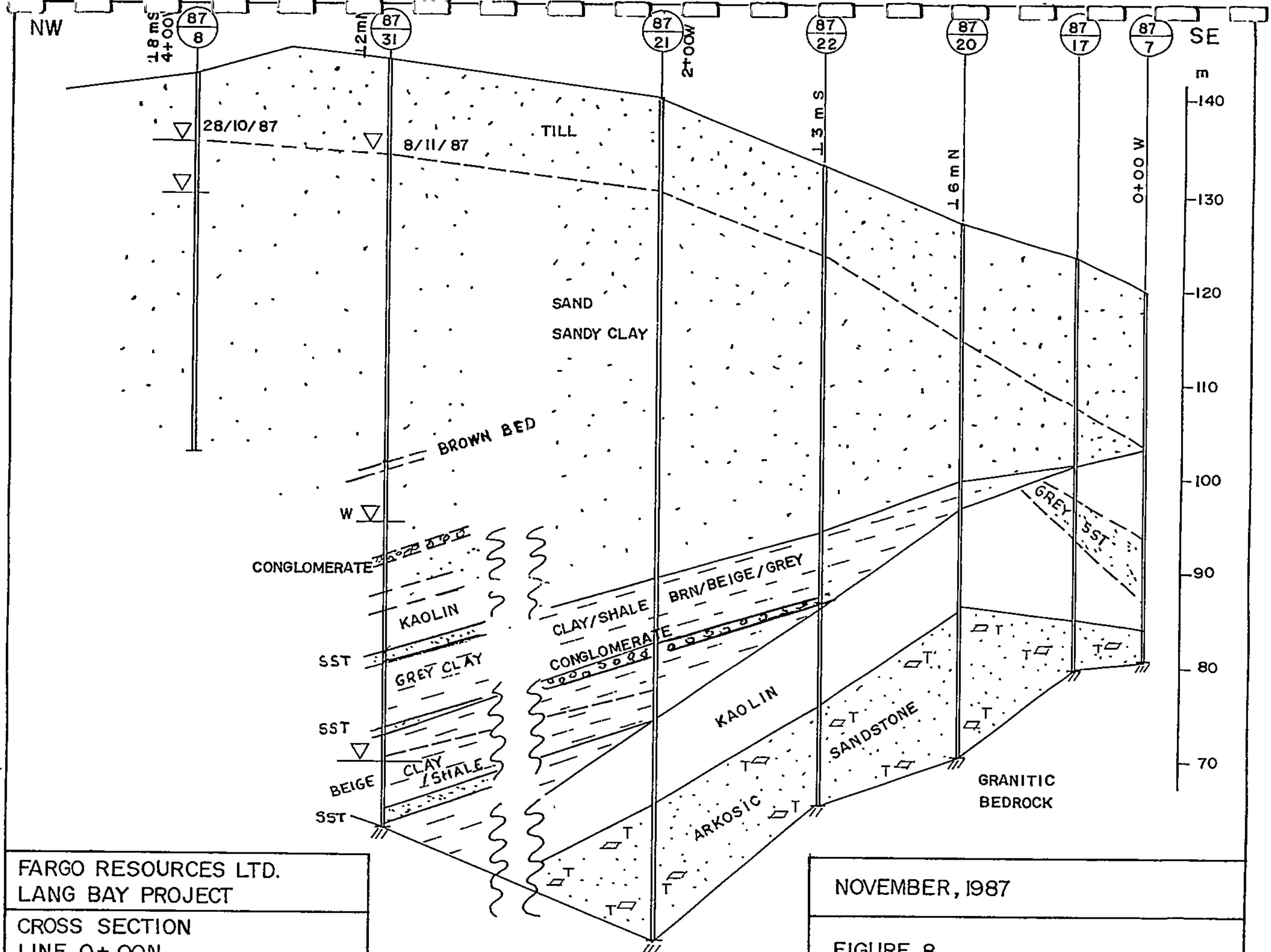


FARGO RESOURCES LTD.
LANG BAY PROJECT

NOVEMBER, 1987

CROSS SECTION LINE 2+00 N

FIGURE 7



FARGO RESOURCES LTD.
LANG BAY PROJECT

CROSS SECTION
LINE 0+ 00N

NOVEMBER, 1987

FIGURE 8

5.2 Kaolin and Arkosic Formation

A. The formation encompasses the four consecutive phases of kaolin formation.

1. Feldspars alteration of the granitic rock in place, the other elements in the granitic structure remain undisturbed.

2. Arkosic sandstones, medium to coarse grained, consisting of reworked, quartz and feldspar. They are moderately to well endurated, interbedded with kaolinitic clay and their biotite content increases with depth.

3. Kaolin residual of primary deposit is found above the arkosic sandstones generally of colour white to light grey.

4. Kaolinitic clays of secondary deposit lay in the upper part of the formation. The colour is white, light grey or beige and the presence of sparses small rounded pebbles indicates some type of water transport.

Secondary kaolinitic clays are also found in the brown beds formation.

The kaolin deposit trend is along a structural feature oriented South-East, North-West and trending through the drill holes 87-9, 97-20, 87-30, and 87-33 (Fig. 2). The maximum thickness and the whitest kaolin found along this line of fracturation would suggest weathering of the underlying granitoid rock by hydrothermal processes.

The arkosic formation lays above the granitic bedrock with an average thickness of 45' (13.5m) to 50' (15m).

6. 1987 DRILLING PROGRAM

During the period between September 27 and November 11, 1987 27 holes were drilled, totalling 4,912' (1,473m); 1060' (318m) were sampled by air circulation drilling through the clay formations. The dry cuttings were bagged on the 2' (0.6m) interval then later split and stored on the property for further analysis. The holes were drilled by Cora-Lynn Drilling, Strathmore, Alberta.

The location of these holes is shown on Figure 2 and attached seismie survey map.

The drill logs of the holes are presented in Appendix "A" to this report.

Drilling Program - Phase I

- Total footage drilled: 4912'
- From September 27 to October 6, the drilling crew was paid on a footage basis.
- From Ocotober 7 to November 10, the crew was paid per hour.

6.1 Drilling Production Day By Day

Sept. 26 & 27	Mobilization from Calgary		
27	Stand by for parts		
28		2 hours	45' drilled
29		12 hours	89' drilled
30		12 hours	144' drilled
Oct. 1		12 hours	85' drilled
2		12 hours	157' drilled
3		12 hours	110' drilled
4, 5, & 6	Stand by for parts and mud equipment		

Total drilled on footage basis: 62 hours 630' drilled
Average hourly production: 10.16'

During this period, only one hole (87-9) has been drilled through the kaolin formation, with a maximum depth of 144'. Six other holes have been started and stopped in the overburden:

- 87-08 stopped at 134', in water sand.
- 87-10 stopped at 85', lost Odex bit and 40' of casing.
- 87-11 stopped at 157', hole got tight, torque was up.
- 87-12A stopped at 22', hole went crooked.
- 87-12B stopped at 17', sand & boulders.
- 87-13 stopped at 110' gravel & boulders.

Drilling Production Day By Day (Continued)

Oct.	7 night & day	20 hours	296' drilled
	8	12 hours	126' drilled
	9	10 hours	218' drilled
	10 coring	11 hours	105' drilled
	11	10½ hours	112' drilled
	12	11 hours	191' drilled
	13	11 hours	180' drilled
	14	9 hours	121' drilled
	15	11½ hours	165' drilled
	16	3½ hours	66' drilled
	17 - 20 shut down		
	21 coring	12 hours	118' drilled
	22 coring	11 hours	77' drilled
	23	12½ hours	154' drilled
	24	10½ hours	184' drilled
	25	11 hours	137' drilled
	26	12 hours	120' drilled
	27	10 hours	171' drilled
	28	11½ hours	187' drilled
	29	10 hours	163' drilled
	30	11 hours	148' drilled
	31 shut down, waiting for parts		
Nov.	1, 2, 3 shut down, waiting for parts		
	4	7 hours	156' drilled
	5	12 hours	218' drilled
	6	8 hours	158' drilled
	7	11 hours	113' drilled
	8	10½ hours	119' drilled
	9	11 hours	183' drilled
	10	9½ hours	296' drilled

Total drilled on hourly basis: 289 hours, 4282' drilled

Average hourly production: 14.66'

During this period, a total of 21 holes has been drilled; all of them to the granitic bedrock.

6.2 Problems Encountered

- Formation

The main drilling difficulties reside in drilling through the overburden. The overburden thickness has been found so far to be between 50' and 170'.

For the next part of the program the overburden thickness should be between 150' and 200' according to the dip of the brown bed formations.

The material encountered could be classified as follows:

- Oxidized till with large amounts of boulders (25').
- Sandy clay with gravel and pebbles.
- Sand - often water saturated.
- Some boulders have been found down to 80'.

- Drilling Procedures

Overburden drilling with Odex bit and simultaneous casing.
The process was very slow through the boulder formation due to the use of a large odex bit (versus hammer). The 6" 5/8 casing had to be welded length after length in the way down and cut in the way up.

After the trial and errors the procedure followed was:

1. Hammer drilling as far as possible; usually stopped when encountering a sand layer.

2. Mud drilling with a tricone bit, through sand and water saturated sand, to the brown bed formation.

3. Casing of hole to formation sealing sand and water.
(5" 3/8 threaded casing)

4. Conversion of rig to reverse circulation configuration.
(45mn to set up, 45mn to set it back)

5. Reverse circulation drilling to bedrock (dry sampling).

Depending on the overburden conditions, steps 2 and 3 were excluded.

Lithology - Correlation

Reverse circulation sampling every 2' does not allow accurate chronology of layers of thickness inferior at 4' and no indication about dip angle and direction of layers.

6.3 Recommendations For Future Drilling

- Wire line coring should be used for sampling the brown beds and primary kaolin formations in each and every hole, if after trial, core recovery is satisfactory.

  The procedure with wire line coring would be:

  1. Hammer drilling as far as possible.
  2. Mud drilling with tricone (tripan bit should be tried and may improve penetration rate in sand and clay with the added advantage of price compared to tricone).
  3. Casing of hole to formation to seal water layers.
  4. Wire line coring with Christensen core barrel.

  Steps 2 and 3 could be excluded depending of overburden.

- Wire line coring is done with the rig in conventional configuration. The 1½ hour spent in converting the rig to reverse circulation would equivalent to the extra time of handling core barrels up and down for about 100' of coring.

- Without a good core recovery, drilling should go on with reverse circulation and correlation from hole to hole should be done with down hole logging (electrical, gamma ray and neutron probes)

  With an increase in cost of about $1,000/day for logging equipment and operator, careful and well devised coring procedure will appear to be a more economical solution.

- Drilling production; the footage per hour average should be substantially increased with deeper holes and larger clay formation as to be expected for the second phase program. (the penetration rate in clay formation is ½' to 1' per mn)

- Footage price versus hourly rate;

  After having experienced both situations during Phase I of the program it appears the hourly way is the most economical situation for all parties involved.

7. GEOPHYSICS PROGRAM

7.1 Seismic Refraction Survey

In September 1987, approximately 6,700m (22,000') of seismic refraction survey was carried out by Foundex Geophysics Inc., over seven East-West oriented parallel lines, between Lang Creek and Kelly Creek. A EG and G Geometrics 12 channels instrument was used, with 30m (100') spacing between geophones. The results are presented in their report dated December 1987.

The seismic work gives a good understanding of the basement configuration and of the faulting involved.

Seismic results can still be improved upon thorough use of tighter geophones spacing and grid profiling.

7.2 Bore Hole Logging

Bore logging was carried out in ten (10) drill holes (87-8, 9, 10, 14, 15, 17, 18, 20, and 87-21) by Foundex Geophysics with a Mount Sopris 1000-C logger equipped with a gamma ray - resistivity-SP probe.

Gamma ray readings were taken in all of the holes either through the casing or through the drill pipe.

Resistivity readings have only been possible in hole 87-14.

The main obstacles to resistivity readings lay with th necessity of casing the overburden and the instability of the holes through the formation as they usually started collaspsing when filled with water to assure conductivity for the electrical probe.

The absence of resistivity readings and reliable correlation to core samples prevented the logging to be used to its full extent for correlation between holes.

The bore hole logging consequenty had been stopped on October 16, 1987.

The gamma logs and resistivity loop have been reproduced to scale corresponding drill logs appended to this report.

8. TOPOGRAPHIC SURVEY

The topographic survey over the exploration area has been conducted by R.J. Durling and Associates, 4775 Joyce Avenue, Powell River, B.C. who established a survey map and provided elevation profiles for the seismic lines.

The drill holes were tied to the exploration grid and surveyed for their elevations.

A copy of Plan For Seismic Survey is filed in Appendix "B" to this report.

9. RECOMMENDATIONS FOR FURTHER WORK

Considerations

- Due to the large economic interest of the white kaolin, primary type of kaolin deposits should be the main target of the next investigation.
- Other clays and shales encountered above the primary deposit have been shown as containing kaolinite and could be exploited as a by-product of kaolin mining, with possible uses as fire clays (cf tests done at Clayburn Refractories Ltd.), ball clays and alumina (cement fabrication).
- The white kaolin deposit appears to be associated with some structural faulting, therefore mapping of all structural anomalies should have priority.
- A fair amount of magnetite is contained in primary kaolin (U.B.C. report by Professor A.C.D. Chaklader "Investigation on Kaolin at the Lang Bay deposit" with 6.3 to 10.5% in weight for samples taken from hole 87-7).
- The total area covered by all the claims represents 32 sq. kms (7,500 acres) with only 1 sq. km (240 acres) surveyed by seismic refraction and

.08 sq. km covered by drilling. A general reconnaissance of the entire property should allow the selection of possible target areas for subsequent detailed work and a possible release of sterile claims.

Objectives

- Mapping of basement rock with structural changes, fault systems and magnetic anomalies by ground magnetic and seismic refraction surveys.
- Delineation of contact between overburden and brown beds formation and between brown beds formation and kaolin formation by electrical survey.
- Kaolin deposits configuration, clay formations sampling by core and between brown beds formation and kaolin formation by electrical survey.
- Kaolin deposit configuration, clay formations sampling by core and reverse circulation drilling.

Program

1. Ground magnetic survey over Phase I area (test and calibration survey) along lines 2+00N, 0+00N, 2+00S, 4+00S, 6+00S, 8+00S, 10+00S, Base line, access road and old logging road.

2. Seismic refraction to complement Phase I program. Seismic spreads with 24 geophones should be used, with a spacing between geophones of 10m (30'). Along line 4+00N, 4+00S and it's east extension, east extensions of line 0+00N and 2+00S, and Base line.

3. Interpretation of geophysical results.

4. Core drilling to follow the actual kaolin deposit trend eastward and on other structural anomalies found by geophysics.

5. If positive results are obtained with the test over Phase I area Ground Magnetic method should be used to map the whole property.

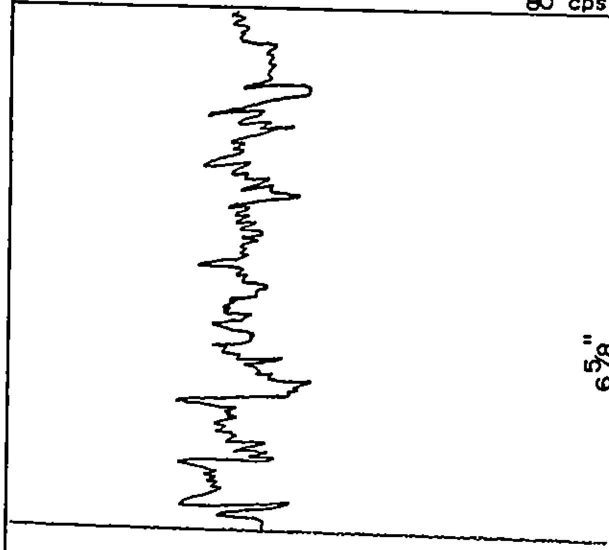
6. Seismic refraction combined with resistivity survey should be run over the magnetic anomalies encountered.

7. Core drilling and reverse circulation sampling of drill holes targeted on these anomalies.

APPENDIX "A"

NATURAL GAMMA LOG | CASING | DRILLING | DEPTH m / ft | LITHOLOGY | DESCRIPTION

0 — 80 cps



Depth (m)	Depth (ft)	Description
0	0	OXIDIZED TILL & BOULDERS
		WATER LEVEL 26/10/87
10		GREY SAND - WATER
	50	
20		GREY SAND
30	100	
40		SATURATED SAND
	150	HOLE STOPPED AT 134'
50		
60	200	
70		
	250	
80		
90	300	
100		
	350	
110		

Casing: 6⅝"

Drilling: ODEX

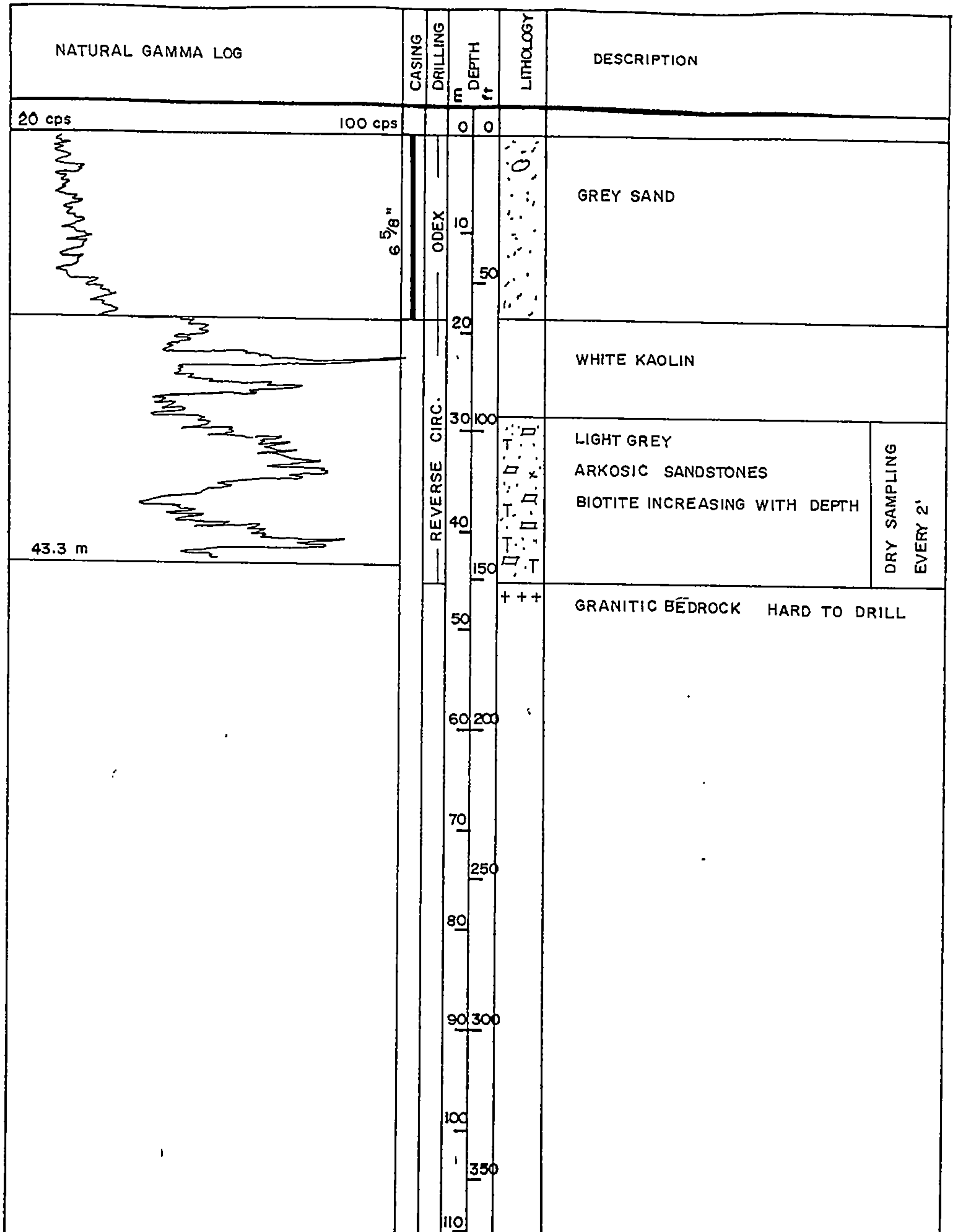
FARGO RESOURCES LTD.

LANG BAY PROJECT

ELEVATION: 142.9 m

NOVEMBER, 1987

HOLE # 87-8



FARGO RESOURCES LTD.	ELEVATION: 122.2 m	HOLE # 87 - 9
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
NONE	REVERSE CIRC.	0–48.8	0–160		GREY SAND
					HOLE STOPPED AT 160' LOSS OF CIRCULATION

Depth scale (m): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110

Depth scale (ft): 0, 50, 100, 150, 200, 250, 300, 350

FARGO RESOURCES LTD.	ELEVATION: 122.6 m	HOLE # 87 - 11
LANG BAY PROJECT	NOVEMBER, 1987	

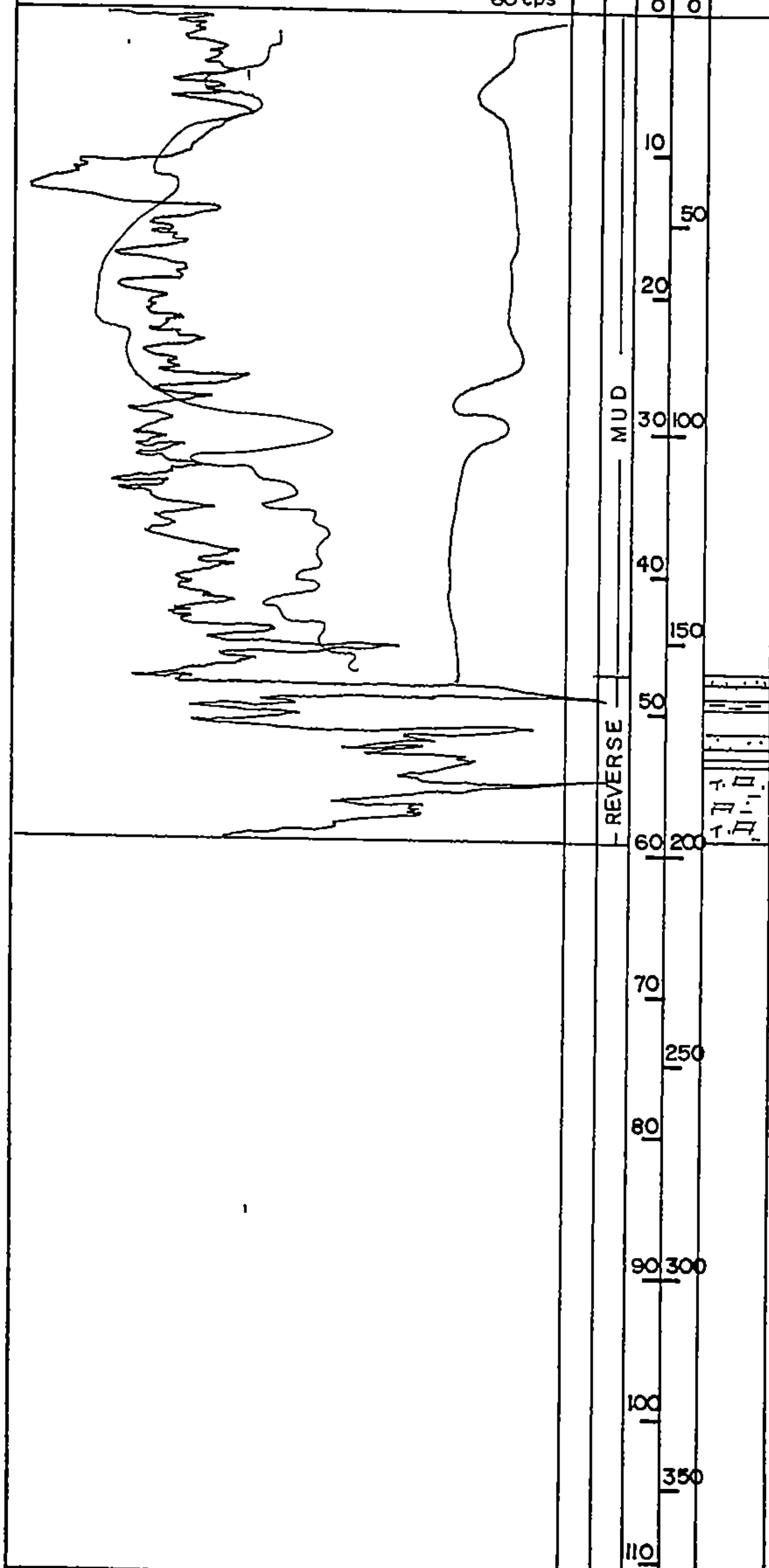
CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
		0	0		
					BOULDERS
		10			87.12 A STOPPED AT 20'
			50		87.12 B STOPPED AT 15'
		20			
		30	100		
		40			
			150		
		50			
		60	200		
		70			
			250		
		80			
		90	300		
		100			
			350		
		110			

FARGO RESOURCES LTD.	ELEVATION: 140.4 m	HOLE # 87 - 12
LANG BAY PROJECT	NOVEMBER, 1987	

	CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
			0	0		
						OXIDIZED TILL
			10			GREY SAND
				50		
			20			
						BLUE CLAYEY SAND
			30	100		
						HOLE STOPPED AT 110'
			40			
				150		
			50			
			60	200		
			70			
				250		
			80			
			90	300		
			100			
				350		
			110			

FARGO RESOURCES LTD.	ELEVATION: 138.6 m	HOLE # 87 - 13
LANG BAY PROJECT	NOVEMBER, 1987	

NATURAL GAMMA LOG S.P. 10 m V / cm	RESISTIVITY 100 Ω /m/ cm	CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
10 cps	60 cps			0	0		

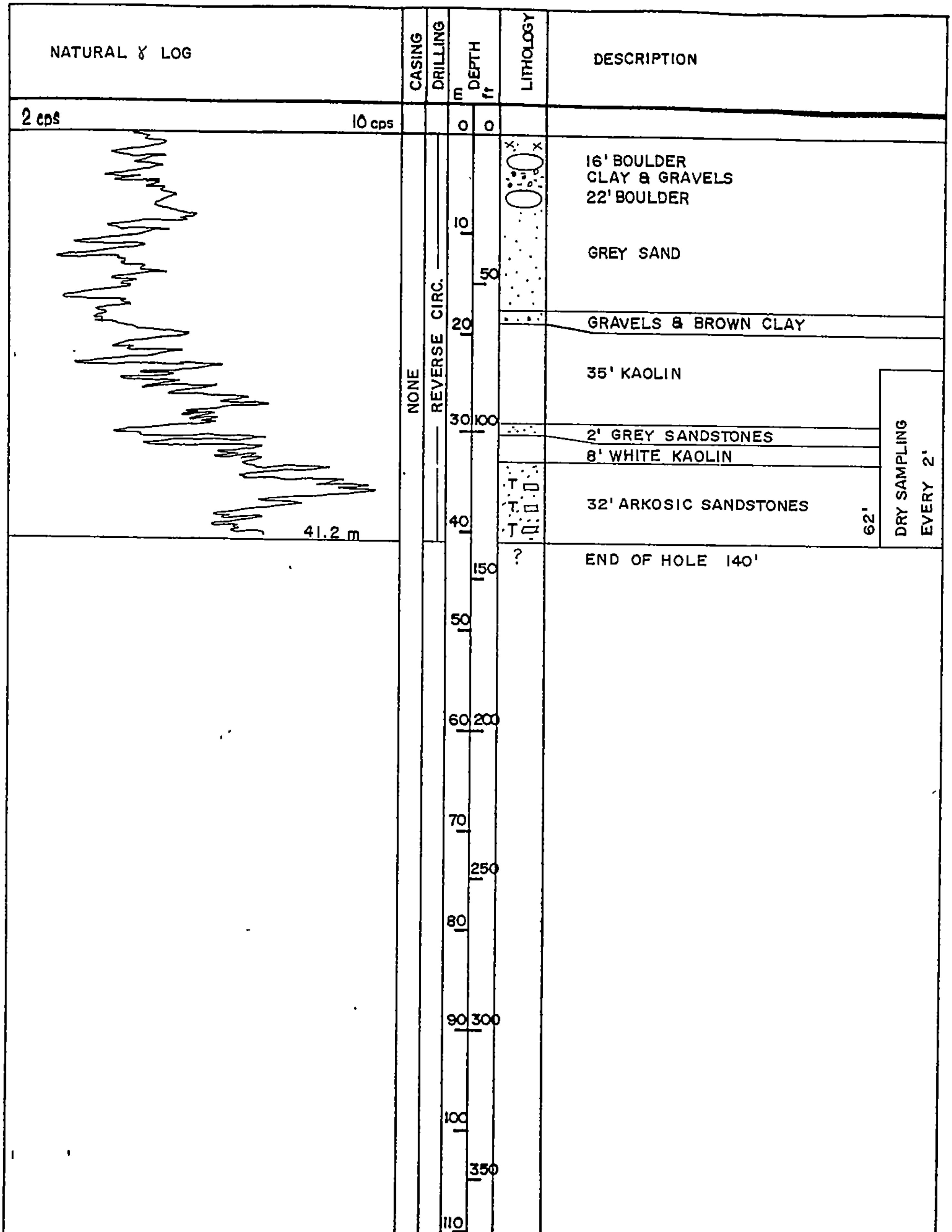


COARSE SAND
GREY CLAY
LIGHT BROWN SHALE
GREY CLAY
GREY SANDSTONE
ARKOSIC SANDSTONE &
CLAY HORIZONS
LIGHT GREY

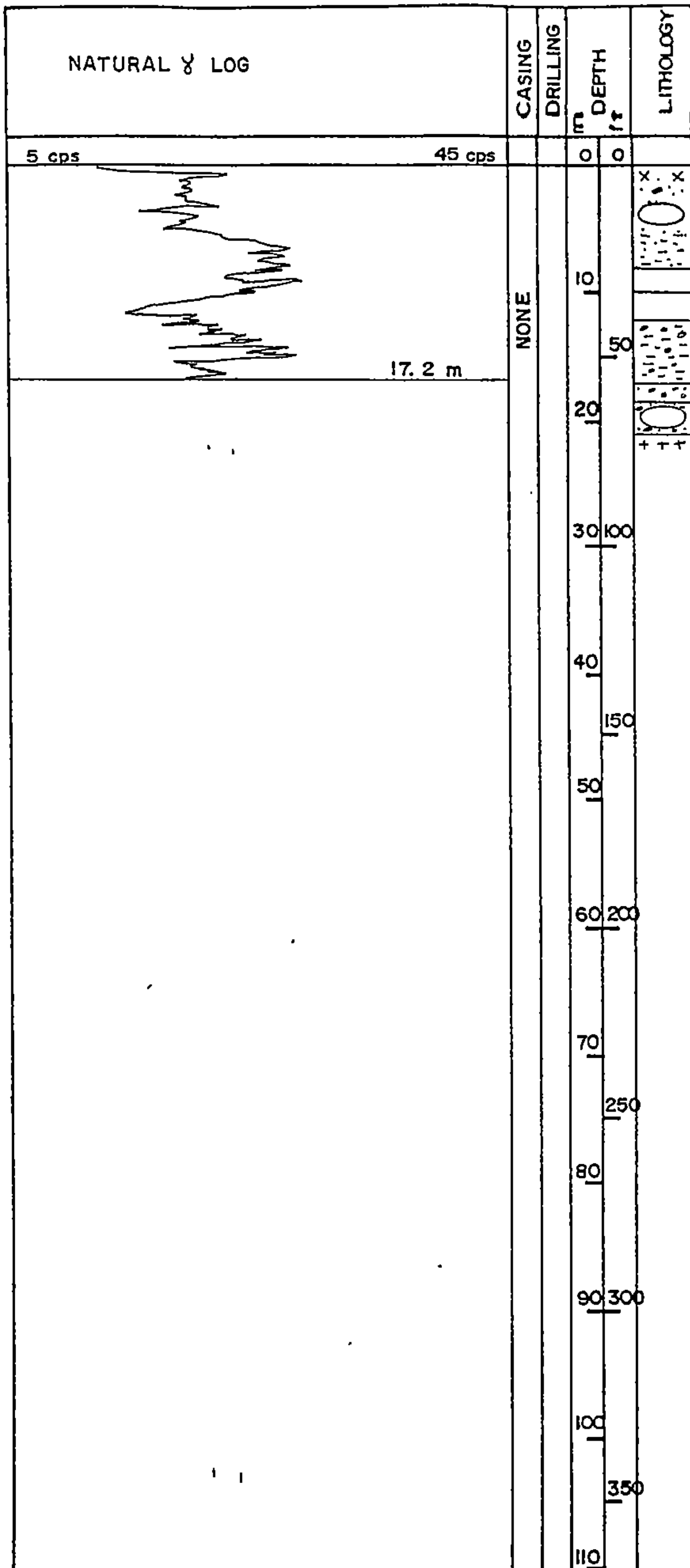
DRY SAMPLING EVERY 2'

END OF HOLE 197' HARD TO DRILL

FARGO RESOURCES LTD.	ELEVATION: 123.3 m	HOLE # 87 - 14
LANG BAY PROJECT	NOVEMBER, 1987	



FARGO RESOURCES LTD.	ELEVATION: 122.7 m	HOLE # 87 – 15
LANG BAY PROJECT	NOVEMBER, 1987	

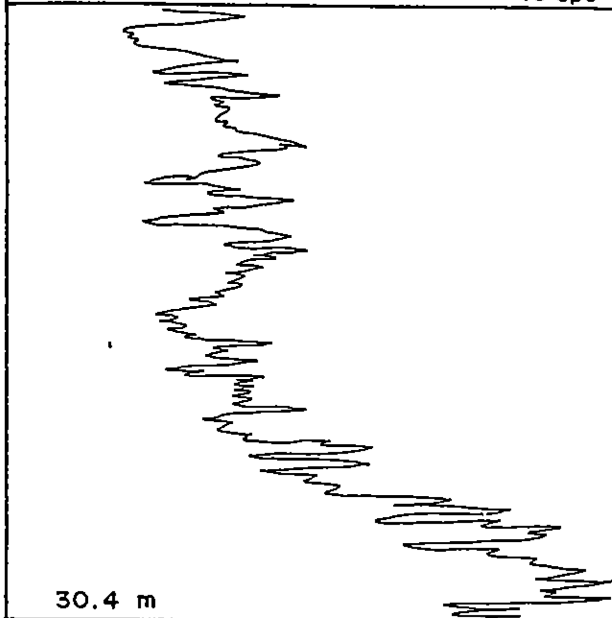


DESCRIPTION :
NO SAMPLES

TILL
19' BOULDER
GREY SANDY CLAY
BROWN CLAY
BLUE CLAY
GREY BLUE CLAY & GRAVELS
CONGLOMERATE
GRAVEL 1/2" – 1"
65' BOULDER
69' PEBBLES 1–2"
GRANITE END OF HOLE 69'

FARGO RESOURCES LTD.	ELEVATION: 117.5 m	HOLE # 87 – 16
LANG BAY PROJECT	NOVEMBER, 1987	

NATURAL γ LOG	CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
2 cps — 10 cps			0	0		

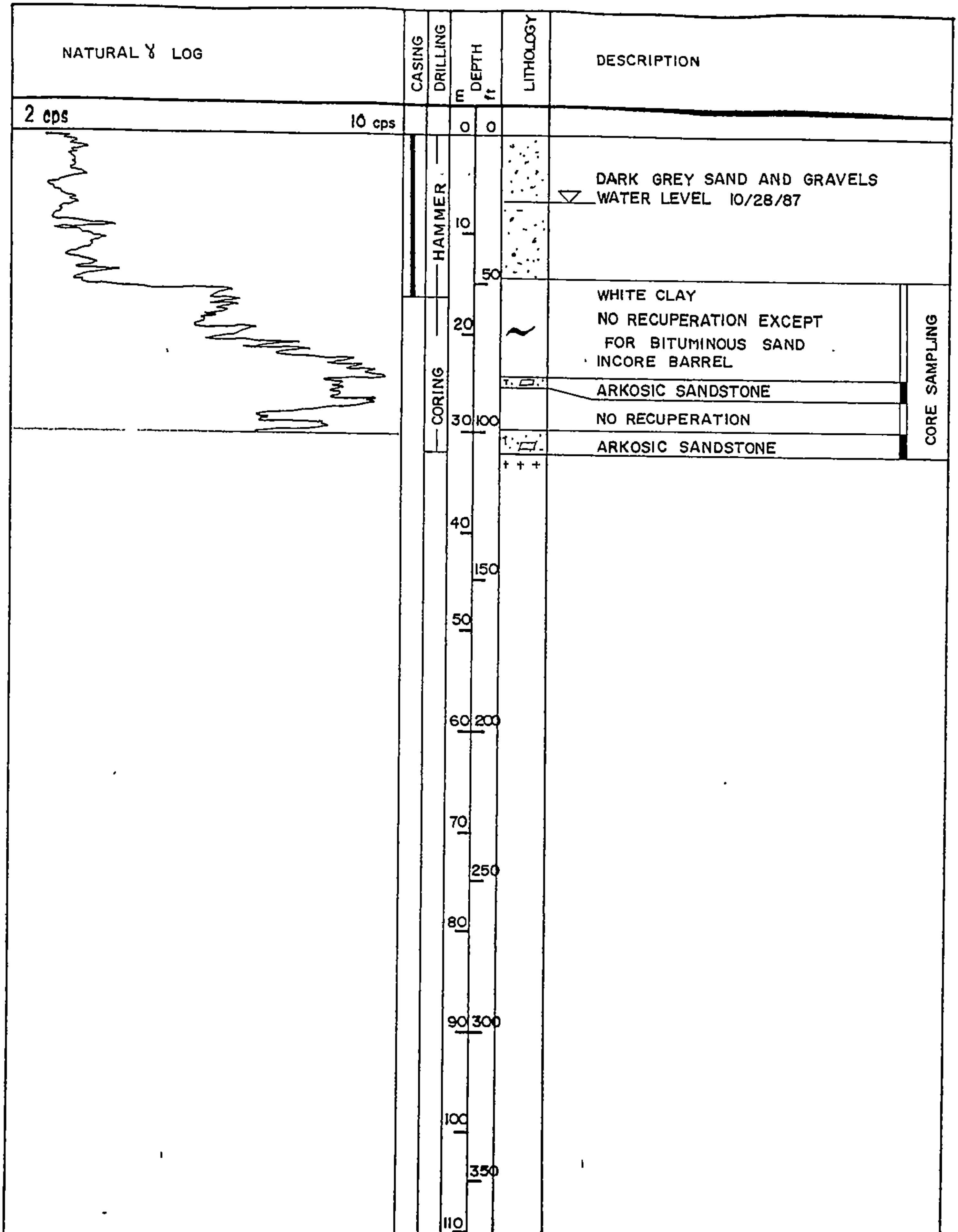


Drilling	Depth (m / ft)	Description
HAMMER	0–22 m	TILL
		GREY SAND
REVERSE CIRC.		2' GREY SANDY CLAY
		2' WHITE KAOLIN
		8' GREY – LIGHT GREY CLAY
	30 / 100	18' MEDIUM GREY SANDY CLAY
		22' WHITE – LT. GREY – GREY CLAY
	40	22' ARKOSIC SANDSTONE DARK GREY
	150	GRANITE END OF HOLE 149'

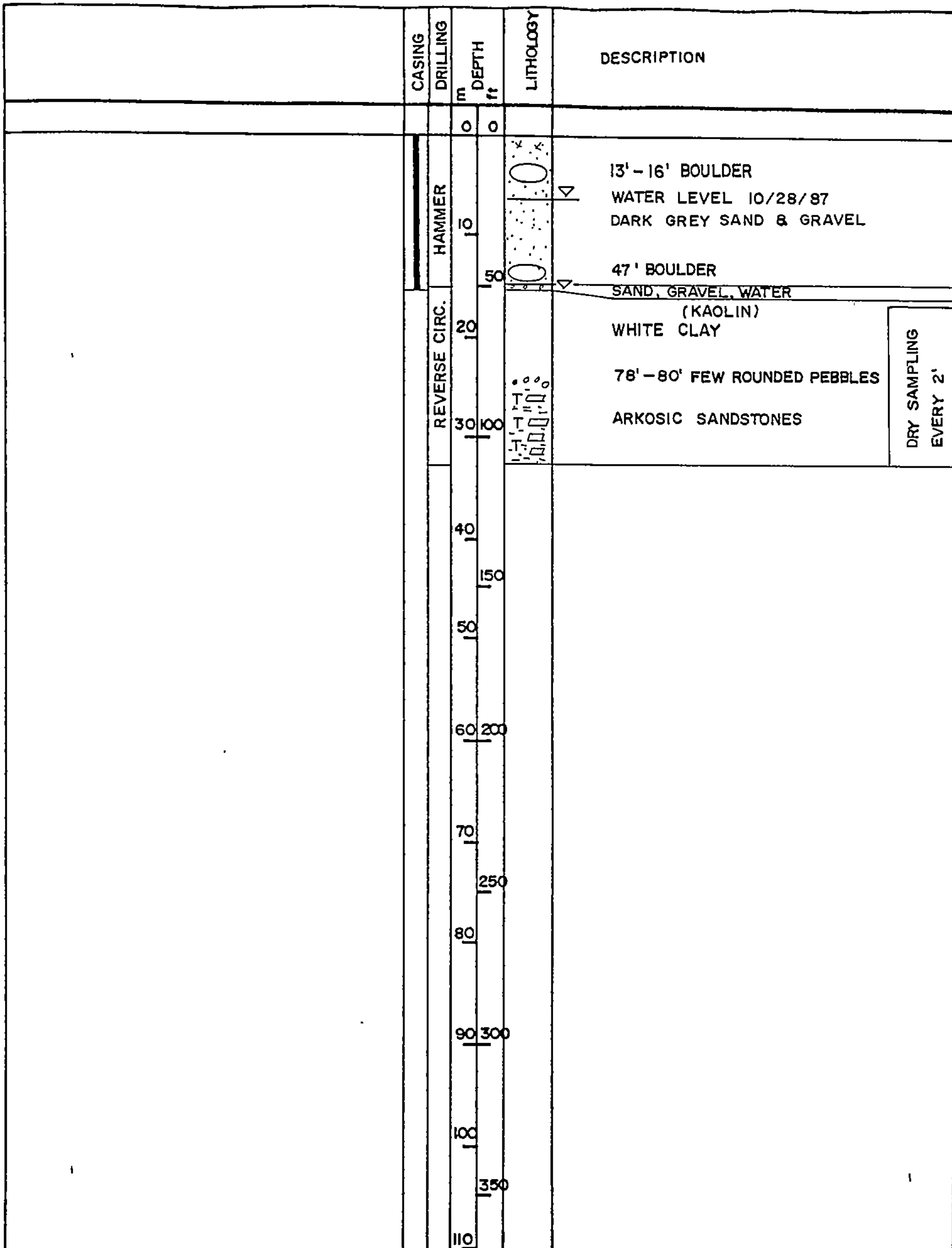
DRY SAMPLING EVERY 2"

Depth scale: m 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110; ft 0, 50, 100, 150, 200, 250, 300, 350

FARGO RESOURCES LTD.	ELEVATION: 123.7	HOLE # 87 - 17
LANG BAY PROJECT	NOVEMBER, 1987	

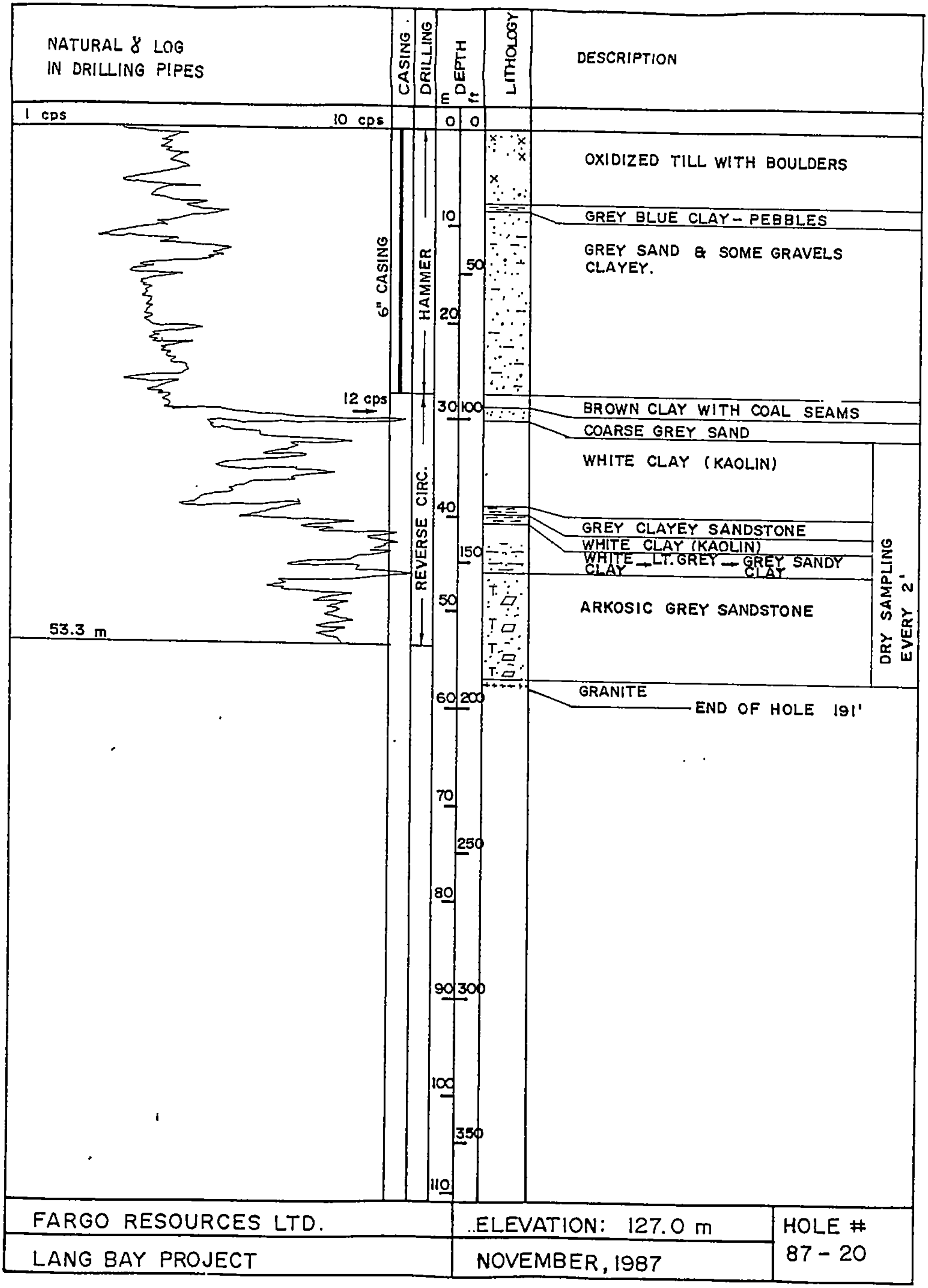


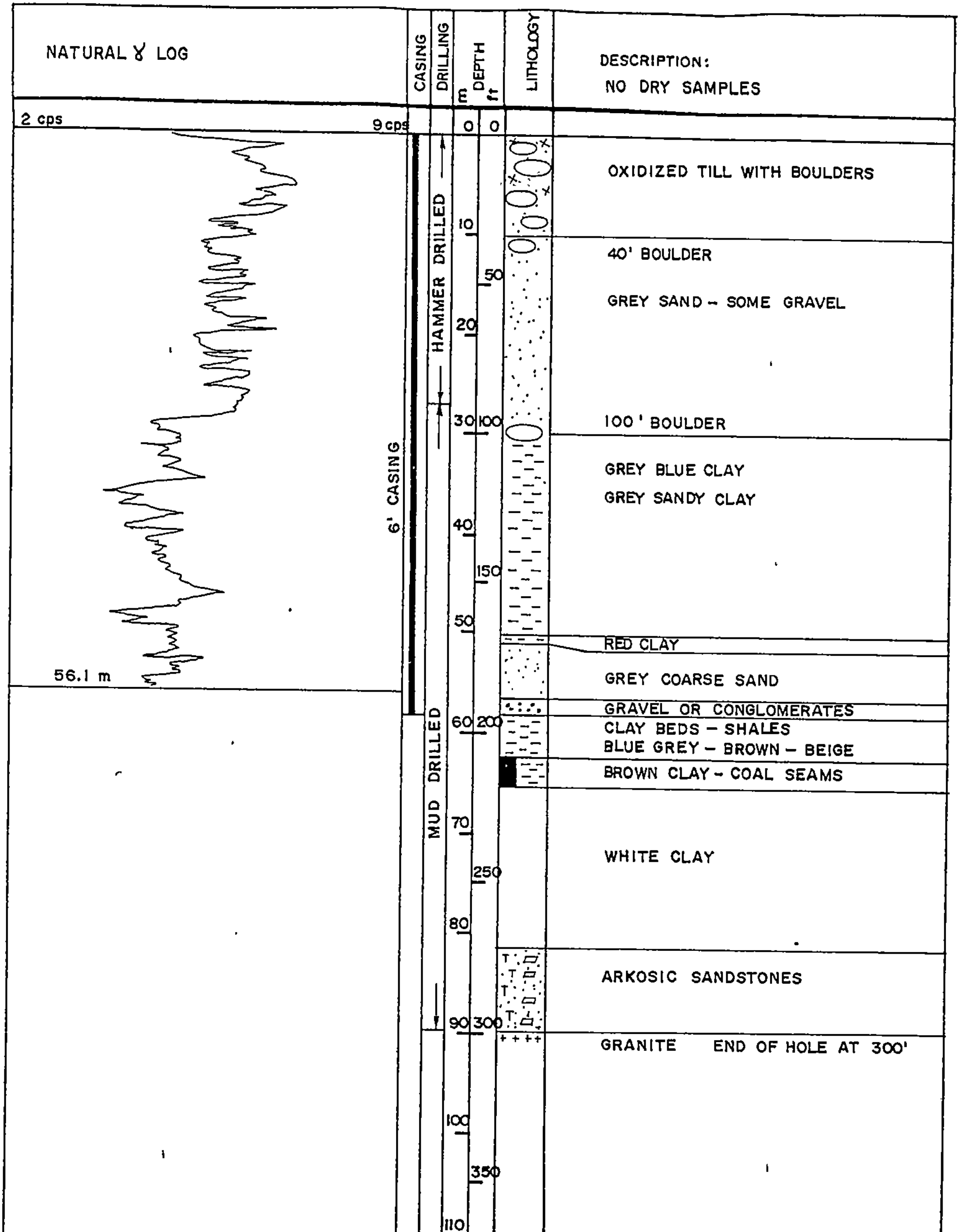
FARGO RESOURCES LTD.	ELEVATION: 119.0 m	HOLE # 87 - 18
LANG BAY PROJECT	NOVEMBER, 1987	



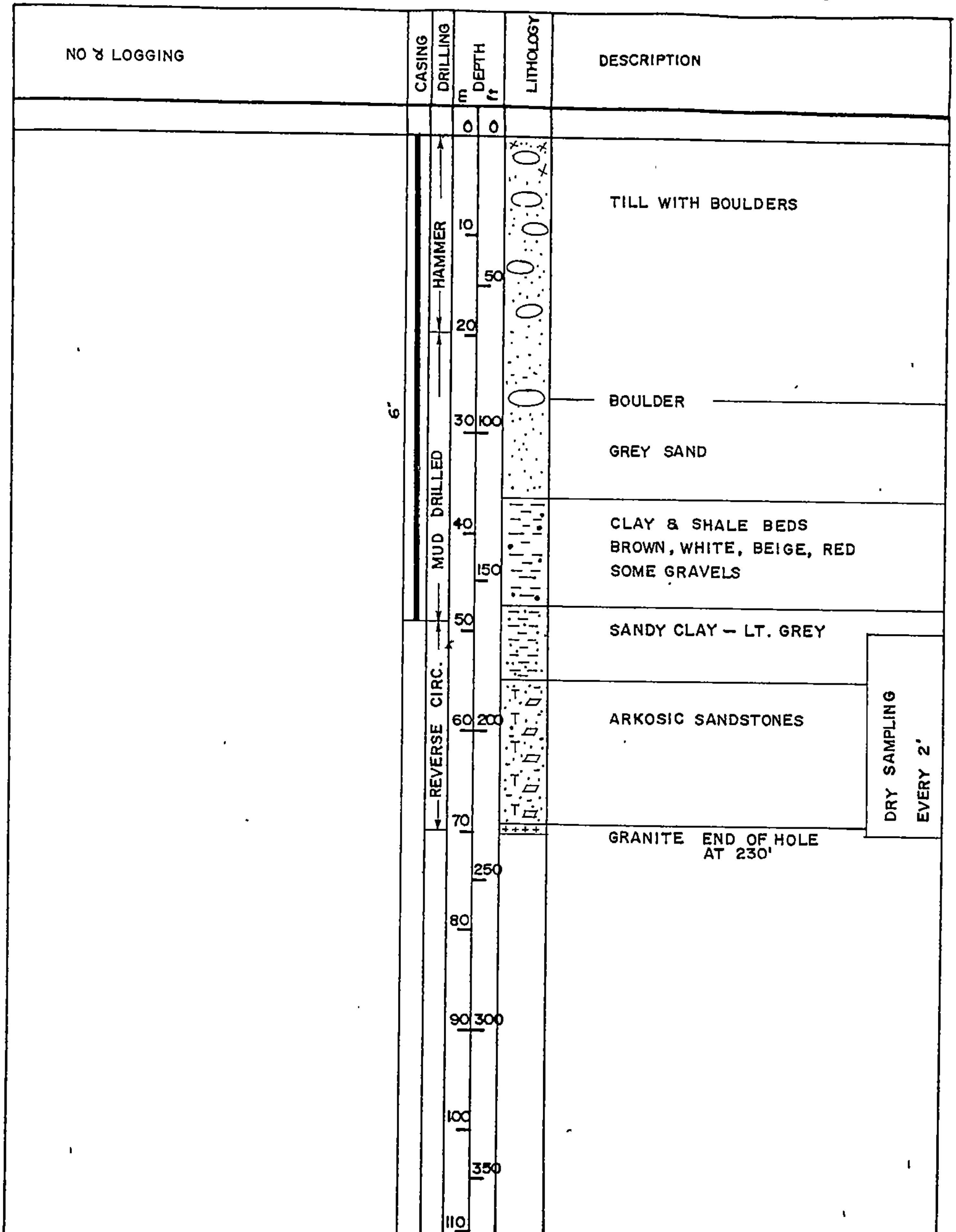
FARGO RESOURCES LTD. | ELEVATION: 119.2 m | HOLE # 87 – 19

LANG BAY PROJECT | NOVEMBER, 1987

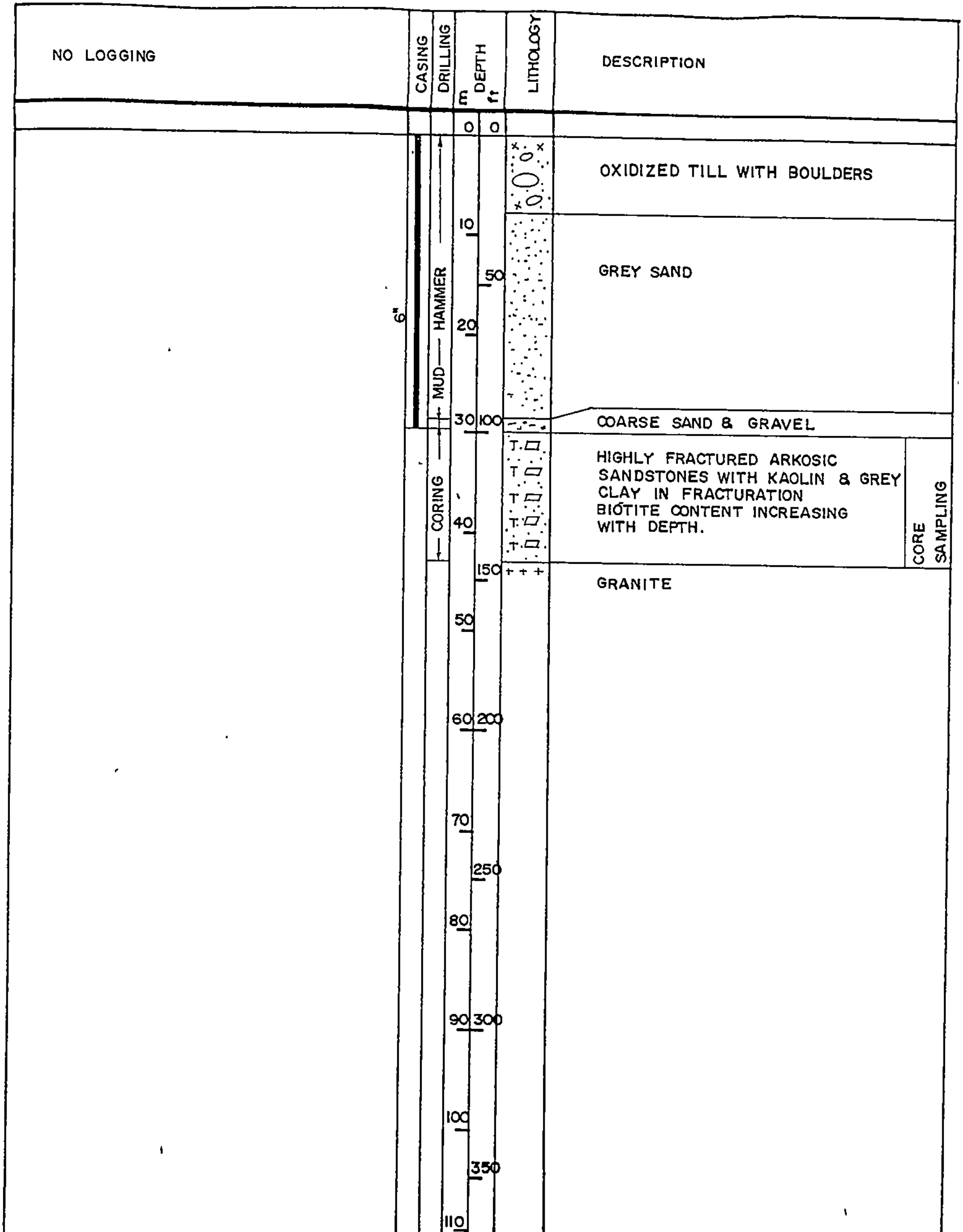

NATURAL γ LOG
IN DRILLING PIPES
CASING
DRILLING
DEPTH
m
ft
LITHOLOGY
DESCRIPTION
1 cps
10 cps
12 cps
53.3 m
6" CASING
HAMMER
REVERSE CIRC.
OXIDIZED TILL WITH BOULDERS
GREY BLUE CLAY – PEBBLES
GREY SAND & SOME GRAVELS CLAYEY.
BROWN CLAY WITH COAL SEAMS
COARSE GREY SAND
WHITE CLAY (KAOLIN)
GREY CLAYEY SANDSTONE
WHITE CLAY (KAOLIN)
WHITE CLAY → LT. GREY → GREY SANDY CLAY
ARKOSIC GREY SANDSTONE
GRANITE
END OF HOLE 191'
DRY SAMPLING EVERY 2'
FARGO RESOURCES LTD.
LANG BAY PROJECT
ELEVATION: 127.0 m
NOVEMBER, 1987
HOLE #
87 - 20



FARGO RESOURCES LTD.	ELEVATION: 141.0	HOLE # 87-21
LANG BAY PROJECT	NOVEMBER, 1987	



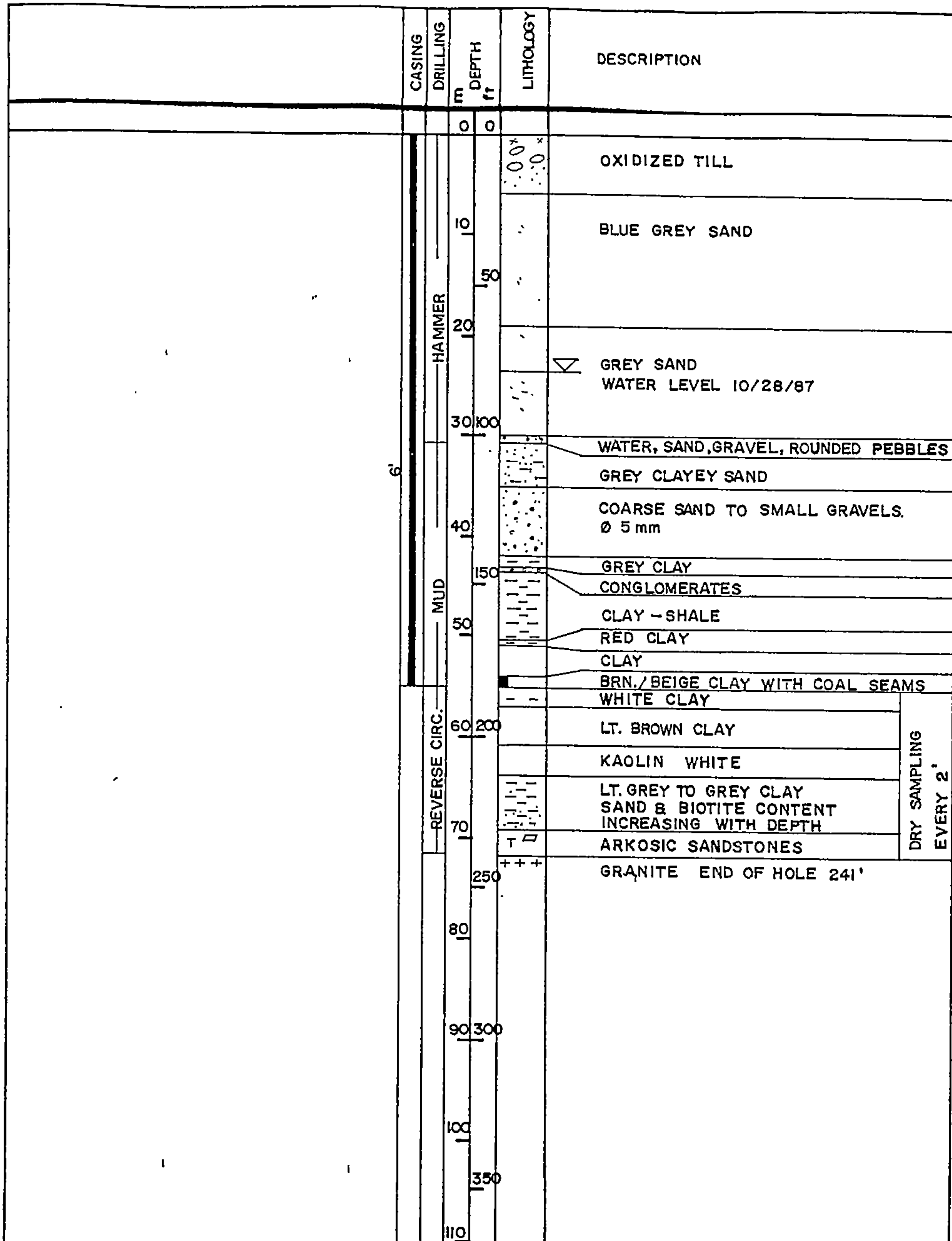
FARGO RESOURCES LTD.	ELEVATION: 135.4 m	HOLE # 87-22
LANG BAY PROJECT	NOVEMBER, 1987	



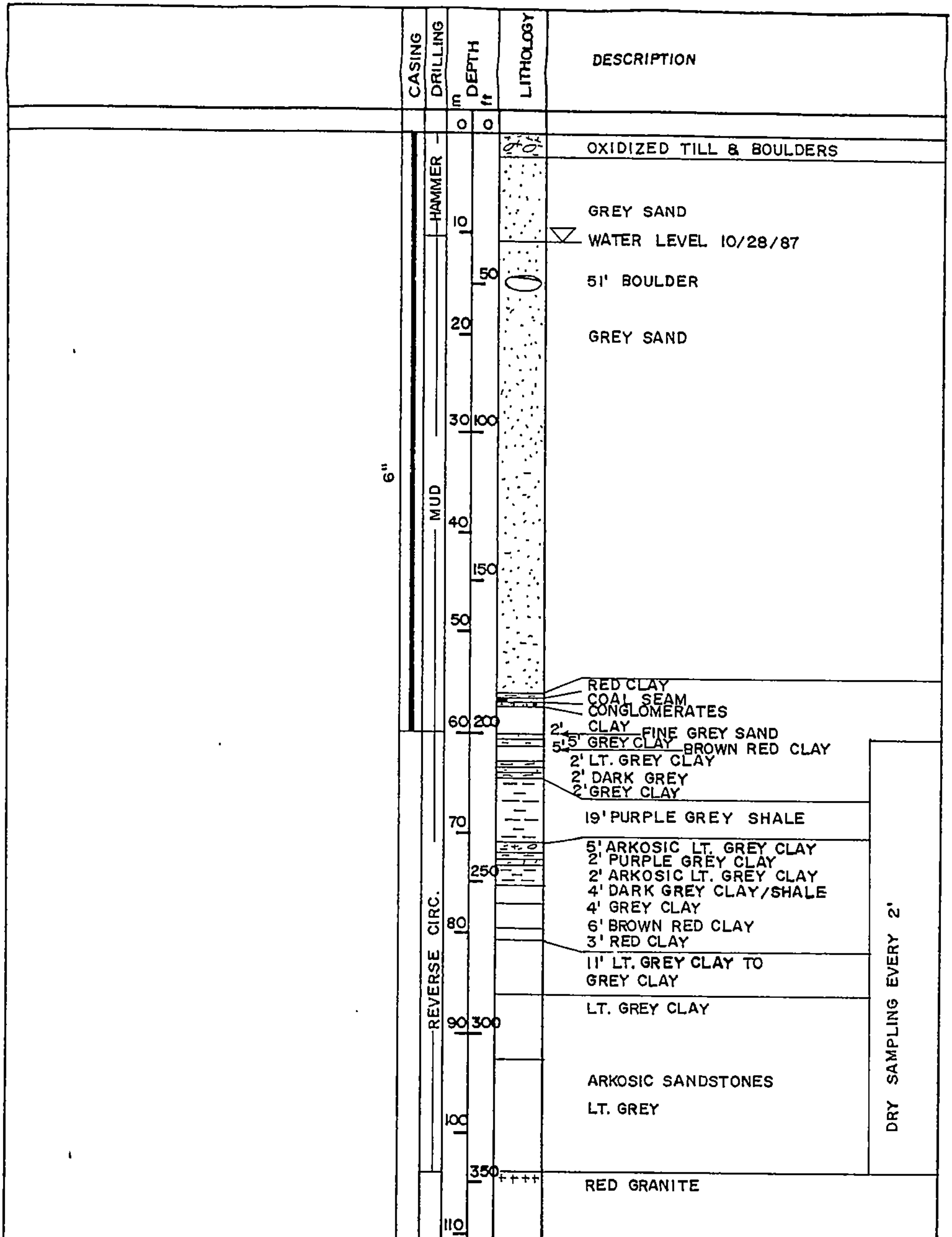
FARGO RESOURCES LTD.	ELEVATION: 128.3 m	HOLE # 87 - 23
LANG BAY PROJECT	NOVEMBER, 1987	

NO LOGGING	CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
	NONE	HAMMER	0	0		OXIDIZED TILL & BOULDERS
		MUD	10	50		GREY SAND SOME PEBBLES
			20, 30	100		99' BOULDER
			40	150		130' BOULDER
			50			
			60	200		CONGLOMERATES BEIGE – LT. BROWN CLAY / SHALE GRAVELS & GREY CLAY
DRY SAMPLING EVERY 2'		REVERSE CIRC				2' THICK BEDS OF CLAY BROWN GREY → LT. BROWN → PURPLE GREY → DARK GREY → BLACK → PURPLE GREY
			70	250		LIGHT GREY ARKOSIC CLAY
						GRANITE END OF HOLE 251'
			80, 90, 100, 110	300, 350		

FARGO RESOURCES LTD.	ELEVATION: 135.3 m	HOLE # 87-24
LANG BAY PROJECT	NOVEMBER, 1987	



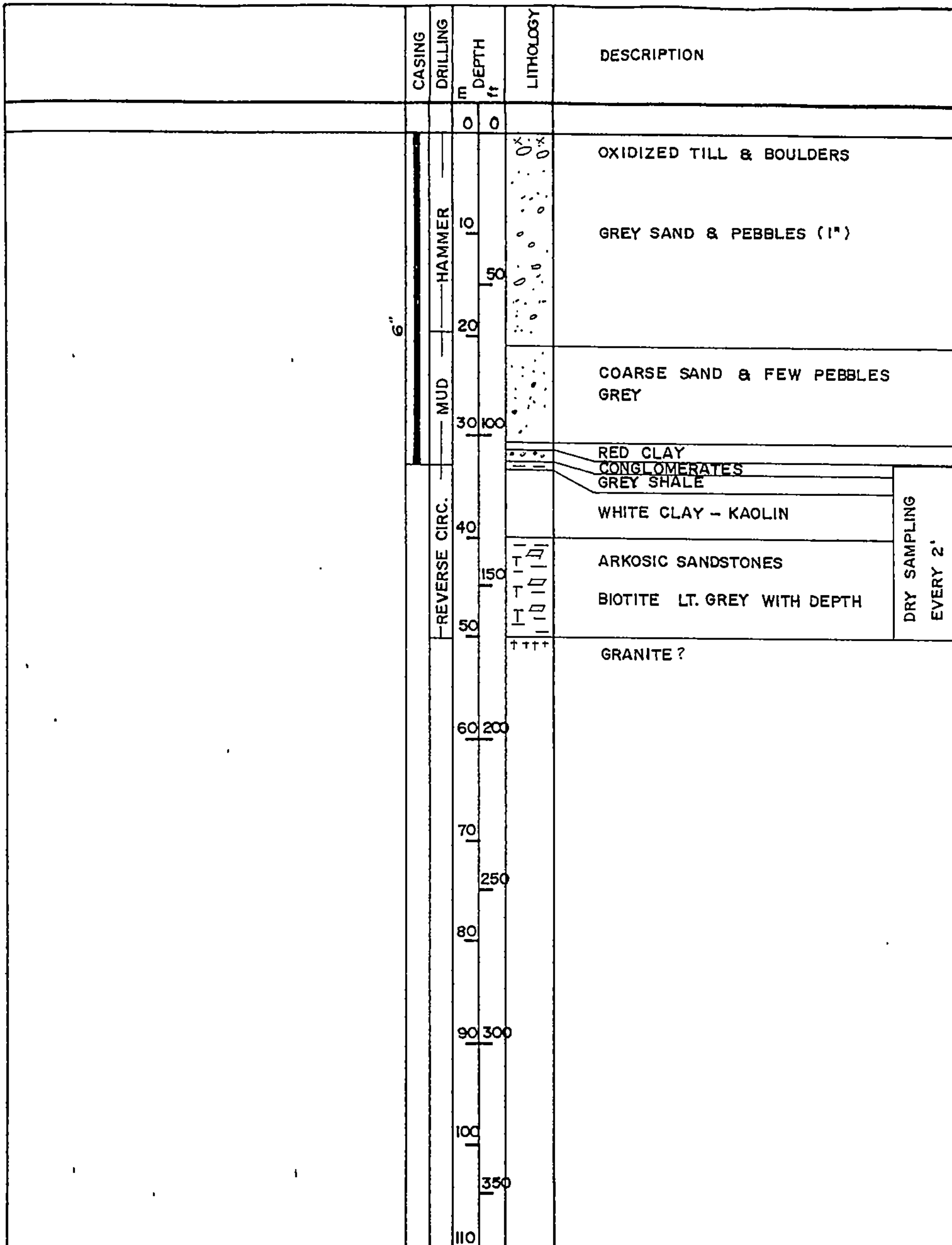
FARGO RESOURCES LTD.	ELEVATION: 136.4 m	HOLE # 87 - 25
LANG BAY PROJECT	NOVEMBER, 1987	



FARGO RESOURCES LTD.	ELEVATION: 144.0 m	HOLE # 87 - 26
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH (m / ft)	LITHOLOGY	DESCRIPTION
NO CASING	HAMMER (0–~28 m)	0 / 0		OXIDIZED TILL & BOULDERS
		10		GREY SAND
		50 ft		
		20		
	MUD (~28–~60 m)	30 / 100 ft		113' BOULDER
				BLUE GREY CLAYEY SAND
		40		SOME GRAVELS
		150 ft		
		50		
	REVERSE CIRC. (~60–~95 m)			CONGLOMERATES
		60 / 200 ft		DARK GREY CLAY & SAND
				CONCLOMERATES
				BROWN CLAY & COAL SEAMS (DRY SAMPLING 2')
				RED CLAY (DRY SAMPLING 2')
				BROWN-BEIGE CLAY/SHALE (DRY SAMPLING 2')
		70		CONGLOMERATES (DRY SAMPLING 2')
				GREY SANDY CLAY
		250 ft		BROWN CLAY WITH COAL SEAMS
				RED BROWN CLAY (DRY SAMPLING EVERY 2')
		80		BEIGE CLAY (DRY SAMPLING EVERY 2')
				LT. GREY CLAY (DRY SAMPLING EVERY 2')
		90 / 300 ft		GREY, SANDSTONE ARKOSIC (DRY SAMPLING EVERY 2')
				RED GRANITE
		100		
		350 ft		
		110		

FARGO RESOURCES LTD.	ELEVATION: 142.4 m	HOLE # 87-27
LANG BAY PROJECT	NOVEMBER, 1987	



FARGO RESOURCES LTD.	ELEVATION: 127.4 m	HOLE # 87 – 28
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
NONE	HAMMER	0	0		
					OXIDIZED BROWN TILL
		10			GREY BLUE CLAYEY SAND, GRAVEL, PEBBLES
			50		GREY BLUE CLAY
					GREY SAND & PEBBLES ▽
		20			CONGLOMERATE BEDS ALTERNATED CLAY BEDS
	REVERSE CIRC.	30	100		33' PURPLE-GREY CLAY – SHALE LT. GREY CLAY BEIGE – BROWN 93' COAL SEAM LT. & DRK. GREY CLAY/BEIGE/BRN.
		40			26' 96 1/2' COAL SEAM 104' COAL SEAM 104-105' RED CLAY 109' COAL SEAM BEIGE CLAY
			150		17' WHITE KAOLIN
		50			ARKOSIC SANDSTONES LT. GREY
					156' END OF HOLE
		60	200		
		70			
			250		
		80			
		90	300		
		100			
			350		
		110			

DRY SAMPLING EVERY 2'

FARGO RESOURCES LTD.	ELEVATION: 125.0	HOLE # 87-29
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
NONE	HAMMER / REVERSE CIRC.	0	0		

DEPTH scale (m): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110

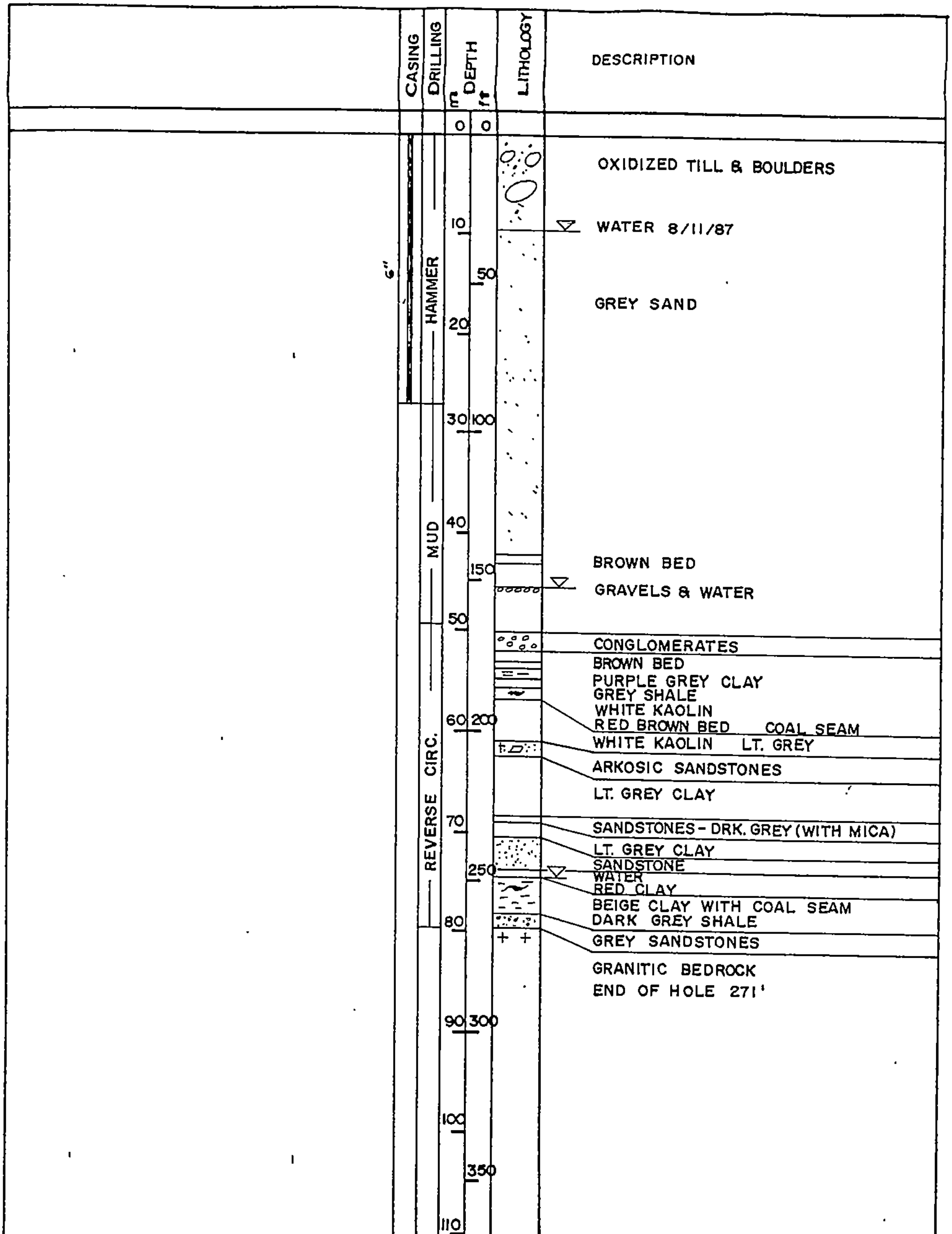
DEPTH scale (ft): 0, 50, 100, 150, 200, 250, 300, 350

DESCRIPTION:

- OXIDIZED TILL & BOULDERS
- BLUE GREY CLAYEY SAND
- WATER
- CONGLOMERATES & BLUE CLAY ALTERNATING
- GRAVELS <1/2" COARSE WASHED SAND
- WATER
- RED BROWN CLAY
- BEIGE SHALE
- GRAVELS – WATER
- DARK GREY SHALE
- 30' LIGHT GREY CLAY
- 23' ARKOSIC SANDSTONES GREY
- GRANITIC · HARD TO DRILL
- END OF HOLE 218'

DRY SAMPLING EVERY 2'

FARGO RESOURCES LTD.	ELEVATION: 132.7 m	HOLE # 87 – 30
LANG BAY PROJECT	NOVEMBER, 1987	



FARGO RESOURCES LTD.	ELEVATION: 144.0 m	HOLE # 87 - 31
LANG BAY PROJECT	NOVEMBER, 1987	

CASING	DRILLING	DEPTH m	DEPTH ft	LITHOLOGY	DESCRIPTION
		0	0		
NONE	HAMMER				BROWN OXIDIZED TILL
		10			BLUE CLAY & GRAVELS
			50		CLAYEY GREY SAND
	REVERSE CIRC.				2' BOULDER
		20			PURPLE GREY CLAYEY SAND
					BROWN TILL
					PURPLE CLAY & PEBBLES
		30	100		GREY CLAYEY SAND
					BLUE CLAY, GRAVELS, WATER
					CONGLOMERATES ½" – ¾"
					GREY SHALE
					SANDSTONES
					GRANITIC ROCK
		40			END OF HOLE AT 118'
			150		
		50			
		60	200		
		70			
			250		
		80			
		90	300		
		100			
			350		
		110			

FARGO RESOURCES LTD.	ELEVATION: 140.0 m	HOLE # 87 – 32
LANG BAY PROJECT	NOVEMBER, 1987	

ARIS SUMMARY SHEET

District Geologist, Victoria

Off Confidential: 89.04.28

ASSESSMENT REPORT 17616 MINING DIVISION: Vancouver

PROPERTY: Kelly
LOCATION: LAT 49 48 00 LONG 124 25 00
UTM 10 5517137 398049
NTS 092F16W
CLAIM(S): Kelly 2,4
OPERATOR(S): Brenda Mines
AUTHOR(S): Currie, J.
REPORT YEAR: 1988, 228 Pages
COMMODITIES
SEARCHED FOR: Kaolinite
GEOLOGICAL
SUMMARY: The geological sequence consists of basement granitoid rocks of the Coast Plutonic Complex of Jurassic-Cretaceous age which are unconformably overlain by the Brown Beds formation a cyclothemic sequence of carbonaceous clays, indurated mudstones, siltstones, shales, conglomerates and minor lignitic coal lenses. It is suggested that these sediments are Late Cretaceous in age. They are confined to a sedimentary basin approximately five kilometres across whose depth has not been determined. The property is known to contain reserves of kaolin and values of gallim and germanium associated with the lignite.

WORK
DONE: Drilling,Geophysical,Physical
MAGG 10.5 km
PERD 2100.0 m 27 hole(s);76mm
RADP 445.0 m
REST 11.0 km
ROAD 1.0 km
SEIS 6.7 km
TOPO 200.0 ha

RELATED
REPORTS: 10384,11263,14303,14872,15836,16734
MINFILE: 092F 137

ASSESSMENT WORK REPORT
ON THE
KELLY 1 – 5 AND TRISH 1 – 2
MINERAL CLAIMS

Located on Lang Creek, in the
Vancouver Mining Division
NTS 92F/16W
British Columbia
at
49° 48' N. Latitude
124° 25' W. Longitude

Owned by
Fargo Resources Limited

Operated by
Fargo Resources Limited

James A. Currie, P.Eng.

July 1988

FARGO RESOURCES LIMITED

Assessment Work Report
Lang Bay Property, B.C.

I N D E X

ILLUSTRATIONS

APPENDICES

GEOLOGICAL BRANCH
ASSESSMENT REPORT

17,616