ARIS SUMMARY SHEET

District Geologist, Victoria   Off Confidential: 89.04.18

ASSESSMENT REPORT 17580   MINING DIVISION: Nanaimo

PROPERTY: Apple
LOCATION: LAT 50 37 39   LONG 127 32 56
UTM 09 5609188 602638
NTS 092L11W 092L12E
CLAIM(S): Apple 2-5,Juno,Mimas,QL 1-2,Lake,Ruby,F 1-15,Ken 1-8,Bob 1-2
Bay 52-63,Kol 1 Fr.-9Fr.,Kol 15-38,Coir 1-3,Cove 17-20
M 34 (L.2145)
OPERATOR(S): BHP-Utah Mines
AUTHOR(S): Clarke, G.A.
REPORT YEAR: 1988, 53 Pages
GEOLOGICAL
SUMMARY: The area is underlain by the Upper Triassic to Lower Jurassic volcanic and sedimentary succession of the Vancouver and Bonanza Groups and Cretaceous sedimentary cover. Middle Jurassic granodioritic stocks (Quatse stock) and quartz-feldspar porphyry dykes cut the gently southwestward dipping succession. Copper and molybdenum are mined from the Bonanza Group east of the claims.
WORK
DONE: Geophysical
EMAB 390.0 km;VLF
Map(s) - 2; Scale(s) - 1:12 000
MAGA 390.0 km
Map(s) - 6; Scale(s) - 1:12 000
RELATED
REPORTS: 17581
MINFILE: 092L 099,092L 135,092L 136,092L 137

LOG NO. 0913	RD.
ACTION:	
FILE NO:	

TABLE OF CONTENTS

1.0 INTRODUCTION

On February 22 and 23, 1988 a helicopter borne magnetic and VLF survey covering 390 line km was flown over an area extending west from the Island Copper Mine to Wanokana Creek. The survey covered roughly 60 square km on the Quatse 88, Apple 88 (now expired), KOL 89 and CENTRAL 89 groups. The notices to Group for these groups are attached as Appendix I describing the claims contained therein. This work forms part of the ongoing mineral exploration program in the area for 1988.

2.0 LOCATION AND ACCESS

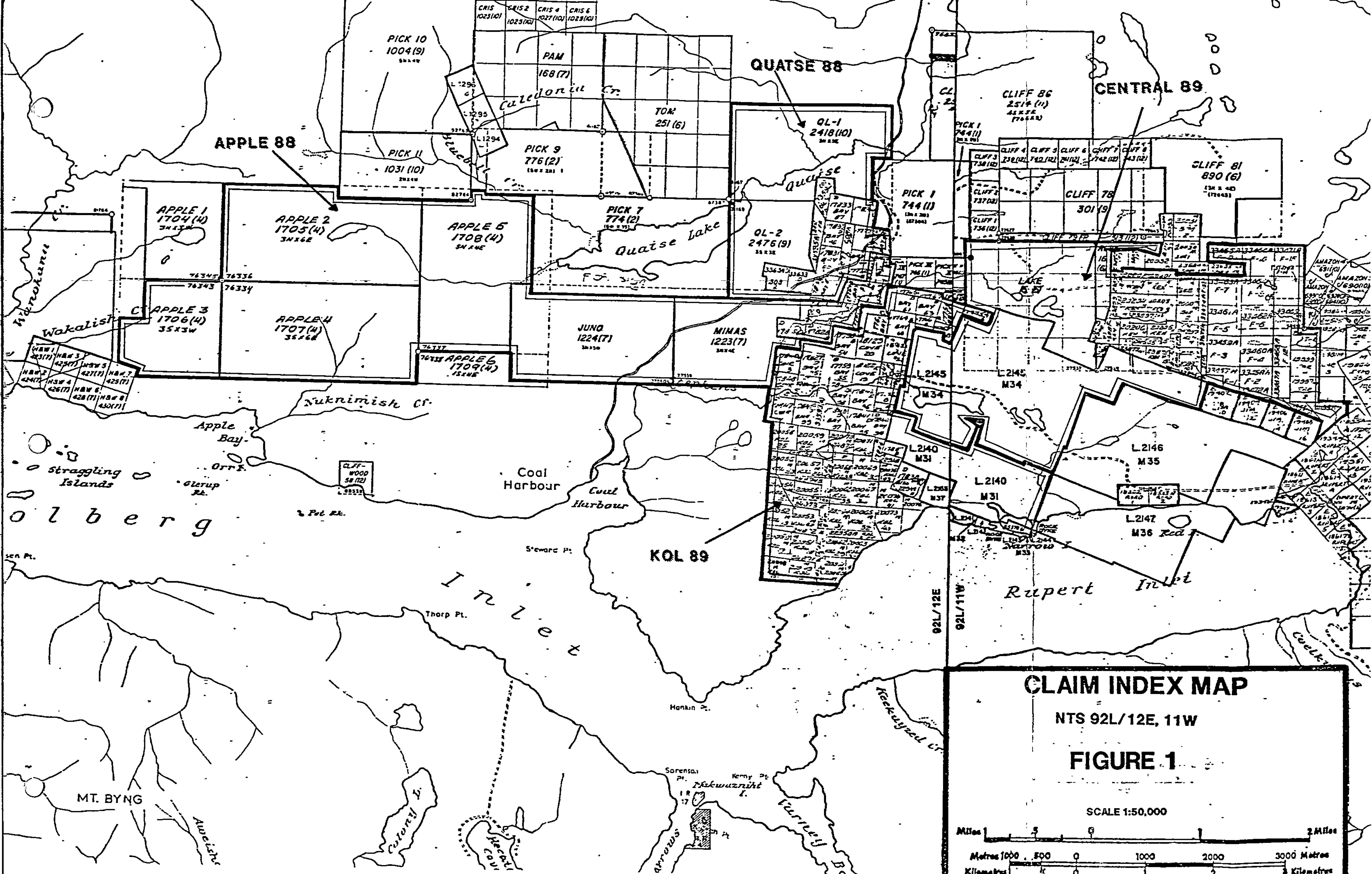
The claim group is located in the Nanaimo Mining Division with co-ordinates 50 degrees 37 1/2' N and 127 degrees 32' W. It is located on the NTS map sheets 92L/12E and 92L/11W and borders on the west boundary of the BHP-Utah Mines Ltd. mineral leases, some 8 km south of Port Hardy (Fig 1). Ground access is provided part way by paved highway from Port Hardy and the remainder by logging roads suitable for two wheel drive vehicles. The aircraft operated out of the Port Hardy airport 15 km NE of the survey area.

3.0 PHYSIOGRAPHY

The area is characterized by low to moderate rolling hills with a maximum relief of 210 meters. The Stephen's Creek cuts across the east end and drains into Coal Harbour while Nukinimish Creek drains from Quatse Lake through the central part of the group and into Apple Bay.

4.0 PREVIOUS WORK

Recent work by BHP-Utah has included mapping, VLF/Mag, I.P. and geochem surveys, and diamond drilling east and northeast of the Mimas and Juno claims, and mapping and a reconnaisance road mag-VLF survey over the remainder of the group.



CLAIM INDEX MAP

NTS 92L/12E, 11W

FIGURE 1

5.0 OBJECTIVES

The Airborne survey was initiated primarily to provide magnetic coverage over the western portion of the Island Copper Claim Group in order to focus further exploration effort on higher priority areas. Specifically, complete coverage was required over the Apple Claims, detailed coverage was required over Bay Lake where the gaps exist in the data, and coverage was required on the KOL claims. A VLF receiver was included as part of the instrument package and the information was recorded and analysed.

6.0 WORK PERFORMED

Aerodat Ltd. of Mississauga, Ontario was contracted to perform helicopter borne magnetic and VLF surveying on 390 km of lines west of Port Hardy. Their report on logistics and instrumentation is attached as Appendix II, and includes the map presentation of the data.

7.0 RESULTS - Summary and Recommendation

Both the Magnetics and the VLF have fulfilled their primary purpose of focussing further exploration efforts on prospective areas. Known associations of geology and mineralization from areas adjacent to the mine can be extrapolated to less well understood areas farther west. Despite limited surface geological alterations, the magnetics in particular indicate the potential on the Apple claims for additional intrusive systems which require further investigation to determine their economic potential.

Ground follow-up of this survey will be required. Initially sufficient ground magnetics will be required to positively identify the ground location of the anomalies. Detailed surface mapping will be required to prioritize drill targets. From the geophysical evidence, the primary targets should be the intersections of anomalies M3 and M5 and anomalies M6 and M5. (The eastern anomalies offer superior geophysical targets but most have already been drill tested).

7.1 MAGNETIC SURVEY

The magnetic survey wholly or partially delineated approximately nineteen distinct anomalously magnetic zones. Many of the easternmost zones - anomalies M12, M14 through M18, and M20 have previously been recognized and are relatable in part to known geological features. The most noteworthy of these is anomaly M20 which is the westernmost extremity of the magnetic anomaly which led to the discovery of Island Copper. This association of magnetics with the copper orebody provides the impetus for performing magnetic surveying.

The anomalies are identified on Fig 3. Selected anomalies have been modelled using a computer routine called MAGMOD. This gives a general indication of the thickness, dip, location and depth of burial of a possible source for the anomaly. This information is also shown on Fig 3. Because of the approximations made and the simple models employed, the calculated anomalies are only rough estimates.

Some of the anomalies form systems interrelated by either underlying geology or by location.

Anomalies M13, M14 and M20 are underlain by known intrusive bodies and anomalies M15 and M16 are suspected to be intrusive related as well. Surface mapping and core logging indicates that the usual cause of high magnetics is magnetite alteration of volcanics adjacent to intrusives. The intrusives themselves occasionally contain magnetite but this frequently is also an alteration by later intrusive phases.

Anomalies M12, M17 and M18 and probably anomaly M10 lie superjacent to the contact between the Kamutsen Formation volcanics and overlying Quatsino Formation limestone. The possibility exists that these features may represent skarn development in the the limestone. However, no geological evidence for this exists in outcrop except for recrystallization (marblization) of the limestone near anomaly M12. The modelling results for anomaly M17 indicate a quite magnetic source corresponding well in location and dip with the Quatsino formation, but evidence of mineralization is absent in outcrop. Anomalies M10, M17 and M18 likely represent stratigraphic variations in the magnetic properties of the Karmutsen volcanics - a positive magnetic anomaly is common in the mine area at this contact.

Anomalies M1 through M9 and M11 were not recognized prior to this survey. Anomalies M2, M5 and probably M7 form a linear claim running at az 30, cross cut by anomalies M3, M4 and M6 trending at az 105-110. No underlying cause is currently known for these anomalies, and surface geological mapping reveals only weak regional type greenschist alterations. However, the geometry of these anomalies suggests an underlying structural cause. By analogy with the better understood eastern anomalies, the potential sources for these anomalies are intrusive related hydrothermal alteration and/or increased primary (?) magnetization of the (Karmutsen) volcanics. Accordingly the anomalies likely represent a structural deformation, eg. doming of the Karmutsen basement, or the presence of intrusives. Regional trends on the property suggest that narrow intrusive bodies tend to run ESE/WNW to E/W. Coupled with the presence of the "Wanokana" Intrusive (Muller et al 1974) northwest of the Apple 1 claim, this supports an intrusive related origin for anomalies M3, M4 and M6. A structural origin for anomalies M2, M3 and M5 is suggested by the correspondence of this trend direction with one of the major regional faulting directions.

The remaining anomalies - M1, M8, M9, M11 and M13 are all isolated features. Anomaly 1 has some surface indication of possible hydrothermal alteration (a small zone of silicification) suggesting an underlying intrusive origin. The modelling results indicate a weakly magnetic source at considerable depth.

Anomaly M13 and part of anomaly M10 overlie the "Quatse" quartz diorite stock (Coal Harbour Instrusive of Muller et al, 1974). No evidence of metallization has been associated with this intrusive to date so no economic significance is accorded this anomaly.

7.1 MAGNETIC SURVEY (cont'd)

Anomalies M9, M11 and M19 all require additional work to determine potential origins. Anomalies M9 and M11 lie within the Bonanza group, but, as with anomalies M2 through M7, limited surface mapping has revealed only minimal alteration. Additional surface work will be required to determine the economic potential of these areas. Anomaly M19 is overlain by Cretaceous sedimentary cover and modelling results suggest a deeply buried source. No economic interest is indicated.

7.2 VLF SURVEY

As mentioned previously, the survey was flown primarily to obtain magnetic information. Since some structural information has been obtained from VLF surveys in the past, this information was analysed as well.

In examining the data, several linear features were noted as identified on Fig 3. Initial examination of these features indicated a possible correlation with topography. Closer examination revealed that variations in VLF are linked to sensor height (a function of topography, aircraft speed and direction, height of trees, etc.) The correlation with altimeter indicates that the ground has a fairly uniform VLF signature and as the sensor height above ground decreases a higher VLF value is recorded. An attempt to quantify this subjective correlation was made using statistical techniques, but these processing results were not very successful.

The other significant feature to note in the data is that the amplitude of anomalies is quite small mostly within the -5 to +7 range. Coupled with the uncertainties arising from the correlation with the altimeter, this fact suggests that the smaller amplitude features are uninterpretable at best and meaningless at worst.

As with the magnetic data, the easternmost VLF anomalies can be better correlated with known geology. Anomaly V6 overlies Parson Bay Formation shales and tuffs with the EM likely reflective of the sulphides and/or graphite within the shales.

7.2 VLF SURVEY (cont'd)

Anomaly V5 also overlies Parson Bay rocks but they are less graphitic at this location and the sulphides do not appear to form adequate electrical conductors to produce the anomaly."'

Anomaly V7 corresponds with the End Creek fault as mapped in the Island Copper pit, but also with a topographic ridge and altimeter low. Thus this feature is probably a reflection of the geology, distorted by elevation variations.

The string of positive anomalies through V4 and V5 may reflect an underlying structural feature. A fault is observed in outcrop southeast of the end of V4 and the feature correlates with a major fault from Muller et al 1974.

Anomaly V8 A and B may represent a contact between the Cretaceous Longarm and Queen Charlotte group clastic sediments, but it appears that the cliff at this location and the corresponding sensor height variations likely overshadow any effect from the contact. This contact has no economic significance to mine personnel and is not well studied.

Anomalies V1, V2 and V3 are not well understood and indicate the scope of required work. Anomaly V1 is the most persistent and merges with V2 at the east end of anomaly V2. At this junction point, the geology is suggestive of Parson Bay formation rocks. There are some interlamellar sulphides but little or no graphite. West of this point the geology is not well known, but the VLF may indicate a stratigraphic strike direction.

Anomaly V2 is parallel to V1 for the most part. Supporting the concept of a relation with lithology. The confluence of V1 and V2 at the east end may be a reflection of a fault.

The origin of anomaly V3 is also speculative, but is noteworthy to observe the magnetic anomaly M1 and a geological anomaly coincide with the strongest portion of this feature.

7.3 BIBLIOGRAPHY

Muller, J.E., Northcote, K.E., and Carlisle, D. 1974: Geology and Mineral Deposits of Alert Bay - Cap Scott Map Area. Vancouver Island, B.C.

8.0 COST STATEMENT

8.1 Contractor Costs:

Mobilization/De-mobilization	$ 5,000	
Survey Charges 390 km @ $50.00/km	$19,500	
Total Contractor Charges	$24,500	$24,500

8.2 Utah Costs:

Supervision, including contract preparation 2 days @ $155/day	$ 310	
Data processing, analysis and reporting 12 days @ $155/day	$ 1,860	
Overhead: 25% of above	$ 540	
	$ 2,710	$ 2,710
Total Cost		$27,210

9.0

STATEMENT OF QUALIFICATION

I submit that I am qualified to prepare and present this report for assessment credit. My qualifications are as follows:

G.A. CLARKE - GEOLOGIST
ISLAND COPPER MINE, BHP-UTAH MINES LTD, PORT HARDY B.C.

1. B.Sc. (Hons) Geophysics, 1976 from University of Manitoba.
2. Employed continuously in mineral exploration since 1976 as Geophysicist and/or Geologist.
3. Currently Geologist, Island Copper Mine.
4. Active Member of the Society of Exploration Geophysicists.

APPENDIX I

SUB-MINING RECORDER
$2,260.00
JAN 8 - 1988
PORT HARDY, B.C.

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

MINERAL ACT

FORM I

NOTICE TO GROUP

Mining Division NANAIMO Location RUPERT INLET

Name of group CENTRAL-89

We, the undersigned owners* of the following adjoining mineral claims, desire to group them according to the provisions of the *Mineral Act*:—

NAME OF CLAIM	Record No. or Lot No.	SIGNATURE OF OWNER*	Free Miner's Certificate No.
M-34 (35 CLAIMS)	L.2145		FLEMJA
LAKE (16 UNITS)	15		
RUBY (8 UNITS)	16		
KEN 1/8	20201/08		
KEN 13/14	23878/79		
SPAM 12 FR/13 FR	23893/94		
SPAM 16 FR/17 FR	23897/98		
SPAM 21 FR/22 FR	24505/06		
SLIM FR	37645		
F1/15	33457/71		
F1 FR.	33472		
F2 FR	1958		
F3 FR	33474		
KEY FR	34195		
TAR 2	19997		
TAR 4	19999		
TAR 6	20001		
BEE 1/2	20006/7		
		J.A. FLEMING	

* May be signed by agent on behalf of owner.

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

SUB-MINING RECORDER
SEP 21 1987
PORT HARDY, B.C.

MINERAL ACT

FORM I

NOTICE TO GROUP

Mining Division NANAIMO Location RUPERT INLET

Name of group QUATSE 88

We, the undersigned owners* of the following adjoining mineral claims, desire to group them according to the provisions of the *Mineral Act:*—

NAME OF CLAIM	Record No. or Lot No.	SIGNATURE OF OWNER*	Free Miner's Certificate No.
QL-1	2478		ROBERB
QL-2	2476		ROBERB
BOB 1/2	33633/34		FLEMJA
BEN 1 FR	33595		
BEN FR	33594		
BAY 84/88	17830/34		
CORK FR	31677		
BAY 68/69	17772/73		
BAY 70	17774		

* May be signed by agent on behalf of owner.

D. ATMEN… MINES AND PETROLEUM RESOURCES

MINERAL ACT

FORM I

SUB-MINING RECORDER
APR 21 1987
#1,790.00
PORT HARDY, B.C.

NOTICE TO GROUP

Mining Division NANAIMO Location RUPERT INLET

Name of group APPLE-88

We, the undersigned owners* of the following adjoining mineral claims, desire to group them according to the provisions of the *Mineral Act*:—

	NAME OF CLAIM	Record No. or Lot No.	SIGNATURE OF OWNER*	Free Miner's Certificate No
	BAR	27499	J.O.Fly	ELEMJA
	BAR FR.	27500		
	BAY 59	17763		
	BAY 56	17760		
	BAY 57	17761		
	BAY 82/83	17828/29		
	COIR ~~3~~/4	17849/50		
10	MIMAS	1223		
15	JUNO	1224		
9	APPLE 3	1706		
13	APPLE 2	1705		
19	APPLE 4	1707		
20	APPLE 5	1708		

{COIR 3 OUT OF GROUP - JUNE 26/87

23031 UTAH MINES LTD.
P.O. BOX 370, PORT HARDY, B.C., V0N 2P0

JOB NO.	VENDOR NO.	INVOICE NO.	INVOICE DATE MO. DAY YEAR	INVOICE AMOUNT	DISCOUNT	NET AMOUNT
		Notice to Group Apple - 88 and Record Work				$1,790.00**

* May be signed by agent on behalf of owner.

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

MINERAL ACT

FORM I

NOTICE TO GROUP

Mining Division Nanaimo Location Rupert Inlet

Name of group KOL-89

We, the undersigned owners* of the following adjoining mineral claims, desire to group them according to the provisions of the *Mineral Act*:—

NAME OF CLAIM	Record No. or Lot No.	SIGNATURE OF OWNER*	Free Miner's Certificate No.
KOL 3 FR	22250		FLEM JA
KOL 4FR / 9FR	24871/76		
KOL 1 FR	22948		
KOL 2 FR	22949		
KOL 15 / KOL 38	20048/71		
KOL 40/44	20073/77		
COIR 7	17886		
COIR FR.	17887		
BAY 92	17838		
COIR 1/3	17847/49		
LONG FR	33593		
ART 6 FR.	27441		
ART 10 FR	27497		
COVE 17/20	18120/23		
BAY 22	17726		
BAY 50	17754		
BAY 52/55	17756/59		
BAY 58	17762		
BAY 60/63	17764/67		
BAY 81	17827		
BAY 94/100	17840/46		
M 37	L.2155		
M32	L.2141		
DAM FR	35370		
ART 4	27229		
M33	L2143/44		
M31	L.2140		

* May be signed by agent on behalf of owner.

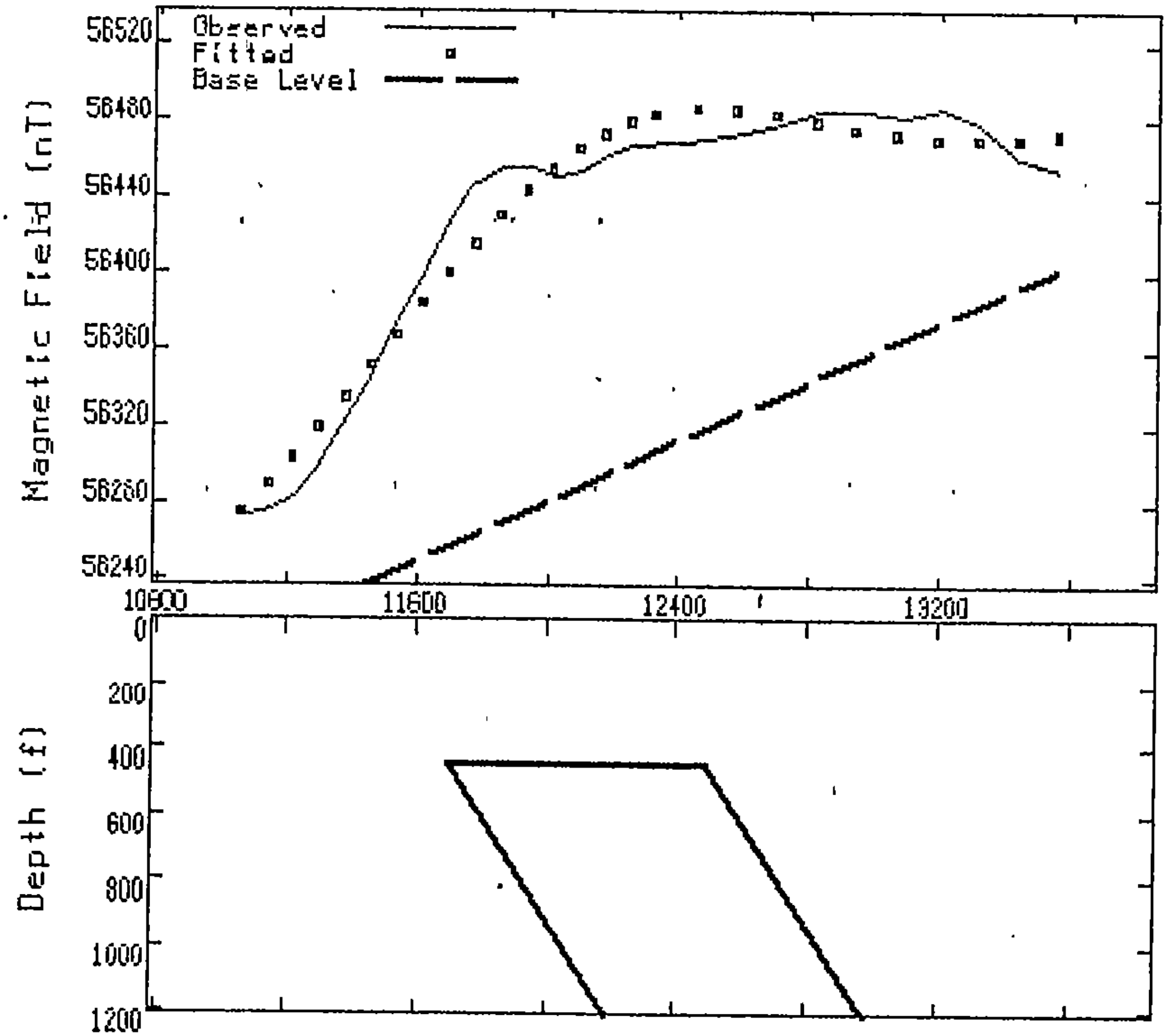
APPENDIX II

(see attached folder for Aerodat Report)

APPENDIX III

Anomaly 88-M1

Line 70



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Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	12095.3 f
Base Level	F	56288.83 nT
Base Slope	F	.078493 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

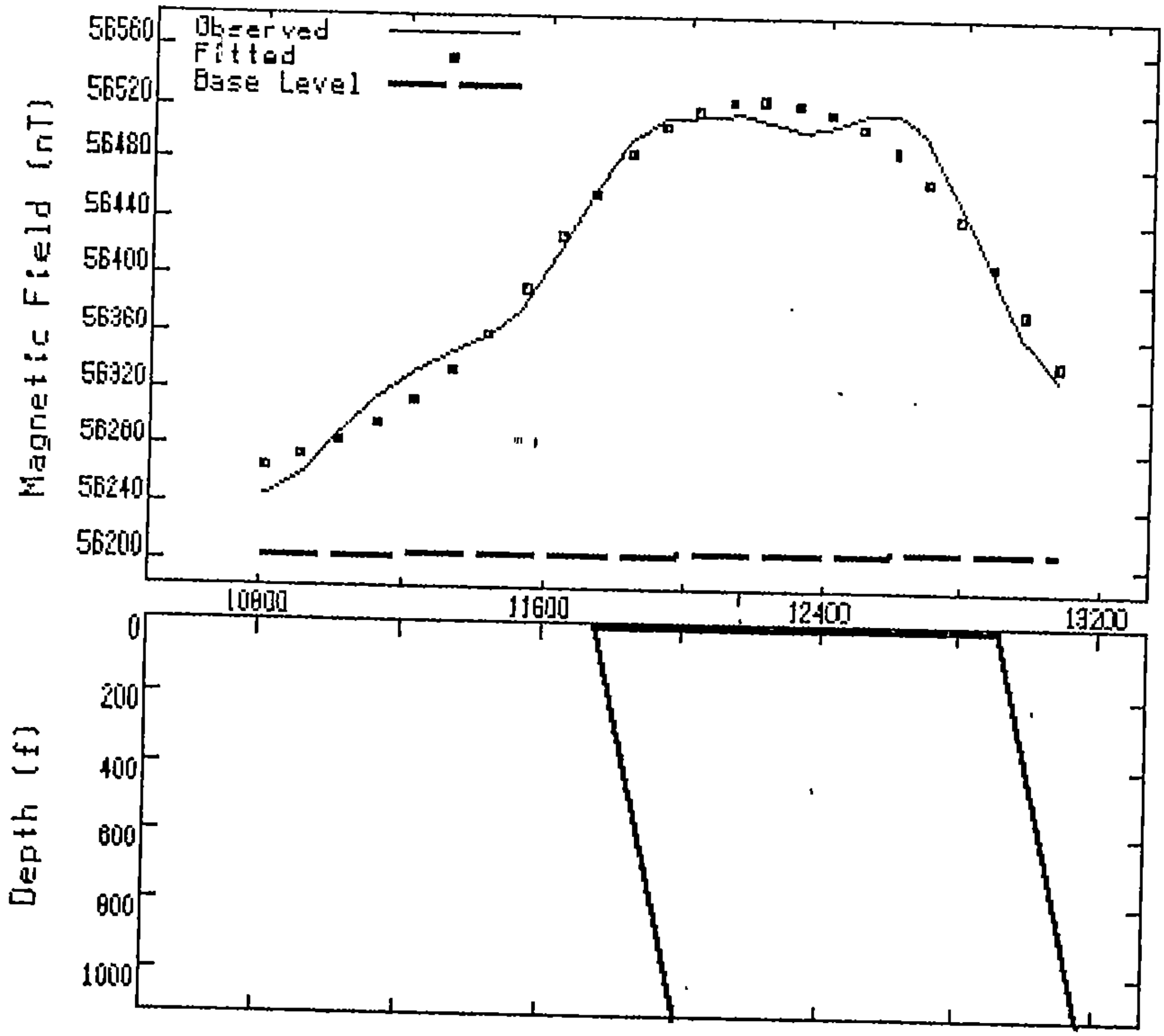
PLAN DIRECTIONS:

Strike Perp	-20 deg
Line Direction	1.2 deg

Sensor Height 520 f

Geosoft MAGMOD-3 Modelling Result 88/06/03

Anomaly 88-M1
Line 80



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Half Width	F	566 f
Dip	F	78 deg
Susceptibility	F	0.00147 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	12333.09 f
Base Level	F	56207.43 nT
Base Slope	F	.0031993 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

PLAN DIRECTIONS:

Strike Perp	-27 deg
Line Direction	.2 deg

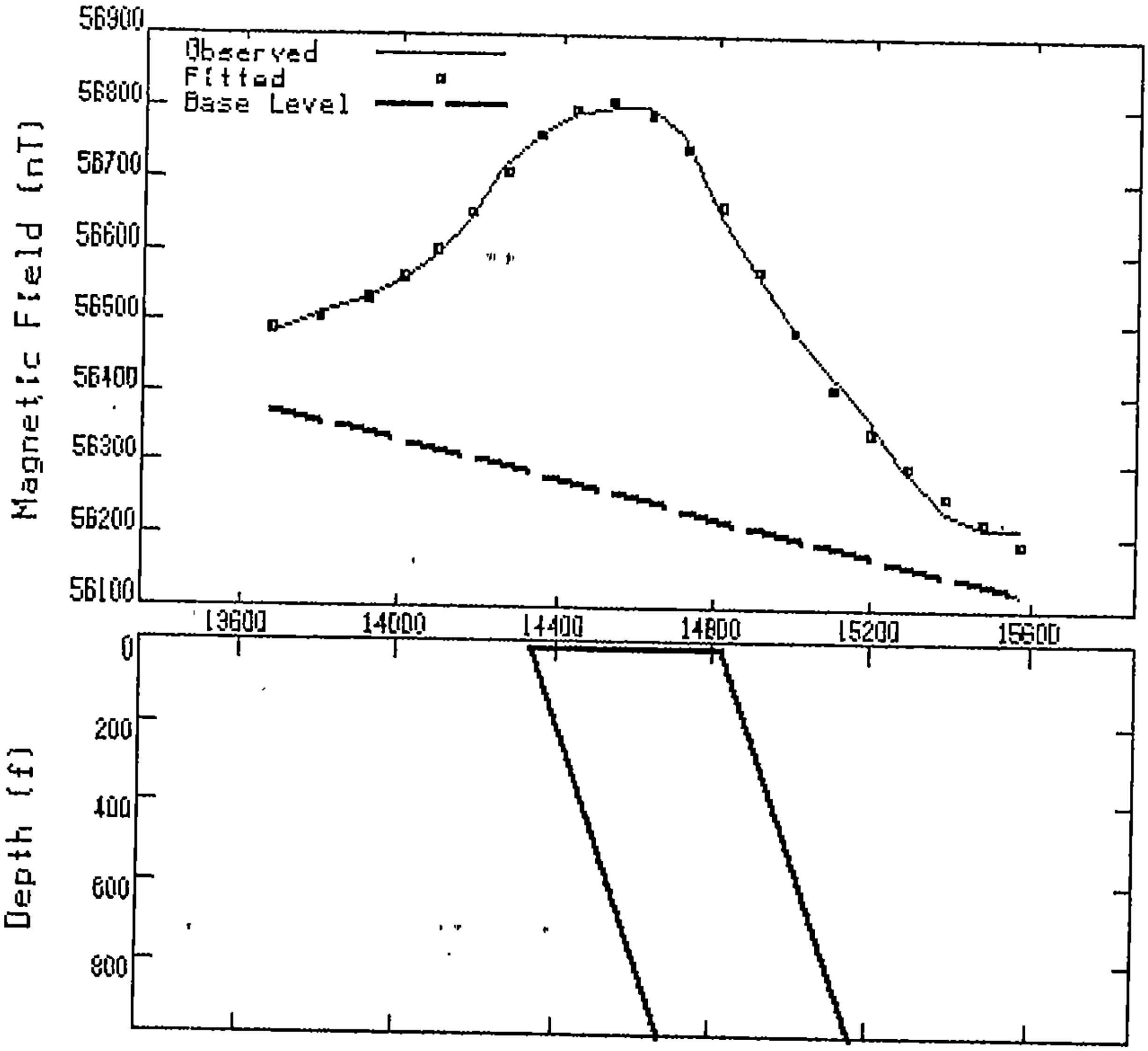
Sensor Height 330 f

Geosoft MAGMOD-3 Modelling Result

88/06/03

Anomaly 88-M2

Line 70



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Remnance Decl	X	0 deg
Position	F	14579.96 f
Base Level	F	56252.17 nT
Base Slope	F	-.1324755 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

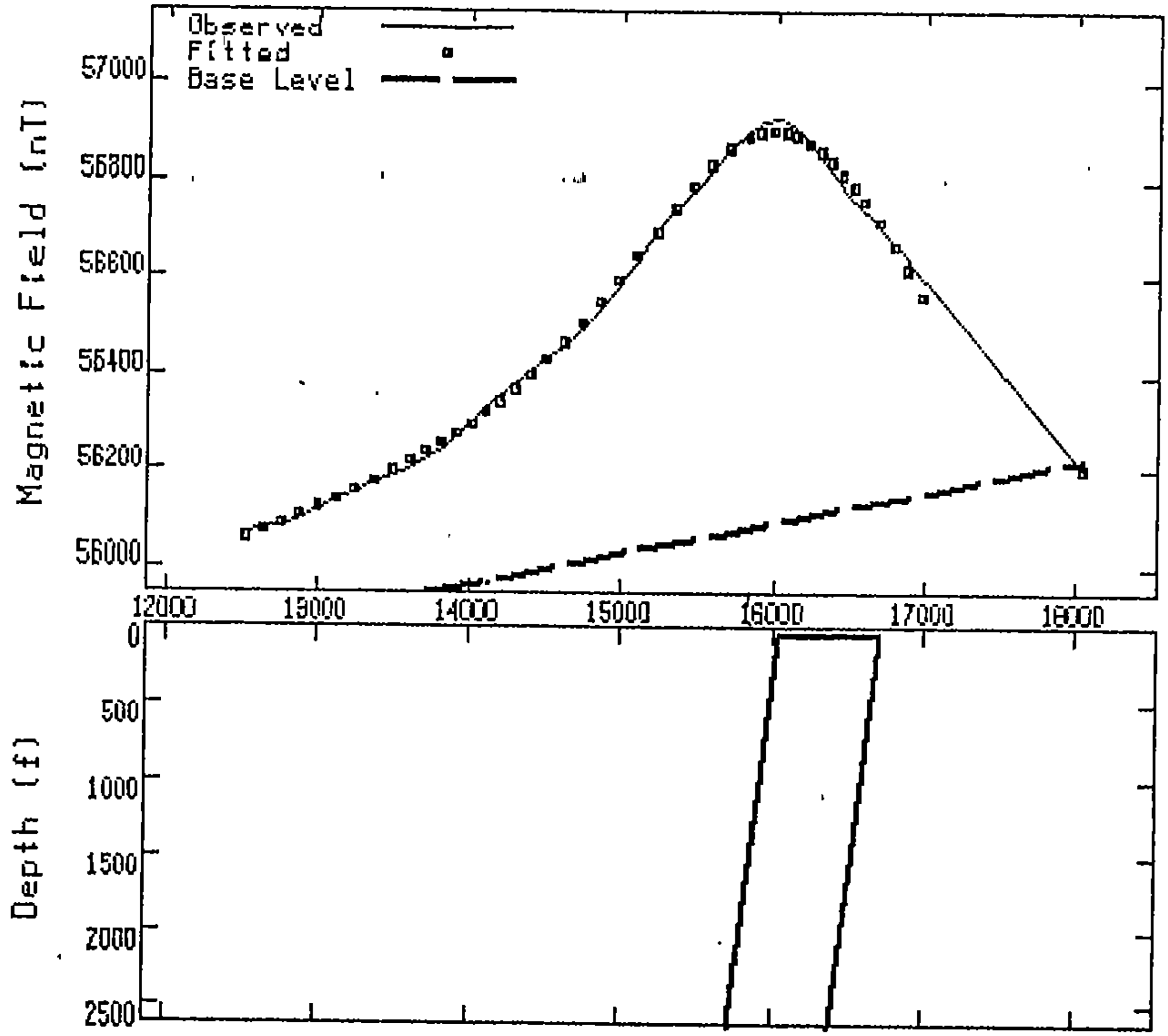
Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

PLAN DIRECTIONS:

Strike Perp	-27 deg
Line Direction	1,2 deg

Sensor Height 320 f

Anomaly 88-M3
Line 120



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Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	16371.39 f
Base Level	F	56117.45 nT
Base Slope	F	.0632949 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

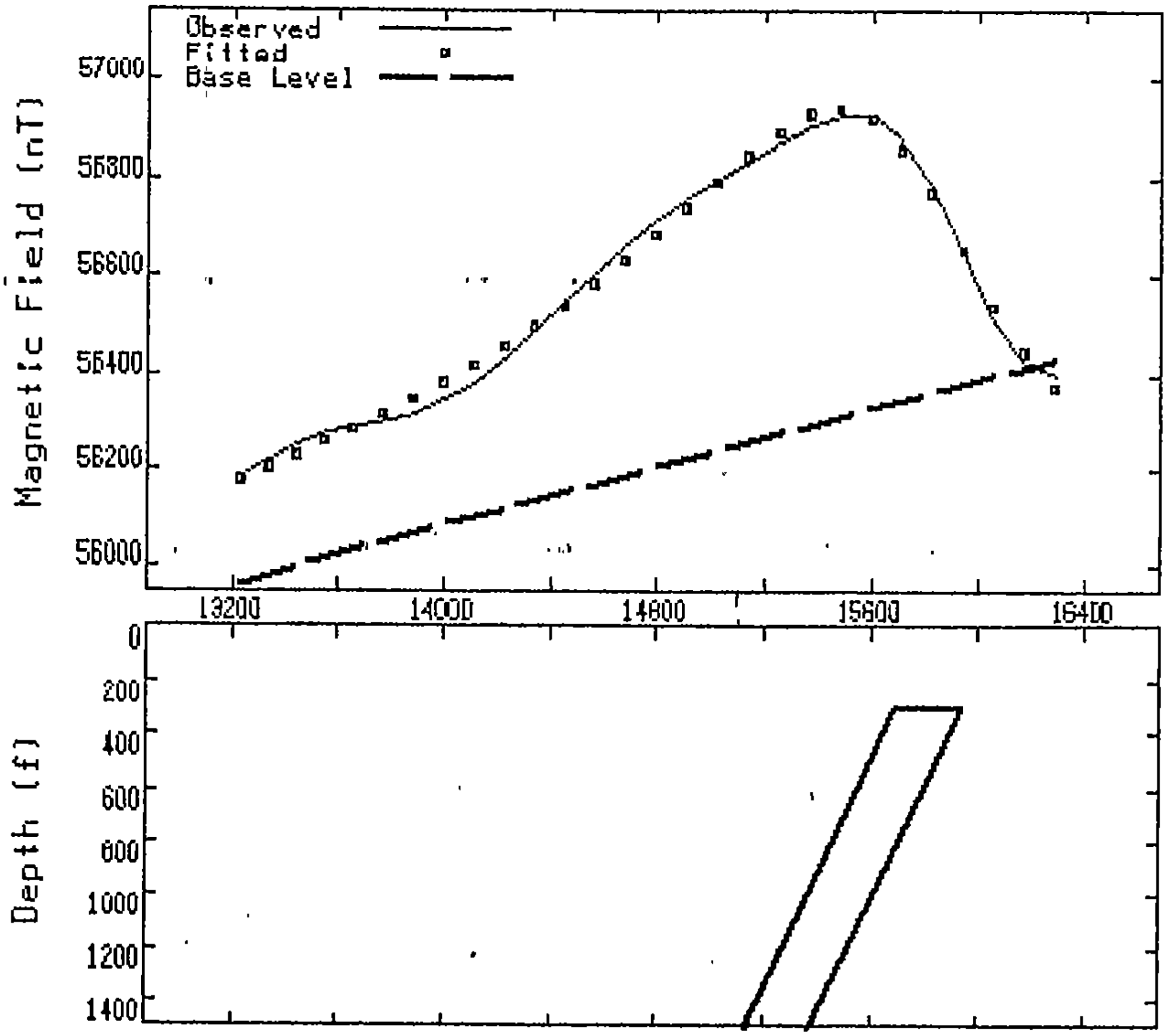
Field Strength	55000 nT
Inclination	72 deg
Declination	24 deg

PLAN DIRECTIONS:

Strike Perp	68 deg
Line Direction	0 deg

Sensor Height 340 f

Anomaly 88_m3
Line 140



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Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	15814.37 f
Base Level	X	56364.54 nT
Base Slope	X	.1538187 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

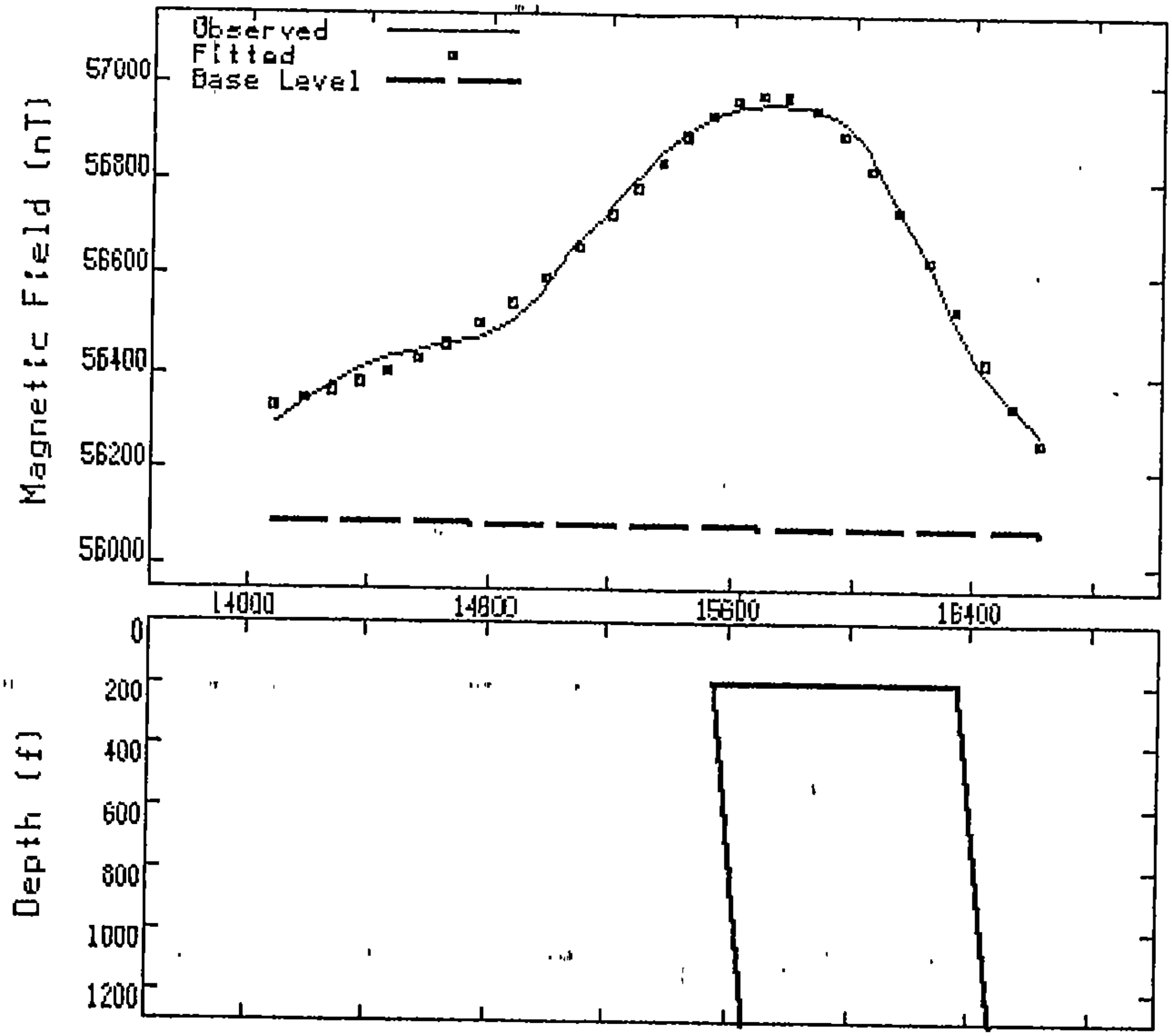
PLAN DIRECTIONS:

Strike Perp	24 deg
Line Direction	2 deg

Sensor Height 330 f

Anomaly 88_m3

Line 150



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Remnance Decl	X	0 deg
Position	F	15951.09 f
Base Level	F	56078.78 nT
Base Slope	F	-.0067819 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

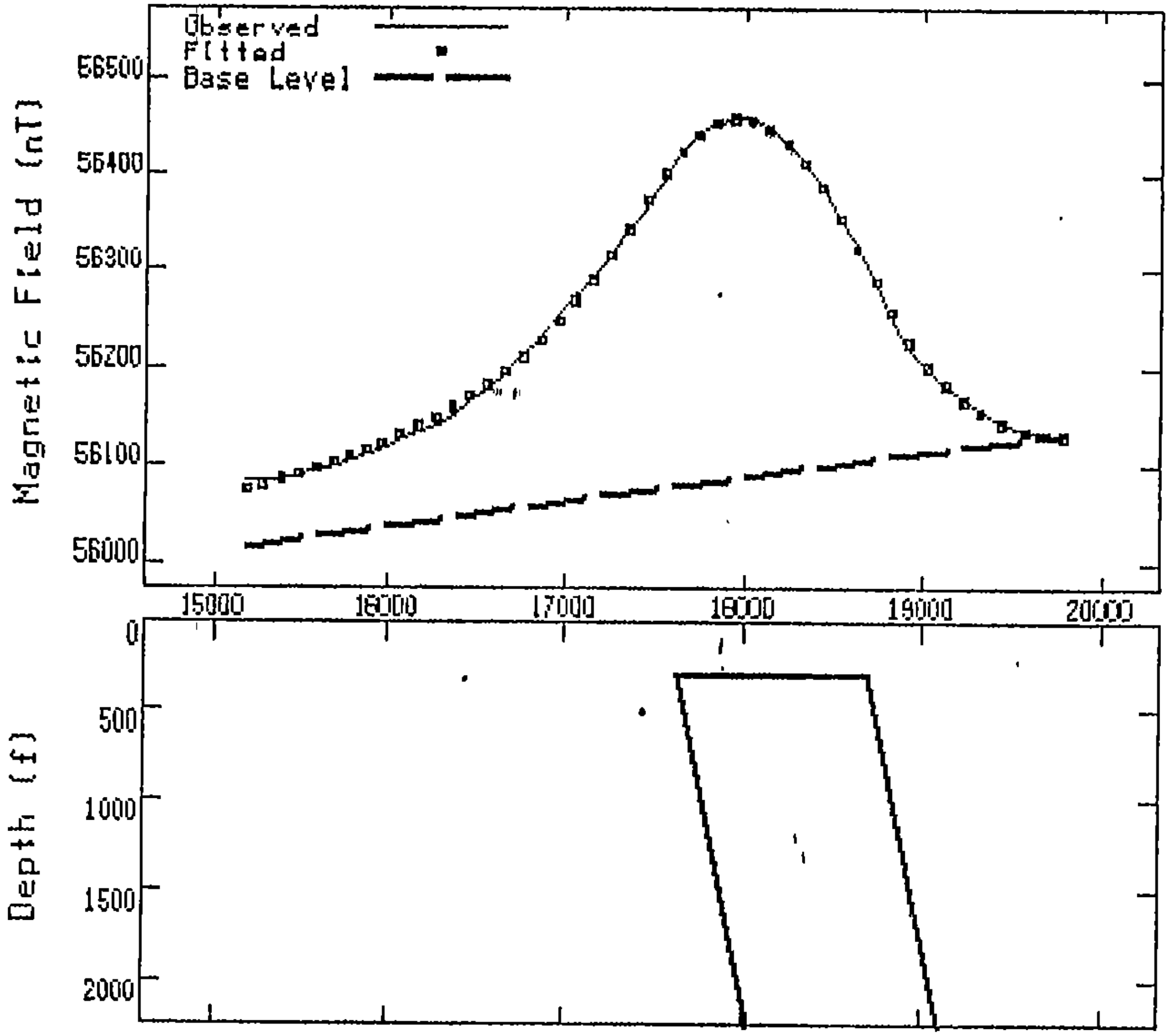
Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

PLAN DIRECTIONS:

Strike Perp	24 deg
Line Direction	.2 deg

Sensor Height 330 f

Line 30 - North anomaly 88-M4



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Dip	F	78 deg
Susceptibility	F	0.00233 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	18157.25 f
Base Level	F	56094.14 nT
Base Slope	F	.0256918 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	57000 nT
Inclination	72 deg
Declination	24 deg

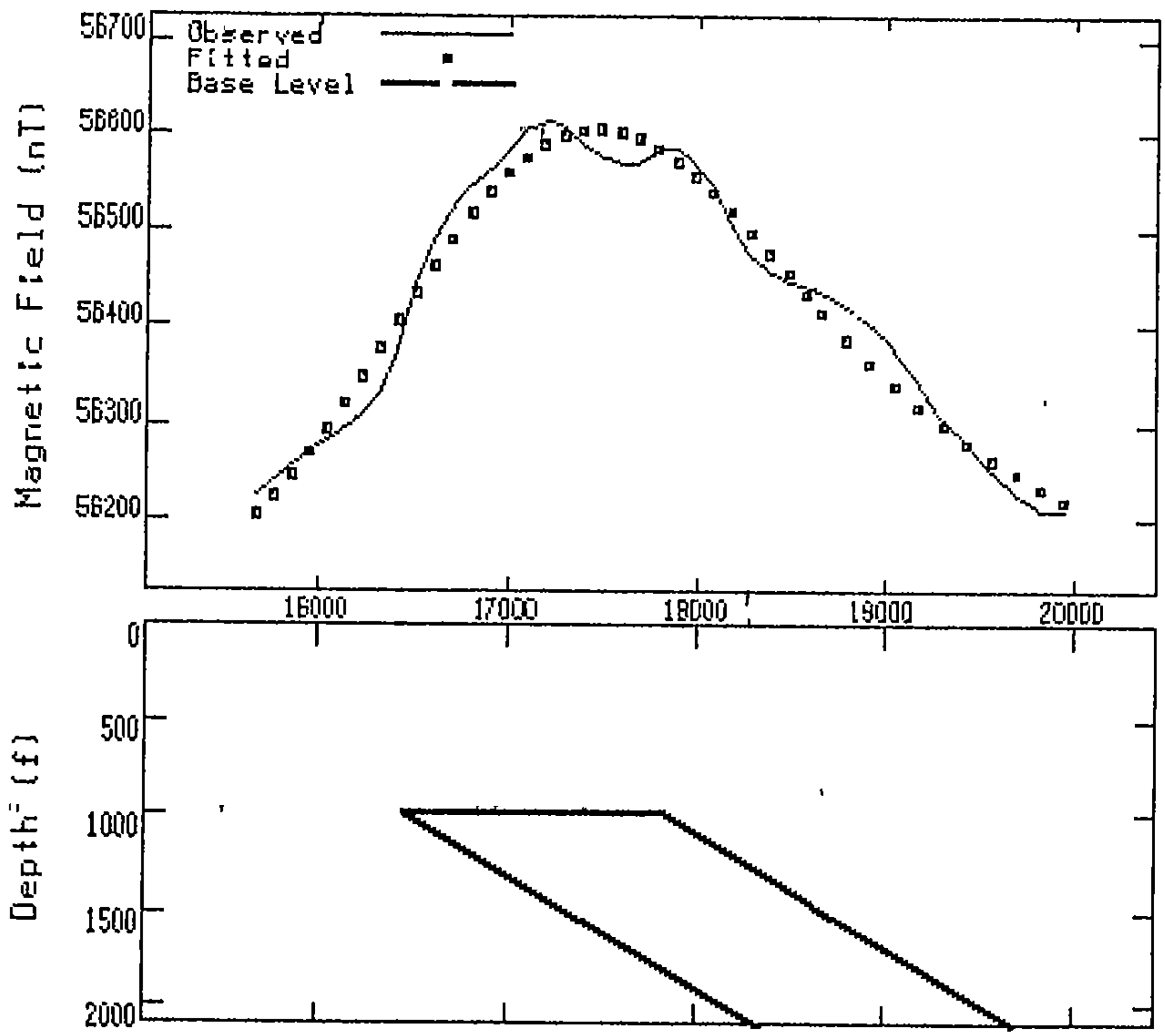
PLAN DIRECTIONS:

Strike Perp	20 deg
Line Direction	1 deg

Sensor Height 300 f

Anomaly 88-M4

Line 70



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Dip	F	31 deg
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Remnance Decl	X	0 deg
Position	F	17125 f
Base Level	F	56025.29 nT
Base Slope	F	-.0095982 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

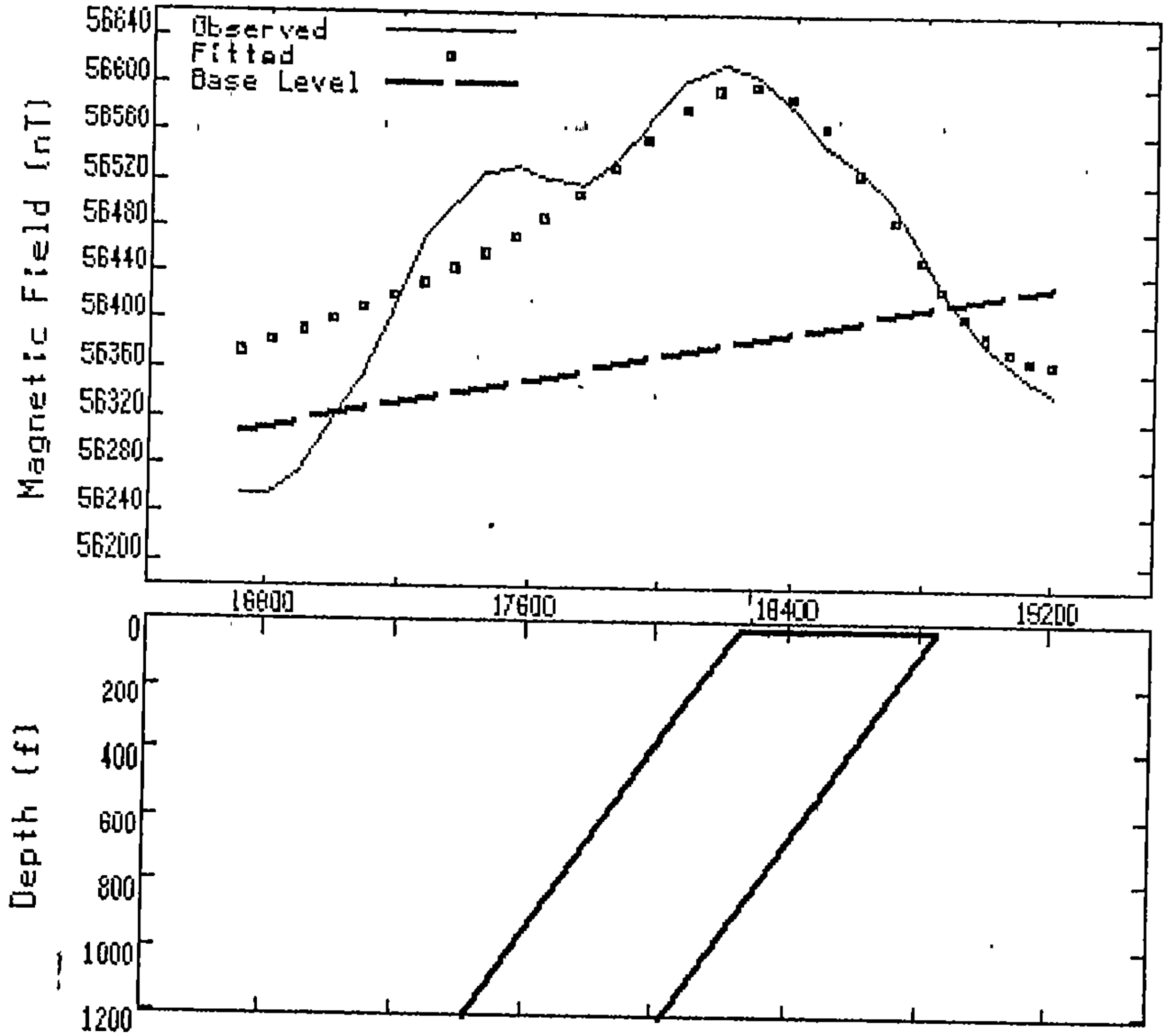
PLAN DIRECTIONS:

Strike Perp	18 deg
Line Direction	1.2 deg

Sensor Height 320 f

Anomaly 88_M5

Line 150



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Dip	F	125 deg
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Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	18553.44 f
Base Level	X	56400 nT
Base Slope	X	.05 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	56700 nT
Inclination	72 deg
Declination	24 deg

PLAN DIRECTIONS:

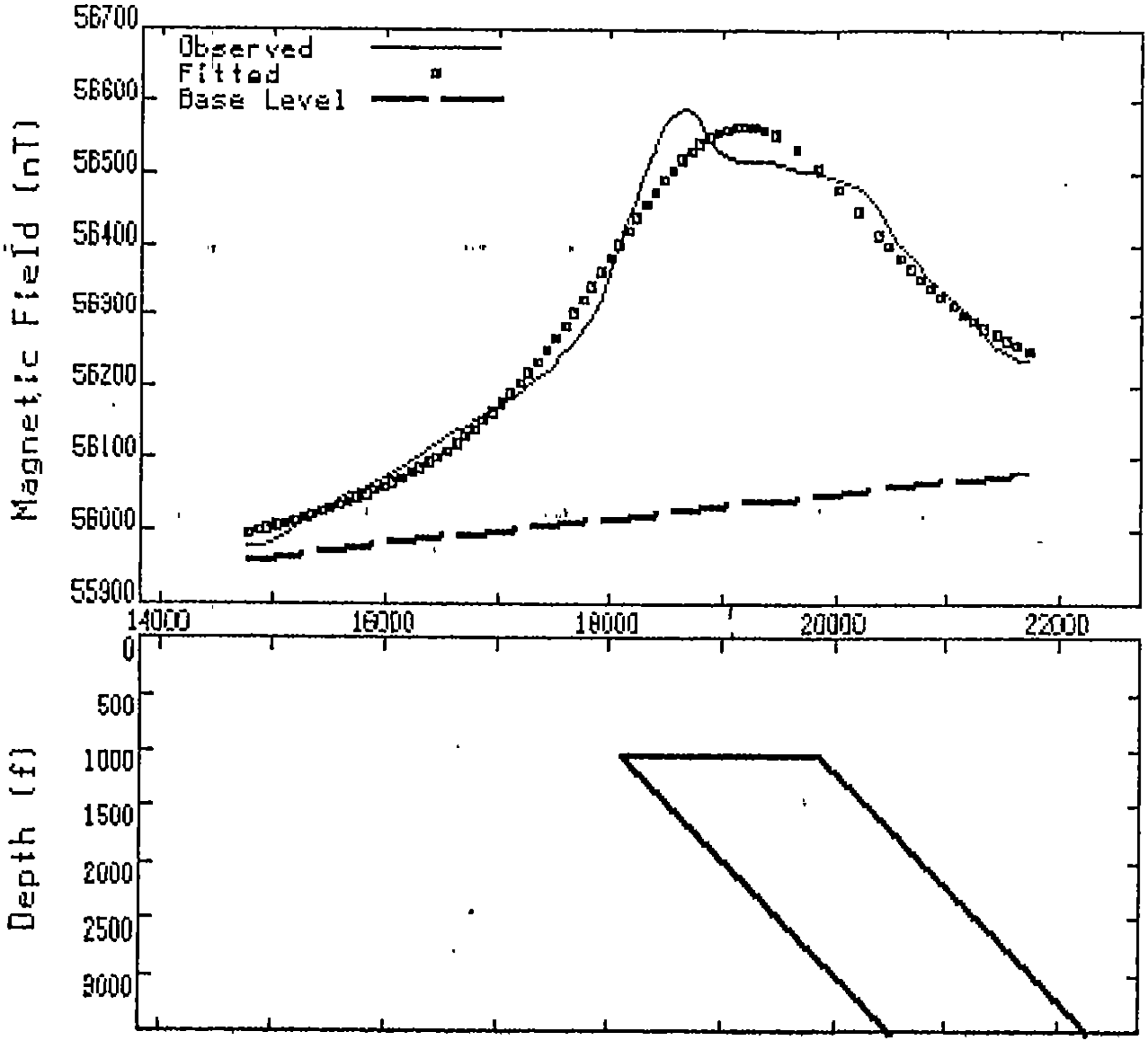
Strike Perp	-28 deg
Line Direction	2 deg

Sensor Height 530 f

Geosoft MAGMOD-3 Modelling Result 88/06/03

Anomaly 88-M6

Line 210



MODEL PARAMETERS:

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Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	18976.61 f
Base Level	F	56034.64 nT
Base Slope	F	.0172328 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

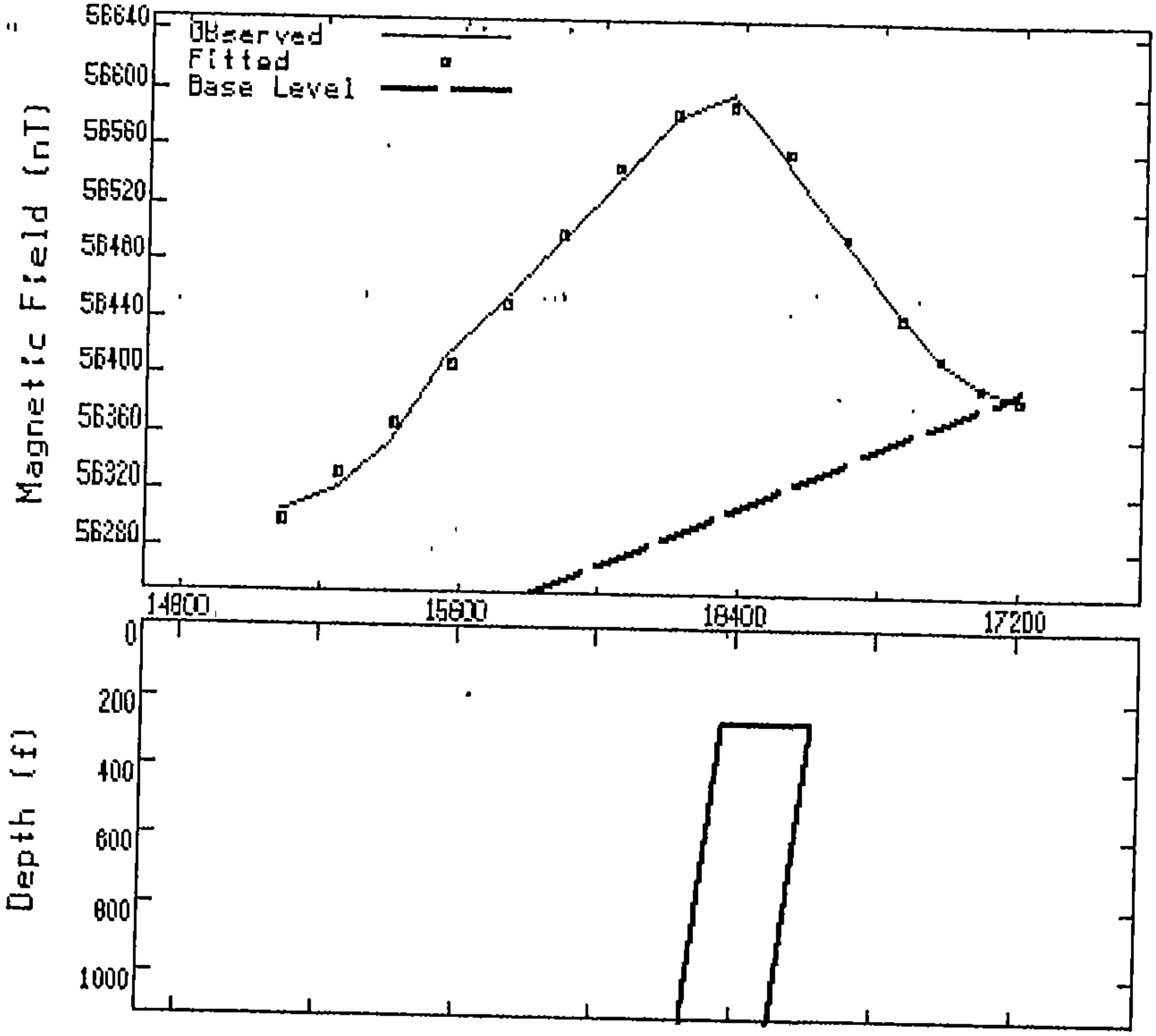
PLAN DIRECTIONS:

Strike Perp	16 deg
Line Direction	0 deg

Sensor Height 315 f

Anomaly 88-M10

Line 580



MODEL PARAMETERS:

Model Type		TABULAR
Depth	F	270 f
Half Width	F	123 f
Dip	F	97 deg
Susceptibility	F	0.00751 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	16492.3 f
Base Level	F	56320.8 nT
Base Slope	F	.1030909 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

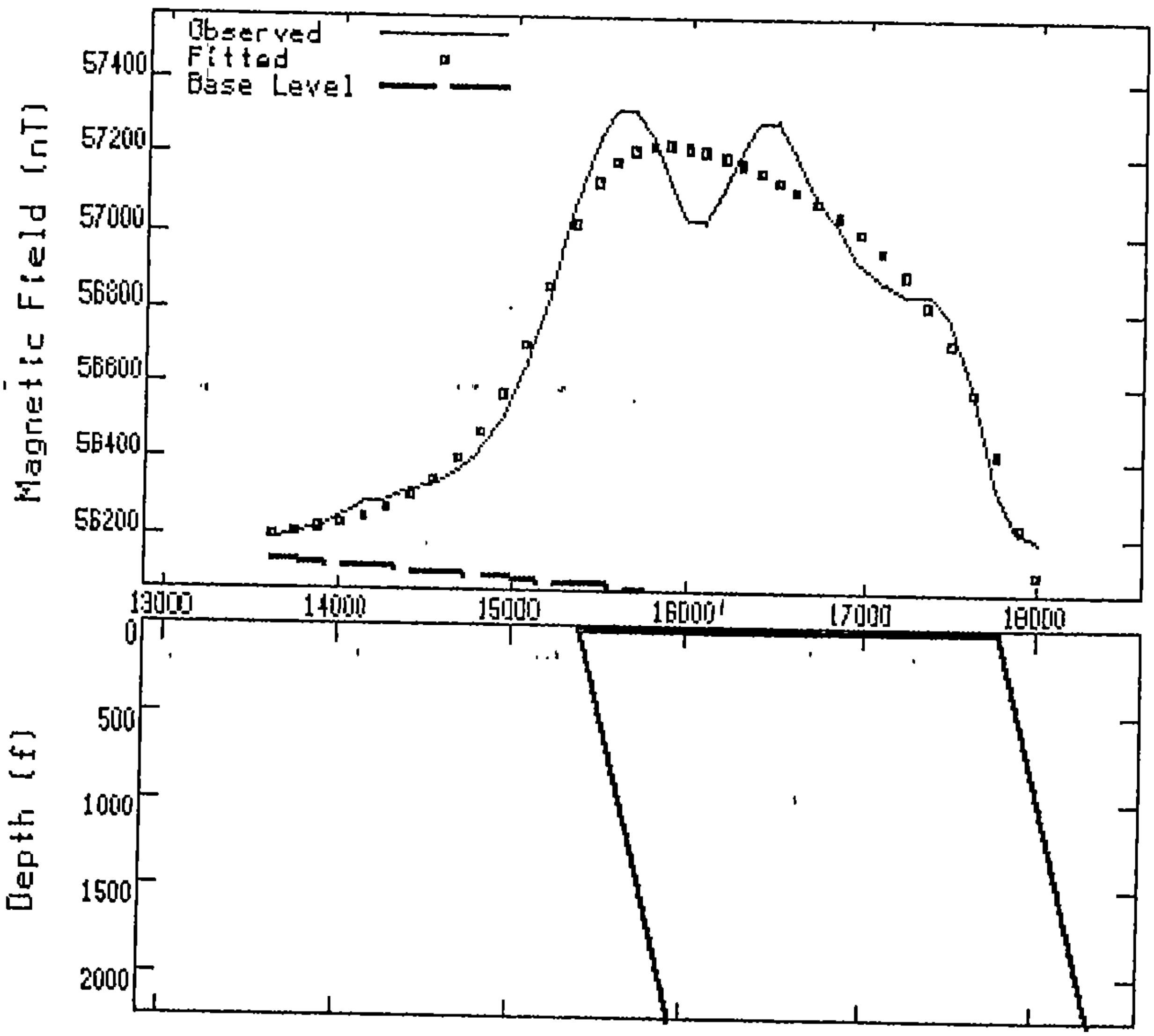
Strike Perp	19 deg
Line Direction	2.5 deg

Sensor Height 322 f

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M14

Line 610



MODEL PARAMETERS:

Model Type		TABULAR2
Depth	L	20.7 f
Half Width	F	1204 f
Length Left	X	1700 f
Length Right	X	1700 f
Dip	F	76 deg
Thickness	X	5000 f
Susceptibility	F	0.00457 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	16582.69 f
Base Level	F	56034.64 nT
Base Slope	F	-.0331083 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

Strike Perp	24 deg
Line Direction	5 deg

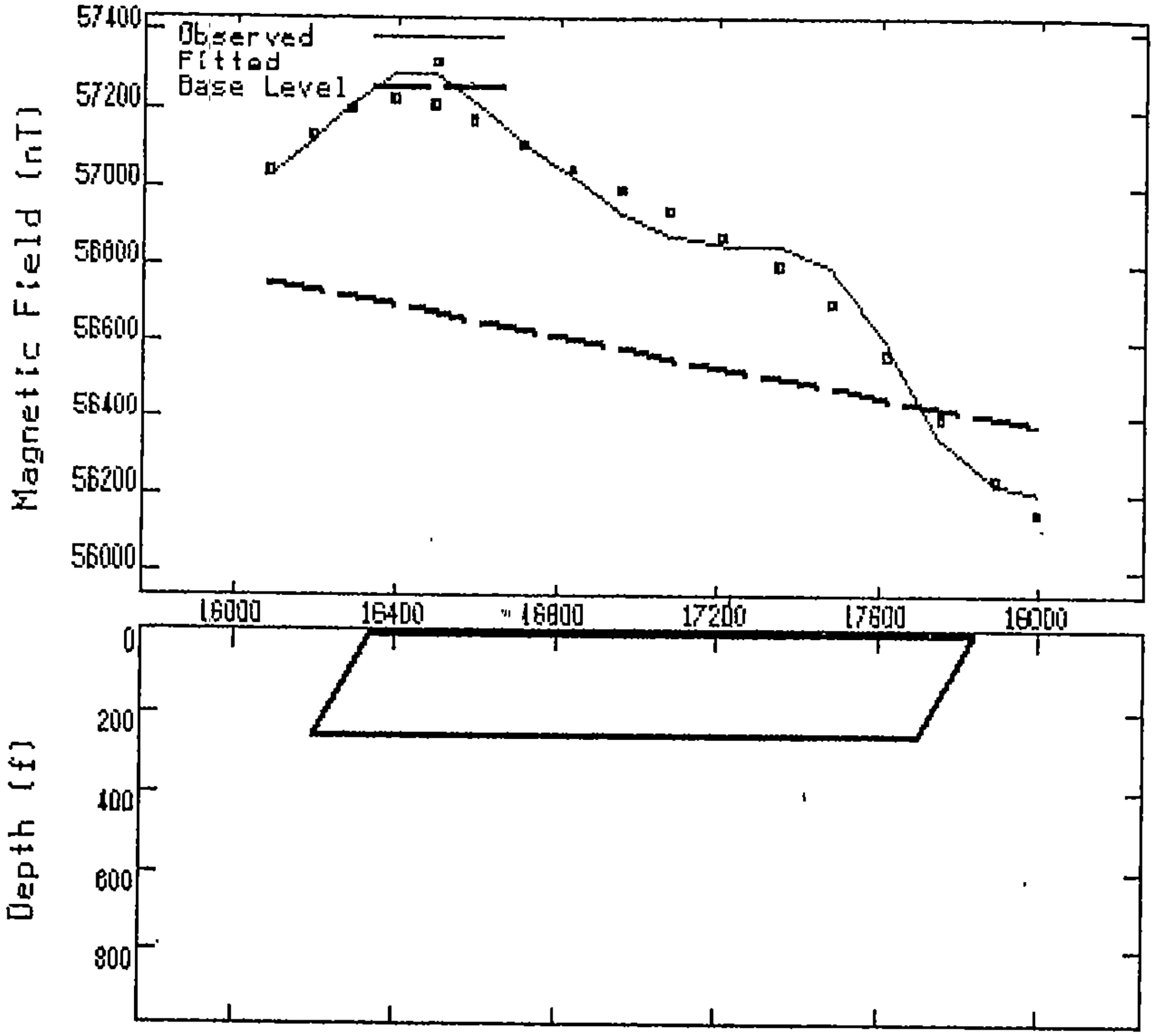
Sensor Height 300 f

Geosoft MAGMOD-3 Modelling Result

88/06/06

Anomaly 88-14A

Line 610



MODEL PARAMETERS:

Model Type		TABULAR2
Depth	L	7.87 f
Half Width	F	751 f
Length Left	X	1700 f
Length Right	X	1700 f
Dip	F	119 deg
Thickness	F	253 f
Succeptibility	F	0.00765 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	17087.72 f
Base Level	F	56554.18 nT
Base Slope	F	-.1958035 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

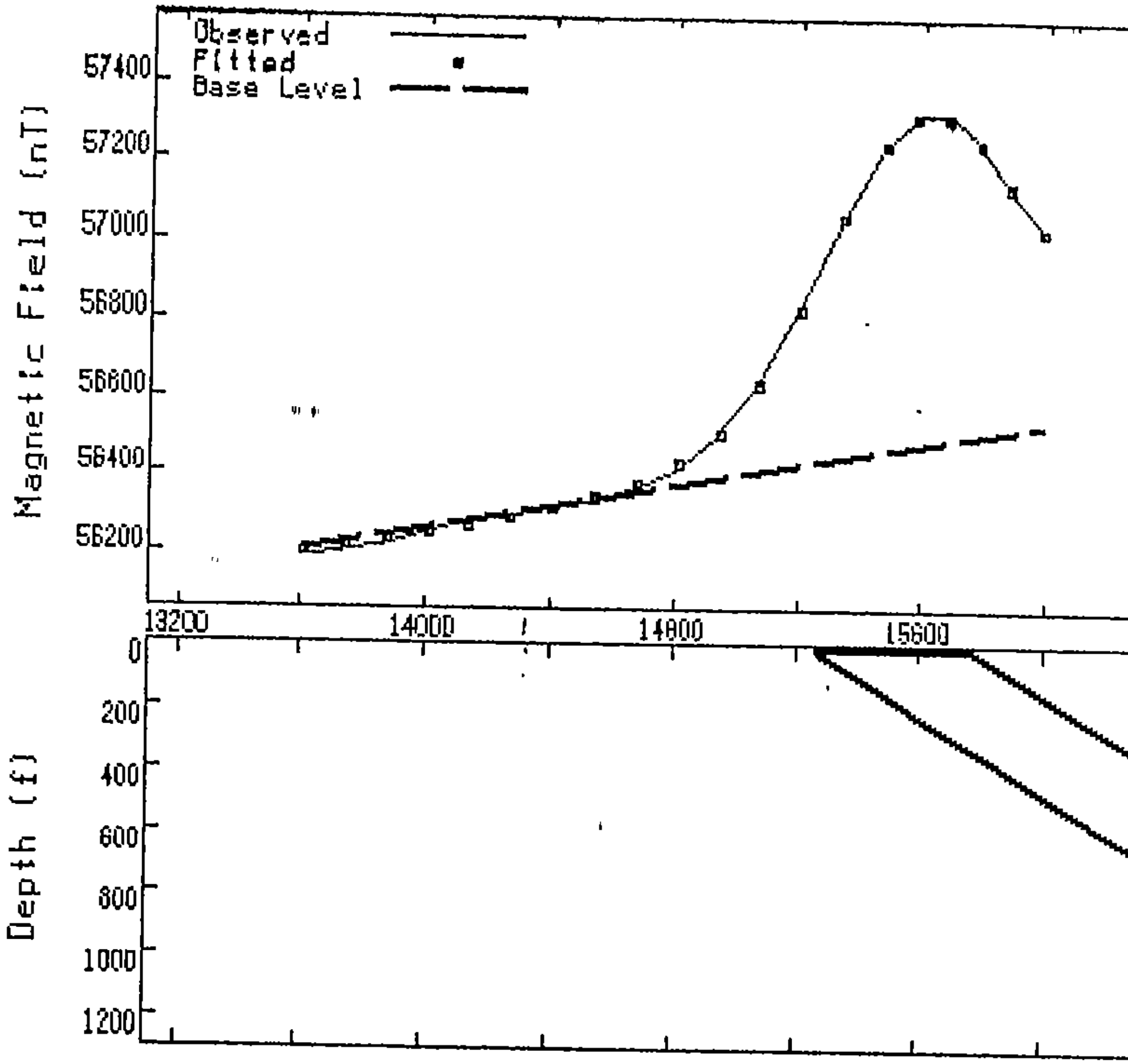
Strike Perp	24 deg
Line Direction	,5 deg

Sensor Height 300 f

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M148

Line 610



MODEL PARAMETERS:

Model Type		TABULAR2
Depth	L	11.1 f
Half Width	F	247 f
Length Left	X	2373 f
Length Right	X	2373 f
Dip	F	32 deg
Thickness	F	871 f
Susceptibility	F	0.0114 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	15513.2 f
Base Level	F	56471.91 nT
Base Slope	F	.1346174 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600
Inclination	72
Declination	23.75

PLAN DIRECTIONS:

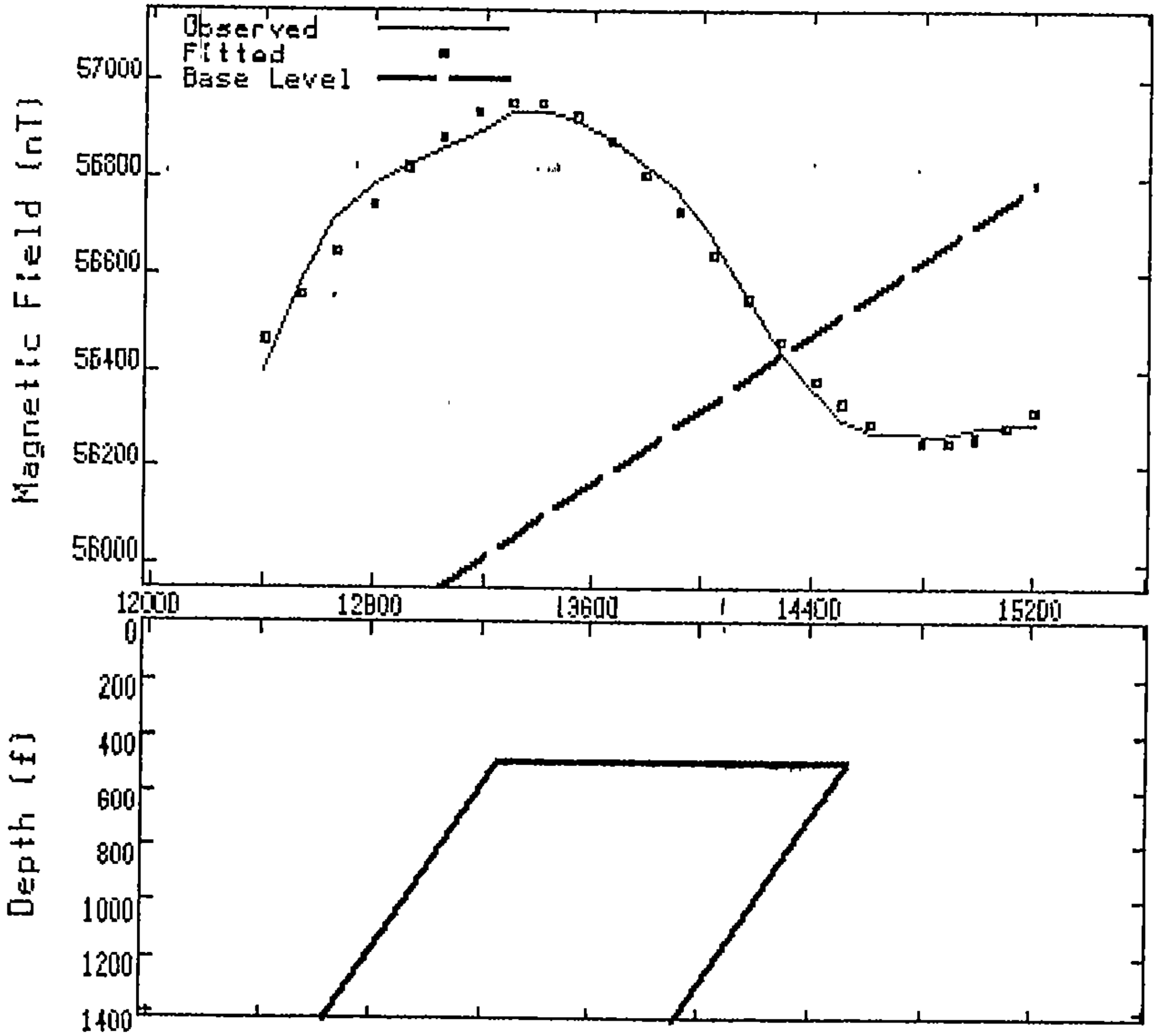
Strike Perp	24
Line Direction	.5

Sensor Height 300

Geosoft MAGMOD-3 Modelling Result

Anomaly 88-M15 : (Mag "A")

Line 670



MODEL PARAMETERS:

Model Type		TABULAR
Depth	L	494 f
Half Width	F	698 f
Dip	F	124 deg
Susceptibility	F	0.0104 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	13896.86 f
Base Level	F	56280.97 nT
Base Slope	F	.3875281 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	25.75 deg

PLAN DIRECTIONS:

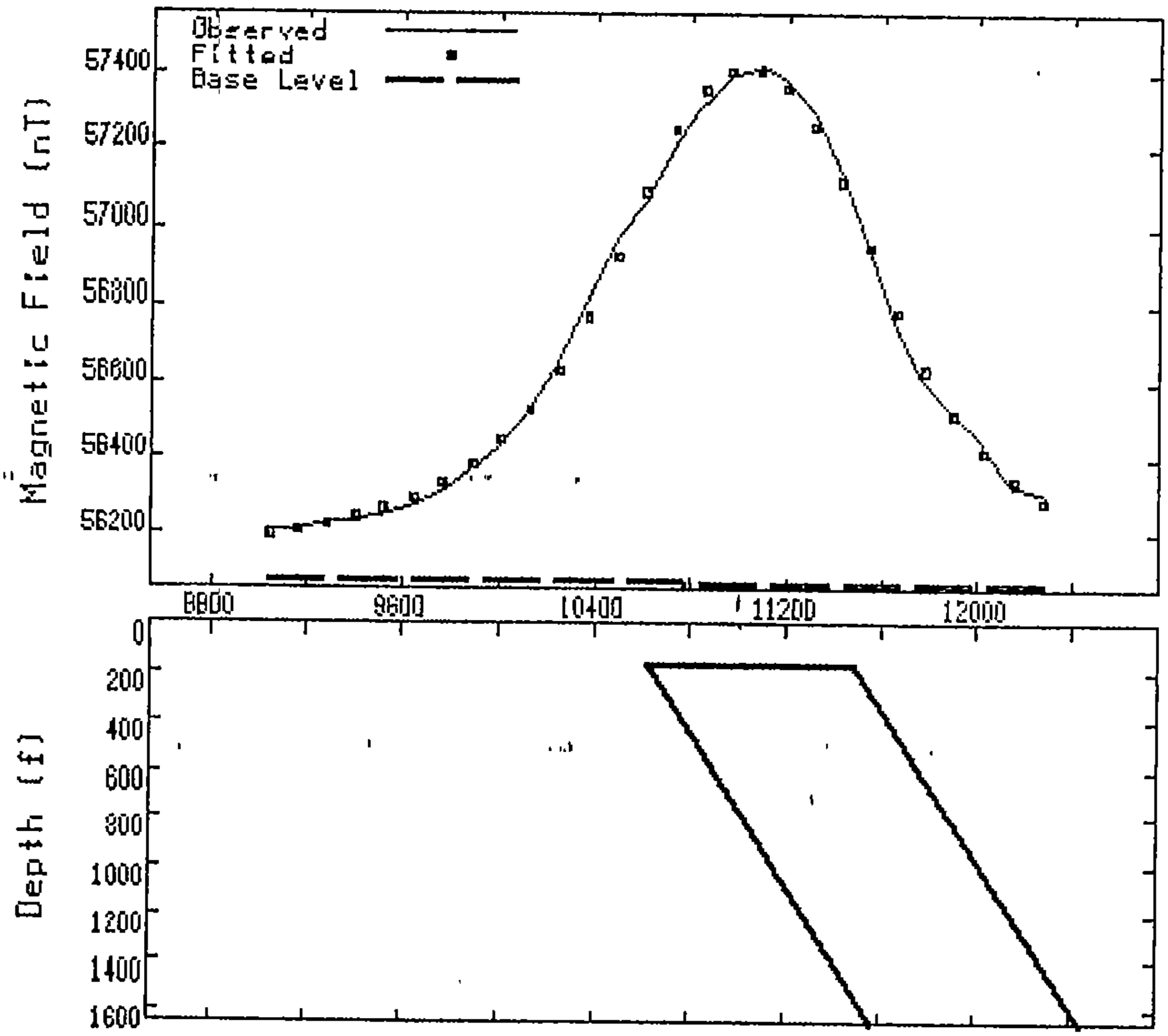
Strike Perp	20 deg
Line Direction	1.5 deg

Sensor Height 292 f

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M16.plt

Line 670



MODEL PARAMETERS:

Model Type		TABULAR
Depth	F	165 f
Half Width	F	438 f
Dip	F	57 deg
Susceptibility	F	0.00940 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	11056.76 f
Base Level	F	56075.92 nT
Base Slope	F	-.0020165 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

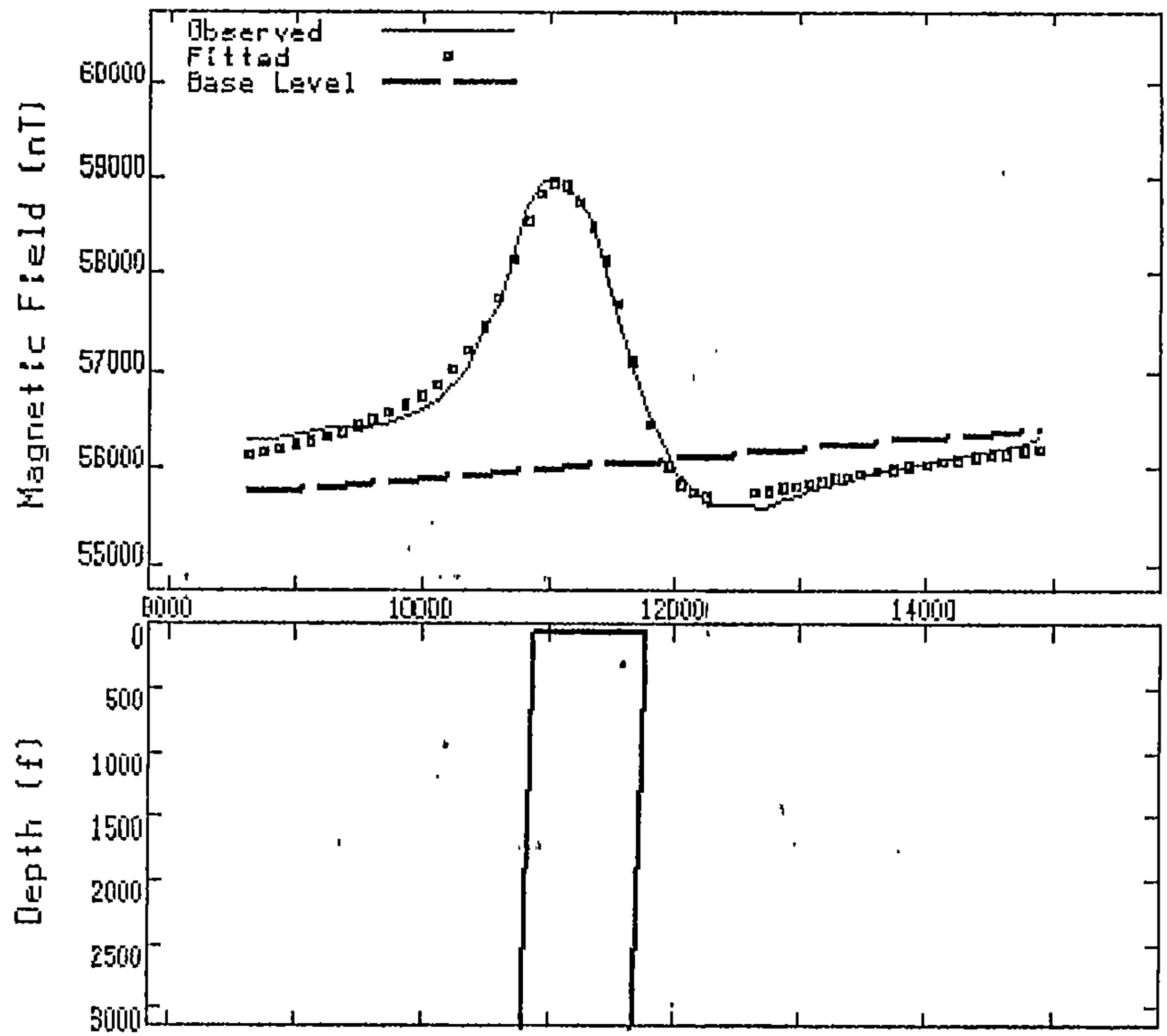
Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

Strike Perp	20 deg
Line Direction	1.5 deg

Sensor Height 292 f

Anomaly 88-M16 (Bay Lake Anomaly)
Line 710



MODEL PARAMETERS:

Model Type		TABULAR
Depth	L	40.7 f
Half Width	F	436 f
Dip	F	92 deg
Susceptibility	F	0.0149 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	11327.76 f
Base Level	F	56045.5 nT
Base Slope	F	.1052289 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55800 nT
Inclination	72 deg
Declination	23.75 deg

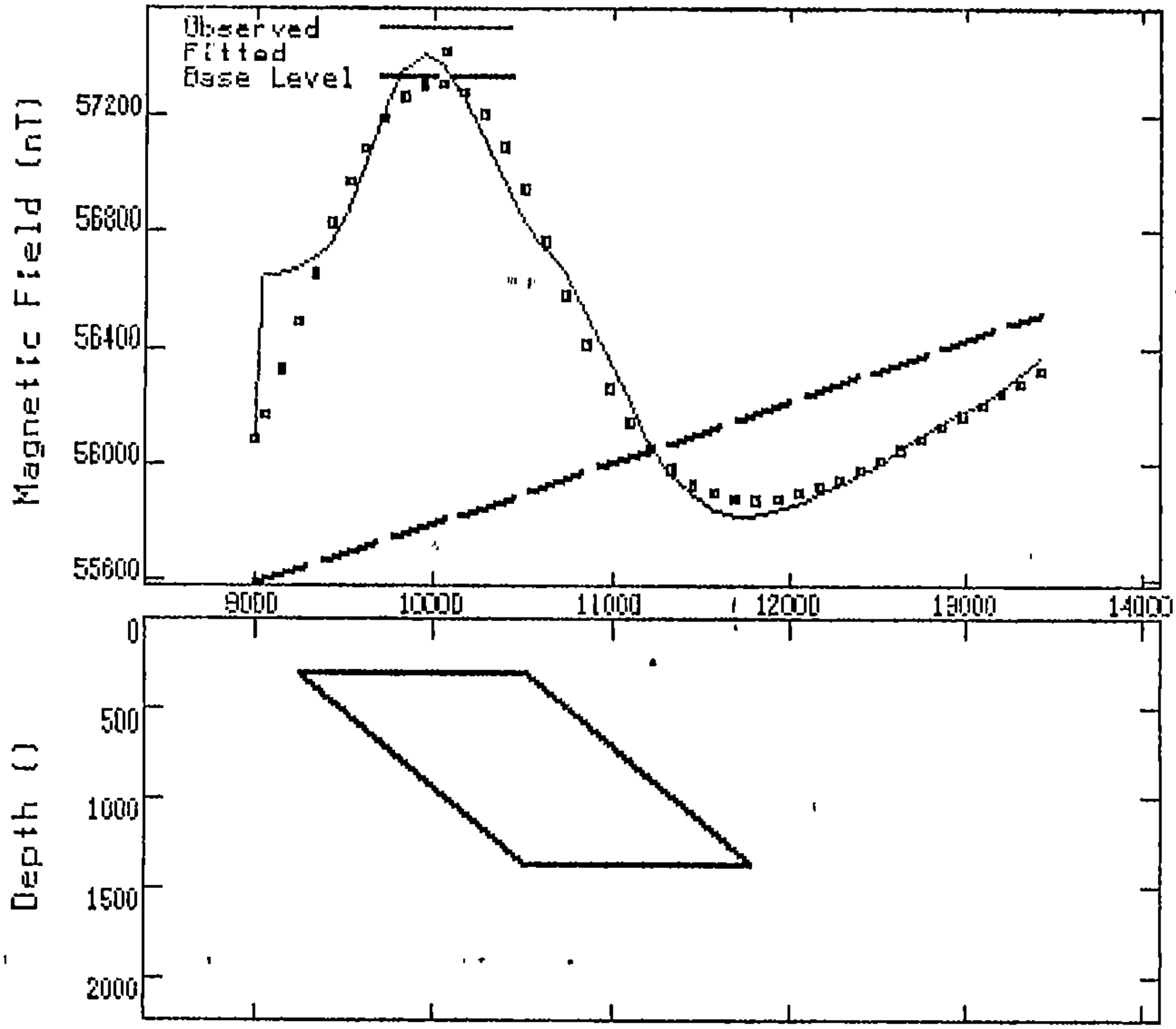
PLAN DIRECTIONS:

Strike Perp	18 deg
Line Direction	6 deg

Sensor Height 270 f

Anomaly 88-M16 (Bay Lake Anomaly)

Line 780



MODEL PARAMETERS:

Model Type		TABULAR2
Depth	L	290
Half Width	F	625
Length Left	X	6400
Length Right	X	1500
Dip	L	41 deg
Thickness	F	1082
Susceptibility	F	0.0161 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	9888.186
Base Level	F	55777.3 nT
Base Slope	F	.209444 nT/

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	25.75 deg

PLAN DIRECTIONS:

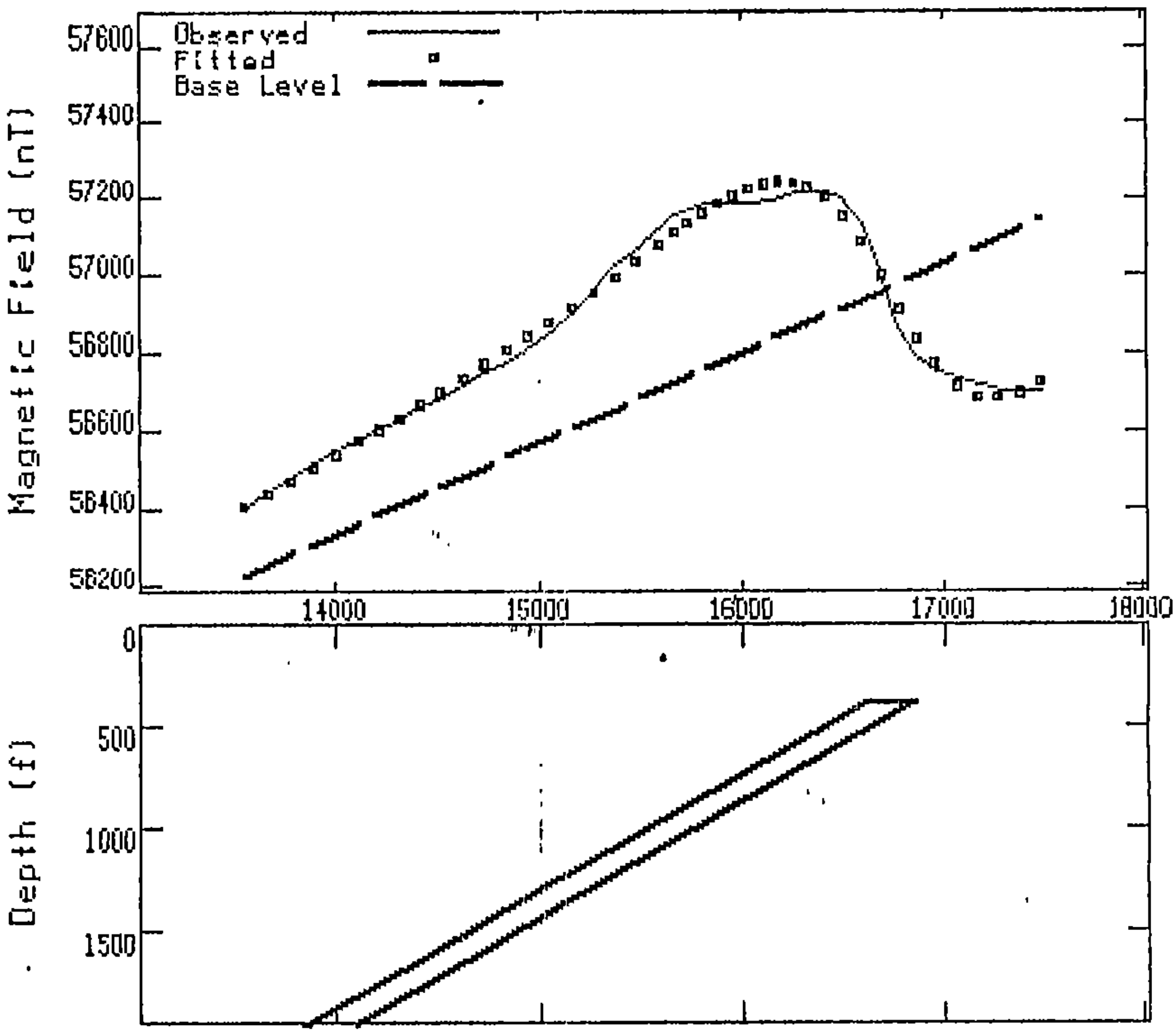
Strike Perp	16 deg
Line Direction	358 deg

Sensor Height 275

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M17

Line 780



MODEL PARAMETERS:		
Model Type		TABULAR
Depth	F	395 f
Half Width	F	129 f
Dip	F	150 deg
Susceptibility	F	0.0412 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	16722.42 f
Base Level	F	56966.45 nT
Base Slope	F	.2317899 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:	
Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

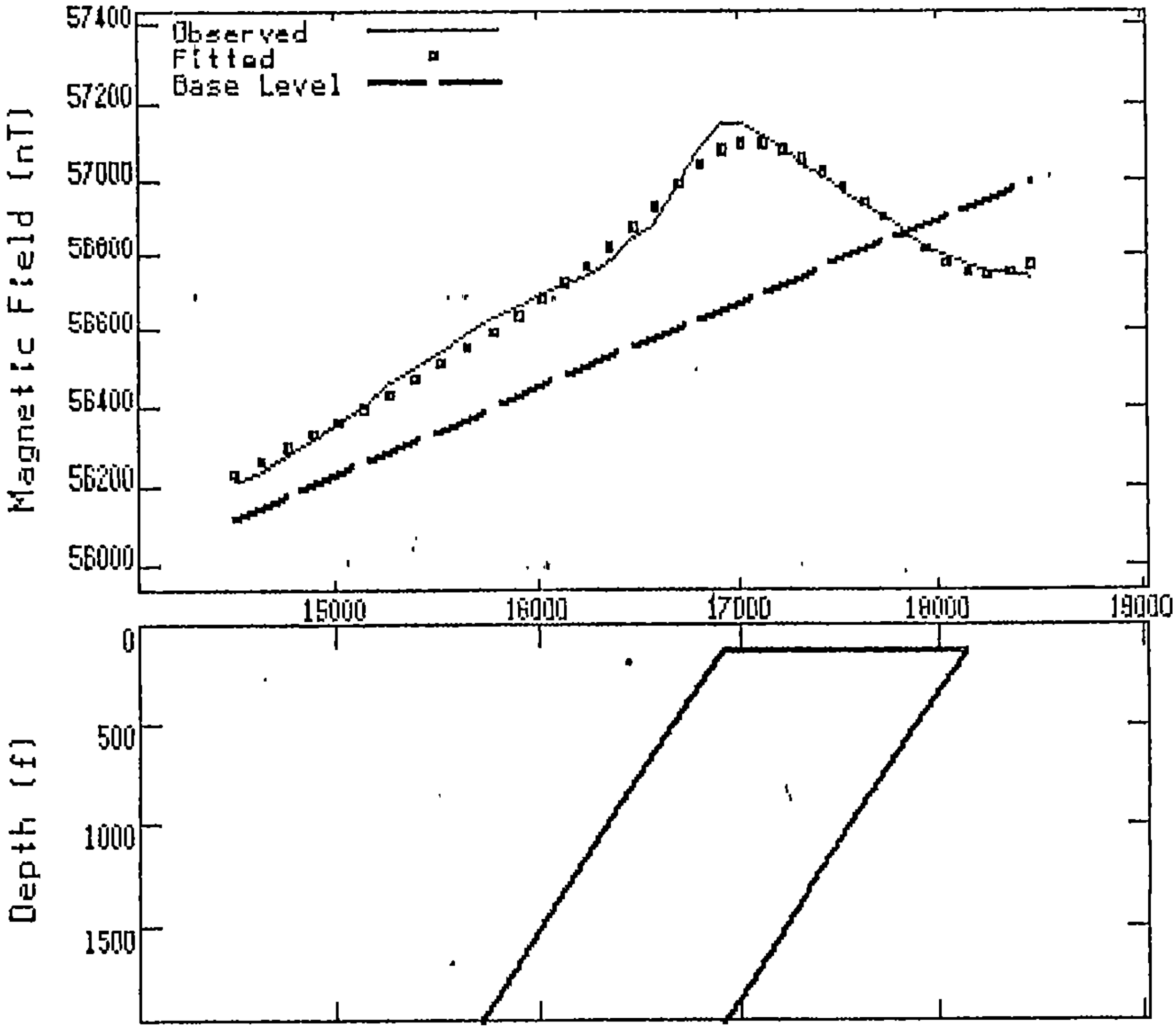
PLAN DIRECTIONS:	
Strike Perp	350 deg
Line Direction	2 deg

Sensor Height 276 f

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M18

Line 710



MODEL PARAMETERS:

Model Type		TABULAR
Depth	F	127 f
Half Width	F	600 f
Dip	F	123 deg
Susceptibility	F	0.00294 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	17523.32 f
Base Level	F	56730.71 nT
Base Slope	F	.2220487 nT/f

(F-fitted. X-fixed. L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

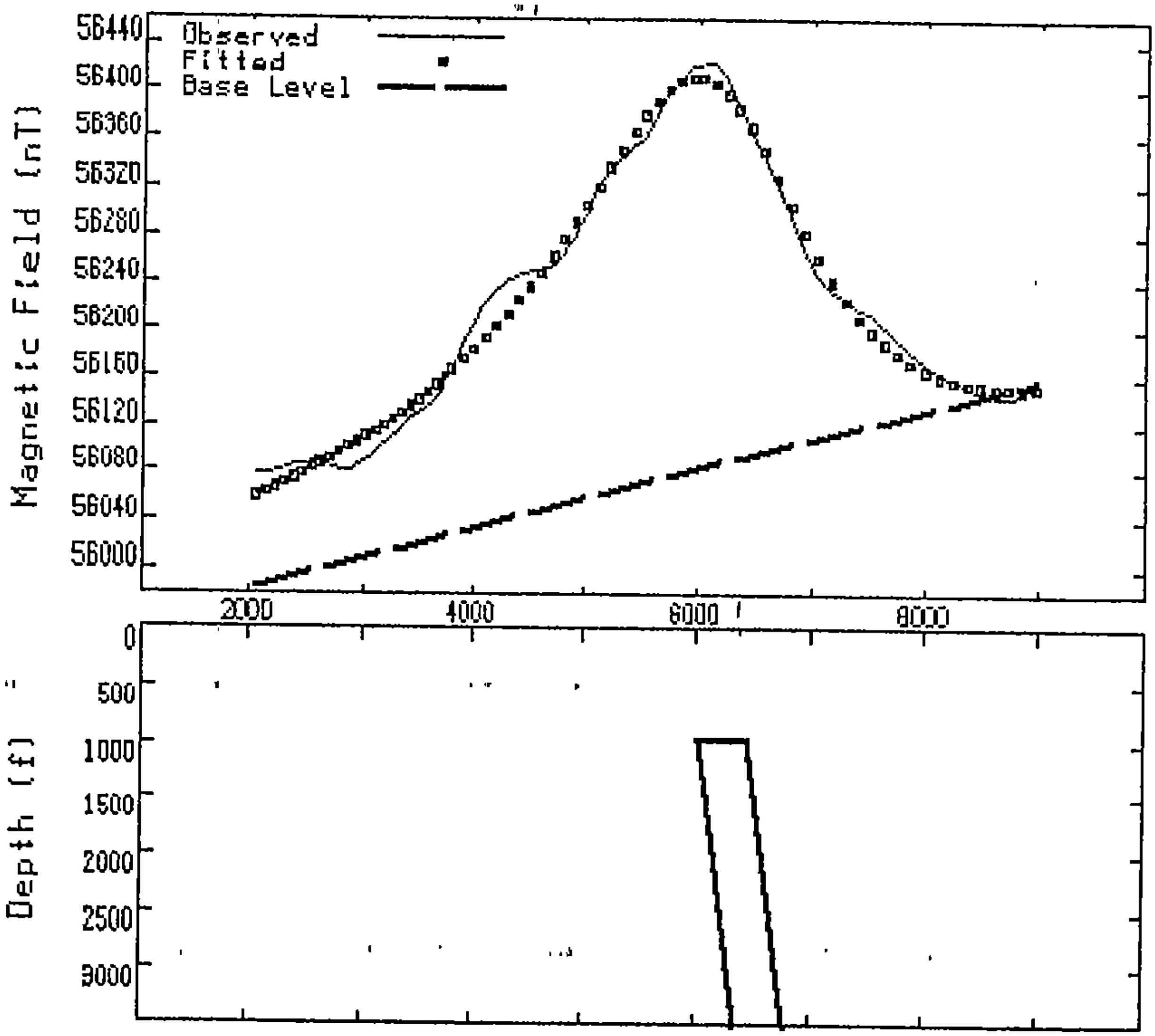
Strike Perp	16 deg
Line Direction	6 deg

Sensor Height 270 f

Geosoft MAGMOD-3 Modelling Result 88/06/06

Anomaly 88-M19

Line 620



MODEL PARAMETERS:

Model Type		TABULAR
Depth	F	977 f
Half Width	F	224 f
Dip	F	82 deg
Susceptibility	F	0.00909 emu
Remnance Ratio	X	0
Remnance Incl	X	0 deg
Remnance Decl	X	0 deg
Position	F	6231.053 f
Base Level	F	56089.67 nT
Base Slope	F	.0248862 nT/f

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

Field Strength	55600 nT
Inclination	72 deg
Declination	23.75 deg

PLAN DIRECTIONS:

Strike Perp	11 deg
Line Direction	0 deg

Sensor Height 290 f

Geosoft MAGMOD-3 Modelling Result 88/06/06


QUATSE 89 Gp.
APPLE 5
1708
APPLE 1
APPLE 2
1705
APPLE 4
1707
APPLE 88 Gp.
APPLE 6
JUNO
CENTRAL 89 Gp.
KOL 89 Gp.
FRANCES LAKE
Survey Limits
BHP-UTAH Mines Ltd.
ISLAND COPPER MINE
Claim Groups
And Survey Location
Figure 2.
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ASSESSMENT REPORT
17,580
RUPERT
INLET

PART 1 OF 2
GEOLOGICAL BRANCH
ASSESSMENT REPORT

17,580

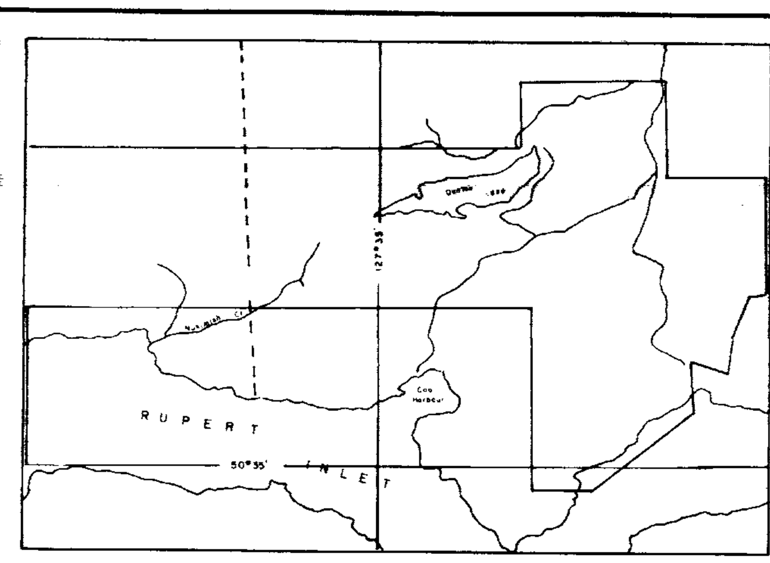
BHP - UTAH MINES LTD.

ANOMALY LOCATIONS

PORT HARDY
VANCOUVER ISLAND, B.C.

AERODAT LIMITED

DATE: February, 1988
NTS NO: 92 L/11,12
Figure 3



KEY

VLF ANOMALY
MAGNETIC ANOMALY
MAGNETIC MODELLING RESULTS
APPARENT DIP
LOCATION

SEP123654789

PAGE SEPARATOR

LOGISTICS REPORT ON
COMBINED HELICOPTER-BORNE
MAGNETIC AND VLF-EM
SURVEY
PORT HARDY AREA,
VANCOUVER ISLAND, B.C.

for
BHP-UTAH MINES LIMITED
by
AERODAT LIMITED
March, 1988

PART 2 OF 2

TABLE OF CONTENTS

LIST OF MAPS

(Scale: 1:12,000)

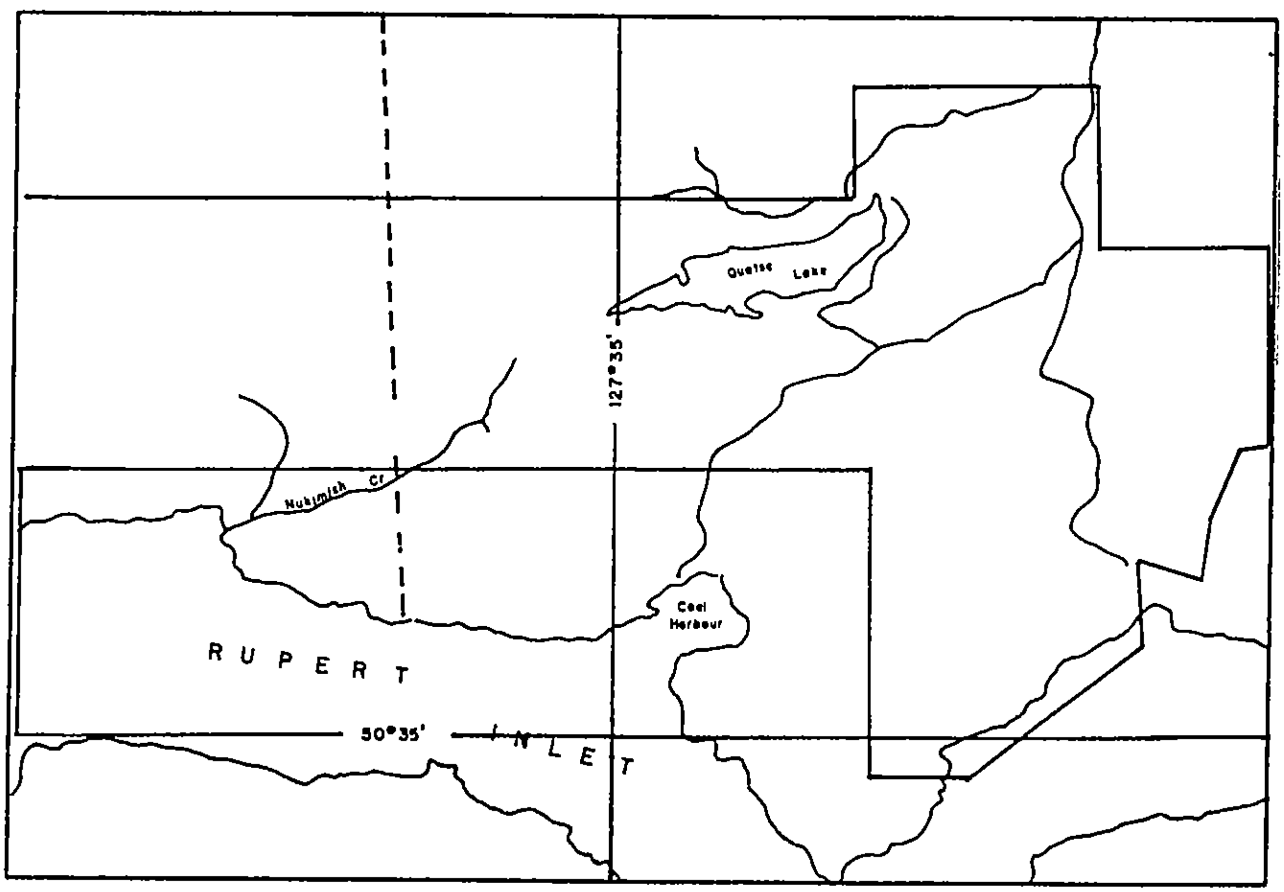
1. INTRODUCTION

This report describes an airborne geophysical survey carried out on behalf of BHP-Utah Mines Limited by Aerodat Limited. Equipment operated included a high-sensitivity Cesium magnetometer, a VLF-EM system, a tracking camera, and a radar altimeter.

The survey area was located on northern Vancouver Island , about ten kilometres southwest of the town of Port Hardy, British Columbia. The survey was flown on February 22 and 23, 1988. At nominal line spacings of 200 metres and 100 metres for the eastern end, 85 transverse lines and two tie lines spanning 390 line kilometres were flown to provide thorough coverage of the area. The quality of the recorded geophysical data was considered to be well within the specifications described in the contract.

2. SURVEY AREA LOCATION

The survey area is depicted on the index map shown below. The flight line direction was north-south.



3. AIRCRAFT AND EQUIPMENT

3.1 Aircraft

The helicopter used for the survey was an Aerospatiale A-Star 350B. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey aircraft was flown at a mean terrain clearance of 60 metres.

3.2 Equipment

3.2.1 VLF-EM System

The VLF-EM system was a Herz Totem 2A. This instrument measured the total field and quadrature components from two transmitting stations, providing two channels of both line and orthogonal information.

The sensor was towed in a bird 10 metres below the helicopter, 50 metres above the terrain. The transmitting station used for the line channels was NLK (Jim Creek, Washington, 24.8 kHz). For the orthogonal direction, the primary station used was NSS (Annapolis, Maryland, 21.4 kHz), with NAA (Cutler, Maine, 24.0 kHz) received on the tie-lines only.

3.2.2 Magnetometer

The magnetometer was a Scintrex Cesium optically pumped high sensitivity type. The sensitivity of the instrument was 0.2 gammas at a 0.2 second sampling rate. The sensor was towed in a bird 15 metres below the helicopter.

3.2.3 Magnetic Base Station

A Geometrics 803 proton precession magnetometer was operated at the base of operations to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to facilitate later correlation.

3.2.4 Radar Altimeter

A King Air radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude for maximum accuracy.

3.2.5 Tracking Camera

A Panasonic video camera was used to record flight path on VHS video tape. The camera was operated with fiducial numbers and time marks imprinted on the margin of the film for cross-reference to the analog and digital data.

3.2.6 Analog Recorder

An RMS dot-matrix recorder was used to display the data during the survey. In addition to manual and time fiducials, the following data was recorded:

Channel	Input	Scale
VLT	VLF-EM Total Field - Line	2.5%/mm
VLQ	VLF-EM Quadrature - Line	2.5%/mm
VOT	VLF-EM Total Field - Ortho	2.5%/mm
VOQ	VLF-EM Quadrature - Ortho	2.5%/mm
ALT	Radar Altimeter	10 ft./mm
MAGC	Magnetometer Sensor-Coarse	25.0 nT/mm
MAGF	Magnetometer Sensor-Fine	2.5 nT/mm

3.2.7 Digital Recorder

An RMS DGR 33 digital acquisition system recorded the survey on magnetic tape. Information recorded was as follows:

Equipment	Interval
VLF-EM	0.5 seconds
Magnetometer	0.2 seconds
Altimeter	0.5 seconds

3.3 Personnel

FIELD: Pilot - P. Tudge

Operator - William Blight

OFFICE: Processing and Report - Richard Yee

4. DATA PRESENTATION

4.1 Base Map and Flight Path

A topographic base of the survey area at a scale of 1:12,000 was supplied by the client for the base.
The flight path was transferred from a photomosaic base, made by Aerodat for both navigational and flight path recovery purposes.

4.2 Total Field Magnetic Contours

The aeromagnetic data was corrected for diurnal variations by subtraction of the digitally recorded base station magnetic profile. No correction for regional variation was applied.

The corrected profile data were interpolated onto a regular grid at a 30 metres true scale interval using a cubic spline technique. The grid provided the basis for threading the presented contours at a 5 gamma interval.

The aeromagnetic data have been presented with flight path on a greyflex copy of the topographic base map.

4.3 Vertical Magnetic Gradient Contours

The vertical gradient was computed from the total field magnetic data to obtain values in nanoteslas/metre. These calculated gradient profile data were then interpolated onto a regular grid at a 30 metres true scale interval, again using a cubic spline technique.

The gridded data were, in turn, contoured at an interval of 0.5 nanotesla per metre and presented with flight path on a greyflex copy of the topographic base map.

4.4 VLF-EM Total Field Contours

The line VLF-EM total field signals from NLK (Jim Creek, Washington) were also gridded at a 30 metre interval and and presented on a greyflex copy of the topographic base map along with the flight lines.

4.5 VLF-EM Total Field and Quadrature Profiles

The VLF-EM total field signal as well as the vertical quadrature component of the VLF-EM signal was compiled in profile form. The mean response level of the signal was removed for this presentation. Also, the quadrature component was normalized to the north flight heading.

The VLF-EM profiles have been presented with flight path on the topographic base at an amplitude scale of 1 % per millimetre.

5. GENERAL INTERPRETIVE CONSIDERATIONS

Total Field Magnetics

The total field magnetic maps show contours of the total field using a high sensitivity magnetometer. Furthermore, a fine contour interval of 5 nanoteslas was used.

The magnetic map is characterized by numerous magnetic features and should be carefully correlated with existing geologic maps of the area. Such correlations should prove extremely useful for updating the known geology of the area.

Measured Vertical Gradient

The vertical gradient map has the inherent advantage of defining contacts between different lithologic units as well as enhancing shorter spatial wavelength features due to near surface bodies of finite dimensions. Hence, the vertical gradient map is a useful supplement to the total field map.

VLF Electromagnetics

The VLF-EM method employs the radiation from powerful military radio transmitters as the primary signals. The magnetic field associated with the primary field is elliptically polarized in the vicinity of electrical conductors. The Herz Totem uses three coils in the X, Y, Z configuration to measure the total field and vertical quadrature component of the polarization ellipse.

The relatively high frequency of VLF (15-25) kHz provides high response factors for bodies of low conductance. Relatively "disconnected" sulphide ores have been found to produce measureable VLF signals. For the same reason, poor conductors such as sheared contacts, breccia zones, narrow faults, alteration zones and porous flow tops normally produce VLF anomalies. The method can therefore be used effectively for geological mapping. The only relative disadvantage of the method lies in its sensitivity to conductive overburden. In conductive ground the depth of exploration is severely limited.

The effect of strike direction is important in the sense of the relation of the conductor axis relative to the energizing electromagnetic field. A conductor aligned along a radius drawn from a transmitting station will be in a maximum coupled orientation and thereby produce a stronger response than a similar conductor at a different strike angle. Theoretically, it would be possible for a conductor, oriented tangentially to the transmitter to produce no signal. The most obvious effect of the strike angle consideration is that conductors favourably oriented with respect to the transmitter location and also near perpendicular to the flight direction are most clearly rendered and usually dominate the map presentation.

The total field response is an indicator of the existence and position of a conductivity anomaly. The response will be a maximum over the conductor, without any special filtering, and strongly favour the upper edge of the conductor even in the case of a relatively shallow dip.

The vertical quadrature component over steeply dipping sheet-like conductor will be a cross-over type response with the cross-over closely associated with the upper edge of the conductor.

The response is a cross-over type due to the fact that it is the vertical rather than total field quadrature component that is measured. The response shape is due largely to geometrical rather than conductivity considerations and the distance between the maximum and minimum on either side of the cross-over is related to target depth. For a given target geometry, the larger this distance the greater the depth.

The amplitude of the quadrature response, as opposed to shape is function of target conductance and depth as well as the conductivity of the overburden and host rock. As the primary field travels down to the conductor through conductive material it is both attenuated and phase shifted in a negative sense. The secondary field produced by this altered field at the target also has an associated phase shift. This phase shift is positive and is larger for relatively poor conductors. This secondary field is attenuated and phase shifted in a negative sense during return travel to the surface. The net effect of these 3 phase shifts determine the phase of the secondary field sensed at the receiver.

A relatively poor conductor in resistive ground will yield a net positive phase shift. A relatively good conductor in more conductive ground will yield a net negative phase shift. A combination is possible whereby the net phase shift is zero and the response is purely in-phase with no quadrature component.

A net positive phase shift combined with the geometrical cross-over shape will lead to a positive quadrature response on the side of approach and a negative on the side of departure. A net negative phase shift would produce the reverse. A further sign reversal occurs with a 180 degree change in instrument orientation as occurs on reciprocal line headings. During digital processing of the quadrature data for map presentation this is corrected for by normalizing the sign to one of the flight line headings.

Respectfully submitted,

AERODAT LIMITED

Richard Yee

March, 1988

J87109

Richard D.C. Yee

P.Eng., Geophysicist

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GEOLOGICAL BRANCH
ASSESSMENT REPORT

17,580

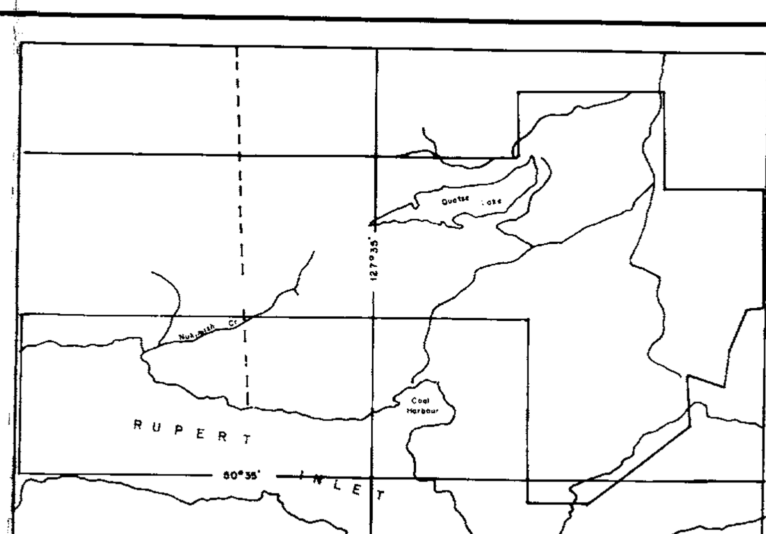
BHP - UTAH MINES LTD.

VLF-EM PROFILES

PORT HARDY
VANCOUVER ISLAND, B.C.

AERODAT LIMITED

DATE: February, 1988
NTS No: 92 L/11,12
MAP No: 6 J87109



N

VLF-EM Profiles

Scale : 1 %/mm
Total Field
Quadrature

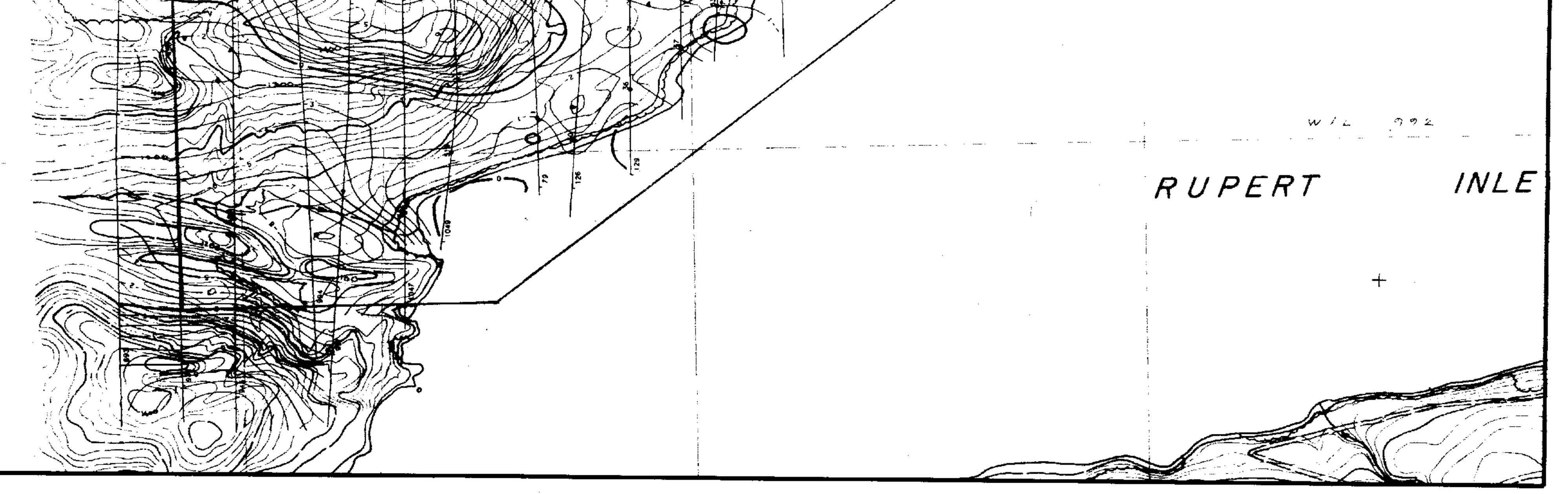
Sensor elevation : 50 m
Station : NLK (Jim Creek, Wash.)
24.8 kHz

Flight Path

Flight path derived from
VHS video tape.

Average terrain clearance 60m

Line spacing = 200m, lines 10-600
= 100m, lines 600-850



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GEOLOGICAL BRANCH
ASSESSMENT REPORT

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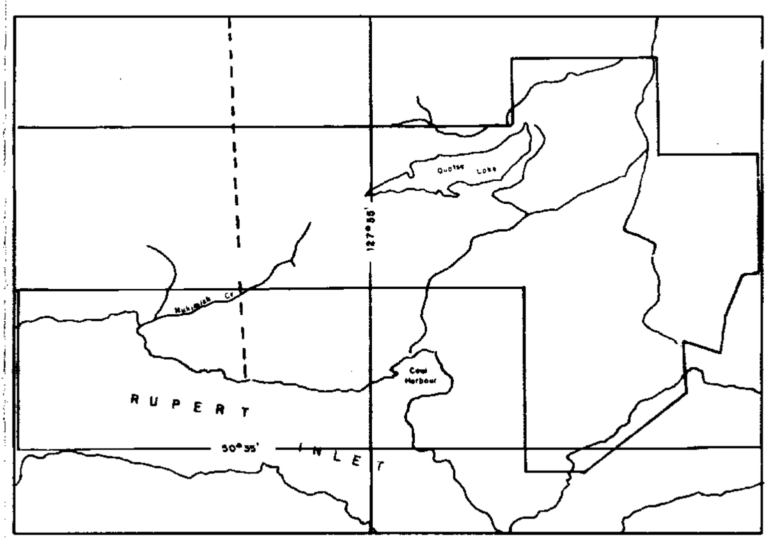
VLF-EM TOTAL FIELD CONTOURS

PORT HARDY

VANCOUVER ISLAND, B.C.



AERODAT LIMITED

DATE:	February, 1988
NTS No:	92 L/11,12
MAP No:	5 J87109

N

VLF-EM

VLF-EM Total Field Intensity in percent

Station : NLK (Jim Creek, Wash.)
24.8 kHz

Sensor elevation 50 m

Map contours are multiples of those listed below.

1 %
5 %
20 %
100 %

Flight Path

Flight path derived from VHS video tape.

Average terrain clearance 60m

Line spacing = 200m, lines 10-600
= 100m, lines 600-850

PART 2 OF 2
GEOLOGICAL BRANCH
ASSESSMENT REPORT

17,580

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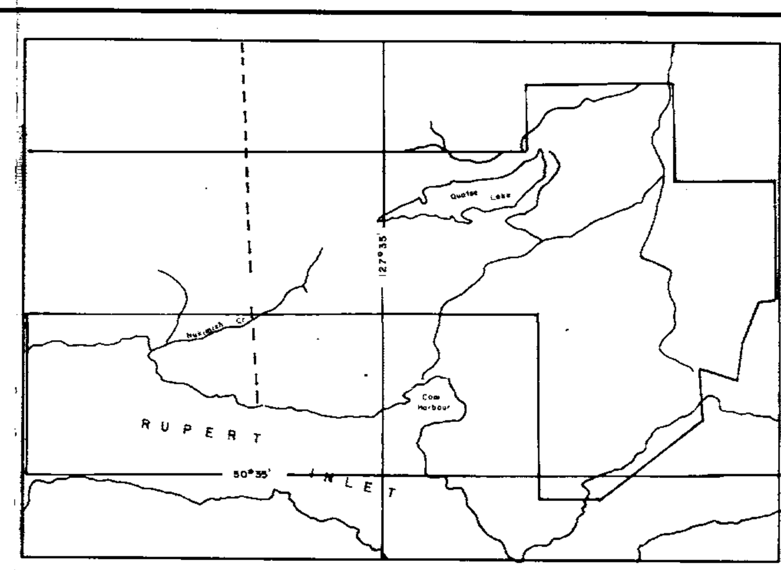
FLIGHT PATH

PORT HARDY
VANCOUVER ISLAND, B.C.

AERODAT LIMITED

DATE: February, 1988
NTS No: 92 L/11,12
MAP No: 2 J87109



N

Flight Path

Flight path derived from VHS video tape.

Average terrain clearance 60m

Line spacing = 200m, lines 10-600
= 100m, lines 600-850

Part 2 of 2
GEOLOGICAL BRANCH
ASSESSMENT REPORT

17,580

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BASE MAP

PORT HARDY
VANCOUVER ISLAND, B.C.

AERODAT LIMITED

DATE:	February, 1988
NTS No:	92 L/11,12
MAP No:	1 J87109

BHP - UTAH MINES LTD.

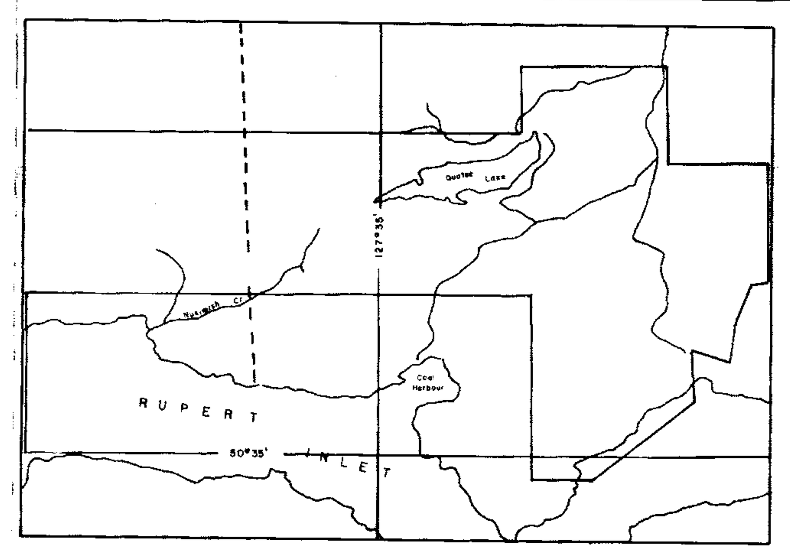
CALCULATED VERTICAL MAGNETIC GRADIENT

PORT HARDY

VANCOUVER ISLAND, B.C.

AERODAT LIMITED

DATE:	February, 1988
NTS No:	92 L/11,12
MAP No:	4 J87109



N

Vertical Gradient

Vertical magnetic gradient calculated from the total field magnetic intensity

Contours in nT/m

Cesium high sense magnetometer
Sensor elevation 45 m

Map contours are multiples of those listed below.

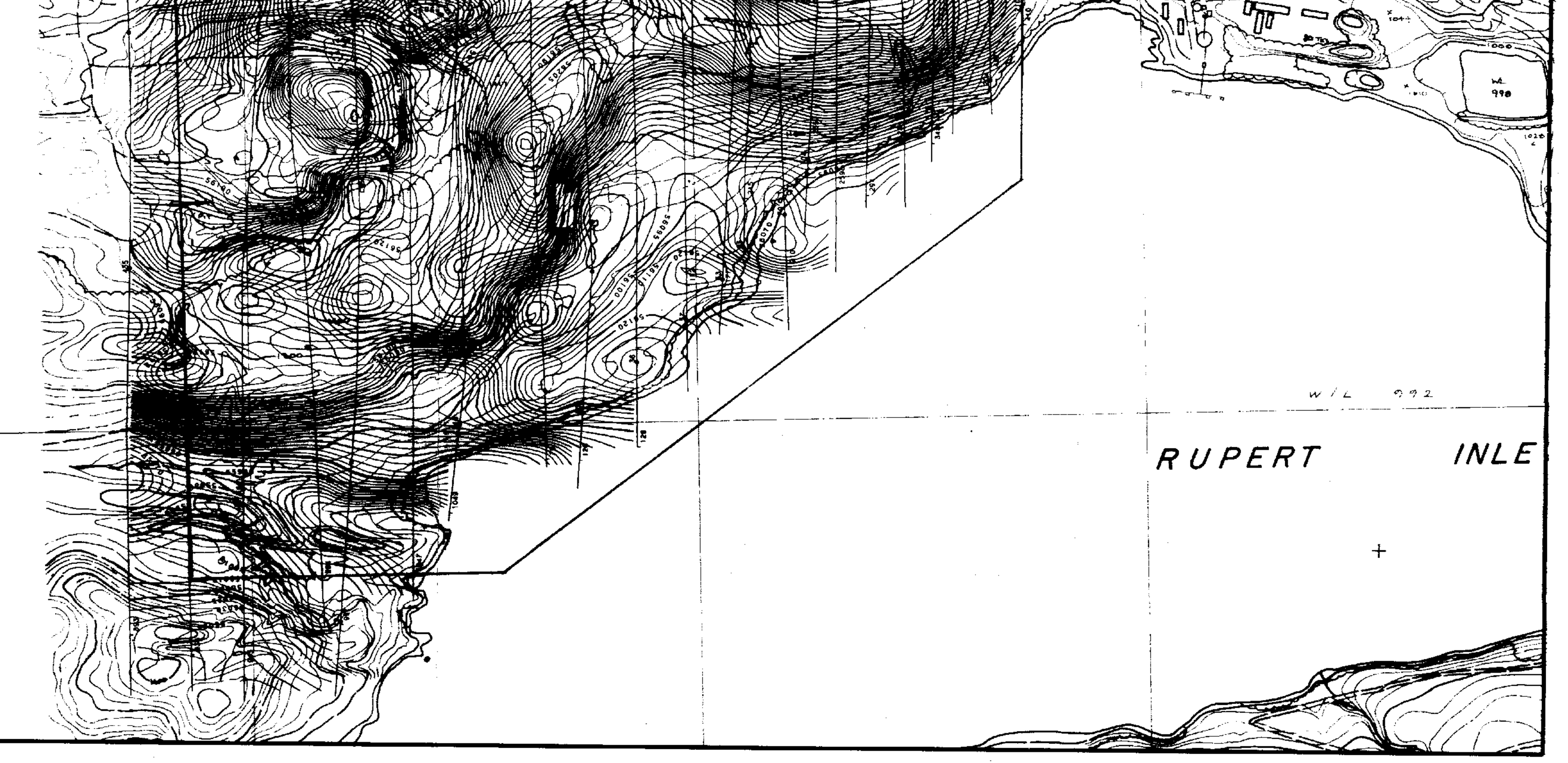
- 0.5 nT/m
- 2 nT/m
- 10 nT/m
- 50 nT/m
- 200 nT/m

Flight Path

Flight path derived from VHS video tape.

Average terrain clearance 60m

Line spacing = 200m, lines 10-600
= 100m, lines 600-850



PART 2 OF 2
GEOLOGICAL BRANCH
ASSESSMENT REPORT

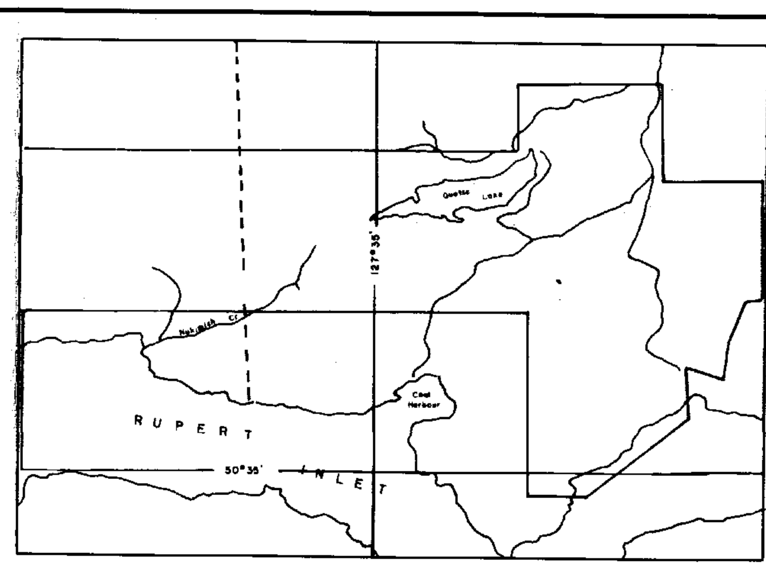
17,580

BHP - UTAH MINES LTD.

TOTAL FIELD MAGNETIC CONTOURS

PORT HARDY

VANCOUVER ISLAND, B.C.



AERODAT LIMITED

DATE:	February, 1988
NTS No:	92 L/11,12
MAP No:	3 J87109

Magnetics

Cesium high sense magnetometer
Sensor elevation 45 m

Total Field Magnetic Intensity
Contours in nT

Map contours are multiples of those listed below.

5 nT
20 nT
100 nT
500 nT
2000 nT

Flight Path

Flight path derived from VHS video tape.

Average terrain clearance 60m

Line spacing = 200m, lines 10-600
= 100m, lines 600-850