85-353-13748

GEOLOGICAL AND GEOPHYSICAL REPORT

on the

Al 1 - Al 12 Claims

FORT STEELE MINING DIVISION,

BRITISH COLUMBIA

NTS 82G/12W

$49^{o}37'$ N Latitude, $115^{o}50'$ West Longitude

OWNER AND OPERATOR OF ALL CLAIMS

Amoco Canada Petroleum Co.
Suite 300 - 89 Queensway West
Mississauga, Ontario
L5B 2V2

CONSULTANTS

Allan Spector and Associates Ltd., Toronto
Commonwealth Geophysical Development Co. Ltd., Calgary

Report Prepared By:
B.H. Kahlert, P. Eng.
May 1985

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INTRODUCTION

The Al 1 - Al 12 claims were staked in late 1984 by the Mining Division of Amoco Canada Petroleum Company. The 12 claims are comprised of a total of 185 units.

The property is located approximately 10 kilometers north of the town of Cranbrook in the Fort Steele Mining Division. It is situated immediately to the west and south of the Kootenay Indian Reserve #1.

Geologically, the property is interpreted to be underlain by easterly dipping, Lower Purcell series sediments, which, in the Wycliffe area, are overlain by Lower Cambrian Eager Formation in a downfaulted Block. Small, Cretaceous granodiorite stocks have intruded the above sequences.

As most of the property is overlain by sand, gravel and glacial tills, much of this geological setting is interpretive.

Geophysically, a large, medium intensity magnetic anomaly underlies much of the property. It is this magnetic anomaly which created interest in the Al property.

Amoco completed line cutting, detailed magnetic surveys and an extensive gravity survey on the claims in late 1984.

LOCATION AND ACCESS

The project area is located halfway between the towns of Cranbrook and Kimberley in the East Kootenay district of southeastern British Columbia. The district is serviced by transcontinental highways and railway as well as an airport with several daily services. Although the district is mountainous, the project area is in a wide, flat valley.

HISTORY

The Al Claims are located less than 20 kilometres southeast of the giant Sullivan lead-zinc-silver deposit at Kimberley, B.C. This deposit is hosted by the Aldridge Formation, which also underlies much of the project area.

Even though the project area is located near the Sullivan mine, it has received little direct attention from exploration companies due mainly to extensive over-burden coverage over the flat terrain.

The nearest drilling was carried out some 6 - 8 kilometres northeast of the target area by Chevron. Over a period of 3 years, from 1975 - 1977, they drilled a 580 metre deep stratigraphic hole. About three quarters of the hole cut Aldridge Formation sediments, the remainder being a 150 metre thick diorite sill (?) situated between 200 and 350 metres. Minor base metal and iron sulphides were noted throughout the entire hole; a 25-metre wide interval of the diorite ran 0.03 percent copper.

In 1968, Imperial Oil from Calgary carried out a magneto-meter and gravity survey to the north and west and partly overlapping Amoco's target area. The gravity gradient increases westward, however a 1 miligal high is indicated in the southeast corner of the survey, over part of Amoco's target area. The magnetic contour map shows a portion of the magnetic high being investigated by Amoco, however reported extreme diurnal variation during the survey prevented compilation of interpretable results.

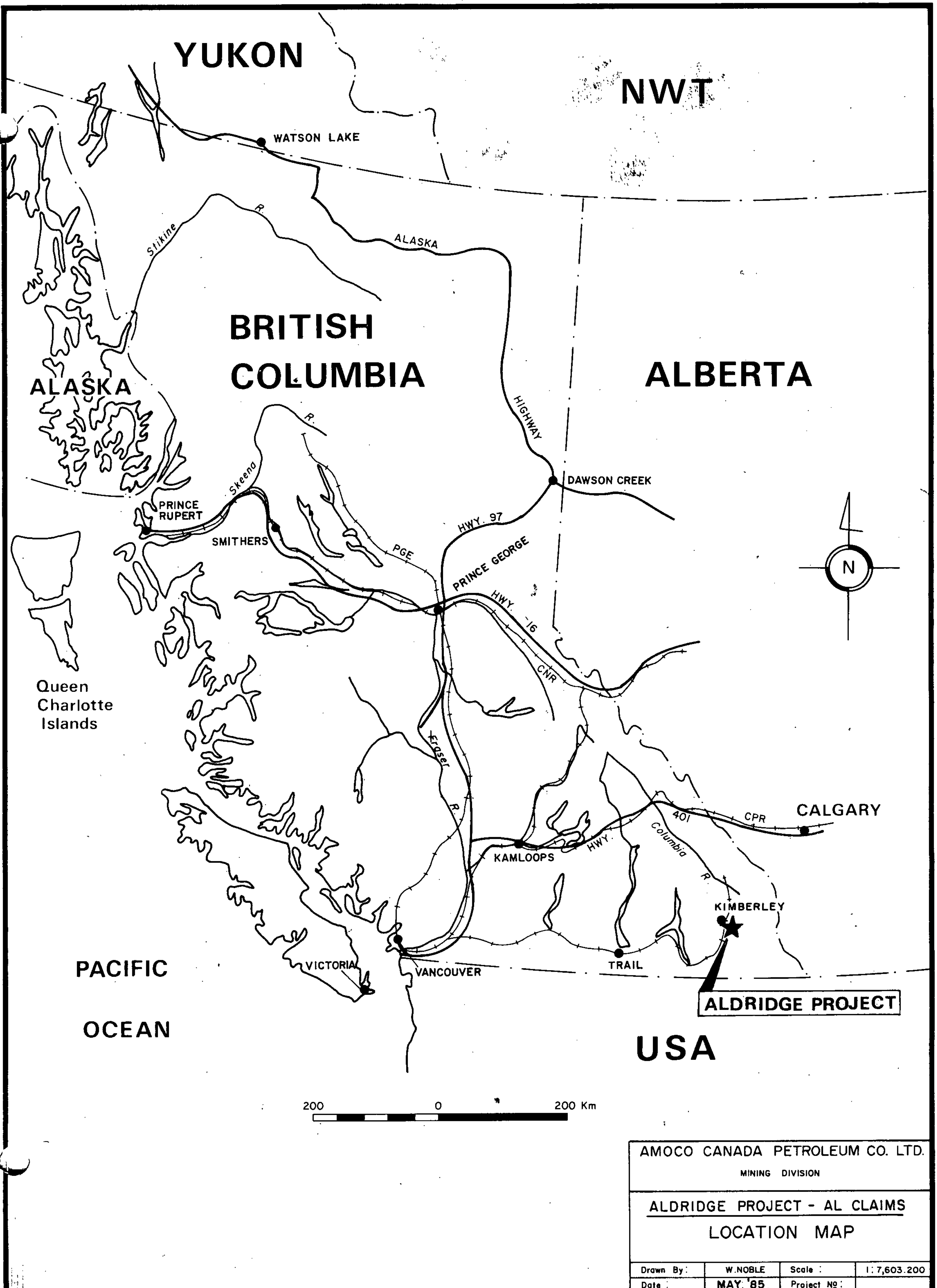

YUKON
NWT
WATSON LAKE
ALASKA
Stikine
R.
BRITISH
COLUMBIA
ALBERTA
ALASKA
HIGHWAY
DAWSON CREEK
PRINCE
RUPERT
Skeena
SMITHERS
PGE
HWY. 97
PRINCE GEORGE
HWY. 16
CNR
Queen
Charlotte
Islands
Fraser
R.
CALGARY
CPR
401
Columbia
R.
HWY.
KAMLOOPS
KIMBERLEY
TRAIL
VICTORIA
VANCOUVER
PACIFIC
OCEAN
ALDRIDGE PROJECT
USA
N
200
0
200 Km
AMOCO CANADA PETROLEUM CO. LTD.
MINING DIVISION
ALDRIDGE PROJECT - AL CLAIMS
LOCATION MAP
Drawn By: W.NOBLE
Scale: 1:7,603,200
Date: MAY '85
Project No:

FIGURE I

CLAIMS

TABLE I

AL NORTH CLAIM GROUP

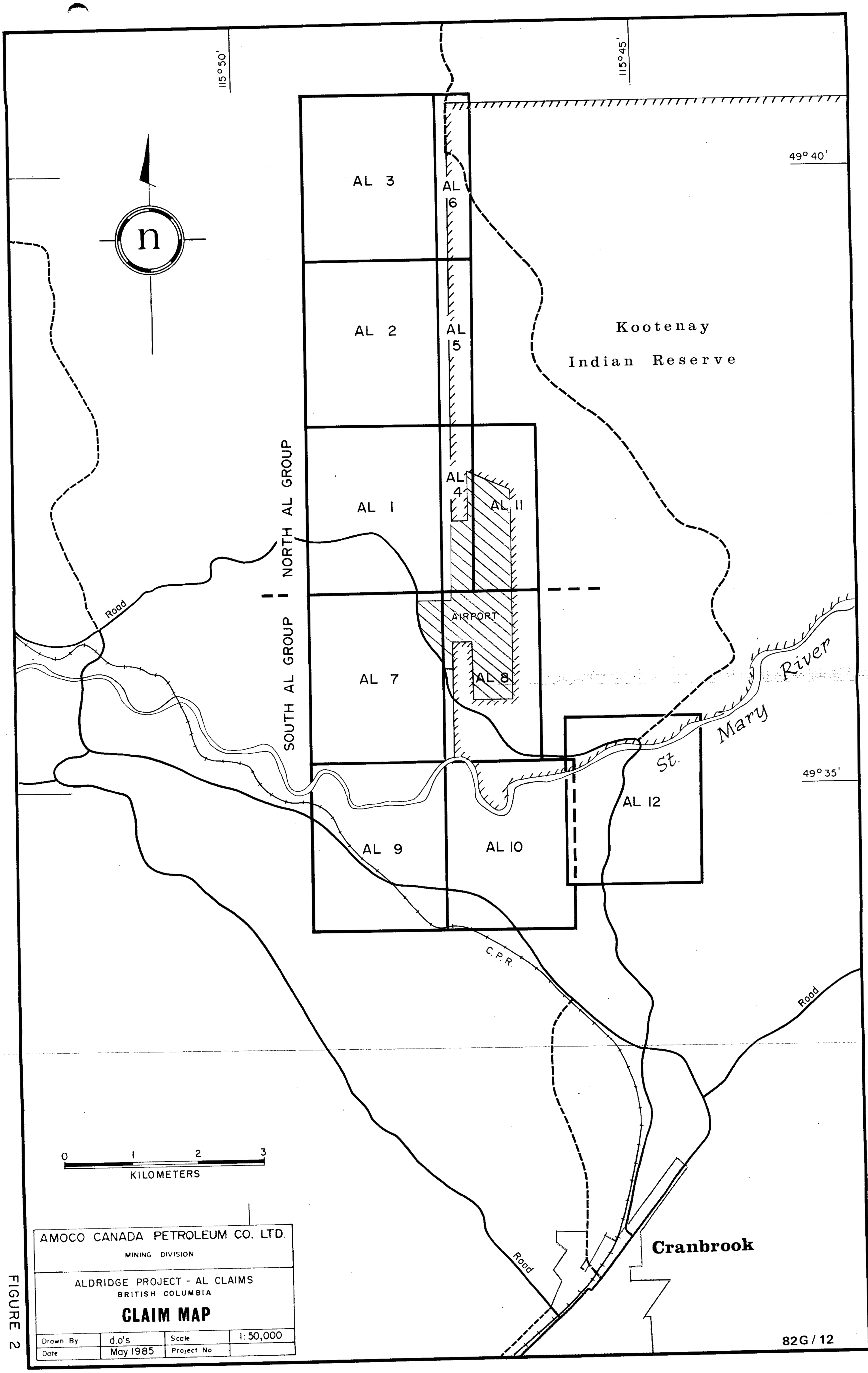
Claim Name	Units	Tag No.	Date Staked	Anniversary Date	Record No.
Al 1	20	83187	Oct. 4/84	Oct. 30/84	2315
Al 2	20	83188	Oct. 5/84	Oct. 30/84	2316
Al 3	20	83189	Oct. 6/84	Oct. 30/84	2317
Al 4	5	77730	Oct. 4/84	Oct. 30/84	2358
Al 5	5	83173	Oct. 5/84	Oct. 30/84	2319
Al 6	5	83174	Oct. 6/84	Oct. 30/84	2320
Al 11	15	90705	Nov. 13/84	Dec. 10/84	2332

Total Units = 90

TABLE II

AL SOUTH CLAIM GROUP

Claim Name	Units	Tag No.	Date Staked	Anniversary Date	Record No.
Al 7	20	90707	Nov. 11/84	Dec. 12/84	2328
Al 8	15	90708	Nov. 11/84	Dec. 12/84	2329
Al 9	20	90709	Nov. 11/84	Dec. 12/84	2330
Al 10	20	90710	Nov. 11/84	Dec. 12/84	2331
Al 12	20	90706	Nov. 14/84	Dec. 12/84	2333



AMOCO CANADA PETROLEUM CO. LTD.			
MINING DIVISION			
ALDRIDGE PROJECT - AL CLAIMS			
BRITISH COLUMBIA			
CLAIM MAP			
Drawn By	d.o's	Scale	1:50,000
Date	May 1985	Project No	

FIGURE 2

GEOLOGY

Regional Geology

The Al claim group is located at the south-eastern boundary of the Omineca crystalline belt of the Canadian Cordillera. It is located in the valley of the Kootenay River, which, in this area represents the centre of the continental Rocky Mountain trench. To the east is the Rocky Mountain belt which, though deformed and faulted, is not strongly metamorphosed.

Rock units to the west of the trench are mostly of mid-Proterozoic age which are moderately to strongly metamorphosed. They have been unconformably covered only by minor Paleozoic sequences and cut by occasional Tertiary intrusives, while, to the east of the trench, a complete Paleozoic suite can be measured.

The mid-Proterozoic suite, called the Purcell Group, has been divided into six sedimentary formations, each of which is comprised of a number of identifiable sedimentary units. In Kimberley district, the Purcell Group is close to 10 kilometres thick, indicating a deep trench setting.

Main rock units of all formations are fine-grained argillites and quartzites, with interbedded dolomites and calcareous units. Higher up in the sequence, sandstones become more common. Occasional volcanic flows and tuffaceous units are interbedded with the sediments.

The latest Purcell unit is the Moyie igneous series, which consists of intrusive diorite and quartz diorite, mostly emplaced as wide dykes and thick sills. Associated extrusives consist of andesitic lava.

The youngest rocks in the district are a series of small stocks of granodiorite and quartz monzonite of Cretaceous-Tertiary age. These intrude rocks of all ages and can be seen to outcrop in the project area.

Geology of the Project Area

As the project area is located in the middle of the wide, flat Kootenay River Valley, outcrop is very sparse. Gravels and claypans underlie the soil covered plain for up to 30 metres or more.

Geologic projections can be made,however. The favourable Aldridge formation, which hosts the Sullivan orebody, outcrops on the western fringes of the property. As this unit dips 25 - 30 degrees to the east, it should be the main rock unit under the unconsolidated material. Some minor Cambrian Sediments of the Eager Formation may overlie the Aldridge formation.

The only outcrop known from the centre of the magnetic anomaly is of the young granodiorite intrusive. It is a coarse-grained equigranular intrusive containing 5 - 10 percent amphibole laths. This intrusive is known to occur as small stocks 200 to 1,000 metres in diameter.

GEOPHYSICAL WORK

In late 1984, Amoco contracted Wild Rose Exploration Services, of Calgary, Alberta, to carry out ground magnetic and gravity surveys over the Al Group of claims. In order to allow proper reduction of the gravity data, detailed level surveys on each of the lines were also completed. This work was carried out by a sub-contractor to Wild Rose Exploration Services.

Line-cutting and marking was completed by AMEX Exploration Services of Kamloops, B.C.

Lines were cut at spacings ranging from 250 metres, 500 metres and 1,000 metres, depending on the detail required. Stations were marked at 50 meter intervals.

Details of Magnetic and Gravity Surveys

For the ground magnetic survey a GEM Systems Inc. Model GSM-8 magnetometer was used for field readings which were taken every 50 metres along lines surveyed. For the Base Station, a Canadian Mining Geophysics Model MR 10 Base Station Recorder with GEM Systems Inc. GS-8 magnetometer was used to record diurnal variation.

Recording of all magnetic units is in gammas. The taped results from the Base Station Recorder was used to add or subtract diurnal variation from the field readings. These final data were plotted on 1:10000 scale maps (figures 3 and 4) and contoured at 100 gamma intervals.

For the Gravity Survey, a Lacoste Romberg Model G Gravimeter was utilized. Readings were taken every 100 metres along lines surveyed. For diurnal variation, a base station was re-occupied every 3 hours and the variation noted and used to correct the daily diurnal. Units used for all recorded and presented values are miligals.

The surface density used to produce a Bouger Map was 28 grams per cm^3. The datum for the density correction is sea level.

Bouger values are plotted on Figures 5 and 6, resulting data was contoured on 0.5 miligal intervals.

Interpretation

A. Magnetic Anomalies

Due to the complex nature of the ground magnetic survey results, interpretation was requested from two consultants.

The interpretation by Alan Spector and Associates Ltd. of Toronto, Ontario is attached as two parts in Appendix I. Spector's interpretation is broken into a Preliminary and Final Report as the survey was completed in two stages. His final report encompasses the results of both stages of the survey.

Sudhir Jain, of Commonwealth Geophysical Development Co. Ltd., of Calgary, Alberta, reviewed the magnetic data and compiled depth interpretation from four magnetic profiles. This interpretation, with map, is attached as Appendix II.

Both geophysical consultants have determined bimodal sources of the main magnetic features. One of these is shallow, at 100 to 150 meters depth, while a second, larger source is over 400 meters deep.

The interpretation by Spector is of more value as it is comprehensive and includes results of the entire survey while Jain examined only four lines. Additionally, Spector includes interpretation of gravity features in assessing prospective target zones.

B. Gravity Anomalies

Interpretation of the gravity survey, also carried out in two stages, is provided in Preliminary and Final Reports by Alan Spector and Associates of Toronto in Appendix I.

Spector and Associates indicate that several gravity anomalies and combined gravity-magnetic anomalies should be examined further by trenching and/or diamond drilling.

These targets are valid exploration bets, however, some further detailed gravity and magnetic surveys should be completed in strategic areas. Also, evaluation of the geological sequences underlying the area of interest should be carried out.

Recommendations

1. Detailed geological field mapping should be carried out over the claims to assist in interpretation of the magnetic and gravity results.

2. Once density and magnetic susceptibility measurements are taken on a number of rock specimen from the area, a modelled interpretation of the geological units underlying the property should be made. Depth of overburden should also be considered in this interpretation.

3. Anomalous features which cannot be modelled by the above work should be isolated and detailed geophysical surveys should be completed on them to outline all pertinent features.

4. A diamond drilling program should be undertaken to test all these anomalies.

PROFESSIONAL
PROVINCE
OF
B. H. KAHLERT
BRITISH
COLUMBIA
ENGINEER

BHKahlert

EVALUATION OF WORK

Work Conducted

1) Line-cutting
2) Topographic Survey
3) Magnetic Survey
4) Gravity Survey
5) Magnetic-Gravity Interpretation - Allan Spector
6) Magnetic Interpretation - Commonwealth Geophysical
7) Staff - B.H. Kahlert - Field Work
   - B.H. Kahlert - Prepare Assessment Report
8) Contract Draftsman - Des O'Shannessy

(1) Line Cutting and Grid Preparation

AMEX Exploration Services

October 1984		
20 km. @ 118.06/km.	$ 2,361.20	
December 1984		
17 km. @ 142.48/km.	2,422.16	
Total		$ 4,783.36

(2,3,4) Topographic, Magnetic and Gravity Survey

All work completed under Contract by Wild Rose Exploration Services of Calgary, Alberta. Work was carried out in two stages: Oct. 17 - Nov. 1/84 and Nov. 12 - Nov. 24/84.

All of this contractor's work is directly related to the survey on the Al Claims. Therefore, invoices showing their breakdown of costs are attached as Tables 3 and 4 (over).

Invoice #43, Nov. 12/84	$14,788.75	
Invoice #53, Dec. 10/84	15,198.00	
Total Survey Costs =		29,986.75

(5) Magnetic-Gravity Interpretation - Allan Spector, Ph.D., P. Eng., (Ont.)

Nov. 14/84	730 Magnetic Data Prints @ $0.50	$ 365.00	
	730 Gravity Data @ $1.00	730.00	
		$ 1,095.00	
Jan. 23/85	650 Magnetic Data @$0.50	325.00	
	650 Gravity Data @ $1.00	650.00	
		$ 975.00	
Total A. Spector & Assoc. =			2,070.00

(6) Magnetic Interpretation

Commonwealth Geophysical Development Co.

Nov. 26/84

4 Profiles, Magdep Interpretation 1,000.00

TABLE III

Wild Rose Exploration Services

a division of (WILD ROSE MANAGEMENT LTD.)

565, 800 - 6th Avenue S.W.
Calgary, Alberta CANADA T2P 3G3

PHONE: (403) 263-7268

INVOICE: JOINT VENTURE #43
INVOICE DATE: November 12, 1984

IN ACCOUNT WITH:
Amoco Canada Petroleum Company Ltd.
Mining Division
Suite 200, 89 Queensway West
Mississauga, Ontario L5B 2V2

Attention: Mr. B.H. Kahlert

Travel October 17th	=	$ 750.00
Work for 11 days October 18 - 28 2 men @ $900.00/day	=	9,900.00
Third man October 21 - 31 11 days @ $200.00/day	=	2,200.00
Travel November 1	=	750.00
Originate Mylar Base Map and check survey by computer	=	599.25
Drafting of maps	=	482.50
10% of third party	=	107.00
Total		$14,788.75

40 kilometers (719 stations)

Canada Petroleum Company Ltd.

TABLE IV

Wild Rose Exploration Services

a division of (WILD ROSE MANAGEMENT LTD.)

565, 800 - 6th Avenue S.W.
Calgary, Alberta CANADA T2P 3G3

PHONE: (403) 263-7268

INVOICE: #53
INVOICE DATE: December 10, 1984

IN ACCOUNT WITH: Amoco Canada Petroleum Company Ltd.
Mining Division
Suite 300, 89 Queensway West
Mississauga, Ontario
L5B 2V2

Attention: Mr. B.H. Kahlert

Re: Cranbrook, B.C.

Travel November 12 @ $750.	=	$ 750.00
Work with 3 men 10 days @ $1,100/day	=	11,000.00
Work with 2 men 1 day @ 900/day	=	900.00
Travel November 24	=	700.00
Drafting of map additions and reproduction	=	845.00
Computing of survey and computer plot	=	603.00
Additional integration charge for two programs	=	400.00
		$15,198.00

(7) Drafting Services

Thomas Exploration Surveys

Dec. 10/84			
80.15 km. @ $3.25/km.		$ 260.49	
Jan. 3/85	Wild Rose Expl.Srvcs.	350.00	
May 1985	Prepare Maps, Prints, Reduce ...Des O'Shannessy	2,000.00	
	Total Drafting		2,610.49

(8) Salary: B.H. Kahlert

1 Month @ $5,000/Mo.	5,000.00
Total Costs of Project Work	$45,450.60
Available from PAC Account Amoco Canada 30% x 45,450	13,635.18
Grand Total of Assessment Fees Attributable to Al Claims	$59,085.78

APPORTIONMENT OF EXPENSES

From the evaluation of work plus 30 percent available from the PAC of Amoco Canada, a total of $59,005.78 may be claimed for assessment credit towards the "Al" claims in the Cranbrook area of the Ft. Steele Mining district.

For the purpose of filing assessment work, the Al claims have been divided into two groups, i.e., the Al North Group and the Al South Group. The Al North Group comprises the Al 1-6 claims and the Al 11 claim and totals 90 units.

The Al South Group comprises the Al 7 - Al 10 claims and the Al 12 claim totalling 95 units.

As all the work covered by this assessment report covers geophysical field work and associated costs such as line cutting, topographic surveys, interpretation and drafting of data, costs can be apportioned on a cost per kilometer of line surveyed.

In the survey, a total of 76.5 kilometres of line were surveyed. Of this, 38 kilometres were surveyed in the Al North Group and 38.5 kilometres were surveyed in the Al South Group (See Table V).

For Assessment work purposes, there is $\frac{38}{76.5}$ x 59,085 = $28,951 available for recording on the Al North Group; there is $\frac{38}{76.5}$ x 59,085 = $30,000 available for recording on the Al South claims.

The Al North Group contains 90 units, therefore $321.11 is available to record per unit.

The Al South Group contains 95 units, therefore $315.78 is available to record per unit.

Amoco hereby requests that 3 years assessment be recorded on each of the Al North Group and Al South Group of claims. The two claim groups total 185 units; at $300 per unit, assessment work to be recorded totals $55,500.

Tables VI and VII indicate each of the claims that have been assigned to the two groups.

TABLE V

DETAILS OF GEOPHYSICAL SURVEY LINES

Al North Group

Line No.	Length		
25S	2,000		
8+50S	1,050		
15+00S	850		
10+00S	2,400		
5 +00S	3,200		
2 +50S	2,200		
0 +00	3,200		
2 +50N	2,200		
5N	2,200		
10N	4,200		
20N	2,200		
1+50E -South	2,500		
1+50E -North	8,700		
10+50E -N. of Gp.	1,500		
	38,400	=	38 km.

Al South Group

10 +50E	1,600		
6 +00W	3,450		
39 +00S	600		
L1	6,300		
L2	6,700		
L3	2,500		
L4	3,700		
L5	1,300		
L6	4,600		
L7	1,500		
L8	3,600		
L9	2,700		
	38,550	=	38.5 km.

TABLE VI

AL NORTH CLAIM GROUP

Name of Claim	No. of Units	Record No.	Date Staked	Anniversary Date
Al 1	20	2315	Oct. 4/84	Oct. 30/84
Al 2	20	2316	Oct. 5/84	Oct. 30/84
Al 3	20	2317	Oct. 6/84	Oct. 30/84
Al 4	5	2358	Oct. 4/84	Oct. 30/84
Al 5	5	2319	Oct. 5/84	Oct. 30/84
Al 6	5	2320	Oct. 6/84	Oct. 30/84
Al 11	15	2332	Nov. 13/84	Dec. 10/84

TABLE VII

AL SOUTH CLAIM GROUP

Name of Claim	No. of Units	Record No.	Date Staked	Anniversary Date
Al 7	20	2328	Nov. 11/84	Dec. 12/84
Al 8	15	2329	Nov. 11/84	Dec. 12/84
Al 9	20	2330	Nov. 11/84	Dec. 12/84
Al 10	20	2331	Nov. 11/84	Dec. 12/84
Al 12	20	2333	Nov. 14/84	Dec. 12/84

APPENDICES

J328

REPORT ON PRELIMINARY
GRAVITY/MAGNETIC INTERPRETATION
CRANBROOK AREA, B. C.

For

AMOCO CANADA PETROLEUM COMPANY LIMITED

By

ALLAN SPECTOR AND ASSOCIATES LIMITED
TORONTO CANADA

November, 1984

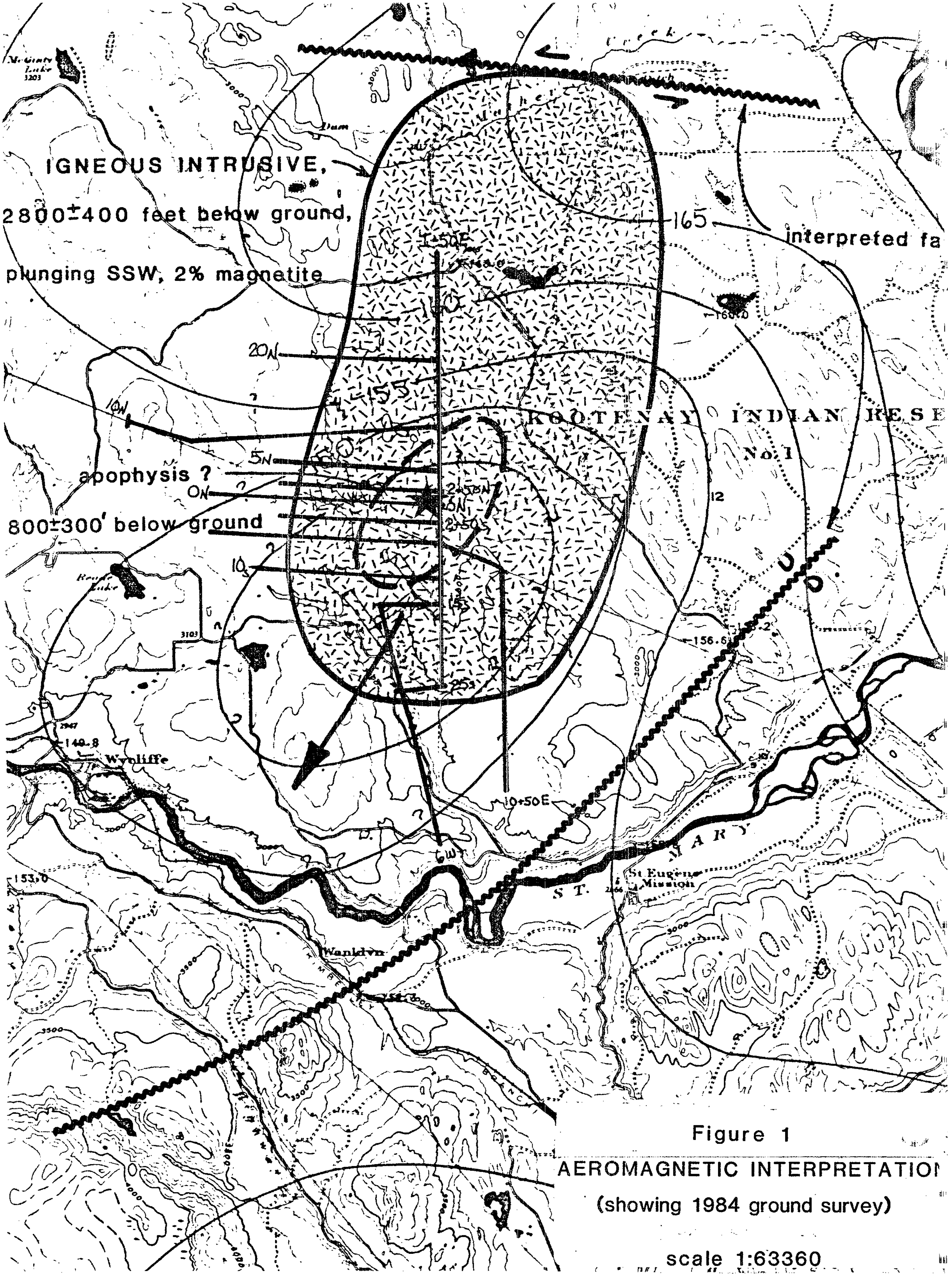


Figure 1

AEROMAGNETIC INTERPRETATION

(showing 1984 ground survey)

scale 1:63360

ALLAN SPECTOR AND ASSOCIATES LTD.
160 DUNCAN MILL ROAD, DON MILLS, ONTARIO, CANADA M3B 1Z5 (416) 449-5473

Nov. 14, 1984
J 328

Mr. B. H. Kahlert
AMOCO Canada Petroleum Company Ltd.
Suite 300, 89 Queensway West
Mississauga, Ont.
L5B 2V2

Dear Bernie,

Re: Cranbrook Area

This letter serves to provide you with the results of our evaluation of gravity and magnetic survey data received so far.

On November 9 we received data in the form of plotted profiles and a map showing posted values of Bouguer gravity and 1/2 mgal. contours; both at 1:10,000 scale. Terrain corrections have been applied to the gravity data. The magnetic data, based on base station monitoring, appear to be free of diurnal variation.

Measurements had been taken at 730 stations located at intervals of 50 m. on east-west lines 250 m. or more apart and on 3 north-south tie lines. Accompanying this report is a copy of the previous aeromagnetic interpretation map - superimposed on which is the location of the ground survey lines.

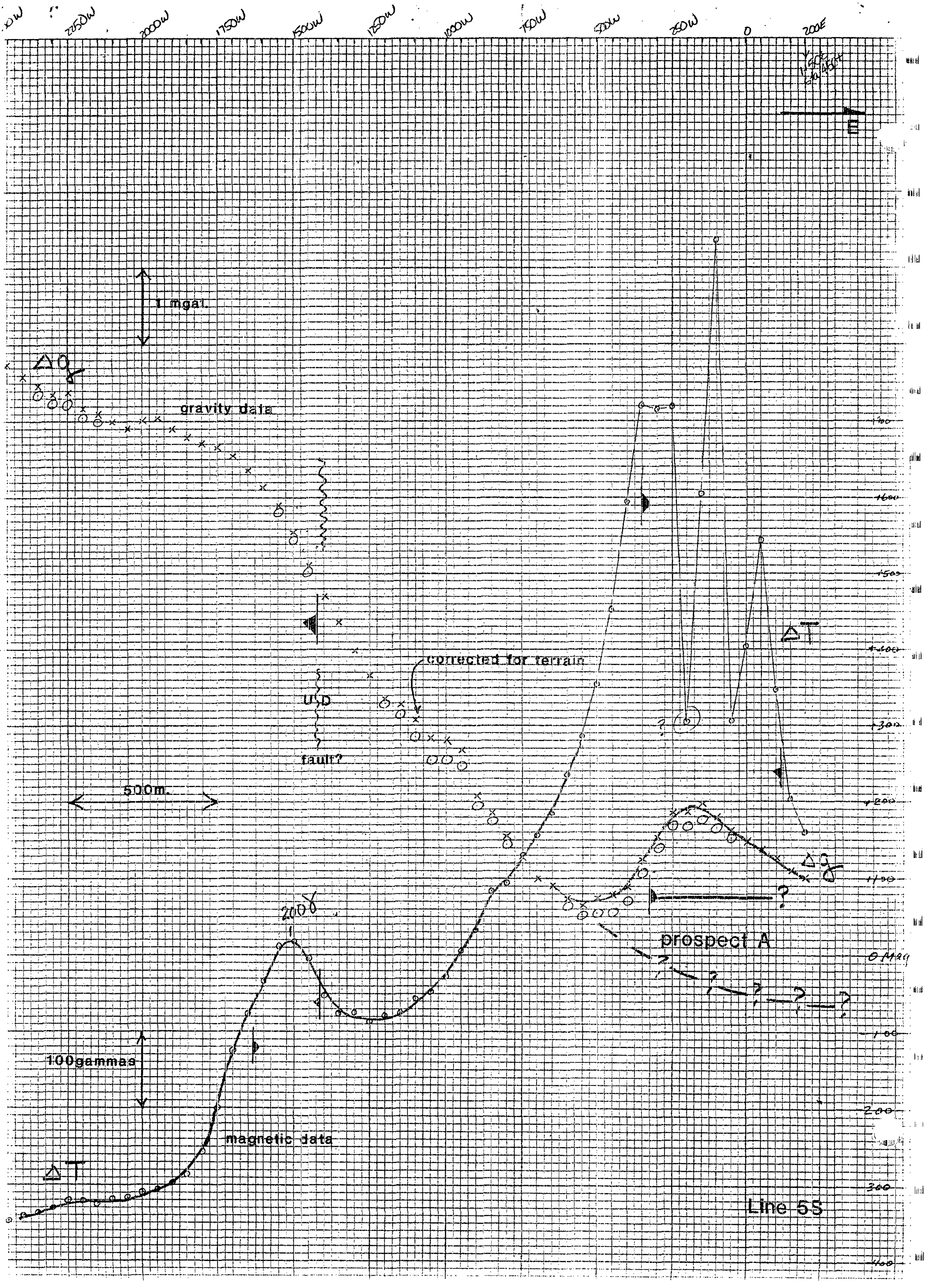
As seen in this map, the ground survey was laid out with the objective of detailing a possible gravity anomaly that was judged by Spector (letter report of July 27, 1984) to be associated with an interpreted igneous intrusive. The presence of a probable intrusive is well expressed in a published G.S.C. aeromagnetic map of the Cranbrook area.

Preliminary Results

The results of the assessment of the ground follow-up survey data are presented in the Gravity/Magnetic Interpretation Map which accompanies this report and described in detail below;

Prospect A

Principal result of the ground surveying is the observation of an appreciable gravity anomaly largely coincident with the intrusive "apophysis" mapped by Spector (July 1984).


2250W
2000W
1750W
1500W
1250W
1000W
750W
500W
250W
0
200E
E
1 mgal.
gravity data
corrected for terrain
U D
fault?
500m.
200γ
prospect A
100gammas
magnetic data
Line 5S

The anomaly is clearly noticeable in the eastern parts of lines 10S, 5S, 2+50S and 0S. It is only perceptible in lines 2+50N and in tie line 1+50E. It trends north-northeasterly.

The gravity anomaly's amplitude is between 1 and 2 mgal. Further gravity surveying by extending the above lines to the east hopefully will provide sufficient information to define the east portion of the anomaly and thereby resolve it from other gravity effects.

The gravity anomaly is associated with vigorous magnetic relief; 700$\pm$ 200 gammas. This relief appears to originate both at deep and shallow level, i.e. a 700 gamma anomaly originating about 200 m. below ground and a $\pm$200 gamma variation originating near ground surface. This shallower effect may be due to either pyrrhotite skarning-alteration above a buried instrusive, or due to the presence of volcanic rocks. The gravity anomaly appears to orginate from a maximum depth of about 200 m.

Other Gravity and Magnetic Features

The 1-2 mgal anomaly involved in Prospect A is dwarfed by a 7 to 9 mgal. step-like gravity gradient developed to the west and parallel to it. The gradient is likely due to a NNE-trending fault whose east side is downthrown. The up-side is associated with a 20 to 200 gamma magnetic anomaly originating within 100 m. of ground surface. The magnetic anomaly may be due to the presence of volcanic rocks.

A second fault may be deduced from a gravity/magnetic gradient to the south of Prospect A. The north side of this WNW-trending 6 to 12 mgal. gradient is associated with reduced gravity. Magnetization (500 gamma anomaly) is associated with the north side.

Follow-Up Recommendations

Although the present survey results confirm the presence of a quite interesting geological feature - additional geophysical surveying is warranted. This should involve extension of gravity and magnetic measurements on lines 10S to 5N, a distance of 1000 m. to the east. With the additional data I would expect the anomaly would be adequately defined for purposes of planning a drilling program. From drill coring density information would be available to do an adquate job of mathematically fitting a model to the observed gravity anomaly.

The vigorous magnetic relief observed over the central part of Prospect A originates close to ground leve. It is therefore recommended that a geological reconnaissance of the area of high relief be done to ascertain the significance of these anomalies.

I trust that these results meet with your requirements.

REGISTERED PROFESSIONAL ENGINEER
A. SPECTOR
PROVINCE OF ONTARIO

Yours sincerely,

ALLAN SPECTOR AND ASSOCIATES LTD.

Allan Spector, Ph.D., P. Eng.

J328/2

FINAL REPORT ON PRELIMINARY
GRAVITY/MAGNETIC INTERPRETATION
CRANBROOK AREA, B. C.

For

AMOCO CANADA PETROLEUM COMPANY LIMITED

By

ALLAN SPECTOR AND ASSOCIATES LIMITED
TORONTO CANADA

January, 1985

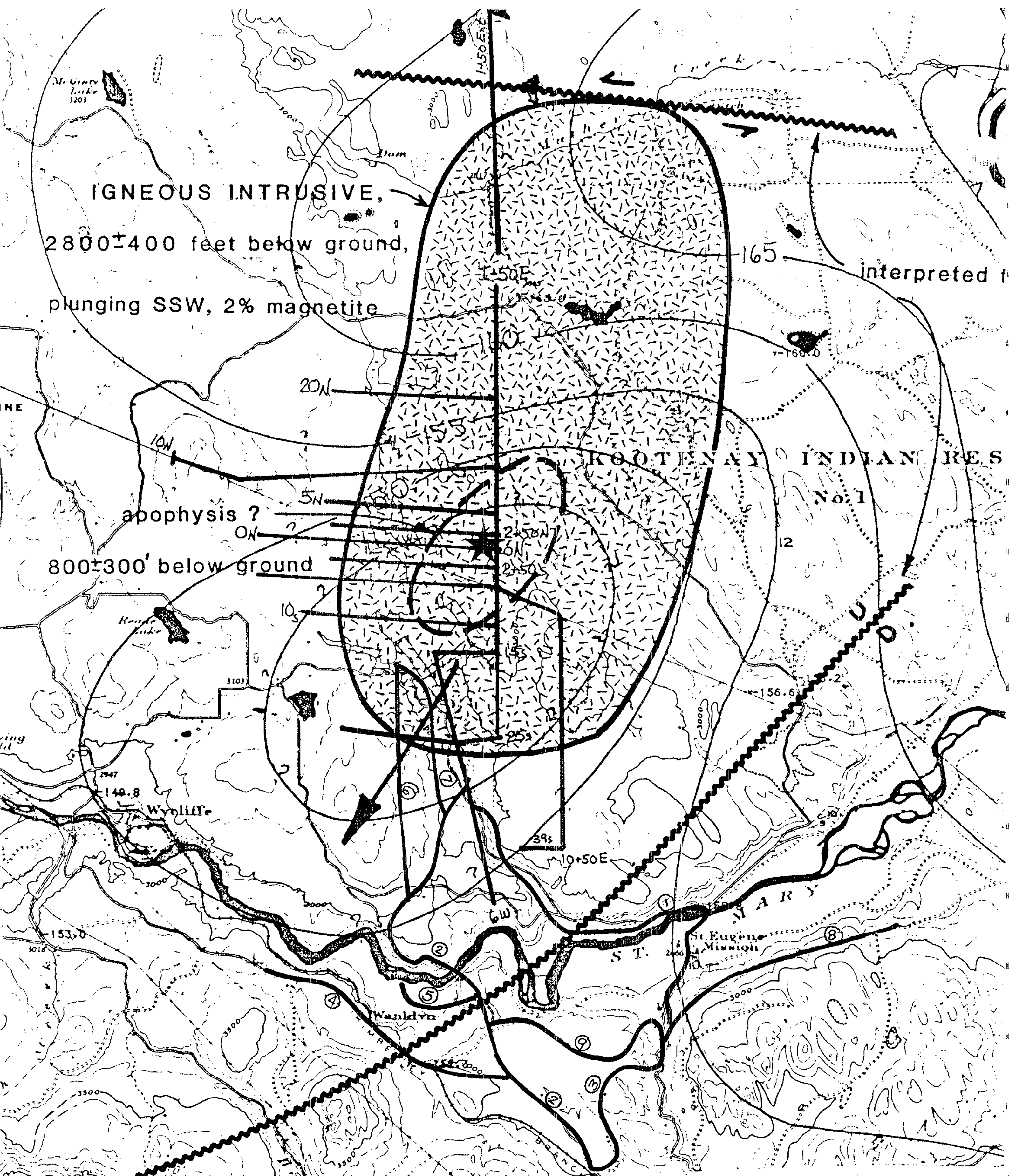


Figure 1
AEROMAGNETIC INTERPRETATIO
(showing 1984 ground survey)

scale 1:63360

Jan. 23, 1985
J 328/2

Mr. B. H. Kahlert
AMOCO Canada Petroleum Company Ltd.
Suite 300, 89 Queensway West
Mississauga, Ont.
L5B 2V2

Dear Bernie,

Re: Cranbrook Area

1. Introduction

This letter serves to report on our assessment of gravity and magnetic survey data in this project area.

As you will recall, interest was drawn to the Cranbrook aeromagnetic anomaly because of the remarkable similarity in geophysical signature between it and the Olympic Dam deposit of south Australia. At Olympic Dam, both a 1200 gamma anomaly (BMR low level 150m. aeromagnetic survey) and a 15 mgal gravity anomaly were observed over a 4 to 5 km. wide circular zone.

Over the Cranbrook prospect, a 1200 gamma anomaly was observed in a GSC aeromagnetic survey (300 m. altitude). From an analysis of the original survey chart recordings (letter report by Spector, July 17, 1984) an elliptically shaped "intrusive" zone was outlined; 8 km in long diameter and 4 km in minor diameter. Although much of the zone was determined to be 800 ± 100 m. below ground, an apparent apophysis was observed in the southern half of the magnetic zone, rising to a shallow depth of 250 m ± 100m.

From an interpolation of regional gravity data (federal government surveys at 5 km spacing) a 15 to 20 mgal gravity anomaly appeared to be coincident with the "intrusive apophysis".

Because of the reconnaissance nature of both the aeromagnetic and the government gravity surveys, ground follow-up surveying was clearly warranted.

......

Ground surveying consisting of gravity and magnetic measurements was conducted over the western and southern parts of the Cranbrook prospect. The measurements were taken by Wild Rose Exploration Services of Calgary, in the period of October - November 1984. The location of survey lines is described in Figure 1. Access to the eastern part of the prospect awaits the outcome of negotiation with the Kootenay Indians.

Measurements were taken at about 1400 locations, magnetic measurements at 50m. spacing and gravity measurements at 100m. The magnetic data was corrected for diurnal variation using measurements from a base station monitor. The gravity data was corrected for topography. Wild Rose provided plotted profiles of the data and maps showing posted and contoured values of Bouguer gravity and magnetic intensity, all at 1:10,000 scale.

A preliminary report dealing with an assessment of the ground geophysical data (received to November 9, 1984) was presented on November 14, 1984. This report attempts to synthesize that assessment with findings from additional measurements mostly in the southern part of the project area.

A 1:10,000 scale Interpretation Map accompanies this report as Figure 2. The map shows results deemed to be significant for mineral exploration. Location of measurements is also shown. Surveying does extend further north, south and southeast of this map sheet. However, in these areas the results were not found to be significant to warrant drafting.

2. Magnetic Anomalies

The following magnetic zones are outlined from the ground data.

Zone M1: this is the most prominent magnetic feature observed in the surveying. The zone is not as yet completely outlined because of lack of access in the Indian Reservation. At present it is T-shaped. The upper part of the 'T' trends NNE-SSW. The stem trends WSW. Magnetic relief ranges from 600 to 1200 gammas. The zone can be spatially related to the magnetic zone outlined from the G.S.C. aeromagnetic data. The north segment of this zone attracts greatest interest because of its association with 2-3 mgal gravity anomaly; Prospect A.

Much of the magnetic relief in Zone M1 originates from shallow depth, i.e. 100m. Where observed the shape of the anomaly would suggest that the magnetic source has great vertical extent and an intrusive as opposed to a plate like body would appear to be most likely.

Zone M2: this rather linear shaped zone trends NNE-SSW parallelling segments of adjacent Zone M1. The 20 to 200 gamma anomaly reflects a zone that is only 100 to 400m. wide. The shape of the zone is suggestive of a sill-like intrusive. Perhaps with further surveying a connection may be observed between Zones M1 and M2. Zone M2 appears to coincide with the outer contact of the aeromagnetic anomaly. Zone M2 is associated with a 7 to 9 mgal step-like gravity gradient which would signify either a change in basement lithology/rock density or a fault. The former case would appear to be more likely.

Prospect C: This localized magnetic zone is observed in Lines 6 and 2. It is conspicuous because of the association between the 300 gamma anomaly and a 2 mgal. gravity anomaly. It is however, removed from the aeromagnetic anomaly.

Zones M4, and M5 are two scattered 350 gamma anomalies observed in lines 1 and 6 + 00W. Zone M5 appears to be associated with a rather broad 5 mgal gravity anomaly.

3. Gravity Anomalies and Prospects

Prospect A is that part of magnetic Zone M1 that is associated with a positive gravity anomaly. The gravity anomaly is at most 2-3 mgal in amplitude and is oriented NNE - SSW. Complete geophysical definition of this anomaly would require access to the adjoining Indian Reservation. The gravity anomaly is well as much of the coincident magnetic relief originate from shallow depth of 100m. It is the considered belief of the author that Prospect A is the most significant feature observed in the ground surveys.

Prospect B is a 6 mgal gravity anomaly observed in lines 6+100W and 7. It has no magnetic association. It is adjacent to the outer contact of magnetic zone M1 and the aeromagnetic anomaly. However because of the lack of direct magnetic association it is considered to be second priority to Prospect A.

Prospect C is a 2 mgal gravity anomaly, observed on line 2 which is associated with a 300 gamma magnetic anomaly. It is however substantially removed spatially from the 'Cranbrook' aeromagnetic feature.

Possibly the most prominent features expressed in the gravity data are two broad, large amplitude, negative gravity anomalies. The Alfa Low (in which Prospect A is located) is a -8 to -20 mgal gravity depression. Only the southwest portion of this depression is included in the surveying. The gravity depression may be due to one or a combination of causes. One may speculate that it is due to a deeply buried granitic intrusive - an apopysis of which is Prospect A.

The St. Mary River Low is a 5 mgal gravity depression that is virtually centred over the St. Mary River. It is most likely that the anomaly is due to the negative effect of lower density valley fill/river deposits.

4. Follow - Up Recommendations

Upon granting of access to the Indian Reservation, it would be recommended that the geophysical surveying (gravity and magnetometer) of Prospect A be completed. This capability may be extended to complete definition of Prospect C.

Drilling/trenching is recommended in the case of Prospects A and C and lastly B.

To provide the necessary information for the mathematical modelling of the observed anomalies, it is recommended that bulk density measurements be conducted on samples received from trenching/drilling and outcrop.

I trust that this report meets with your requirements.

Yours sincerely,

ALLAN SPECTOR AND ASSOCIATES LTD.

Allan Spector, Ph.D., P. Eng.

REGISTERED PROFESSIONAL ENGINEER
A. SPECTOR
PROVINCE OF ONTARIO

INTERPRETATION OF GROUND MAGNETIC MAP

CRANBROOK AREA, B.C.

SUDHIR JAIN

COMMONWEALTH GEOPHYSICAL DEVELOPMENT COMPANY, LTD.

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INTERPRETATION OF GROUND MAGNETIC MAP

CRANBROOK AREA, B.C.

Wild Rose Exploration Services operated a gravity and magnetic field crew from Amoco Canada in an area bounded by latitude 49°35' and 49°40' and longitude 115°46'W and 115°51'W. The map of the magnetic field resulting from this survey was made available for interpretation. Four profiles from this survey numbered 0, 5, and 10 in the East-West direction and 8 in the North-South direction were picked for depth interpretation of the data.

The profiles were interpreted using the Werner-based automatic computer method MAGDEP. The detailed description of this method is enclosed. The anomalies seem to originate at two levels, one at around 150 meters and the other deeper at around 400 meters. The profiles indicate the picked top of these two levels. The circled numbers are the susceptibility contrasts x 10^5 assigned to various interfaces. The enclosed overlay indicates the outline of shallow intrusives inferred from this interpretation and their depths.

It is concluded from the profiles and the overlay that there are several places where intrusives come quite close to the surface and these places do not necessarily correspond to the highest magnetic anomaly. However, the profiles indicate several off-shoots of the main intrusive mass which could be tested for their mineral content.

A small positive high on the North-South line corresponds approximately to a small dike which may be related to an almost vertical fault.

Respectfully submitted,

COMMONWEALTH GEOPHYSICAL DEVELOPMENT COMPANY, LTD.

Sudhir Jain
Consultant

November 1984.

GEOPHYSICS, VOL. 41, NO. 3 (JUNE 1976), P. 531-541; 6 FIGS.

AN AUTOMATIC METHOD OF DIRECT INTERPRETATION OF MAGNETIC PROFILES

SUDHIR JAIN*

The well-known equations for the total magnetic field due to thin sheets and the edges of a thick body (Werner, 1953) can be programmed to compute automatically the depth to the top, susceptibility contrast, and the dip of these features from a given total magnetic field profile. The synthetic anomalies show that in ideal cases the depths can be determined to the accuracy of 10 percent or better, provided the source of the anomaly can be identified as a bounding edge or the thin sheet. It has also been found that the anomalies due to edges approximately one depth unit apart in horizontal direction can be resolved. Vertically, the interpretation of shallow bodies is not affected by the presence of deeper bodies. However, the deeper bodies can be located only when they cause anomalies much stronger than those associated with shallow bodies, or when the shallow bodies are displaced from the deep edges horizontally by a distance equal to or greater than the depth to the top of deep edges. The shallow high-frequency anomalies tend to mask the interpretation of deeper anomalies rather than cause erroneous estimates. Susceptibility contrasts can be estimated reasonably accurately only when the dips are about 40 degrees or greater. The dip estimates are accurate to within 10 percent.

INTRODUCTION

The potential field data can be interpreted either in map form or on the profiles. Each approach has its advantages. The maps represent the total picture available and no assumptions regarding strike and lateral extent of the source need be made. On the other hand, the maps are not made from the original data but from the grids which are computed from the field data and do not always represent it in true form. The grid interval is invariably much larger than sample spacing on the traverses; therefore, shallow source anomalies may not be represented adequately even in the close vicinity of the actual profiles. On the other hand, the spacing between profiles is much larger than the grid spacing. Hence, over a large proportion of the map even deep anomalies may be contoured erroneously.

The analysis of profiles allows the interpretation of data as recorded. However, the direct interpretation methods must assume that the profiles are normal to the strike direction and that the bodies extend to large distances on either side of the profile. Fortunately, "large distance" needs only to be a few times the depth of the source, and most bodies meet this limitation. Moreover, the inspection of interpreted depths on adjacent profiles, in conjunction with the inspection of the map, allows an experienced interpreter to select valid depth estimates from appropriate anomalies and to construct a reliable picture of the geology of the area. Ideally, of course, one would like to have both the profile and two-dimensional (or grid) interpretations. The direct interpretation of grids has been discussed elsewhere (Jain et al, 1974). In this paper, we will limit ourselves to the interpretation of total field profiles.

Several methods of automatic interpretation of digitized magnetic profile data have been sugges-

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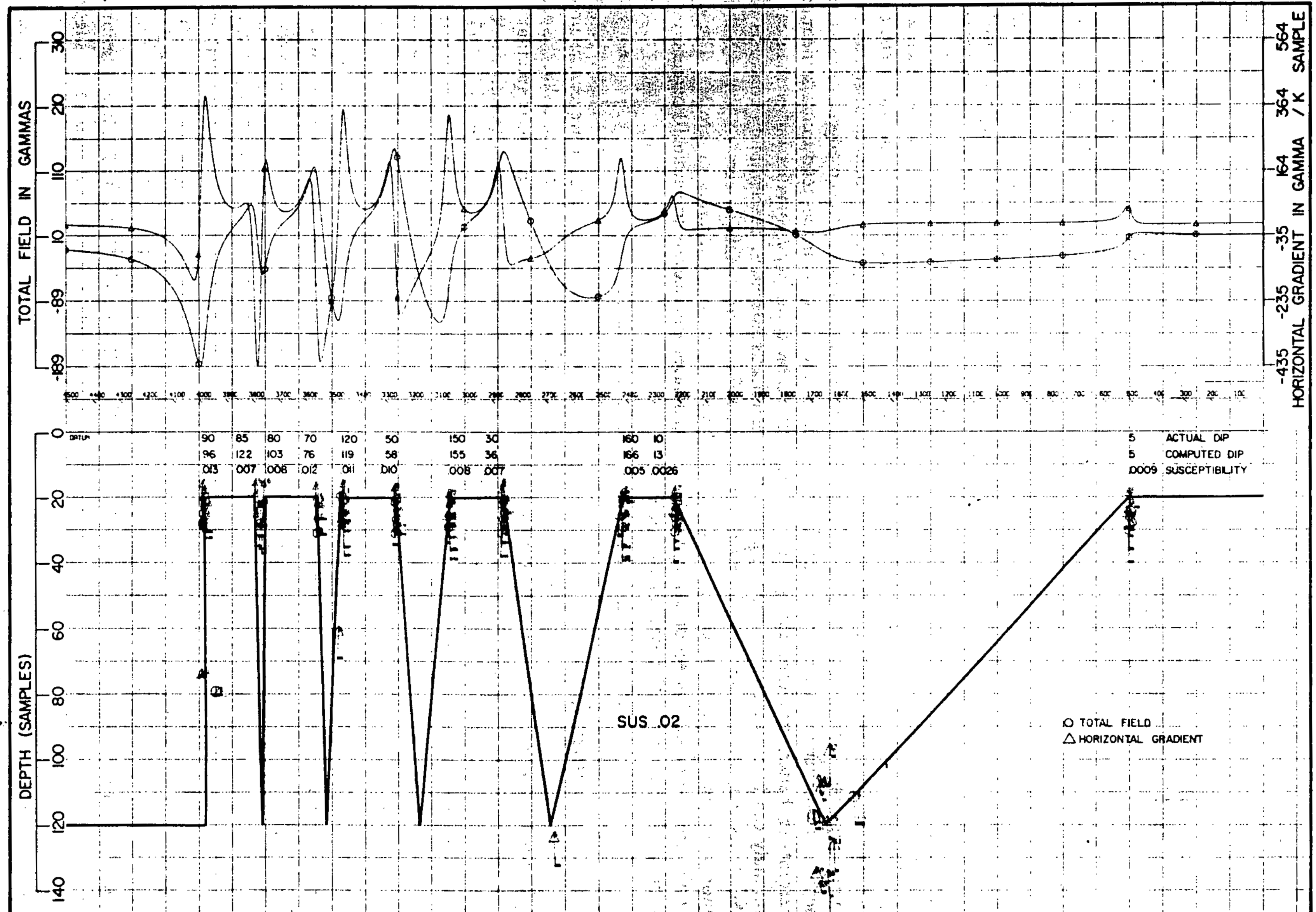

FIG. 1. The effect of dip on the interpretation.

ted in the last few years (Koulomzine et al, 1970; O'Brien, 1971; Hartman et al, 1971; Naudy, 1971; Nabighian, 1972). However, very few authors analyze the results from their methods in any detail. In this paper, we will describe the results obtained with the equations given by Werner (1953) in various simulated situations. In this manner, the limits of resolution and possible accuracy of this method of interpretation of a magnetic profile will be established.

BASIC EQUATIONS

For the purposes of direct interpretation, the source bodies can be divided into two types:

1. The bodies whose width is comparable to their depth from the observation plane. These can be called thin bodies, because the edges of these bodies cannot be located easily, with reasonable accuracy.
2. The bodies of considerable lateral extent, whose bounding edges can be separately identified.

The expression for the total magnetic field due to thin dikes of any arbitrary dip was given in a very convenient form by Werner (1953). Werner's interpretation equations were partially reproduced by Hartman et al (1971). For the sake of completeness, all relevant equations are presented here, but without derivation.

The equation for the magnetic field due to a thin dike is of the form:

$$F_r + a_0 + a_1 x + b_0 F + b_1 x F = x^2 F. \quad (1)$$

where $(x, 0)$ are the coordinates where the field F is observed, F_r is the unknown ambient noise polynomial of the type:

$$F_r = \Delta F + K_F x + K_{F'} x^2 + \cdots \quad (1a)$$

and a_0, a_1, b_0, and b_1 are related to the properties of the source of the anomaly.

For total fields, a_0, a_1, b_0, and b_1 are related to the various parameters as follows:

$$x_0 = b_1/2, \quad (2)$$

$$t_0 = \sqrt{-b_0 - b_1^2/4}, \quad (3)$$

$$tM_{11} = \frac{(2a_0 + a_1 b_1)\nu_Z - 2a_1 t_0 \nu_x}{4t_0(\nu_x^2 + \nu_z^2)}, \quad (4)$$

$$tM_1 = \frac{-(2a_0 + a_1 b_1)\nu_x - 2a_1 t_0 \nu_z}{4t_0(\nu_x^2 + \nu_z^2)}, \quad (5)$$

where ν_x and ν_z are the direction cosines of the total field, x_0 is the location of the dike, t_0 is the depth to the top, t is the thickness, and M_{11} and M_1 are the crossmagnetization of the sheet. From M_{11} and M_1, one can determine the susceptibility contrast and the dip of the dike.

The same equation [except for factor t in equations (4) and (5)] is applicable to the horizontal gradient of the total field for a dipping edge. Therefore, one can compute the horizontal gradient from the total field and use the same equations to estimate the source parameters for an edge. Thus, the same algorithm provides solutions for a dike or an edge, and the interpreter can choose the right depth whether the source is a thin dike or a thick body with distinct edges.

Effect of spurious fields on interpretation equation

The interpretation of an observed magnetic anomaly is adversely affected by at least three factors:

1. The magnetic fields due to deep-seated bodies, commonly called regional anomalies. Anomalies due to shallow bodies located at large lateral distances can also be included in this group.
2. Anomaly due to a sheet of limited extent, laterally or vertically.
3. The presence of local magnetic masses or observation errors, which affect a small area and then rapidly become insignificant.

The series F_r in equation (1) is intended to limit the errors due to these bodies. To account for distant anomalies and the limited extent of the sheet, the evaluation of the first three terms on the right-hand side of (1a) will be adequate. In this case, equation (1) has seven unknowns, and, therefore, the solution of seven equations corresponding to seven observation points provides all relevant parameters about the body.

When shallow anomalies and random errors are significant, the equation of higher degree must be solved. This leads to very cumbersome calculations. It is believed that in such cases the interpretation of deeper anomalies can be obtained more economically with the help of controlled filtering than by solving the above equations (Jain and Hartman, 1972). In practice, the data are filtered with an appropriate anti-alias filter for the sample interval of the seven points. In addition, the interpretations not consistent with those from nearby points are considered invalid. The net effect of anti-alias filtering, filtering implicit in the

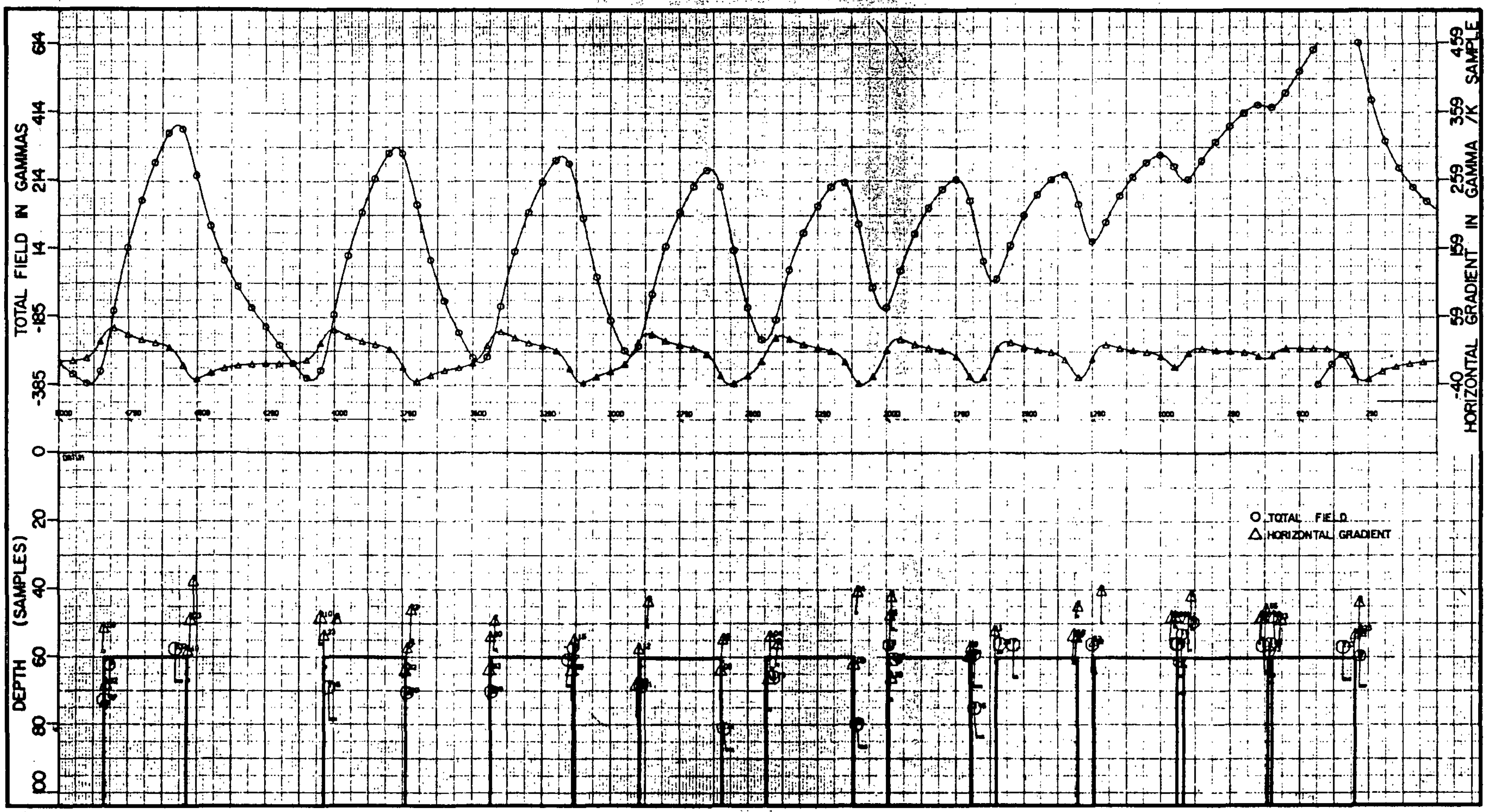

FIG. 2. Interpretation of vertical dikes with different horizontal separation.

selection of sample interval, and of the consistency tests is to minimize the appearance of interpretation from noisy data in the final plot. As will be evident from the model described later (Figure 4), the high-frequency anomalies, even of limited extent, mask interpretation of anomalies of comparable magnitude originating from deeper sources.

Werner (1953) showed that for finite sheets the method provides accurate location, depth, and dip; but the susceptibility measurements are in error. Of course, when the profile is located beyond the edge of the body, all parameters are in error.

DESCRIPTION OF COMPUTER PROGRAM MAGDEP

A computer program was written to interpret evenly spaced profile data, in accordance with equations (1) through (5). The program uses seven points at regular intervals to compute the parameters of the sheet (or edge). The window of these seven points is moved along the profile at one point intervals. The size of the window is controlled by the interval between each of the seven points. The data are filtered to minimize aliasing effects. The range of depths which can be interpreted accurately is related to the window length. Thus, the process has to be repeated several times to cover the whole range of depths in a deep basin. Five or six loops are commonly employed. A new horizontal gradient is computed (using Lagrange's interpolation) for each window size, but only one of these is plotted.

The computed location of the sheets or edges in distance-depth plane are plotted as circles and triangles, respectively. The size of the symbols indicates the size of window used when the particular interpretation was made. The dips are marked after scaling for horizontal and vertical scales and the susceptibility contrasts are written in units of 10^{-4} cgs units.

The spurious high-frequency anomalies cause stray (and erroneous) depth interpretations. To minimize the number of these stray interpretations and to reduce the clutter on the plots, the depth estimates are grouped together when (a) the locations [x_0 of equation (2)] are within a very narrow range (usually about half of the sample interval), and (b) the depths are within 5 percent of the previous determination or within 5 percent of the representative depth for the group (i.e., the minimum depth estimate for the group).

The number of estimates in a group is plotted along with other information. This number can be regarded as a weighting factor when evaluating individual interpretations.

MODEL EXPERIMENTS

In order to evaluate the technique for accuracy and resolving power, several models were analyzed. The anomalies were computed, using the equation for a two-dimensional step given by Nabighian (1972). No random noise was added to the data. The examples illustrated here simulate middle latitudes and declination of 30 degrees.

Estimation of dip

Figure 1 illustrates the interpretation of dipping edges. The total magnetic field due to a series of intrusives, each with a susceptibility contrast of .02 cgs units, was generated. The edges of this intrusive had slopes increasing from 5 degrees (extreme right) to 90 degrees (extreme left). The interpretation with highest weights is listed in the figure. This figure shows clearly that the edges can be located very accurately and the dips computed within 10 degrees. However, this error in dip computation is quite serious for low dips, and the computation of magnetism of the bodies is adversely affected by this inaccuracy. Once the dips approach 40 degrees, the computed susceptibilities do not seem to be affected greatly by this error in dip computation.

This model (as well as the ones to follow) demonstrates clearly that the depths to the sources are computed with and accuracy of 10 percent or better in most cases. The locations are computed almost exactly.

Horizontal resolution

Figure 2 shows the interpretation of a synthetic anomaly due to identical thick vertical dikes whose separation ranges from one-quarter to eight depth units. The figure shows that when the bodies are one depth unit (60 samples) or further apart, the edges can be separately identified—both by total field and by horizontal gradient. Moreover, the depth estimates from gradients are not measurably affected by the vicinity of other bodies. When the edges are located one depth unit apart, the depth estimates from total field approach those from gradients, indicating that the edges approach a thin dike case in total field interpretation while they can still be separated by horizontal gradients. However, as the bodies come

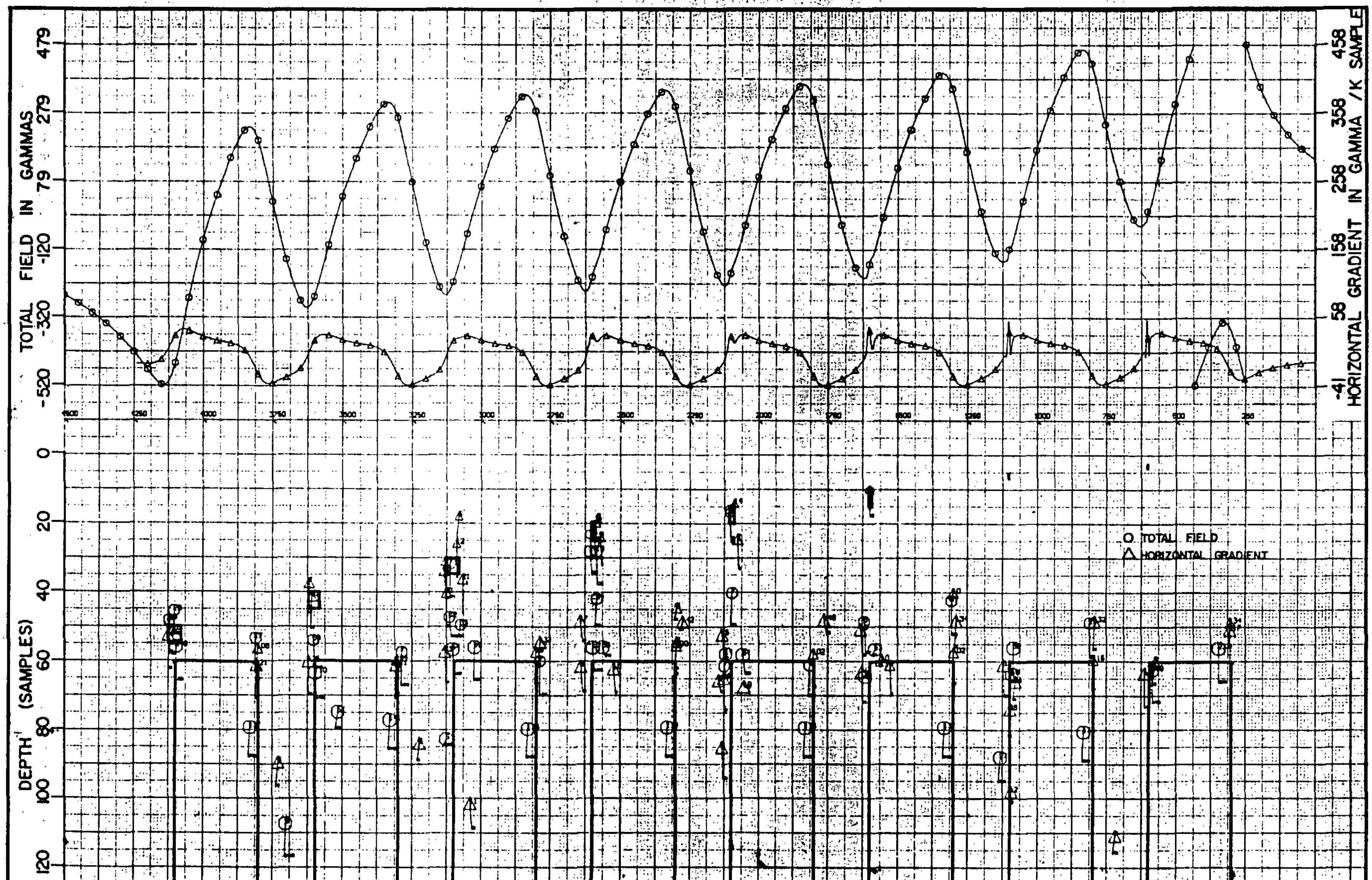

FIG. 3. Effect of very weak shallow anomalies or deep edges.

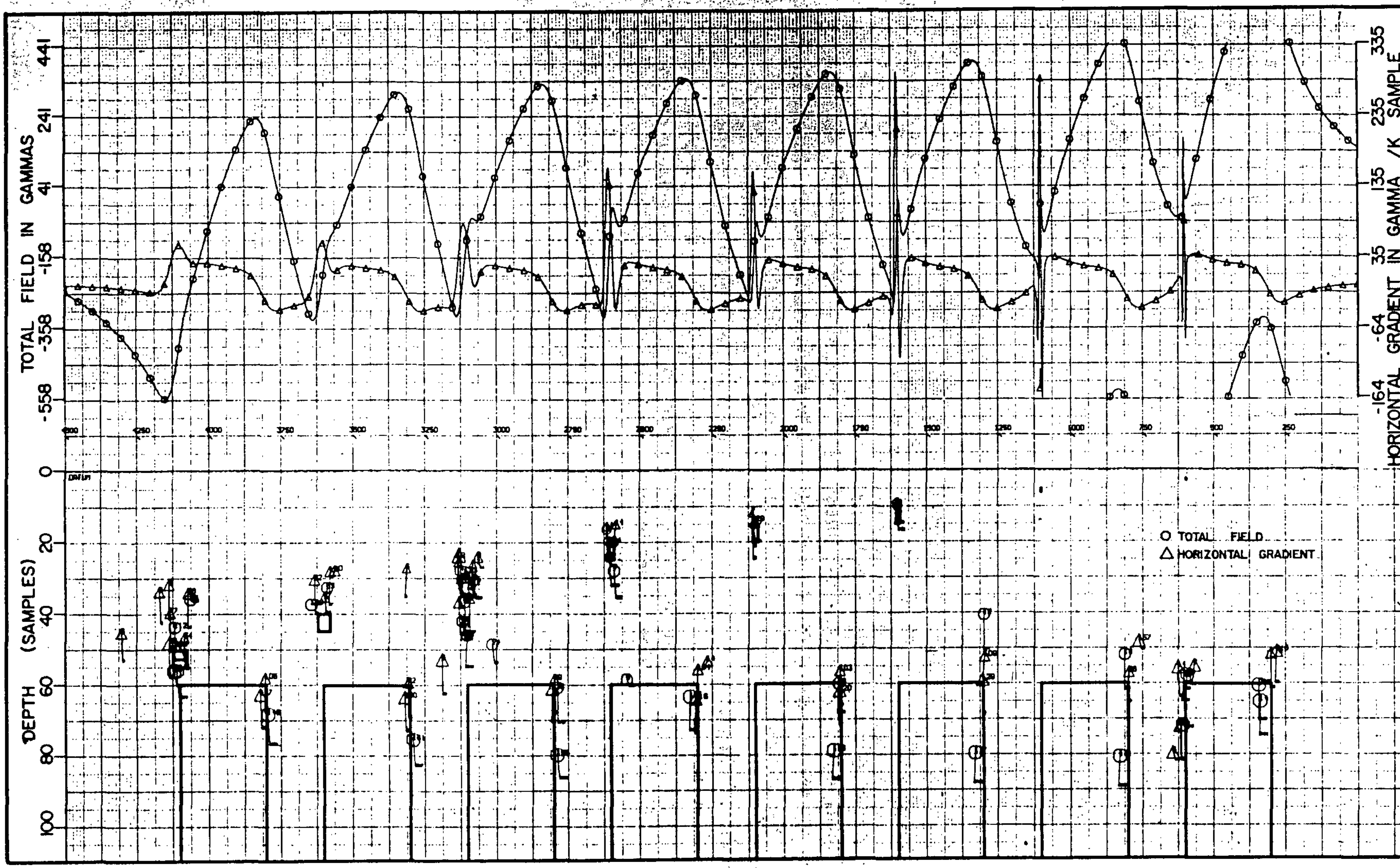

FIG. 4. Effect of shallow anomalies of moderate magnitude or deep edges.

closer still, they cannot be resolved by horizontal gradients. In fact, the depths estimated from horizontal gradients are up to 20 percent too shallow. In this case, the depth estimates from total field are accurate. We conclude that: (a) When vertical edges are one depth unit or farther apart, they can be separately identified and accurately located by horizontal gradient. (b) When edges are less than one depth unit apart, they cannot be identified separately but their depth, dips, and magnetization are accurately estimated by total field.

Vertical resolution and effect of high-frequency anomalies

Figure 3 shows a model with eight identical dikes with flat tops located at 60 units below the observation plane. One edge of the bodies is overlain by shallow bodies; their depths range from 2.5 to 50 units. The total field anomalies due to the shallow bodies are less than one-tenth of that due to deep bodies, and all bodies are easily and accurately interpretable. Note that the interpretation of the two shallowest bodies was not plotted because their anomalies did not extend far enough for the interpretation to have minimum weight specified for the plot.

Figure 4 shows the same bodies except that the shallow anomalies are five times stronger than in Figure 3. In this case, the shallow bodies have been identified in the same manner but the deeper edges have not been interpreted at all, not even erroneously, except in the case of the shallowest body. Note that the edges with no covering shallow bodies remain undisturbed.

The conclusion is that all but the weakest of shallow anomalies suppress the interpretation of deeper edges. Thus, if an interpretation shows two edges, one directly beneath the other, the lower edge is most likely invalid.

Figure 4 also illustrates the effect of high-frequency noise on interpretation of low-frequency anomalies. Note that the shallow-source anomalies of any significant magnitude, even when of very limited extent, do not provide erroneous depth estimates but completely mask the interpretation of deeper bodies. The high-frequency anomalies due to random noise and observation errors may be expected to have similar effects. As mentioned earlier, the absence of erroneous interpretations is due to filtering of data and consistency tests on interpreted values.

More models were generated to determine how far the shallow body has to be from the deeper edge before both can be identified. The shallow bodies were moved progressively away from the edges. The deeper edges showed up earliest when the shallow bodies were located sixty units (one depth unit for deep bodies) from the deep edge (Figure 5). The deep edges are identified as accurately as the shallow bodies. It is noteworthy that in intermediate cases, the deeper edges were not identified at all, and there were no consistent depth estimates in the intermediate range.

REAL DATA EXAMPLE

Figure 6 shows the interpretation of an aeromagnetic profile located in middle latitudes. The structural interpretation of the profile is also shown. Although no drilling or seismic information is available in the prospect, the interpretation is in very good agreement with detailed interpretation of the aeromagnetic data of the whole area.

CONCLUSION

The model studies indicate that the automatic direct interpretation of magnetic profiles using Werner's equations can locate the tops of thin dikes and the edges of thick bodies with desired accuracy. The dips can be computed within 10 degrees. However, the computation of susceptibility contrasts are reliable only when dips are 40 degrees or steeper. The edges can be identified separately only when they are at least one depth unit apart. Shallow bodies effectively mask deeper sources, unless they are separated laterally by a distance equal to the depth of the deeper bodies. However, this is not a serious limitation in most cases and, as the real data example indicates, meaningful interpretation is possible in many cases where magnetic anomalies originate at more than one level. Although the example shown relates to the basement studies in a petroleum province, it is hoped that the model studies described here have shown the usefulness of such methods in determining magnetization and the dip of the ore bodies in a mining prospect. However, the configuation of complex ore bodies can be determined only when the resolution constraints described above are satisfied.

ACKNOWLEDGMENTS

Dr. Andrew Holder of Shell Canada Ltd., Calgary, and Don Simpson and Neil Thompson of Digitech Ltd., Calgary, read the draft and suggested improvements. Dan Elms is responsible

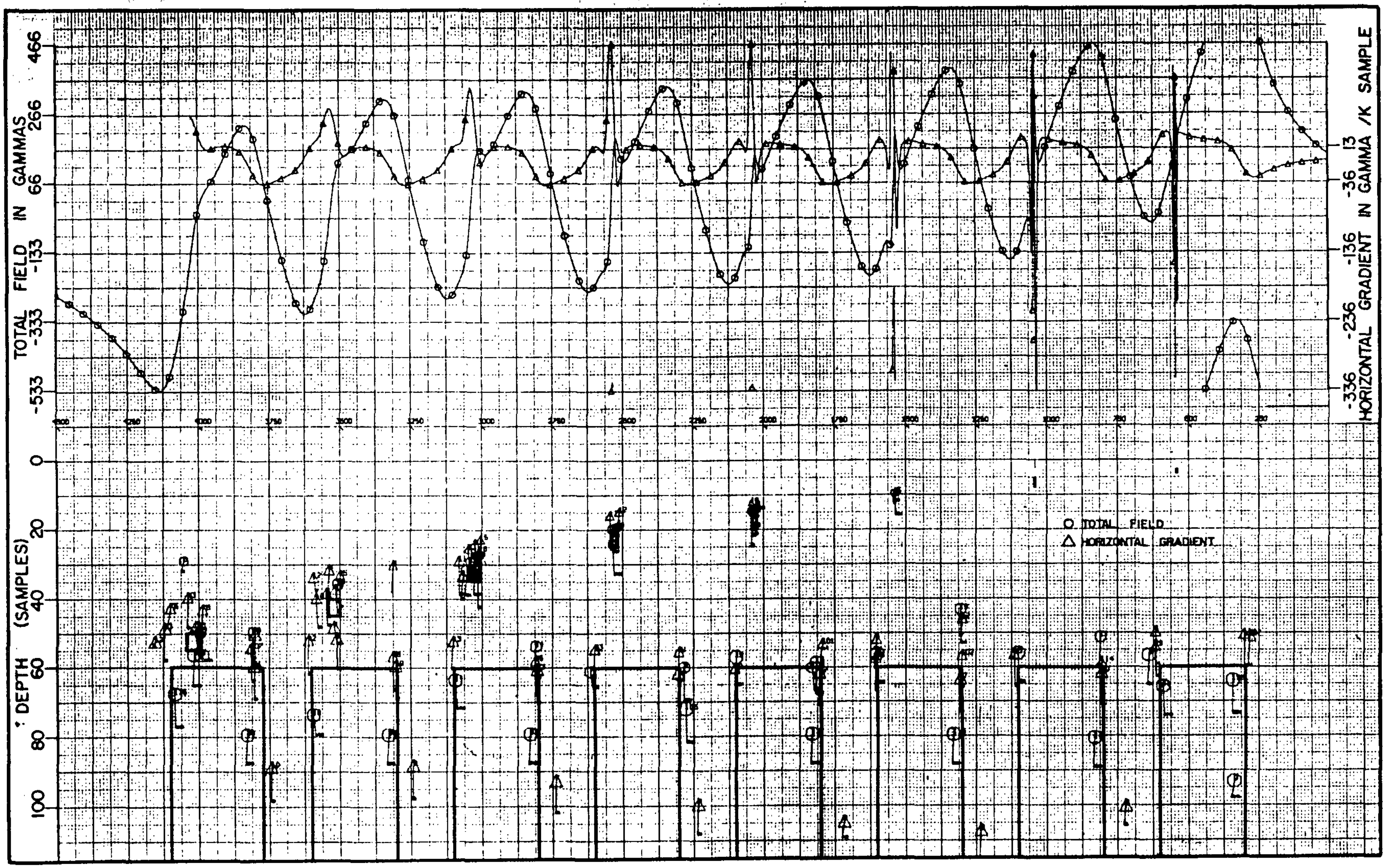

FIG. 5. Effect of shallow anomalies on deep edges when shallow bodies are displaced laterally by distance equal to the depth of deep edges.

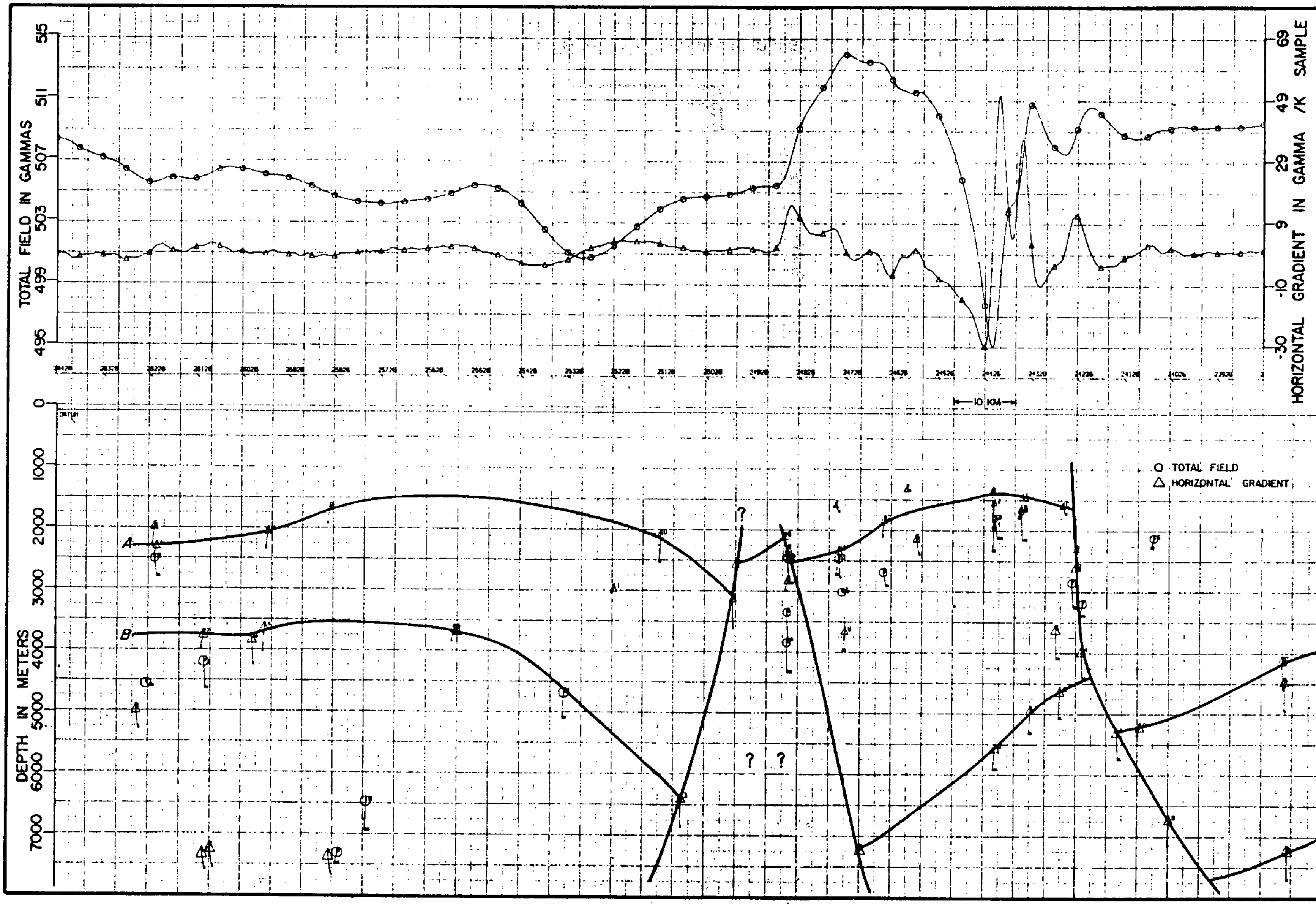

FIG. 6. An example of the multilayer interpretation of actual aeromagnetic data.

for the quality of illustrations. Beryl Spear assisted in the preparation of the manuscript.

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Biographical Sketch
(February 1982)

ALLAN SPECTOR

TITLE:		Chief Geophysicist and Managing Director
NATIONALITY:		Canadian
PLACE & DATE OF BIRTH:		Toronto, Canada 25th July, 1941
EDUCATION:		B.A. Sc. (1963): Engineering Physics, University of Toronto M.A. (1964): Physics, University of Toronto Ph.D. (1968): Physics, University of Toronto
LANGUAGES:		English, French (written)
PROFESSIONAL EXPERIENCE:	1962-1963	Scientific Officer, Dominion Observatory measurement and interpretation of gravity data in Canadian Arctic Islands.
	1965	Scientific Officer, Geological Survey of Canada, research and development of aeromagnetic interpretation methods.
	1967	Geophysical consultant for Huntec Limited, measurement and interpretation of gravity surveys.
	1968-1969	Senior geophysicist, Huntec Limited, analysis and interpretation of aeromagnetic data, ground magnetic and gravity data with special emphasis on application of digital computer. Over 20 reports completed.
	1969-1972	Chief Geophysicist, Lockwood Survey Corporation Limited, Toronto. Main activities: (1) Planning and Supervision of airborne geophysical surveys, (2) analysis and geological interpretation of aeromagnetic, EM and spectrometer survey data, (3) ground geophysical surveys. Over sixty reports dealing with survey operations and data interpretation completed.
	1972-1985	Chief Geophysicist, Allan Spector and Associates Limited, computer processing analysis and geological interpretation of aeromagnetic and gravity data for both mining and oil exploration. Over two-hundred reports completed.

PUBLICATIONS:	1966	"A Gravity Survey of the Melville Islands Icecaps". Journal of Glaciology, Vol. 6, pp. 393-400.
	1966	"Energy Density Spectrum and Autocorrelation Functions of Anomalies due to Simple Magnetic Models". Geophysical Prospecting Vol. 14, pp. 242-272.
	1970	"Statistical Models for Interpreting Aeromagnetic Maps". Geophysics, Vol. 35, pp. 293-302.
	1970	"Gravity Studies Over Three Evaporite Piercement Domes in the Canadian Arctic". Geophysics, Vol. 35. No. 1.
	1971	"Aeromagnetic Map Interpretation with the Aid of the Digital Computer". CIMM Bulletin, Vol. 64, pp. 27-33.
	1972	"Applications of Aeromagnetic Maps to Copper Exploration". Reprint of paper given at 42nd SEG Convention, Anaheim, California.
	1975	"Application of Aeromagnetic Data for Porphyry Copper Exploration in Areas of Volcanic Cover". Reprint of paper given at 45th SEG Convention, Denver Colorado.
	1975	"Deep Hydrocarbon Exploration by Gravity Stripping". Reprint of paper given at 45th SEG Convention, Denver, Colorado.
	1979	"Applications of Aeromagnetic Data to Uranium Exploration in Northern Saskatchewan". Reprint of paper given at 81st annual meeting of the CIM, Montreal, Quebec
	1979	"Computer Compilation and Interpretation of Geophysical Data" in Geological Survey of Canada Ec. Geology Report 31, p. 527-544.
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SUDHIR JAIN

Sudhir Jain is a Geophysical Consultant based in Calgary, Alberta since March 1, 1976. He has specialized in the development and use of advanced data processing and interpretation techniques in seismic and potential field methods. During the last eight years he has worked on seismic data from all over the Western Canadian basin, Arctic, East Coast, Texas, Louisiana, Michigan, and the Gulf Coast, as well as on aeromagnetic data from Kenya, Costa Rica, Alberta, Algeria, Zambia and the Western United States. Prior to consulting, Sudhir Jain was associated with Geophysical Service, Mobil Oil, Aero Service and Digitech Ltd. in various capacities and at various locations.

He received his B.Sc.(Hons.) and M.Tech. in Exploration Geophysics from the Indian Institute of Technology, Kharagpur, India in 1958 and 1960, respectively. After one year on a gravity-magnetic field party, he joined the University of Liverpool in England where he completed his Ph.D. in Geophysics in 1964. Papers resulting from his thesis were presented to the European Association of Exploration Geophysicists and he was awarded the Van Weelden Award in 1966. Dr. Jain has published papers on seismic and potential field methods in Geophysics, Geophysical Prospecting, Journal of CSEG, Oil and Gas Journal, etc., and presented papers in almost all SEG Meetings since 1972. He was awarded the Meritorious Service Award by CSEG in 1980. He is a member of SEG, CSEG and APEGGA.

April 1984

QUALIFICATIONS OF BERNARD H. KAHLERT

B.Sc., Geology, University of British Columbia, 1966.

Member, Association of Professional Engineers (Geological), British Columbia, 1971.

Member, Canadian Institute of Mining & Metallurgy, 1971.

Member, Geological Society of Australia.

Member, Australasian Institute of Mining and Metallurgy.

APPENDIX IV

NAMES AND ADDRESSES OF PERSONS CONDUCTING WORK

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Kamloops, B.C.
V2C 5K6

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M5N 1S7

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#902, 441- 5th Avenue S.W.
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DES O'SHANNESSY MAPPING SERVICES
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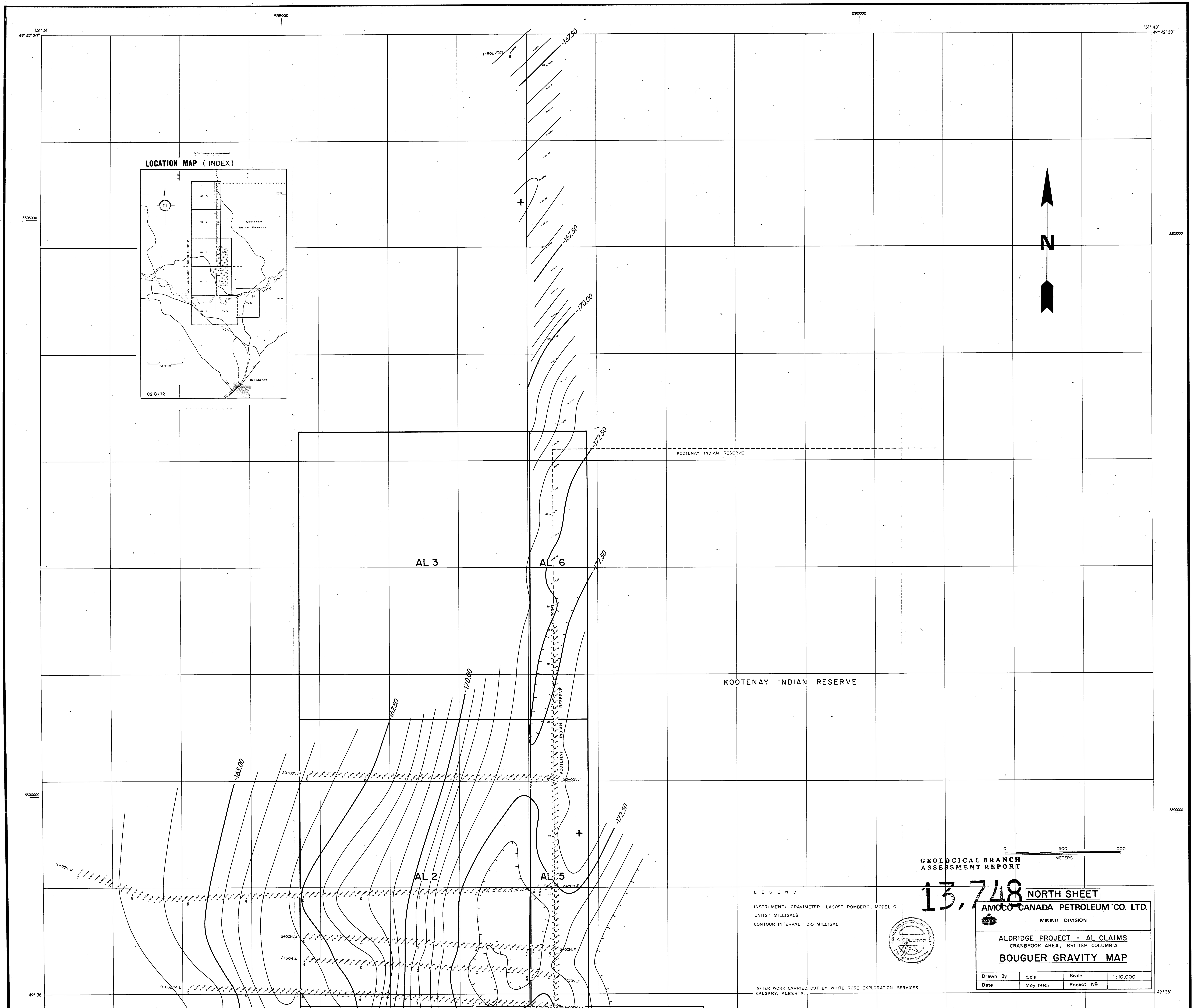
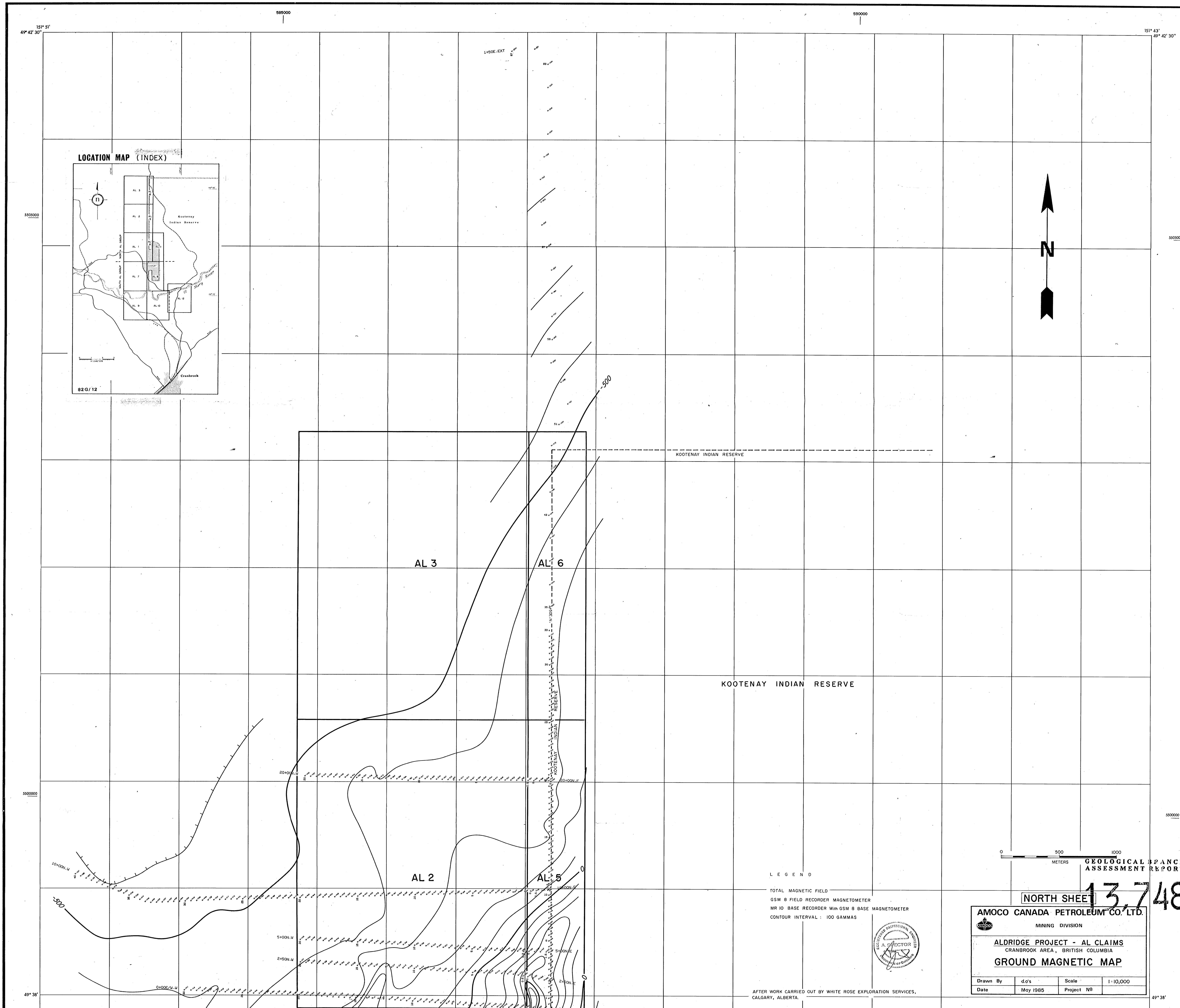
Toronto, Ontario
M4S 1J7

B.H. KAHLERT
1152 Indian Road
Mississauga, Ontario
L5H 1R7



LOCATION MAP (INDEX)
82 G/12
Cranbrook
AL 3
AL 6
AL 2
AL 5
KOOTENAY INDIAN RESERVE
N
-165.00
-167.50
-170.00
-172.50
0 500 1000
METERS
GEOLOGICAL BRANCH
ASSESSMENT REPORT
13,748
NORTH SHEET
LEGEND
INSTRUMENT: GRAVIMETER - LACOST ROMBERG, MODEL G
UNITS: MILLIGALS
CONTOUR INTERVAL : 0·5 MILLIGAL
AFTER WORK CARRIED OUT BY WHITE ROSE EXPLORATION SERVICES, CALGARY, ALBERTA.
A. SPECTOR
AMOCO CANADA PETROLEUM CO. LTD.
MINING DIVISION
ALDRIDGE PROJECT - AL CLAIMS
CRANBROOK AREA, BRITISH COLUMBIA
BOUGUER GRAVITY MAP
Drawn By d.o's
Scale 1:10,000
Date May 1985
Project Nº.
49° 38'

FIGURE 5



585000
590000
151° 51'
49° 42' 30"
151° 43'
49° 42' 30"
5505000
5500000
49° 38'
LOCATION MAP (INDEX)
Kootenay
Indian Reserve
Cranbrook
82G/12
N
KOOTENAY INDIAN RESERVE
AL 3
AL 6
AL 2
AL 5
-500
KOOTENAY INDIAN RESERVE
20+00N.W
10+00N.W
5+00N.W
2+50N.W
0+00E/W.W
0
0
500
1000
METERS
GEOLOGICAL BRANCH
ASSESSMENT REPORT
13,748
L E G E N D
TOTAL MAGNETIC FIELD
GSM 8 FIELD RECORDER MAGNETOMETER
MR 10 BASE RECORDER With GSM 8 BASE MAGNETOMETER
CONTOUR INTERVAL : 100 GAMMAS
REGISTERED PROFESSIONAL ENGINEER
A. SPECTOR
PROVINCE OF ONTARIO
AFTER WORK CARRIED OUT BY WHITE ROSE EXPLORATION SERVICES, CALGARY, ALBERTA.
NORTH SHEET
AMOCO CANADA PETROLEUM CO. LTD.
AMOCO
MINING DIVISION
ALDRIDGE PROJECT - AL CLAIMS
CRANBROOK AREA, BRITISH COLUMBIA
GROUND MAGNETIC MAP
Drawn By
d.o's
Scale
1:10,000
Date
May 1985
Project Nº.

FIGURE 3

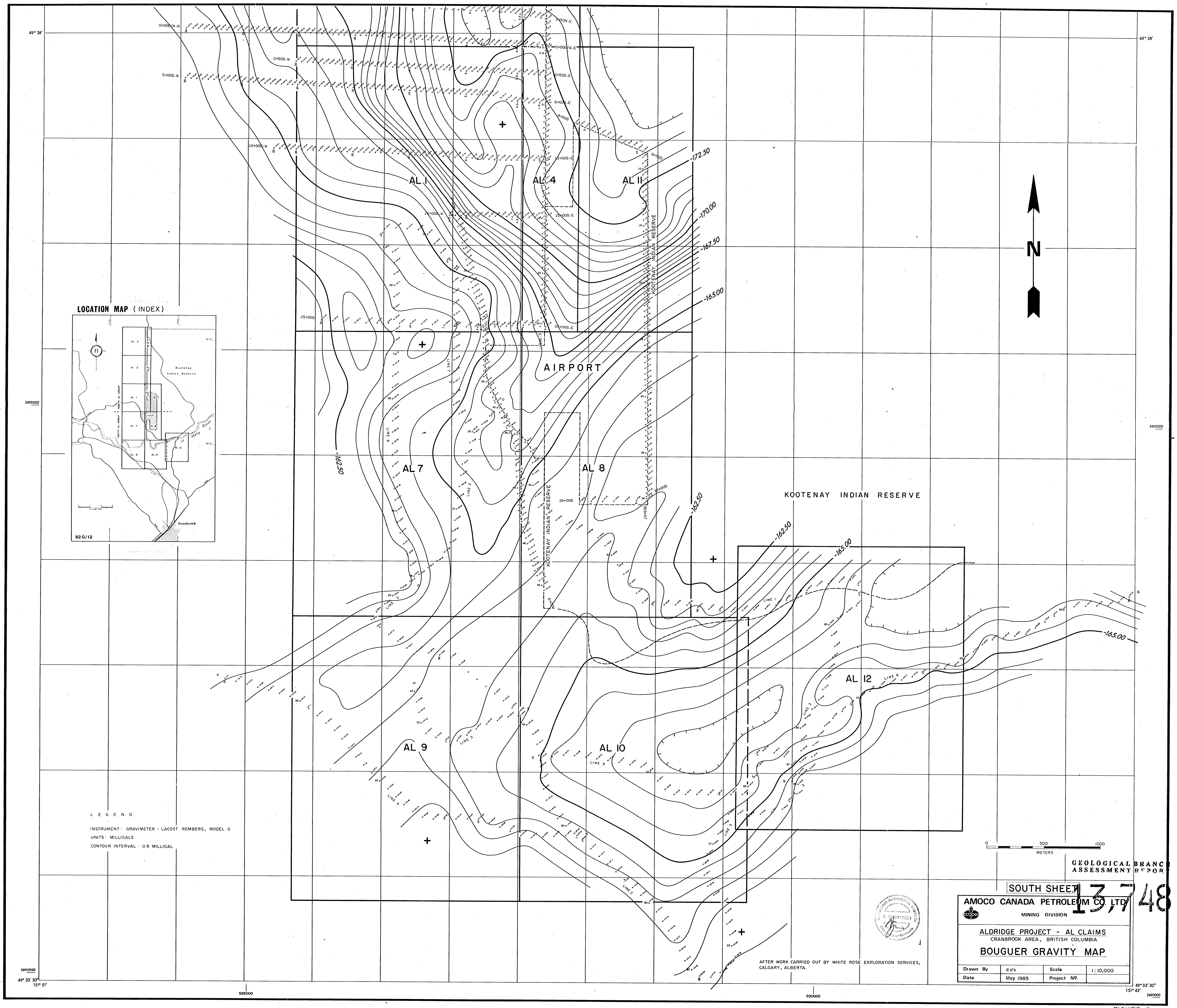
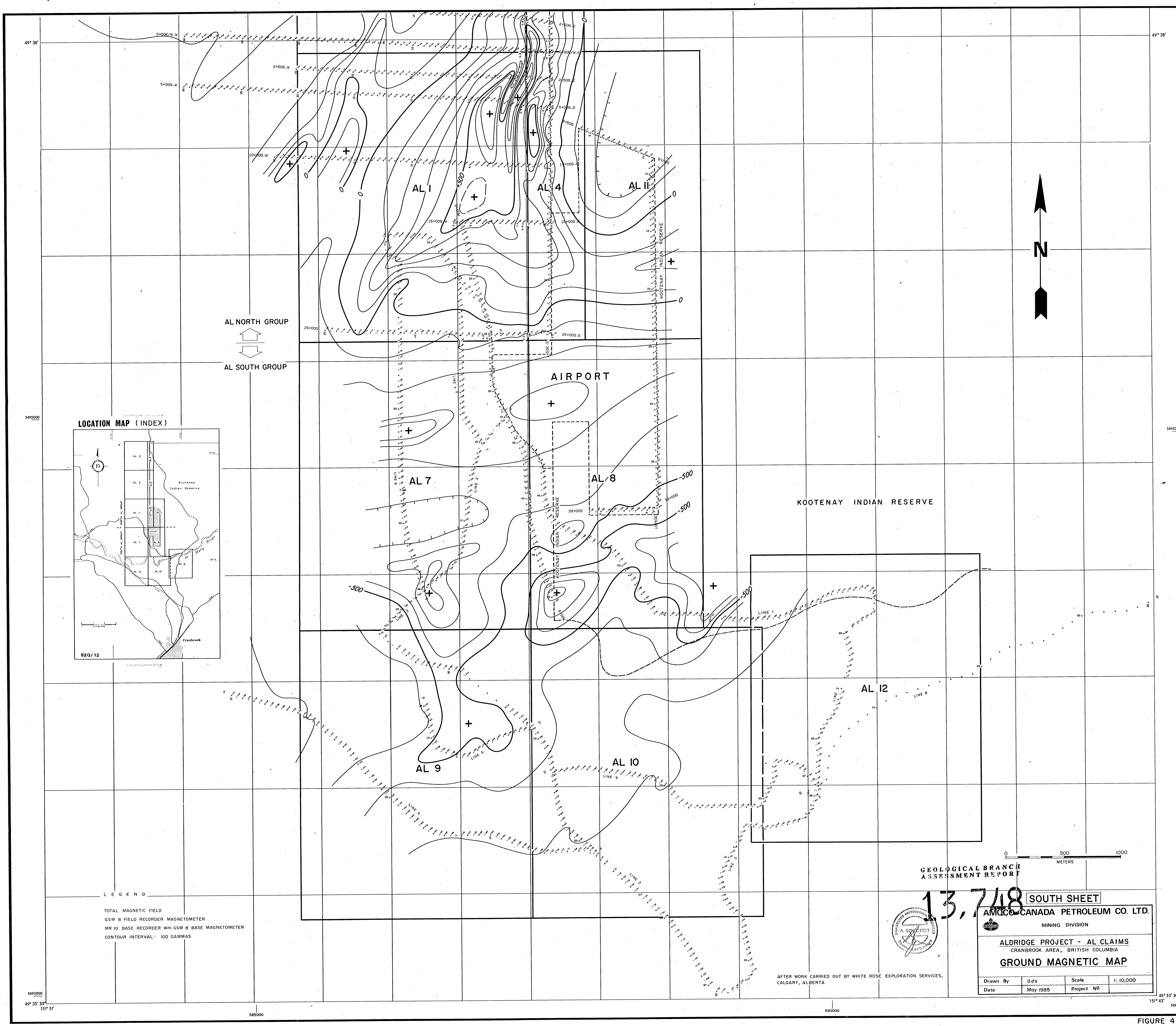
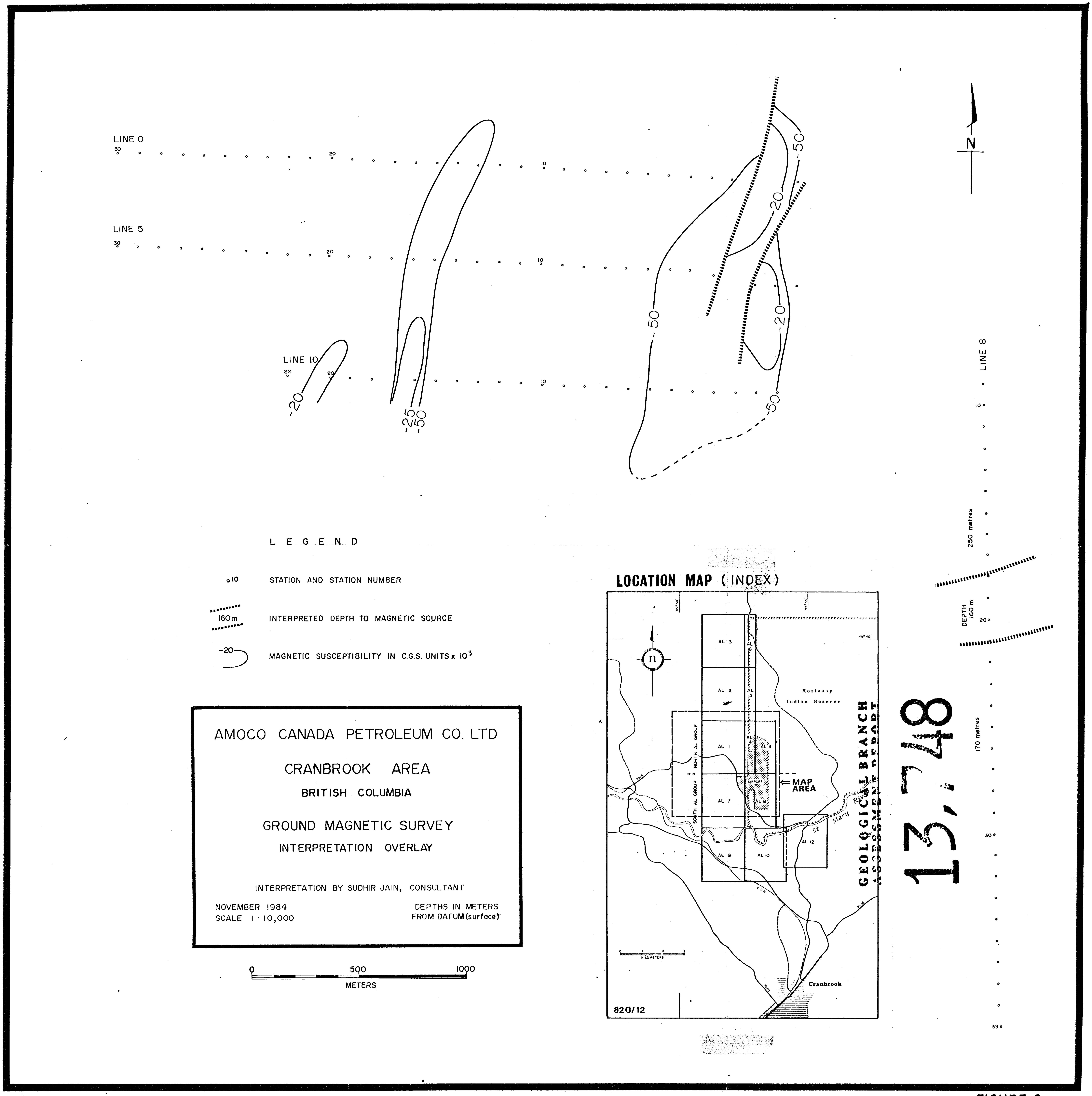

49° 38'
49° 38'
AL 1
AL 4
AL 11
AL 7
AL 8
AL 9
AL 10
AL 12
AIRPORT
KOOTENAY INDIAN RESERVE
KOOTENAY INDIAN RESERVE
KOOTENAY INDIAN RESERVE
-172.50
-170.00
-167.50
-165.00
-162.50
-162.50
-162.50
-165.00
-165.00
N
LOCATION MAP (INDEX)
Kootenay Indian Reserve
St. Mary River
Cranbrook
82G/12
L E G E N D
INSTRUMENT: GRAVIMETER - LACOST ROMBERG, MODEL G
UNITS: MILLIGALS
CONTOUR INTERVAL: 0·5 MILLIGAL
0 500 1000
METERS
GEOLOGICAL BRANCH
ASSESSMENT REPORT
13,748
SOUTH SHEET
AMOCO CANADA PETROLEUM CO. LTD.
MINING DIVISION
ALDRIDGE PROJECT - AL CLAIMS
CRANBROOK AREA, BRITISH COLUMBIA
BOUGUER GRAVITY MAP
Drawn By d.o's
Scale 1:10,000
Date May 1985
Project No.
AFTER WORK CARRIED OUT BY WHITE ROSE EXPLORATION SERVICES, CALGARY, ALBERTA.
A. SPECTOR
5495000
5490000
585000
590000
49° 33' 30"
151° 51'
151° 43'

FIGURE 6



49° 38'
AL NORTH GROUP
AL SOUTH GROUP
AL 1
AL 4
AL 11
AIRPORT
AL 7
AL 8
KOOTENAY INDIAN RESERVE
AL 12
AL 9
AL 10
N
LOCATION MAP (INDEX)
82G/12
Cranbrook
LEGEND
TOTAL MAGNETIC FIELD
GSM 8 FIELD RECORDER MAGNETOMETER
MR 10 BASE RECORDER With GSM 8 BASE MAGNETOMETER
CONTOUR INTERVAL: 100 GAMMAS
0 500 1000
METERS
GEOLOGICAL BRANCH
ASSESSMENT REPORT
13,748
SOUTH SHEET
AMOCO CANADA PETROLEUM CO. LTD.
MINING DIVISION
ALDRIDGE PROJECT - AL CLAIMS
CRANBROOK AREA, BRITISH COLUMBIA
GROUND MAGNETIC MAP
Drawn By d.o's
Scale 1:10,000
Date May 1985
Project No.
AFTER WORK CARRIED OUT BY WHITE ROSE EXPLORATION SERVICES, CALGARY, ALBERTA
A. SPECTOR
49° 33' 30"
151° 51'
151° 43'
585000
590000
5490000
5495000

FIGURE 4



LINE 0
LINE 5
LINE 10
LINE 8
-20
-25
-50
250 metres
DEPTH 160 m
170 metres
N
LEGEND
10 STATION AND STATION NUMBER
160m INTERPRETED DEPTH TO MAGNETIC SOURCE
-20 MAGNETIC SUSCEPTIBILITY IN C.G.S. UNITS x 10^3
AMOCO CANADA PETROLEUM CO. LTD
CRANBROOK AREA
BRITISH COLUMBIA
GROUND MAGNETIC SURVEY
INTERPRETATION OVERLAY
INTERPRETATION BY SUDHIR JAIN, CONSULTANT
NOVEMBER 1984
SCALE 1 : 10,000
DEPTHS IN METERS
FROM DATUM (surface)
0
500
1000
METERS
LOCATION MAP (INDEX)
Kootenay
Indian Reserve
MAP AREA
St. Mary
Cranbrook
82G/12
GEOLOGICAL BRANCH
13,748

FIGURE 8

115 51'
49 40'
49'
48'
47'
115 46'
39'
38'
37'
36'
49 35'
LEGEND
magnetized zone
estimated maximum depth in meters
gravity anomaly zone
interpreted fault
D
U
20N
10N
5N
2-50N
0S
2-50S
5S
10S
25S
39S
1-50E
10-50E
ALFA LOW
Zone M1
Prospect A
ALFA LOW
Zone M2
Zone M1
600γ
600γ
200γ
1200γ/2mgal
-20mgal
Prospect B
Prospect C
Zone M3
ZoneM4
Zone M5
St. Mary River Low
LOCATION MAP (INDEX)
MAP AREA
Kootenay Indian Reserve
Cranbrook
82G/12
Figure-2
AMOCO CANADA PETROLEUM COMPANY LTD.
Gravity / Magnetic Interpretation
Cranbrook Area
scale: 1:10,000
date Jan., 1985
0 500 1000
METERS
INTERPRETATION BY
AS ALLAN SPECTOR AND ASSOCIATES LTD.
160 Duncan Mill Road, Don Mills, Ontario, Canada M3B 1Z5
REGISTERED PROFESSIONAL ENGINEER
A. SPECTOR
PROVINCE OF ONTARIO
GEOLOGICAL BRANCH
ASSESSMENT REPORT
13,748

FIGURE 7