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19990004

BIRCH MOUNTAIN RESOURCES LTD.

ASSESSMENT REPORT:
February 11, 1999, Grouping

Athabasca Permits, Northeastern Alberta

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BIRCH MOUNTAIN RESOURCES, LTD.

Assessment Report:
February 11, 1999 Grouping

Athabasca Permits
NTS 74D, E & L, Northeastern Alberta

1 SUMMARY

The objectives of Birch Mountain's 1998 exploration on its Athabasca permits were directed at one potential deposit type: kimberlite-hosted diamonds. This objective was met through exploration activities involving ground and airborne magnetometer surveys, diamond drilling, and analysis of subsurface data.

In September, 1997, Birch Mountain contracted APEX Geoscience to undertake a study of the its previously conducted Athabasca aeromagnetic survey and other data to evaluate the diamond potential of its northern Alberta properties. The final report was submitted January, 1998, is summarized in Section 5.1, and is included as Appendix C.1.

In January, 1998, APEX Geoscience and GEDCO were contracted to undertake a comprehensive examination of the Athabasca aeromagnetic survey to identify additional potential kimberlite targets. The examination process and results are summarized in Section 5.1 and included as Appendix C.2. Apex and GEDCO identified over 200 magnetic anomalies from which seventy-two were selected for detailed examination of leveled and culturally edited aeromagnetic line profiles. These 75 anomalies were prioritized yielding 10 high priority anomalies, 24 medium priority anomalies, 32 low priority anomalies, 5 subgrade anomalies and one reject anomaly.

Eight magnetic anomalies or potential kimberlites were selected as drilling targets. Field operations began in latest January and ended in latest March, 1998. The field program comprised two parts: (1) verification of the location and character of magnetic anomalies picked from the airborne magnetometer survey by ground and air magnetic surveys (Appendices D and E); and (2) drilling of *bona fide* anomalies (Appendix F).

1.0 INTRODUCTION

The objectives of Birch Mountain's 1998 exploration on its Athabasca permits were directed at one potential deposit type: kimberlite-hosted diamonds. The discovery of diamondiferous kimberlites in the Buffalo Head Hills by Ashton Mining of Canada Ltd. in early 1997 and the delineation of diamond indicator mineral trends in the Fort McMurray-Fort McKay by the Alberta Geological Survey suggests that there is potential for such deposits to occur in the area. This objective was met through exploration activities involving ground and airborne magnetometer surveys, diamond drilling and analysis of subsurface data.

1.1 Previous Work

Prior to 1998, previous exploration by Birch Mountain Resources, Ltd. within the Athabasca permit area was directed at precious metals. This previous exploration has been documented previous assessment reports prepared and submitted by Birch Mountain. Previous mineral exploration is summarized in Section 1.1.1. Prior to 1998, Birch Mountain Resources Ltd. had performed little or no diamond exploration on its Athabasca permits. A summary of diamond exploration on or near the northeastern Alberta permits is presented in Section 1.1.2.

1.1.1 Precious and Base Metals Exploration

(summarized from Appendix C.1., Apex Geoscience Ltd. Report)

Previous metallic mineral exploration within the Birch Mountain's Athabasca permits has largely focused on two commodities: uranium and gold. Exploration for these metals was most active during the 1960's and 1970's, although there has been a recent resurgence in exploration for gold and base metals in the area. Dufresne et al. (1994) and Olson et al. (1994) provided summaries of the history of metallic mineral exploration for the Bitumount map area (NTS 74E).

Work by Feng and Abercrombie (1994) documented the presence of anomalous gold in basement granitoids and red bed sandstones and associated mudstones that immediately overlie the basement in the vicinity of Fort McKay. Feng and Abercrombie (1994) and Abercrombie and Feng (1997) reported that gold exists in native form as well as: Au+Si, Au+Ca, Au+Al, Au+Ag, Au+Cd and Au+salts compounds or alloys. Locally, these compounds are accompanied by Pt, other platinum group elements, and a variety of Ni and Al alloys (Abercrombie and Feng, 1997; Birch Mountain Resources Ltd., 1997; Tsang, 1998). The presence of Pt in conjunction with the Ni and Al alloys

could indirectly indicate the presence of local mantle derived kimberlites or other related deeply derived volcanic rocks in the area (Abercrombie and Feng, 1997; Ballantyne and Harris, 1997).

1.1.2 Diamond Exploration

(summarized from Appendix C.1., Apex Geoscience Ltd. Report)

1.1.2.1 Athabasca Permits

Birch Mountain Resources Ltd. conducted a fixed-wing airborne magnetic geophysical survey over these permits in early 1997. Reconnaissance diamond indicator mineral sampling has resulted in the discovery of interesting indicator minerals at several sites. The AGS has collected a total of 36 till or sand and gravel samples for diamond indicator analysis in NTS map areas 74D, 74E, 84A and 84H, including: (a) 11 till samples from NTS 74D, (b) 19 samples (including 16 till samples and 3 recent river sand and gravel samples) from NTS 74E, (c) 4 till samples from NTS 84A, and (d) 2 till samples from NTS 84H.

Approximately 17 of the 36 reconnaissance sample sites lie within or near the Athabasca mineral permits. Dufresne et al. (1996) suggested that at least 17 of the 36 samples that were collected in the region yielded indicator minerals of interest in 2 distinct trends, named the Fort McKay Trend and the Fort McMurray Trend. The Fort McKay Trend is centered over the northern half of the Athabasca mineral permits and the area of the airborne magnetic survey. Seven of the seventeen anomalous samples that yielded indicator minerals of interest in the region were collected from within or near the Athabasca mineral permits. One of these seven anomalous samples, which was collected from a site along the Athabasca River in the vicinity of Fort McKay, yielded two high quality indicator minerals including a picroilmenite and an eclogitic garnet. In addition, two of the seven anomalous samples, including one sample site along the Clearwater River and another sample site along the Firebag River, yielded a chrome diopside and one or more eclogitic garnets with at least one of the indicator minerals in each sample being of high to moderate quality chemistry. Other more distant sample sites, but in a direction considered to be down-ice of the Athabasca permits, have yielded important indicator minerals such as kimberlitic chromites, a pyrope garnet, eclogitic garnets, chrome diopsides and a picroilmenite.

At present, a typical glacial dispersion pattern has not been documented for any known Alberta kimberlites. However, based upon work conducted to date by Fenton and Pawlowicz (pers comm., 1997), it is probable that many kimberlites or related intrusions

in northern Alberta may yield narrow (less than 1 km in width), linear dispersal patterns that could range from a few kilometres to tens of kilometres in length. In addition, in areas where the local till cover is relatively thin, significant volumetric increases in the number of number of indicator minerals recovered from the till can be expected in close proximity to or even immediately overlying the kimberlite or related intrusion. This has been illustrated at Mountain Lake and in the Buffalo Head Hills (Fenton and Pawlowicz, pers comm., 1997).

1.2. Work Completed to February 11, 1999

In September, 1997, Birch Mountain contracted APEX Geoscience to undertake a study of the Athabasca aeromagnetic survey and other data to evaluate the diamond potential of its northern Alberta properties. The final report was submitted January, 1998, is summarized in Section 5.1 and is included as Appendix C.1.

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Eight magnetic anomalies or potential kimberlites were selected as drill targets. Field operations began in latest January and ended in latest March, 1998. The field program comprised two parts: (1) verification of the location and character of magnetic anomalies picked from the airborne magnetometer survey by ground and airborne magnetic surveys; and (2) drilling of *bona fide* anomalies.

2.0 LOCATION AND ACCESS

The Athabasca permits area located in the Fort McMurray-Fort McKay region of northeastern Alberta (NTS 74D, E & L; Appendix A.2). Much of this area is underlain by the McMurray Formation oil sand deposits. Near the Athabasca River between Fort McMurray and Fort McKay, road access is good; once away from the river and further north, the number and condition of the roads decreases. A winter road exists from Fort McKay to Fort Chipewyan. The Athabasca permits are generally accessible by road

with some of the more remote locations requiring the use of a helicopter. During exploration activities on the Athabasca permits, accommodation, food, supplies and fuel are available in Fort McMurray.

The regional physiography in the immediate vicinity of the Athabasca permits is generally low lying (from 300 to 350 m above sea level), with open and spruce-forested swampy ground. In the northern section of the mineral permits, the swampy areas are separated by well defined pine-forested sand flats. Spruce-forested swampy ground in this area gives way to the south and southwest to ground that is well drained and densely forested, with a mix of deciduous and coniferous trees on the northern side of a roughly circular elevated area called Muskeg Mountain (with elevations of up to 580 m above sea level). The best outcrop exposures occur in the river valleys; in elevated areas swamps are almost ubiquitous and outcrop is absent. Therefore, much of the information on the geology and structure of the area is from drill core examination.

Infrastructure in the area is centered on the major community of Fort McMurray, which is serviced by regular passenger air service. Road access to the area is provided by several major highways including Highway 63 to Fort McMurray.

3.0 PERMIT TABULATION

Land descriptions for the Athabasca permits are given in Appendix A. Maps showing the locations of these exploration permits may be found in Appendix A.

4.0 REGIONAL GEOLOGY

The Athabasca permit area is underlain by Precambrian basement and Phanerozoic rocks of the Western Canada Sedimentary Basin. The Precambrian basement is exposed in the extreme northeast and is overlain by a southwest thickening wedge of gently westward dipping Phanerozoic sedimentary rocks (Appendix B). A generalized stratigraphic column for the Athabasca permit area is shown in Figure 1. Much of the information summarized here is from Dufresne et al. (1994), Cotterill and Hamilton (1995) and Birch Mountain Resources Ltd. lithological core logs of drill holes in the study area.

4.1 Precambrian Basement

Precambrian basement underlies all of the Athabasca permit area and outcrops at surface in the northeastern part of the province (Appendix B). Crystalline basement comprises both an Archean craton to the east (Rae Subprovince) and an Early Proterozoic mobile belt in the west (Taltson Magmatic Zone); the subdivision of these is based primarily on government aeromagnetic data. The Taltson Magmatic Zone has been dated to between 1.932 to 1.975 Ga (Ross et al., 1989; McNicholl et al., 1993; Villeneuve et al., 1993).

Precambrian rocks outcrop at the Paterson High in the Marguerite River area and further to the northeast; these rocks include Archean granite, gneiss and mafic igneous rocks (Appendix B) and Paleoproterozoic metasediments. At least three Archean lithological subdivisions can be made (Dufresne et al., 1994): (1) granitoid rocks; (2) mafic meta-igneous rocks; and (3) strongly mylonitic rocks. Paleoproterozoic age metasediments are found only in drill core obtained from the northeastern part of the study area; similar rocks are exposed in northwestem Saskatchewan (Tremblay, 1961). These have been metamorphosed to granulite grade with superimposed retrograde amphibolite to greenschist facies metamorphism (Abercrombie, 1996).

Middle Proterozoic metasediments of the Athabasca Basin are exposed to the northeast of the map area. The Athabasca Basin is 400 km long east to west and 200 km north to south and occupies an area of 80 000 km^2 in Saskatchewan and Alberta (Wilson, 1985). It comprises flat-lying Athabasca Group sediments up to 1255 m thick that unconformably overlie the crystalline basement (Wilson, 1985). The Athabasca Group consists of poorly to well sorted, clay-rich sandstones, siltstones and mudstones intercalated with conglomerates; conglomerates are more common at the base of the section (Hoeve et al., 1980). These units were deposited in predominantly fluvial environments, with minor nearshore marine facies rocks (Wilson, 1985).

4.2 Phanerozoic Rocks

In general, Phanerozoic sedimentary rocks are poorly exposed within the study area; most outcrops occur along river valleys. As a result, most of the information on the sedimentary succession has been gamered from drill hole logs. The sedimentary rocks range in age from Middle Devonian to Cretaceous and are capped by a succession of Quaternary glacially-derived sediments of variably thickness; locally the thickness of Quaternary sediments exceeds 200 m. to a zero edge against the Precambrian basement in the northeast (Figure 1). The Devonian rocks form an unconformity-

bounded wedge of predominantly carbonate, evaporite and clastic sediments that include the Elk Point and Beaverhill Lake groups (Figure 1).

Period	Deposition Interval	Group	Formation	Member	Lithology
Quaternary	Present to 1.6 Ma				unconsolidated sediments
Upper Cretaceous	74.5 Ma	Smoky			silty shales
		La Biche	La Biche		shales
	97.5 Ma		Shaftesbury		shales
Lower Cretaceous	103 Ma	Mannville	Grand Rapids		lithic sands
			Clearwater		shales, glauconitic sandstones
	119 Ma		McMurray		quartzose sandstones
Upper Devonian	372 Ma	Beaverhill Lake	Waterways	Mildred	lime mudstones & shales
				Moberly	mudstone & limestone
				Christina	shale
				Calumet	limestone
				Firebag	lime mudstone
			Slave Point		limestone
	374 Ma		Fort Vermilion		limestone, shale, dolostone
Middle Devonian	374 Ma	Upper Elk Point	Watt Mountain		shales
			Prairie		salt/anhydrite
			Methy		dolostone
	401 Ma	Lower Elk Point	La Loche/ McLean River		sandstone & shales
Pre-cambrian	>570 Ma				granitic basement

Figure 1. Generalized stratigraphic column for the Athabasca permit area (modified after Carrigy, 1959; 1973; Norris, 1963; 1973; Hamilton 1971; Dufresne et al., 1994). Major unconformities are indicated by dashed lines. The depositional interval indicates the ages represented by preserved sediments.

4.2.1 Devonian Rocks

Within the Athabasca permit area, Devonian age rocks are-up to 900 m thick but thin to a zero edge against the Precambrian basement in the northeast (Figure 1). The Devonian rocks form an unconformity-bounded wedge of predominantly carbonate, evaporitic and clastic sediments that include the Elk Point and Beaverhill Lake groups (Figure 1).

In BMRD-98-6, there is abundant evidence of post-Cretaceous solution collapse/karsting and faulting. The top of the Slave Point Formation is approximately 80 m below what would be predicted from regional structure. Devonian rocks are highly brecciated, and in places limy shale fragments and overlying McMurray sand have been cemented together in sub-horizontal beds (internal sedimentation). Shales in the overlying Cretaceous McMurray Formation show soft sediment deformation. The Quaternary Lake sediments appear undisturbed.

4.2.1.1 Elk Point Group

The oldest Devonian unit in the study area is the Lower to Middle Devonian Elk Point Group which has been subdivided into Lower and Upper subgroups (Appendix B; Figure 1). The Lower Elk Point Group is represented in the study area by the La Loche/McLean River Formation; this unit consists of a fining upwards sequence of red sandstone, red and green sandy shales and green shale with anhydrite/gypsum. Sediment thickness and facies were controlled by the Peace River Arch suggesting that it was active and elevated at Lower Elk Point time (Abercrombie and Feng, 1997).
The Upper Elk Point Group conformably overlies the McLean River Formation and contains the Methy (or equivalents Winnipegosis and Keg River) Formation, the Prairie Formation and the Watt Mountain Formation, the youngest Middle Devonian unit. The Methy Formation comprises reef to non-reefal, massive to bedded dolostone, dolomitic limestone and minor anhydrite and gypsum (Figure 1; Cotterill and Hamilton, 1995). The Prairie Formation comprises salt and gypsum/anhydrite with thin beds of shale and dolostone and occur only to the west of the salt dissolution front (Appendix B; Figure 1; Cotterill and Hamilton, 1995). The dolomitic shales of the Watt Mountain Formation disconformably overlie the salt sequence.

4.2.1.2 Beaverhill Lake Group

Upper Devonian Beaverhill Lake Group rocks disconformably lie atop the Upper Elk Point Group. These rocks include the Fort Vermilion, Slave Point and Waterways formations (Figure 1).

The Fort Vermilion Formation comprises interbedded (50-100 cm) and finely laminated anhydrite, green to brown shale, gray and cream coloured limestone and light brown dolomite (Figure 1). A 1.4 metre dark green silty shale is found at the base of the formation; a 10-20 cm thick brown to gray shale, often desiccated, marks the top of the Fort Vermilion Formation.

The Slave Point Formation is characterized by light brown laminated to nodular limestone with thin, dark brown, bituminous, carbonaceous shale beds (Figure 1). The base of the formation is marked by a fine grained calcareous quartz sandstone, 70 to 90 cm thick, that grades upwards into the limestone.

The Waterways Formation has been subdivided into 5 members (Figure 1). The lowermost Firebag Member consists of a basal green limey shale unit that is overlain by repeated sequences of shales grading upwards into interbedded limestone and shale then grading into nodular limestone; it is up to 50 m thick. The Calumet Member comprises fossiliferous, light green to brown nodular limestone with shaly intervals, with a maximum thickness of 32 m. The Christina Member is up to 26 m thick and consists of a lower unit of green-gray calcareous shale with rare fossils and limestone lamina and an upper unit of interbedded limestone and shale with abundant intraformational conglomerates and hardground surfaces. The Moberly Member is composed primarily of brown nodular limestone overlain by a porous, bitumen-stained, bioclastic limestone; the maximum thickness attained is 60 m. The Mildred Member is the youngest Waterways Formation unit and contains variably argillaceous nodular lime mudstones and calcareous shales; it is up to 45 m thick (Cotterill and Hamilton, 1995).

The top of the Devonian is marked by an erosional unconformity (Figure 1); it is postulated that several periods of subaerial erosion and karsting have affected the limestone at the unconformity (Dufresne et al., 1994).

4.2.2 Cretaceous Rocks

Cretaceous rocks in the Athabasca permit area are predominantly siliciclastic sediments. They have a variable thickness due to post-depositional erosion but can be up to 500 m thick. Cretaceous rocks include the Mannville, La Biche and Smoky Groups (Figure 1).

4.2.2.1 Mannville Group

The Lower Cretaceous sediments of the Mannville Group overlie the post-Devonian unconformity (Appendix B; Figure 1). In the Athabasca permit area, the Mannville Group comprises the McMurray, Clearwater and Grand Rapids formations.

The McMurray Formation, which hosts the oil sands deposits in this region, comprises interbedded sandstone, siltstone and shale deposited in fluvial to deltaic to shallow marine environments (Dufresne et al., 1994); it is up to 50 m thick. The McMurray Formation is conformably overlain by Clearwater Formation shale and glauconitic sandstone, up to 100 m thick (Dufresne et al., 1994). The Grand Rapids Formation comprises lithic sandstone, laminated siltstone and silty shale with thin coal beds deposited in nearshore to marine environments with a maximum thickness of 100 m (Dufresne et al., 1994).

4.2.2.2 Upper Cretaceous Units

The Mannville Group is conformably overlain by sediments of the Upper Cretaceous La Biche Group, including the Shaftesbury and La Biche formations. The Shaftesbury Formation, 250-300 m thick, contains fossiliferous marine shales with local thin interbeds of siltstones and sandstones (Appendix B; Figure 1; Dufresne et al., 1994). Numerous bentonitic horizons within the shale may be interpreted to indicate regional late Lower to early Upper Cretaceous volcanic activity (Syncrude Canada Ltd. Co-Development agreement).

The Upper Cretaceous La Biche Formation directly overlies the Shaftesbury Formation in most of the Athabasca permit area, but in the extreme northwest, it overlies the Smoky Group. The La Biche Formation consists of shale and silty shale that were deposited in a marine environment; the Smoky Group comprises silty shale also deposited in a marine environment (Dufresne et al., 1994).

4.2.3 Quaternary Sediments

Quaternary sediments in the Athabasca permit area consist of tills, outwash deposits, lacustrine and eolian sediments. Regional mapping has divided the Quaternary sediments into 11 units (Dufresne et al., 1994). In general, accumulations are thickest on elevated areas and thinnest on lowlands and along rivers.

Sandy till units, composed largely of eroded Athabasca Formation, are found on high ground east and west of the Athabasca River, including the Birch Mountains and

Muskeg Mountain. Flutings on these sandy tills indicate ice flow from the north-northeast and north-northwest. Glacial striations on bedrock near the Marguerite River also indicate ice flow from the north-northwest.

Outwash sands and gravels as well as lacustrine and eolian sediments are found mainly along river valleys and adjacent lowlands. Drilling in 1998 by Birch Mountain Resources intersected two distinct units: (1) an upper outwash/eolian sand unit exposed at surface; and (2) a lower lacustrine mud unit. The upper unit averages 25 m thick and consists of medium to coarse grained sand, previously mapped as a glacial outwash deposit (Dufresne et al., 1994). Dune forms exposed north of McClelland Lake indicate eolian reworking and transport of this unit. The lower unit averages 23 m thick and consists of pink to dark brown mud with scattered white and red quartzite dropstones and occasional centimetre scale varves. Boulder till lenses, one to 10 m thick, are found within both the pink and brown muds. The pink mud is likely derived from red sandstones of the Athabasca Sedimentary Basin while the brown lacustrine mud is probably derived from Clearwater Formation shales.

Other Quaternary units in the area include meltwater sand and gravel along the Athabasca River and alluvial fan and slump sediment along the eastern slope of the Birch Mountains.

5.0 1998 EXPLORATION PROGRAM

5.1 Diamond Potential Evaluation

(summarized from Appendix C.1., Apex Geoscience Ltd. Report)

The 1997 high resolution fixed-wing airborne magnetic survey conducted over the Athabasca permits indicates the presence of many strong linear northwest and northeast trending basement structures that have likely been reactivated during periodic reactivation of the PRA. The presence of these arch-related structures is thought to be favourable for the emplacement of kimberlites. In addition, work to date indicates that the Athabasca permits are roughly centered over the axis of the PRA, which is a comparable structural setting to Ashton's kimberlite field in the Buffalo Head Hills.

Seventy five magnetic anomalies were selected from a low band pass filter of the second vertical derivative of the total magnetic field (Peirce, In Preparation) in order to compare the magnetic signature of anomalies on or near the Athabasca permits to the known magnetic signature of near surface kimberlite in Alberta. For all 75 magnetic

anomalies, profiles of the total magnetic field, the diurnal magnetic variation, magnetic noise, topography and removed culture were reviewed by Mr. M. Dufresne and either Dr. M. Best or Dr. J. Peirce (GEDCO), in order to evaluate each of the magnetic anomalies. At least 18 magnetic anomalies displayed a magnetic profile that could be indicative of near surface intrusive pipes (Appendix C.1. Table 3). Eight of the eighteen magnetic anomalies were classified as either medium or high priority near surface magnetic anomalies that require follow-up exploration for kimberlites or related intrusions. Most of the 18 magnetic anomalies that display magnetic characteristics that could be indicative of kimberlites exist in 5 distinct clusters, with the most important cluster located in the north-central to northeastern portion of the magnetically surveyed area in the vicinity of the Firebag River in Tps 97 to 99 and Rgs 7 to 9 (Appendix C.1. Figure 5). Two high priority and three medium priority magnetic anomalies exist in the Firebag cluster. The two high priority magnetic anomalies, numbers 14 and 29, appear as sharp well defined magnetic peaks of 17 and 6 nT magnitude, respectively. Each of the two anomalies appear to have a source that is close to surface. Magnetic anomaly 14 yields an estimated width of about 700 m, whereas anomaly 29 yields an estimated width of about 200 m. Each of these anomalies should be further investigated, along with other magnetic anomalies of similar magnitude in the vicinity of these magnetic anomalies that were not reviewed as part of this evaluation. These two high priority magnetic anomalies and the other six medium or high priority anomalies have total field magnetic characteristics that are similar in character to the magnetic signature for the Mountain Lake Kimberlite northeast of Grande Prairie (Leckie et al., 1997) and other kimberlite or associated intrusive rocks in the Western Canada Sedimentary Basin of Alberta and Saskatchewan.

Other potentially important clusters of magnetic anomalies exist in the vicinity of the Pierre River (Townships 97 and 98, Ranges 10 and 11 W4M), southeast of Syncrude's Aurora minesite (T95, R10W4) and along the Ells River (Townships 94 and 95, Range 12 W4M) west of Syncrude's Basemine property (Appendix C.1. Figure 5). Many other unevaluated magnetic anomalies that are similar in magnitude and appearance to the 8 medium to high priority magnetic anomalies need to be further evaluated in order to determine if they have a magnetic profile that could indicate the presence of near surface kimberlite pipes.

5.2 Selection of Potential Kimberlite Targets

Potential kimberlite targets, selected by Apex Geoscience and GEDCO, are summarized in Appendix C.2. Magnetic line profiles for all priority-ranked targets are also included in Appendix C.2.

5.3 Mapping Support for Target Selection

The magnetic anomalies were further evaluated prior to drill target selection using cultural data. This was done in order to: (1) identify the Mineral Permit holders in relationship to potential drill targets; (2) identify land use categories using the Alberta Environment, Lands and Forests Division maps; (3) locate environmentally sensitive areas, such as moose habitat or caribou caving grounds; (4) prepare digital elevation models for flight planning of 300 m and 100 m aeromagnetic surveys; (5) locate trap lines; (6) identify field access along roads, cutlines to potential drill targets; and (7) identify surface features, such as vegetation patterns and topography.

In addition, regional and detailed cross sections were constructed from available well log data for each potential drill target. This was done to provide an understanding of depth to bedrock for geophysical modeling. These sections were also used by well site geologists for drill planning.

5.4 Ground Magnetic Surveys

Geophysical exploration on ten pre-selected sites within a specified area approximately 90 km north of Fort McMurray, Alberta (Figure 5.4). The sites were provisionally located from data provided by an airborne magnetic survey. The use of ground magnetic surveys was required to provide more detailed information on the location and nature of the airborne anomalies. The aim of these surveys was to identify the anomalies that could be the result of shallow kimberlitic diatreme features, and thus provide viable targets for a drilling program. Ground magnetic surveys were conducted by Komex International, Ltd. and by Birch Mountain Resources, Ltd.

The use of ground magnetic surveying proved to be useful in defining the plan view, extent and relative magnitude of anomalies initially located by airborne surveys. The first vertical derivative plots of the regional airborne data accurately identified locations of the magnetic anomalies. The high resolution airborne data was particularly useful in areas of poor access. However, the ground magnetic profiles still provided significantly more detailed delineation of the anomalies.

5.4.1 Komex Surveys

(summarized from Appendix D.1., Komex International Ltd. Report)

In total, nine anomalies were investigated. Seven of the nine sites were investigated using survey lines laid out in a grid pattern centered over the anomalies. The number of survey lines within these grids varied from 8 to 10. Where possible, all lines were 1000 m in length. In areas of dense vegetation, the lines were cut prior to the survey in order to allow easy access. Sites 16 and 221 were located in remote sections of the field area and were approached by helicopter. On these two grids, only two perpendicular lines centered over each anomaly were surveyed.

5.4.1.1 Instrumentation

Instrumentation for the survey consisted of two identical GSM-19 Overhauser magnetometer/ gradiometers. One instrument was set up as a base station on or near the grid to monitor variations in the geomagnetic field due to diurnal changes and magnetic storms. The second instrument was used in the mobile mode and carried by an operator walking the survey lines. Total magnetic field and vertical magnetic gradient data were acquired by the roving instrument. The vertical gradient is simply the difference in magnetic intensity measured by two vertically separated sensors, divided by the separation distance. Vertical gradient data can be useful in determining the relative depths of magnetic anomalies. In most surveys, the vertical gradient is derived mathematically from the horizontal gradients of the total field.

The total magnetic field data collected by the mobile magnetometer reflects both the anomalies caused by changes in geology and the temporal changes in the magnetic field. The gradiometer data are insensitive to the temporal changes. The base station data are used to remove the temporal variations leaving only the anomalies due to the geology of the survey area. Base station data were collected every 2 seconds during the mobile magnetometer survey. Plots of the total magnetic field versus time for the base station on each day were constructed (Appendix D.1.). Temporal variations in the field as recorded by the base station, varied from over 50 nT on active days, to as little as 10 nT on magnetically quiet days.

Magnetic susceptibility measurements were made on a core collected by Birch Mountain Resources at Site 14, to support the magnetic modeling component of the survey. The Exploranium KT9 meter was used for this survey.

5.4.1.2 Surveying and Grid Design

The locations of the anomalies were picked from the airborne magnetic data. These locations were placed on topographical maps and a grid was designed over each target. A typical grid layout consisted of 8 to 10 survey lines, each of approximately 1000 m in length. A baseline and at least one tieline of similar lengths were cut perpendicular to the survey lines. The layout for each grid is shown in the site plans, and is also shown on the colour contoured maps of the magnetic field (Appendix D.1). A total of 92.3 kilometres of survey lines were cleared.

A surveying company (Stewart Weir & Co. Ltd.) was employed to locate the center of each grid on the ground using a Global Positioning System (accuracy ~0.1 m). The surveying crew established a baseline and flagged the location of the survey lines. Line cutters then prepared shoulder width cutline on all survey, base, and tie lines. All locations in this report are given in Universal Transverse Mercator (UTM) co-ordinates (Zone 12, North American Datum 1927).

After the grids were established, the geophysical crew set up a magnetometer base station. Care was taken to set up the instrument away from potential sources of noise such as passing vehicles. Only one sensor is used when operating in base station mode. On the grid, magnetic field data were collected at 12.5 m intervals along survey lines spaced 100 m apart. Data were also collected on at least one baseline or tieline. These cross-lines are necessary to perform leveling of the survey lines.

5.4.1.3 Data Processing and Results.

The magnetic field data are processed using the following steps: (1) removal of base station variations; (2) statistical leveling of tielines; (3) full leveling of survey lines to tielines; (4) gridding of survey lines; (5) translation from grid to UTM co-ordinates; (6) reduction to the IGRF; and (7) removal of a regional field (second order polynomial fit to total field). In the case of grids 16 and 221, high resolution airborne data were available over the grids, and these data have been processed in an identical manner to the ground data.

Generally, each grid contained a significant magnetic anomaly (> 20 nT), with a similar form as the anomalies identified in the airborne data. On grids 112 and 42, the anomaly was masked by strong regional gradients. The centers of the anomalies as well as results for each grid and profiles are presented in Appendix D.1.

All modeling was based on the proposed geometry of kimberlite pipes (pipe shaped bodies with a flared top) discovered some 300 km to the west of this survey area. The results of the modeling are shown in Appendix D.1.

The magnetic susceptibilities of the background lithologies were derived from the log at BMR98-14 (Appendix F.4). In general, the susceptibilities of the sedimentary rocks are close to the minimum detection level on the susceptibility meter (0.001×10^{-3} SI). The major unknown in the background model is the susceptibility of the Precambrian basement. Given the location of the study area over a range of basement tectonic terranes, basement susceptibilities are expected to be highly variable. The modeled susceptibility of the pipe was based on values derived from previously published reports on kimberlites, and in-house data. An attempt was also made to model the data using a much lower susceptibility value for the body, derived from known kimberlite pipes in the N.W.T. The lower susceptibilities required placing the bodies at improbably shallow depths, leading to the conclusion that the causative bodies in the Fort McMurray area must have higher magnetic susceptibility values.

5.4.2 Birch Mountain Resources Magnetic Survey

Birch Mountain Resources conducted a ground magnetic survey over Anomaly 6 in March, 1998, as part of the Birch Mountain Athabasca diamond exploration program. This survey was performed using a Gem Systems GSM-19 Overhauser Magnetometer with the detector mounted on a 6 foot high aluminum rod. Unlike the Komex surveys, no grid was cut for Anomaly #6 due to time constraints. The center of the total field magnetic anomaly for #6 was located through a series of successive east-west and north-south lines established using a hip chain and compass. Diurnal variations in the earth's magnetic field were compensated for by surveying each line in both directions, resulting in two profiles for each line.

The first magnetic survey conducted was discovered to be approximately 625 meters too far to the east. Only data from the western part of the east-west line of the survey is included because it covers the eastern extent of the anomaly.

A second magnetic survey consisted of three lines, two east-west and one north-south (Appendix D.2.). The approximate location of the center of the airborne total field magnetic anomaly was located on the ground and given the coordinates (0,0). The first line was run east-west through this point. The second line was run north-south through (0,0); on this line, the center of the magnetic anomaly occurred at (0, 150 S) . A third line was run east-west through (0, 150 S); on this line, the center of the anomaly was

at (150 S, 50 E). This point was interpreted to correspond to the center of the total field magnetic anomaly from the airbome survey. The drill collar was offset 25 meters south and 50 east of (150 S, 50 E) at (175 S, 100 E) to compensate for a relatively steep gradient in the regional magnetic field.

5.5 Aeromagnetic Surveys

(summarized from Appendix E., Canagrad Surveys Ltd. Report)

Canagrad Surveys Ltd. was commissioned by Birch Mountain Resources to follow-up several magnetic targets identified primarily from interpretation by GEDCO and APEX (Section 5.2.) of the Athabasca aeromagnetic survey flown by World GeoScience in 1997.

The survey tasks were defined as follows: (1) confirm anomalies picked from Geological Survey of Canada (GSC) data; (2) confirm, improve location and resolution of anomalies picked from HRAM data; (3) provide comparison with Komex International ground survey of selected targets; and (4) evaluate replacement of traditional ground magnetic survey with detailed aeromagnetic survey in remote areas.

The survey was conducted in two parts, phases 1 and 2. The survey and technical specifications for both Phase 1 and Phase 2 are given in Appendix E.

5.5.1 Phase 1

A Cessna 310 long-range survey aircraft equipped for combined gravity and magnetic survey was used for Phase 1. A high resolution counter operated at a 25Hz sampling rate was used to collect magnetic information. Precise GPS velocity data as well as inertial data was collected in addition to the magnetometer data. A GPS precise velocity measuring receiver was deployed as a ground reference station. Data acquisition parameters are given in Appendix E.

Special attention was given to low-level flying at low speeds; typically 220-240 km/h. The aircraft has been modified with vortex generators for improved slow flight performance which provided the safety margin required for this type of flying. The flying height above ground was maintained at or below 65 m typically depending on terrain.

The data were processed in Calgary. Due to long baselines, the GPS data were corrected using precise ephemeris and clock corrections purchased from Natural

Resources Canada. The data corrected using this method are accurate to less than 5m. Residuals noted were typically 0.3 - 0.5m from most satellites used in the solution. Corrected GPS and magnetometer data were merged using the ORBIT-PPS program and mapped with Geosoft MONTAJ.

5.5.2 Phase 2

Changes were made to the data acquisition system support equipment before beginning Phase 2. These included: (1) removing gravity sensors; (2) replacing acquisition software, thereby adding 2000 Hz laser altimeter capability; (3) replacing the Philips counter with a standard Picodas 1,000 series PC-card; (4) adding linear power supply for magnetometer sensor; (5) changing the ORBIT-PPS program to include merging of 20OOHz laser data; (6) uninstalling the GPS reference station; and (7) including Geosoft MONTAJ field processing system. Data acquisition parameters are listed in Appendix E. The aircraft navigation was based on real-time GPS without corrections which provides navigation accuracy of ~30m.

5.6 1998 Drill Program

Six of the eight top priority magnetic anomalies were drilled in eight drill holes during 1998 exploration. These are summarized in Table 1. The locations of the eight drill holes are shown in Figure 5.6. A total of 93 kilometres of line were cleared and three ice bridges were constructed during drilling operations.

5.6.1 Drill Hole Lithology

The lithological logs identify only the major geological formations and members and detailed lithological descriptions are provided only where warranted. Lithological logs for each hole are given in Appendix F.1. Stratigraphic columns are in Appendix F.2. Lithological characteristics of each geological unit are given in Table 2. Lithological characteristics of each hole are given in Table 3. For the most part, the lithologies and unit thicknesses are consistent with regional geology (Section 4).

5.6.2 Core Structure

Significant structure was identified at BMRD-98-21OA&B, BMRD-98-189A&B, and at BMRD-98-6. The age of the structural disturbance is primarily post-Devonian, pre-Cretaceous, with some post-Cretaceous disturbance as well. No deformation of Quaternary sediments was observed.

The top of the Slave Point Formation is 7.60 meters lower in BMRD-98-210B than in BMRD-98-210A, giving dip of 3 degrees to the east. This is not only steeper than regional dip, but also is in the opposite direction (regional dip is approximately 0.2 degrees to the west). This vertical offset is best explained by a normal fault between the two holes, with east-side down movement. There is essentially no vertical offset of the erosional top of the Devonian (top of the Firebag Member) between the two holes, indicating movement was post-Devonian and Pre-Cretaceous. The Quaternary Lake sediments in both holes appear undisturbed. The core for both BMRD-98-210A and BMRD-98-210B has only minor fracturing, typical of the area. Therefore, it is likely that a fault between the two holes is roughly half way between them and not proximal to either one of them.

Similar structural disturbance occurs at BMRD-98-189A & B. The top of the Slave Point Formation is 10.50 m lower in BMRD-98-189B than in BMRD-98-189A. The two holes are only 11 m apart. There is essentially no vertical offset of the erosional top of the Devonian (top of the Firebag Member) between the two holes, but there are slicken-sided surfaces within McMurray Formation shales, suggesting movement was primarily post-Devonian, pre-Cretaceous, with some deformation continuing into post-Cretaceous times. The Quaternary Lake sediments appear undisturbed. It should be noted that there are two circular surface depressions 200 m southwest of the BMRD-98-189A & B drill pad, likely due to recent solution collapse. The depressions are 12 m across and 5 m deep.

In BMRD-98-6, there is abundant evidence of post-Cretaceous solution collapse/karsting and faulting. The top of the Slave Point Formation is approximately 80 m below what would be predicted from regional structure. Devonian rocks are highly brecciated, and in places limey shale fragments and overlying McMurray sand have been cemented together in sub-horizontal beds (internal sedimentation). Shales in the overlying Cretaceous McMurray Formation show soft sediment deformation. The Quaternary Lake sediments appear undisturbed

5.6.3 Core Sampling

All Quaternary and Cretaceous aged rocks were sampled in each hole for diamond indicator minerals. A catalog of samples is given in Appendix F.3. Those samples containing bitumen (includes only samples from the Cretaceous sediments) remain in Birch Mountain's Calgary core storage facility.

Table 1. Drill hole summary.

Hole[1]	Total Depth (m)	Formation at Total Depth (age)	Samples (bitumen stained)	Grid Location[2]	UTM NAD27 N[3]	UTM NAD27 E[3]	Elevation (m)[4]	DLS Location	Core Recovery
BMRD-98-14	152.89	La Loche Fm (Devonian)	10 (3)	374N + 282E	6379864	494624	290	11-04-99-7W4	good
BMRD-98-210A	118.50	Methy Fm (Devonian)	7 (2)	615N + 470E	6380234	491641	290	14-06-99-7W4	moderate
BMRD-98-210B	117.15	Granitoid Gneiss (Precambrian)	8 (2)	615N + 615E	6380234	491786	290	15-06-99-7W4	moderate
BMRD-98-112	149.05	Firebag Member (Devonian)	33 (31)	512N + 535E	6360208	450847	325	01-02-97-12W4	good
BMRD-98-189A	102.00	Ft. Vermilion Fm (Devonian)	12 (1)	400N + 550E	6375984	489922	290	01-26-98-8W4	poor
BMRD-98-189B	115.20	Ft. Vermilion Fm (Devonian)	4 (1)	395N + 560E	6375979	489932	290	01-26-98-8W4	poor
BMRD-98-29	147.18	Methy Fm (Devonian)	8 (0)	585N + 400E	6388159	478079	265	11-35-99-9W4	good
BMRD-98-6	163.82	Slave Point Fm (Devonian)	21 (0)	175N + 100E	6382138	483171	305	13-08-99-8W4	poor
Totals	1065.79		103 (40)						

[1] in chronological order
[2] no magnetic survey grid was down for BMRD-98-6. The centre of the total field anomaly was established on the ground by a set of successive perpendicular east-west/north-south lines.
[3] determined from the offset between the UTM coordinates of a point on the grid (as determined by surveyors) and the grid coordinate of drill collar
[4] approximated from topographic map

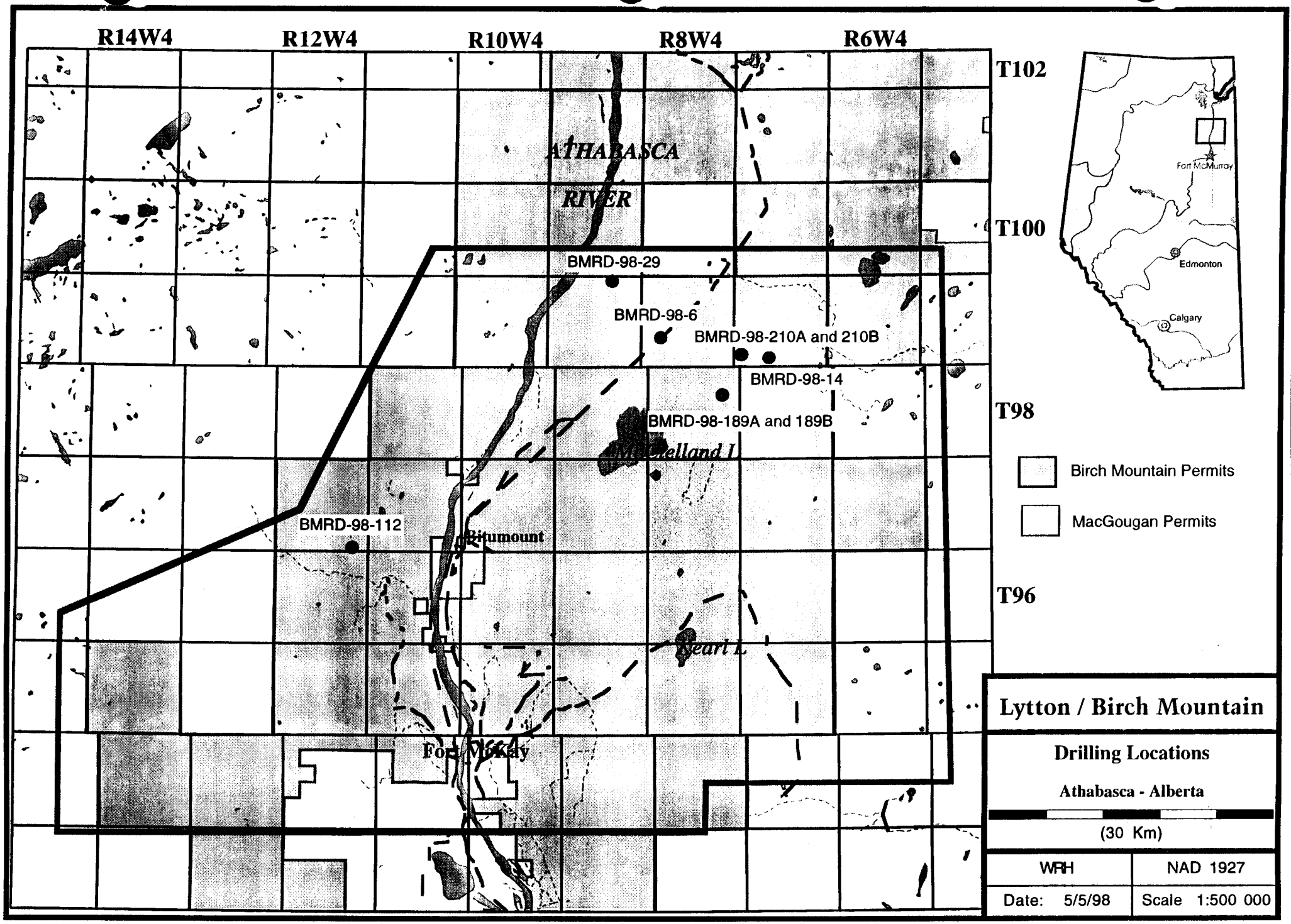

Figure 2. Location of drilled magnetic anomalies

Table 2. Summary of lithological characteristics by geological unit.

Unit	Age	Thicknesses Cored (average)[1]	Lithology
Outwash Sand	Quaternary	14.30 - 51.80 (25)	Medium grained sand. Has a slight reddish hue at surface. Landforms (dunes) indicate eolian transport.
Lake Sediments	Quaternary	3.10 - 53.3 (23)	Pink to dark brown mud. Scattered white and red quartzite dropstones. Occasional cm-scale varves. Rare boulder till intervals to 10 m.
Clearwater Fm.	Cretaceous	51.35 (one incomplete section in BMRD-98-112)	Black mudstone, fine grained tar sand, glauconitic sandstone.
McMurray Fm.	Cretaceous	3.7 - 43.05 (19) (complete section of 43.05m in BMRD-98-112)	Tar sand, water sand (unconsolidated sand with very minor bitumen), grey to light brown shale.
Firebag Member of Waterways Fm.	Devonian	10.80 - 35.20 (22.5)	Light green limey shale, light grey nodular limestone
Slave Point Fm.	Devonian	8.50 - 11.50 (10.30)	Light brown limestone, bituminous shale laminations.
Ft. Vermilion/ Watt Mt. Fms.	Devonian	18.50 - 23.50 (20.40)	Interbedded green and grey shale, limestone, dolomite.
Methy Fm.	Devonian	26.00 - 81.00 [2] (44.00)	Light brown dolomite, bituminous shale laminations.
Mclean River Fm.	Devonian	24.0 (bottom cored in BMRD-98-21OA only)	Green shale, gypsum beds and veins to 20 cm.
La Loche Fm.	Devonian?	7.00 (bottom cored in BMRD-98-21OA only)	Red sandstone, gypsum beds and veins to 20 cm.
Basement	Archean?	13.15 (cored in BMRD-98-210A)	Red granitoid gneiss.

[1]values only from those holes which cored the bottom of the unit.
[2]cored 81 m of Methy in BMRD-98-29, bottom of hole in Methy.

Table 3. Summary of lithological characteristics by drill hole.

Hole[1]	Lithological Characteristics
BMRD-98-14	Lithologies and thicknesses typical of regional geology.
BMRD-98-210A	Lithologies and thicknesses typical of regional geology. (Note: the top of the Slave Point Formation is 7.6 m higher in BMRD-98-210B than in BMRD-98-210A. The holes are 145 m apart.)
BMRD-98-210B	Lithologies and thicknesses typical of regional geology. (Note: the top of the Slave Point Formation is 7.6 m lower in BMRD-98-210A than in BMRD-98-210B. The holes are 145 m apart.)
BMRD-98-112	Lithologies and thicknesses typical of regional geology.
BMRD-98-189A	Abundant structural disturbance, top of McMurray Formation downward - scattered fracturing/brecciation and slicken-sided surfaces throughout, bedding inclined up to 30 degrees to horizontal. (Note: the top of the Slave Point Formation is 10.5 m lower in BMRD-98-189B than in BMRD-98-189A. The holes are 11 m apart.)
BMRD-98-189B	Abundant structural disturbance, top of McMurray Formation downward -scattered fracturing/brecciation, and slicken-sided surfaces throughout, bedding inclined up to 30 degrees to horizontal. (Note: the top of the Slave Point Formation is 10.5m lower in BMRD-98-189B than in BMRD-98-189A. The holes are 11 m apart.)
BMRD-98-29	Cored 81.80 m of the Methy dolomite (still in Methy at the bottom of the hole). The Methy is typically 25 to 50 m thick, but can reach up to 100 m thick in reefal highs.
BMRD-98-6	Increasing structural disturbance downward, none observed in the Quaternary lake sediments, moderate soft sediment deformation in the McMurray Formation. Intense brecciation in the Firebag and Slave Point Units. Evidence of karsting includes calcite cementation of the McMurray Formation, internal sedimentation within the Firebag Member, and vuggy porosity in the Slave Point Formation.

[1]in chronological order.

5.6.4 Magnetic Susceptibility

A hand held Exploranium KT-9 Kappameter was used to generate magnetic susceptibility profiles for each core. A summary of typical values for each geological unit are given in Table 4. Readings from each hole are given in Appendix F.4., graphic profiles are included with the stratigraphic columns in Appendix F.2. In order to identify any thin (10-50 cm) magnetically susceptible horizons, the entire core was slowly scanned with the meter set to take continuous reading. A profile was then generated by taking readings every 20 cm to 5 m.

Magnetic susceptibilities in general were very low, ranging from 0.00 - 0.50×10^{-3} units SI. No magnetic horizon was identified in any of the cores that would account for the anomalies observed on the airborne or ground geophysical surveys. BMRD-98-210B was the only hole that cored basement, a granitoid gneiss likely belonging to the Archean Rae Province, with magnetic susceptibilities over 13.15 m of core ranging from 0.00 - 0.53×10^{-3} units SI, which is not significantly different from the sedimentary package.

Magnetic susceptibilities of several drill cores from the Athabasca permits stored in Birch Mountain's core facility in Calgary were also measured in order to see if some lithologies present that were not intersected in the eight 1998 drill holes, might produce a magnetic anomaly. These results are given in the bottom part of Table 5.6.4. Magnetic susceptibilities of altered mafic and felsic gneiss intersected in Birch Mountain's AL94-01 hole are low, ranging from 0.09-0.54×10^{-3} units SI. Readings from de-calcified and sideritized limey shale intervals of the Firebag Member located immediately below the sub-Cretaceous unconformity range from 0.14 to 0.76×10^{-3} units SI, approximately 2 to 3.5 times that of unaltered limey shale. 50 cm scale intervals of the Firebag Member containing 5% pyrrhotite (visual estimation) gave magnetic susceptibilities up to 0.60 $\times 10^{-3}$ units SI, roughly 3 times that of adjacent non-pyrrhotite bearing rocks of the same lithology. Relatively high magnetic susceptibilities up to 65×10^{-1} units SI were obtained from diorite of the Taltson Magmatic Arc in a core drilled by LAC Minerals Ltd. in 1994 (now in possession of Birch Mountain Resources Ltd.).

Table 4. Summary of Magnetic Susceptibilities.

Unit	Lithology	Typical Magnetic Susceptibility (units SI)	Range of Magnetic Susceptibility (units SI)
Quaternary sand	Sand	0.20 - 0.30	0.01- 2.01
Quaternary mud	Mud	0.30 - 0.50	0.04 - 0.88
Clearwater Fm	Mudstone/Tar sand	0.10 - 0.30	0.01 - 2.07
McMurray Fm	Tar sand/shale	0.10 - 0.30	0.00 - 0.88
Firebag Member	Limey shale	0.10 - 0.20	0.01 - 0.62
Slave Point Fm.	Limestone	0.05	0.03 - 0.12
Watt Mt. - Ft. Vermilion Fms.	Interbedded Lms/shale/dol	0.07	0.01 - 0.37
Methy Formation	Dolomite	0.05	0.00 - 0.09
McLean River Fm (BMRD-98-210B only)	Green shale/gypsum	0.06	0.06 - 0.17
La Loche Formation (BMRD-98-210B only)	Red sandstone	0.10	0.06 - 0.21
Basement (BMRD-98-210B only)	Granitoid Gneiss	0.10 - 0.25	0.01 - 0.53
Basement in AL94-01	Altered mafic/felsic gneiss	0.15 - 0.25	0.09 - 0.54
Altered Firebag Member	De-calcified shale, siderite	0.30 - 0.50	0.14 - 0.76
Firebag with 5% pyrrhotite	Limey shale	0.32 - 0.60	0.32 - 0.60
Basement in ATH-03 (Talston Arc)	Granite	0.50	0.21 - 1.24
Basement in ATH-03 (Talston Arc)	Granodiorite	8.00 - 12.00	0.78 - 13.30
Basement in ATH-03 (Talston Arc)	Diorite	40.00 - 50.00	1.56 - 65.10

6.0 CONCLUSIONS

The objectives of Birch Mountain's 1998 exploration on its Athabasca permits were directed at one potential deposit type: kimberlite-hosted diamonds. This objective was met through exploration activities involving airborne magnetometer surveys, diamond drilling, and analysis of subsurface data.

In September, 1997, Birch Mountain contracted APEX Geoscience to undertake a study of the Athabasca aeromagnetic survey and other data to evaluate the diamond potential of its northern Alberta properties. The final report was submitted January,

1998, is summarized in Section 5.1. and is included as Appendix C.1.

In January, 1998, APEX Geoscience and GEDCO were contracted to undertake a comprehensive examination of the Athabasca aeromagnetic survey to identify additional potential kimberlite targets. The examination process and results are summarized in Section 5.1. and included as Appendix C.2. Apex and GEDCO identified over 200 magnetic anomalies from which seventy-two were selected for detailed examination of leveled and culturally edited aeromagnetic line profiles. These 75 anomalies were prioritized yielding 10 high priority anomalies, 24 medium priority anomalies, 32 low priority anomalies, 5 subgrade anomalies and one reject anomaly.

Eight magnetic anomalies or potential kimberlites were selected as drilling targets. Field operations began in latest January and ended in latest March, 1998. The field program comprised two parts: (1) verification of the location and character of magnetic anomalies picked from the airborne magnetometer survey by ground and air magnetic surveys (Appendices D and E); and (2) drilling of *bona fide* anomalies (Appendix F).

7.0 EXPLORATION EXPENDITURES

The costs reported in this section represent those costs paid directly by Birch Mountain Resources, Ltd. The data provided in the report represents the complete data set compiled under Birch Mountain Resources, Ltd.'s 1998 Athabasca exploration program.

Table 5. Exploration expenditures.

Activity	Item: Report Author	Appendix	Amount
Identification of Potential Kimberlite Targets	Diamond Potential Report: Apex Geoscience	C.1	$16,923.61
	Magnetic Anomaly Evaluation: Apex Geoscience, GEDCO:	C.2	$11,205.52
Ground Magnetic Surveys	Grid geophysical surveys including linecutting and surveying: Komex International	D.1	$299,994.60
	Field supervision, office support, interpretation and report preparation: Birch Mountain	D.1	$32,602.13
	Line geophysical survey: Birch Mountain	D.2	$1,605.17
Aeromagnetic Surveys	Aeromagnetic surveying and interpretation: Canagrad, Osprey	E	$94,700.23
Drill Program	Office support, interpretation and report preparation: Birch Mountain	E	$9,120.21
	Drilling, road and ice-bridge construction, reclamation	F	$523,389.49
	Field supervision, office support, interpretation and report preparation: Birch Mountain	F	$59,757.53
		Total	$1,049,298.49

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8.0 APPENDICES

AppendixA

Athabasca Exploration Permits

Appendix A.1.

Land Description

February 11, 1999, Grouping

Permit Description

February 11,1999, Grouping

Type	Number	Owner	Term Date	Period	Amount Due	Amount Filed
Permit	9390070004	Birch Mountain	10-Jul-90	5	$39,057.90	$0.00
Permit	939007A003	Birch Mountain	10-Jul-90	5	$29,300.40	$0.00
Permit	9393080687	Birch Mountain	31-Aug-93	3	$86,281.50	$86,281.50
Permit	9393090134	Birch Mountain	28-Sep-93	3	$92,160.00	$92,160.00
Permit	9393110019	Birch Mountain	29-Nov-93	3	$92,160.00	$39,309.90
Permit	9393110020	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110021	Birch Mountain	29-Nov-93	3	$89,600.00	$0.00
Permit	9393110023	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110026	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110034	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110035	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110036	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110037	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110038	Birch Mountain	29-Nov-93	3	$83,360.00	$0.00
Permit	9393110065	Birch Mountain	29-Nov-93	3	$79,360.00	$0.00
Permit	9393110066	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110067	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110068	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9393110082	Birch Mountain	29-Nov-93	3	$92,160.00	$0.00
Permit	9394020001	Birch Mountain	11-Feb-94	3	$38,400.00	$0.00
Permit	9394020002	Birch Mountain	11-Feb-94	3	$46,080.00	$0.00
Permit	9394020003	Birch Mountain	11-Feb-94	3	$61,280.00	$0.00
Permit	9394020004	Birch Mountain	11-Feb-94	3	$40,960.00	$0.00
Permit	9394020006	Birch Mountain	11-Feb-94	3	$74,240.00	$0.00
Permit	9394020007	Birch Mountain	11-Feb-94	3	$71,040.00	$0.00
Permit	9394020008	Birch Mountain	11-Feb-94	3	$24,908.80	$0.00
Permit	9394020009	Birch Mountain	11-Feb-94	3	$92,160.00	$0.00
Permit	9394020010	Birch Mountain	11-Feb-94	3	$92,160.00	$0.00
Permit	9394020011	Birch Mountain	11-Feb-94	3	$51,840.00	$0.00
Permit	9394020012	Birch Mountain	11-Feb-94	3	$65,120.00	$0.00
Permit	9394020013	Birch Mountain	11-Feb-94	3	$57,920.00	$0.00
Permit	9394020014	Birch Mountain	11-Feb-94	3	$86,886.80	$0.00
Permit	9394020015	Birch Mountain	11-Feb-94	3	$86,993.60	$0.00
Permit	9394020016	Birch Mountain	11-Feb-94	3	$92,160.00	$0.00
Permit	9394040029	Birch Mountain	14-Apr-94	3	$83,844.20	$0.00
Permit	9394040030	Birch Mountain	14-Apr-94	3	$91,545.00	$0.00
Permit	9394040031	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040032	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040033	Birch Mountain	14-Apr-94	3	$44,077.20	$0.00
Permit	9394040034	Birch Mountain	14-Apr-94	3	$25,600.00	$0.00
Permit	9394040035	Birch Mountain	14-Apr-94	3	$90,080.00	$0.00

Permit Description

February 11,1999, Grouping

Type	Number	Owner	Term Date	Period	Amount Due	Amount Filed
Permit	9394040036	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040037	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040038	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040039	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040040	Birch Mountain	14-Apr-94	3	$6,907.09	$6,907.09
Permit	9394040041	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040042	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040043	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040044	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040045	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040046	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040047	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9394040048	Birch Mountain	14-Apr-94	3	$92,160.00	$0.00
Permit	9396060018	Birch Mountain	18-Jun-96	1	$23,040.00	$23,040.00
Permit	9396060019	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060020	Birch Mountain	18-Jun-96	1	$42,240.00	$42,240.00
Permit	9396060021	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060022	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060023	Birch Mountain	18-Jun-96	1	$37,120.00	$37,120.00
Permit	9396060024	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060025	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060027	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396060088	Birch Mountain	18-Jun-96	1	$46,080.00	$46,080.00
Permit	9396080027	Birch Mountain	14-Aug-96	1	$38,400.00	$38,400.00
Permit	9396080028	Birch Mountain	14-Aug-96	1	$39,680.00	$39,680.00
Permit	9396080029	Birch Mountain	14-Aug-96	1	$39,680.00	$39,680.00
Permit	9396080030	Birch Mountain	14-Aug-96	1	$46,080.00	$46,080.00
Permit	9396080091	Birch Mountain	29-Aug-96	1	$46,080.00	$46,080.00
Permit	9396080092	Birch Mountain	29-Aug-96	1	$46,080.00	$46,080.00
Permit	9396080093	Birch Mountain	29-Aug-96	1	$46,080.00	$46,080.00
Permit	9396080094	Birch Mountain	29-Aug-96	1	$44,800.00	$44,800.00
Permit	9398070213	Birch Mountain	29-Jul-98	1	$46,080.00	$0.00
Permit	9398070263	Birch Mountain	30-Jul-98	1	$21,760.00	$0.00
Permit	9398070320	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070321	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070322	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070323	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070324	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070325	Birch Mountain	31-Jul-98	1	$45,120.00	$0.00
Permit	9398070326	Birch Mountain	31-Jul-98	1	$7,680.00	$0.00
Permit	9398070327	Birch Mountain	31-Jul-98	1	$18,560.00	$0.00
Permit	9398070328	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070329	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00
Permit	9398070330	Birch Mountain	31-Jul-98	1	$46,080.00	$0.00

Permit Description

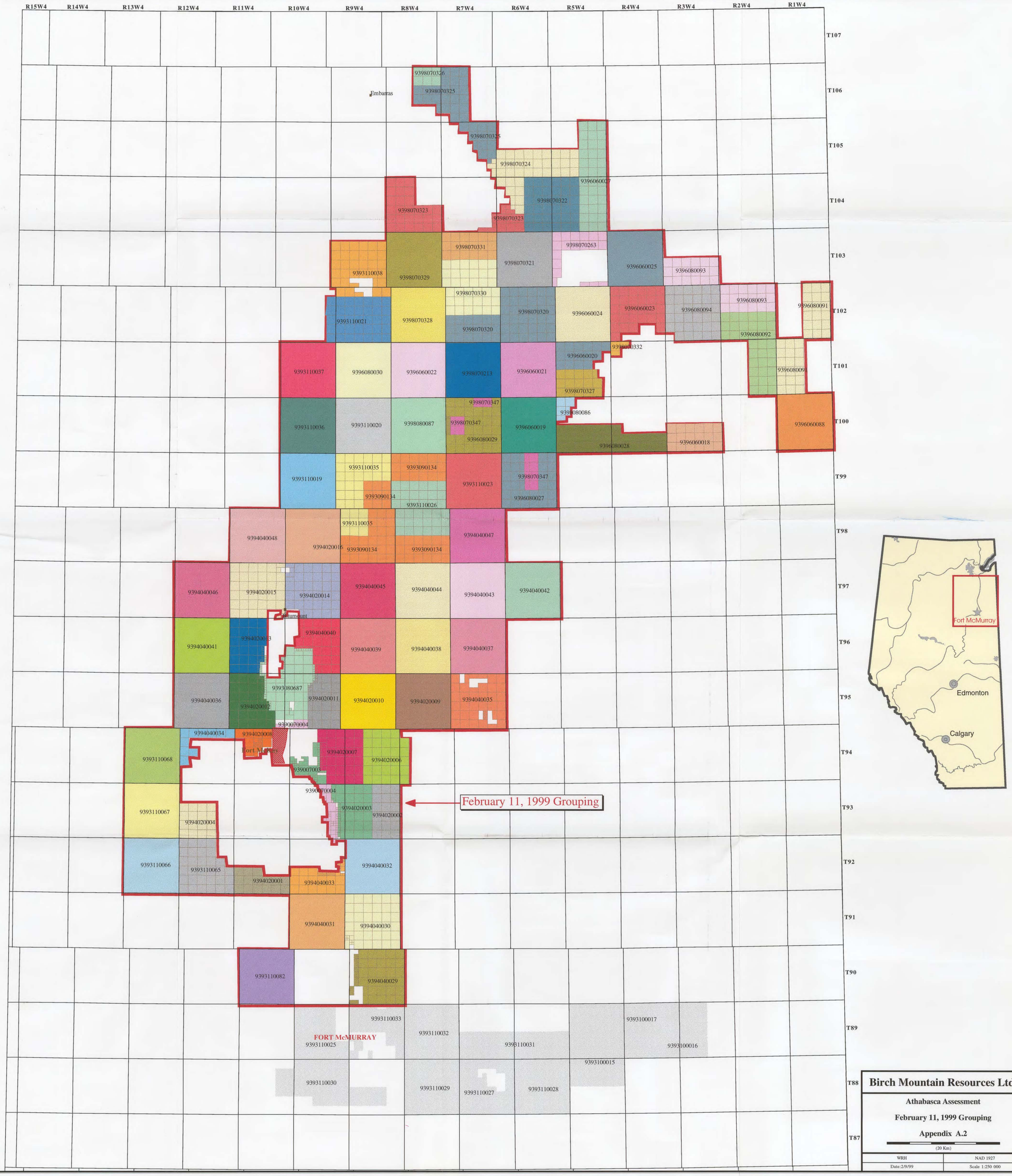
February 11,1999, Grouping

Type	Number	Owner	Term Date	Period	Amount Due	Amount Filed
Permit	9398070331	Birch Mountain	31-Jul-98	1	$23,040.00	$0.00
Permit	9398070332	Birch Mountain	31-Jul-98	1	$2,560.00	$0.00
Permit	9398070347	Birch Mountain	31-Jul-98	1	$14,080.00	$0.00
Permit	9398080086	Birch Mountain	28-Aug-98	1	$8,320.00	$0.00
Permit	9398080087	Birch Mountain	28-Aug-98	1	$46,080.00	$0.00
Permit	9390070003	K Richardson	10-Jul-90	4	$6,720.00	$6,720.00
Permit	9396110048	L MacGougan	21-Nov-96	1	$46,080.00	$46,080.00
					Total	$1,049,298.49

Appendix A.2.

Map of Athabasca Exploration Permits

(Pocket)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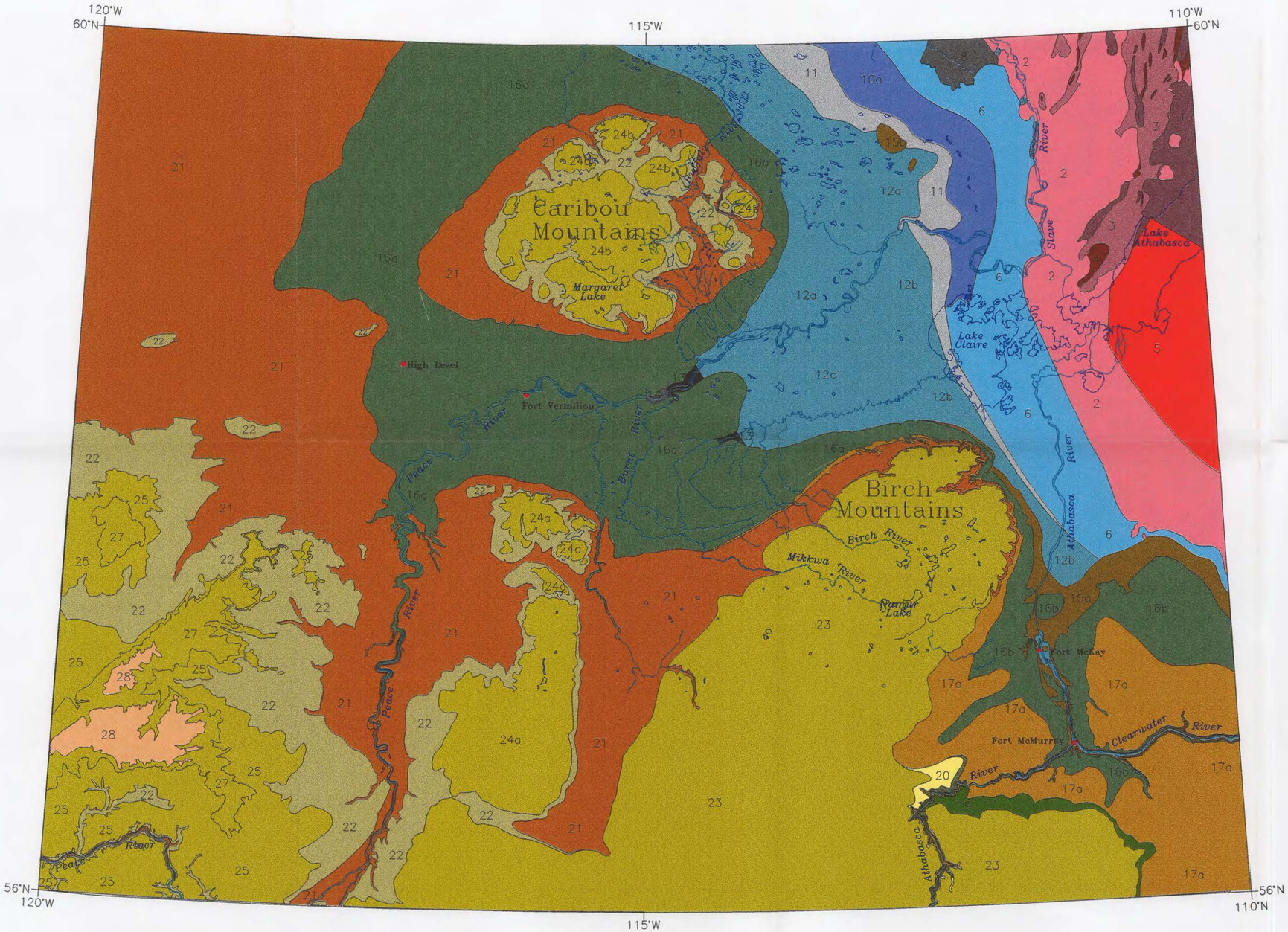
Embarras
Bitumount
Fort McMurray
FORT McMURRAY
February 11, 1999 Grouping
Fort McMurray
Edmonton
Calgary
Birch Mountain Resources Ltd.
Athabasca Assessment
February 11, 1999 Grouping
Appendix A.2
(20 Km)
WRH
NAD 1927
Date:2/9/99
Scale 1:250 000

Appendix B

Regional Geological Map

1:250,000 Scale

(Pocket)



Birch Mountain Resources

REGIONAL GEOLOGY

NTS 84 A to M, 74 D, E, L, M

Scale 0 20 40 60 80 100 Kilometres

KMA/APEX

21/01/98

Geology modified after Green et al., 1970

LEGEND

CRETACEOUS

28 — ***WAPITI FORMATION:*** grey carbonaceous feldspathic sandstone, silty shale, bentonite; thin coal beds; nonmarine

27 — ***PUSKWASKU FORMATION:*** dark grey fossiliferous shale, silty in upper part; marine

25 — ***KASKAPAU FORMATION:*** dark grey silty shale, ironstone partings: interbedded in lower part with fine–grained quartzose sandstone and thin beds of ferruginous oolitic mudstone; marine

24b — ***UNNAMED DARK GREY SHALE*** Caribou Mountains and Buffalo Head Hills

24a — ***SMOKY GROUP:*** dark grey and silty shale, ironstone partings and concretions; marine

23 — ***LABICHE FORMATION:*** dark grey shale and silty shale, ironstone partings and concretions; thin fish scale–bearing silty beds in lower part; marine

22 — ***DUNVEGAN FORMATION:*** grey fine–grained feldspathic sandstone with hard calcareous beds, laminated siltstone and grey silty shale; deltaic to marine

21 — ***SHAFTESBURY FORMATION:*** dark grey fish scale–bearing shale, silty in upper part; numerous nodules and thin beds of concretionary ironstone; bentonite partings; interbedded locally in lower part with thin silty and sandy intervals; marine

20 — ***PELICAN FORMATION:*** fine–grained quartzose sandstone, silty and glauconitic in lower part; marine

19 — ***JOLI FOU FORMATION:*** dark grey fossiliferous shale, silty interbeds in upper part; marine

18 — ***PEACE RIVER FORMATION, CADOTTE MEMBER*** (upper): fine–grained quartzose sandstone; ***HARMON MEMBER*** (middle): dark grey silty shale: ***NOTIKEWIN MEMBER*** (lower): fine–grained glauconitic sandstone, silty interbeds in lower part; marine

17a — ***GRAND RAPIDS FORMATION:*** fine–grained quartzose and feldspathic sandstone, laminated siltstone and silty shale; thin coaly beds; deltaic to marine

16b — ***CLEARWATER FORMATION:*** dark fossiliferous silty shale, laminated siltstone, fine–grained cherty sandstone; glauconitic sandstone ***(WABISKAW MEMBER)*** near base; marine

16a — ***LOON RIVER FORMATION:*** dark grey fossiliferous silty shale and laminated siltstone, ironstone nodules and partings; marine

15b — ***BASAL CRETACEOUS,*** Wood Buffalo Park: calcareous quartz sandstone, equivalent in position to ***McMURRAY FORMATION*** of Athabasca River region

15a — ***McMURRAY FORMATION:*** cross–bedded quartzose sandstone and siltstone; oil–impregnated with grey silty shale interbeds in upper part; deltaic

DEVONIAN

14 — ***GROSMONT FORMATION:*** grey fine–grained granular partly vuggy dolomite; marine

13 — ***MIKKWA FORMATION,*** upper member: brownish–grey to olive green, purplish–red mottled, fine–grained limestone, dolomitic limestone and shaly limestone; lower member: dark grey to brownish–grey fine–grained limestone and dolomitic limestone; marine

12c — ***IRETON FORMATION:*** greenish–grey shale and calcareous shale and siltstone; marine

12b — ***WATERWAYS FORMATION:*** grey and greenish–grey shale and argillaceous limestone units alternating with grey and greyish–brown fine–grained and clastic limestone units; marine

12a — ***HAY RIVER FORMATION:*** greenish–grey calcareous shale, argillaceous siltstone and argillaceous limestone; marine

11 — ***CARIBOU MEMBER, SLAVE POINT FORMATION:*** grey and brown fine– to medium–grained limestone and dolomitic limestone; minor shale, gypsum; marine

10a — ***NYARLING FORMATION:*** white and grey gypsum, argillaceous and dolomitic gypsum; some fine–grained limestone and dolomitic limestone;anhydrite, minor dolomite and salt, greenish shale and limestone in subsurface; evaporitic

8 — ***CHINCHAGA FORMATION:*** white and grey gypsum, argillaceous and dolomitic gypsum and anhydrite; some dolomite, dolomitic limestone, red and green shale; some salt in subsurface; evaporitic

6 — ***MIDDLE DEVONIAN*** (undivided) includes ***METHY FORMATION:*** brown and buff massive porous dolomite, brown to grey thin–bedded dolomite, dolomitic limestone, minor anhydrite and gypsum; ***McLEAN RIVER FORMATION*** and leached ***PRAIRIE EVAPORITE FORMATION:*** gypsum, anhydrite, grey–green silty and dolomitic shale, minor dolomite; marine to evaporitic

PRECAMBRIAN

5 — ***ATHABASCA FORMATION:*** white, grey and red, medium– to coarse–grained sandstone, flat–bedded to strongly crossbedded; local conglomerate and shale beds

4 — ***METASEDIMENTARY ROCKS:*** black and grey quartzite and impure quartzite, biotite schist, phyllite; minor sericite and hornblende schist, phyllonite, amphibolite; variable amounts of pegmatite and granite

3 — ***GRANITE GNEISS:*** predominantly biotite and hornblende granite gneiss; minor amphibolite, schist, foliated granite, pegmatite and other gneisses

2 — ***UNDIVIDED GRANITIC PLUTONIC ROCKS:*** including biotite granite, porphyroblastic and porphyritic granites; some granite gneiss and metasedimentary rocks

1 — ***PORPHYROBLASTIC GRANITES:*** foliated to massive, white, grey and pink biotite granite and gneissic granite, quartz diorite, with feldspar porphyroblasts; variable amounts of sedimentary rocks and granite gneiss

Geology modified after Green et al., 1970

Birch Mountain Resources

REGIONAL GEOLOGY

NTS 84 A to M, 74 D, E, L, M

Scale 0 20 40 60 80 100 Kilometres

KMA/APEX

21/01/98

Appendix C

Potential Kimberlite Targets

Appendix C.1.

Apex Geoscience Diamond Potential Report

NTS 84 H, J, O
74 D, E

AN EVALUATION OF THE DIAMOND POTENTIAL OF BIRCH MOUNTAIN RESOURCES LTD.'S NORTHERN ALBERTA MINERAL PERMITS

Prepared for

Birch Mountain Resources Ltd.

APEX Geoscience Ltd.

January, 1998

L. Chin
M. B. Dufresne

AN EVALUATION OF THE DIAMOND POTENTIAL OF BIRCH MOUNTAIN RESOURCES LTD.'S NORTHERN ALBERTA MINERAL PERMITS

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2 BUDGET FOR RECOMMENDED 1998 EXPLORATION . . . . . AT END

AN EVALUATION OF THE DIAMOND POTENTIAL OF BIRCH MOUNTAIN RESOURCES LTD.'S NORTHERN ALBERTA MINERAL PERMITS

SUMMARY

Birch Mountain Resources Ltd.'s (BMRL) current land holdings in northern Alberta include: (a) about 432,682 acres in 19 townships in the Caribou Mountains area, approximately 80 km northeast of Fort Vermilion, (b) about 204,955 acres in 9 townships in the Birch Mountains area, approximately 120 km northwest of Fort McKay, and (c) about 1,227,711 acres in 66 separate townships in the immediate vicinity of Fort McKay and Fort McMurray along the Athabasca River. These properties are prospective and should be evaluated for the presence of diamondiferous kimberlites or related intrusions.

The Caribou Mountains permits straddle the boundary between two Proterozoic basement terranes named the Buffalo Head Terrane and the Taltson Magmatic Zone (TMZ). The permits lie along the eastern edge of a strong gravity low and magnetic basement of unknown affinity due to poor government geophysical survey coverage in the area. The permits are approximately 160 km north of the axial trace of the Peace River Arch (PRA) and about 215 km northeast of Ashton Mining of Canada Inc.'s (Ashton) discovery area for the Buffalo Head Hills kimberlites. The Caribou Mountains permits are underlain by predominantly shaly sediments of Lower Cretaceous to Upper Cretaceous Loon River through to Labiche formations.

The Birch Mountains permits are about 50 km north of the axial trace of the PRA along the north flank of the arch. The Birch Mountains permits are underlain by magnetically low basement that could be either the eastern portion of the Buffalo Head Terrane or the western portion of the TMZ. The permits lie at the edge of the gravity low that is host to Ashton's Buffalo Head Hills kimberlites, which occur about 145 km to the southwest. As with the Caribou Mountains permits, the Birch Mountains permits are underlain by a sequence of Lower to Upper Cretaceous shale dominated sediments of the Loon River, Pelican, Shaftesbury, Second White Specks and Labiche formations. The regional geological and tectonic setting for both the Caribou Mountains and Birch Mountains permit areas is considered favourable for the formation and preservation of diamonds in the upper mantle beneath these areas. The risk of exploration success is considered high for both permit areas because of the lack of exploration conducted to date.

The Athabasca permits are situated near the axial trace of the PRA about 220 km east of the Ashton kimberlite discovery area and are underlain by magnetically high basement of the Proterozoic TMZ and magnetically low basement of the Archean Rae Sub-province. The Fort McKay to Fort McMurray area is predominantly underlain by a poor quality gravity high, which in comparison to areas underlain by gravity lows such as the Buffalo Head Hills, is thought to indicate thin crust and, therefore, less favourable conditions for the formation and preservation of diamonds in the upper mantle. On a more positive note, seismic refraction data indicates that the crust is thick in the vicinity of BMRL's Athabasca permits. In addition, although the TMZ is not thought to be a good target for diamond exploration, it is possible that the TMZ represents a thrust slice that

originated well to the west and that large portions of the BMRL permits are underlain by the more favourable Archean basement of the Rae Sub-province. The relationship between gravity, crust thickness and the diamond stability field at the time of emplacement of any intrusions in the vicinity of the Athabasca permits is speculative at present. The permits are predominantly underlain by Devonian carbonates and Lower to mid-Cretaceous clastic sediments and shale of the McMurray, Clearwater and Grand Rapids formations, which span a time interval from about 120 to 100 Ma. Several of the Fort à la Corne kimberlites were emplaced during this time period. In addition, Ashton's Buffalo Head Hills kimberlites and the Mountain Lake Kimberlite near Grande Prairie have all been emplaced post deposition of the sediments underlying BMRL's Athabasca permits. The likelihood for discovery of kimberlites or related intrusions on BMRL's Athabasca permits is considerably higher than for the Caribou Mountains and Birch Mountains permits based upon: (a) the position of BMRL's permits with respect to the axial trace of the PRA, (b) the recent identification of multiple high quality magnetic anomalies that could be indicative of shallow intrusive bodies in the sedimentary column, and (c) prior diamond indicator results from samples within or in a down-ice direction of the permits.

Even though all three BMRL permit areas are at different stages of exploration, all three permit areas have either moderate or high potential to host kimberlitic pipes based upon the existing preliminary geological, geochemical and geophysical data for each of the three properties. Therefore, a three phase exploration program is recommended for BMRL's three northern Alberta permit areas. **Phase 1** should consist of: (a) conducting a fixed-wing aeromagnetic survey over the Caribou Mountains and Birch Mountains permit areas, and those parts of the Athabasca permits that have not yet been magnetically surveyed, and (b) further evaluation of the exisiting magnetic data for the Athabasca permits in order to prioritize those anomalies identified to date and delineate other high priority magnetic anomalies for follow-up fieldwork during Phase 2. The estimated cost to conduct the Phase 1 program is about $270,000. This program should be initiated immediately. The **Phase 2** program should consist of: (a) ground geophysics followed by dry auger drilling of selected moderate to high priority magnetic anomalies within BMRL's Athabasca permits in order to obtain samples of the basal till and near surface bedrock, and (b) conduct a thorough review of the magnetic data obtained from the airborne magnetic survey for the Caribou Mountains, Birch Mountains and unflown Athabasca permits in conjunction with existing topographic and LandSat Satellite data in order to identify and prioritize aeromagnetic anomalies for follow-up exploration. The preliminary estimated cost to conduct the Phase 2 exploration program is about $190,000. This program should be conducted during early 1998. The **Phase 3** exploration program is dependent upon the results of the Phase 1 and 2 programs, but will likely consist of one or more of the following: (a) a field program for the Caribou Mountains and Birch Mountains permit areas to ground check any magnetic anomalies with signatures that may be indicative of kimberlitic pipes, (b) a systematic soil, stream sediment and/or till sampling program in the vicinity of selected medium to high priority magnetic anomalies for all three permit areas, and (c) drill testing magnetic anomalies on the Athabasca permits that yielded encouraging results during the Phase 2 program. The scope and cost for the Phase 3 program will be entirely dependent upon the results of the Phase 1 and 2 programs, but it is anticipated that an expenditure on the order of $400,000 to $500,000 will likely be required as a minimum.

INTRODUCTION

Terms of Reference

APEX Geoscience Ltd. (APEX), was retained on October 8, 1997 as consultants by Birch Mountain Resources Ltd. (BMRL) to prepare an independent evaluation of the diamond potential of BMRL's northern Alberta mineral permits. This evaluation has been prepared on the basis of available published and unpublished material, and previous fieldwork conducted by one of the authors.

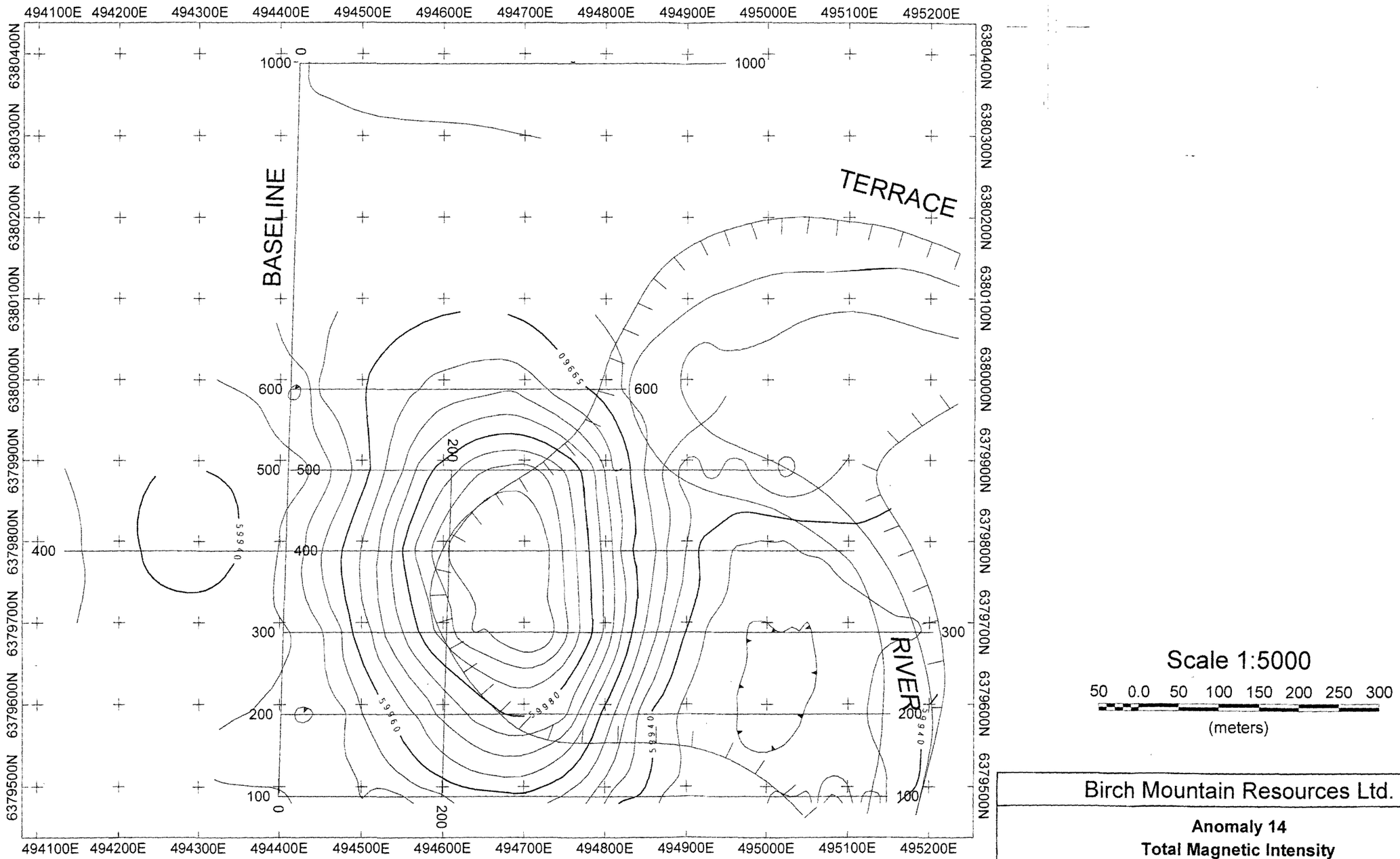
Property Description and Location

Birch Mountain Resources Ltd. holds 1,865,348 acres in three separate permit areas in northern Alberta including about 432,682 acres in the Caribou Mountains, 204,955 acres in the Birch River area and 1,227,711 acres in the Fort McMurray to Fort McKay area. The legal description for BMRL's mineral permits are provided in Appendices 1a, 1b and 1c. Birch Mountain Resources Ltd.'s Caribou Mountains permits are about 575 km north of the provincial capital of Edmonton, with the nearest community being Fort Vermilion (pop. <500) which is approximately 80 km to the southwest of these permits (Figure 1). The Birch Mountains Permits are about 120 km northwest of the nearest community of Fort McKay. The Athabasca Permits are centered about Fort McMurray and Fort McKay along the Clearwater and Athabasca Rivers (Figure 1).

Accessibility, Climate and Local Resources

The Caribou Mountains permits may be accessed via winter road or helicopter with some of the more remote northern locations accessible only by helicopter. Some of the southern portions of the Caribou Mountains permits may be accessed by four-wheel drive truck. Accommodation, food, supplies and fuel are available in Fort Vermilion. The Birch Mountains permits may be accessed by winter road or helicopter with accommodation, food, supplies and fuel available in either Fort Vermilion or Fort McKay. The Athabasca permits are generally accessible by road with some of the more remote locations requiring the use of a helicopter. During exploration activities on the Athabasca permits, accommodation, food, supplies and fuel are available in Fort McMurray.

The regional physiography in the immediate vicinity of the Athabasca permits is generally low lying (from 300 to 350 m above sea level), with open and spruce-forested swampy ground. In the northern section of the mineral permits the swampy areas are separated by well defined pine-forested sand flats. Spruce-forested swampy ground in this area gives way to the south and southwest to ground that is well drained and densely forested, with a mix of deciduous and coniferous trees on the northern side of a roughly circular elevated area called Muskeg Mountain (with elevations of up to 580 m above sea level). To the northwest, within the Birch Mountains and Caribou Mountains permits, are large areas of dryer and well drained sand flats and hills with elevations of up to 1000 m above sea level and thick pine forests.



Scale 1:5000

50 0.0 50 100 150 200 250 300

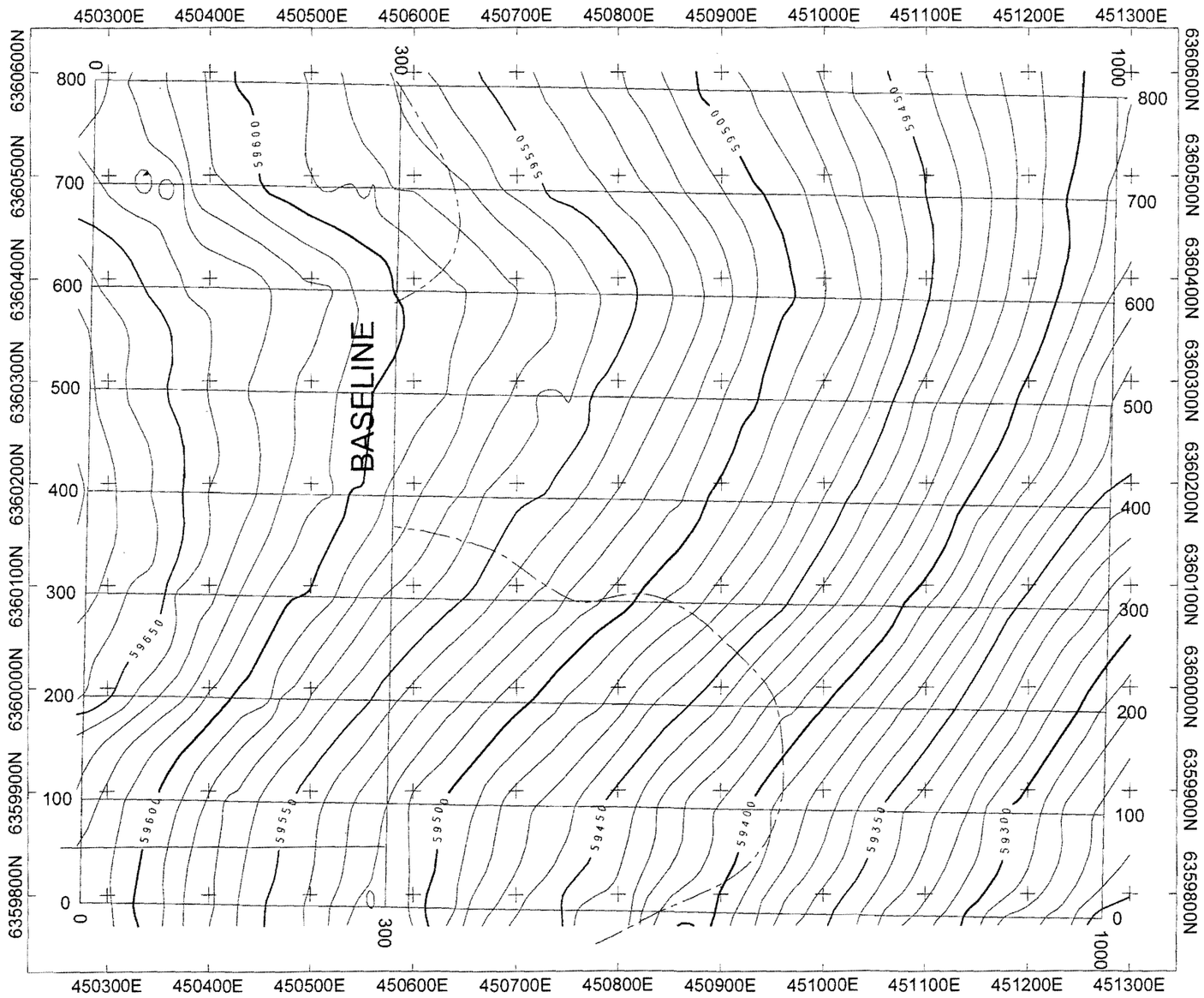
(meters)

Birch Mountain Resources Ltd.

Anomaly 14
Total Magnetic Intensity

Data collected 12, 13, 22 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



Scale 1:5000

100 0.0 100 200

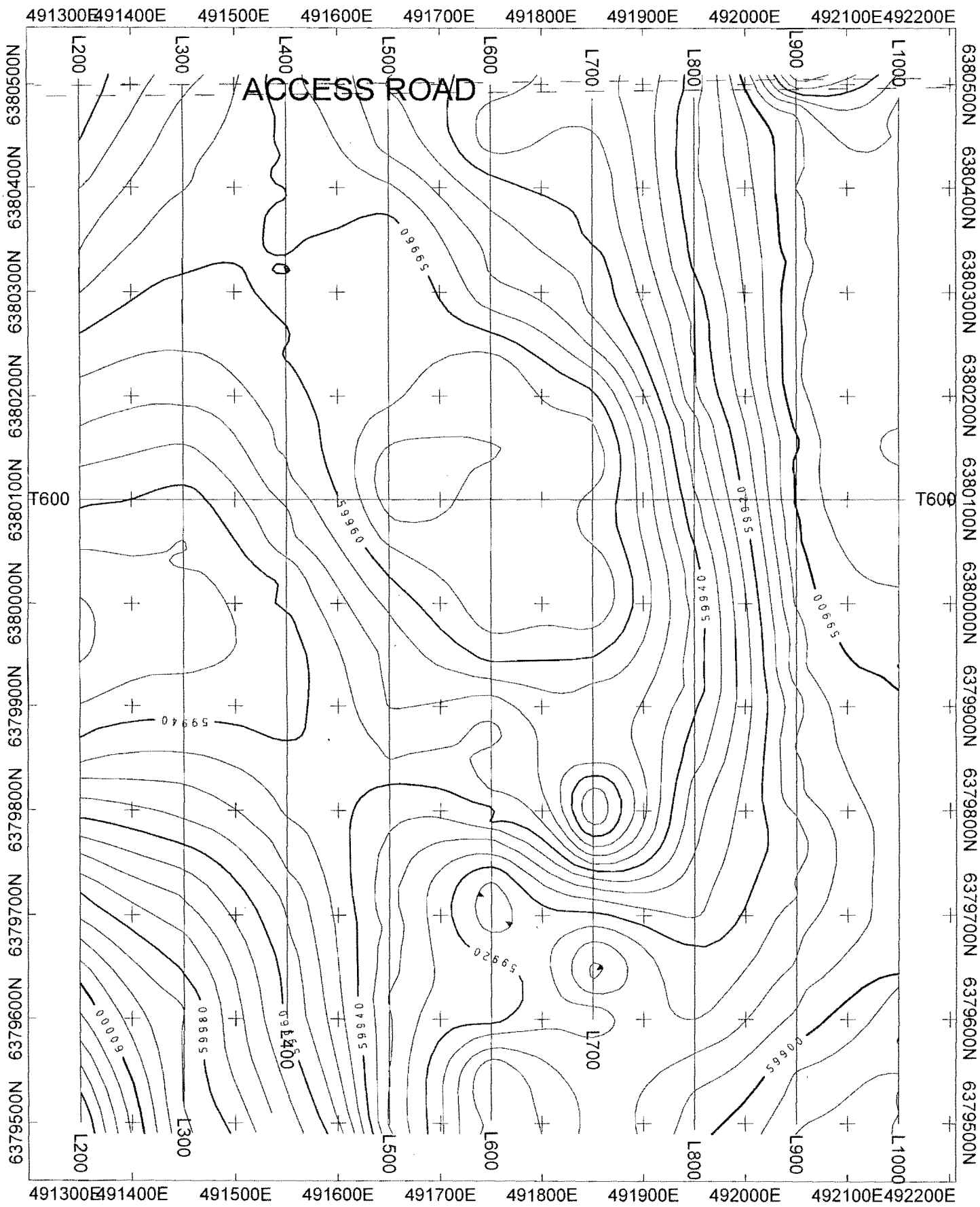
(meters)

Birch Mountain Resources Ltd.

Anomaly 112
Total Magnetic Field
Reduced to IGRF

Data collected 14, 15 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



Scale 1:5000

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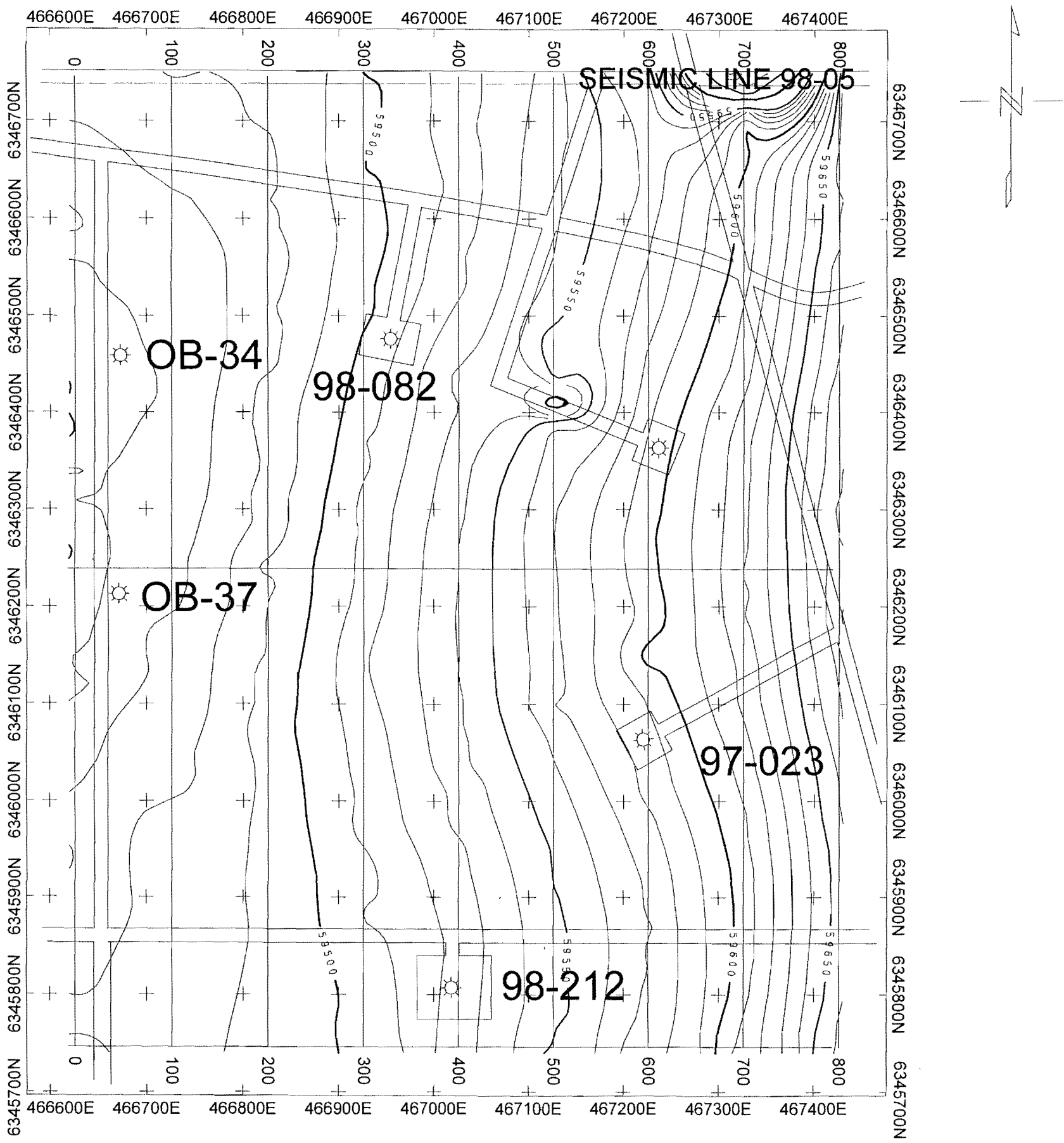
(meters)

Birch Mountain Resources Ltd.
Anomaly 210 **Total Magnetic Intensity**
Data collected 18, 19, 20 February 1998 Line Spacing 100 m : Station Spacing 12.5 m
KOMEX International Ltd. : KI98-4762



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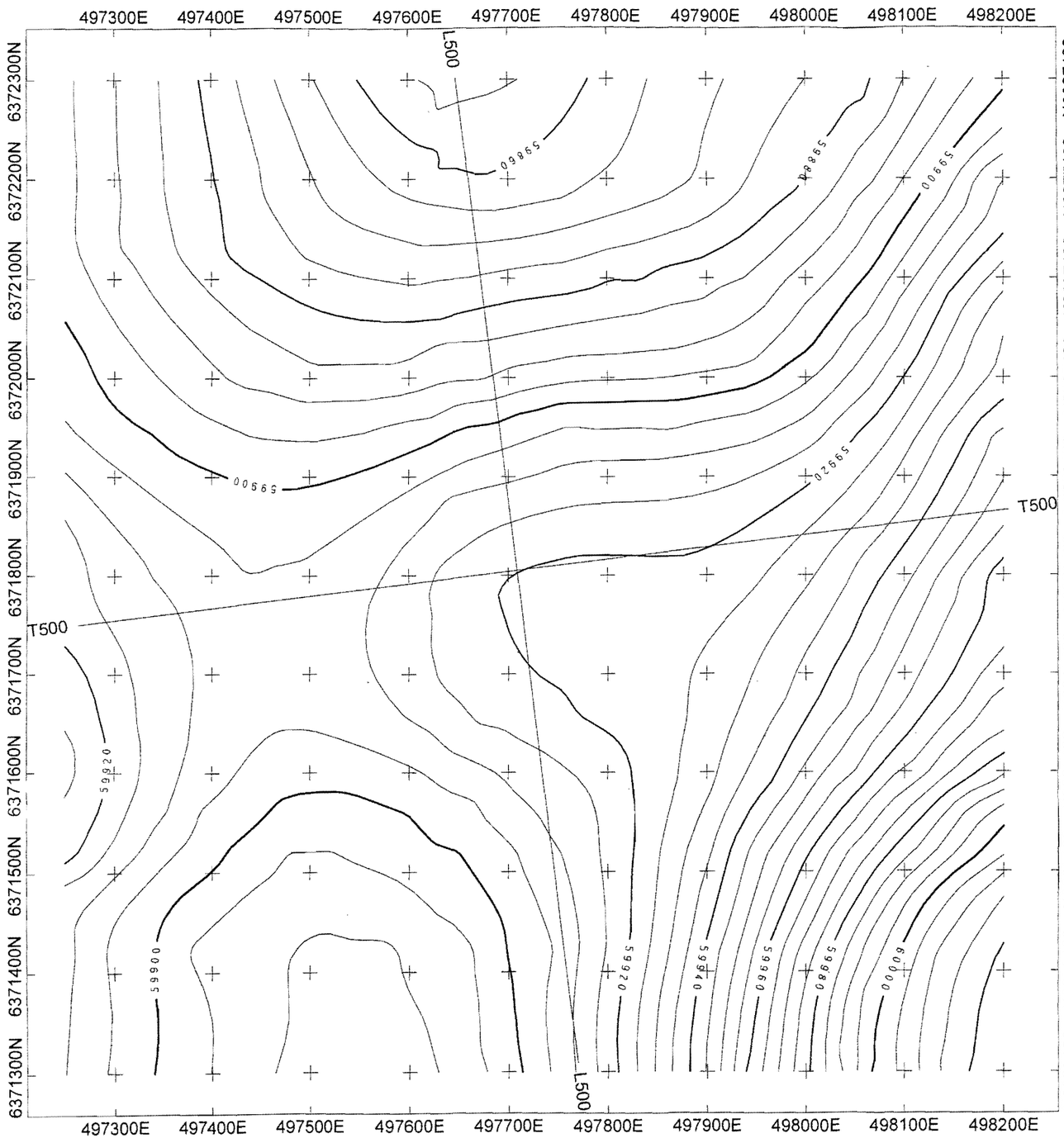
50 0.0 50 100 150 200

(meters)

Birch Mountain Resources Ltd.
Anomaly 42 **Total Magnetic Intensity**
Data collected 20, 21 February 1998 Line Spacing 100 m : Station Spacing 12.5 m
KOMEX International Ltd. : KI98-4762

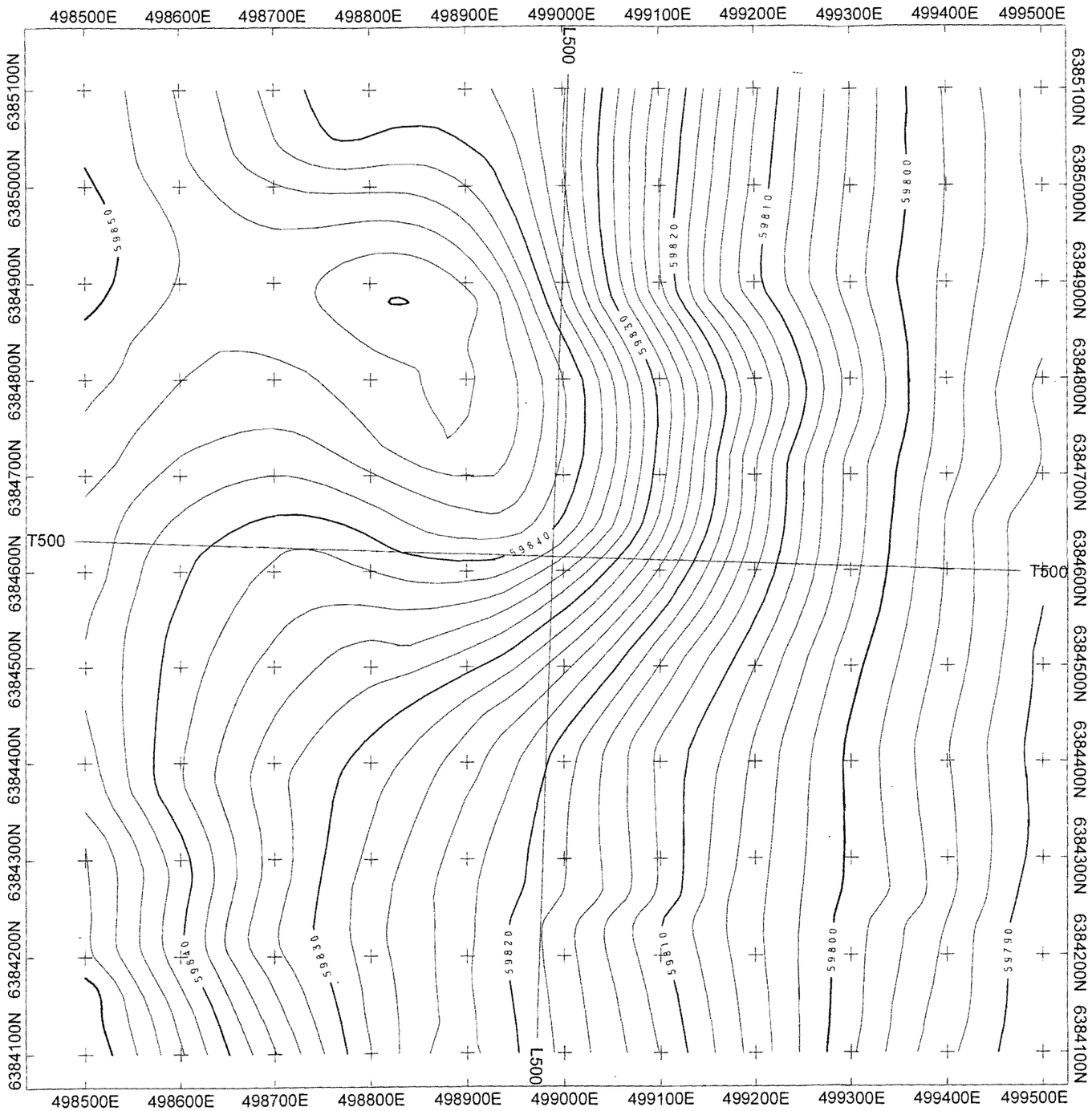


Scale 1:5000

100 0.0 100 200

(meters)

Birch Mountain Resources Ltd.
Anomaly 16 **Total Magnetic Intensity**
Ground Data collected 23 February 1998 Ground Profiles Station Spacing 12.5 m Airborne Data Elevation 45 m : Line Spacing 100 m : Station Spacing 5 m
KOMEX International Ltd. : KI98-4762

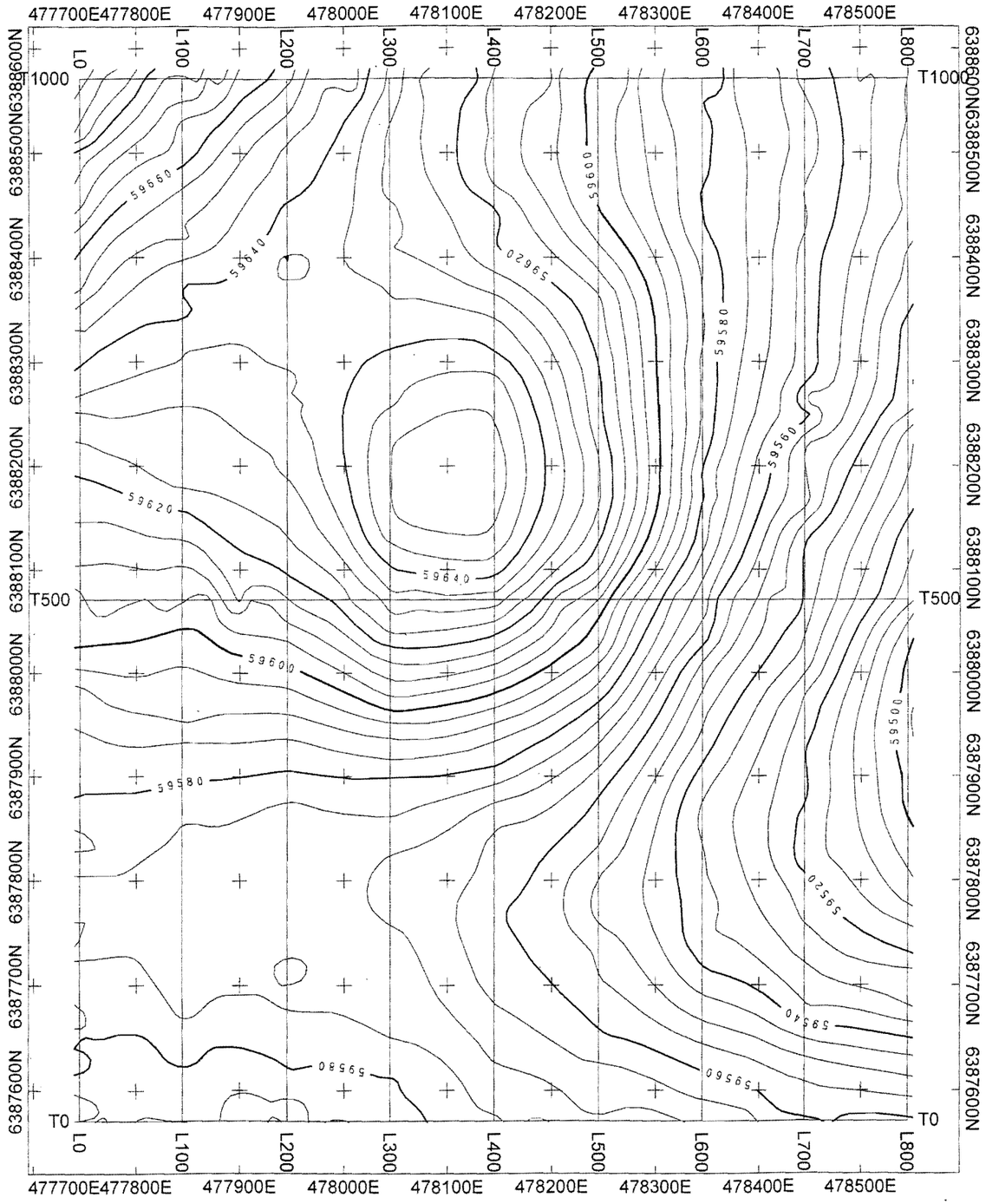


Scale 1:5000

100 0.0 100 200

(meters)

Birch Mountain Resources Ltd.
Anomaly 221 **Total Magnetic Intensity**
Ground Data collected 24 February 1998 Ground Profiles Station Spacing 12.5 m Airborne Data Elevation 45 m : Line Spacing 100 m : Station Spacing 5 m
KOMEX International Ltd. : KI98-4762

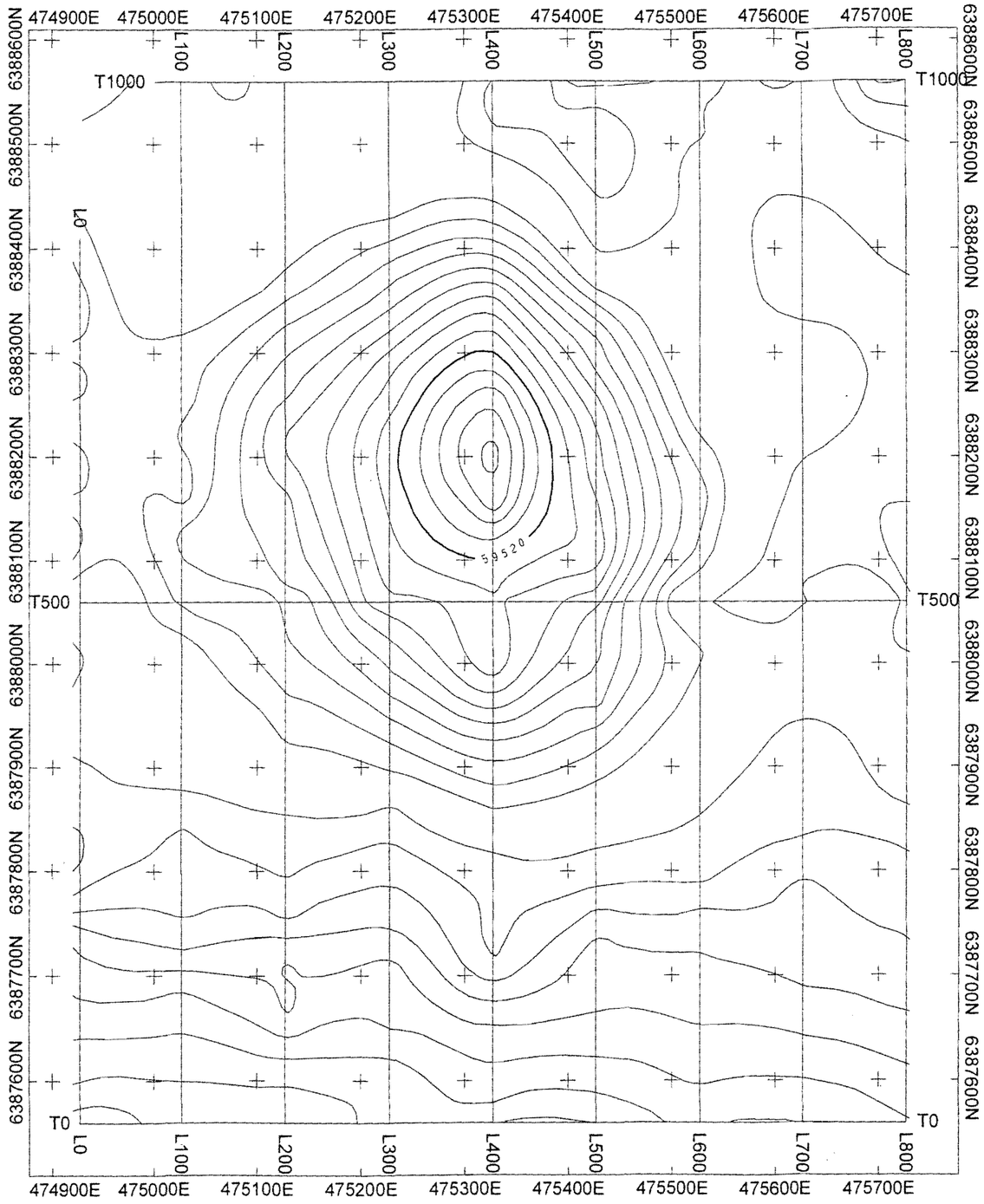


Scale 1:5000

50 0.0 50 100 150 200 250

(meters)

Birch Mountain Resources Ltd.
Anomaly 29 **Total Magnetic Intensity**
Data collected 25, 26 February 1998 Line Spacing 100 m : Station Spacing 12.5 m
KOMEX International Ltd. : KI98-4762



Scale 1:5000

50 0.0 50 100 150 200 250

(meters)

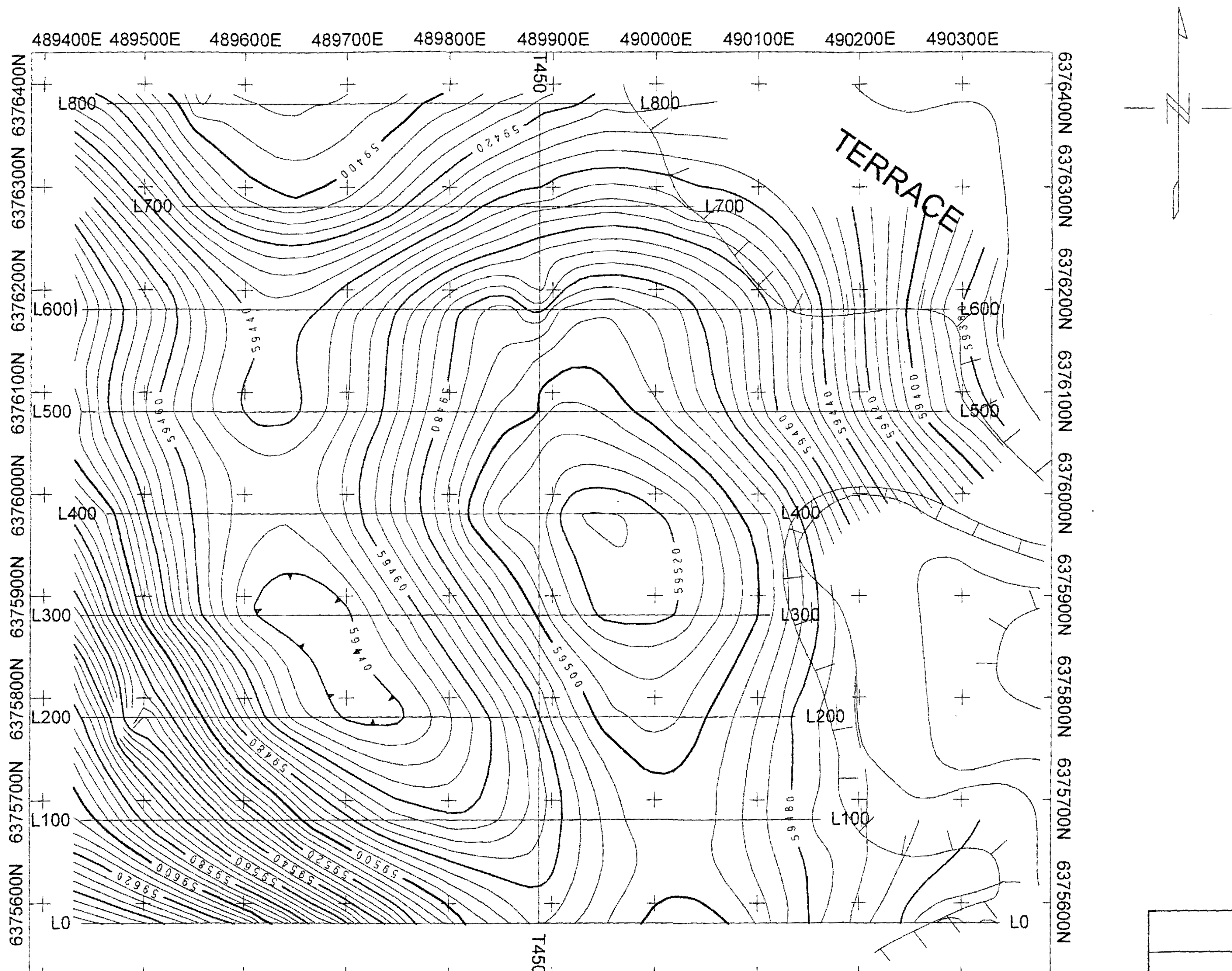
Birch Mountain Resources Ltd.

Anomaly 169

Total Magnetic Intensity

Data collected 27, 28 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



Scale 1:5000

50 0.0 50 100 150 200 250 300

(meters)

Birch Mountain Resources Ltd.

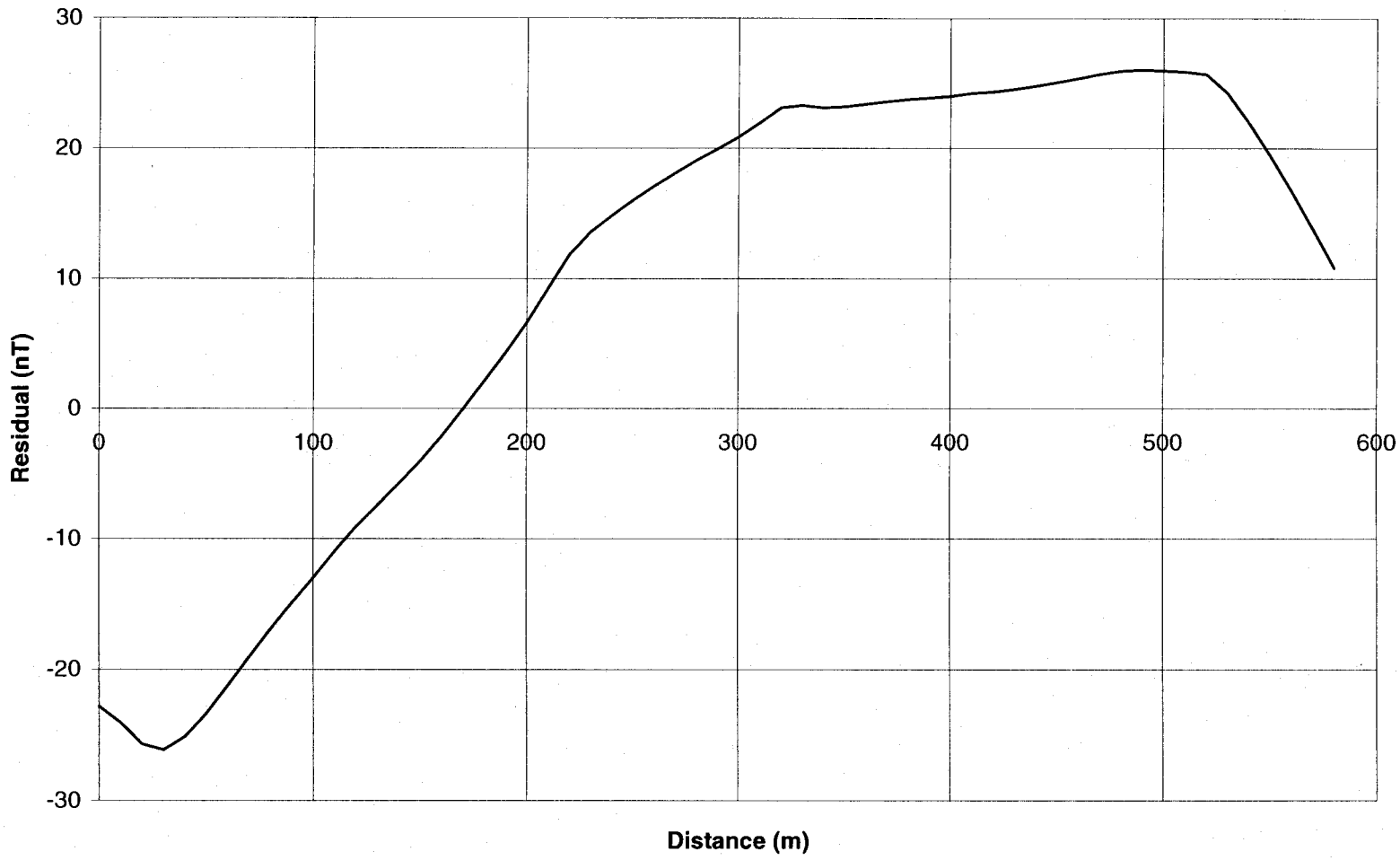
Anomaly 189
Total Magnetic Intensity

Data collected 28 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762

APPENDIX III

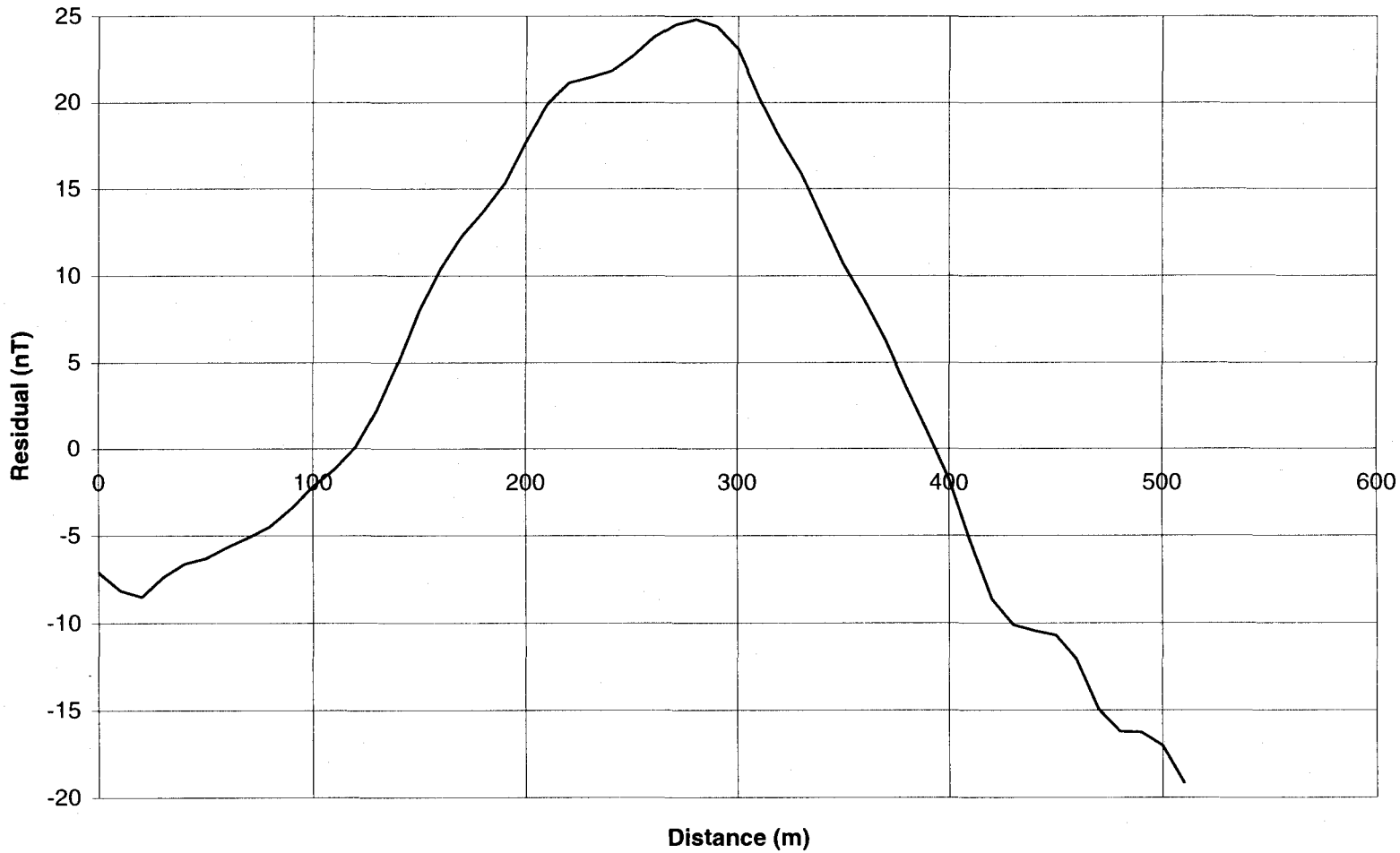
ANOMALY PROFILES



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 14 South-North Profile
Date Collected February 12-13/22, 1998
Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 14 West-East Profile
Date Collected February 12-13/22, 1998
Figure

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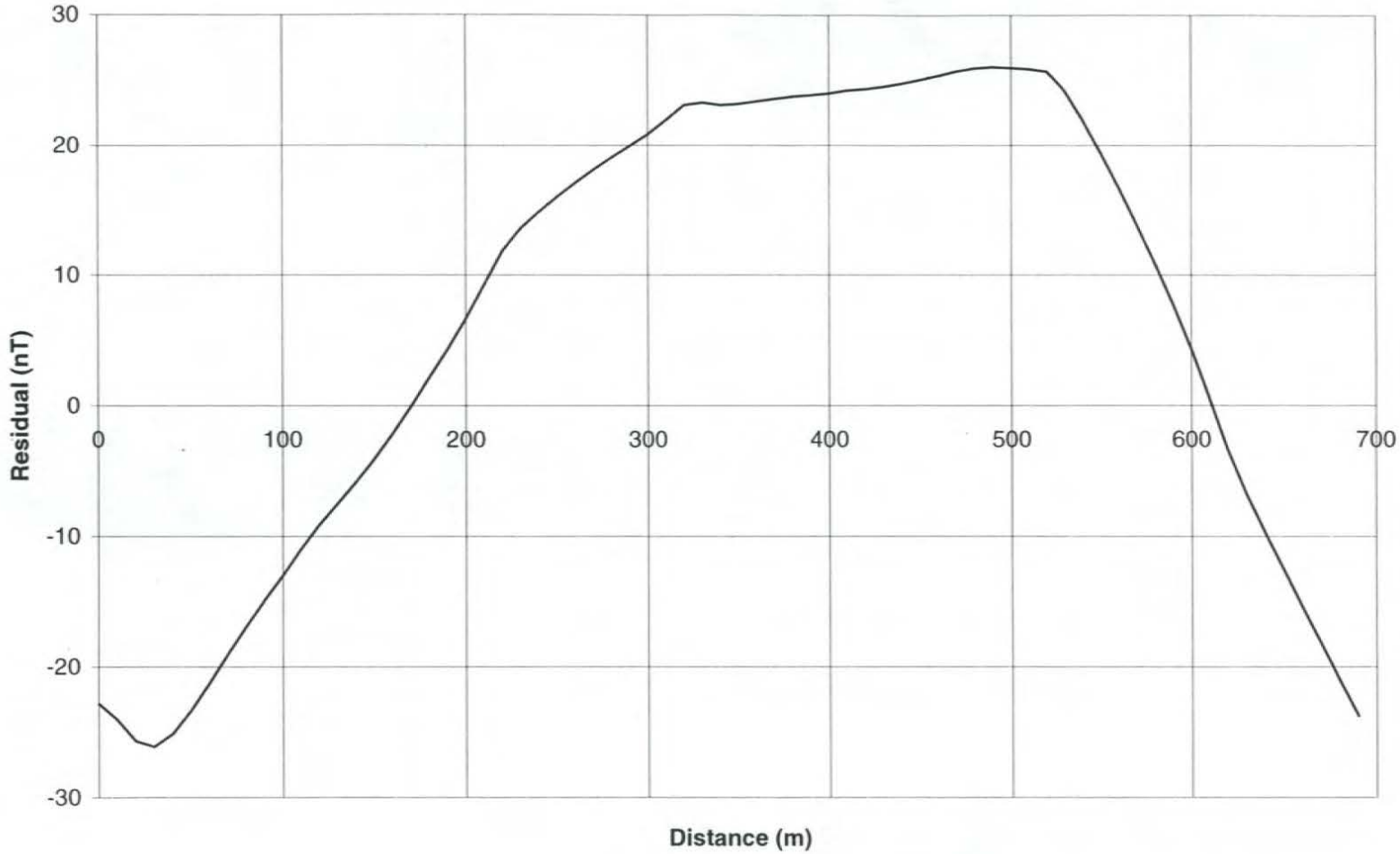

BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 112 South-North Profile
Date Collected February 14-15, 1998
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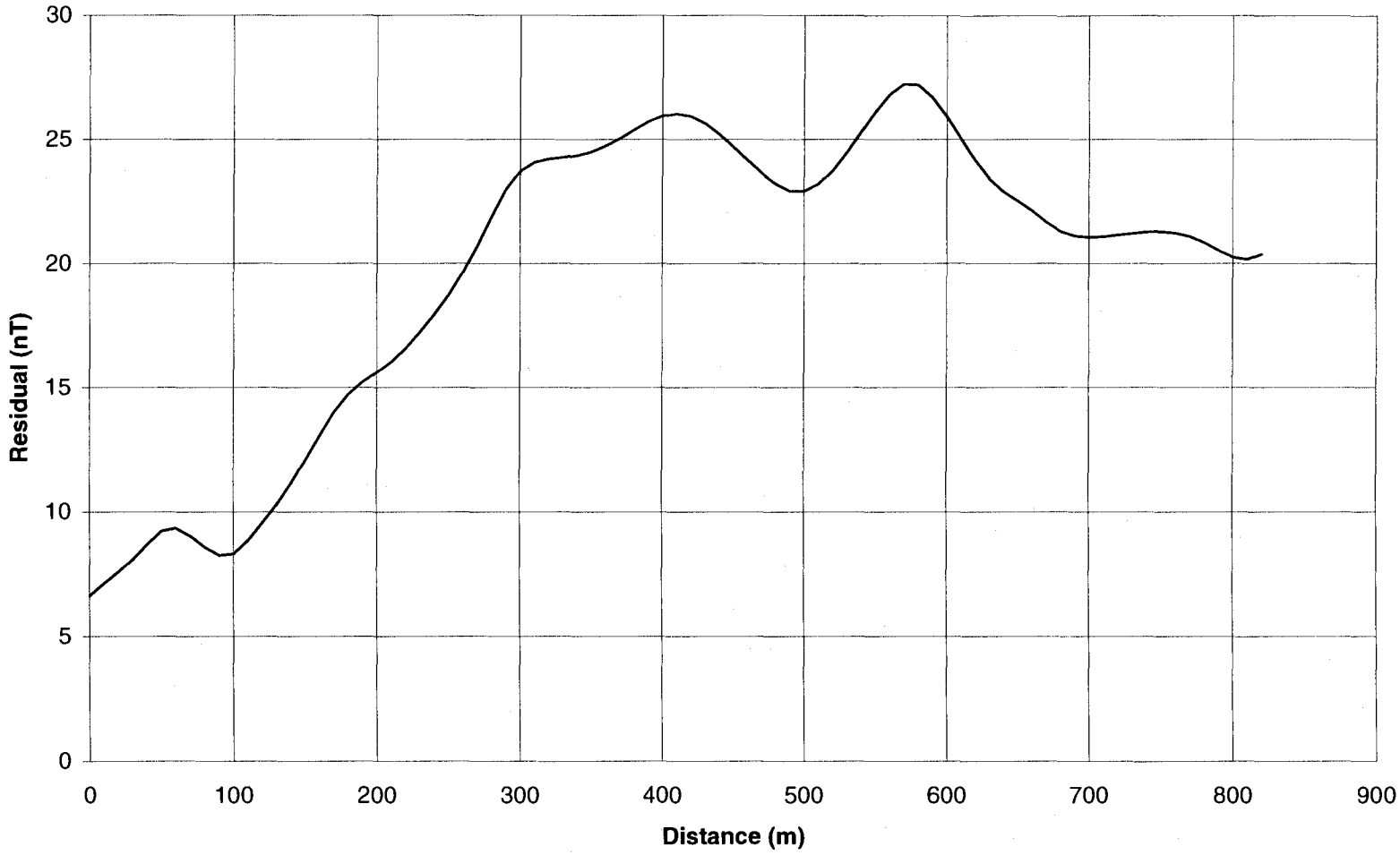
KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 112 West-East Profile
Date Collected February 14-15, 1998
Figure

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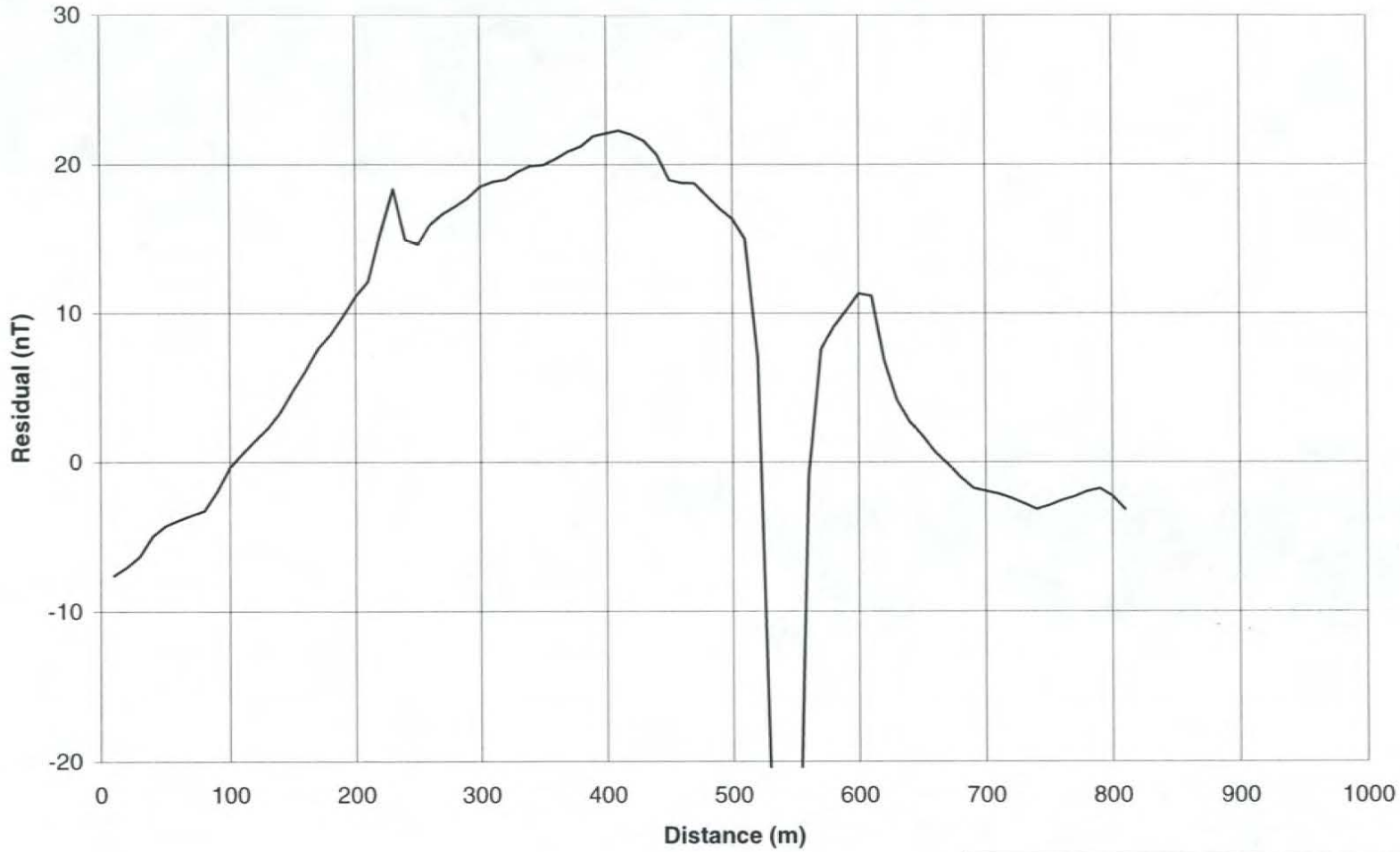

BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual

GRID 42 South-North Profile

Date Collected February 20-21, 1998

Figure

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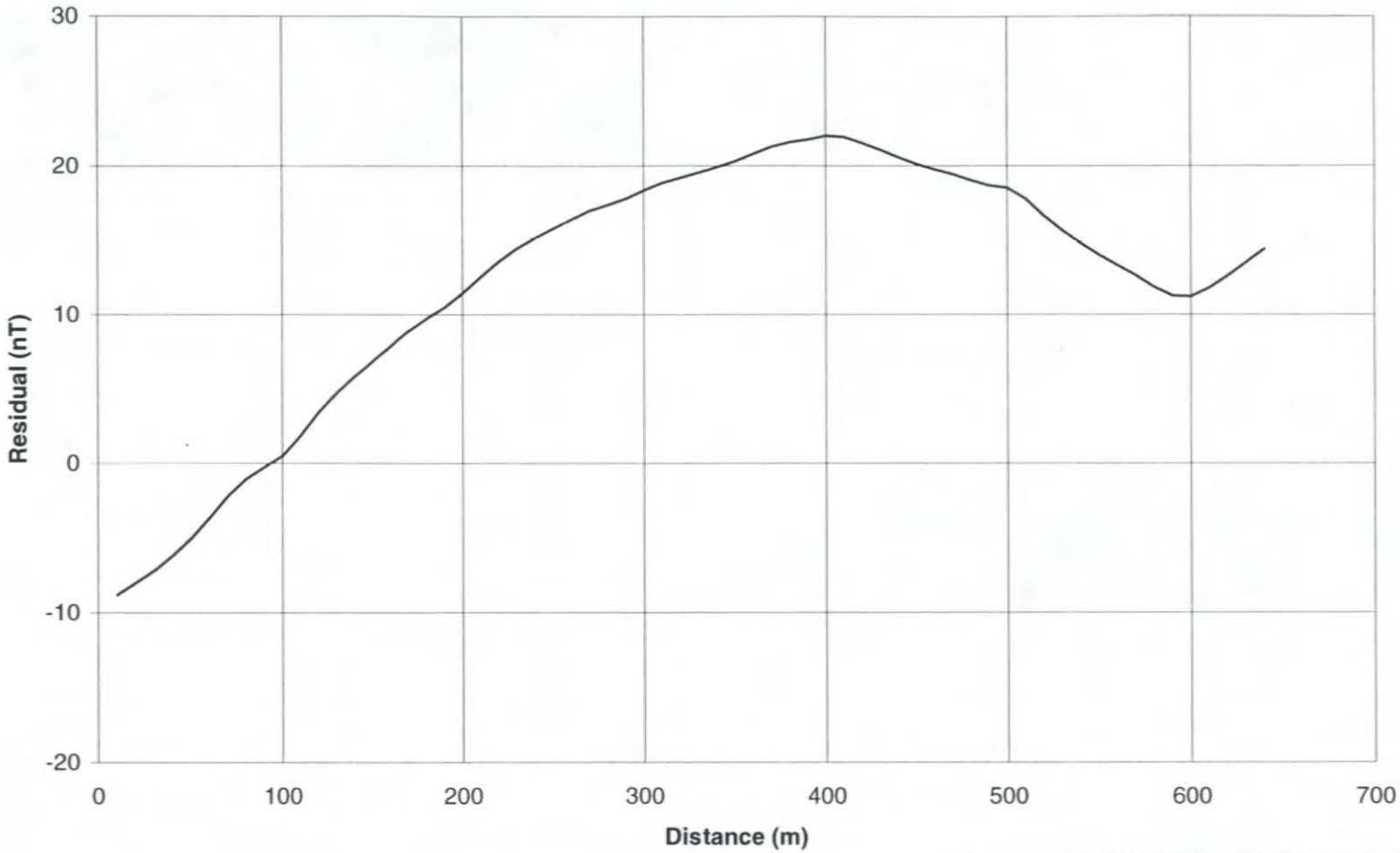
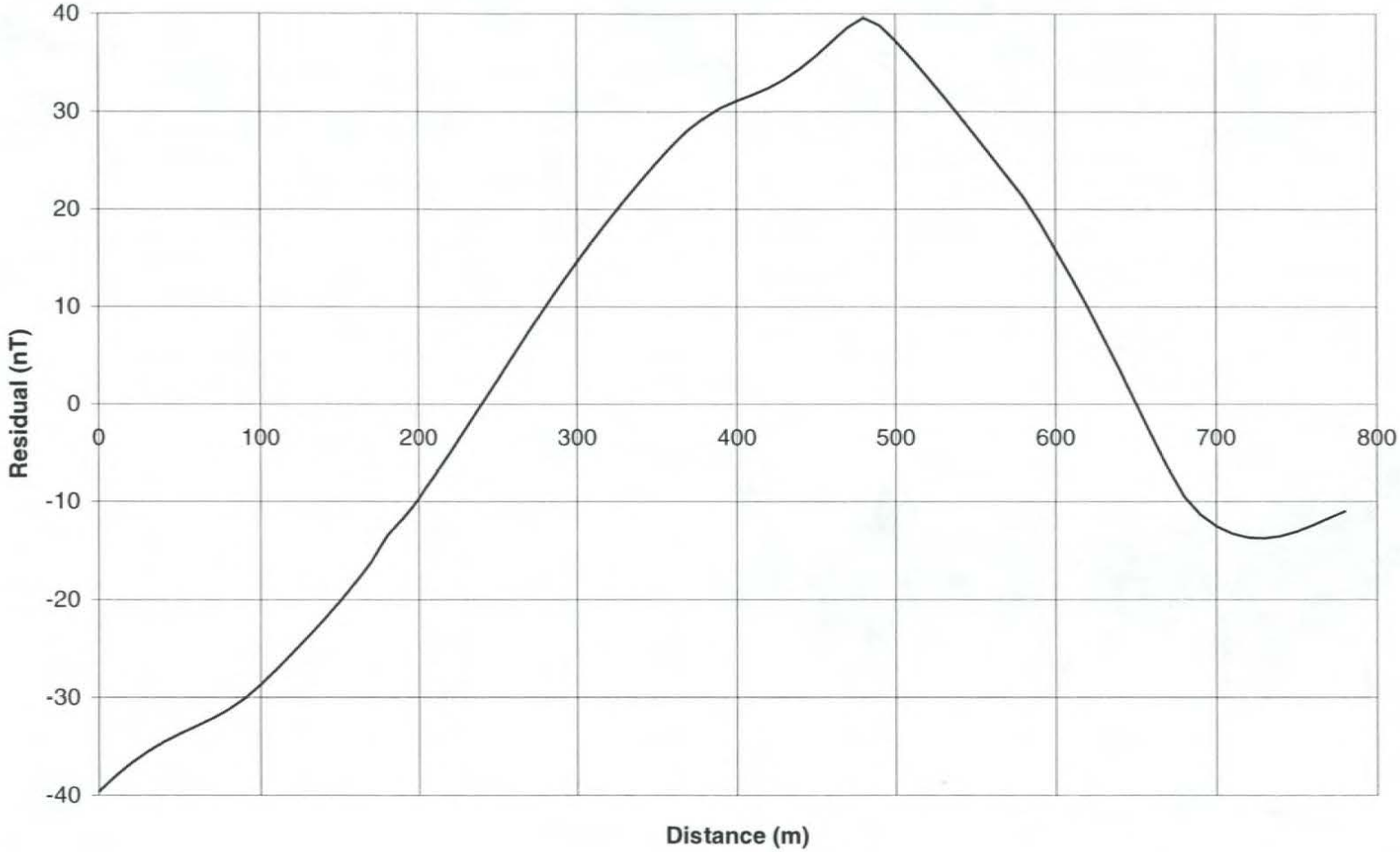


BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 42 West-East Profile
Date Collected February 20-21, 1998
Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 210 West-East Profile
Date Collected February 16/18-20, 1998
Figure

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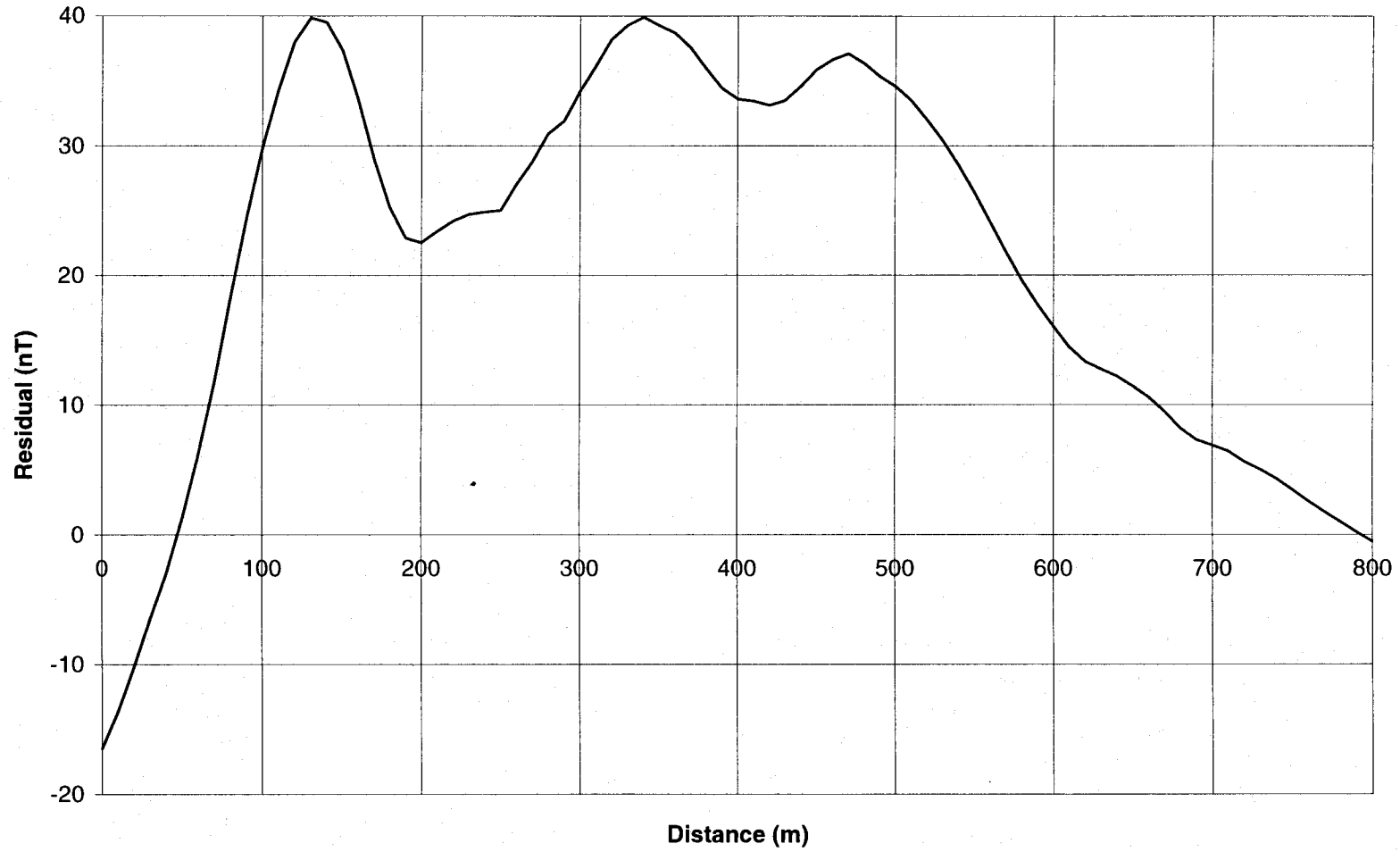

BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 210 South-North Profile
Date Collected February 16/18-20, 1998
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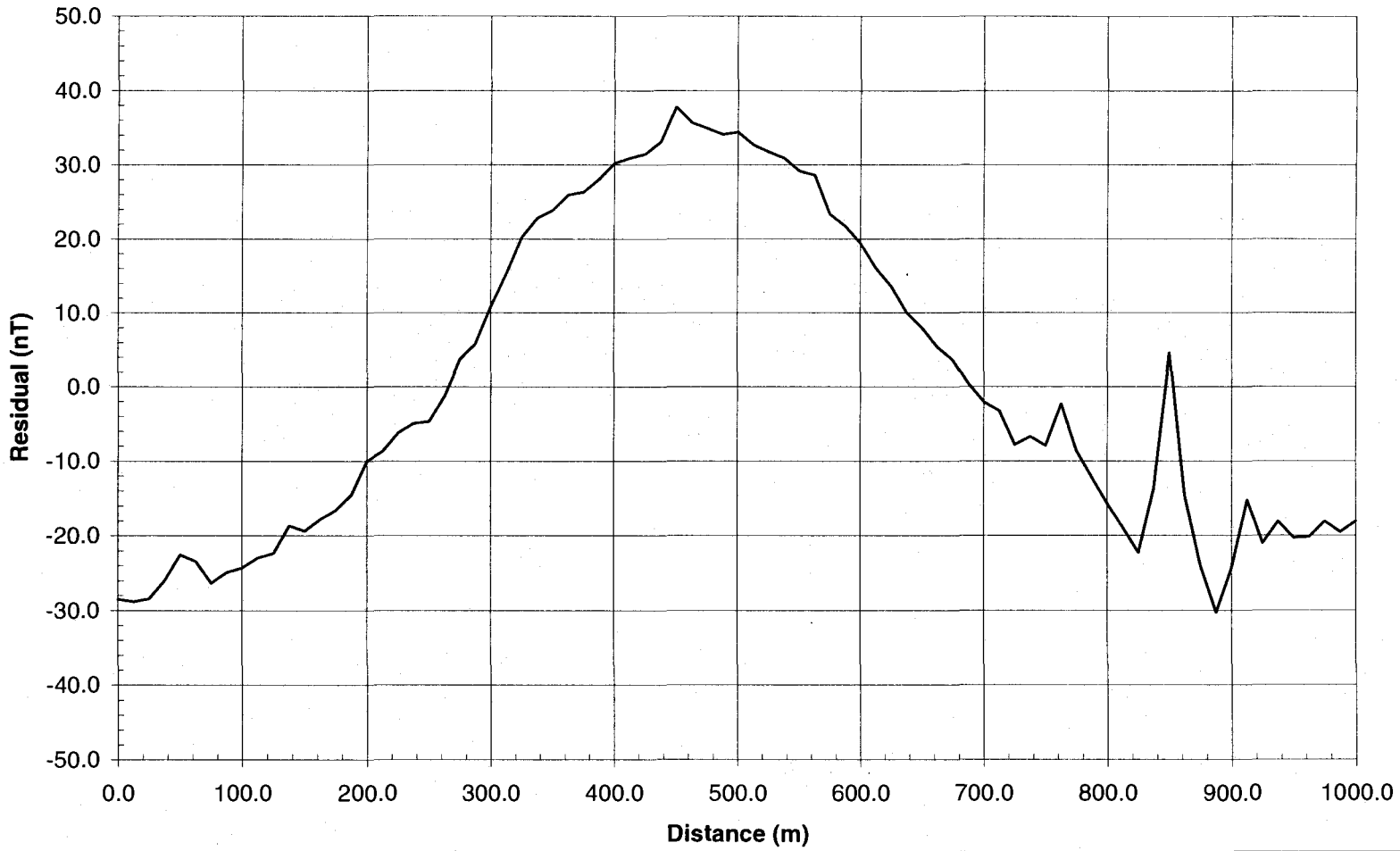

BIRCH MOUNTAIN RESOURCES Ltd.

Profile Residual

GRID 16 South-North Profile

Date Collected February 23 1998

Figure

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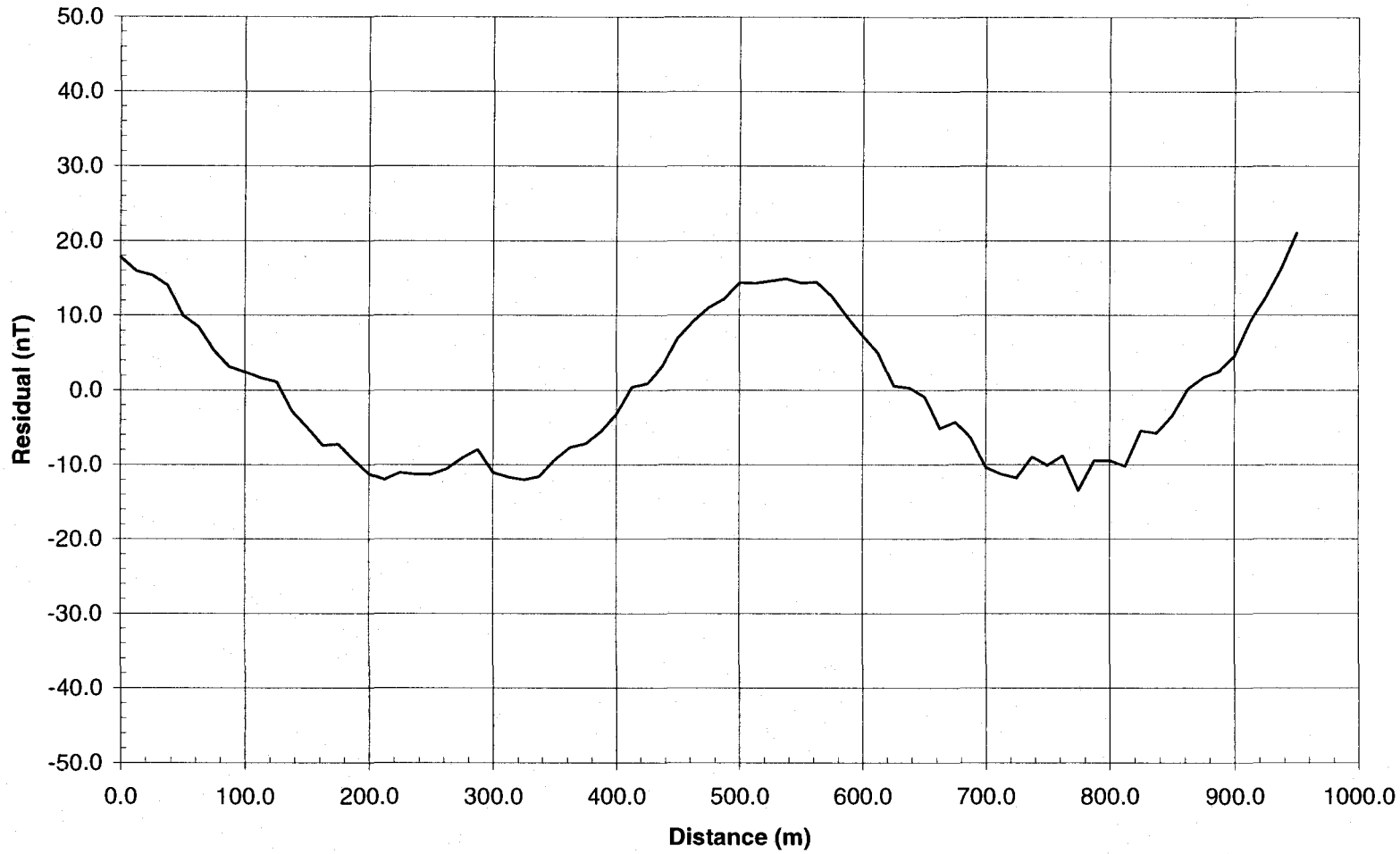

BIRCH MOUNTAIN RESOURCES Ltd.

Profile Residual

GRID 16 West-East Profile

Date Collected February 23 1998

Figure

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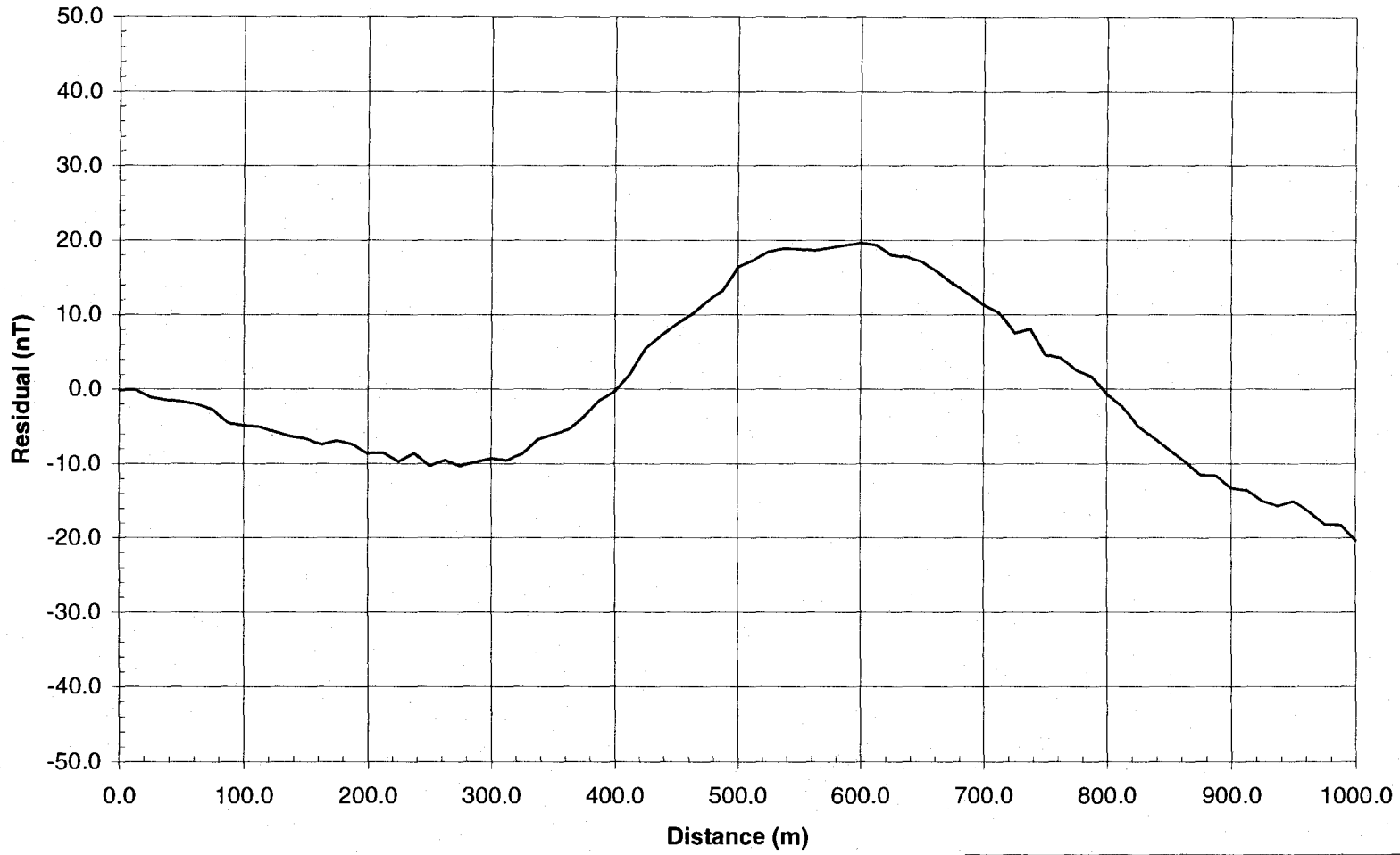


BIRCH MOUNTAIN RESOURCES Ltd.

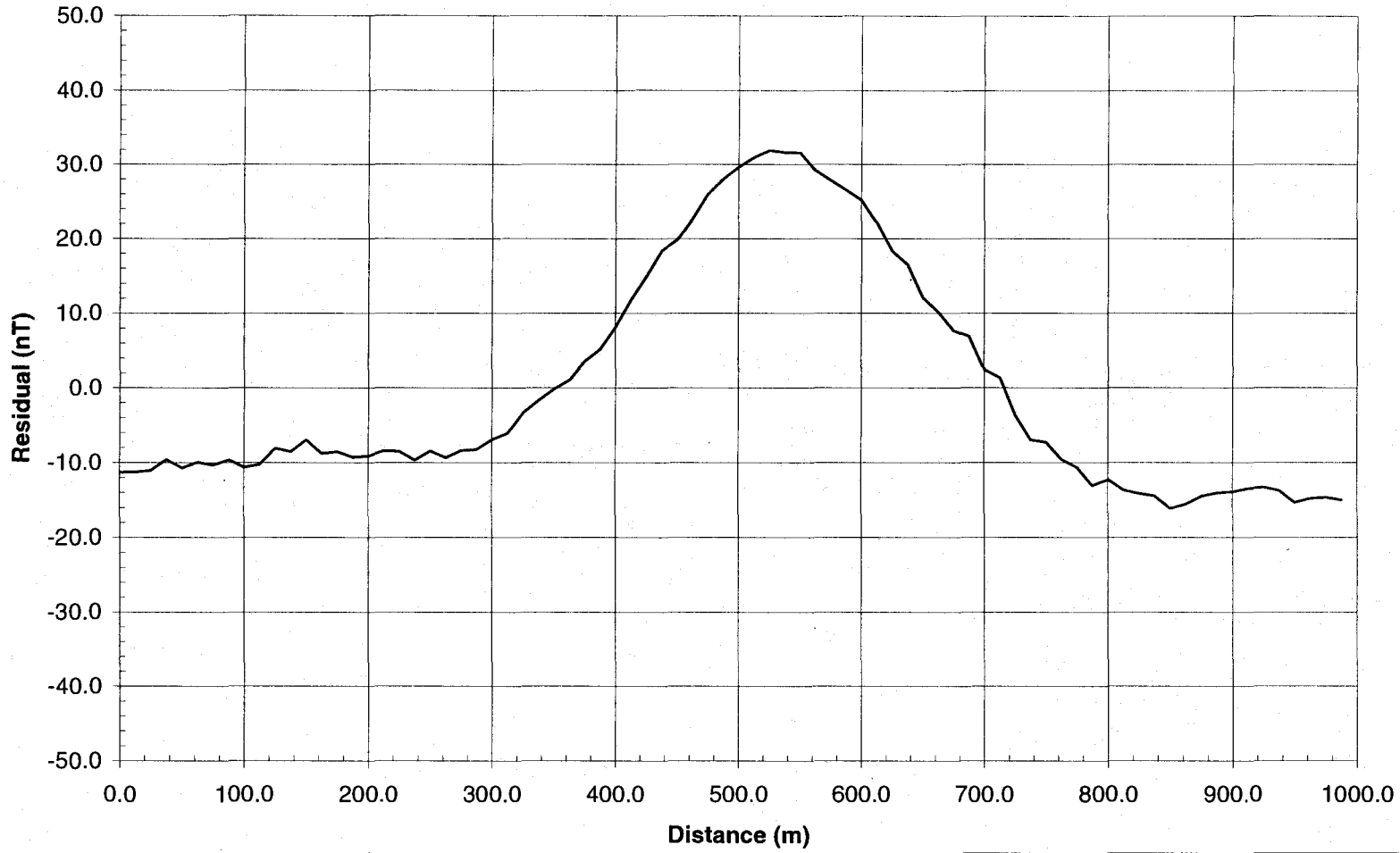
Profile Residual

GRID 221 South-North Profile

Date Collected February 24 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Profile Residual

GRID 221 West-East Profile

Date Collected February 24 1998

Figure

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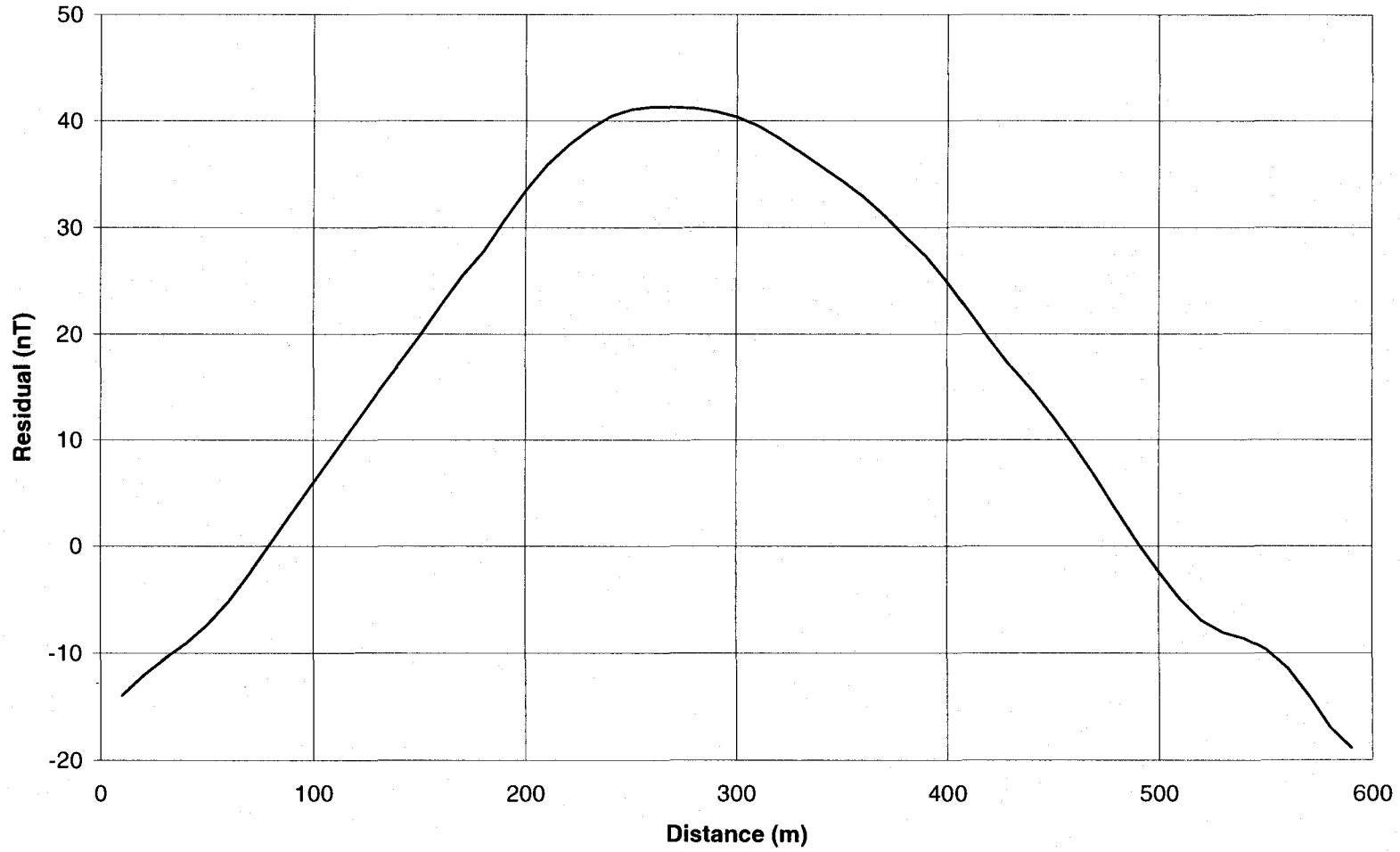
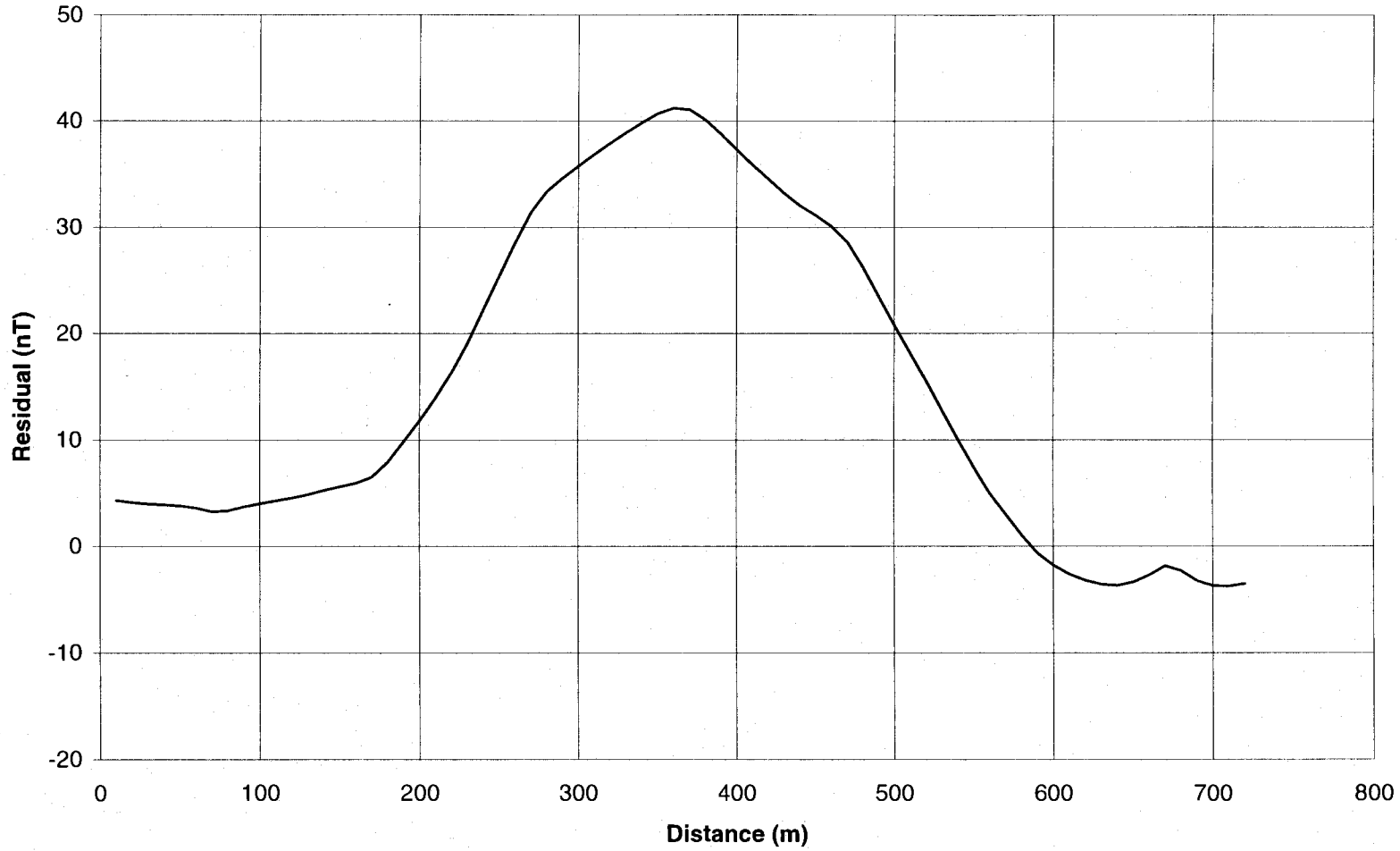


BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 29 South-North Profile
Date Collected February 25-26, 1998
Figure

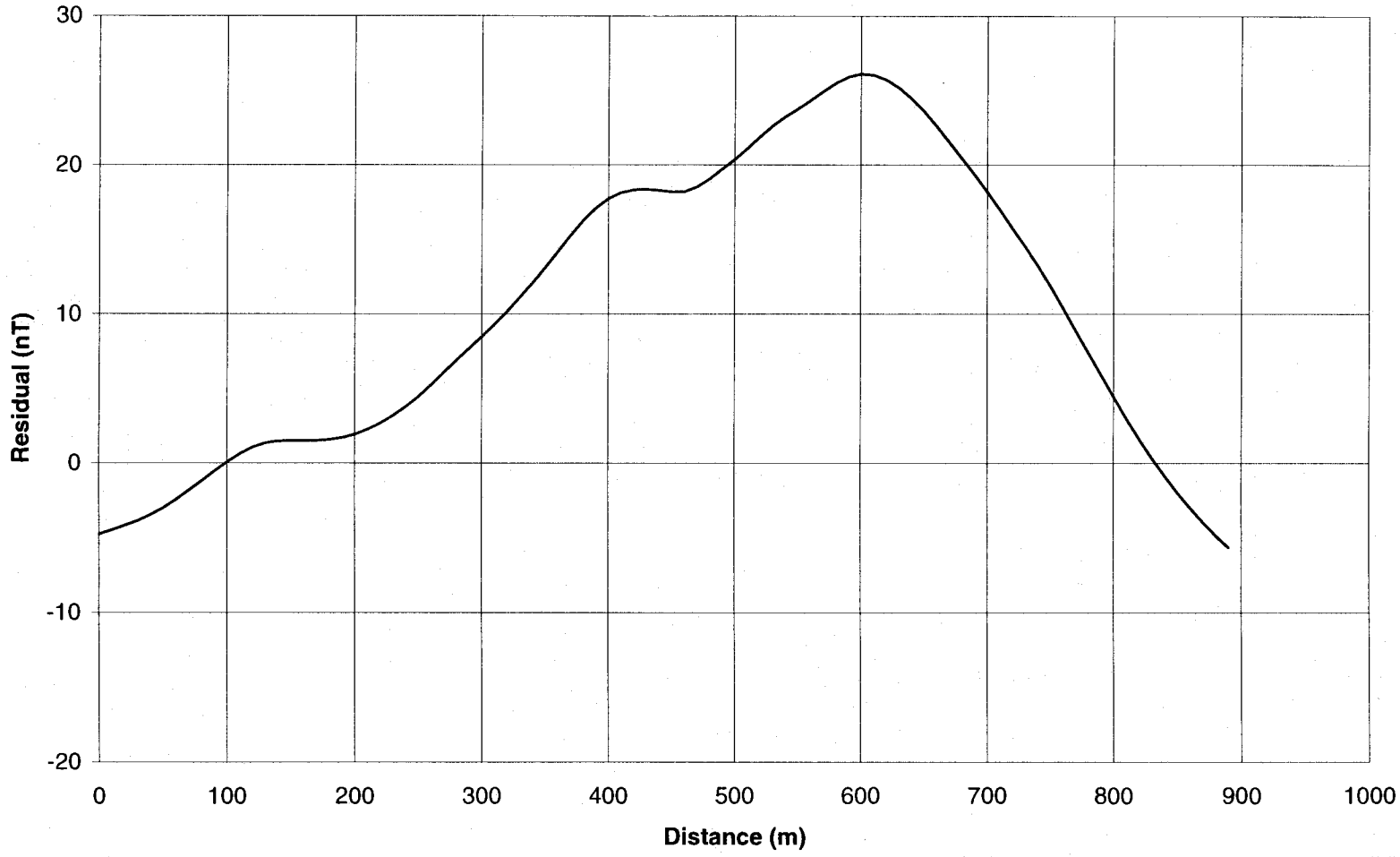
KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 29 East-West Profile
Date Collected February 25-26, 1998
Figure

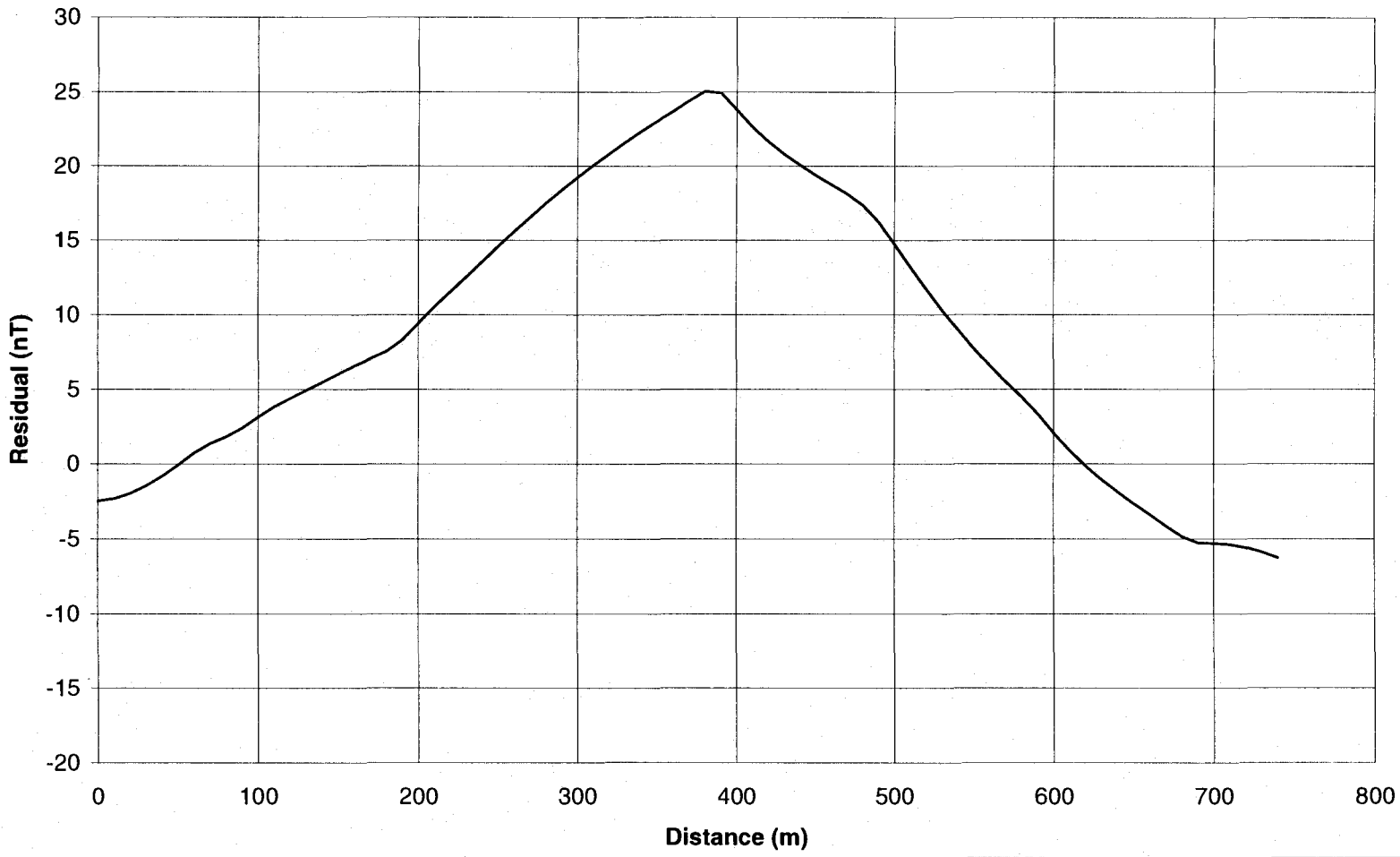
KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 169 South-North Profile
Date Collected February 26-28, 1998
Figure

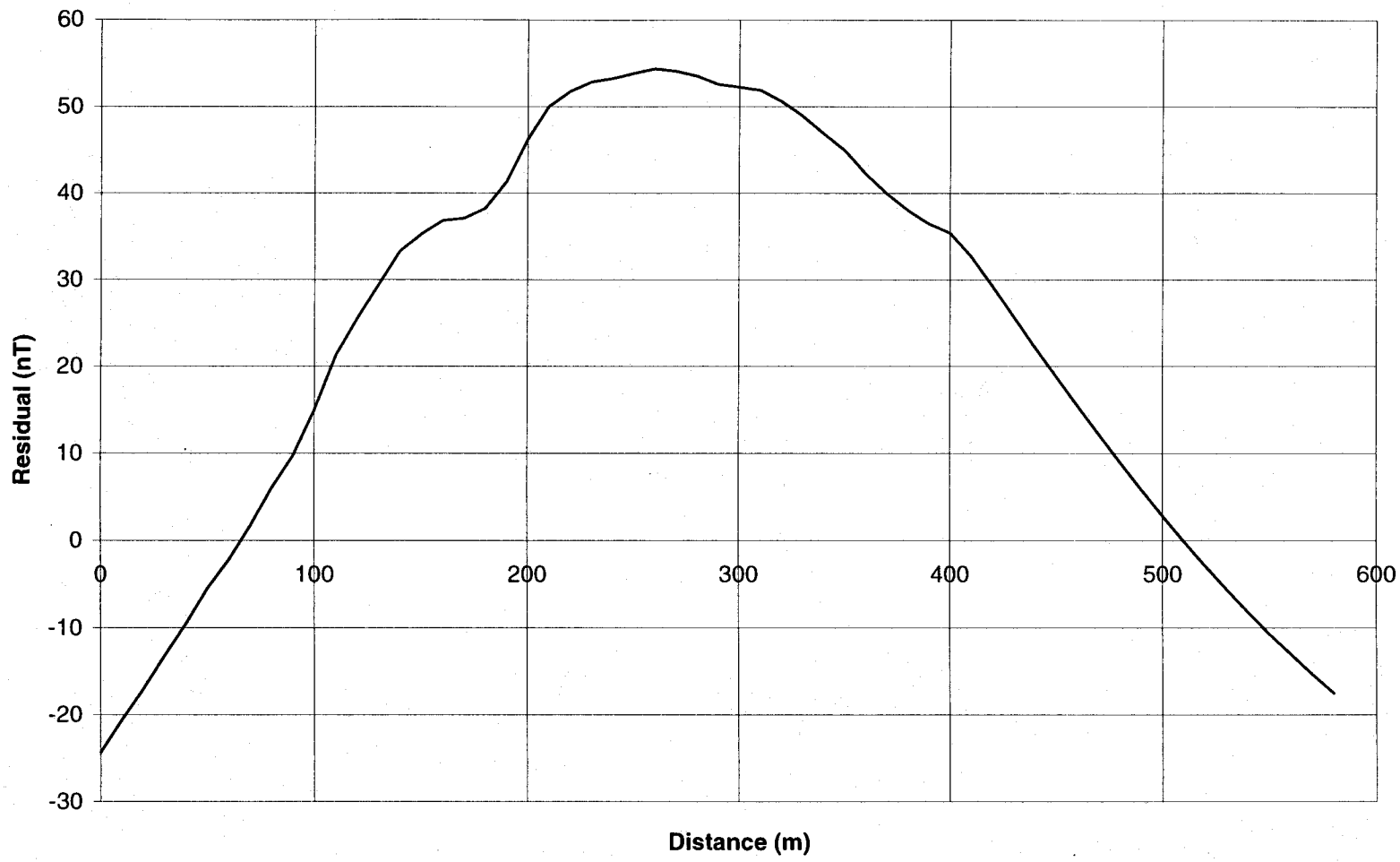
KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 169 West-East Profile
Date Collected February 26-28, 1998
Figure

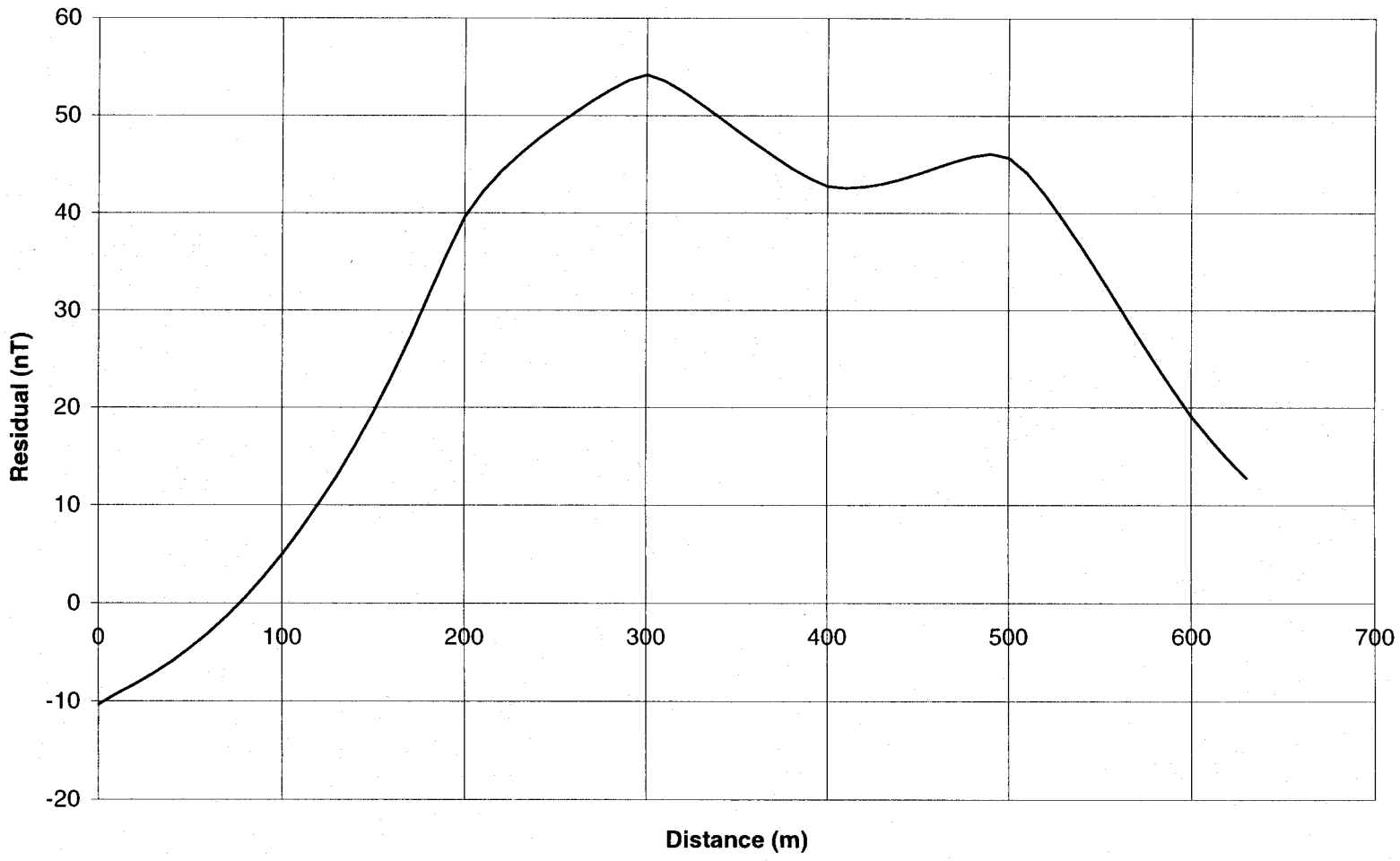
KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Second Order Residual
GRID 189 West-East Profile
Date Collected February 28-March 1, 1998
Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

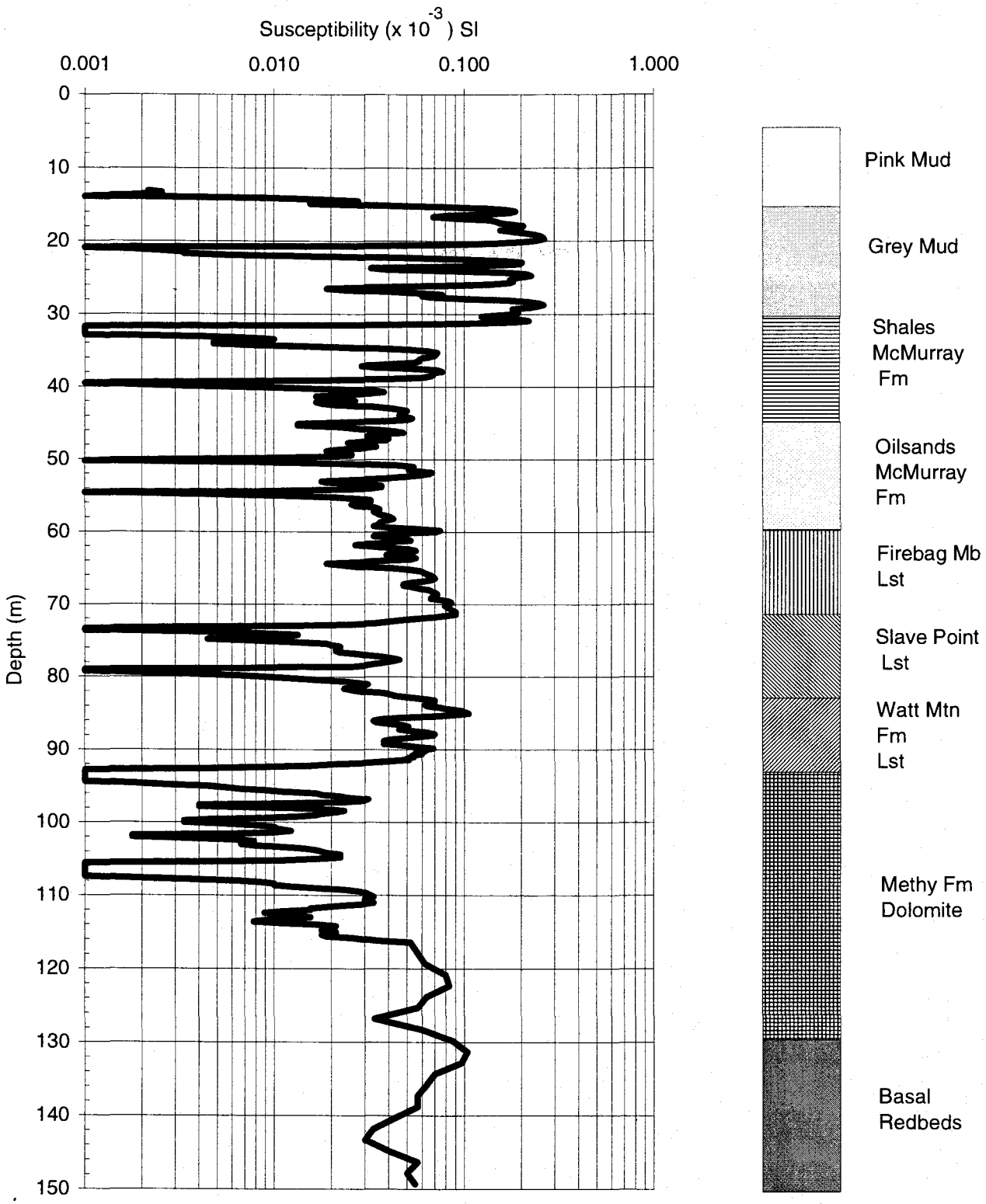
Second Order Residual
GRID 189 South-North Profile
Date Collected February 28-March 1, 1998
Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762

APPENDIX IV

SUSCEPTIBILITY LOG OF BMR 98-14

BOREHOLE BMR98-14

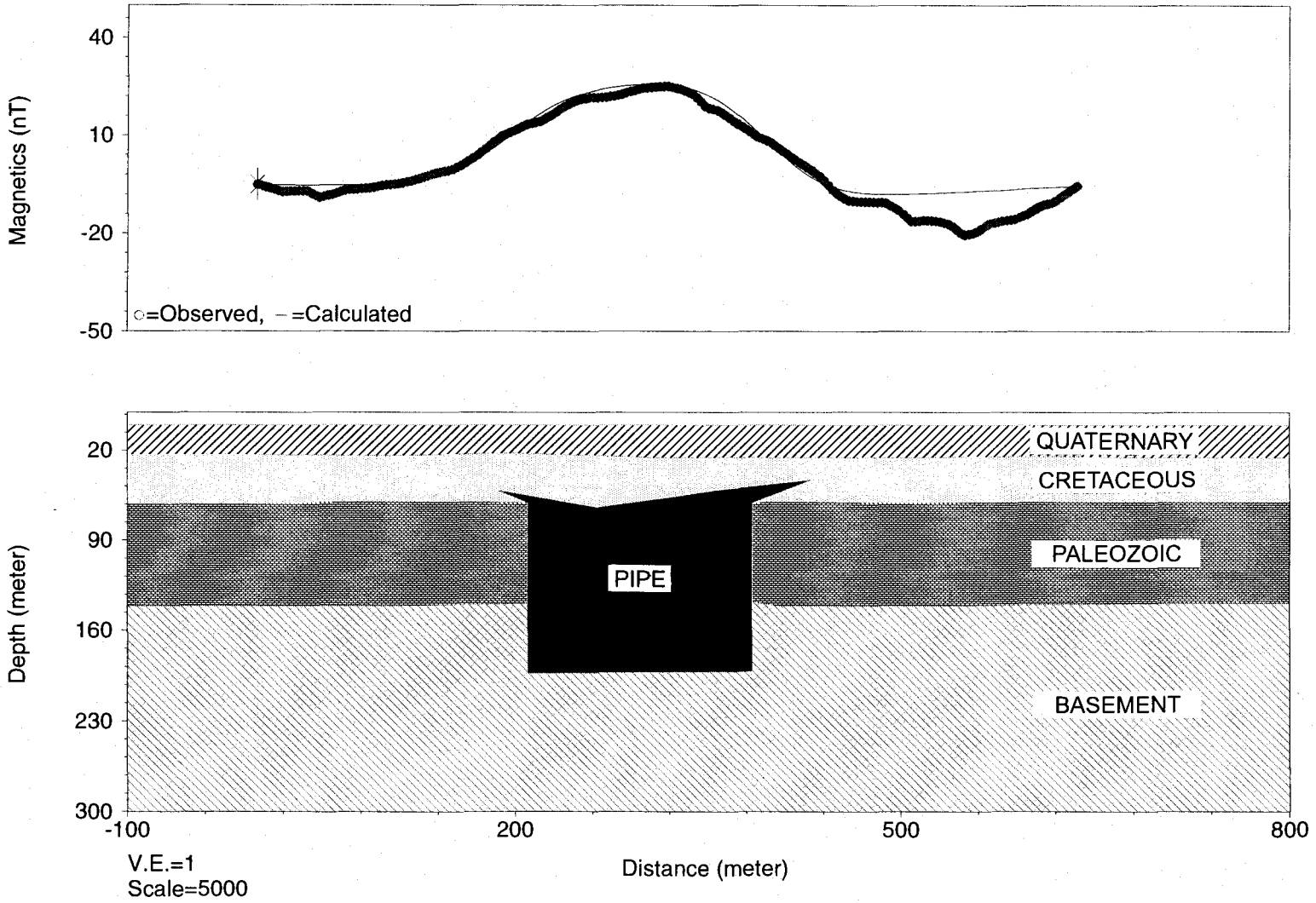


APPENDIX V

PRELIMINARY MODELS

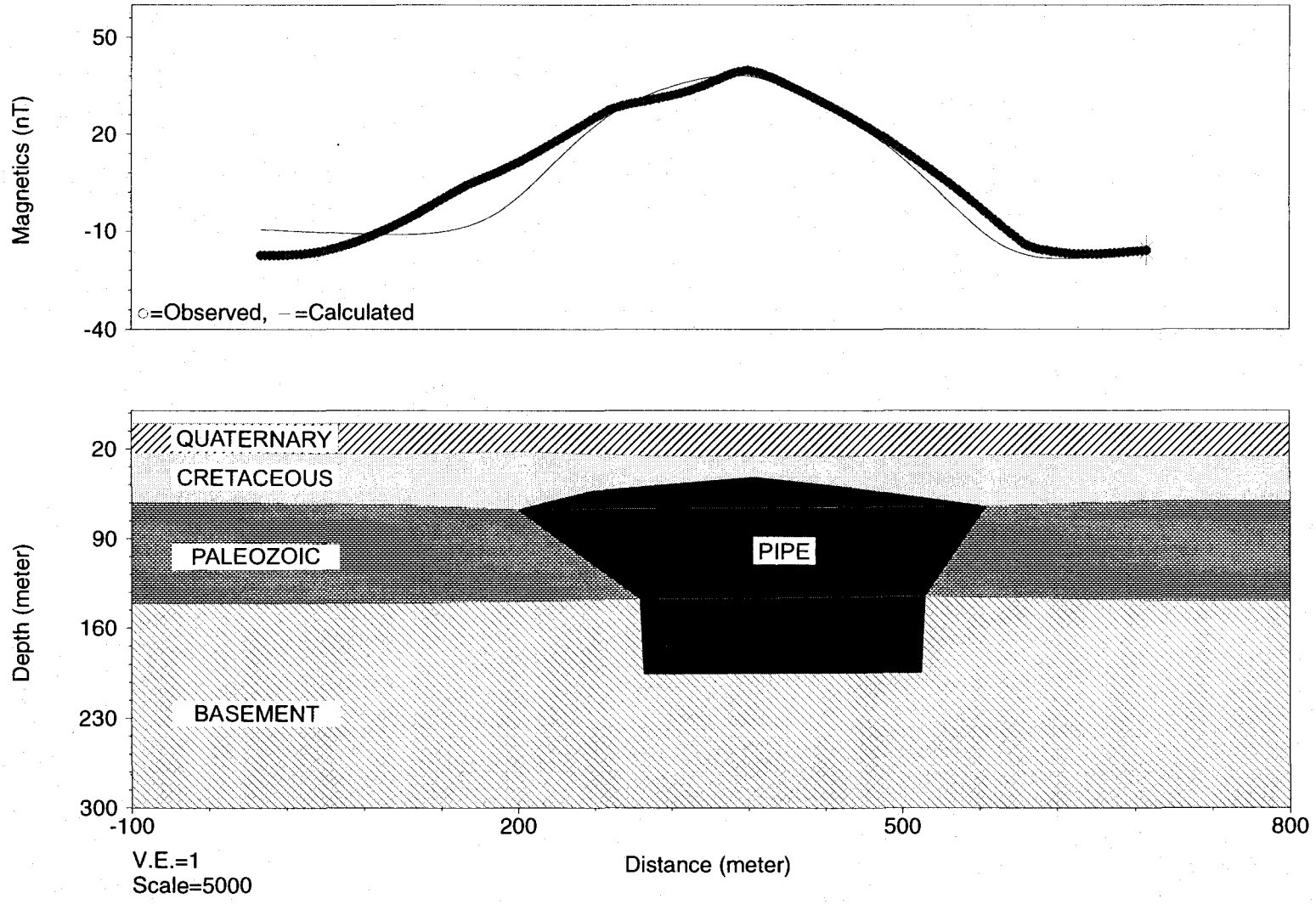
Anomaly 14

EW Profile of 2nd Order Residual



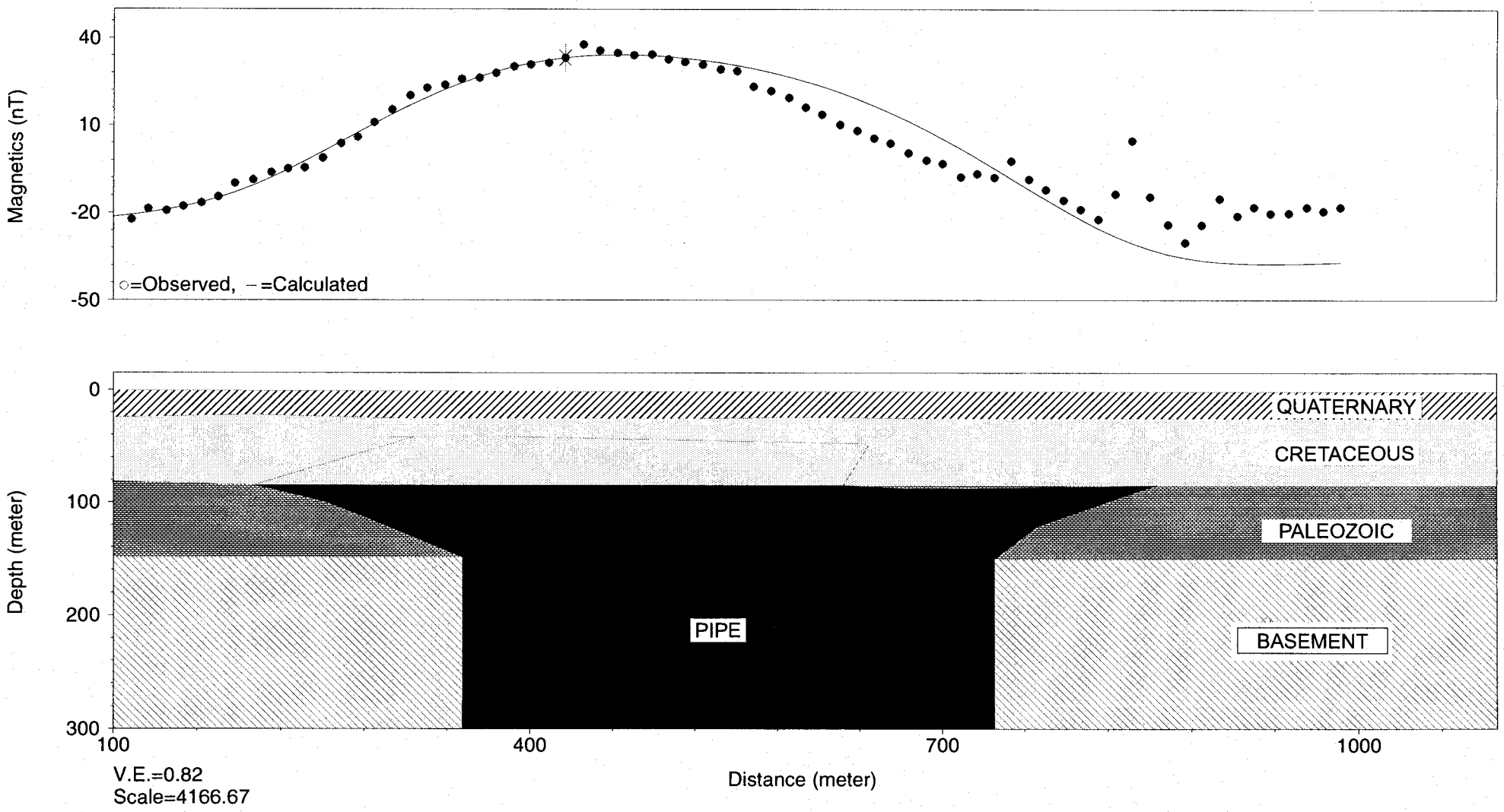
Anomaly 210

NE Profile of 1st Order Residual



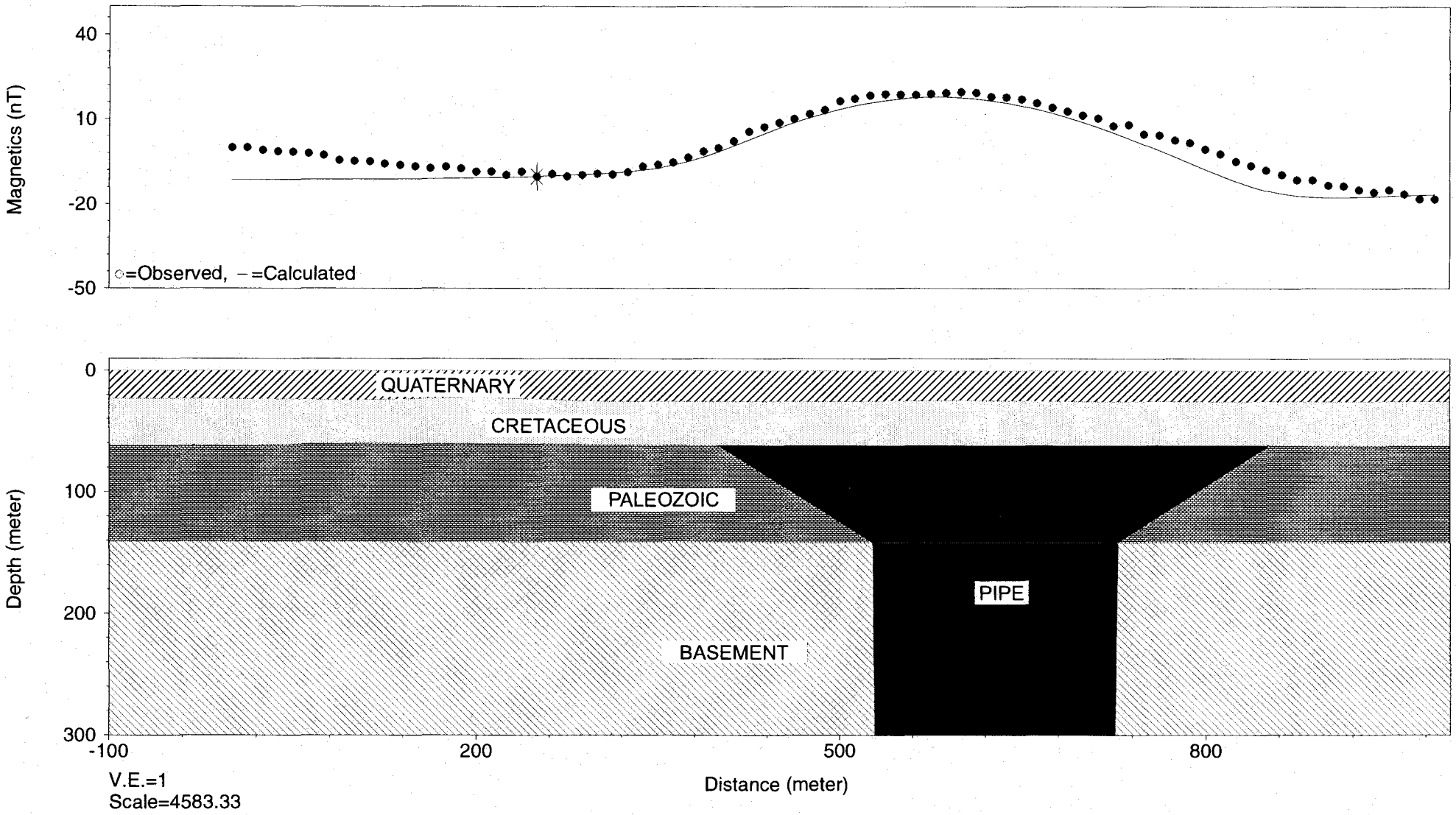
Anomaly 016

NE Residual Profile



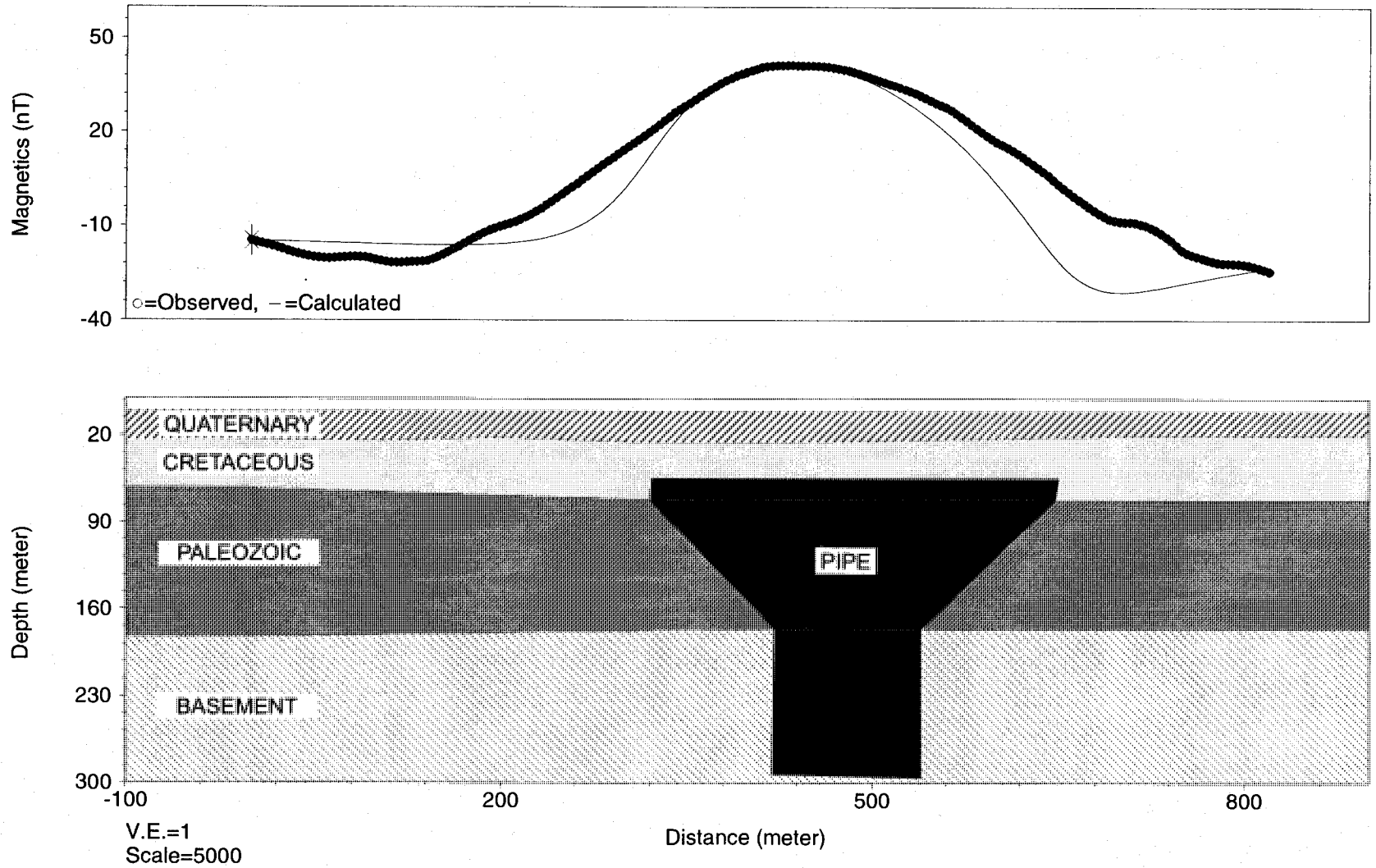
Anomaly 221

NE Residual Profile



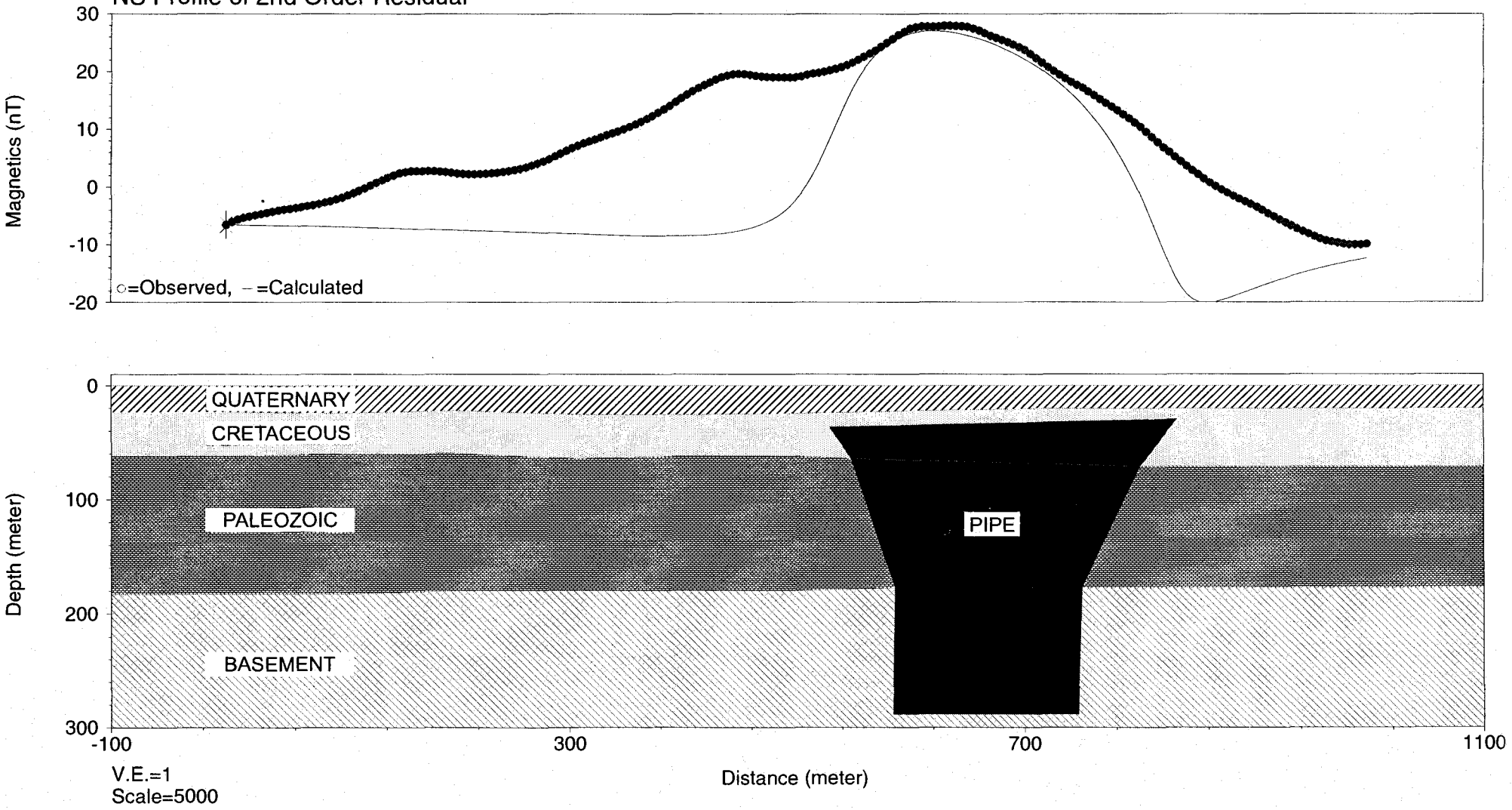
Anomaly 29

NS Profile of 2nd Order Residual



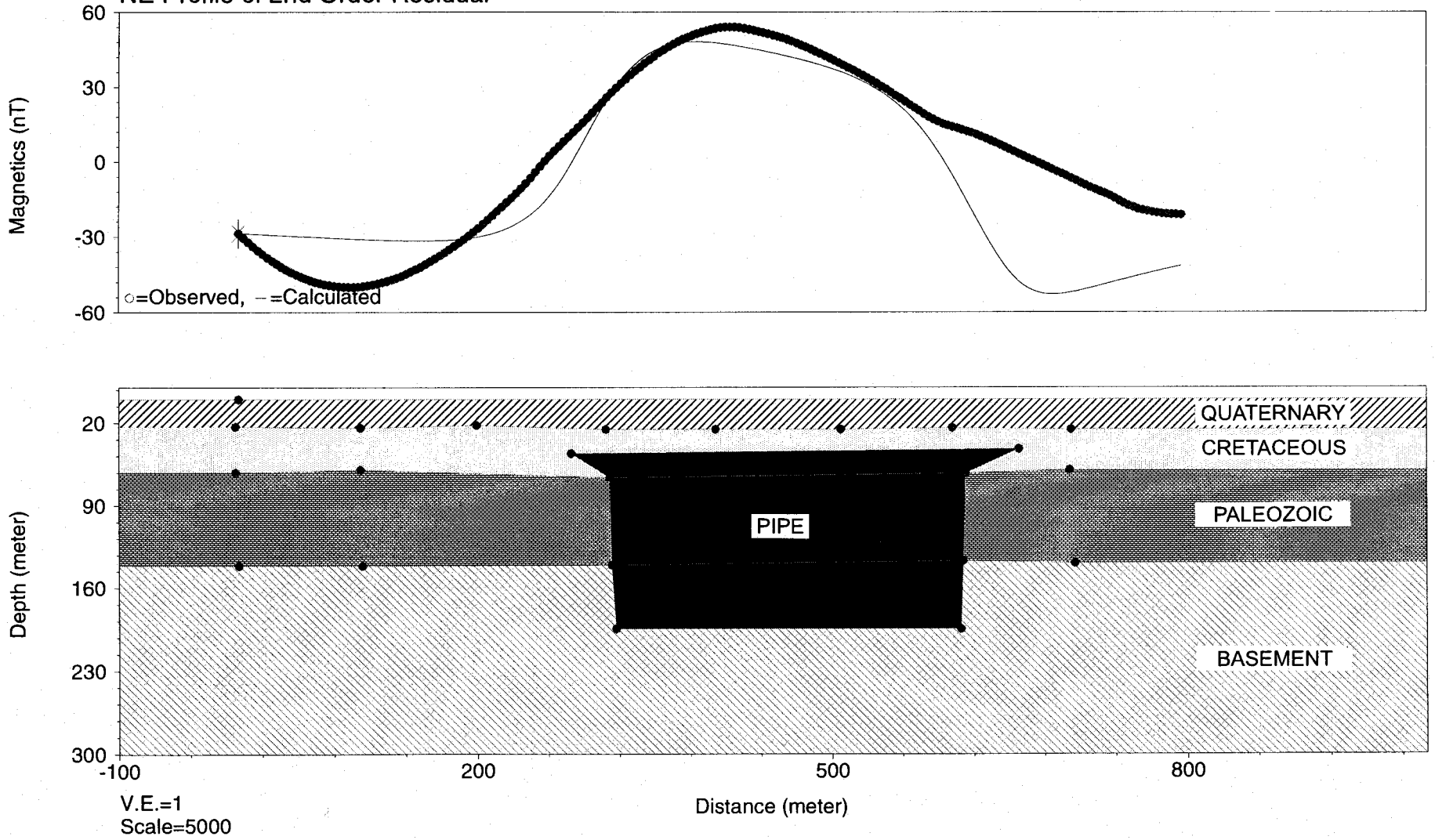
Anomaly 169

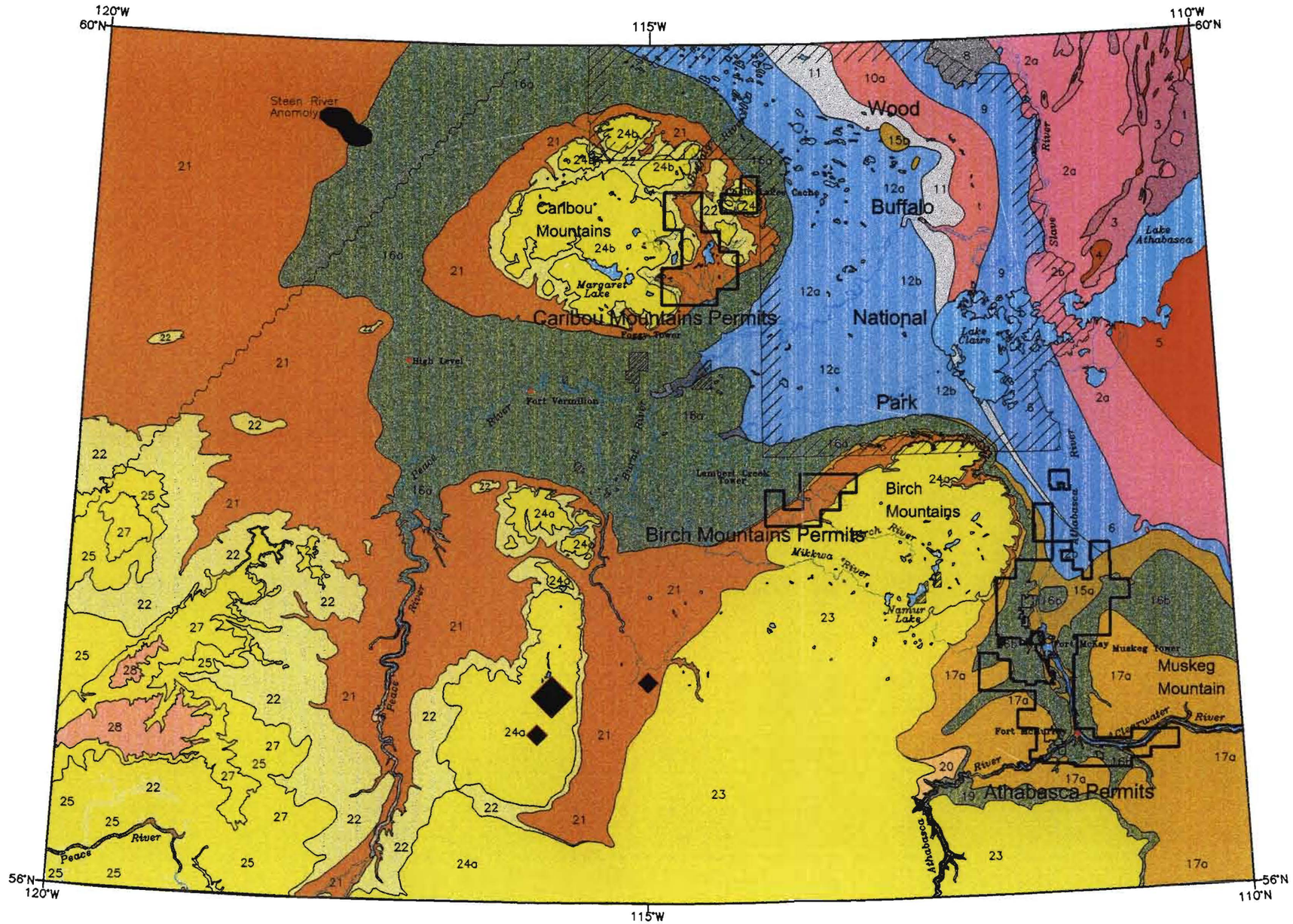
NS Profile of 2nd Order Residual



Anomaly 189

NE Profile of 2nd Order Residual





Geology modified after Green et al., 1970

See back for legend and symbols

MAP AREA

SYMBOLS

- Birch Mountian Resources Ltd. claim boundaries
- Location of known kimberlite
- Location of reported kimberlite

BIRCH MOUNTAIN RESOURCES LTD.

LOCATION AND REGIONAL GEOLOGY

NTS 84 A to M, 74 D, E, L, M

Scale 0 20 40 60 80 100 Kilometres

APEX Geoscience Ltd.

EDMONTON, ALBERTA

DECEMBER, 1997

Figure 1

LEGEND

CRETACEOUS

28 — *WAPITI FORMATION:* grey carbonaceous feldspathic sandstone, silty shale, bentonite; thin coal beds; nonmarine

27 — *PUSKWASKU FORMATION:* dark grey fossiliferous shale, silty in upper part; marine

26 — *BAD HEART FORMATION:* fine–grained quartzose sandstone, ferruginous oolitic sandstone and mudstone; marine

25 — *KASKAPAU FORMATION:* dark grey silty shale, ironstone partings: interbedded in lower part with fine–grained quartzose sandstone and thin beds of ferruginous oolitic mudstone; marine

24b — *UNNAMED DARK GREY SHALE* Caribou Mountains and Buffalo Head Hills

24a — *SMOKY GROUP:* dark grey and silty shale, ironstone partings and concretions; marine

23 — *LABICHE FORMATION:* dark grey shale and silty shale, ironstone partings and concretions; thin fish scale–bearing silty beds in lower part; marine

22 — *DUNVEGAN FORMATION:* grey fine–grained feldspathic sandstone with hard calcareous beds, laminated siltstone and grey silty shale; deltaic to marine

21 — *SHAFTESBURY FORMATION:* dark grey fish scale–bearing shale, silty in upper part; numerous nodules and thin beds of concretionary ironstone; bentonite partings; interbedded locally in lower part with thin silty and sandy intervals; marine

20 — *PELICAN FORMATION:* fine–grained quartzose sandstone, silty and glauconitic in lower part; marine

19 — *JOLI FOU FORMATION:* dark grey fossiliferous shale, silty interbeds in upper part; marine

18 — *PEACE RIVER FORMATION, CADOTTE MEMBER* (upper): fine–grained quartzose sandstone; *HARMON MEMBER* (middle): dark grey silty shale: *NOTIKEWIN MEMBER* (lower): fine–grained glauconitic sandstone, silty interbeds in lower part; marine

17b — *ALICE CREEK TONGUE, GRAND RAPIDS FORMATION:* fine–grained quartzose sandstone; marine

17a — *GRAND RAPIDS FORMATION:* fine–grained quartzose and feldspathic sandstone, laminated siltstone and silty shale; thin coaly beds; deltaic to marine

16b — *CLEARWATER FORMATION:* dark fossiliferous silty shale, laminated siltstone, fine–grained cherty sandstone; glauconitic sandstone *(WABISKAW MEMBER)* near base; marine

16a — *LOON RIVER FORMATION:* dark grey fossiliferous silty shale and laminated siltstone, ironstone nodules and partings; marine

15b — *BASAL CRETACEOUS,* Wood Buffalo Park: calcareous quartz sandstone, equivalent in position to *McMURRAY FORMATION* of Athabasca River region

15a — *McMURRAY FORMATION:* cross–bedded quartzose sandstone and siltstone; oil–impregnated with grey silty shale interbeds in upper part; deltaic

DEVONIAN

14 — *GROSMONT FORMATION:* grey fine–grained granular partly vuggy dolomite; marine

13 — *MIKKWA FORMATION,* upper member: brownish–grey to olive green, purplish–red mottled, fine–grained limestone, dolomitic limestone and shaly limestone; lower member: dark grey to brownish–grey fine–grained limestone and dolomitic limestone; marine

12c — *IRETON FORMATION:* greenish–grey shale and calcareous shale and siltstone; marine

12b — *WATERWAYS FORMATION:* grey and greenish–grey shale and argillaceous limestone units alternating with grey and greyish–brown fine–grained and clastic limestone units; marine

12a — *HAY RIVER FORMATION:* greenish–grey calcareous shale, argillaceous siltstone and argillaceous limestone; marine

CARIBOU MEMBER, SLAVE POINT FORMATION: grey and brown fine– to medium–grained limestone and dolomitic limestone; minor shale, gypsum; marine

10c — *FORT VERMILION MEMBER, SLAVE POINT FORMATION:* white and grey gypsum, argillaceous and dolomitic gypsum; minor anhydrite; some fine–grained limestone, dolomitic limestone and green shale; evaporitic

10b — *MUSKEG FORMATION:* white and grey gypsum, anhydrite; minor dolomite, salt and shale; evaporitic

10a — *NYARLING FORMATION:* white and grey gypsum, argillaceous and dolomitic gypsum; some fine–grained limestone and dolomitic limestone;anhydrite, minor dolomite and salt, greenish shale and limestone in subsurface; evaporitic

9 — *KEG RIVER FORMATION:* upper member: grey and brown fine– to medium–grained limestone, thin–bedded to massive, locally richly fossiliferous and coarse grained; grey medium–grained dolomite , locally vuggy; lower member: fine–grained brown dolomite and laminated dolomite, locally vuggy; minor limestone; unit locally much brecciated and recemented; marine

CHINCHAGA FORMATION: white and grey gypsum, argillaceous and dolomitic gypsum and anhydrite; some dolomite, dolomitic limestone, red and green shale; some salt in subsurface; evaporitic

7 — *FITZGERALD FORMATION:* grey and brown fine– to medium–grained dolomite to sandy dolomite and dolomitic limestone. locally vuggy; grading down into sandstone, arkose and breccia *(LA LOCHE FORMATION);* marine

6 — *MIDDLE DEVONIAN* (undivided) includes *METHY FORMATION:* brown and buff massive porous dolomite, brown to grey thin–bedded dolomite, dolomitic limestone, minor anhydrite and gypsum; *McLEAN RIVER FORMATION* and leached *PRAIRIE EVAPORITE FORMATION:* gypsum, anhydrite, grey–green silty and dolomitic shale, minor dolomite; marine to evaporitic

PRECAMBRIAN

5 — *ATHABASCA FORMATION:* white, grey and red, medium– to coarse–grained sandstone, flat–bedded to strongly crossbedded; local conglomerate and shale beds

4 — *METASEDIMENTARY ROCKS:* black and grey quartzite and impure quartzite, biotite schist, phyllite; minor sericite and hornblende schist, phyllonite, amphibolite; variable amounts of pegmatite and granite

3 — *GRANITE GNEISS:* predominantly biotite and hornblende granite gneiss; minor amphibolite, schist, foliated granite, pegmatite and other gneisses

2b — *GRANITE:* pink to grey, massive to foliated biotite, hornblende and leucocratic granite; local granite pegmatite

2a — *UNDIVIDED GRANITIC PLUTONIC ROCKS:* including biotite granite, porphyroblastic and porphyritic granites; some granite gneiss and metasedimentary rocks

1 — *PORPHYROBLASTIC GRANITES:* foliated to massive, white, grey and pink biotite granite and gneissic granite, quartz diorite, with feldspar porphyroblasts; variable amounts of sedimentary rocks and granite gneiss

SYMBOLS

RESERVES

TOWER

Highway

Infrastructure in the area is centered on the major communities of High Level and Fort McMurray both of which are serviced by regular passenger air service. Road access to the area is provided by several major highways including: (a) Highway 2 to Peace River, (b) Highway 58 to Fort Vermillion, (c) Highway 35 to High Level, and (d) Highway 63 to Fort McMurray.

REGIONAL GEOLOGICAL SETTING

Caribou Mountains and Birch Mountains Permit Areas

Outcrop in the area of the Caribou Mountains and Birch Mountains permits is generally poor, and is typically limited to the main river valleys and creeks cutting through plateau edges. Bedrock is covered by a thin to thick veneer of glacial drift in most places and the plateaus are covered by a mature forest of coniferous and deciduous trees (Collins, 1968; Collins and Conrad, 1968), while cover in the low lying areas generally consists of swamp and muskeg.

Precambrian

Precambrian rocks are not exposed in the area of the Caribou Mountains and Birch Mountains Permits in the Fort Vermilion region. The nearest exposure of Precambrian rocks is east of the Athabasca River in the vicinity of the Marguerite River (Dufresne *et al.*, 1994). Villeneuve *et al.* (1993) suggested that the Precambrian basement underlying the Phanerozoic succession in the Fort Vermilion region belongs to the Buffalo Head Terrane (BHT), which is an area of high positive magnetic relief with a north to northeasterly fabric (Figure 2). The area of Ashton Mining of Canada Inc.'s (Ashton) kimberlite discovery is underlain by basement of the BHT sometimes referred to as the Buffalo Head Craton. The BHT is part of the Churchill Structural Province and is thought to represent either Archean crust that has been thermally reworked during the Hudsonian (Proterozoic) Orogeny (Burwash *et al.*, 1962; Burwash and Culbert, 1976; Burwash *et al.*, 1994) or an accreted Proterozoic terrane that may or may not have an Archean component (Ross and Stephenson, 1989; Ross *et al.*, 1991; Villeneuve *et al.*, 1993). Precambrian rocks which have been intersected in drill core from the BHT comprise felsic to intermediate metaplutonic rocks, felsic metavolcanic rocks and high-grade gneisses (Villeneuve *et al.*, 1993). The presence of a large number of eclogitic garnets and eclogitic pyroxenes in association with kimberlites or related intrusions in northern Alberta may indicate the presence of significant volume of accreted and subducted sedimentary protolith in basement rocks.

The Caribou Mountains mineral permits likely are underlain by the boundary between the BHT and the Taltson Magmatic Zone (Figure 2). Although the Birch Mountains permits are shown to be underlain mostly by the Taltson Magmatic Zone (TMZ) on Figure 2, the eastern boundary of the BHT is not well defined and could easily be drawn well east of the Birch Mountains permits on the basis of the magnetic data in Villeneuve *et al.* (1993) and Dufresne *et al.* (1996). As a result, it is quite possible that either

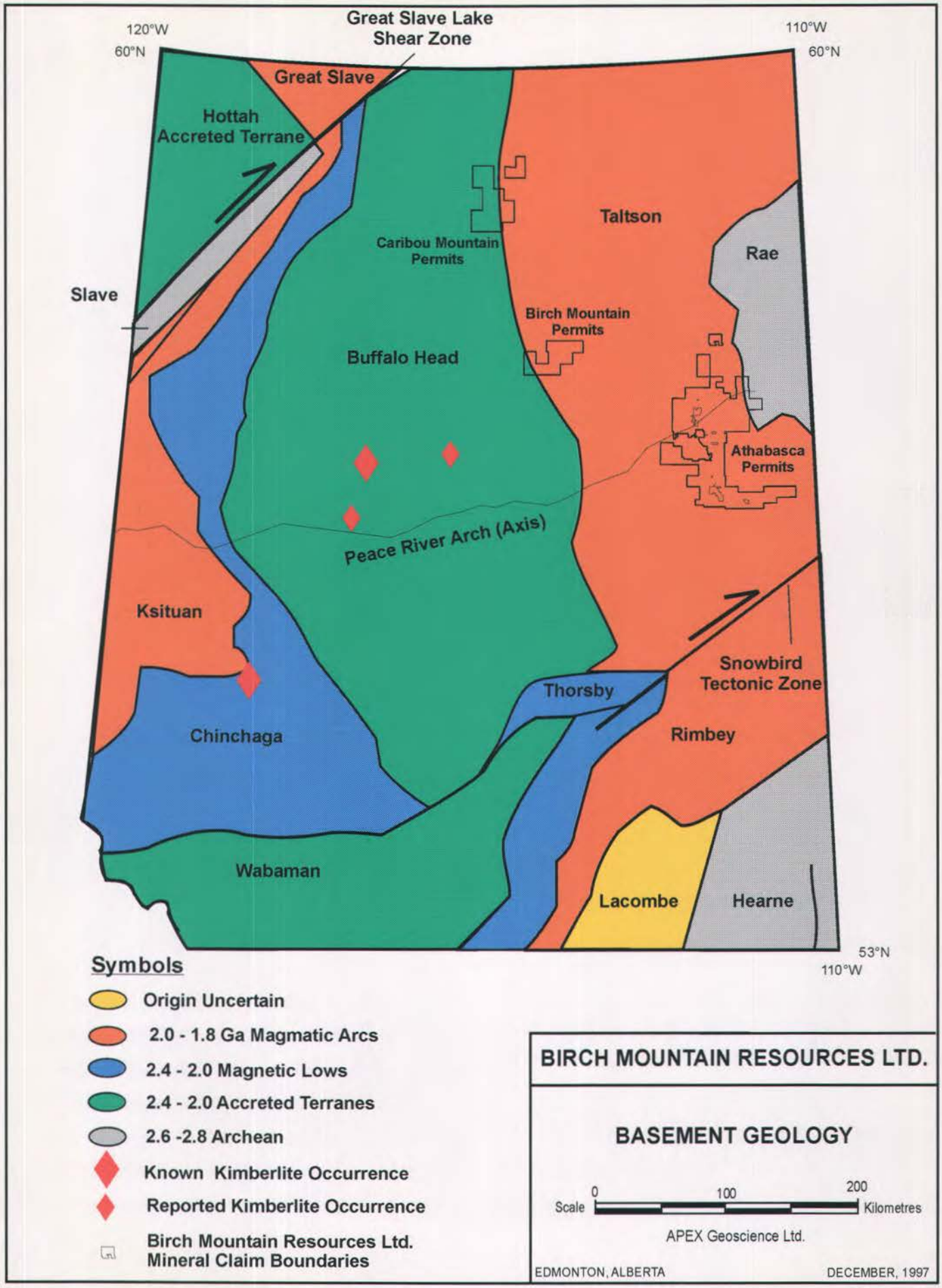

Great Slave Lake
Shear Zone
120°W
60°N
110°W
60°N
Great Slave
Hottah
Accreted Terrane
Slave
Caribou Mountain
Permits
Taltson
Rae
Birch Mountain
Permits
Buffalo Head
Athabasca
Permits
Peace River Arch (Axis)
Ksituan
Snowbird
Tectonic Zone
Thorsby
Chinchaga
Rimbey
Wabaman
Lacombe
Hearne
53°N
110°W
Symbols
Origin Uncertain
2.0 - 1.8 Ga Magmatic Arcs
2.4 - 2.0 Magnetic Lows
2.4 - 2.0 Accreted Terranes
2.6 -2.8 Archean
Known Kimberlite Occurrence
Reported Kimberlite Occurrence
Birch Mountain Resources Ltd.
Mineral Claim Boundaries
BIRCH MOUNTAIN RESOURCES LTD.
BASEMENT GEOLOGY
Scale
0
100
200
Kilometres
APEX Geoscience Ltd.
EDMONTON, ALBERTA
DECEMBER, 1997

Figure 2

significant portions or all of BMRL's Caribou Mountains and Birch Mountains permits are underlain by basement of the Buffalo Head Craton, which is the underlying basement to Ashton's kimberlite discovery area.

Phanerozoic

The majority of the Fort Vermilion area is underlain by rocks of Devonian and Cretaceous ages (Figure 1). However, these units are poorly exposed except in some river and creek valleys. Table 1 shows the generalized stratigraphy for the Fort Vermilion region in northern Alberta. Further information pertaining to the distribution and character of these units can obtained from well log data and fieldwork by Carrigy (1959, 1966, 1973), Norris (1963, 1973), Green *et al.* (1970), Hamilton (1971), Stewart (1963, 1981), Mossop (1980), Mossop and Flach (1983), Flach (1984), Flach and Mossop (1985), Anderson *et al.* (1993) and Dufresne *et al.* (1994).

TABLE 1
GENERALIZED STRATIGRAPHY
CARIBOU MOUNTAINS AND BIRCH MOUNTAINS PERMIT AREAS*

SYSTEM	GROUP	FORMATION	MEMBER	DOMINANT LITHOLOGY
UPPER CRETACEOUS	Smoky	Smoky Group		Shale and ironstone
	La Biche	La Biche		Shale
		Dunvegan		Sands and silts
		Shaftesbury		Shale, bentonites, Fish-Scale Fm.
LOWER CRETACEOUS	Mannville	Grand Rapids		Lithic sands
		Loon River		Shale, silts and glauconitic sands
		McMurray		Quartzose sands, heavy oil
UPPER DEVONIAN	Woodbend	Grosmont		Dolomitic Limestone
		Mikkwa		Limestone, dolomitic limestone
	Beaverhill Lake	Waterways	Mildred	Argillaceous limestone
			Moberly	Limestone and shale
			Christina	Shale and limestone
			Calumet	Limestone and shale
			Firebag	Shale, minor limestone
		Slave Point		Limestone and dolomite
		Fort Vermilion		Anhydrite, dolomite and shale
MIDDLE DEVONIAN	Upper Elk Point	Watt Mountain		Shale and dolostone
		Prairie Evaporite		Salt, anhydrite and dolomite
		Keg River		Fossiliferous dolostone

*Modified after Carrigy (1959, 1973), Norris (1963,1973), Green *et al.* (1970), Hamilton (1971), Dufresne *et al.* (1994), Meijer Drees (1994) and Dufresne *et al.* (1995).

The surface and near surface bedrock in the area of the Caribou Mountains and Birch Mountains permits consist of Lower to Upper Cretaceous shale-rich strata. The strata in both permit areas is likely age equivalent with: (a) the Fort à la Corne kimberlites in Saskatchewan, and (b) Ashton's Buffalo Head Hills kimberlites. If kimberlites or related intrusions are present on either the Caribou Mountains or Birch Mountains permits, they would most likely be at or very near surface if they are coeval with the Fort à la Corne or the Buffalo Head Hills kimberlites.

In general, the Lower to Upper Cretaceous strata in both the Caribou Mountains and Birch Mountains permit areas are composed of alternating units of marine bioturbated grey shales and anoxic black shales with fluvial sands, ironstone-rich horizons, siltstones and bentonite-rich layers. The stratigraphy of the Caribou Mountains and Birch Mountains permit areas is relatively similar with the exception of: (a) the Caribou Mountains permit area contains strata which is slightly younger than that found in the Birch Mountains permit area, and (b) a few of the units which are present in the Birch Mountains permit area are not found in the Caribou Mountains permit area.

Caribou Mountains Permit Area

The oldest exposed strata in the Caribou Mountains permit area is the Lower Cretaceous Loon River Formation, which is a marine, dark grey, fossiliferous, iron-rich shale and laminated siltstone. The unit has been reported to contain scattered beds of nodular sideritic ironstone.

The next oldest unit is the Shaftesbury Formation, which is comprised of a 250 m to 300 m thick sequence of marine, highly fissile, dark-coloured shales with thin bentonite beds and abundant concretionary ironstone. Sulphide-rich horizons have been identified within the Shaftesbury Formation in the vicinity of the McIvor River along the northeast flank of the Birch Mountains (Franklin, 1994; Sabag and Dufresne, 1994). The Shaftesbury Formation also contains the Fish Scale marker horizon which is estimated to have been deposited about 96 Ma (Leckie *et al.*, 1992; Bloch *et al.*, 1993; Dufresne *et al.*, 1995; Dufresne *et al.*, In Preparation). The Shaftesbury Formation overlies Grand Rapids Formation lithic sandstones on the eastern and northern flank of the Birch Mountains, but further to the west and north the Shaftesbury Formation conformably overlies Loon River Formation shale and siltstone.

Volcanism from Albian to Turonian time, particularly during deposition of the Shaftesbury Formation, may have been ongoing and extensive because: (a) numerous bentonitic horizons occur throughout the Shaftesbury Formation, especially within and near the Fish Scales horizon across much of Alberta (Leckie *et al.*, 1992; Bloch *et al.*, 1993), (b) the Crowsnest Formation volcanics of southwest Alberta were being deposited at about this time (Olson *et al.*, 1994; Dufresne *et al.*, 1995), (c) kimberlitic/lamproitic diatreme activity occurred in Saskatchewan and, possibly, in the vicinity of the Peace River Arch about this time (Lehnert-Thiel *et al.*, 1992; Scott Smith *et al.*, 1994), and finally (d) there is documented igneous activity associated with the Steen

River Anomaly, a possible impact structure, which also formed in northwestern Alberta about this time (Carrigy, 1968; Dufresne *et al.*, 1995).

The Dunvegan Formation overlies the Shaftesbury Formation, and is characterized by feldspathic sandstones, silty shales and laminated carbonaceous siltstones. The sequence occupies narrow strips along the slopes of the Caribou and Birch Mountains and is believed to be of deltaic origin. The Dunvegan Formation is about 100 m thick in the Fort Vermilion region (Swinden and Horsley, 1971), and is overlain by a dark grey shale to silty shale with ironstone partings, concretions, and in some places, fish scale-bearing siltstone beds. This overlying shale unit is given a variety of names in the Fort Vermilion to Fort McMurray region, including the Labiche Formation, Smoky Group and "unnamed Dark Grey Shale" (Green *et al.*, 1970).

Birch Mountains Permit Area

The oldest strata that crops out in the Birch Mountains permit area belongs to the Loon River Formation which is as described in the previous section. Overlying the Loon River Formation is the Grand Rapids Formation, which can be generalized as a salt and pepper lithic sandstone, laminated siltstone and shale with thin coal beds (Green *et al.,* 1970). The unit is approximately 100 m thick, and is exposed on the eastern flank of the Birch Mountains, but pinches out to the northwest in the Fort Vermilion region. In the area of the Birch Mountains permits, the Grand Rapids Formation is overlain by the Shaftesbury Formation and then subsequently by the Dunvegan Formation (see previous section for descriptions). Along the east slope of the Birch Mountains the Dunvegan sands are extremely thin or are absent (Dufresne *et al.*, In Preparation).

The youngest strata in the Birch Mountains permit area consists of the Labiche Formation and the conformably overlying Smoky Group. These units are contemporaneous with the "unnamed Dark Grey Shale" described in the previous section. Along the east slope of the Birch Mountains, the Upper Shaftesbury or Dunvegan equivalent sediments are overlain by a highly bentonitic, carbonaceous black shale named the Second White Specks Formation (Dufresne *et al.*, In Preparation). This black shale is unconformably overlain by grey bioturbated shale of the Lea Park Formation. A time gap of about 4 to 8 Ma has been identified by Dufresne *et al.* (In Preparation).

Quaternary

Data and information about the surficial geology in the Fort Vermilion region is sparse and typically is of a regional nature. Mapping done by Bayrock (1971) in the Bitumount map sheet (NTS 74E), Bayrock and Reimchen (1974) in the Waterways map sheet (NTS 74D), (now referred to as the Fort McMurray map sheet) and a reconnaissance stratigraphic study conducted along the lower two-thirds of the Firebag River (Dufresne *et al.*, 1994), are the only surficial mapping near or on the BMRL mineral permits. Additional information regarding bedrock topography and drift thickness in northeast Alberta is

available from the logs of holes drilled for petroleum, coal or groundwater exploration. However, most of this information is restricted to the Bitumount map sheet.

Prior to continental glaciation during the Pleistocene, the Fort Vermilion region had reached a mature stage of erosion with drainages mainly flowing in an east to northeasterly direction. Beginning in the Pleistocene there were multiple southwesterly and westerly glacial advances, with the last glaciers receding about 10,000 years ago. During glaciation, deposition of ground moraine was common, as well as widespread deposits of glacial outwash material such as gravels, sands, silts and clays (Collins, 1968; Collins and Conrad, 1968). During interglacial periods, and initially after the final glacial retreat, lacustrine clays and silts were deposited in many places, and kame deposits and kettle-developed topography formed locally. After the final de-glaciation, an easterly to northeasterly drainage regime similar to that of the pre-Pleistocene was re-established. In general, glacial and interglacial drift thicknesses of up to 75 m exist in the northeast parts of the Fort Vermilion region, but drift thickness in the region typically averages from 15 to 30 m. Some areas exhibit locally thin drift, such as the south face of the Caribou Mountains, while other area contain extremely thick deposits of till or moraine. In the Buffalo Head Hills, Ashton has reported drift thicknesses ranging from nonexistent up to 74 m (Ashton Mining of Canada, 1997a,b). This range and variation in glacial and interglacial drift thickness is expected for BMRL's Caribou Mountains and Birch Mountains permits.

Geophysics and Structural Geology

Little is known about the structural geology of the Fort Vermilion region because of poor outcrop exposure, limited access and little detailed geological mapping of the surface bedrock. However, considerable seismic surveys and subsurface geological work have been performed in the region by various oil and gas companies. A number of wells have been drilled and much of the well data are on file with the Alberta Energy and Utilities Board (AEUB). However, most of the seismic data are privately held and not available in the public domain.

The Fort Vermilion region lies in the Interior Plains structural province where the Phanerozoic strata are generally undisturbed and the regional strike of the Paleozoic strata is to the north-northwest, with a shallow dip to the west-southwest. The Cretaceous beds also dip gently to the southwest. Localized structures, such as high-angle faults, gentle folds and solution collapse phenomena are superimposed on the regional southwest dip. Little is known about the structures that affect the Phanerozoic succession, but what is known is well summarized in Dufresne *et al.* (1994), Mossop and Shetsen (1994), Olson *et al.*, (1994) and Dufresne *et al.*, (1995).

Aerial photographs of the Fort Vermilion region show there are many distinctive topographic lineaments, some of which may indicate faults or fractures in Phanerozoic bedrock (Collins, 1968; Collins and Conrad, 1968; Greggs, 1994). Many of these lineaments have northwest or northeast trends and may reflect deep-seated structures, some of which may extend into and be controlled by structures in the

Precambrian basement. In the Fort McKay area, for example, some incised valleys and lineaments on the top of the Devonian actually directly overlie older known basement structures (Dufresne *et al.*, 1994). This indicates that the basement structures may have been periodically re-activated during the Phanerozoic as a result of stress variations in the Western Canada Sedimentary Basin during such events as Antler and Laramide orogenic activity. Such deep-seated and, possibly, long-lived structures could be of exploration interest for kimberlites. As an example, Monopros Ltd.'s (Monopros) Mountain Lake Kimberlite northeast of Grand Prairie exists in close proximity to the intersection of the well documented northeast trending South Peace River Fault and the northwest trending Belloy Fault (Dufresne *et al.*, 1996). The Ashton kimberlite field also exists in close proximity to the South Peace River Fault and other associated structures approximately 200 km northeast of the Mountain Lake Kimberlite.

Athabasca Permit Area

The northern two-thirds of the Athabasca permits are situated in the Bitumount map area (NTS 74E), whereas the southern third is in the Fort McMurray map area (NTS 74D), which is also referred to as the Waterways map area. Due to poor outcrop, most of the structural geology in this area is based upon interpretations of aeromagnetic data, lineament analysis of bedrock jointing and structure contour surfaces created from drillhole information by such workers as Sproule (1938), Hume (1949), Kidd (1951), Carrigy (1959), Garland and Bower (1959), Martin and Jamin (1963), Norris (1963, 1973), Stewart (1963), Martin (1966), Godfrey (1970), Babcock and Sheldon (1976), Langenberg and Nielson (1982), Wilson (1985b), Sprenke *et al.* (1986) and Dufresne *et al.* (1994).

Precambrian

Interpretations of the nature of the crystalline basement in this region are based almost entirely upon geophysical data because exposed Precambrian shield rocks exist in only one small area south of Lake Athabasca in the vicinity of the Marguerite River, near the northeast corner of BMRL's mineral permits. The Precambrian rocks in the Marguerite River area have not yet been dated. The basement underlying the Phanerozoic succession in the area of the Athabasca permits can be divided into two distinct magnetic terranes based on government aeromagnetic data (Geological Survey of Canada, 1983; Sprenke *et al.*, 1986; Wilson, 1986). Ross and Stephenson (1989), Ross *et al.* (1989, 1991, 1993), Ross (1991, 1992) and Villeneuve *et al.* (1993) have suggested that the basement underlying the northeastern corner of the permits which yields a relatively low background magnetic signature, is part of the Archean Rae Sub-province. This terrane is thought to have been thermally reworked during the Hudsonian (Proterozoic) Orogeny (Burwash *et al.*, 1962; Burwash and Culbert, 1976; Burwash *et al.*, 1994). Archean crystalline basement in conjunction with thick crust and structures such as the PRA is regarded as highly favourable for the formation and preservation of diamonds in the upper mantle, and transport of diamonds from the upper mantle to surface via kimberlitic or related magmas. The presence of thick crust underlying the Athabasca permits is indicated by seismic refraction data in Dufresne *et al.* (1996).

The basement underlying the larger southwestern portion of these permits, however, yields a strong background magnetic signature and is therefore interpreted to be part of the Proterozoic TMZ. The TMZ, which has been dated between 1,932 Ma and 1,975 Ma from outcrops north of Lake Athabasca and from oil well drill core to the south (Ross *et al.*, 1989; McNicoll *et al.,* 1993; Villeneuve *et al.*, 1993), is a north-south trending magmatic belt that originates near Great Slave Lake, as part of the Thelon Tectonic Zone, and is truncated in east-central Alberta by the Snowbird Tectonic Zone. In general, magmatic zones are thought to be indicative of high heat flow and thin crust. Such conditions are not thought to be favourable for either the formation of preservation of diamonds in the upper mantle. However, high heat flow and thin crust associated with the TMZ during the Proterozoic does not preclude the possibility that diamonds could have formed and been preserved in the upper mantle beneath the TMZ from 1.9 Ga to present.

The Shield exposure in the nearby Marguerite River area represents the only Precambrian basement exposure that exists south of Lake Athabasca in Alberta. In addition, since the Marguerite River area includes relatively abundant outcrop exposures, in contrast to the paucity of outcrop in most of the Bitumount map area, it has perhaps received more geological attention than most other parts of the map area (Tremblay, 1961; Godfrey, 1970). The Precambrian rocks in the Marguerite River area comprise Archean granite, gneiss, mafic igneous rocks and mylonite. Dufresne *et al.* (1994) summarized the available data on the exposed basement rocks in the Marguerite River area, and concluded that there are three main rock types: (1) various types of granitoid rocks, (2) mafic meta-igneous rocks of unknown origin, and (3) strongly mylonitic rocks. The granitoids include: (a) a granite to granite gneiss unit, which is generally leucocratic and quartz- and plagioclase-rich, (b) a megacrystic alkali feldspar granite to syenite unit, with abundant K-feldspar, from <20% to often <10% quartz, 15 to 30% mafic minerals and minor amounts of corundum, and (c) an alkali feldspar granite to alkali feldspar granite gneiss unit, which is similar to the peraluminous megacrystic unit, but is less coarse grained, is more quartz- and plagioclase-rich, and locally contains garnet and pyrophyllite.

Proterozoic sedimentary rocks also occur northeast of BMRL's Athabasca permits along the Richardson River in the northeast corner of the Bitumount map area. Their presence is known only from drilling associated with uranium exploration during the 1970's, and their geology is well summarized by Wilson (1985a, 1987a,b).

Phanerozoic

The Athabasca permit area is underlain by predominantly sedimentary rocks of Devonian and Lower Cretaceous age, but these units are poorly exposed except in some river and creek valleys. Table 2 shows the generalized stratigraphy for the Fort McKay to Fort McMurray region in northeast Alberta. Further information pertaining to the distribution and character of these units can be obtained from well log data and fieldwork by Carrigy (1959, 1966, 1973), Norris (1963, 1973), Green *et al.* (1970), Hamilton (1971), Stewart (1963, 1981), Mossop (1980), Mossop and Flach (1983), Flach (1984), Flach and Mossop (1985), Anderson *et al.* (1993) and Dufresne *et al.* (1994).

TABLE 2
GENERALIZED STRATIGRAPHY
ATHABASCA PERMIT AREA*

SYSTEM	GROUP	FORMATION	MEMBER	DOMINANT LITHOLOGY
UPPER CRETACEOUS	Smoky	Lea Park		Grey bioturbated shale
		2nd White Specks		Black shale, highly bentonitic
		Dunvegan		Sandstone and siltstone
		Shaftesbury		Shale, bentonites, Fish-Scale Fm.
LOWER CRETACEOUS		Pelican		Quartzose sands
		Joli Fou		Shale
	Mannville	Grand Rapids		Lithic sands
		Clearwater		Shale and glauconitic sands
		McMurray		Quartzose sands, heavy oil
			Beaver River	Quartz-Py cemented sandstone
UPPER DEVONIAN	Beaverhill Lake	Waterways	Mildred	Argillaceous limestone
			Moberly	Limestone and shale
			Christina	Shale and limestone
			Calumet	Limestone and shale
			Firebag	Shale, minor limestone
		Slave Point		Limestone, local breccia
MIDDLE DEVONIAN	Upper Elk Point	Watt Mountain		Shale and dolostone
		Prairie Evaporite		Salt, anhydrite (gypsum), and
		Keg River		Dolomite, minor reefs

*Modified after Carrigy (1959, 1973), Norris (1963, 1973), Hamilton (1971), Dufresne *et al.* (1994) and Meijer Drees (1994).

Near surface bedrock in the vicinity of BMRL's mineral permits consists predominantly of marine to non-marine sediments of the Middle Devonian Keg River Formation (also known locally as Methy Formation), Upper Devonian Waterways Formation and Lower Cretaceous McMurray to Grand Rapids formations. Areas underlain by Lower Cretaceous McMurray to Grand Rapids formations are of considerable interest in terms of diamond exploration since they are roughly coeval or slightly older than the ages of known kimberlite intrusions in other parts of the Western Canada Sedimentary Basin, such as the Fort à la Corne kimberlites, Buffalo Head Hills kimberlites and the Mountain Lake Kimberlite. Several kimberlite pipes or pyroclastic horizons in the Fort à la Corne area have been documented as coeval with McMurray to Grand Rapids sedimentation (Jellicoe, *pers comm.*, 1997). Age of existing bedrock could be important in some cases because most of the kimberlites associated with the fields mentioned are younger than bedrock in

the Fort McKay to Fort McMurray area. As a consequence, those pipes that are lenticular and pyroclastic in nature, similar to the Fort à la Corne kimberlites and the Mountain Lake Kimberlite, may have had their upper portions, if not all of the kimberlite pipe, removed via erosion if they were even slightly younger than the sediments of the McMurray to Grand Rapids formations. However, northeastern Alberta is not likely to have had greater than 1 km of original Tertiary to mid-Cretaceous sediments removed during glaciation (Abercrombie, *pers comm.*, 1997). Therefore, it is quite likely that any more traditional carrot shaped kimberlite pipes, such as those in the northwest Territories or in the Buffalo Head Hills, may be largely intact in the Fort McKay to Fort McMurray area.

The Keg River Formation carbonates are the lowermost Devonian rocks exposed in the vicinity of the Athabasca permits. A rise in sea level and reduction in production of carbonate sediment during the Middle Devonian resulted in reefal growth and the deposition of the Keg River Formation carbonates, which are predominantly dolomitic in nature (Cotterill and Hamilton, 1995).

Upper Devonian Waterways Formation consists of a 200 m to 230 m thick sequence of calcareous shale and argillaceous limestone alternating with clastic limestone in the vicinity of Fort McKay (Green *et al.*, 1970; Norris, 1973). The Waterways Formation, which is the uppermost Devonian unit that crops out in the vicinity of Fort McKay, is well exposed along the banks of the Athabasca River and in Wood Buffalo National Park. The Devonian units are separated from the overlying Lower Cretaceous units by an erosional unconformity (Carrigy, 1959, 1973). This unconformity represents a marked change in lithology and it has been postulated that the pre-Cretaceous units underwent several periods of subaerial erosion and karsting, and that the erosional surfaces resulting from these processes affected the sedimentation of the lowermost Mesozoic units that were subsequently deposited (Carrigy, 1973; Dufresne *et al.*, 1994).

The McMurray Formation is the oldest Lower Cretaceous unit, consisting mainly of deltaic sediments that include thick cross bedded oil-impregnated quartz sands, with interbeds of silt and shale. Carrigy (1973) suggested that lower McMurray Formation was predominantly of fluviatile origin, the middle McMurray of fluviatile to deltaic origin, and the upper McMurray of delta platform to brackish water origin. The McMurray Formation is laterally extensive within the Bitumount map area and the Birch Mountains although it tapers out to the northwest as a result of a large Paleozoic topographic high (McPhee, 1994). The McMurray Formation is approximately 45 m thick in the Fort McKay to Fort McMurray area.

The McMurray Formation oil sands are conformably overlain by marine shale, laminated siltstone and cherty, glauconitic sandstone of the Clearwater Formation (Carrigy, 1973), which is approximately 100 m thick in the Fort McKay to Fort McMurray area. The Clearwater Formation underlies a large portion of BMRL's mineral permits. The unit contains scattered beds and nodules of sideritic ironstone.

The Grand Rapids Formation underlies much of the drift covered region in the southeast corner of the Bitumount map area, particularly in the vicinity of Muskeg

Mountain. The unit is approximately 100 m thick where it is exposed on the eastern flank of the Birch Mountains, but pinches out to the northwest. The Grand Rapids Formation consists of salt and pepper lithic sandstone, laminated siltstone and shale with thin coal beds (Green *et al.*, 1970).

Quaternary

Data on surficial geology for the Fort McKay to Fort McMurray area comes from mapping done by Bayrock (1971) within the Bitumount map area, Bayrock and Reimchen (1974) within the Waterways map area, and from more detailed investigations in the western portion of the area by McPherson and Kathol (1977), and Dufresne *et al.* (1994). Horne and Seve (1991) described a buried channel east of the Athabasca River, and Smith and Fisher (1993) discussed the development of the Athabasca River during the Late Wisconsin deglaciation.

The surficial geology map for the Bitumount map area (Bayrock, 1971), along with field observations from Dufresne *et al.* (1994), indicate that the area is primarily blanketed by one to three tills up to 40 m in total thickness. Previous work by Dufresne *et al.* (1994) has shown that drift thicknesses are quite variable in the area, ranging from little or no drift in parts of the Marguerite River and Fort McKay areas, to about 185 m thick in the vicinity of Muskeg Mountain. Also present in the area are lesser amounts of lacustrine and outwash sand and gravel deposits. Outwash sand is extensive along the Athabasca River and the lower portions of the Firebag River in the northwest part of the Bitumount map area.

Dufresne *et al.* (1994) divided the tills in the Bitumount map area on the basis of grain size distribution into two distinct types. The area south of the Firebag River is divided into "Kinosis Till" to the west and "Gypsy Till" to the east (Dufresne *et al.*, 1994). The area north of the Firebag River is dominantly underlain by Gypsy Till. The Kinosis Till has a loamy composition, with more or less equal amounts of sand, silt, and clay, whereas the Gypsy Till is dominated by sand (90% or greater) with minor amounts of silt, pebbles, and cobbles. The Gypsy Till has a composition and textural character similar to that of glacial outwash. The high sand content of the Gypsy Till likely reflects the source Athabasca Formation sandstones which crop out to the north and northeast within the Athabasca Basin. Flutings on the Kinosis Till indicate ice-flow direction from the north-northeast and north-northwest (Bayrock, 1971).

Geophysics and Structural Geology

Most of the structural geology in this area is based upon interpretations of aeromagnetic data, lineament analysis of bedrock jointing and structure contour surfaces created from drillhole information by such workers as Sproule (1938), Hume (1949), Kidd (1951), Carrigy (1959), Garland and Bower (1959), Martin and Jamin (1963), Norris (1963, 1973), Stewart (1963), Martin (1966), Godfrey (1970), Babcock and Sheldon (1976), Langenberg and Nielson (1982), Wilson (1985b), Sprenke *et al.* (1986) and Dufresne *et al.* (1994).

In general, the Precambrian and the Devonian erosional surfaces slope gently to the southwest (Carrigy, 1959; Hackbarth and Nastasa, 1979), but the topography of the Precambrian surface is poorly constrained due to the limited number of drillholes that have penetrated Precambrian basement. The Precambrian shield in the vicinity of the Marguerite River is the only known Precambrian basement exposure south of Lake Athabasca in northern Alberta. Wilson (1985a) and Ramaekers (1979) suggested that the Marguerite River basement exposures are remnants of the once active Paterson High, a basement high that controlled sedimentation at the southwest end of the Athabasca Basin during the Late Proterozoic and was perhaps related to Proterozoic uplift associated with the PRA (Stelck *et al.*, 1978; O'Connell *et al.*, 1990; and Ross 1991). More recent work in the Birch Mountains by Dufresne *et al.* (In Preparation) indicates that a significant Upper Cretaceous unconformity exists between the Second White Specks and Lea Park formations, based upon preliminary micropaleontological work. These data indicate that a 4 to 8 Ma time gap is present within the shales from about 91 to 83 Ma and is likely the result of uplift associated with the PRA (Dufresne *et al.,* In Preparation). Interestingly, the indicated period of uplift may also be coeval with the approximate age of intrusion of Ashton's Buffalo Head Hills kimberlites.

Northwest trending fault structures have been identified in the basement rocks below the Athabasca succession of sediments in the vicinity of the Richardson and Maybelle Rivers (Mitchell and Fortuna, 1978; McWilliams *et al.,* 1979). For example, Wilson (1985b) identified several prominent northwest and northeast trending structures, one of which is the northwest trending Richardson River Fault, in the northeast corner of the Bitumount map area. Based on the GSC aeromagnetic data for the Bitumount map area, at least one prominent northeast trending basement fault named the Muskeg River Fault (MRF), transects BMRL's Athabasca permits (Geological Survey of Canada, 1983; Wilson, 1985b; Sprenke *et al.,* 1986; Dufresne *et al.*, 1994). A second prominent northeast trending fault, named the Johnson Lake Fault (JLF), is located roughly 10 km east of the permits and runs from the center of Township (Tp) 100 and Range (R) 2 west of the fourth Meridian (W4), to at least as far southwest as the northeast corner of Tp 97, R 6W4. On the basis of the GSC aeromagnetic data alone, the JLF does not appear to transect BMRL's Athabasca permits, however, it does appear to offset a northwest trending magnetic high in the Marguerite River area, which corresponds to a 2 to 4 km wide north-northwest trending mylonitic zone, a distance of about 5 km (Godfrey, 1970; Geological Survey of Canada, 1983; Wilson, 1985b; Sprenke *et al.,* 1986; Dufresne *et al.,* 1994). The MRF transects BMRL's permits based upon the GSC aeromagnetic data (Geological Survey of Canada, 1983; Sprenke *et al.,* 1986; Dufresne *et al.,* 1994) and it is also visible as a prominent northeast trending structure on BMRL's recently flown fixed-wing aeromagnetic survey (World Geoscience Ltd., 1997; Peirce, In Preparation). Based upon the newly acquired magnetic data, the MRF may have a length of more than 80 km with several minor north-south offsets along its length (World Geoscience Ltd., 1997; Peirce, In Preparation). The MRF and many other associated northeast and northwest trending basement faults are easily recognized on BMRL's 1997 aeromagnetic survey. Several interesting magnetic anomalies that could be indicative of near surface kimberlites or related intrusions exist in close proximity to the MRF and other associated northwest or northeast trending structures. The relationship between structures and kimberlites should

not be overlooked because the discovery area for Ashton's Buffalo Head Hills kimberlites and Monopros' Mountain Lake Kimberlite exist in close proximity to the prominent northeast trending South Peace River Fault, which has likely been reactivated during periodic movement of the PRA. Similar prominent northeast trending structures, such as the MRF, underlie BMRL's Athabasca permits and may provide an important regional control for the localization of kimberlitic intrusions.

Based upon structure contours for the sub-Cretaceous unconformity and present day drainage, several basement structures in the vicinity of BMRL's Athabasca permits appear to have been reactivated during the Devonian and likely during the Cretaceous. As an example, a significant stretch of the MRF underlies the approximate present day location of the Muskeg River (World Geoscience Ltd., 1997; Peirce, In Preparation). Regional structure contour maps for the sub-Cretaceous unconformity in the area of BMRL's Athabasca permits show two prominent northeast trending structures, one of which is the MRF (Figure 3), that affect Devonian carbonates in the vicinity of the Muskeg River (Dufresne *et al.*, 1994; Cotterill and Hamilton, 1995). The second prominent structure parallels the MRF and exists from 10 to 15 km southeast of the MRF (Figure 3). Interestingly, this structure lines up well with the projected southwesterly extension of the JLF, which is a well documented basement fault northeast of the Firebag River. The MRF and JLF together form a horst-like structure that has been referred to as the McKay Horst (Figure 3). Hackbarth and Nastasa (1979) described a major northwest to north trending basement fault, the Sewetakun Fault, that generally has a similar trace to that of the present day salt dissolution edge of the Prairie Evaporite. Hackbarth and Nastasa (1979) provided evidence that the Sewetakun Fault was active during the Devonian. Structure contour maps for the sub-Cretaceous unconformity by Martin and Jamin (1963), Hackbarth and Nastasa (1979) and Cotterill and Hamilton (1995) show that the erosional surface developed on the top of the Devonian in the vicinity of Fort McKay is extremely complex with substantive relief and has the appearance of being a highly dissected paleo-landscape, particularly in the area of Tps 94 to 99 and Rs 7 to 11W4 (Figure 3). Martin and Jamin (1963), have suggested that this landscape is due to faulting. It has been speculated that the north, northeasterly and northwesterly trending paleo-valleys and paleo-ridges are a product of reactivation of basement faults, such as the Muskeg River, Johnson Lake and Sewetakun faults described above, associated with uplift of the east to northeast trending PRA (Dufresne *et al.*, 1994; Cotterill and Hamilton, 1995; Dufresne *et al.*, In Preparation).

The pre-Cretaceous topography, which developed on a highly dissected Devonian erosional surface (Martin and Jamin, 1963; Hackbarth and Nastasa, 1979), played a major role in controlling the thickness and extent of the McMurray Formation (Stewart, 1963). Evidence of tectonic deformation affecting the post-Devonian units is limited, and is difficult to distinguish from deformation brought about by collapse due to salt dissolution. However, Tammam (*pers comm.*, 1996) indicates that strong evidence exists for Lower Cretaceous or later block faulting at Syncrude Canada Ltd.'s (Syncrude) Aurora property northeast of Fort McKay based on: (a) discrepancies in the positions of certain Lower Cretaceous marker horizons, (b) the juxtaposition of different environments of deposition, and (c) the absence of certain stratigraphic units in the McMurray Formation,

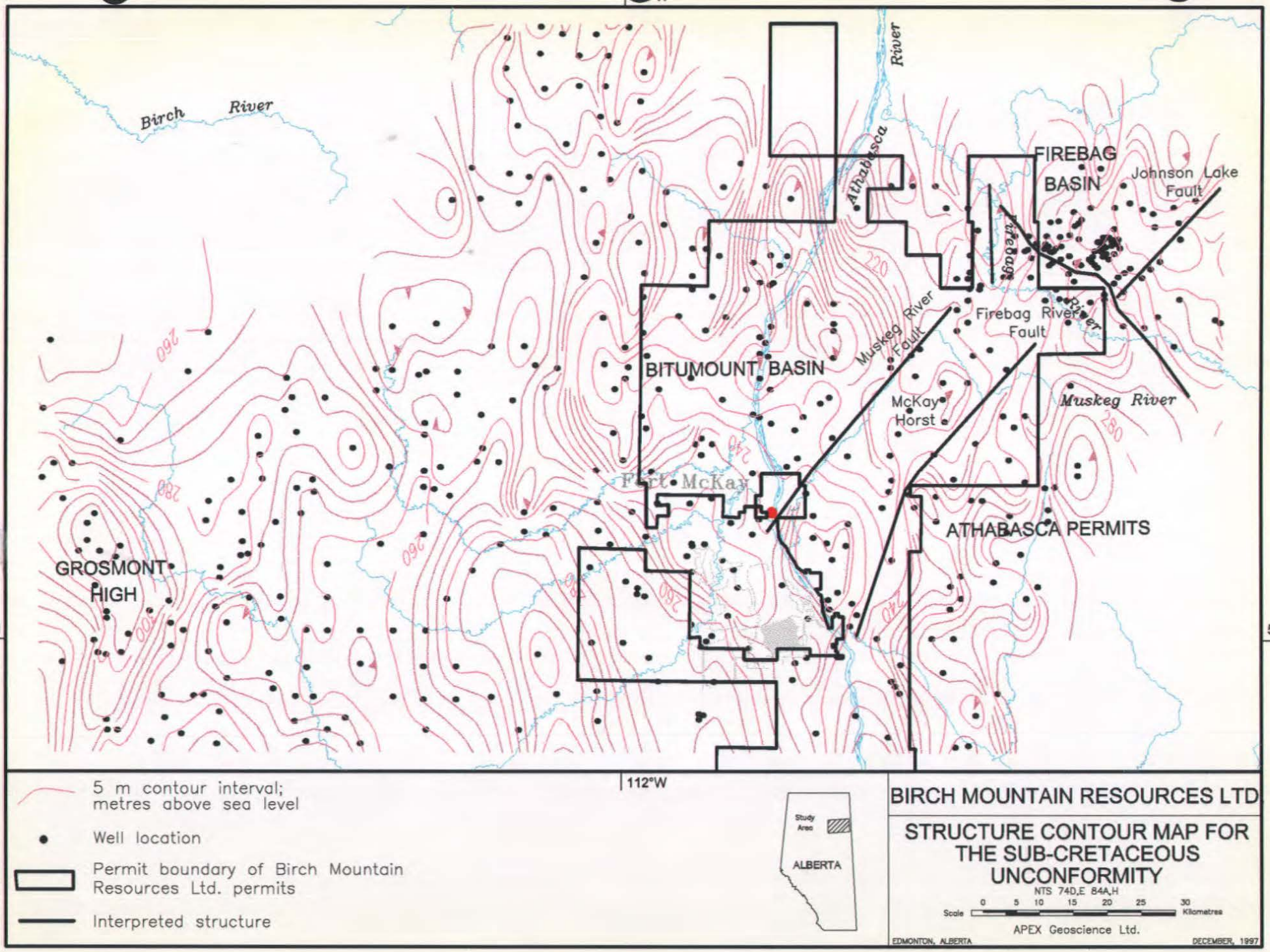

Birch River
Athabasca River
FIREBAG BASIN
Johnson Lake Fault
Firebag River
Firebag River Fault
Muskeg River Fault
BITUMOUNT BASIN
McKay Horst
Muskeg River
Fort McKay
ATHABASCA PERMITS
GROSMONT HIGH
57°N
112°W
5 m contour interval; metres above sea level
Well location
Permit boundary of Birch Mountain Resources Ltd. permits
Interpreted structure
Study Area
ALBERTA
BIRCH MOUNTAIN RESOURCES LTD.
STRUCTURE CONTOUR MAP FOR THE SUB-CRETACEOUS UNCONFORMITY
NTS 74D,E 84A,H
Scale 0 5 10 15 20 25 30 Kilometres
APEX Geoscience Ltd.
EDMONTON, ALBERTA
DECEMBER, 1997

Figure 3

such as the lowermost fluvial units. In addition, Stewart (1963) suggested that the McMurray and Clearwater formations are anomalously topographically high in the vicinity of Telegraph Creek (Tp 84, R 12W4) due to reactivation of an underlying Precambrian fault. Kidd (1951) presented evidence that movement took place during the Lower Cretaceous along a northwesterly trending fault that cuts across the Clearwater River east of Fort McMurray, and suggested that the western block was downthrown. Hume (1949) suggested that post-Cretaceous folding, possibly unrelated to salt dissolution, affected Lower Cretaceous units in the Mildred-Ruth Lakes area. Babcock and Sheldon (1976) documented the existence of many lineaments in the Bitumount map area. They suggested that the vast majority of these lineaments are related to the dominant trend of joints and fracture sets in the McMurray and Waterways Formation. However, they also stated that fault related lineaments cannot be ruled out.

PREVIOUS EXPLORATION

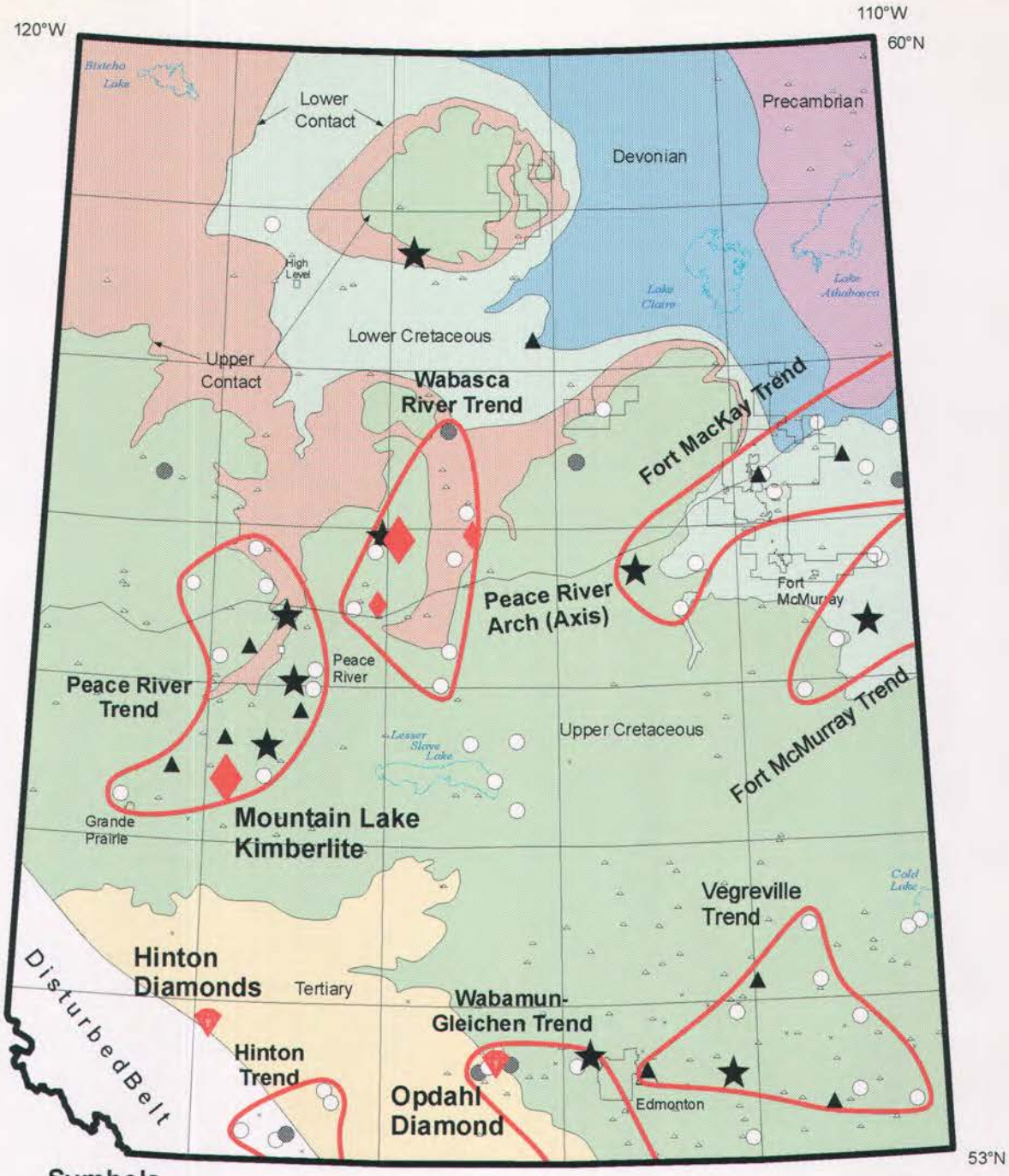
Precious and Base Metals

Previous metallic mineral exploration within the vicinity of BMRL's northern Alberta mineral permits has largely focused on two commodities: uranium and gold. Exploration for these metals was most active during the 1960's and 1970's, although there has been a recent resurgence in exploration for gold and base metals in the area. Dufresne *et al.* (1994) and Olson *et al.* (1994a) provided summaries of the history of metallic mineral exploration for the Bitumount map area (NTS 74E). Work by Feng and Abercrombie (1994), of the GSC, has documented the presence of anomalous gold in basement granitoids, and red bed sandstones and associated mudstones that immediately overlie the basement in the vicinity of Fort McKay. Feng and Abercrombie (1994) and Abercrombie and Feng (1997) reported that gold exists in native form as well as: Au+Si, Au+Ca, Au+Al, Au+Ag, Au+Cd and Au+salts compounds or alloys. Locally, these compounds are accompanied by Pt, other platinum group elements, and a variety of Ni and Al alloys (Abercrombie and Feng, 1997; Birch Mountain Resources Ltd., 1997). The presence of Pt in conjunction with the Ni and Al alloys could indirectly indicate the presence of local mantle derived kimberlites or other related deeply derived volcanic rocks in the area (Abercrombie and Feng, 1997; Ballantyne and Harris, 1997).

Diamonds

Caribou Mountains Permits

Birch Mountain Resources Ltd. has performed little or no diamond exploration on their Caribou Mountains permits. In addition, little diamond indicator mineral sampling has been conducted by the AGS in the Caribou Mountains area. What sampling has been conducted in the region has resulted in the discovery of several excellent indicator minerals at two sample sites (Figure 4), including a sample from glacial sediment about 70 km south of the permits (Dufresne *et al.*, 1996) and a second sample from creek sediment about



Symbols

- Reported Diamond occurrence
- Known Kimberlite occurrence
- Reported Kimberlite occurrence
- Sample site with multiple diamond indicator minerals of high quality chemistry; requires follow-up exploration.
- Sample site with one or more diamond indicator minerals of good to high quality chemistry; requires follow-up exploration.
- Sample site with one or more diamond indicator minerals of moderate to good quality; may require follow-up exploration.
- Sample site with one or more diamond indicator minerals of moderate quality; may require follow-up exploration.

BIRCH MOUNTAIN RESOURCES LTD.

REGIONAL DIAMOND INDICATOR ANOMALIES, NORTHERN ALBERTA

Scale 0 100 200 Kilometres

APEX Geoscience Ltd.

EDMONTON, ALBERTA DECEMBER, 1997

Figure 4

60 km west of the permits (Dufresne *et al.,* In Preparation). The site which is 70 km south of BMRL's Caribou Mountains permits and 40 km northwest of the Birch Mountains permits, yielded a chrome diopside and an eclogitic garnet, both with major element chemistry comparable to that of diamond inclusion varieties of these minerals (Dufresne *et al.*, 1996). The sample was collected from glacial outwash sediment along Harper Creek and could be derived from as far north as the Caribou Mountains, or from further east within Wood Buffalo National Park.

The second sample, which was collected from a site about 60 km west of the Caribou Mountains permits, was collected from recent river sediments along the Caribou River beside an outcrop of Peace River through to Lower Shaftesbury Formation sediments. The sample yielded a G9 pyropic garnet, three magnesium rich chromites and a Cr-Ti-Mg magnetite series spinel. One of the chromites yielded 57.76 weight per cent (wt%) Cr_2O_3 and borders the diamond inclusion field for chromites on a scatter plot of Cr_2O_3 versus MgO (Dufresne *et al.*, In Preparation). Pure Gold Minerals Ltd. (1997) recently performed follow-up sampling along the Caribou River and confirmed the presence of anomalous indicator minerals in the Caribou River drainage, including a peridotitic pyropic garnet, two possible eclogitic garnets and a possible chromite. Although the river sediments sampled are likely derived from bedrock and till well west of BMRL's permits, the results from this sample site demonstrate that the Caribou Mountains have potential for the discovery of kimberlites. In addition, it cannot be entirely ruled out that the source area for the indicator minerals in the Caribou River could exist as far east as BMRL's permits if the indicator minerals in the drainage are originally derived from till or pyroclastic material within bedrock. The indicator results to date, coupled with the favourable gravity signature underlying the Caribou Mountains indicates that moderate to high potential exists for the discovery of kimberlites in the Caribou Mountains.

Birch Mountains Permits

Birch Mountain Resources Ltd. has performed little or no diamond exploration on their Birch Mountains permits. In addition, little diamond indicator mineral sampling has been conducted by the AGS in the area of the permits. One till sample, which was collected by the AGS from Tp 102, R 22W4 from within BMRL's permits, yielded a high titanium kimberlitic chromite (Dufresne *et al.*, 1996). In addition, a sample that was collected by the AGS from glaciofluvial outwash sediment along Harper Creek about 40 km northwest of the Birch Mountains permits (Dufresne *et al.*, 1996), yielded a chrome diopside and an eclogitic garnet, both with major element chemistry comparable to that of diamond inclusion varieties of these minerals (Figure 4). The favourable indicator mineral results for these two samples demonstrates that potential exists for the discovery of kimberlites or related intrusions at least locally along the north slope of the Birch Mountains and perhaps within BMRL's mineral permits along the Birch River.

Athabasca Permits

Birch Mountain Resources Ltd. has performed little or no diamond exploration on their Athabasca mineral permits, with the exception of a fixed-wing airborne magnetic

geophysical survey conducted during early 1997. Reconnaissance diamond indicator mineral sampling has been conducted by the AGS in the region that resulted in the discovery of interesting indicator minerals at several sites. The AGS has collected a total of 36 till or sand and gravel samples for diamond indicator analysis in NTS map areas 74D, 74E, 84A and 84H, including: (a) 11 till samples from NTS 74D, (b) 19 samples (including 16 till samples and 3 recent river sand and gravel samples) from NTS 74E, (c) 4 till samples from NTS 84A, and (d) 2 till samples from NTS 84H (Figure 5). Approximately 17 of the 36 reconnaissance sample sites lie within or near BMRL's Athabasca mineral permits. Dufresne *et al.* (1996) suggested that at least 17 of the 36 samples that were collected in the region yielded indicator minerals of interest in 2 distinct trends, named the Fort McKay Trend and the Fort McMurray Trend. The Fort McKay Trend is centered over the northern half of BMRL's Athabasca mineral permits and the area over which BMRL conducted its airborne magnetic survey (Figure 5). Seven of the seventeen anomalous samples that yielded indicator minerals of interest in the region were collected from within or near BMRL's Athabasca mineral permits. One of these seven anomalous samples, which was collected from a site along the Athabasca River in the vicinity of Fort McKay, yielded two high quality indicator minerals including a picroilmenite and an eclogitic garnet (Figure 5). In addition, two of the seven anomalous samples, including one sample site along the Clearwater River and another sample site along the Firebag River, yielded a chrome diopside and one or more eclogitic garnets with at least one of the indicator minerals in each sample being of high to moderate quality chemistry (Figure 5). Other more distant sample sites, but in a direction considered to be down-ice of the BMRL permits, have yielded important indicator minerals such as kimberlitic chromites, a pyropic garnet, eclogitic garnets, chrome diopsides and a picroilmenite (Figure 5). At present, a typical glacial dispersion pattern has not been documented for any known Alberta kimberlites. However, based upon work conducted to date by Fenton and Pawlowicz (*pers comm.*, 1997), it is probable that many kimberlite or related intrusions in northern Alberta may yield narrow (less than 1 km in width), linear dispersal patterns that could range from a few kilometres to tens of kilometres in length. In addition, in areas where the local till cover is relatively thin, significant volumetric increases in the number of number of indicator minerals recovered from the till can be expected in close proximity to or even immediately overlying the kimberlite or related intrusion. This has been illustrated at Mountain Lake and in the Buffalo Head Hills (Fenton and Pawlowicz, *pers comm.*, 1997).

In summary, preliminary wide-spaced till and stream sediment sampling by the AGS from within and in a down-ice direction of BMRL's Athabasca mineral permits has yielded important diamond indicator minerals including chromites, picroilmenites, chrome diopsides, pyropic garnets and eclogitic garnets. Several of the recovered diamond indicator minerals may have been derived from within the diamond stability field and could be locally derived from intrusions within or near BMRL's permits. Sampling is not currently of high enough density to evaluate whether any of the indicator minerals recovered to date could be related to potential intrusions defined by BMRL's 1997 airborne magnetic survey.

Review of the 1997 Airborne Geophysical Survey Results

A recent high resolution fixed-wing airborne magnetic survey conducted on the Athabasca permits (World Geoscience Ltd., 1997; Peirce, In Preparation) on behalf of BMRL indicates the presence of many strong linear northwest and northeast trending basement structures that have likely been reactivated during periodic reactivation of the PRA. The presence of these arch related structures is thought to be favourable for the emplacement of kimberlites. In addition, work to date indicates that BMRL's Athabasca permits are roughly centered over the axis of the PRA, which is a comparable structural setting to Ashton's kimberlite field in the Buffalo Head Hills (Figures 2 and 4).

Seventy five magnetic anomalies were selected from a low band pass filter of the second vertical derivative of the total magnetic field (Peirce, In Preparation) in order to compare the magnetic signature of anomalies on or near the BMRL permits to the known magnetic signature of near surface kimberlite in Alberta. For all 75 magnetic anomalies, profiles of the total magnetic field, the diurnal magnetic variation, magnetic noise, topography and removed culture were reviewed by Mr. M. Dufresne and either Dr. M. Best or Dr. J. Peirce, geophysicists with Geophysical Exploration and Development Corp. (GEDCO), in order to evaluate each of the magnetic anomalies. At least 18 magnetic anomalies displayed a magnetic profile that could be indicative of near surface intrusive pipes (Table 3). Eight of the eighteen magnetic anomalies were classified as either medium or high priority near surface magnetic anomalies that require follow-up exploration for kimberlites or related intrusions (Table 3). These magnetic anomalies appear to stand out better on a map of the first vertical derivative of the total magnetic field rather than the band pass filtered map (Peirce, In Preparation). Most of the 18 magnetic anomalies that display magnetic characteristics that could be indicative of kimberlites, exist in 5 distinct clusters, with the most important cluster located in the north-central to northeastern portion of the magnetically surveyed area in the vicinity of the Firebag River in Tps 97 to 99 and Rs 7 to 9 (Figure 5). Two high priority and three medium priority magnetic anomalies exist in the Firebag cluster. The two high priority magnetic anomalies, numbers 14 and 29, appear as sharp well defined peaks of 17 and 6 nT magnitude, respectively, based on the total field magnetic profiles (Figures 6 and 7). Each of the two anomalies appear to have a source that is close to surface with magnetic anomaly 14 displaying a weak dipole effect (Figure 8). Magnetic anomaly 14 yields an estimated width of about 700 m, whereas anomaly 29 yields an estimated width of about 200 m. Each of these anomalies should be further investigated, along with other magnetic anomalies of similar magnitude in the vicinity of these magnetic anomalies that were not reviewed as part of this evaluation. These two high priority magnetic anomalies and the other six medium or high priority anomalies have total field magnetic characteristics that are similar in character to the magnetic signature for the Mountain Lake Kimberlite northeast of Grande Prairie (Leckie *et al.*, 1997) and other kimberlite or associated intrusive rocks in the Western Canada Sedimentary Basin of Alberta and Saskatchewan.

TABLE 3
GEOPHYSICAL ANOMALIES ON THE ATHABASCA PERMITS THAT REQUIRE FOLLOW-UP EXPLORATION

Anomaly #	Profile Line	Fiducial	Description	Priority Rank
5	12000	6697	Shallow, near surface magnetic anomaly, deep component present; roughly 10-15 nT, hill present; could be basement anomaly	Low
6	71070	8855	Slight deflection on E-W profile and well defined on N-S profile; appears to be a shallow anomaly, but the 20-30 nT anomaly could be related to basement; exists adjacent to prominent northwest structure	Med
10	11440	4754	Poorly developed broad shoulder; however, near surface 5 nT (?) anomaly at edge of large lake; visible bulge in total field map	Med
14	11690	1160	Sharp well defined 17 nT anomaly about 30 m below surface at edge of creek valley, about 700 m diameter; associated dipole effect	High
15	11620	8090	Poorly defined 8 nT shoulder with a diameter of about 1000 m; exists near #14 and has associated dipole effect (weaker than that of #14)	Low
16	71310	15818	Well defined 20 nT anomaly that sources from about 200 m depth and is about 670 m wide; weak dipole effect but centered in strong basement high, near or within a structure	Med
27	11270	1965	Shoulder anomaly of about 5 nT on broad basement related anomaly; likely source about 30 m below surface; situated in large basement mag high	Low
29	11960	2330	Sharp well defined 6 nT anomaly that is at or near surface and about 200 m wide; exists in proximity to a prominent northwest structure and other potential anomalies that were not reviewed	High
37	11180	8185	Sharp 20 nT peak on N-S line but barely noticeable on E-W line 70790; roughly 200 m deep and about 525 m wide, but could be basement	Low
38	11310	5740	Anomalies 38 and 39 are an interesting pair of shallow magnetic features; Anomaly 38 is about 10 nT and 60-70 m below surface; could be part of basement complex	Low
39	11310	5755	About 16 nT peak that results from source about 40-50 m below surface	Low
42	70800	2314	Well defined shoulder anomaly of about 2-3 nT that is roughly 330 m wide and at surface; at junction of N-S and NE trending structures	Med

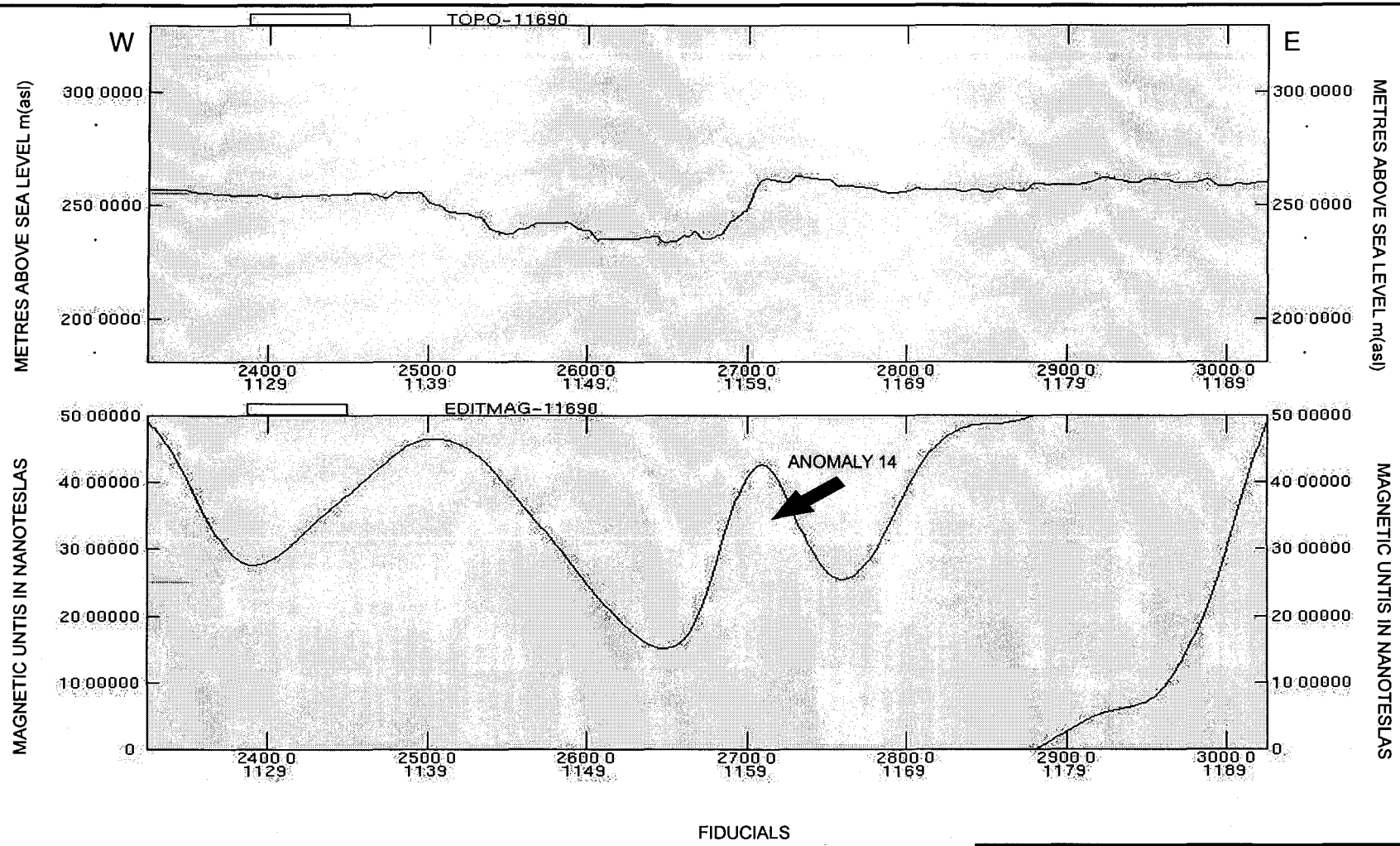
Anomaly #	Profile Line	Fiducial	Description	Priority Rank
46	10140	11607	Well defined 20 nT anomaly that is from a source 100 m below surface and about 800 m wide; could be basement	Low
47	10390	3844	Sharp well defined shoulder anomaly of about 5 nT on magnetic high; roughly sourced from about 60 m below surface and is 700 m wide; possible weak dipole effect	High
55	10510	9438	Shoulder anomaly of about 2 nT underlying a creek; source is near surface and about 200 m wide	Low
57	10380	2182	Well defined peak or shoulder anomaly of about 7-8 nT; sourced from near surface and is roughly 400 m wide	High
61	71220	7815	A 15 nT magnetic low that is roughly sourced from 40 m below surface and is about 700 m wide	Low
70	10580	2590	Weak, poorly defined 2-3 nT shoulder about 30m below surface and about 500 m wide	Low

Other potentially important clusters of magnetic anomalies exist in the vicinity of the Pierre River (Tps 97 and 98, Rs 10 and 11W4), southeast of Syncrude's Aurora minesite (Tp 95, R 10W4) and along the Ells River (Tps 94 and 95, R 12W4) west of Syncrude's Basemine property (Figure 5). Many other unevaluated magnetic anomalies that are similar in magnitude and appearance to the 8 medium to high priority magnetic anomalies listed in Table 3, exist on the map of the first vertical derivative of the total magnetic field (Peirce, In Preparation) or on the Pseudo Depth Slice 1 map provided by World Geoscience Ltd. (1997), particularly in the vicinity of the Firebag cluster. These magnetic anomalies should be further evaluated in order to determine if they have a magnetic profile that could indicate the presence of near surface kimberlite pipes.

DISCUSSION OF DIAMOND POTENTIAL

Ages of Kimberlitic Volcanism in and Adjacent to Alberta

The age of potential kimberlitic volcanism in Alberta is considered to be relevant to all of BMRL's mineral permits as the age may have a bearing on the style of volcanism and, therefore, different preservation potential for different ages and styles of pipes. In addition, the age and style of kimberlitic volcanism may even affect the diamond content. As an example, Early Tertiary kimberlite pipes of the Lac de Gras region are typically small, carrot shaped pipes that can be highly diamondiferous, in comparison to the Fort à la Corne and Mountain Lake pipes, which are poorly diamondiferous and are lenticular stratabound pyroclastic deposits.



BIRCH MOUNTAIN RESOURCES LTD.

ATHABASCA PERMITS

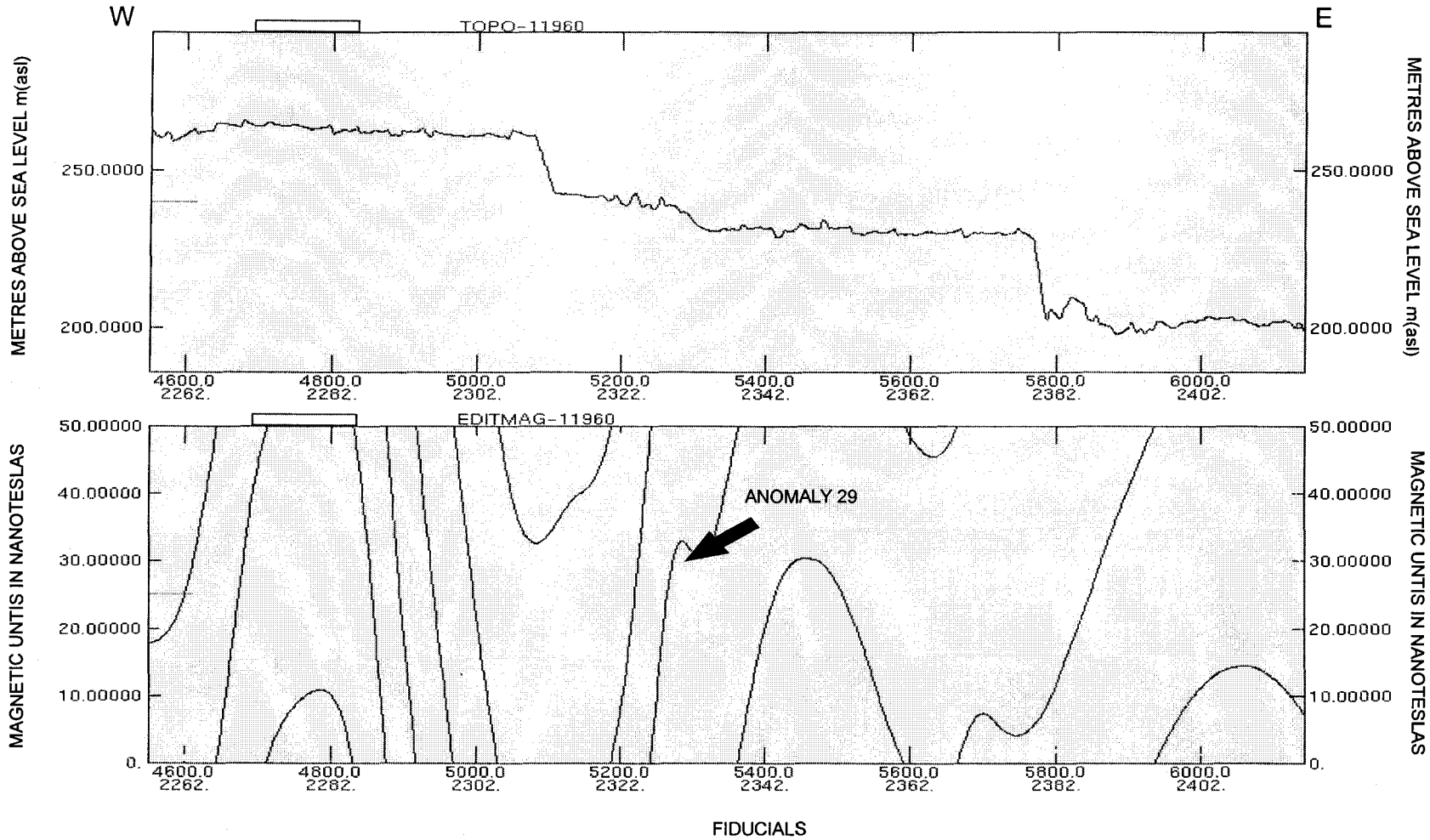
MAGNETIC ANOMALY 14 TOPOGRAPHIC AND TOTAL FIELD MAGNETIC PROFILES

NTS 74E

APEX Geoscience Ltd.

EDMONTON, ALBERTA DECEMBER, 1997

Figure 6



BIRCH MOUNTAIN RESOURCES LTD.

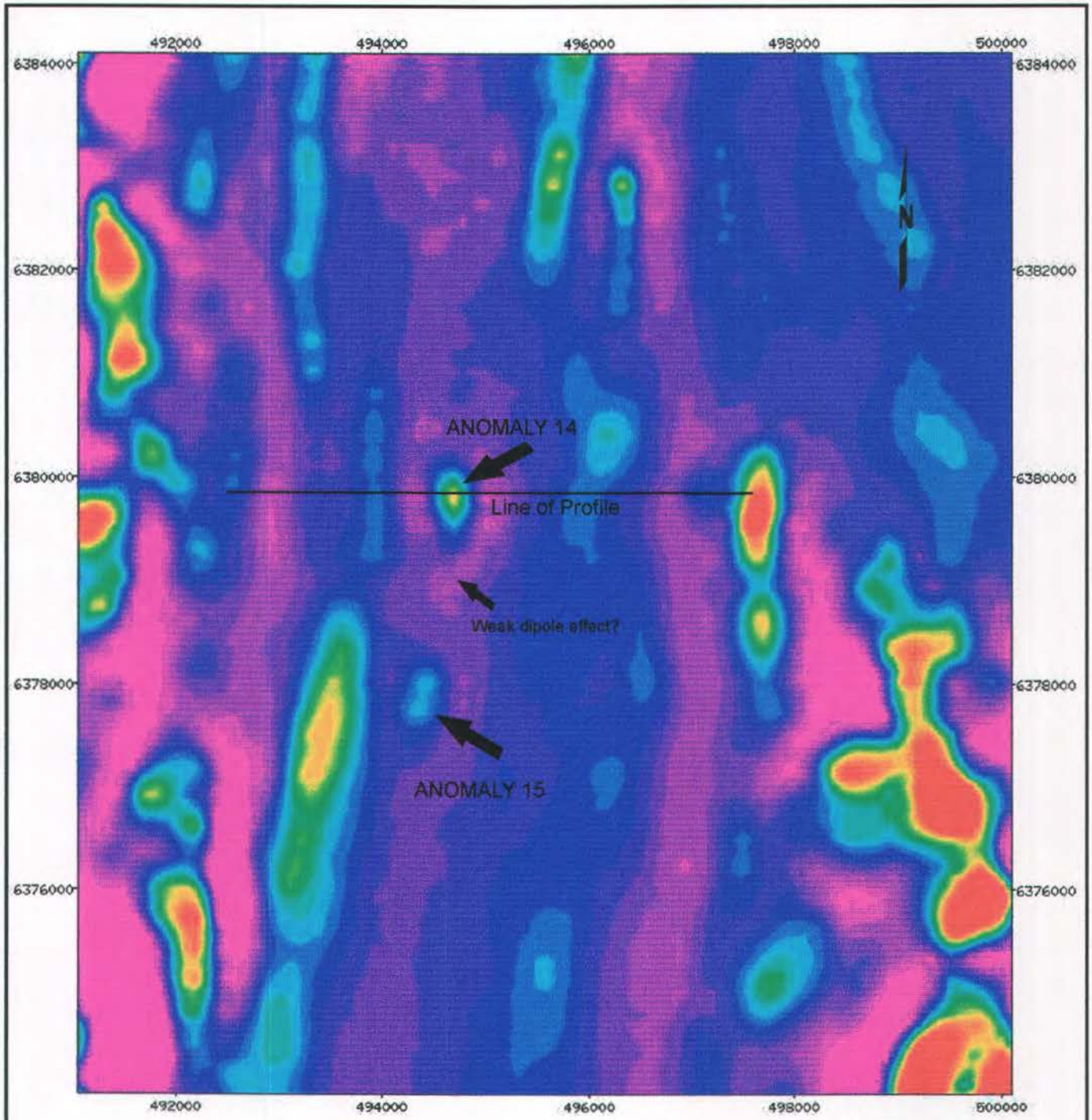
ATHABASCA PERMITS

MAGNETIC ANOMALY 29 TOPOGRAPHIC AND TOTAL FIELD MAGNETIC PROFILES

APEX Geoscience Ltd.

EDMONTON, ALBERTA DECEMBER, 1997

Figure 7



Scale

(Units in nanoteslas (nt))

BIRCH MOUNTAIN RESOURCES LTD.

ATHABASCA PERMITS

RESIDUAL OF UPWARDS CONTINUED TOTAL FIELD MAGNETICS LESS TOTAL FIELD MAGNETICS, ANOMALIES 14 AND 15

NTS 74E

Scale 0 1 2 3 Km

APEX Geoscience Ltd.

EDMONTON, ALBERTA DECEMBER, 1997

Figure 8

In Alberta, evidence exists for four and possibly five ages of alkaline volcanic activity. Table 4 shows the temporal relationship between Alberta volcanic events, Canadian occurrences of kimberlites and related intrusions, and selected kimberlites and related intrusions from around the world. The oldest Alberta volcanics have been dated between 1,100 and 1,580 Ma and are represented by the dioritic Moyie Sills and andesitic Purcell Lavas, which are restricted to the Clark Range in southwestern Alberta. Neither of these is related to any known kimberlite or related intrusions in Alberta or elsewhere in western or northern Canada. The next oldest volcanics in Alberta consist of a series of Upper Devonian to Lower Mississippian alkaline mafic to ultramafic diatremes that straddle the Alberta-B.C. border in southeastern B.C. and southwestern Alberta. Outside of the Rocky Mountains, no pipes have been discovered in Alberta or Saskatchewan of this age, with the possible exception of diatreme material associated with the Elbow Diatreme in southern Saskatchewan. Proterozoic or Paleozoic kimberlitic intrusions are likely not to be an important factor on any of BMRL's permit areas due to the limited extent of known kimberlites associated with this volcanic event across western and northern Canada, and the fact that if pipes of this age were even formed in any of BMRL's permit areas they would likely have been eroded or would be deeply buried at present.

In short, any important kimberlites that have been or will be discovered in northeast Alberta will likely be associated with the third major period of volcanism that is evident in Alberta and Saskatchewan from Aptian to Turonian age, approximately from 119 Ma to 89 Ma. This period encompasses the depositional span of the McMurray Formation through to the overlying Second White Specks Formation, which essentially includes all exposed Cretaceous sedimentary units in the Bitumount map area (NTS 74E), and those likely to be exposed underlying BMRL's Caribou Mountains and Birch Mountains permits (Olson *et al.*, 1994a; Dufresne *et al.*, 1995). Kimberlitic volcanism has been noted in several areas of western and northern North America during this period including Kansas, Saskatchewan and the Northwest Territories. Although the main kimberlitic event appears to be from 101 Ma to 94 Ma in the Fort à la Corne area of Saskatchewan (Lehnert-Thiel *et al.*, 1992; Scott Smith *et al.*, 1994; Kjarsgaard, 1995; Kjarsgaard *et al.*, 1995; Kjarsgaard, 1996), several intrusions have been dated as old as 119 Ma and have been described as conformable pyroclastic horizons within Lower Mannville Group sediments that are equivalent in age to McMurray Formation sediments in the Fort McKay to Fort McMurray area (Jellicoe *pers comm.*, 1997). Local volcanism in northern Alberta during this period may be evidenced by extensive and locally variable bentonite horizons that are preserved in such units as the Viking Formation (Tizzard and Lerbekmo, 1975), the Shaftesbury Formation and the Second White Specks Formation (Bloch *et al.*, 1993; Dufresne *et al.*, In Preparation). Locally, some of these bentonites, such as those within the Shaftesbury Formation near Peace River, have been identified as kimberlitic on the basis of geochemistry (Dufresne *et al.*, In Preparation). If pipes of this age are discovered on or near BMRL's mineral permits they are likely to be of significant size, with pyroclastic aprons and crater facies material potentially preserved. Any pipes related to this volcanic event found on BMRL's permits would likely be either wholly or partially preserved based upon the age of the local sediments underlying each of the three permit areas.

TABLE 4. AGES OF KIMBERLITE AND LAMPROITE INTRUSIONS

PERIOD	Series	Stage	Kimberlites World Wide	Lamproites World Wide	Kimberlites North America	Lamproites & Ultramafic Lamprophyres North America	Alberta Volcanic Events
QUATERNARY		Holocene 0.01		Gaussberg, ANT (Recent)			
		Pleistocene 1.6				Leucite Hills, WY (1-2)	
TERTIARY		Pliocene 6		Mercia & Almeira, SP (6-8)			
		Miocene 24		Kef Hahouner, AG (9-11) **Noonkanbah (18-20) & Ellendale (20-25), AL**	Buell Park, AZ & Green Knobs, NM(25)	Navajo Volcanic Field, UT & AZ (UML's 20-30)	
		Oligocene 37			Mule Ear & Moses Rock, UT (28-30)	Smoky Butte, MT (27)	
		Eocene 58	Mwadui, TZ (41) Nzega, TZ (51-54)		Williams Ranch, MT (47-52) Lac de Gras, NT (52)	Karnes & Moon Canyon, UT (40) Bearpaw Mountains, MT (50-54)	Sweetgrass Intrusions (48)
		Paleocene 66	Mukorob, NB (61), Deutsche Erde, NB (66)				Kneehills Tuff (66)
CRETACEOUS	Upper	Maastrichtian 75	Mbujil-Mayi, ZA (71)		Lac de Gras, NT (74)		Belly River Bentonites (75) **Mountain Lake (75)**
		Campanian 84	M1, BT (77), Bultfontein, SA (78-84), Outoitspan, SA (84)		Ison Creek, Elliot Co., KY (80)		
		Santonian 86	Jagersfontein, SA (86)		Somerset Island, NT (88-105)	Rose & Hills Pond, KN (88-91)	
		Coniacian 89					Buffalo Head Hills (85-90?)
		Turonian 91	DeBeers, SA (90), Wesselton, SA (90) Koffiefontein, SA (90), Monastery, SA (90)				
		Cenomanian 98	Koidu, SL (92), Orapa, BT (93), Finsch, SA (94), Kimberly Pool, SA (95)		Fort a la Corne, SK (94-101)		Crowsnest Volcanics (96)
	Lower	Albian 113	Uintjes Berg, SA (100)		Somerset Island, NT (99) Riley County, KN (110-120)	Prairie Creek, AK (106)	Viking Bentonites (100)
		Aptian 119	**Newlands (114), Frank Smith (114), Mayeng (117) all SA**				
		Barremian 124	**Bellsbank (119), Finsch (119), Star (124) al**	Lomam, CIS (119-124)	Syracuse, NY (121-128)		
		Hauterivian 131	New Elands, SA (126) **Roberts Victor, SA (128)**			Ile Bizard, QU (UML 126)	
		Valanginian 138	Obnazhennaya, CIS (135-143)	Murun (132-138), Kayla (133) & Ryabinovaya (137-142) all CIS			
		Berriasian 144		Yakokut, CIS (142-147)	Ithaca, NY (139-146)		
JURASSIC	Upper		**Swartruggens, SA (156), Mzongwana, SA (152)** Slyudyanka (147), Irina (149), Muza & Tokur (151), Marichka (156), Khrizolitovaya (159) all CIS		**Kirkland Lake, ON (155)**	Hearst, ON (UML 152)	
	Middle		**Klipfontein, SA (159), Wandagee, AL (160), Orroroo, AL (170)** Elandskloof, SA (165-176),				
	Lower	208	Pyramidefjeld, GL (193) **Dokolwayo, SZ (204)**		**Lake Ellen, MC (190)**	Hearst, ON (UML 180)	
TRIASSIC	Upper		Pozdnyaya, CIS (217), Nigerdlikasik, GL (220	**Kapamba, ZM (220?)**			
	Middle						

TABLE 4 - CONTINUED

PERIOD	Series	Stage	Kimberlites World Wide	Lamproites World Wide	Kimberlites North America	Lamproites & Ultramafic Lamprophyres North America	Alberta Volcanic Events
TRIASSIC	Lower	245	**Jwaneng, BT (235)**		Crossing Creek, BC (244)		
PERMIAN	Upper						
	Lower	286					
PENNSYLVANIAN	Upper	295		Pendennis Point, UK (280-320?)			
	Middle	310					
	Lower	320					
MISSISSIPPIAN	Upper		Sytykanskaya, CIS (344) Rassvet (344), Svetlaya (344) & Kolskovnaya (347) all CIS			Ospika River, BC (UML 323-334)	
	Lower	360	Festivalnaya, CIS (358) Internationalnaya, CIS (360)		Sloan, CO (350)	HP Pipe, BC (UML 349-396)	
DEVONIAN	Upper	Famennian 367	Mir, CIS (361), Fuxian, CH (366-398) Iskorka, CIS (363)				Exshaw tuffs
		Frasnian 374	Zagadochnaya, CIS (370), Svetlaya, CIS (372)			Elbow Diatreme, SK (Comp. unknown)	
	Middle	Givetian 380			Avon, MI (377-399)		
		Eifelian 387					
	Lower	Emsian 401			**Kelsey Lake, CO (390)**		
		Siegenian	Tayezhnaya, CIS (403)				
		Gedinnian 408					
SILURIAN		438	Druhza, CIS (412)	Mt. Bayliss, ANT (413-430)		**Mountain Diatreme, NT (UML? 427-445)** Russell Peak, BC (UML 435-440)	
ORDOVICIAN	Upper		Amakinskaya, CIS (450), Muna Field, CIS (450)		**Cross Lake, NT (450)**		
	Middle						
	Lower	505	**Shengli, CH (482-498)**				
CAMBRIAN	Upper	515					
	Middle	540					
	Lower	570					
PROTEROZOIC	Upper	Hadrynian 955	**Venetia, SA (600)** Holsteinsborg (587), Umivit (589) & Sarfartoq (593-598) all GL Skerring, AL (810), Pteropus Ck, AL (810), Lattavaram, IN (940-1023)		**George Creek, CO (600)**		
	Middle	Helikian 1,735	**Majhgawan, IN (1,056-1,140)** **Premier, SA (1,202)** Zero (1,635), Elston (1,674) & Bathlaros (1,64 SA	**Argyle, AL (1,178), Bobi, IC (1,400** Yinniugou, CH (1,100-1,200), Chelima, IN (1,200) Holsteinborg, GL (1,214-1,227)	**Kyle Lake, ON (1,140)**		Purcell Lavas (1,100) Moyie dykes (1,400-1,580)
	Lower	Aphebian 2,480				**Outlet Bay & Parker Lake, NT** Christopher Island Fm, NT (1,840)	

AG=Algeria, AK=Arkansas, AL=Australia, ANT=Antarctica, AZ=Arizona, BC=British Columbia, BT=Botswana, CH=China, CIS=Former USSR, CO=Colorado, GL=Greenland, IC=Ivory Coast, IN=India
KY=Kentucky, MC=Michigan, MI=Missouri, MT=Montana, NB=Namibia, NM=NewMexico, NT=NorthwestTerritories, NY=NewYork, ON=Ontario, QU=Quebec, SA=SouthAfrica, SK=Saskatchewan, SP=Spain
SZ=Swaziland, TZ=Tanzania, UK=England, UT=Utah, WY=Wyoming, ZA=Zaire, ZM=Zambia
BOLD=Diamondiferous, HIGHLIGHTED INTERVAL=most prospective age interval to discover DIAMONDIFEROUS intrusions in Alberta

Although no ages have been reported to date for the Buffalo Head Hills kimberlites, based upon the location of the pipes and the existing local geology, it is quite likely that they will range from a maximum of Middle Cenomanian (95 Ma) to a minimum of Middle Santonian (86 Ma). This is based upon the fact that pyroclastic aprons as well as deeply developed weathering profiles have been reported for the Buffalo Head Hills pipes (Hillier *pers comm.*, 1997), indicating that they are likely penecontemporaneous with the enclosing sediments. In addition, the well developed weathering profiles may indicate that some of the pipes were exposed during uplift of the PRA, which based upon missing stratigraphic units in the nearby Birch Mountains (Dufresne *et al.*, In Preparation), occurred some time between Early Turonian (91 Ma) and Early Campanian (84 Ma). Pipes in the Fort McKay to Fort McMurray area which are equivalent in age to the Buffalo Head Hills kimberlites could be somewhat smaller targets as the pyroclastic aprons and potentially significant portions of the crater facies material would likely have been removed during recent erosion. However, Ashton has indicated that the Buffalo Head Hills kimberlites are dominantly comprised of the more traditional carrot shaped pipe. Therefore, there is a strong possibility that age equivalent pipes, if found within BMRL's Athabasca permits, could have significant portions of the pipes preserved. In addition, the potential for preservation of pipes on BMRL's Caribou Mountains and Birch Mountains permits that are age equivalent to the Buffalo Head Hills kimberlites is high. This is an important factor in that the Buffalo Head Hills kimberlites have produced the most exciting results for diamonds in the Western Canada Sedimentary Basin to date.

The fourth generation of potentially important alkaline volcanic activity in Alberta is represented by Monopros' Mountain Lake Kimberlite northeast of Grande Prairie (Leckie *et al.*, 1997), which is hosted in Wapiti Group sediments. The Mountain Lake Kimberlite is about 75 Ma old, and is roughly age equivalent to Late Cretaceous Bentonites in the Belly River Formation. Similar to the Fort à la Corne kimberlites, the Mountain Lake Kimberlite is poorly diamondiferous, appears to be dominantly comprised of a conformable succession of pyroclastics within Wapiti Group sediments and may in fact be lenticular in shape as opposed to a traditional carrot shaped pipe. The implication of this is that pipes of this age and style of volcanism are likely not to have been preserved in BMRL's Athabasca permits, the Caribou Mountains permits or the Birch Mountains permits due to the current level of erosion, particularly for the stratabound lenticular shaped variety of kimberlite as exhibited by the Fort à la Corne and Mountain Lake kimberlites.

Tertiary intrusions in the vicinity of the Sweetgrass Arch of southern Alberta represent the youngest generation of known alkaline volcanic activity in Alberta (Williams and Dyer, 1930; Russel and Landes, 1940; Irish 1971). The Sweetgrass intrusions are potassic in composition and were dated at 49 to 54 Ma by Baadsgard *et. al.* (1961), Taylor *et al.* (1964), Folinsbee *et. al.* (1965), Kjarsgaard (1994a,b) and Kjarsgaard and Davis (1994). Kjarsgaard (1994a) suggested that these intrusions are predominantly minettes and have low diamond potential due to their overall geochemistry and contained indicator minerals. Although the intrusions found to date in southern Alberta have low diamond potential, the highly diamondiferous Lac de Gras kimberlites of the Northwest Territories are predominantly Early Tertiary in age, therefore the potential for kimberlites of this age

should not be ignored. However, as with any Wapiti aged kimberlites, the chance for preservation of these pipes in the Fort McKay to Fort McMurray region is low.

Buffalo Head Hills Kimberlites and their Relevance to BMRL's Permits

To date, Ashton has reported the discovery of 17 kimberlite pipes in the Buffalo Head Hills area in the northwest quarter of NTS 84B (Ashton Mining of Canada Inc., 1997a to l). Ashton has also reported that a total of 13 of the 17 pipes are diamondiferous with 7 pipes yielding initial diamond counts encouraging enough to warrant mini-bulk sampling of each of the 7 kimberlites. Diamond evaluation for all of the pipes is in the very early stages of exploration, however, Ashton has reported that the K14 pipe has yielded an average grade of 36 carats per 100 tonnes for an 8 tonne sample collected by drilling (Ashton Mining of Canada Inc., 1997k). The Buffalo Head Hills kimberlite field is roughly centered over the following: (a) the axis of the PRA, (b) one of the largest residual gravity lows in Alberta, (c) an area of highly thickened crust based upon seismic refraction data, and (d) the magnetically high Buffalo Head craton, an interpreted Proterozoic accreted terrane (Dufresne *et al.*, 1996). The pipes are in an area of basement structural complexity that is reflected in the Phanerozoic sediments and by the number of surrounding oil and gas fields. The kimberlite pipes display characteristics such as stratigraphically conformable pyroclastic aprons and deep paleo-weathering profiles that indicate the pipes are roughly coeval with the sedimentary units that they are enclosed by. Therefore, based upon the local geology, the Buffalo Head Hills kimberlites are estimated to be anywhere from Middle Cenomanian (95 Ma) to Middle Santonian (86 Ma) in age. Preliminary and very limited diamond indicator sampling in the region by the AGS has resulted in the recovery of few G10 pyropic garnets or diamond inclusion chromites. The Wabasca Trend of diamond indicator minerals is characterized by G1, G2 kimberlitic garnets, chrome diopsides, G9, G11 and G12 pyropic garnets, rare kimberlitic chromites and rare picroilmenites. The diamond potential of the Buffalo Head Hills kimberlites may be related to the quantity and quality of eclogitic indicator minerals such as G3, G5 and G6 eclogitic garnets, and high Na and Al omphacitic pyroxenes in conjunction with the typical kimberlite assemblage of indicator minerals. To date, Ashton has reported the presence of olivine dominated tuffaceous volcanic kimberlite with crater and diatreme facies, and indicator minerals such as peridotitic pyropic garnets (including G10's), diamond inclusion chromites and eclogitic garnets (Ashton Mining of Canada Inc., 1997a,b)

Little is known about BMRL's Caribou Mountains and Birch Mountains permits. However, both properties display some of the positive regional settings that characterize Ashton's Buffalo Head Hills kimberlite field. The Caribou Mountains permits, although somewhat distant from the PRA, are underlain by or are in close proximity to a strong gravity low, as well as being at least partially underlain by the Buffalo Head craton. In addition, although little diamond indicator sampling has been conducted on the permits to date, important diamond indicator minerals that could indicate the presence of kimberlites in the Caribou Mountains have been recovered in the region.

Although little detailed information exists for the Birch Mountains permits, the permits are less than 145 km northeast of the Buffalo Head Hills kimberlite field. As well, the Birch Mountains permits are underlain by the edge of the Buffalo Head craton and the

edge of the same gravity low that underlies the Buffalo Head Hills kimberlite field. In addition, a kimberlitic chromite, which could indicate the presence of kimberlitic intrusions along the north slope of the Birch Mountains, has been recovered from stream sediments within the permit area.

Similar to the structural setting of Ashton's Buffalo Head Hills kimberlite field, the Athabasca permits are situated over the crest or axial trace of the PRA. Periodic activity of the PRA and structures associated with the arch are likely responsible for the emplacement of kimberlites, therefore, the potential for emplacement of kimberlites in the Fort McKay to Fort McMurray region is considered high to at least moderate. This conclusion is supported by indicator minerals recovered to date in the region. Most of the permitted area is underlain by magnetically high basement of the Proterozoic TMZ, with a small portion of the permits underlain by magnetically low basement of the Archean Rae Sub-province. Ancient magmatic zones are generally thought to be poor targets for diamond exploration because they indicate hot, thinned crust and, therefore, the likelihood for formation or preservation of diamonds in the upper mantle is considered low. However, the magnetic signature of the TMZ is comparable to large portions of the BHT, which underlies the area of Ashton's recent kimberlite discovery. In addition, although there is a strong possibility that any Archean or Early Proterozoic diamonds in the upper mantle were likely destroyed during the high heat flow period associated with development of the TMZ during the Middle Proterozoic, diamonds could have been formed and preserved in the upper mantle from Late Proterozoic until recent. Alternatively, the TMZ could represent a relatively thin crustal slice that has been transported from west to east and thrusted over top of the Archean basement of the Rae Sub-province as has been documented for several Proterozoic terranes in Saskatchewan. The eastern portion of BMRL's Athabasca permits, which is directly underlain by the Archean Rae Sub-province and the axial trace of the PRA, is considered prospective for the formation and preservation of diamonds in the upper mantle.

The Athabasca permits are underlain mostly by a weak gravity high, which is thought to be indicative of thinner crust than in areas of gravity lows, such as the low that underlies the Buffalo Head Hills. Areas of thin crust are not considered favourable for the formation and preservation of diamonds in the upper mantle. However, seismic refraction data indicate that much of the area underlying the PRA, including the Fort McKay to Fort McMurray region, is underlain by thick continental crust estimated to be between 35 and 45 km thick (Dufresne *et al.*, 1996). In addition, the relationship between current gravity and seismic refraction data, and crust thickness and the diamond stability field at the time of emplacement of any intrusions in the vicinity of the Athabasca permits is highly speculative at present.

Potential for Discovery of Kimberlites on BMRL's Permits and Level of Risk

The potential for discovery of an economic diamondiferous kimberlite on any of BMRL's mineral permits is low based upon world statistics for the discovery of economic kimberlites. However, the levels of risk can be reduced through systematic, well-planned cost-efficient staged exploration.

Once a kimberlite field is discovered, the risk for finding an economic diamondiferous pipe can be significantly lowered. As an example, the Lac de Gras kimberlite field in the Northwest Territories, which is comprised of about 200 kimberlite pipes, is ovoid in shape and is about 65 km wide and 170 km long. Approximately half of the pipes are diamondiferous and it is likely that diamonds will be produced from between 10 to 20 pipes over time. Exploration within the Lac de Gras kimberlite field has been highly successful since the initial pipes were discovered in 1991. The Caribou Mountains and Birch Mountains permits are 200 and 145 km northeast, respectively, of the current discovery area for Ashton's Buffalo Head Hills kimberlites, hence, based upon a comparison to the size of the Lac de Gras kimberlite field, the likelihood of any kimberlites from the Buffalo Head Hills field existing on BMRL's permits is remote. Therefore, any kimberlites found on BMRL's mineral permits will likely belong to a separate kimberlite field. On a positive note, the regional geological and tectonic setting for both permit areas is very favourable for the formation and preservation of diamonds in the upper mantle beneath these areas. As well, the presence of favourable indicator minerals, in particular, kimberlitic chromites detected in government surveys in the vicinity of the Caribou Mountains permits and on the Birch Mountains permits, is important and indicates that follow-up exploration should be performed. At present, the level of risk for the exploration and discovery of diamondiferous kimberlites on either the Caribou Mountains or Birch Mountains permits is very high because: (a) kimberlites have not been discovered on the permits to date, (b) the permits are too distant from the Buffalo Head Hills to yield pipes belonging to Ashton's kimberlite field, and (c) little or no exploration has been performed to date in order to minimize the risk of further exploration.

The regional geological and tectonic setting for the Athabasca mineral permits displays both similarities and some differences to the setting for Ashton's Buffalo Head Hills kimberlite field. Similar to the Buffalo Head Hills discovery area, the BMRL permits are centered over the axial trace of the PRA. Periodic tectonic activity and structures related to the PRA likely have controlled the emplacement of kimberlites in the Buffalo Head Hills. Therefore, the potential for past emplacement of kimberlites in the Fort McKay to Fort McMurray area is considered high, because similar structures associated with periodic activity of the PRA have been documented for the area. The TMZ underlies the vast majority of BMRL's Athabasca permits. The potential for formation and preservation of diamonds in the upper mantle beneath the TMZ is generally considered low. However, on a more positive note, the TMZ could represent a thrust slice that may have originated well to the west of BMRL's current permit area and has been thrust over the more prospective crust of the Archean Rae Sub-province. In addition, seismic refraction data indicates that the crust is thick in the vicinity of BMRL's permits, even though the gravity signature is not particularly indicative of thickened crust. The relationship between current gravity and seismic refraction data, and crust thickness and the diamond stability field at the time of emplacement of any intrusions in the vicinity of BMRL's permits is speculative at present. The presence of favourable diamond indicator minerals recovered in government surveys to date within and in a down-ice direction from BMRL's Athabasca permits indicates that kimberlites could be present in the region, therefore follow-up exploration is warranted. The discovery of medium to high priority magnetic anomalies that could be indicative of near surface, weakly magnetic intrusive bodies in a similar structural

setting to that of the Buffalo Head Hills discovery area, indicates that the potential is moderate to high for the discovery of kimberlites on BMRL's Athabasca mineral permits. Because of the identification of discreet magnetic anomalies, the risk is considered less than for the Caribou Mountains or Birch Mountains permits even if the tectonic setting is not quite as favourable. The risk is considered moderate to high for the discovery of diamondiferous kimberlites or other related intrusions on BMRL's Athabasca permits because: (a) kimberlites have not been discovered on the permits to date, and (b) the permits are too distant from the Buffalo Head Hills to yield pipes belonging to Ashton's kimberlite field. However, the recent airborne magnetic survey was successful in identifying important magnetic anomalies, which has enhanced the potential to identify a new kimberlite field in northern Alberta.

CONCLUSIONS

Even though all three BMRL permit areas are at different stages of exploration, all three permit areas are underlain by a favourable geological and tectonic framework with similarities and some differences to the framework underlying the Buffalo Head Hills kimberlite discovery area. Therefore, each of the permit areas has at least moderate to high potential to host kimberlitic pipes based upon: (a) the results reported by Ashton to date for their diamondiferous kimberlites in the Buffalo Head Hills area, (b) the existing preliminary geological information for each of the three areas such as, the presence of favourable basement terranes, favourable structures and strata which were deposited coeval or prior to the intrusion of other kimberlites in Western Canada, (c) the existing preliminary geochemical information gathered by the AGS, which indicates the presence of anomalous diamond indicator minerals within or immediately adjacent to each of the three permit areas, and (d) the presence of highly prospective magnetic anomalies detected on a recently flown airborne geophysical survey of the Athabasca permit area. On the basis of the data reviewed, each of BMRL's three northern Alberta permit areas warrant follow-up exploration for kimberlites and related intrusions.

Although the Caribou Mountains and Birch Mountains permit areas are underlain by a highly favourable geological and tectonic framework the likelihood for discovery of kimberlites is considered low and the risk high because: (a) no kimberlites or related intrusions have been discovered in the immediate vicinity of either of the permit areas, (b) little or no diamond exploration has been conducted to date on either of the properties, and (c) only the Birch Mountains permit area has directly yielded a diamond indicator mineral, a kimberlitic chromite, that could be indicative of local intrusions. If kimberlites are discovered on either of the two permits, the potential for discovery of diamonds in the pipes is considered to be high on the basis of the tectonic framework that underlies each of the two properties.

The likelihood for discovery of kimberlites or related intrusions on the Athabasca permits is considerably higher than for the Caribou Mountains and Birch Mountains permit areas and, therefore, the associated risk is lower on the basis of: (a) the position of the permits with respect to the axis of the PRA, (b) the identification of multiple high quality

magnetic anomalies that could be related to shallow intrusive bodies within the sedimentary column, and (c) the discovery of several important anomalous indicator minerals in samples within or in a down-ice direction of the permits. If kimberlites or related intrusions are discovered within the Athabasca permits, the potential for the discovery of diamonds is considered to be indeterminate to low for the permitted area underlain by the TMZ on the basis of conflicting evidence for the presence of cold, thick crust beneath the TMZ. The potential for discovery of diamonds in any pipes that are discovered in permits overlying the Archean Rae Sub-province or permits overlying the contact zone of the TMZ and the Rae Sub-province is considered indeterminate to high on the basis of the tectonic framework.

RECOMMENDATIONS

A three phase follow-up exploration program is recommended for BMRL's northern Alberta permits to evaluate the potential for the presence of diamondiferous kimberlites or related intrusions. Specifically:

Phase 1: should consist of: (a) conducting a fixed-wing aeromagnetic survey over the Caribou Mountains and Birch Mountains permit areas, and those parts of the Athabasca permits that have not yet been magnetically surveyed, (b) further evaluation and compilation of the existing magnetic data for the Athabasca permits in order to prioritize those anomalies identified to date and delineate other high priority magnetic anomalies for follow-up fieldwork based upon modeling the magnetic, topographic and LandSat satellite signature for each of the anomalies delineated to date, and (c) construct a detailed cost estimate for conducting the recommended Phase 2 ground geophysical and auger drilling program for selected magnetic targets.

The estimated cost to conduct the Phase 1 program is about $270,000 based upon conducting an aeromagnetic survey with 300 m crosslines and 1,200 m tielines for about 60 townships (Appendix 2). This program should be initiated immediately. If the airborne magnetic survey is flown during January or February, the cost of the survey may be 20 to 30% higher than the estimated cost provided here.

Phase 2: should consist of: (a) ground geophysics followed by dry auger drilling of selected moderate to high priority magnetic anomalies within BMRL's Athabasca permits in order to confirm the presence of the magnetic anomalies followed by drill testing the anomalies to a depth of about 50 m to obtain samples of the basal till and near surface bedrock, and (b) conduct a thorough review of the magnetic data obtained from the airborne magnetic survey for the Caribou Mountains and Birch Mountains permits in conjunction with existing topographic and LandSat Satellite data in order to identify and prioritize aeromagnetic anomalies for follow-up exploration.

The preliminary estimated cost to conduct the Phase 2 exploration program is about $190,000, including about $170,000 to conduct a two week auger drilling program and the required ground geophysics and road building in order to identify drill collars prior to commencing the drilling program (Appendix 2). This estimate is a preliminary cost only as a detailed cost will need to be completed once the exact location and number of magnetic anomalies are identified in the Phase 1 compilation for the Athabasca permits.

The recommended Phase 2 program would require a three-man crew, consisting of a party leader and an assisting geologist or technician, for about 24 days, working under the supervision of Mr. M.B. Dufresne. The Phase 2 fieldwork should be commenced as soon as possible after completion of the Phase 1 compilation for the Athabasca permits in order to take advantage of the winter conditions for truck mounted auger drilling.

The **Phase 3** exploration program is dependent upon the results of the Phase 1 and 2 programs, but will likely consist of one or more of the following: (a) a field program for the Caribou Mountains and Birch Mountains permit areas to ground check any magnetic anomalies with signatures that may be indicative of kimberlitic pipes, (b) a systematic soil, stream sediment and/or till sampling program in the vicinity of or immediately over top of selected medium to high priority magnetic anomalies for all three permit areas, and (c) drill testing magnetic anomalies on the Athabasca permits that yielded encouraging results during the Phase 2 program. The scope and cost for the Phase 3 program will be entirely dependent upon the results of the Phase 1 and 2 programs, but it is anticipated that an expenditure on the order of $400,000 to $500,000 will likely be required as a minimum.

PERMIT TO PRACTICE
APEX Geoscience Ltd.
Signature
Date January 16/1998
PERMIT NUMBER: P-5824
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

APEX Geoscience Ltd.

L. Chin, B.Sc.

PROFESSIONAL GEOLOGIST MICHAEL B. DUFRESNE ALBERTA

M. B. Dufresne M.Sc., P.Geol.

January, 1998
Edmonton, Alberta

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CERTIFICATION

I, L.W. CHIN OF [redacted] AVE, EDMONTON, ALBERTA, CERTIFY AND DECLARE THAT I AM A GRADUATE OF THE UNIVERSITY OF ALBERTA WITH A B.SC. SPECIALIZATION DEGREE IN GEOLOGY (1997). I AM REGISTERED AS A GEOLOGIST IN TRAINING WITH THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS AND GEOPHYSICISTS OF ALBERTA.

MY EXPERIENCE INCLUDES SERVICE AS AN EXPLORATION GEOLOGIST WITH BHP MINERALS, VANCOUVER, BRITISH COLUMBA IN 1995 AND COMINCO EXPLORATION, TORONTO, ONTARIO, IN 1996. FROM MAY 1997 TO PRESENT I HAVE CONDUCTED AND DIRECTED PROPERTY EXAMINATIONS AND EXPLORATION PROGRAMS ON BEHALF OF COMPANIES AS A GEOLOGIST IN THE EMPLOY OF APEX GEOSCIENCE LTD.

I HAVE NO INTEREST, DIRECT OR INDIRECT, IN THE PROPERTIES THAT ARE THE SUBJECT OF THIS REPORT OR SECURITIES OF BIRCH MOUNTAIN RESOURCES LTD., NOR DO I EXPECT TO RECEIVE SUCH INTEREST. AS WELL, APEX GEOSCIENCE LTD. HAS NO INTEREST, DIRECT OR INDIRECT, IN THE PROPERTIES, OR SECURITIES OF BIRCH MOUNTAIN RESOURCES LTD., NOR DOES IT EXPECT TO RECEIVE SUCH INTEREST.

THIS REPORT ENTITLED "AN EVALUATION OF THE DIAMOND POTENTIAL OF BIRCH MOUNTAIN RESOURCES LTD.'S NORTHERN ALBERTA MINERAL PERMITS" IS BASED UPON PAST FIELD EXAMINATIONS AND SAMPLING BY MR M.B. DUFRESNE AND UPON THE STUDY OF PUBLISHED AND UNPUBLISHED DATA.

L. CHIN, B.SC., GEOL. I.T.

JANUARY, 1998
EDMONTON, ALBERTA

CERTIFICATION

I, M.B. DUFRESNE OF [redacted], EDMONTON, ALBERTA, CERTIFY AND DECLARE THAT I AM A GRADUATE OF THE UNIVERSITY OF NORTH CAROLINA AT WILMINGTON WITH A B.SC. DEGREE IN GEOLOGY (1983) AND A GRADUATE OF THE UNIVERSITY OF ALBERTA WITH A M.SC. DEGREE IN ECONOMIC GEOLOGY (1987). I AM REGISTERED AS A PROFESSIONAL GEOLOGIST WITH THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS AND GEOPHYSICISTS OF ALBERTA.

MY EXPERIENCE INCLUDES SERVICE AS AN EXPLORATION GEOLOGIST WITH THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT, YUKON, FROM 1983 TO 1985. FROM 1986 TO 1993, I HAVE CONDUCTED AND DIRECTED PROPERTY EXAMINATIONS AND EXPLORATION PROGRAMS ON BEHALF OF COMPANIES AS A GEOLOGIST IN THE EMPLOY OF R.A. OLSON CONSULTING LTD. AND ITS PREDECESSOR COMPANY TRIGG, WOOLLETT, OLSON CONSULTING LTD. OF EDMONTON, ALBERTA. SINCE JANUARY 1994, I HAVE CONDUCTED AND DIRECTED PROPERTY EXAMINATIONS, PROPERTY EVALUATIONS AND EXPLORATION PROGRAMS ON BEHALF OF COMPANIES AS A PRINCIPAL IN APEX GEOSCIENCE LTD.

I HAVE NO INTEREST, DIRECT OR INDIRECT, IN THE PROPERTIES THAT ARE THE SUBJECT OF THIS REPORT OR SECURITIES OF BIRCH MOUNTAIN RESOURCES LTD., NOR DO I EXPECT TO RECEIVE SUCH INTEREST. AS WELL, APEX GEOSCIENCE LTD. HAS NO INTEREST, DIRECT OR INDIRECT, IN THE PROPERTIES, OR SECURITIES OF BIRCH MOUNTAIN RESOURCES LTD., NOR DOES IT EXPECT TO RECEIVE SUCH INTEREST.

THIS REPORT ENTITLED "AN EVALUATION OF THE DIAMOND POTENTIAL OF BIRCH MOUNTAIN RESOURCES LTD.'S NORTHERN ALBERTA MINERAL PERMITS" IS BASED UPON PAST FIELD EXAMINATIONS AND SAMPLING CONDUCTED BY MR. DUFRESNE AND UPON THE STUDY OF PUBLISHED AND UNPUBLISHED DATA.

PROFESSIONAL GEOLOGIST
MICHAEL B. DUFRESNE
ALBERTA

M.B. DUFRESNE, M.SC., P. GEOL.

JANUARY, 1998
EDMONTON, ALBERTA

APPENDIX 1

APPENDIX 1a

CARIBOU MOUNTAINS PERMITS

PERMIT NO.	TERM DATE	LAST UPDATE	COMPANY*	INTEREST	AREA (ha)	LEGAL LAND DESCRIPTION** TWP	RGE	MER	SECTION/LSD
9394070325	7/26/94	3/28/96	BMRL	100	9216.00	113	3	5	1-36
9394070326	7/26/94	3/28/96	BMRL	100	9216.00	113	4	5	1-36
9394070327	7/26/94	3/28/96	BMRL	100	9216.00	113	5	5	1-36
9394070329	7/26/94	3/28/96	BMRL	100	9216.00	114	2	5	1-36
9394070330	7/26/94	3/28/96	BMRL	100	9216.00	114	3	5	1-36
9394070331	7/26/94	3/28/96	BMRL	100	9216.00	114	4	5	1-36
9394070332	7/26/94	3/28/96	BMRL	100	9216.00	114	5	5	1-36
9394070334	7/26/94	3/28/96	BMRL	100	9216.00	115	2	5	1-36
9394070335	7/26/94	3/28/96	BMRL	100	9216.00	115	3	5	1-36
9394070336	7/26/94	3/28/96	BMRL	100	9216.00	115	4	5	1-36
9394070340	7/26/94	3/28/96	BMRL	100	9216.00	116	3	5	1-36
9394070341	7/26/94	3/28/96	BMRL	100	9216.00	116	4	5	1-36
9394070346	7/26/94	3/28/96	BMRL	100	9216.00	117	4	5	1-36
9394070347	7/26/94	3/28/96	BMRL	100	9216.00	117	5	5	1-36
9394070348	7/26/94	3/28/96	BMRL	100	9216.00	118	1	5	1-36
9394070349	7/26/94	3/28/96	BMRL	100	9216.00	118	2	5	1-36
9394070351	7/26/94	3/28/96	BMRL	100	9216.00	118	4	5	1-36
9394070352	7/26/94	3/28/96	BMRL	100	9216.00	118	5	5	1-36
9394070353	7/26/94	3/28/96	BMRL	100	9216.00	119	1	5	1-36
				TOTAL	**175,104**	**ha**	**(432,682 acres)**		

* BMRL = Birch Mountain Resources Ltd.

**Legal Land Description is in the form of township-range-meridian-section-legal subdivision

APPENDIX 1b

BIRCH MOUNTAINS PERMITS

PERMIT NO.	TERM DATE	LAST UPDATE	COMPANY*	INTEREST	AREA (ha)	LEGAL LAND DESCRIPTION** TWP	RGE	MER	SECTION/LSD
9394070068	7/14/94	3/28/96	BMRL	100	9216.00	101	22	4	1-36
9394070069	7/14/94	3/28/96	BMRL	100	9216.00	101	23	4	1-36
9394070074	7/14/94	3/28/96	BMRL	100	9216.00	102	21	4	1-36
9394070075	7/14/94	3/28/96	BMRL	100	9216.00	102	22	4	1-36
9394070077	7/14/94	3/28/96	BMRL	100	9216.00	102	24	4	1-36
9394070081	7/14/94	3/28/96	BMRL	100	9216.00	103	20	4	1-36
9394070082	7/14/94	3/28/96	BMRL	100	9216.00	103	21	4	1-36
9394070083	7/14/94	3/28/96	BMRL	100	9216.00	103	22	4	1-36
9394070132	7/19/94	3/28/96	BMRL	100	9216.00	101	24	4	1-36
				TOTAL	**82,944**	**ha**	**(204,955 acres)**		

* BMRL = Birch Mountain Resources Ltd.

**Legal Land Description is in the form of township-range-meridian-section-legal subdivision

APPENDIX 1c

ATHABASCA PERMITS

PERMIT NO.	TERM DATE	LAST UPDATE	COMPANY*	INTEREST	AREA (ha)	LEGAL LAND DESCRIPTION** TWP	RGE	MER	SECTION/LSD
9390070004-1	7/10/90	2/7/97	BMRL	100	64.00	92	10	4	35NEP
9390070004-2	7/10/90	7/2/97	BMRL	100	1136.00	93	10	4	1L13;11L9,L16;12L4,L5,L12,L13;13L4,L5,L12,L13;14E,L11,L14;
									23;24L4,L5,L12;26W,L2;27NE,L1,L7,L8,L14;34N,SE,L3,L6;35W
9390070004-3	7/10/90	7/2/97	BMRL	100	320.00	95	10	4	4W;5N,SE;6SEP
9390070004-4	7/10/90	7/2/97	BMRL	100	64.00	95	11	4	1SP
9393080687-1	8/31/93	2/5/96	BMRL	100	3204.15	95	10	4	7S,NW,NEP;8;9W;16W;17;18WP,L2P;19;20;21W;28W,L15;
									29-33;34L5,L12,L13
9393080687-2	8/31/93	2/5/96	BMRL	100	2240.00	96	10	4	3L4,L5,L12,L13;4-9;16S,L9-L12;17S,L9-L12;18
9393080687-3	8/31/93	2/5/96	BMRL	100	2256.00	95	11	4	12;13;14E,L3,L6,L11,L14;22L8,L9,L16;23-26;27L1,L8,L9,L16;
									34L1,L8,L9,L14-L16;35S;36S,NE
9393080687-4	8/31/93	2/5/96	BMRL	100	928.00	96	11	4	1SE,L9,L16;3L3,L6,L11,L14;10L1-L3,L8,L9,L16;12NE,L1,L8;13;
									14;15L1,L8,L9,L16
9393100015-1	10/19/93	11/4/96	BMRL	100	4608.00	88	5	4	19-36
9393100015-2	10/19/93	11/4/96	BMRL	100	4608.00	89	5	4	1-18
9393100016-1	10/19/93	5/2/96	BMRL	100	4608.00	89	3	4	4-9; 16-21; 28-33
9393100016-2	10/19/93	5/2/96	BMRL	100	4608.00	89	4	4	1-18
9393100017-1	10/19/93	11/4/96	BMRL	100	4608.00	89	4	4	19-36
9393100017-2	10/19/93	11/4/96	BMRL	100	4608.00	89	5	4	19-36
9393100074	10/20/93	3/28/96	BMRL	100	9216.00	95	14	4	1-36
9393100109	10/20/93	3/28/96	BMRL	100	9216.00	94	14	4	1-36
9393110023-1	11/23/93	5/1/96	BMRL	100	4608.00	99	7	4	1-3;10-15;22-27;34-36
9393110023-2	11/23/93	5/1/96	BMRL	100	4608.00	99	7	4	4-9;16-21;28-33
9393110025-1	11/23/93	5/1/96	BMRL	100	1536.00	88	10	4	31-36
9393110025-2	11/23/93	5/1/96	BMRL	100	3584.00	89	10	4	1-12;14W;23W;26W;35W
9393110025-3	11/23/93	5/1/96	BMRL	100	4096.00	89	10	4	15-22;27-34
9393110027	11/23/93	11/4/96	BMRL	100	8172.50	88	7	4	1-13;14S;15-21;24;25;26NP;28SEP;29-36
9393110028	11/29/93	5/1/96	BMRL	100	9216.00	88	6	4	1-36
9393110029	11/23/93	5/1/96	BMRL	100	9216.00	88	8	4	1-36
9393110030-1	11/23/93	11/4/96	BMRL	100	2048.00	88	9	4	7-10;15-18
9393110030-2	11/23/93	11/4/96	BMRL	100	5632.00	88	10	4	9-30
9393110030-3	11/23/93	11/4/96	BMRL	100	1536.00	88	11	4	13;14;23-26
9393110031-1	11/29/93	11/4/96	BMRL	100	4608.00	89	6	4	1-18
9393110031-2	11/29/93	11/4/96	BMRL	100	4608.00	89	7	4	1-18

PERMIT NO.	TERM DATE	LAST UPDATE	COMPANY*	INTEREST	AREA (ha)	LEGAL LAND DESCRIPTION** TWP	RGE	MER	SECTION/LSD
9393110032	11/23/93	11/4/96	BMRL	100	9216.00	89	8	4	1-36
9393110033-1	11/23/93	11/4/96	BMRL	100	4608.00	88	9	4	11-14;19-25;28-33;36
9393110033-2	11/23/93	11/4/96	BMRL	100	4604.81	89	9	4	1;4W;5;6;7E;8W;11N;12-14;17L4;18SP;22-27;28NE;33S;34S;
									35;36
9393110034-1	11/23/93	5/2/96	BMRL	100	2304.00	98	8	4	4-9;16-18
9393110034-2	11/23/93	5/2/96	BMRL	100	6912.00	98	9	4	1-18;22-27;34-36
9393110035-1	11/23/93	11/4/96	BMRL	100	2304.00	98	9	4	19-21;28-33
9393110035-2	11/23/93	11/4/96	BMRL	100	6912.00	99	9	4	4-9;16-36
9393110036	11/23/93	11/5/96	BMRL	100	9216.00	100	10	4	1-36
9393110037	11/23/93	5/2/96	BMRL	100	9216.00	101	10	4	1-36
9393110038-1	11/23/93	5/2/96	BMRL	100	1120.00	102	9	4	31;32;33SP;35;36
9393110038-2	11/23/93	5/2/96	BMRL	100	7216.00	103	9	4	1;2E;4SP;5-30
9393110065	11/23/93	3/28/96	BMRL	100	7936.00	92	12	4	1-23;27-34
9393110066	11/23/93	3/28/96	BMRL	100	9216.00	92	13	4	1-36
9393110067	11/23/93	3/28/96	BMRL	100	9216.00	93	13	4	1-36
9393110068	11/23/93	3/28/96	BMRL	100	9216.00	94	13	4	1-36
9393110082-1	11/23/93	3/28/96	BMRL	100	8192.00	90	11	4	3-10;13-36
9393110082-2	11/23/93	3/28/96	BMRL	100	1024.00	90	11	4	1;2;11;12
9394020001	2/11/94	5/2/96	BMRL	100	3840.00	92	11	4	1-12;16-18
9394020002	2/11/94	5/2/96	BMRL	100	4608.00	93	9	4	1-3;10-15;22-27;34-36
9394020003-1	2/11/94	5/2/96	BMRL	100	4608.00	93	9	4	4-9;16-21;28-33
9394020003-2	2/11/94	5/2/96	BMRL	100	1520.00	93	10	4	1E,L6,L11,L14;12E,L3,L6,L11,L14;13E,L3,L6,L11,L14;24E,L3,L6,
									L11,L13,L14;25;26NE,L1,L7,L8;35E;36
9394020004	2/11/94	3/28/96	BMRL	100	4096.00	93	12	4	3-10;15-22
9394020006-1	2/11/94	5/2/96	BMRL	100	1280.00	94	8	4	6;7;18;19;30
9394020006-2	2/11/94	5/2/96	BMRL	100	6144.00	94	9	4	1-4;9-16;21-28;33-36
9394020007-1	2/11/94	5/2/96	BMRL	100	3072.00	94	9	4	5-8;17-20;29-32
9394020007-2	2/11/94	5/2/96	BMRL	100	4032.00	94	10	4	1;2;10NE,L11,L14;11-14;15E,L3,L6,L11,L14;22E,L3,L6,L11,L14;
									23-26;27N,SE,L3,L6;34-36
9394020008	2/11/94	2/10/97	BMRL	60	2490.88	94	11	4	20;21N,SW;28SP,NWP;27-29;31-34;35WP
9394020009	2/11/94	5/2/96	BMRL	100	9216.00	95	8	4	1-36
9394020010	2/11/94	5/2/96	BMRL	100	9216.00	95	9	4	1-36
9394020011	2/11/94	3/28/96	BMRL	100	5184.00	95	10	4	1-3;4E;9E;10-15;16E;21E;22-27;28SE,L9,L10,L16;34E,L3,L4,L6,
									L11,L14;35;36
9394020012	2/11/94	2/10/97	BMRL	60	6512.00	95	11	4	2-11;14L4,L5,L12,L13;15-21;22W,L1,L2,L7,L10,L15;27W,L2,L7,
									L10,L15;28-33;34SW,L2,L7,L10-L13

PERMIT NO.	TERM DATE	LAST UPDATE	COMPANY*	INTEREST	AREA (ha)	LEGAL LAND DESCRIPTION** TWP	RGE	MER	SECTION/LSD
9394020013	2/11/94	2/10/97	BMRL	60	5792.00	96	11	4	3L4,L5,L12,L13;4-9;10NW,L4-L7,L10,L15;15W,L2,L7,L10,L15;
									16-22;27-34
9394020014	2/11/94	5/2/96	BMRL	100	8688.68	97	10	4	1-4;5E;7-29;30S,NWP,NEP;31N,SEP;32-36
9394020015	2/11/94	5/2/96	BMRL	100	8699.36	97	11	4	1SWP,NEP;3-35;36N,SW
9394020016	2/11/94	5/2/96	BMRL	100	9216.00	98	10	4	1-36
9394040029	4/14/94	5/2/96	BMRL	100	8384.42	90	9	4	1-4;5E;6SP;7WP;8E;9-17;18EP;19EP;20-29;30EP;31SEP;32-36
9394040030	4/14/94	5/2/96	BMRL	100	9154.50	91	9	4	1-5;6WP,L9,L10P,L15,L16;7N,SE,L3,L4,L5P,L6;8-36
9394040031	4/14/94	5/2/96	BMRL	100	9216.00	91	10	4	1-36
9394040032	4/14/94	5/2/96	BMRL	100	9216.00	92	9	4	1-36
9394040033	4/14/94	5/2/96	BMRL	100	4407.72	92	10	4	1-12;13SW,NE,L1,L2,L14;14SP;15SP;16-18;24SE,NEP,L3,L5,L6
9394040034	4/14/94	5/2/96	BMRL	100	2560.00	94	12	4	18-20;30-36
9394040035	4/14/94	5/2/96	BMRL	100	9008.00	95	7	4	1;2S;3-9;10EP;11E;12-27;28S;29-31;32E;33N;34-36
9394040036	4/14/94	5/2/96	BMRL	100	9216.00	95	12	4	1-36
9394040037	4/14/94	5/2/96	BMRL	100	9216.00	96	7	4	1-36
9394040038	4/14/94	5/2/96	BMRL	100	9216.00	96	8	4	1-36
9394040039	4/14/94	5/2/96	BMRL	100	9216.00	96	9	4	1-36
9394040040	4/14/94	5/2/96	BMRL	100	5952.00	96	10	4	1;2;3E,L3,L6,L11,L14;10-15;16L13-L16;17L13-L16;20-28;29E;
									32E;33-36
9394040041	4/14/94	5/2/96	BMRL	100	9216.00	96	12	4	1-36
9394040042	4/14/94	5/2/96	BMRL	100	9216.00	97	6	4	1-36
9394040043	4/14/94	5/2/96	BMRL	100	9216.00	97	7	4	1-36
9394040044	4/14/94	5/2/96	BMRL	100	9216.00	97	8	4	1-36
9394040045	4/14/94	5/2/96	BMRL	100	9216.00	97	9	4	1-36
9394040046	4/14/94	5/2/96	BMRL	100	9216.00	97	12	4	1-36
9394040047	4/14/94	5/2/96	BMRL	100	9216.00	98	7	4	1-36
9394040048	4/14/94	5/2/96	BMRL	100	9216.00	98	11	4	1-36
939007A003-1	7/10/90	10/7/97	BMRL	100	1587.00	94	10	4	3;4L8,L9,L16;7L13P;8;9;10L5-L8,L12,L13;15L4,L5,L12,L13;17S
									17NE,L14;18NW,L5-L7,L10;21E;22L4,L5,L12,L13;27L4,L5;28SE
939007A003-2	7/10/90	10/7/97	BMRL	100	366.36	94	10	4	4L1,L7,L10,L11,L13-L15;7E,L3P,L6P,L11P,L14P,;18L1-L3,L4P
				TOTAL	**496,848**	**ha**	**(1,227,711 acres)**		

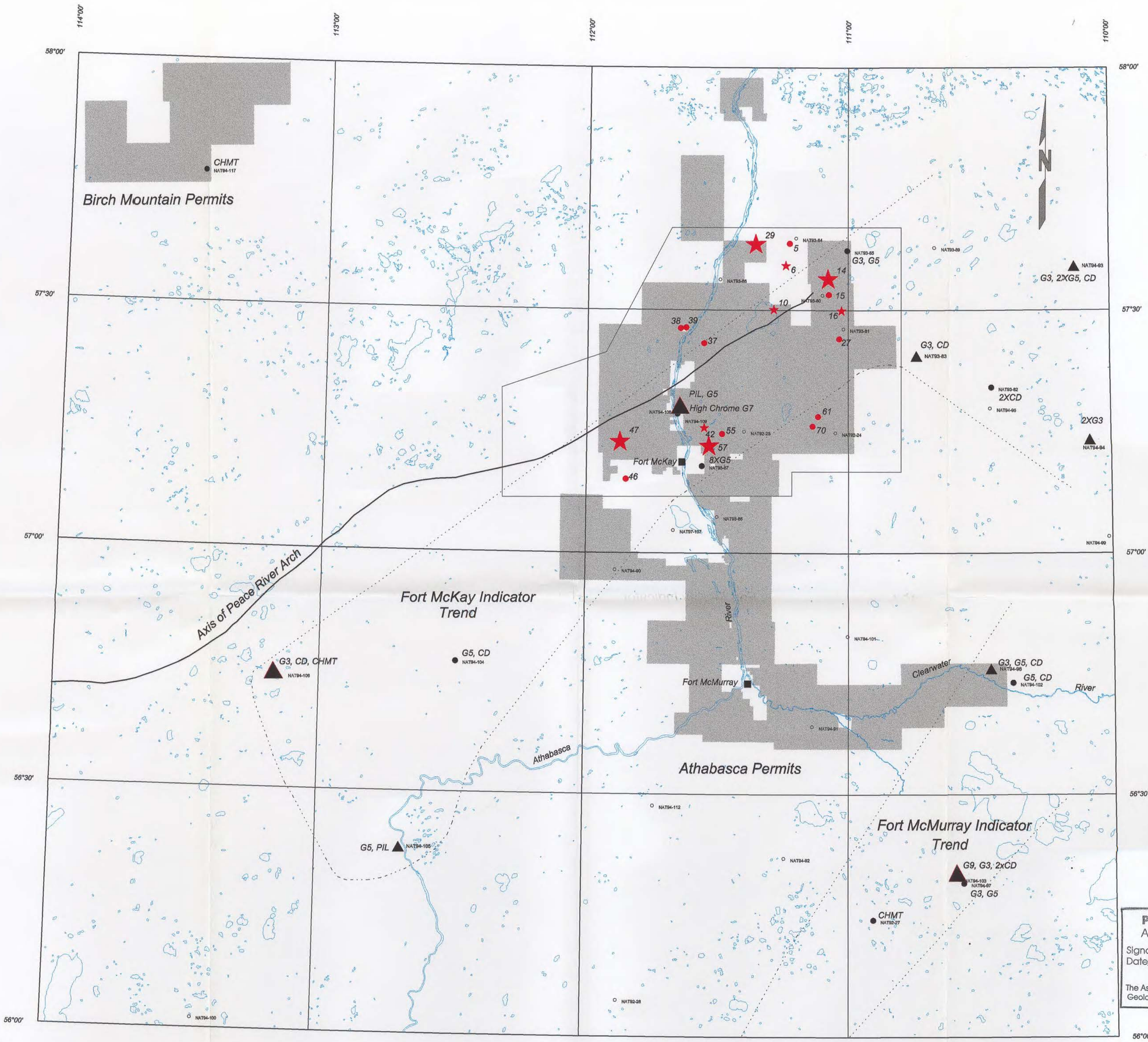
* BMRL = Birch Mountain Resources Ltd.

**Legal Land Description is in the form of township-range-meridian-section-legal subdivision

APPENDIX 2

APPENDIX 2
BUDGET FOR RECOMMENDED 1998 EXPLORATION

Description	Budgeted Costs
STAGE 1 - AIRBORNE GEOPHYSICS AND FURTHER EVALUATION OF EXISTING ATHABASCA MAGNETIC DATA	
January 15 to February 28	
TOTAL SALARIES	$10,000.00
TOTAL SUBCONTRACT	$5,000.00
TOTAL ADMINISTRATIVE	$2,000.00
FIELD COSTS (AIRBORNE SURVEY)	$252,000.00
TOTAL RENTALS	$0.00
TOTAL EQUIPMENT PURCHASED	$0.00
MISCELLANEOUS	$1,000.00
	$270,000.00
STAGE 2a - PREFIELD COMPILATION, GROUND GEOPHYSICS AND DRILL SITE PREPARATION	
February 1 to April 15	
TOTAL SALARIES	$55,000.00
TOTAL SUBCONTRACT	$11,000.00
TOTAL ADMINISTRATIVE	$1,500.00
FIELD COSTS	$70,000.00
TOTAL RENTALS	$8,000.00
TOTAL EQUIPMENT PURCHASED	$0.00
MISCELLANEOUS	$7,000.00
	$152,500.00
STAGE 2b - ANALYTICAL AND REPORTING	
April 16 to May 31	
TOTAL SALARIES	$12,500.00
TOTAL SUBCONTRACT	$0.00
TOTAL ADMINISTRATIVE	$1,000.00
FIELD COSTS (ANALYTICAL)	$22,000.00
TOTAL RENTALS	$0.00
TOTAL EQUIPMENT PURCHASED	$0.00
MISCELLANEOUS	$2,000.00
	$37,500.00
TOTAL PROJECT COSTS	**$ 460,000.00**
ESTIMATED GST	**$ 32,200.00**
TOTAL PROJECT COSTS (INCLUDING GST)	**$ 492,200.00**



PROFESSIONAL GEOLOGIST MICHAEL B. DUFRESNE ALBERTA

PERMIT TO PRACTICE
APEX Geoscience Ltd.
Signature
Date February 10, 1998
PERMIT NUMBER: P-5824
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

LEGEND

- NAT94-106 — Excellent diamond indicator site with multiple diamond indicator minerals of high quality chemistry. Requires follow-up exploration. (Sample Identifier)
- NAT94-105 — Good diamond indicator site with one or more diamond indicator minerals of high quality chemistry and one or more of moderate quality geochemistry. Requires follow-up exploration. (Sample Idenfier)
- NAT94-105 — Diamond indicator site with one or more diamond indicator minerals of moderate quality chemistry. May require follow-up exploration. (Sample Idenfier)
- NAT94-100 — Sample Site (Sample Identifier)
- 47 — Excellent quality airborne magnetic anomaly that requires follow-up exploration for kimberlites. (Anomaly Number)
- 6 — Moderate to good quality airborne magnetic anomaly that requires follow-up exploration for kimberlites. (Anomaly Number)
- 46 — Low to moderate quality airborne magnetic anomaly that may require follow-up exploration for kimberlites. (Anomaly Number)
- 1997 Aeromagnetic survey area boundary
- Birch Mountain Resources Ltd. Metallic mineral permit boundary
- River

ABBREVIATIONS

CHMT - Chromite
CD - Chrome Diopside
PIL - Picroilmenite
G3 and G5 - Eclogitic Garnet
G7 - Grossular Garnet
G9 - Pyrope Garnet

BIRCH MOUNTAIN RESOURCES LTD.

FORT McKAY TO FORT McMURRAY AREA

DIAMOND INDICATOR AND GEOPHYSICAL ANOMALY SUMMARY

NTS: 84 A,H AND 74 D,E

Scale 0 — 40 Kilometres
1:625,000

APEX Geoscience Ltd.

EDMONTON, ALBERTA — DECEMBER, 1997

Figure 5

Appendix C.2.

Apex & GEDCO MagneticAnomaly Evaluation

Preliminary Birch Mountain Geophysical Anomaly Review					(MBD)	(JWP)	(JWP)	(JWP)
ex priority and anomaly #					Apex	Geophys.	Geophys.	
Anomaly#	Profile Line	Fiducial	UTM Easting	UTM Northing	Priority	Quality	Risk	Comments
14	L11690	1160	494671	6379835	High	I	M	Drill target
16	L71310	15818	497701	6371743	Medium	I	L	
29	L11960	2330	478064	6388064	High	I	M	Drill target
42	L70800	2314	467015	6346156	Medium	I	L	Sharp shoulder
127	L10840	9925	460154	6354604	Low	I	VH	Topo
167	L12070	2347	468773	6391424	Low	I	L	MD look again!
169	L11960	2373	475266	6388048	Medium	I	M	Near topo edge
170	L11872	2014	472456	6385402	Low	I	L	MD look again!
172	L11930	3190	475647	6387166	Low	I	L	MD look again!
189	L11560	1313	489920	6375972	High	I	L	Drill target
210	L11700	15786	491674	6380151	High	I	L	Drill target
221	L11850	1188	498989	6384615	High	I	L	Drill target
223	L12010	6039	498785	6389412	Medium	I	L	Sharp; 2 Line anomaly with 224?
229	L71500	738	509140	6384360	Low	I	L	MD look again!
6	L71070	8855	483342	6382156	Medium	I-2	L	
57	L10380	2180	468815	6340720	High	I-2	L	Shoulder
61	L71220	7815	492221	6348528	Low	I-2	H	Rev. Magn./Drill because diff. age?
112	L70530	235	450855	6360038	Medium	I-2	L	Shoulder
156	L11460	7015	473967	6373090	Medium	I-2	L	
162	L11810	5433	464951	6383627	Medium	I-2	M	Small and sharp; culture?
224	L12020	4786	496043	6389724	Medium	I-2	L	Broad
227	L71430	4568	504908	6375920	High	I-2	L	Drill target
232a	L12040	2932	502682	6390292	Medium	I-2	L	Drill target; Sharp w/ 2 peaks
38	L11310	5740	462015	6368671	Low	II	H	Could be Rev. Magn. At FID 5747
39	L11310	5751	462610	6368660	Low	II		
46	L10140	11603	448025	6333637	Low	II	H	Rev. Magn.
55	L10510	9444	469332	6344596	Low	II		
102	L10360	20870	448579	6337262	Medium	II	M	Deeper
147	L11170	7282	479357	6364397	Medium	II	M	Shoulder
166	L11993	5542	471545	6389004	Low	II		
168	L12070	2365	469958	6391402	Low	II		
183	1950 and L11	169 and 218	487673	6387686	Medium	II	M	2 Line anomaly

190	L71190	5078	490517	6377913	Low	II	L	
194	L11710	14605	488025	6380525	Low	II		
198	L11160	6308	486152	6364006	Medium	II	L	Weak shoulder
212	L11690	1115	497120	6379828	?	II	M	est. depth 120 m; otherwise looks good
215	L11490	10277	497239	6373825	Medium	II	L	Shoulder
218b	L11390	15018	499029	6370818	Medium	II	L	2 lines; shoulder
218b2	L11380	13333	499089	6370516	Medium	II	L	2nd line
225	L71230	8560	492977	6389245	Medium	II	L	Deeper
228	L11970	1686	506757	6388164	High	II	L	Strong, but could be too deep
232b	L12040	2940	502134	6390288	High	II	M	Shoulder
5	L12000	6694	486803	6389187	Low	III		
10	L11440	4754	482791	6372414	Medium	III	L	Very subtle
15	L11620	8088	494319	6377742	Low	III		
27	L11270	1959	497433	6367226	Low	III		
37	L11180	8179	466097	6364724	Low	III		
47	L10390	3844	448142	6341162	High	III	H	Deep shoulder; basement?
70	L10580	2592	496136	6346525	Low	III		
108	L10750	13462	449435	6351958	Low	III	L	
121	L10261	4175	449959	6337262	Low	III	H	deep and in drainage channel
123	L10450	790	463400	6342856	Low	III	VH	Drainage
137	L11570	2000	452927	6376531	Low	III		Broad
139	L11570	2120	452927	6376531	Low	III		
140	L10330	16458	468744	6339212	Medium	III	L	Subtle
142	L10030	9900	466097	6330233	Low	III		
145	L10980	14732	480779	6358643	Low	III		
165	L11970	1079	470900	6388402	Medium	III	H	Topo
171	LI2030	3912	475575	6390164	Low	III	VH	Drainage
184	L11970	1374	488289	6388292	Medium	III	H	Topo
196b	L11240	12963	489437	6365780	Low	III-2	L	very subtle shoulder anomaly
202	L10470	3365	483034	6343323	Low	III		Subtle
206	L11220	15098 ??	487157	6366391	Low	III		weak shoulder - 2 line anomaly
206-2	L11230	13724			Low	III		weak shoulder - 2 line anomaly
214	L1490	10288	497924	6373814	Medium	III	L	Very weak shoulder
217a	L11360	11188	499544	6369926	Low	III		same as 217b
226	L12000	6408	504266	6389068	Medium	III	L	Weak shoulder

195	L11600	9934	490514	6377297	Low	IV	H	Basement
141b	L10380	2284	475821	6340682	Low	IV	H	Basement
Notes:								
1. Apex priority based on map view and initial profile review on WS.						I		excellent
2. Geophysical quality based on strengh and sharpness of anomaly						I-2		excellent but …
3. Risk factors include topography (if at creek valley edge or within drainage channel);						II		good
if reversely magnetized; other suspicions						III		poor - fair
4. JWP believes multi-peaked and 2-line anomalies deserve close look.						IV		Too deep, probably basement
One reversed anomaly should be considered for drilling.								
Last Updated: Jan. 28 by JWP								

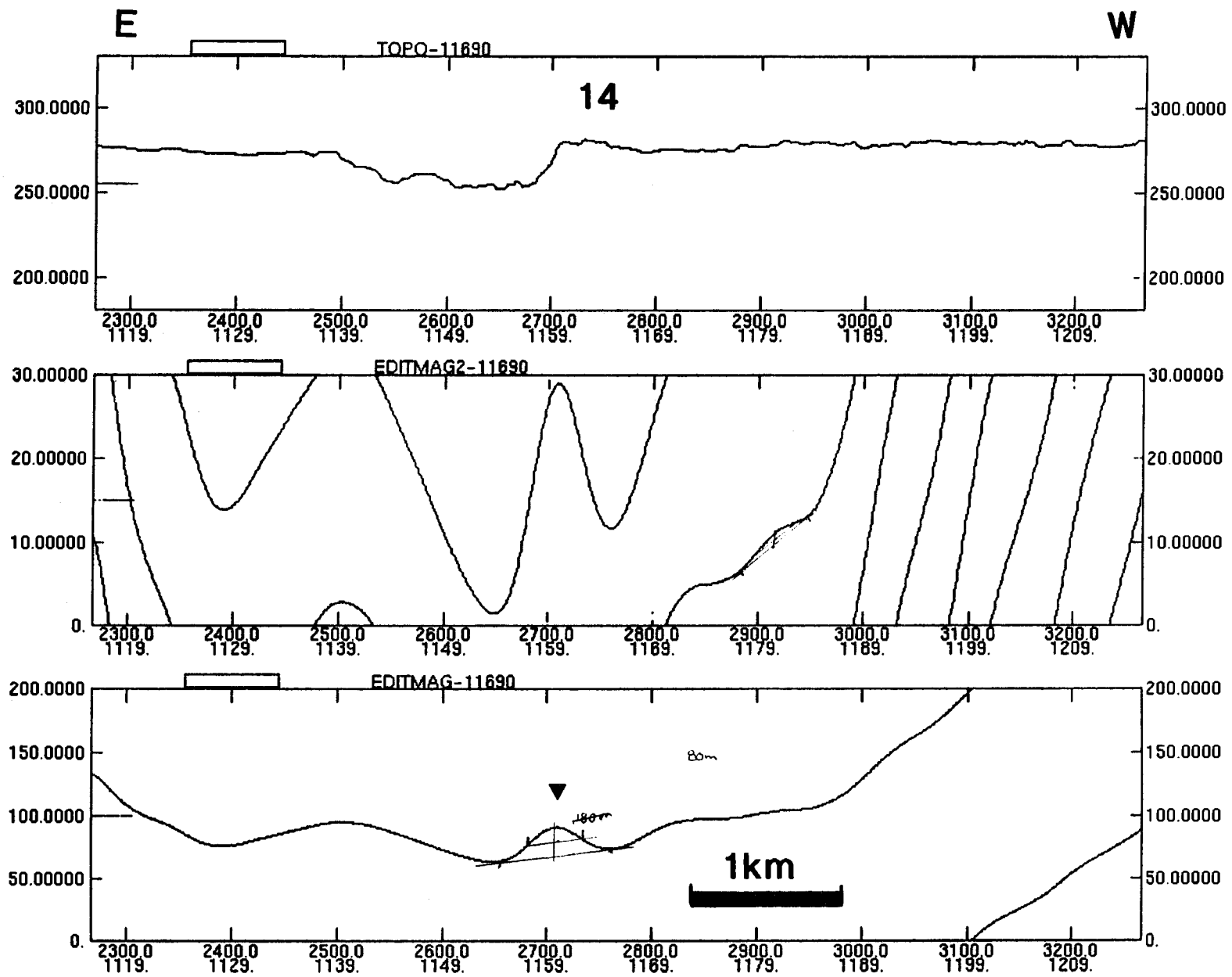
Preliminary Birch Mountain Geophysical Anomaly Review					
Anomaly#	Profile Line	Fiducial	UTM Easting	UTM Northing	Priority
14	L11690	1160	494671	6379835	High
29	L11960	2330	478064	6388064	High
47	L10390	3844	448142	6341162	High
57	L10380	2180	468815	6340720	High
189	L11560	1313	489920	6375972	High
210	L11700	15786	491674	6380151	high
221	L11850	1188	498989	6384615	High
227	L71430	4568	504908	6375920	High
228	L11970	1686	506757	6388164	High
232b	L12040	2940	502134	6390288	High — 12 High
6	L71070	8855	483342	6382156	Medium
10	L11440	4754	482791	6372414	Medium
16	L71310	15818	497701	6371743	Medium
42	L70800	2314	467015	6346156	Medium
102	L10360	20870	448579	6337262	Medium
112	L70530	235	450855	6360038	Medium
140	L10330	16458	468744	6339212	Medium
147	L11170	7282	479357	6364397	Medium
156	L11460	7015	473967	6373090	Medium
162	L11810	5433	464951	6383627	Medium
165	L11970	1079	470900	6388402	Medium
169	L11960	2373	475266	6388048	Medium
183	L11950 and L11940	3169 and 2187	487673	6387686	Medium
184	L11970	1374	488289	6388292	Medium
198	L11160	6308	486152	6364006	Medium
214	L1490	10288	497924	6373814	Medium
215	L11490	10277	497239	6373825	Medium
223	L12010	6039	498785	6389412	Medium
224	L12020	4786	496043	6389724	Medium
225	L71230	8560	492977	6389245	Medium
226	L12000	6408	504266	6389068	Medium
218b	L11390	15018	499029	6370818	Medium
218b	L11380	13333	499089	6370516	Medium
232a	L12040	2932	502682	6390292	Medium — 24 Med
5	L12000	6694	486803	6389187	Low
15	L11620	8088	494319	6377742	Low
27	L11270	1959	497433	6367226	Low
37	L11180	8179	466097	6364724	Low
38	L11310	5740	462015	6368671	Low
39	L11310	5751	462610	6368660	Low
46	L10140	11603	448025	6333637	Low
55	L10510	9444	469332	6344596	Low
61	L71220	7815	492221	6348528	Low
70	L10580	2592	496136	6346525	Low
* 108	L10750	13462	449435	6351958	Low
* 121	L10261	4175	449959	6337262	Low

New Anomalies: birchanom98.xls

123	L10450	790	463400	6342856	Low
127	L10840	9925	460154	6354604	Low
137	L11570	2000	452927	6376531	Low
139	L11570	2120	452927	6376531	Low
141b	L10380	2284	475821	6340682	Low
142	L10030	9900	466097	6330233	Low
145	L10980	14732	480779	6358643	Low
166	L11990	5542	471545	6389004	Low
167	L12070	2347	468773	6391424	Low
168	L12070	2365	469958	6391402	Low
171	L12030	3912	475575	6390164	Low
172	L1930	3190	475647	6387166	Low
190	L71190	5078	490517	6377913	Low
194	L11710	14605	488025	6380525	Low
195	L11600	9934	490514	6377297	Low
202	L10470	3365	483034	6343323	Low
217a	L11360	11188	499544	6369926	Low
217b	L11360	11195	498664	6369914	Low
229	L71500	738	509140	6384360	Low
166	L11990 ??	5542	471545	6389004	Low - ?
170	L11870 ??	2014	472456	6385402	Low - ?
172	L1930 ??	3190	475647	6387166	Low - ?
196b	L11220	15098 ??	487157	6366391	Low - ?
206	L11240	12963 ??	489437	6365780	Low - ?
212	L11690	1115	497120	6379828	Omit
212	L11690	1115	497120	6379828	Omit

New Anomalies: birchanom98.xls

PRIORITY I-1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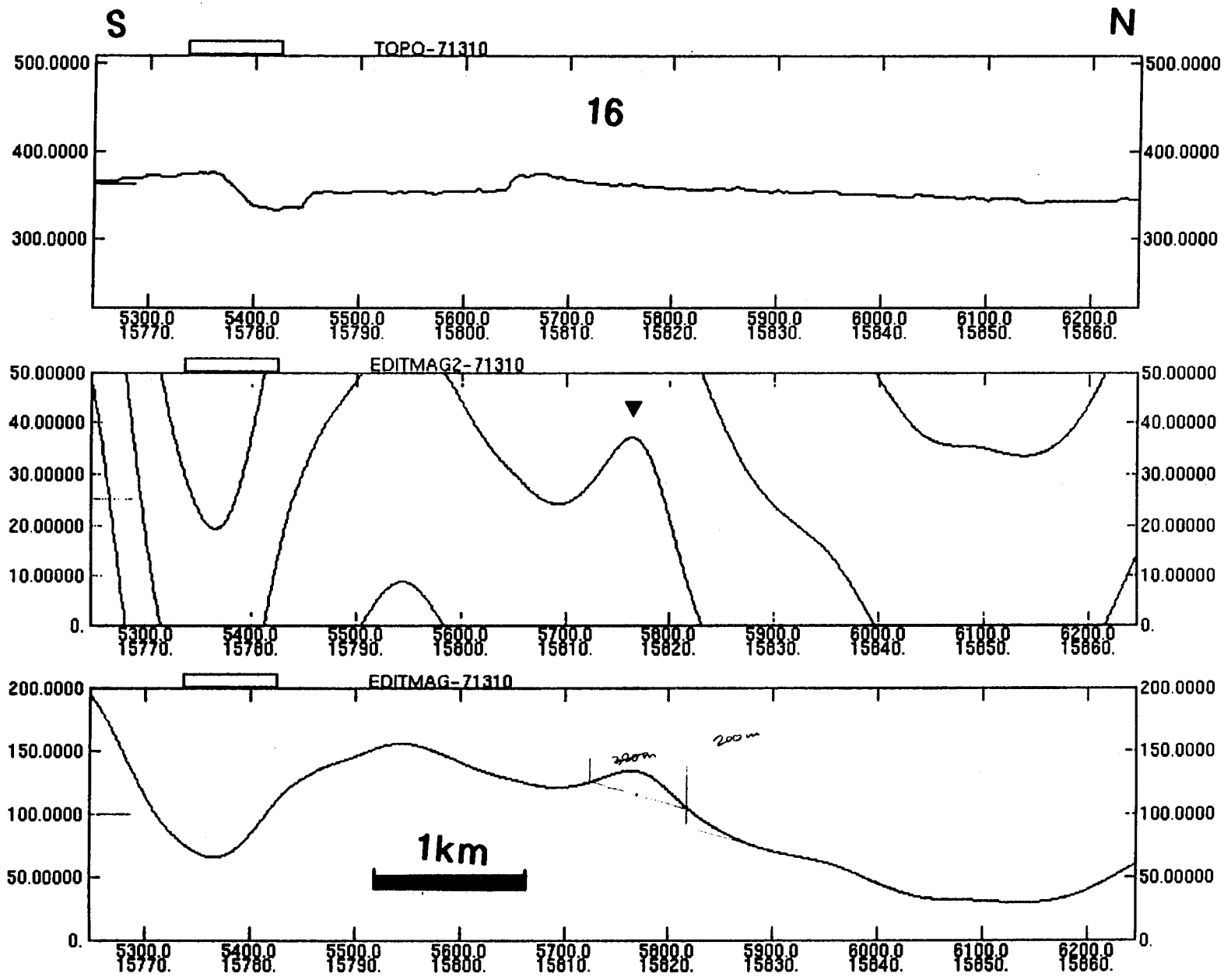
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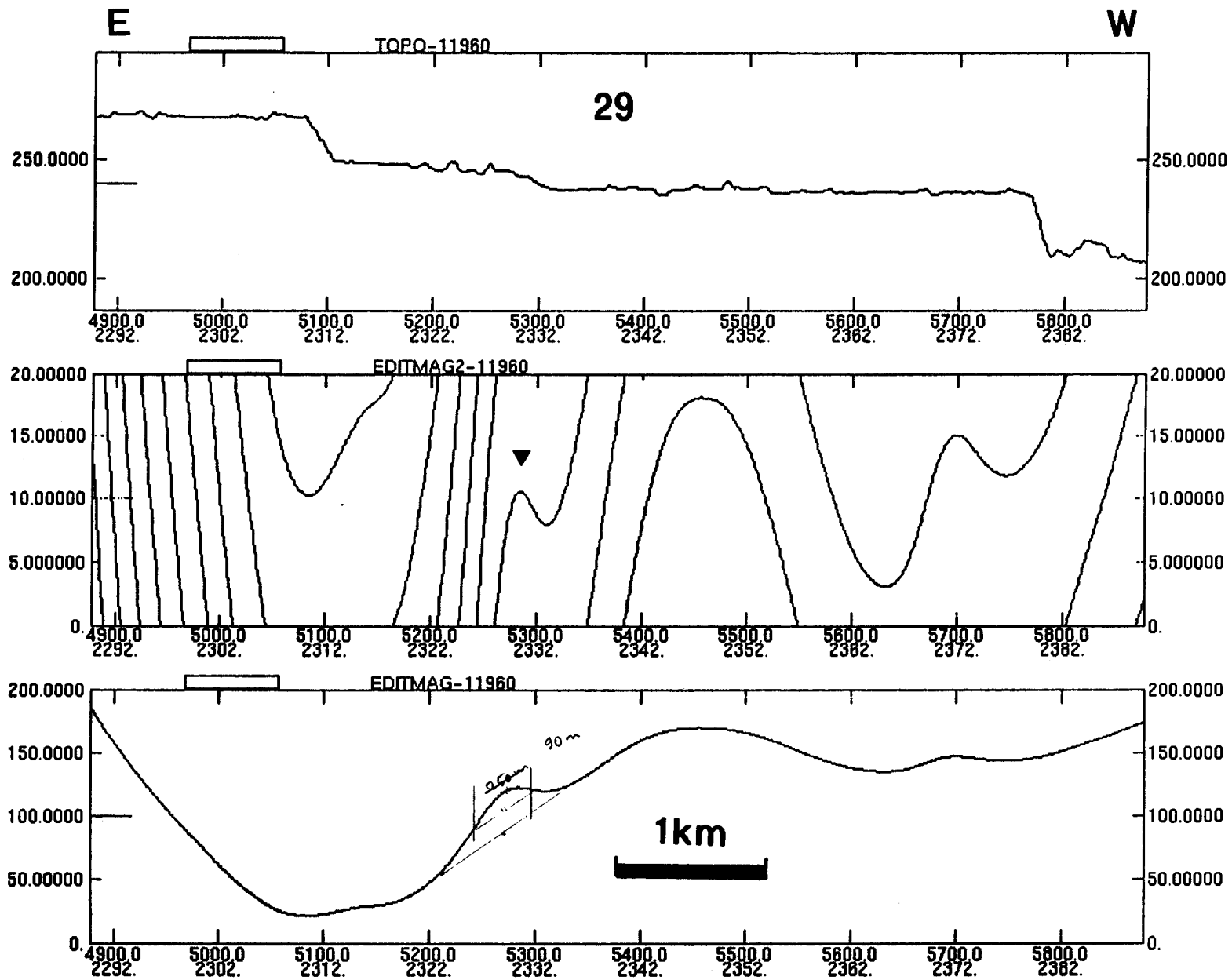
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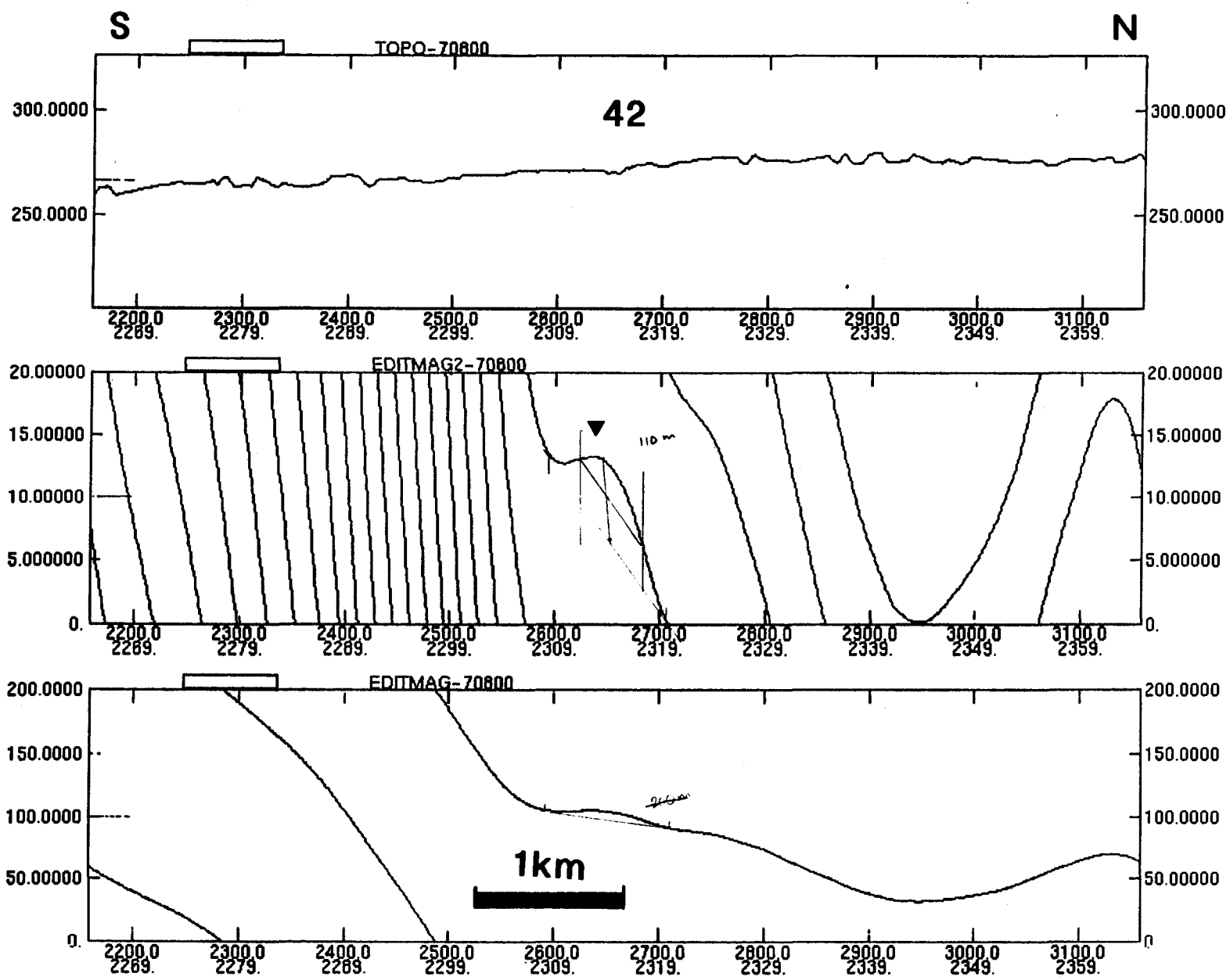
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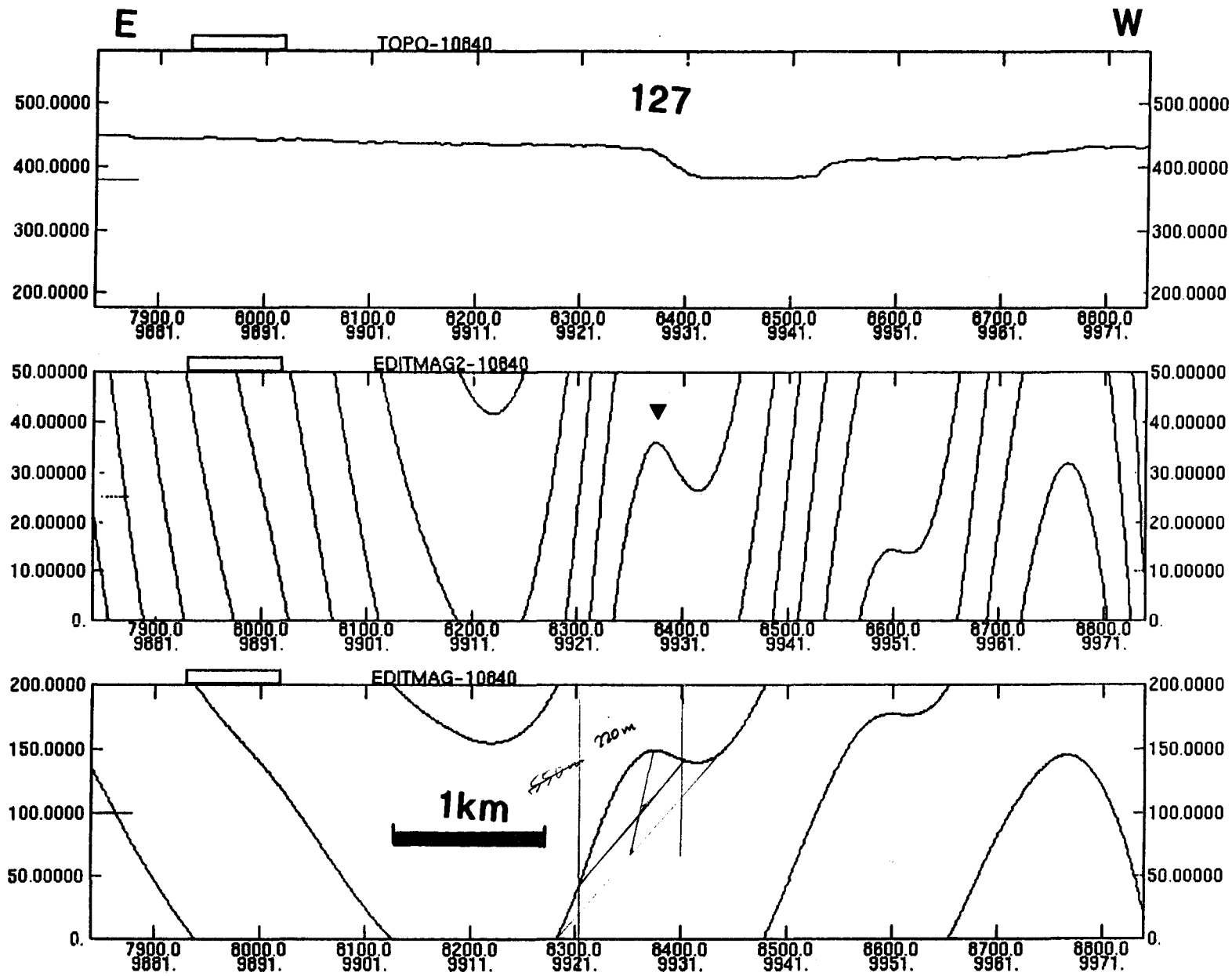
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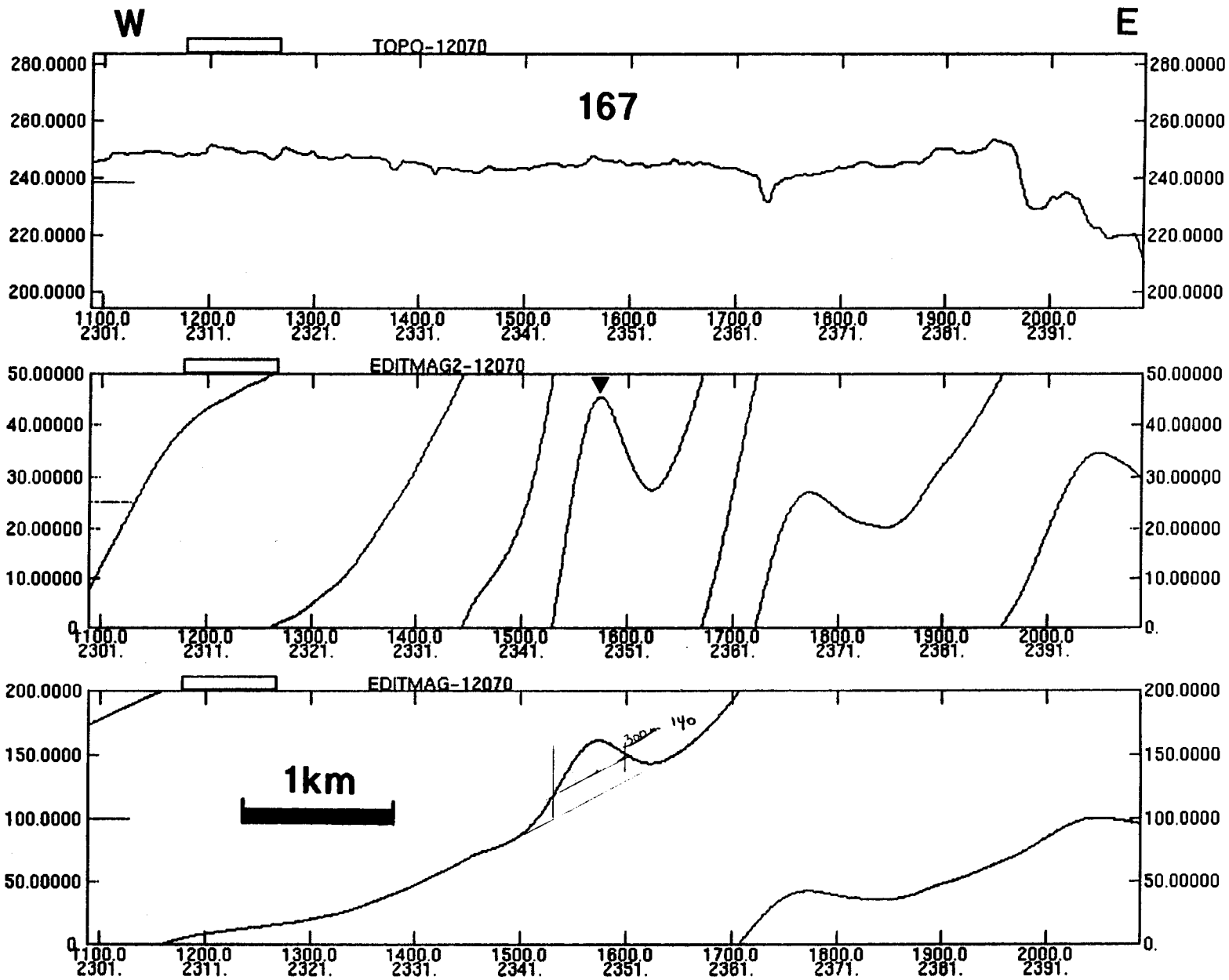
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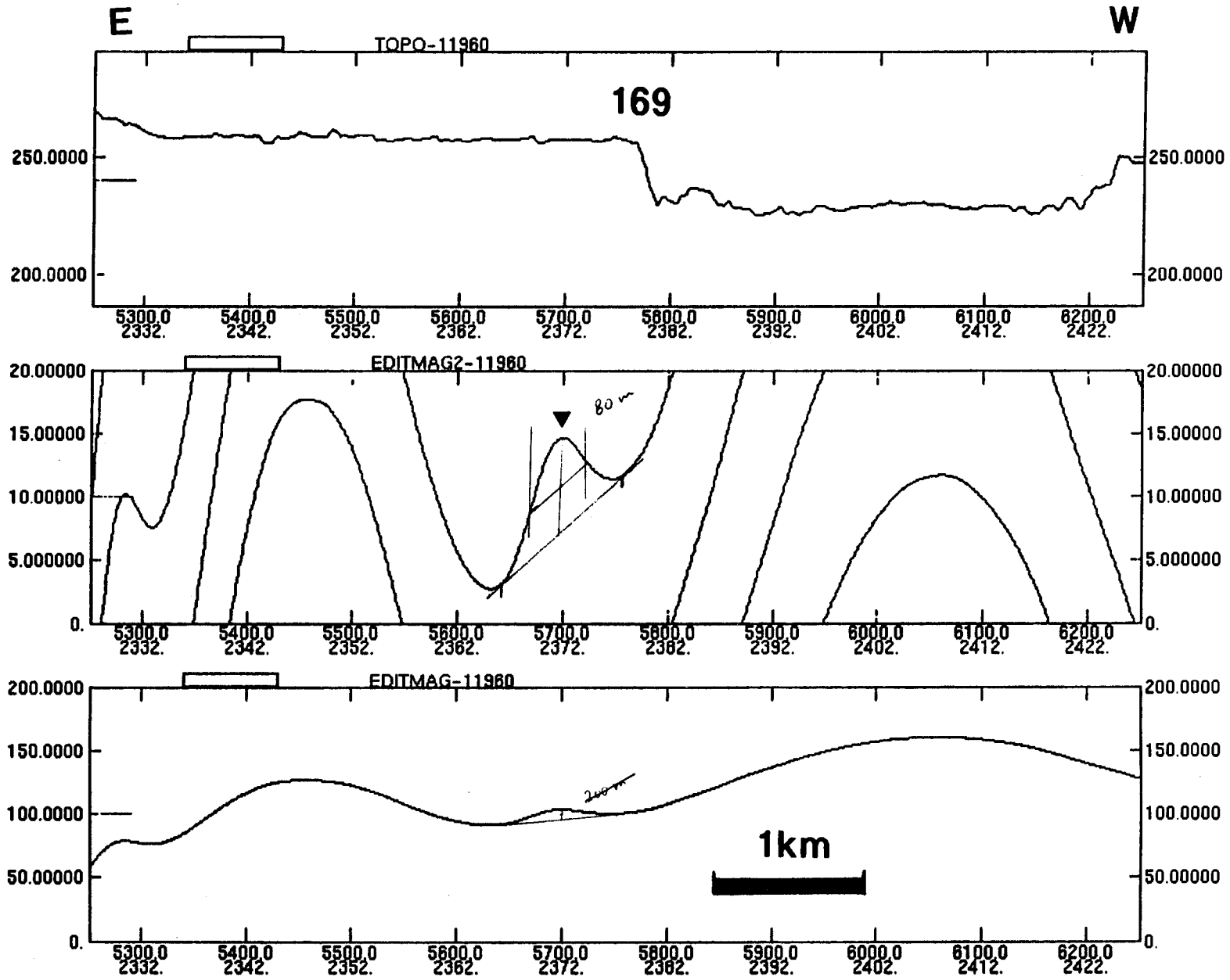
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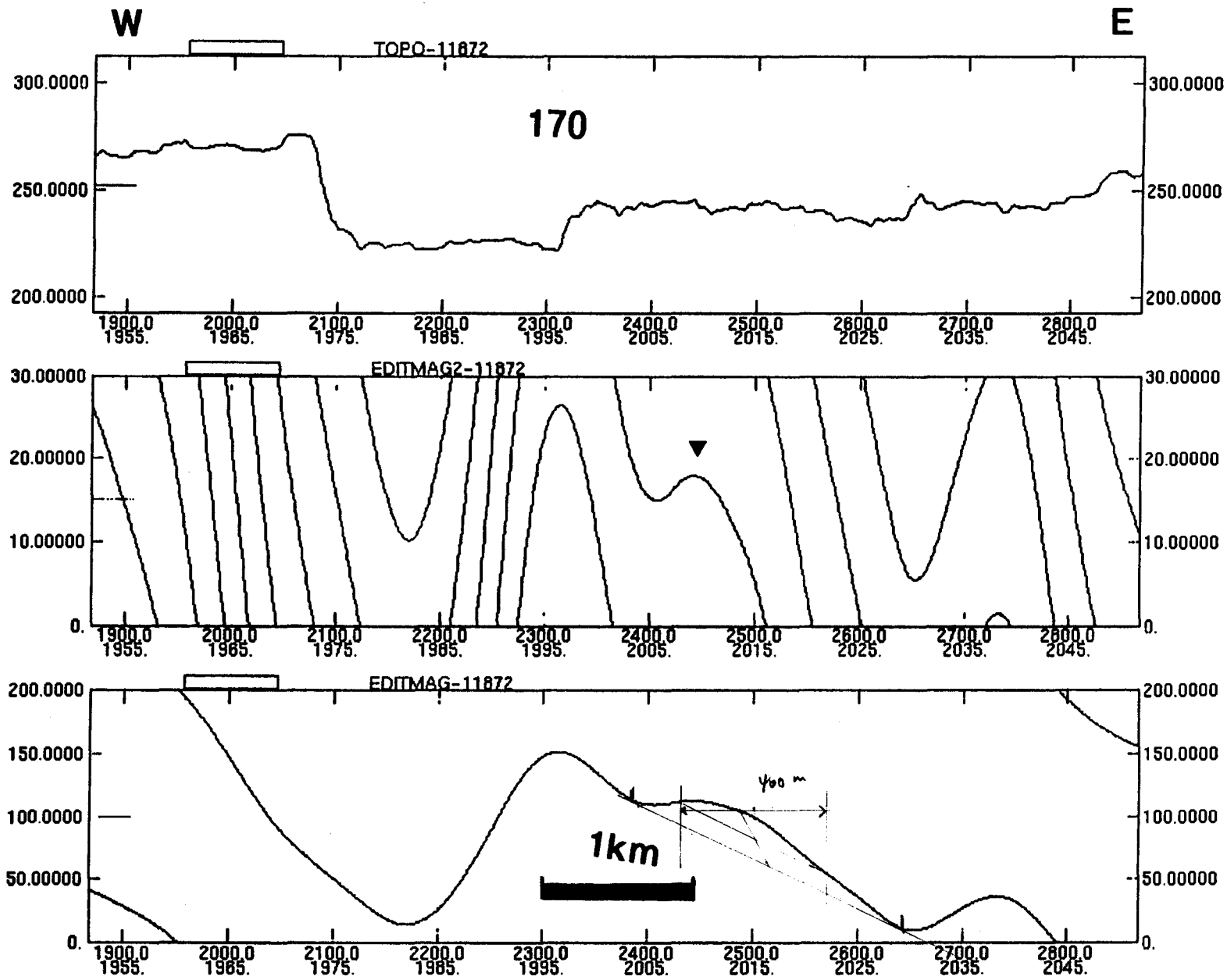
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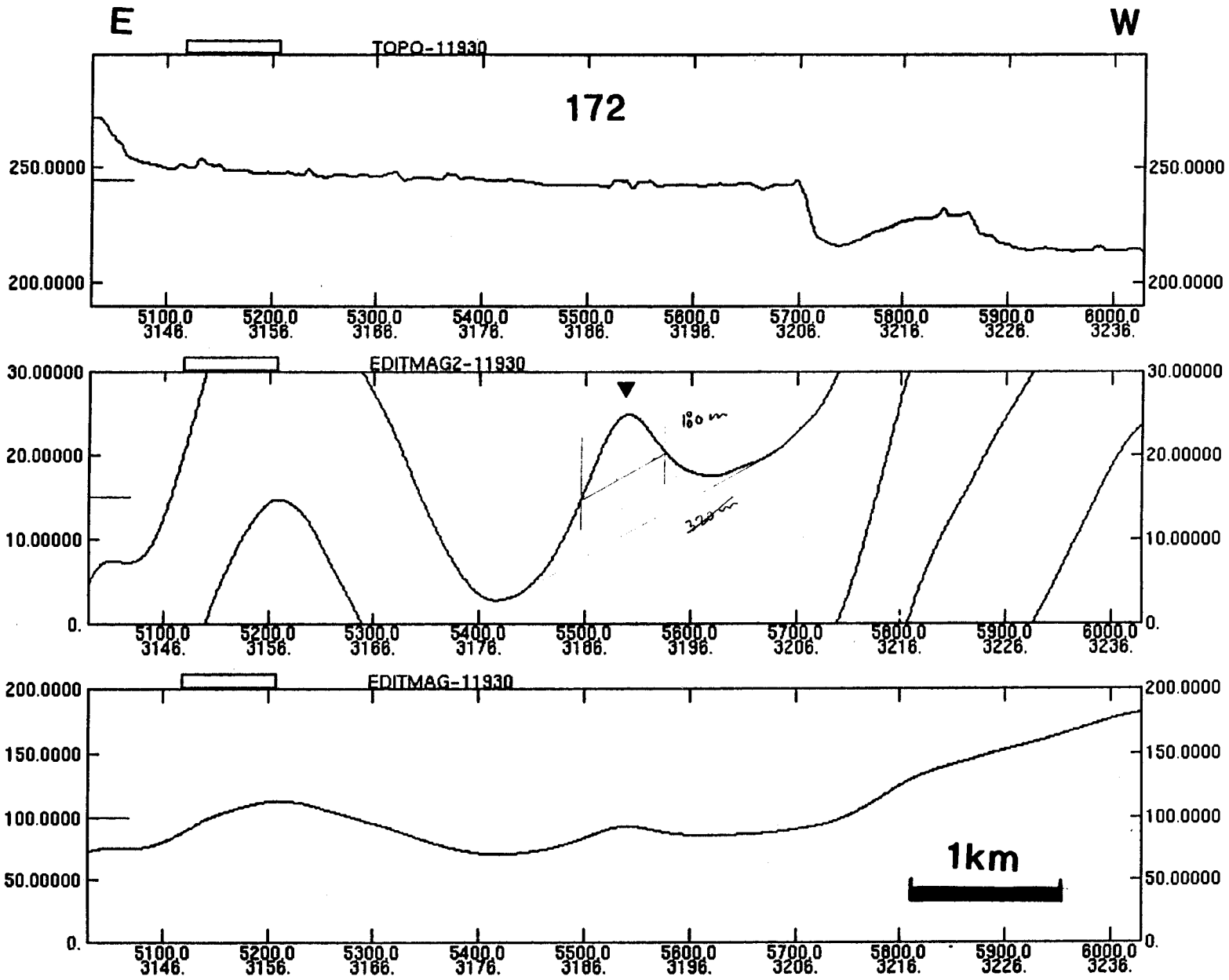
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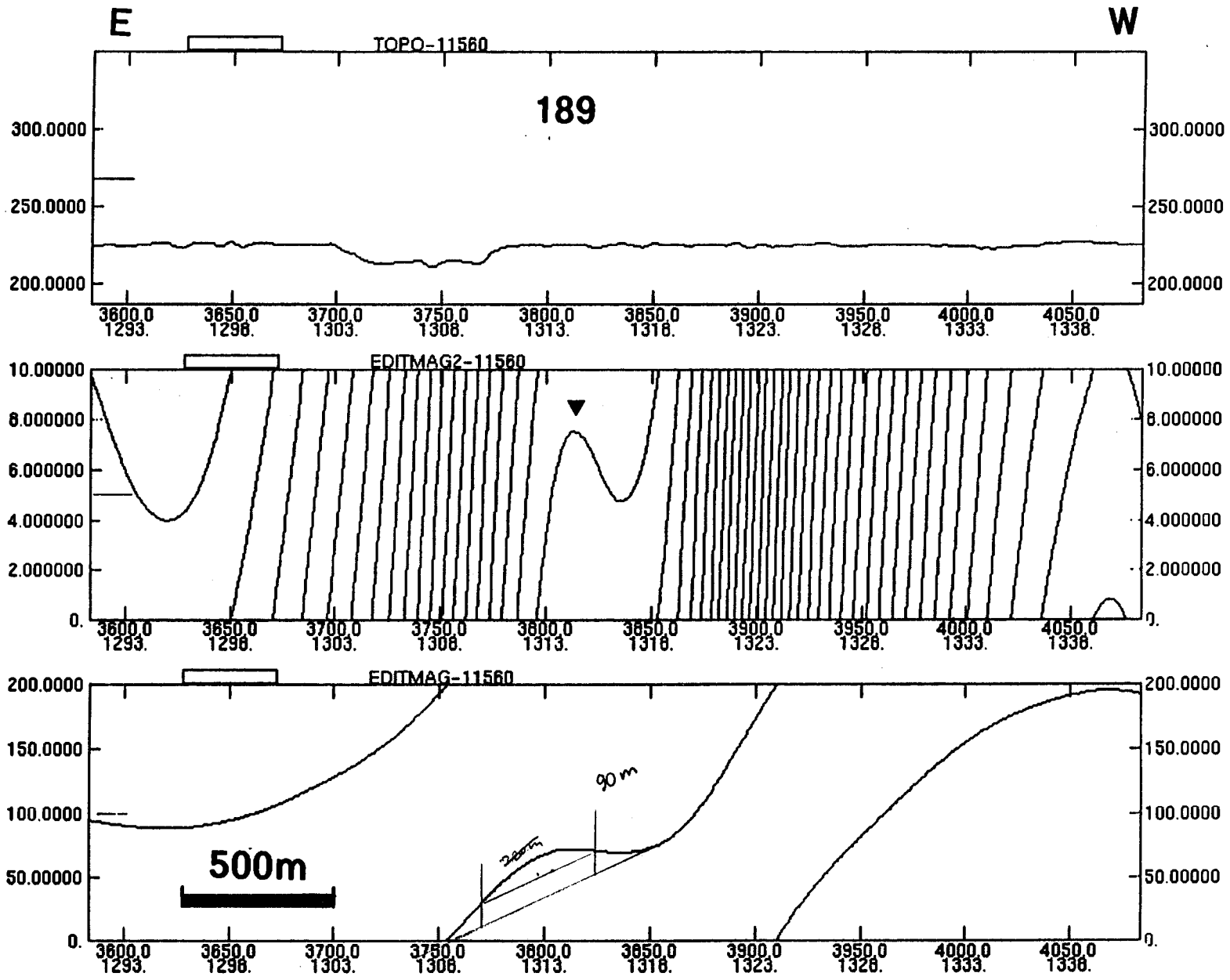
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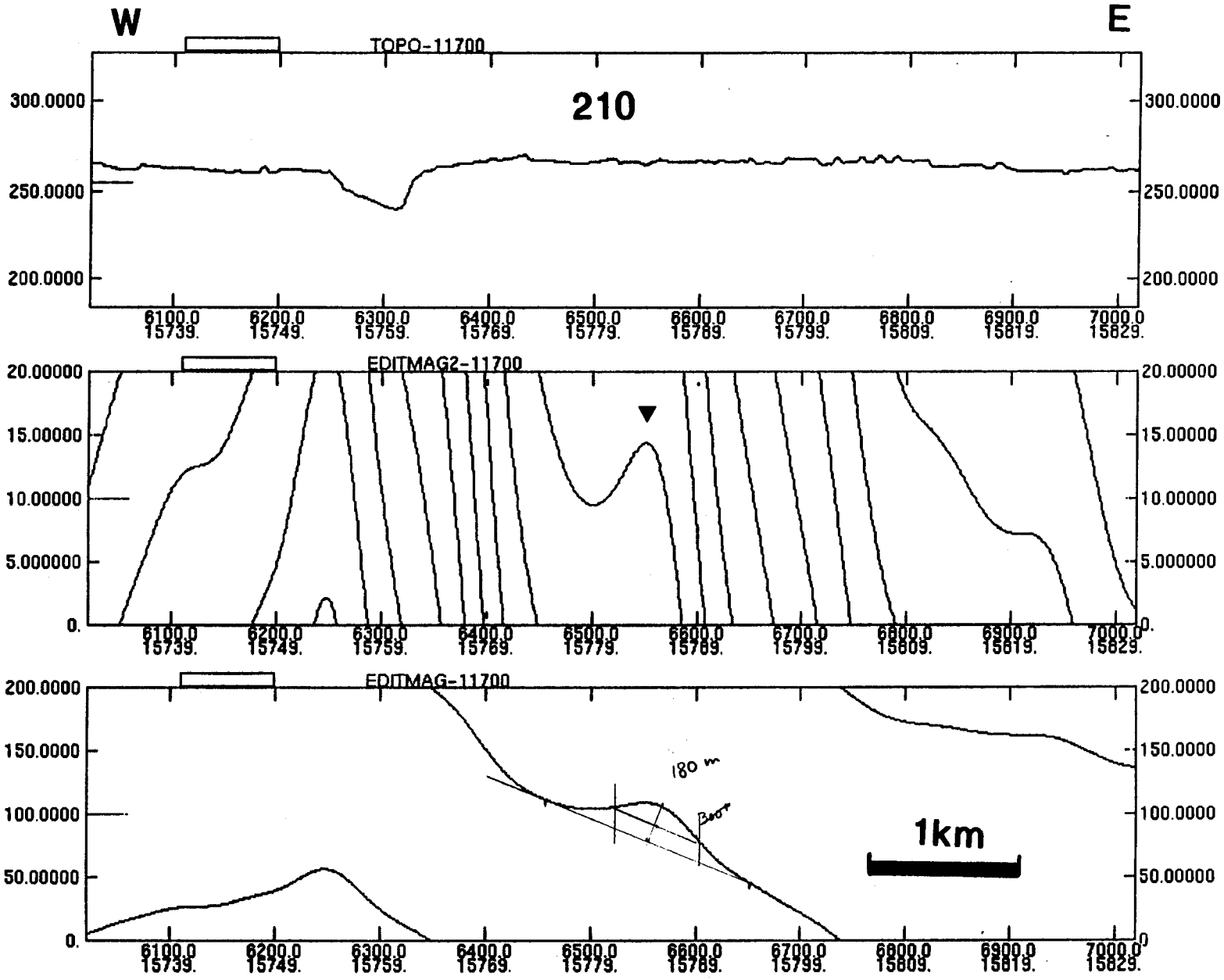
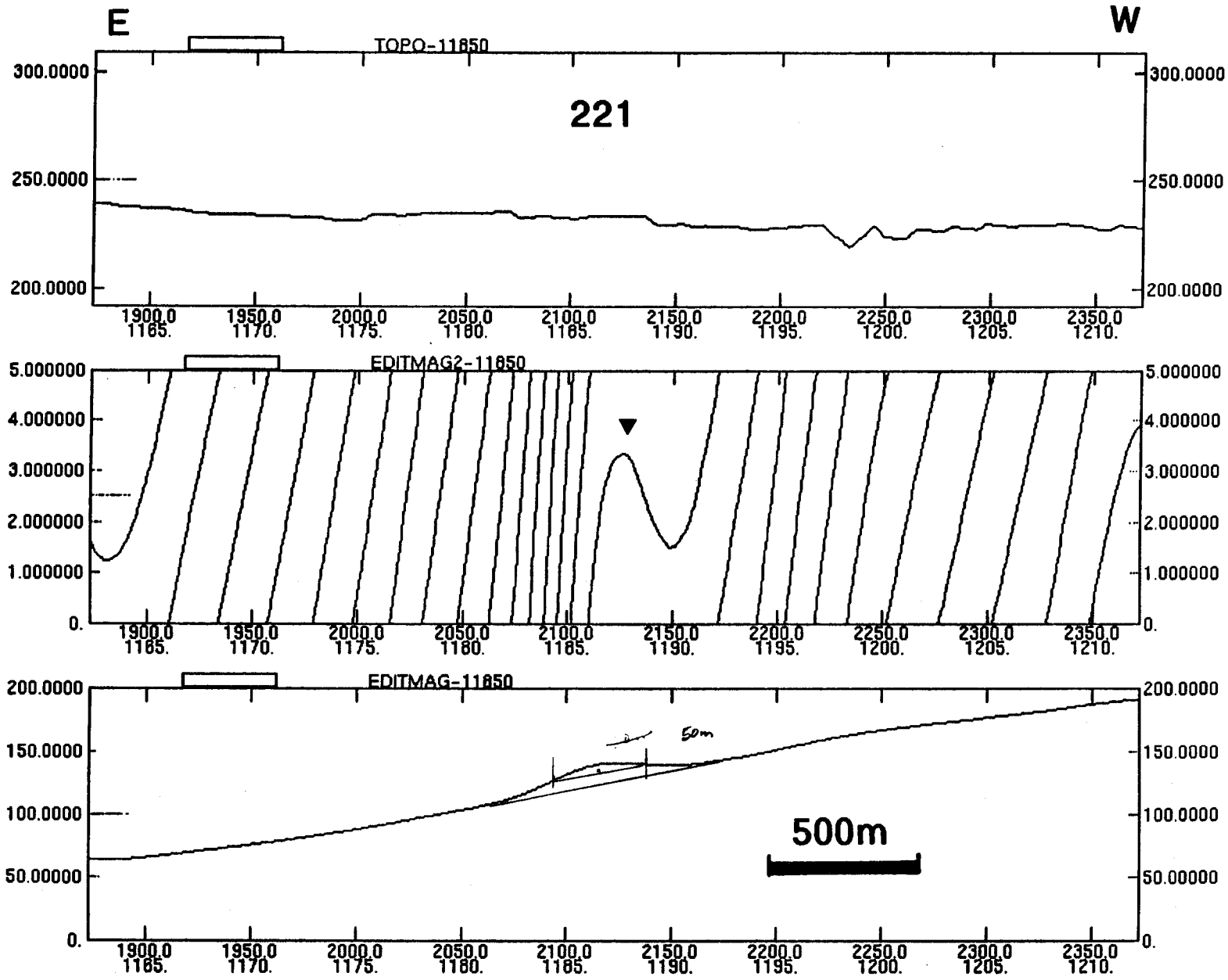
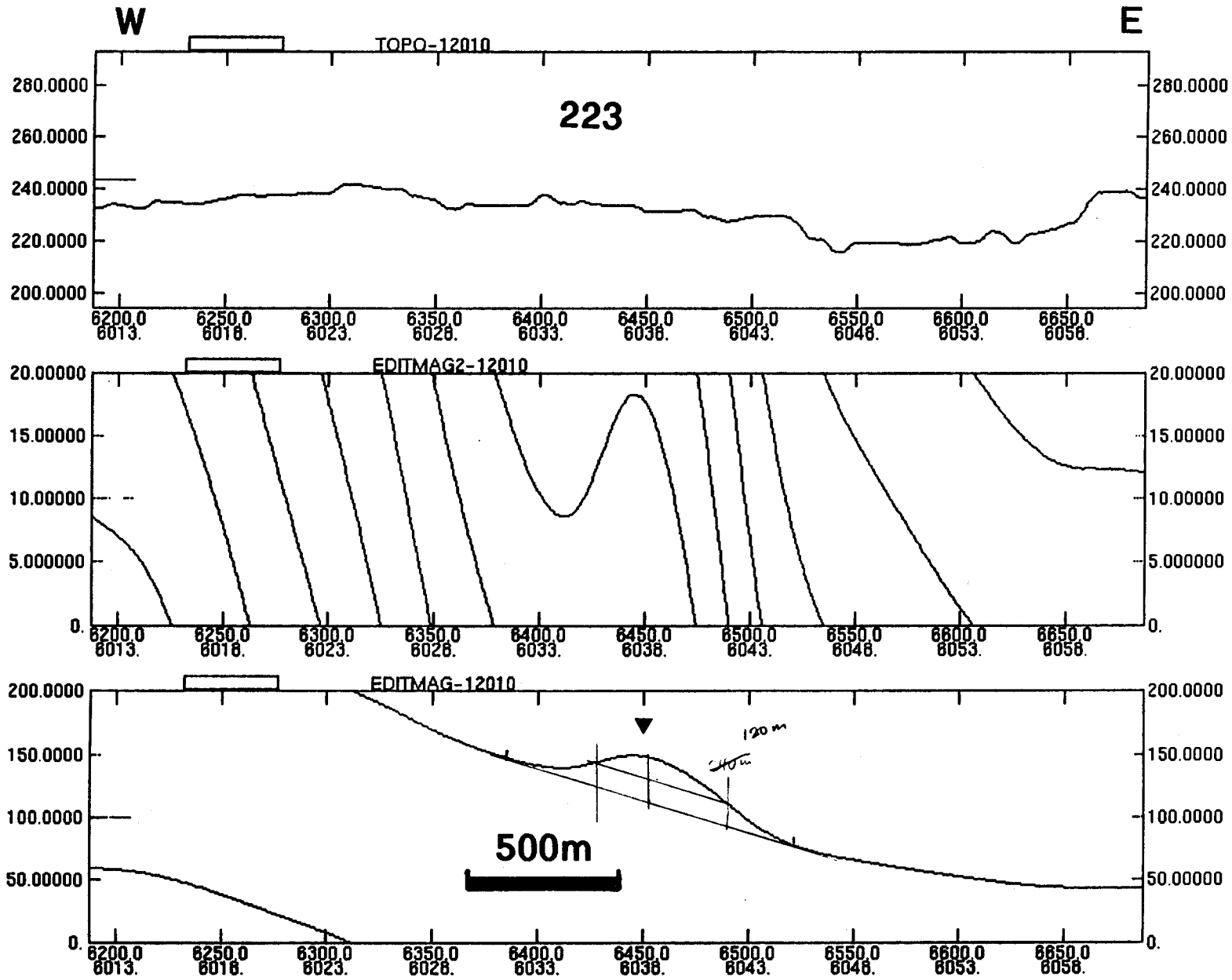
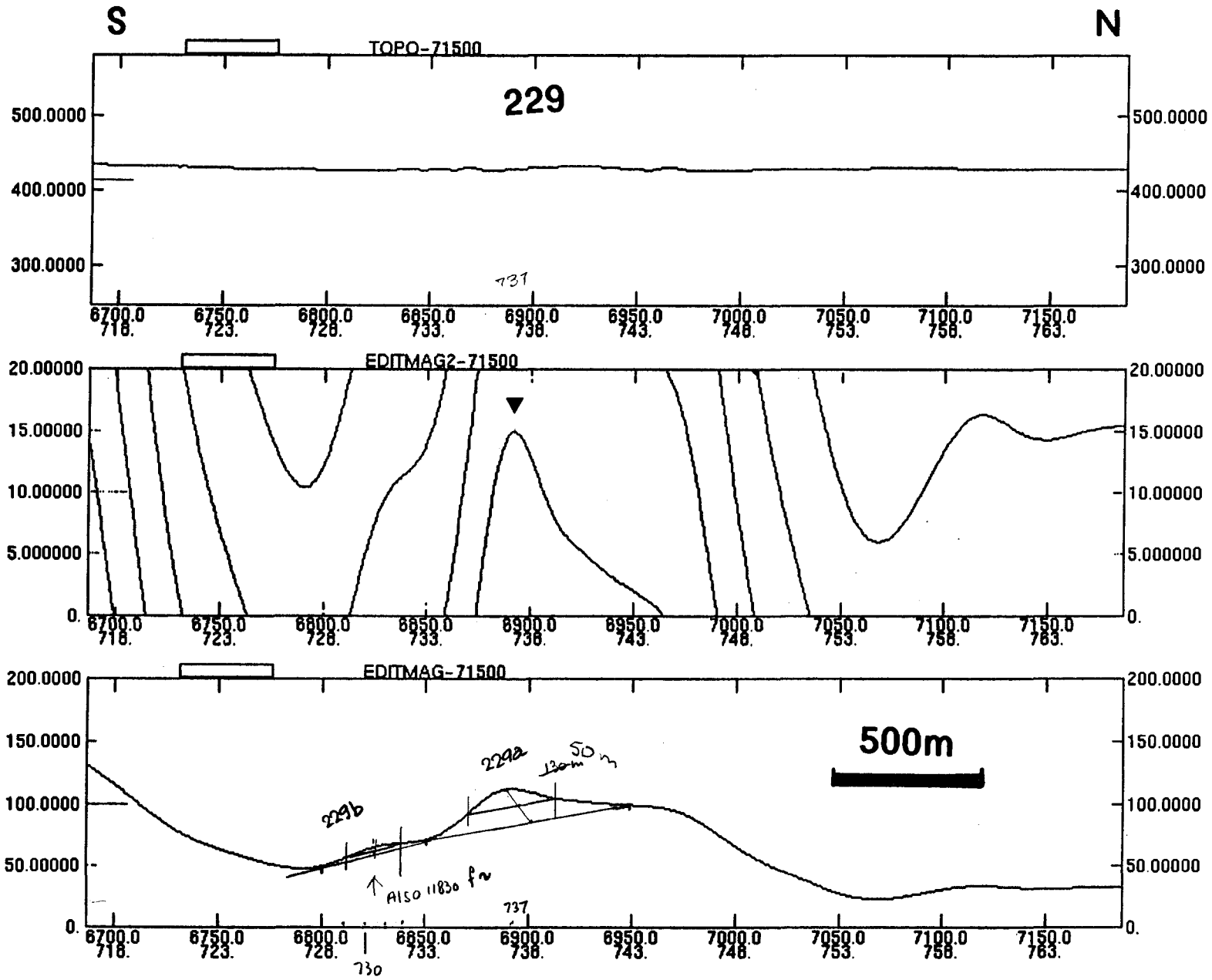
90 m
500m

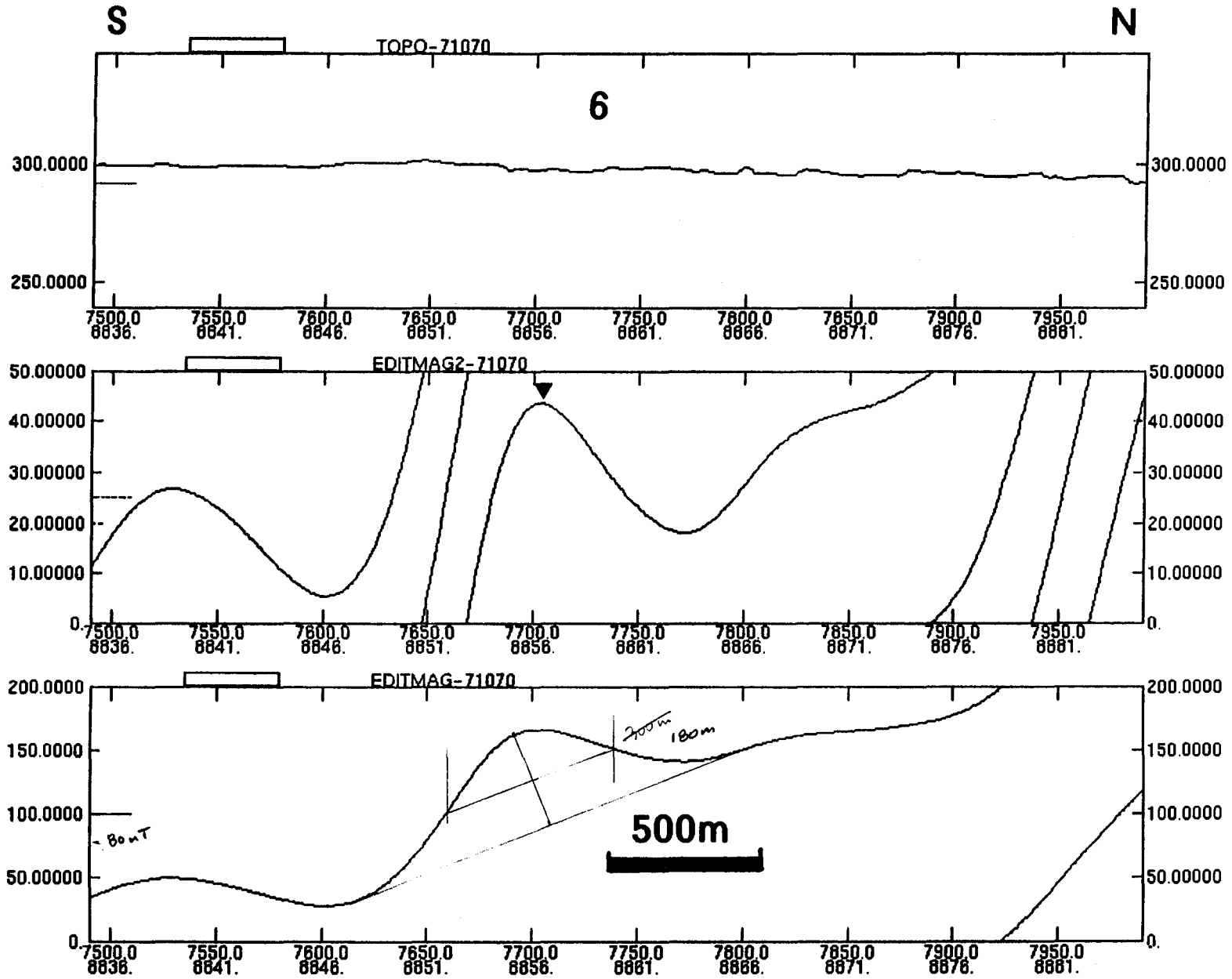

W
E
TOPO-11700
210
300.0000
250.0000
200.0000
6100.0 15739.
6200.0 15749.
6300.0 15759.
6400.0 15769.
6500.0 15779.
6600.0 15789.
6700.0 15799.
6800.0 15809.
6900.0 15819.
7000.0 15829.
EDITMAG2-11700
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-11700
200.0000
150.0000
100.0000
50.00000
180 m
1km

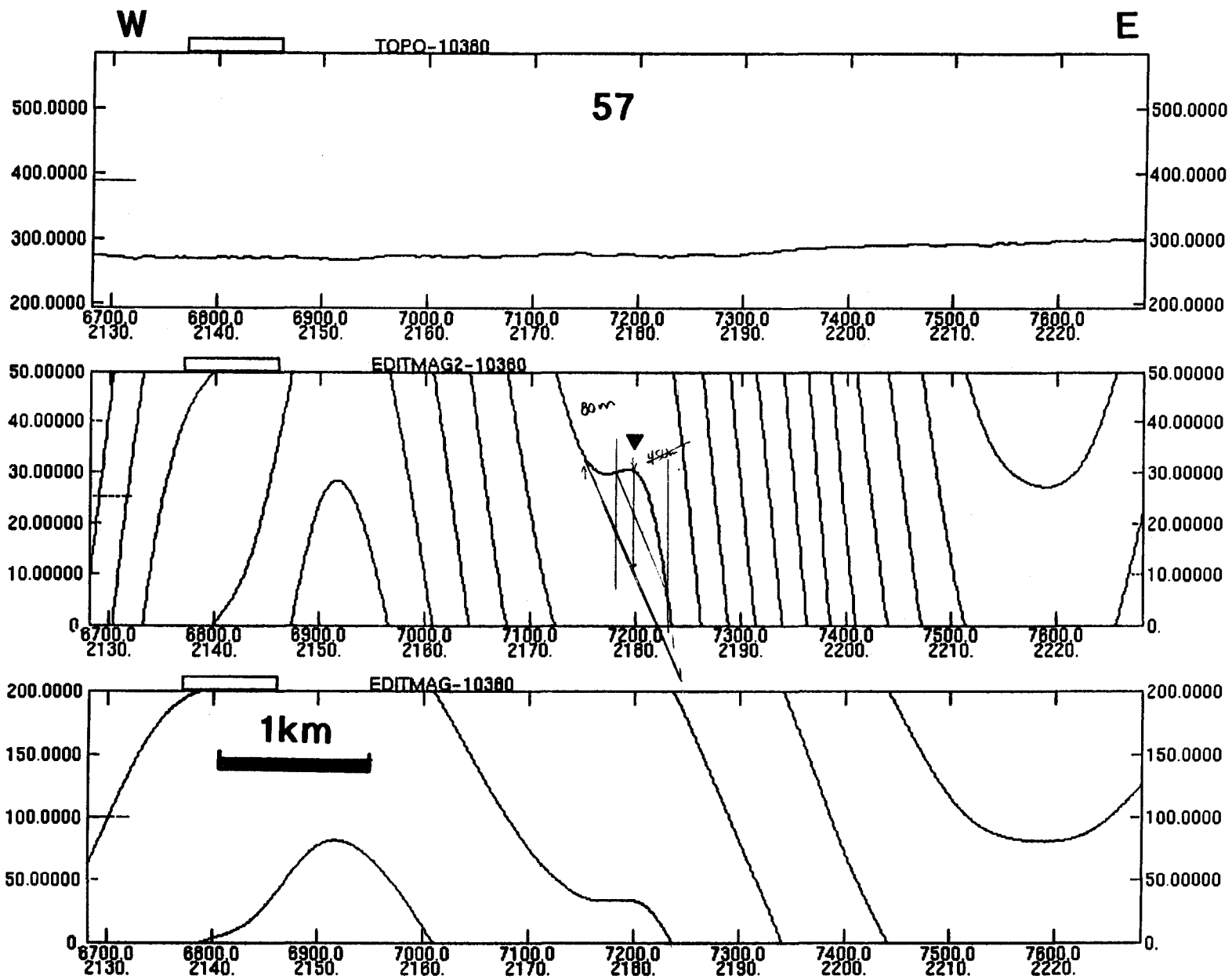

E
W
TOPO-11850
221
300.0000
250.0000
200.0000
1900.0 1165.
1950.0 1170.
2000.0 1175.
2050.0 1180.
2100.0 1185.
2150.0 1190.
2200.0 1195.
2250.0 1200.
2300.0 1205.
2350.0 1210.
EDITMAG2-11850
5.000000
4.000000
3.000000
2.000000
1.000000
0.
EDITMAG-11850
200.0000
150.0000
100.0000
50.00000
0.
50m
500m

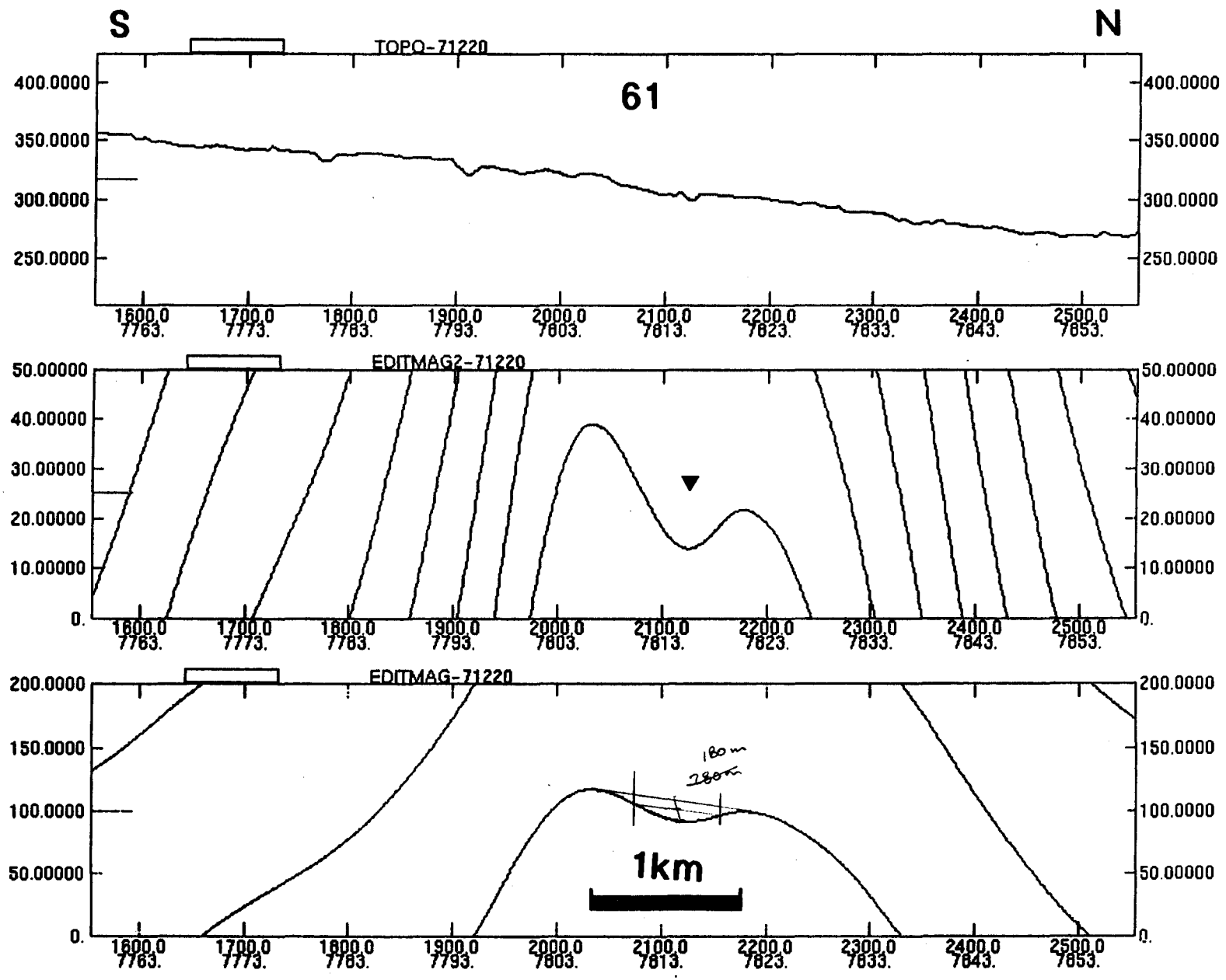

W
E
TOPO-12010
223
280.0000
260.0000
240.0000
220.0000
200.0000
6200.0 6013.
6250.0 6018.
6300.0 6023.
6350.0 6028.
6400.0 6033.
6450.0 6038.
6500.0 6043.
6550.0 6048.
6600.0 6053.
6650.0 6058.
EDITMAG2-12010
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-12010
200.0000
150.0000
100.0000
50.00000
0.
120 m
500m

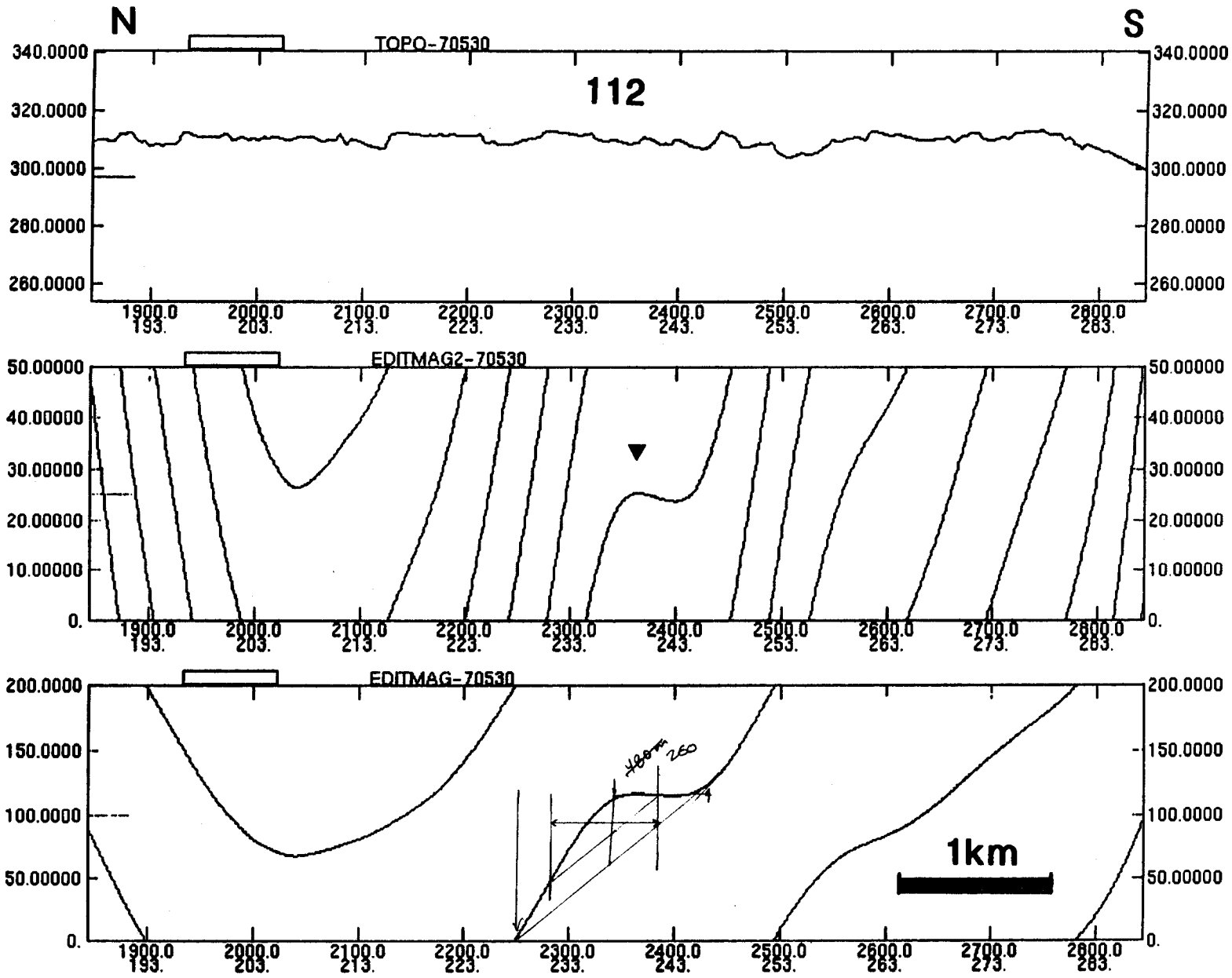

S
N
TOPO-71500
229
500.0000
400.0000
300.0000
737
6700.0 718.
6750.0 723.
6800.0 728.
6850.0 733.
6900.0 738.
6950.0 743.
7000.0 748.
7050.0 753.
7100.0 758.
7150.0 763.
EDITMAG2-71500
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-71500
200.0000
150.0000
100.0000
50.00000
500m
229a
229b
50 m
130m
Also 11830 fn
730

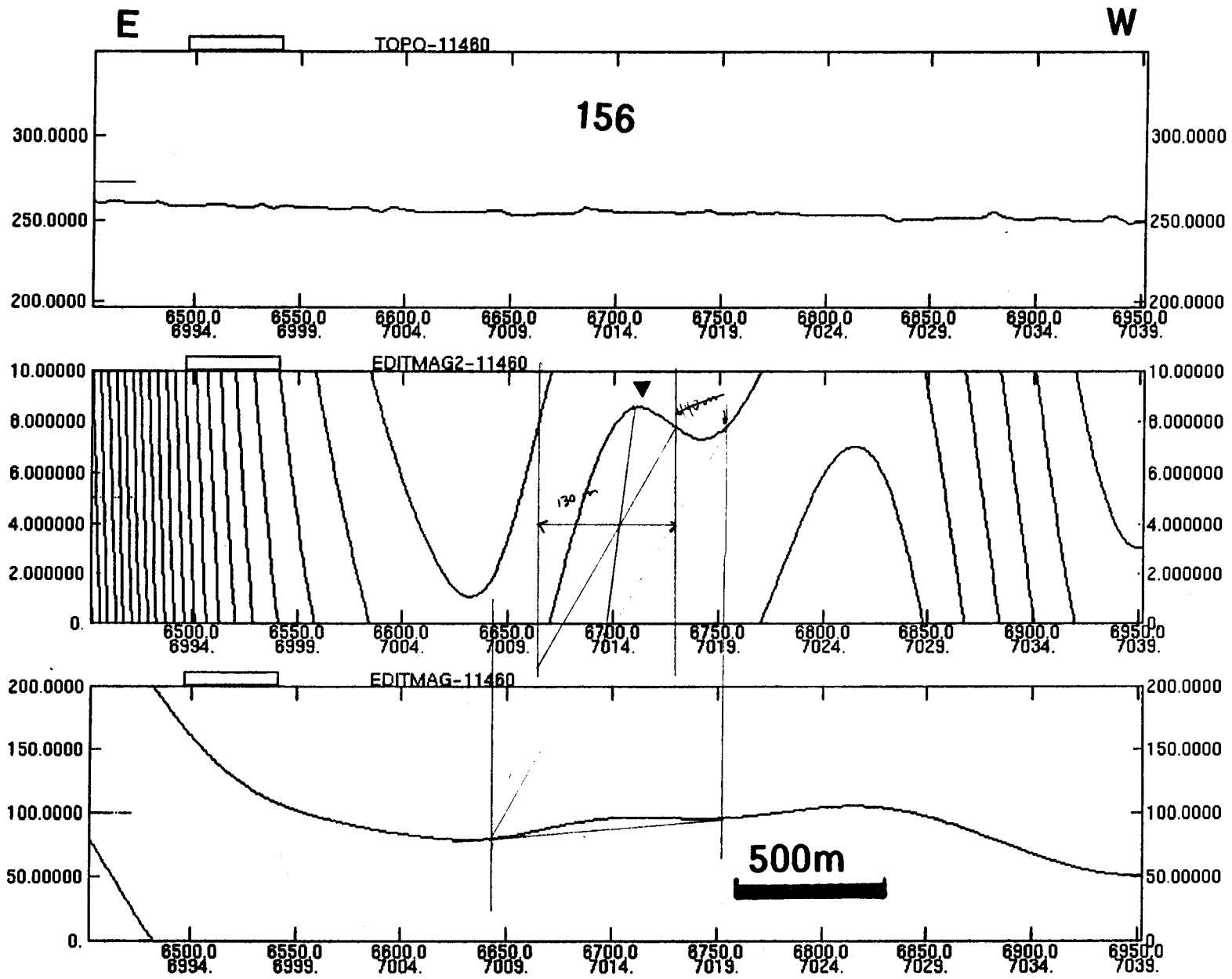
PRIORITY I-2

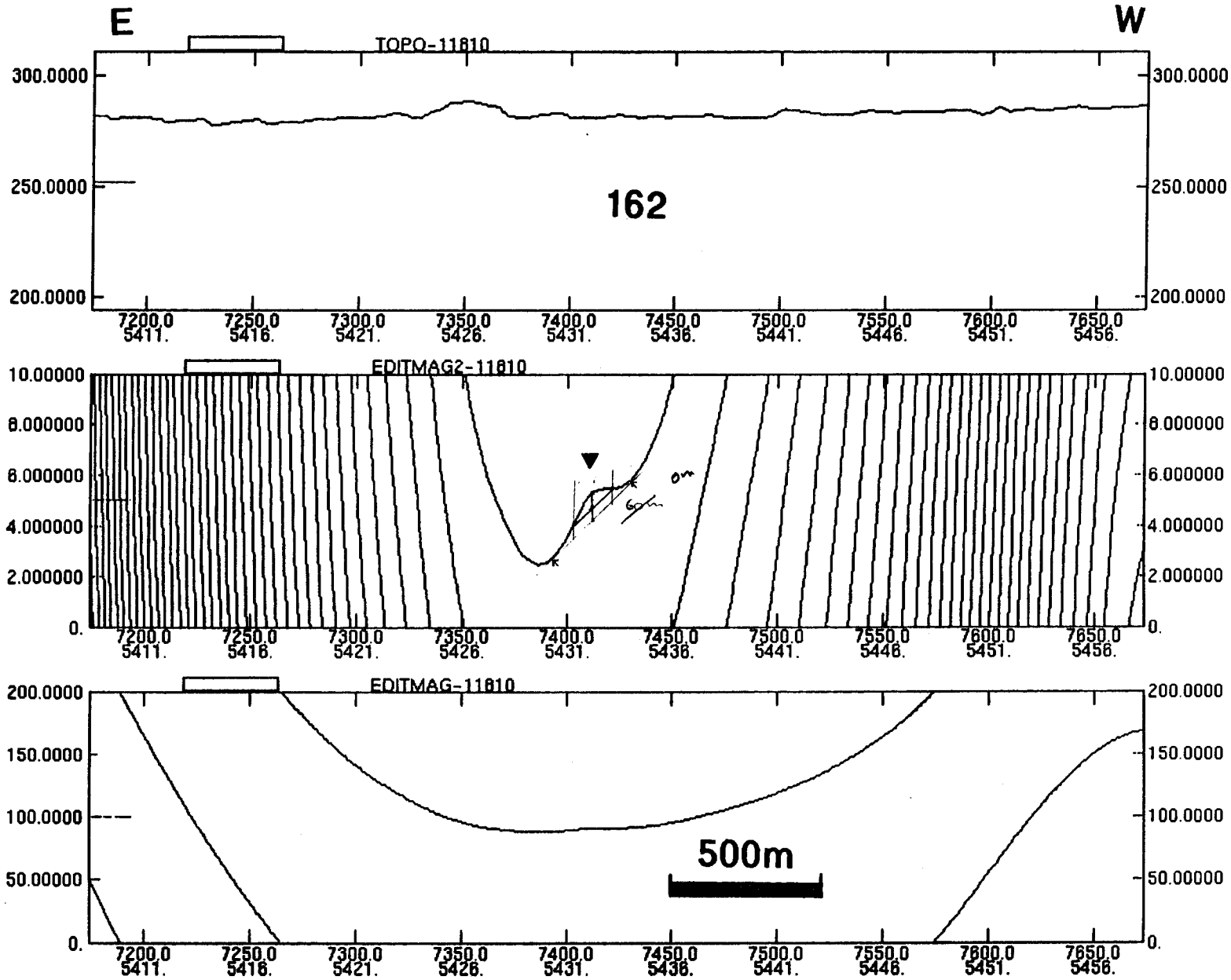

S
N
TOPO-71070
6
300.0000
250.0000
EDITMAG2-71070
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-71070
200.0000
150.0000
100.0000
50.00000
0.
-80nT
200m
180m
500m
7500.0
7550.0
7600.0
7650.0
7700.0
7750.0
7800.0
7850.0
7900.0
7950.0
8836.
8841.
8846.
8851.
8856.
8861.
8866.
8871.
8876.
8881.


W
E
TOPO-10380
57
500.0000
400.0000
300.0000
200.0000
6700.0 2130.
6800.0 2140.
6900.0 2150.
7000.0 2160.
7100.0 2170.
7200.0 2180.
7300.0 2190.
7400.0 2200.
7500.0 2210.
7600.0 2220.
EDITMAG2-10380
50.00000
40.00000
30.00000
20.00000
10.00000
0
80m
EDITMAG-10380
200.0000
150.0000
100.0000
50.00000
0.
1km

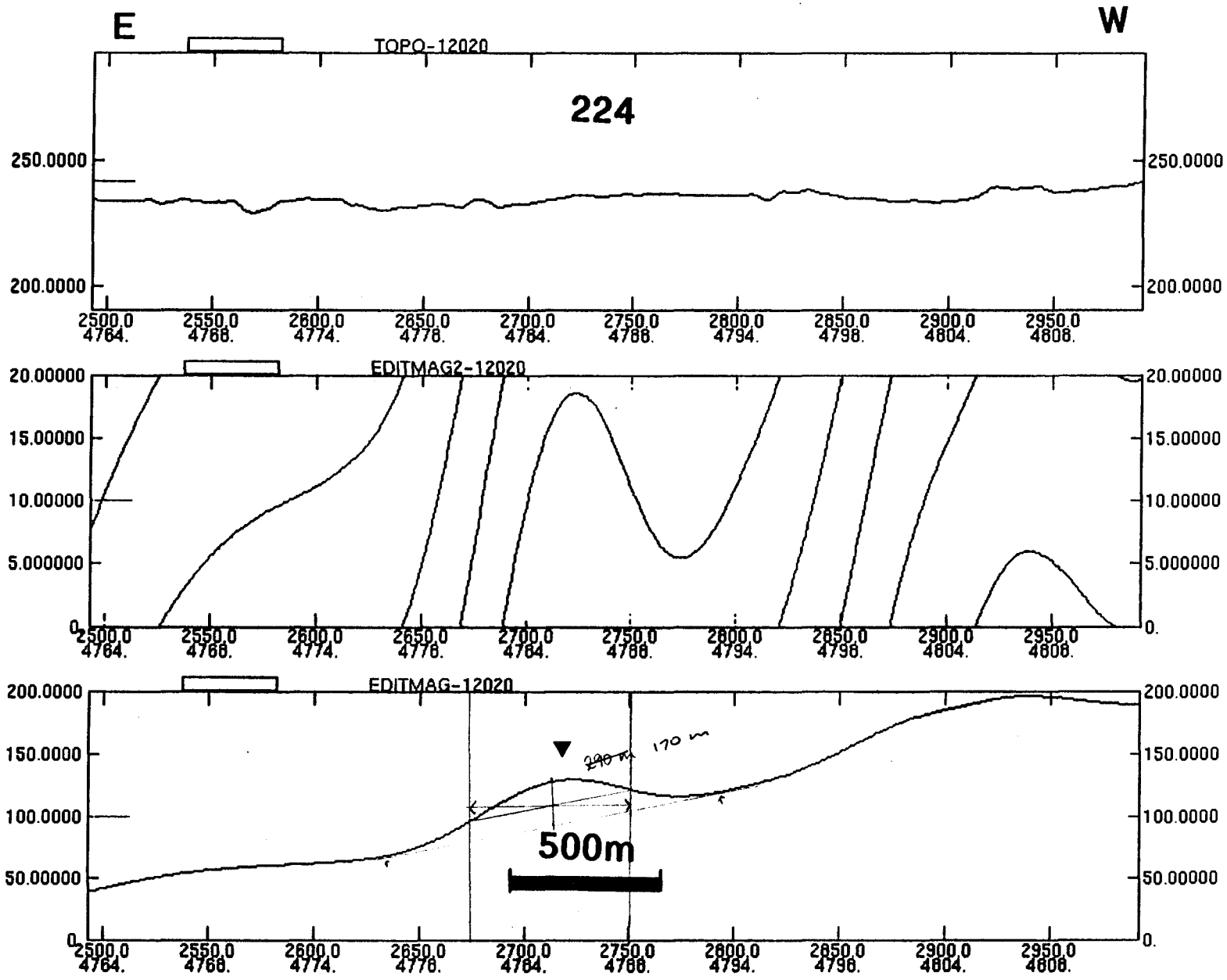

S
N
TOPO-71220
61
400.0000
350.0000
300.0000
250.0000
1600.0 7763.
1700.0 7773.
1800.0 7783.
1900.0 7793.
2000.0 7803.
2100.0 7813.
2200.0 7823.
2300.0 7833.
2400.0 7843.
2500.0 7853.
EDITMAG2-71220
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-71220
200.0000
150.0000
100.0000
50.00000
0.
180m
280m
1km

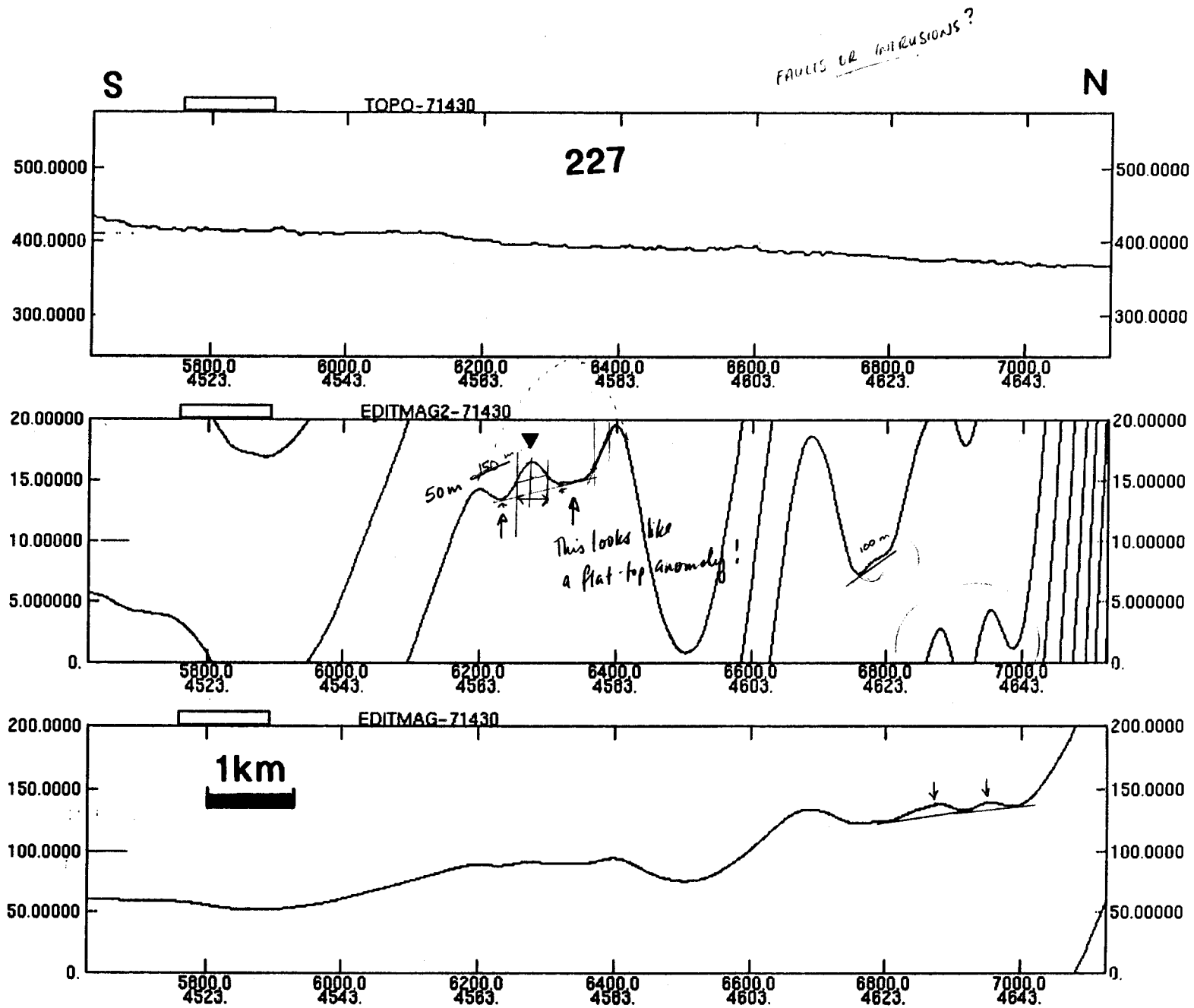

N
S
TOPO-70530
112
340.0000
320.0000
300.0000
280.0000
260.0000
1900.0 193.
2000.0 203.
2100.0 213.
2200.0 223.
2300.0 233.
2400.0 243.
2500.0 253.
2600.0 263.
2700.0 273.
2800.0 283.
EDITMAG2-70530
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-70530
200.0000
150.0000
100.0000
50.00000
0.
1km

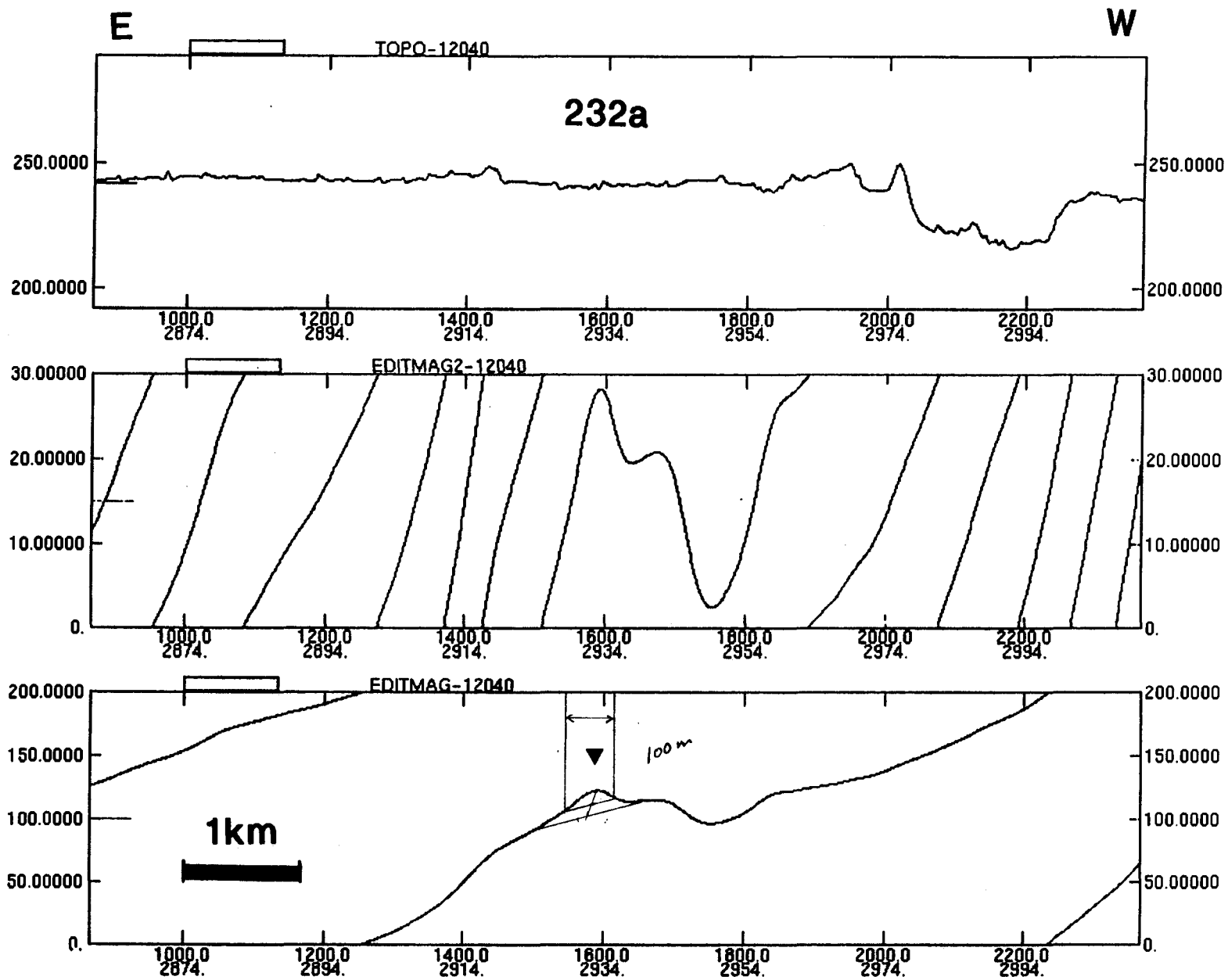

E
W
TOPO-11460
156
300.0000
250.0000
200.0000
6500.0 6994.
6550.0 6999.
6600.0 7004.
6650.0 7009.
6700.0 7014.
6750.0 7019.
6800.0 7024.
6850.0 7029.
6900.0 7034.
6950.0 7039.
EDITMAG2-11460
10.00000
8.000000
6.000000
4.000000
2.000000
0.
130
EDITMAG-11460
200.0000
150.0000
100.0000
50.00000
0.
500m



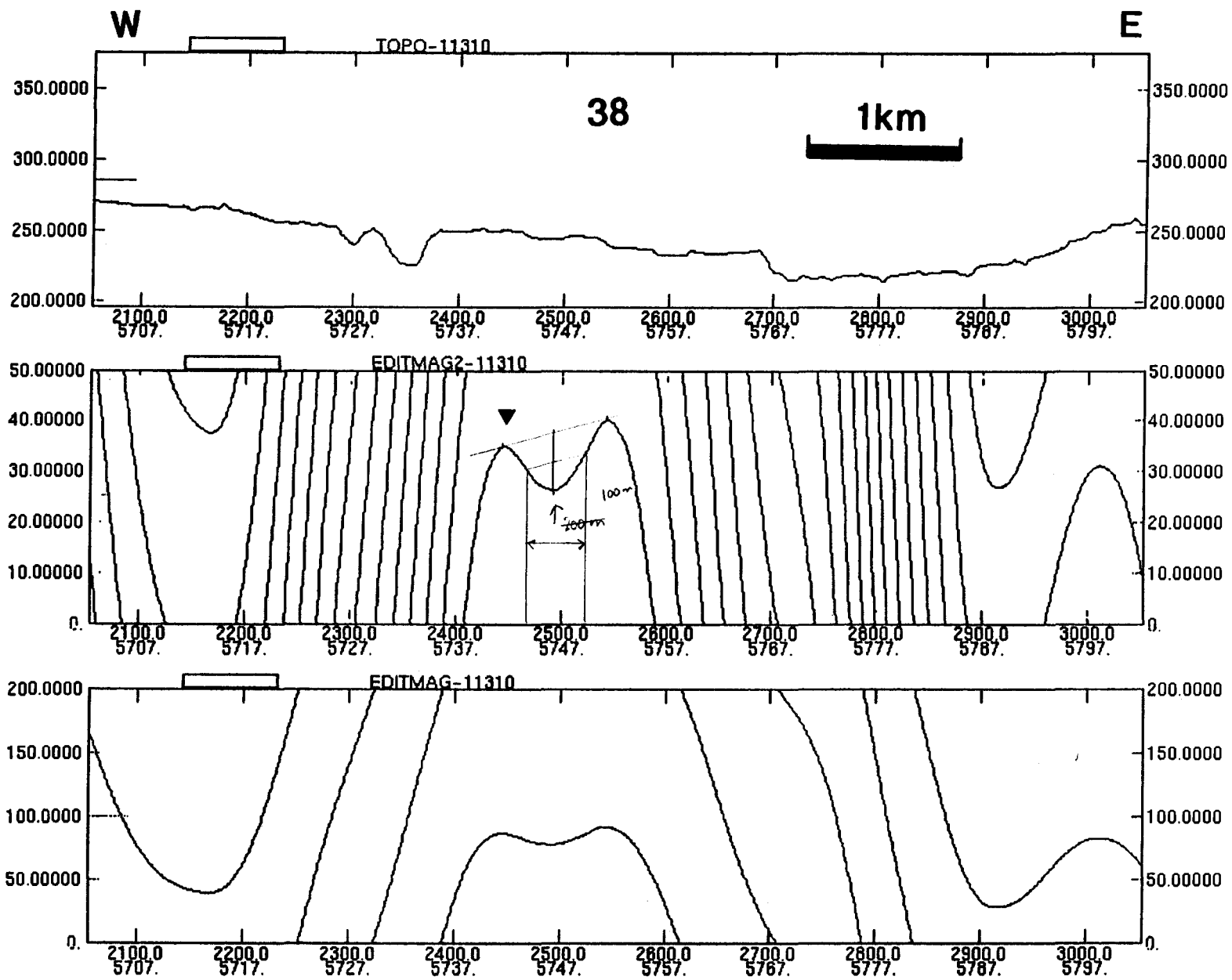
should be looking at
L11800
f 5840

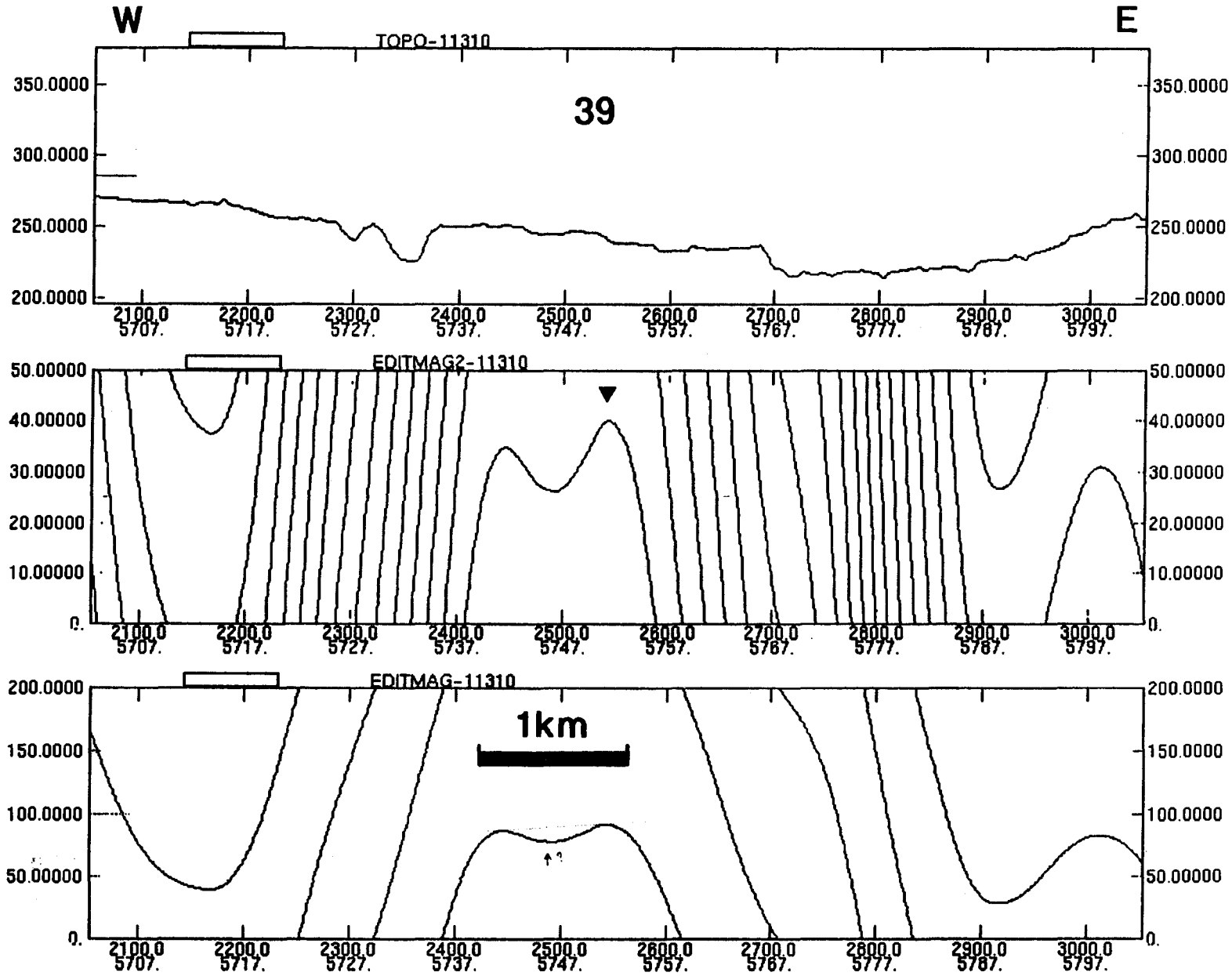

E
W
TOPO-12020
224
250.0000
200.0000
2500.0 4764.
2550.0 4766.
2600.0 4774.
2650.0 4776.
2700.0 4784.
2750.0 4786.
2800.0 4794.
2850.0 4796.
2900.0 4804.
2950.0 4806.
EDITMAG2-12020
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-12020
200.0000
150.0000
100.0000
50.00000
0.
170 m
500m

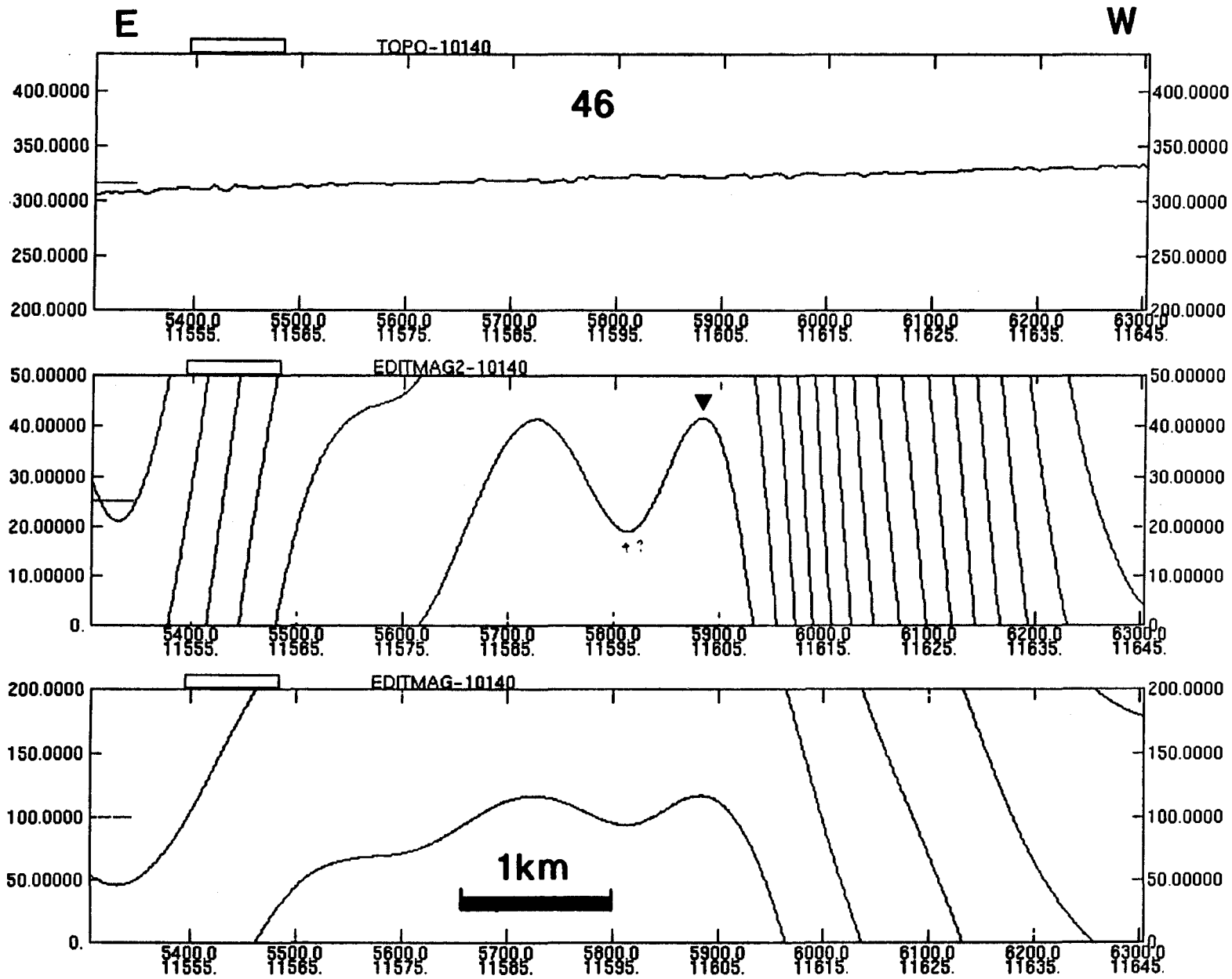

FAULTS OR INTRUSIONS?
S
N
TOPO-71430
227
500.0000
400.0000
300.0000
5800.0 4523.
6000.0 4543.
6200.0 4563.
6400.0 4583.
6600.0 4603.
6800.0 4623.
7000.0 4643.
EDITMAG2-71430
20.00000
15.00000
10.00000
5.000000
0.
50m
150
This looks like a flat-top anomaly!
100m
EDITMAG-71430
200.0000
150.0000
100.0000
50.00000
1km

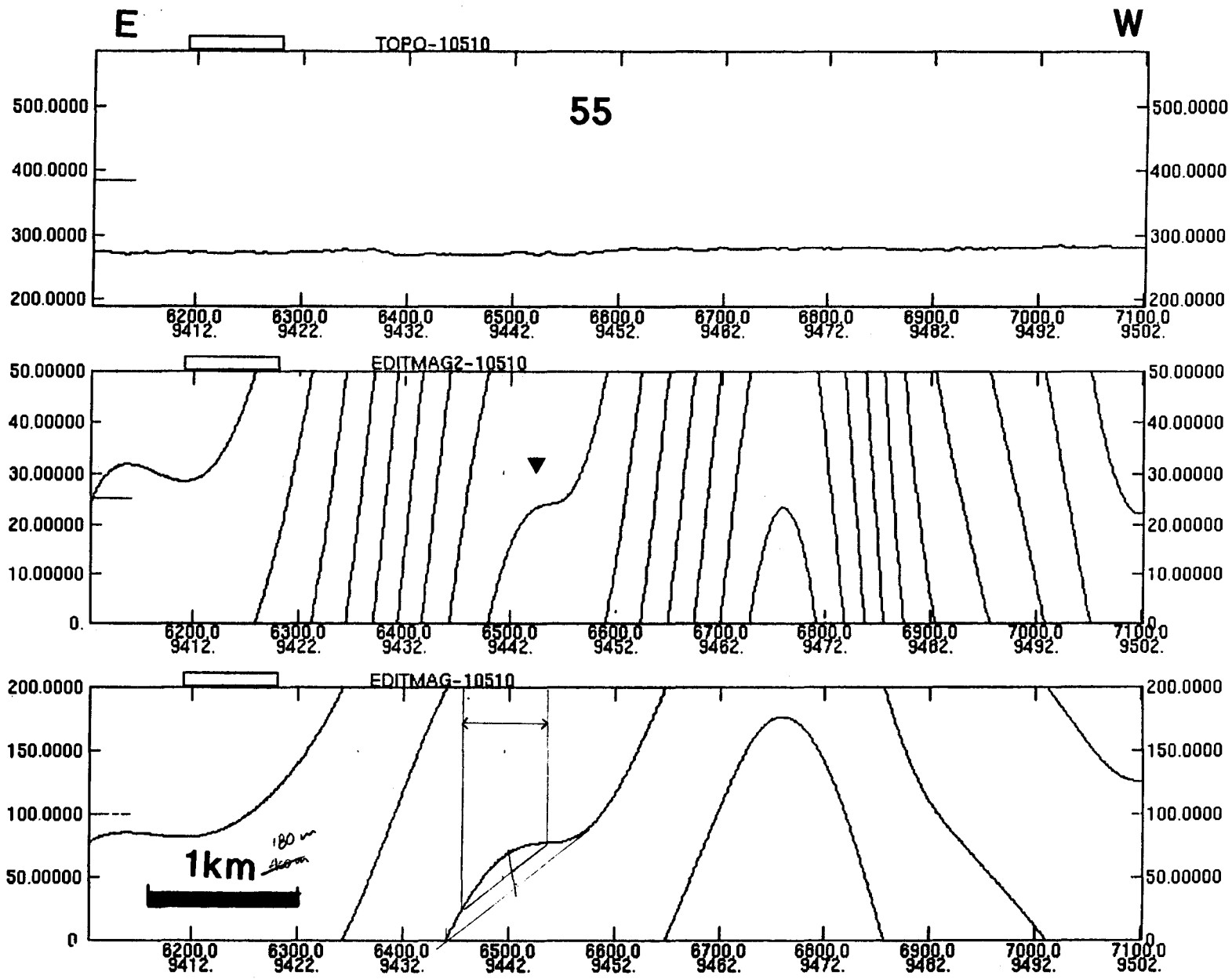

E
W
TOPO-12040
232a
250.0000
200.0000
1000.0 2874.
1200.0 2894.
1400.0 2914.
1600.0 2934.
1800.0 2954.
2000.0 2974.
2200.0 2994.
EDITMAG2-12040
30.00000
20.00000
10.00000
0.
EDITMAG-12040
150.0000
100.0000
50.00000
1km
100 m

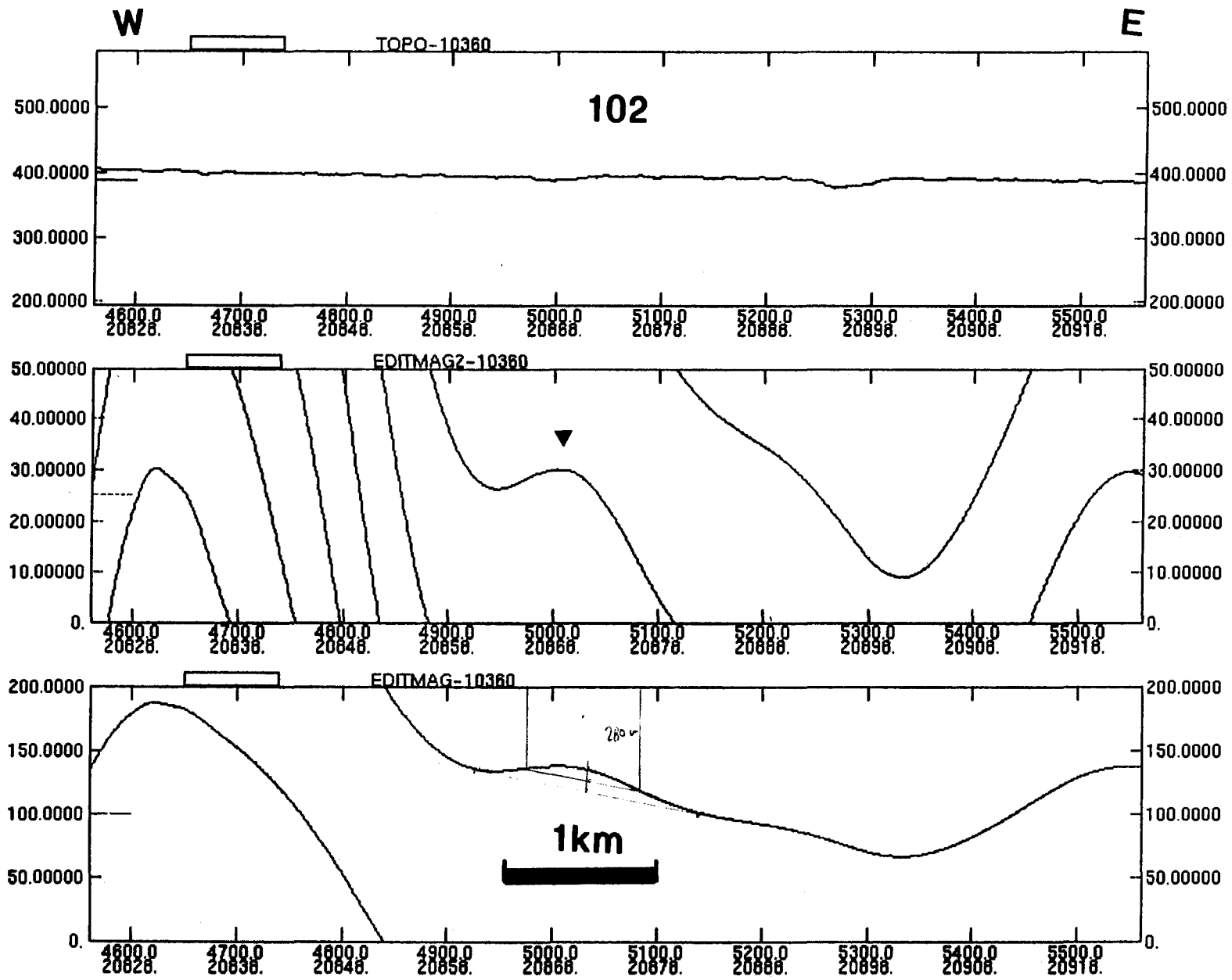
PRIORITY II

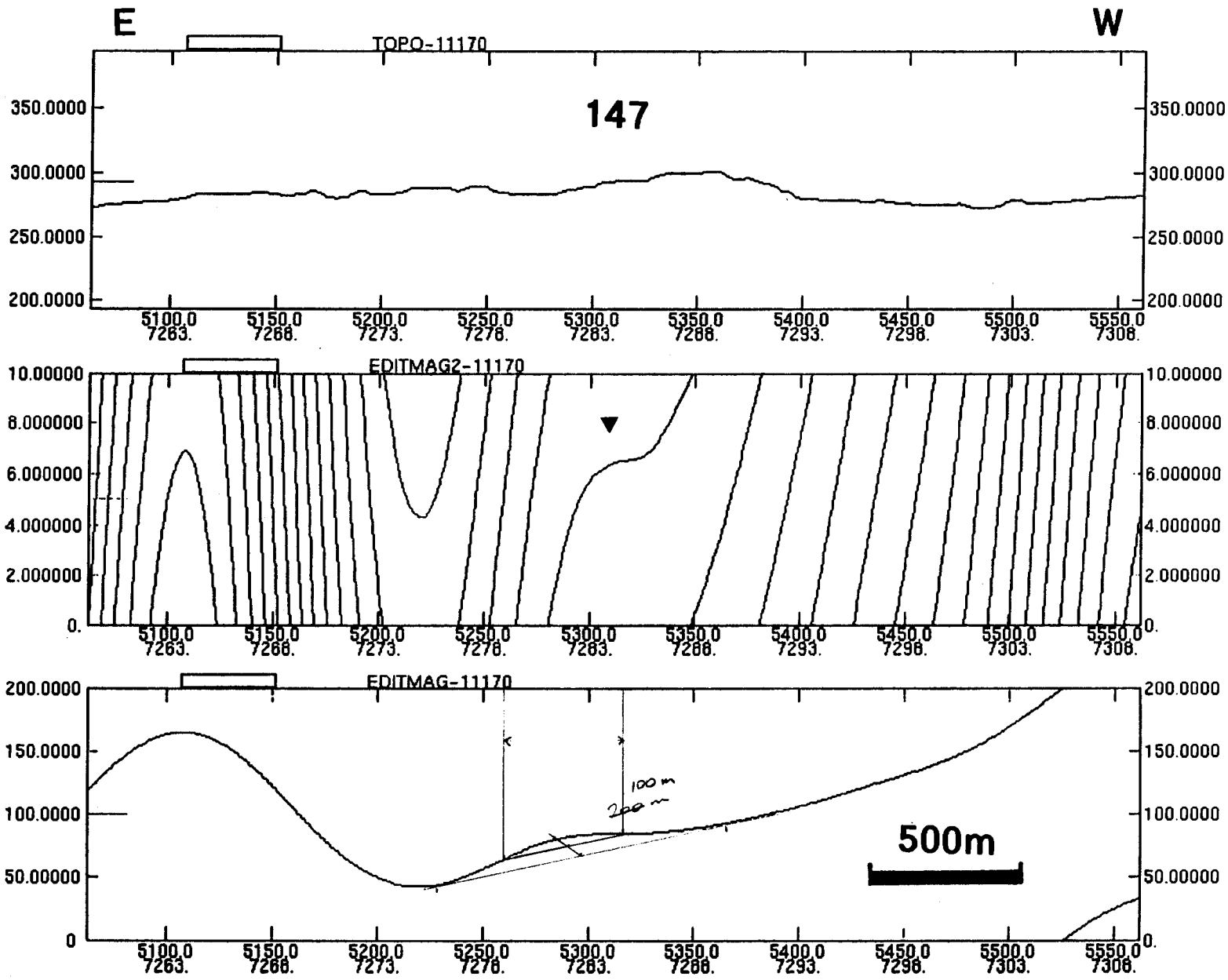

W
E
TOPO-11310
38
1km
350.0000
300.0000
250.0000
200.0000
2100.0 5707.
2200.0 5717.
2300.0 5727.
2400.0 5737.
2500.0 5747.
2600.0 5757.
2700.0 5767.
2800.0 5777.
2900.0 5787.
3000.0 5797.
EDITMAG2-11310
50.00000
40.00000
30.00000
20.00000
10.00000
0.
100m
100m
EDITMAG-11310
200.0000
150.0000
100.0000
50.00000
0.

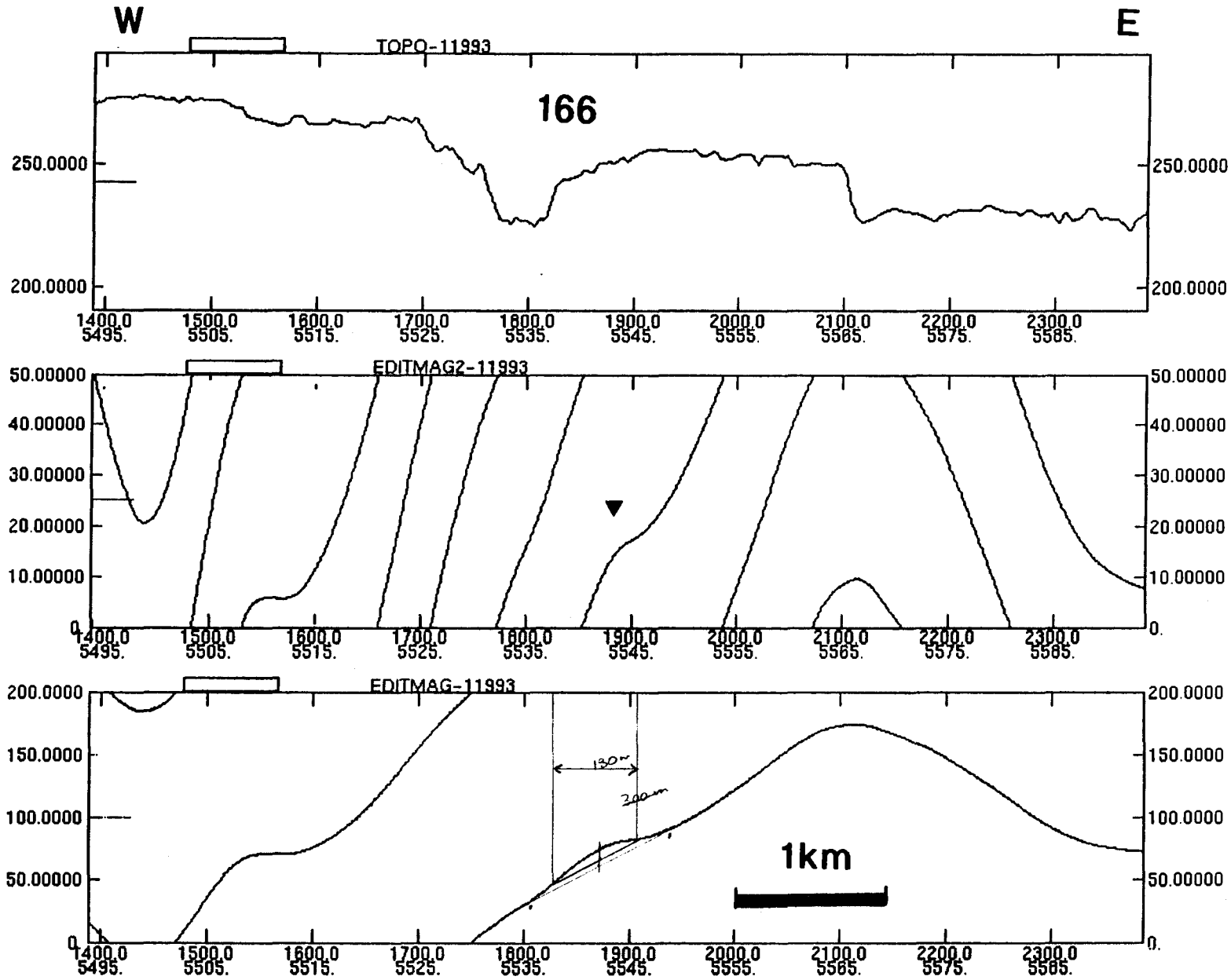

W
E
TOPO-11310
39
350.0000
300.0000
250.0000
200.0000
2100.0 5707.
2200.0 5717.
2300.0 5727.
2400.0 5737.
2500.0 5747.
2600.0 5757.
2700.0 5767.
2800.0 5777.
2900.0 5787.
3000.0 5797.
EDITMAG2-11310
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11310
1km
200.0000
150.0000
100.0000
50.00000
0.

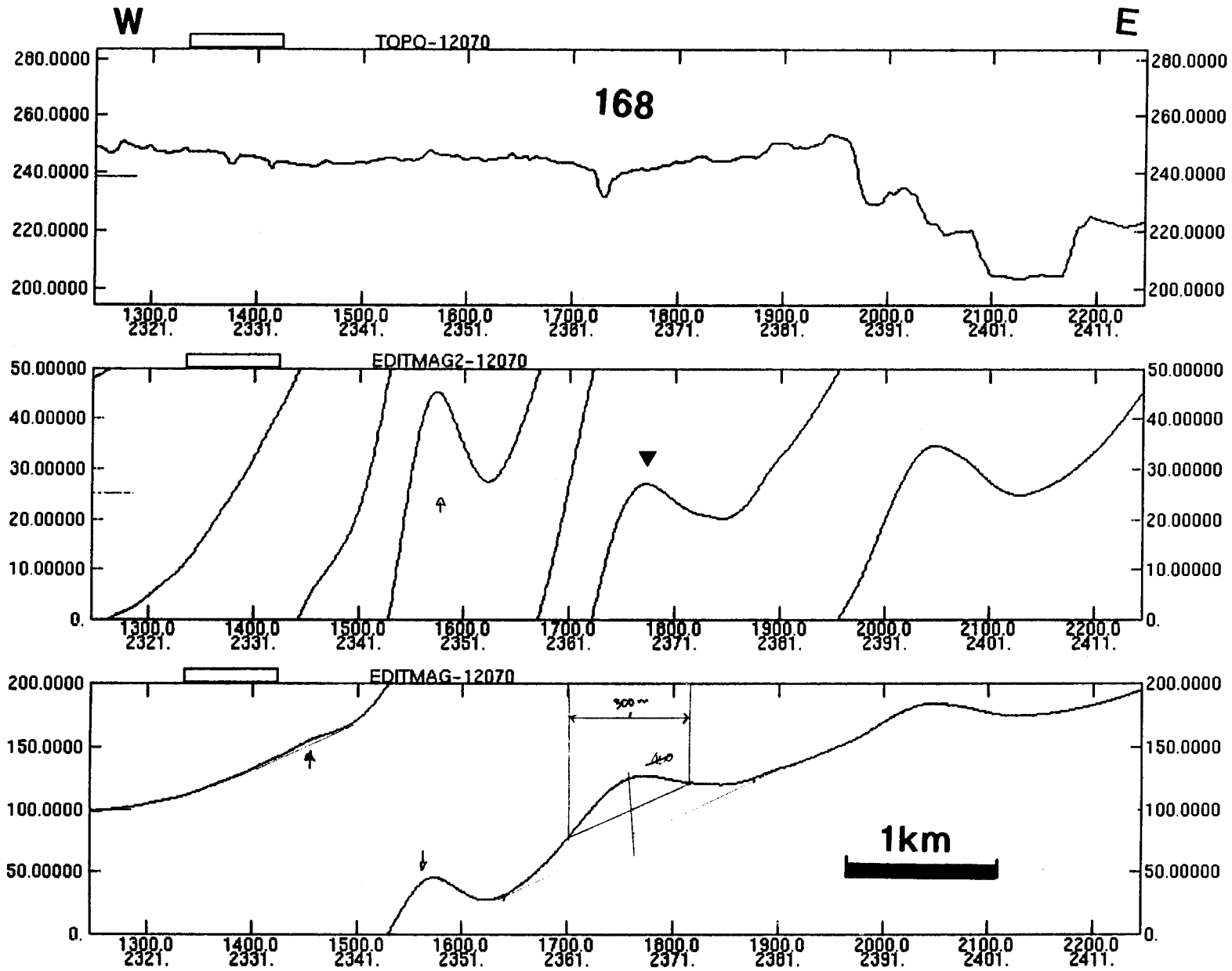

E
W
TOPO-10140
46
400.0000
350.0000
300.0000
250.0000
200.0000
5400.0 11555.
5500.0 11565.
5600.0 11575.
5700.0 11585.
5800.0 11595.
5900.0 11605.
6000.0 11615.
6100.0 11625.
6200.0 11635.
6300.0 11645.
EDITMAG2-10140
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10140
200.0000
150.0000
100.0000
50.00000
0.
1km

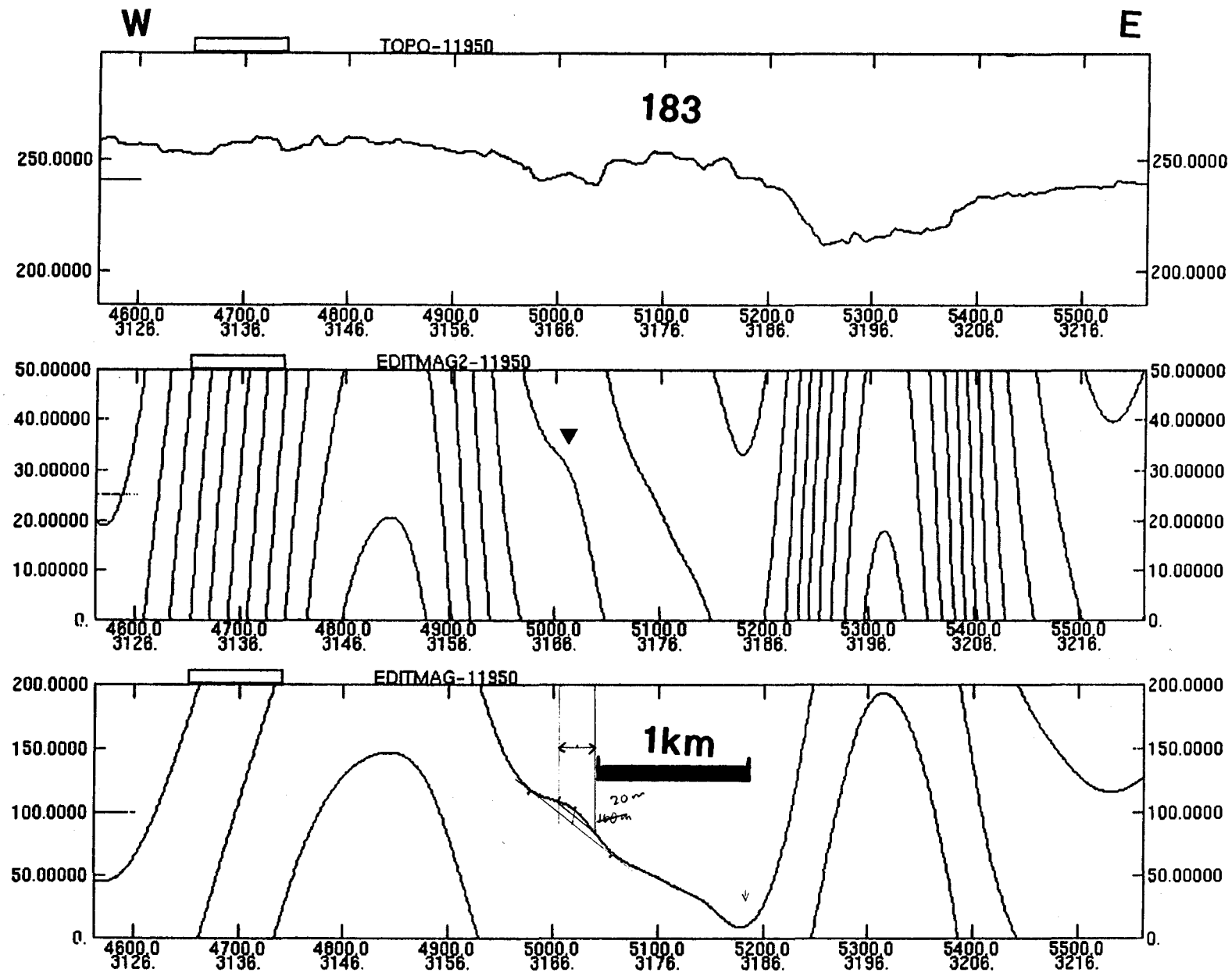

E
W
TOPO-10510
55
500.0000
400.0000
300.0000
200.0000
6200.0 9412.
6300.0 9422.
6400.0 9432.
6500.0 9442.
6600.0 9452.
6700.0 9462.
6800.0 9472.
6900.0 9482.
7000.0 9492.
7100.0 9502.
EDITMAG2-10510
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10510
200.0000
150.0000
100.0000
50.00000
0
1km
180 m

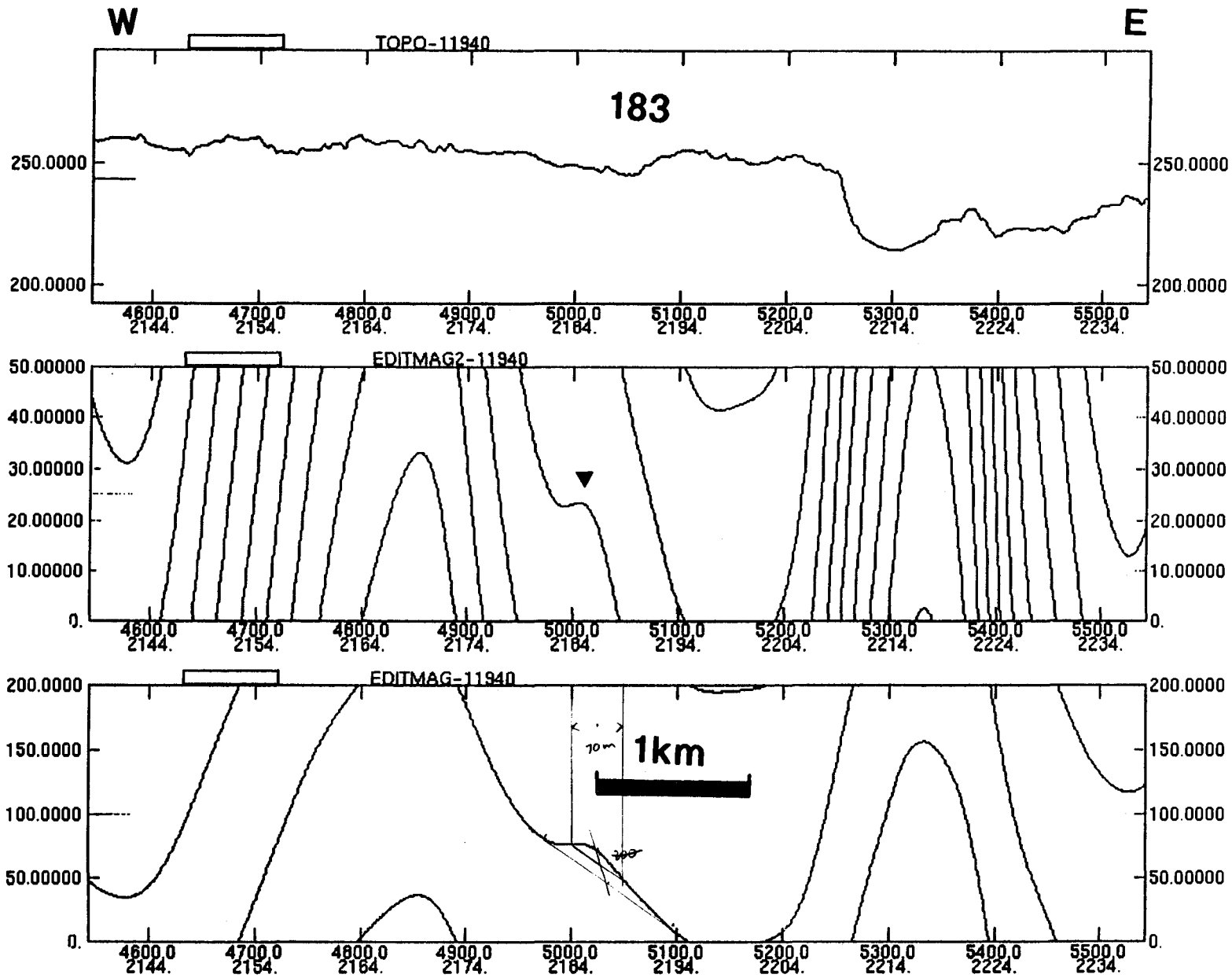

W
E
TOPO-10360
102
500.0000
400.0000
300.0000
200.0000
4600.0
4700.0
4800.0
4900.0
5000.0
5100.0
5200.0
5300.0
5400.0
5500.0
EDITMAG2-10360
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10360
200.0000
150.0000
100.0000
50.00000
0.
1km

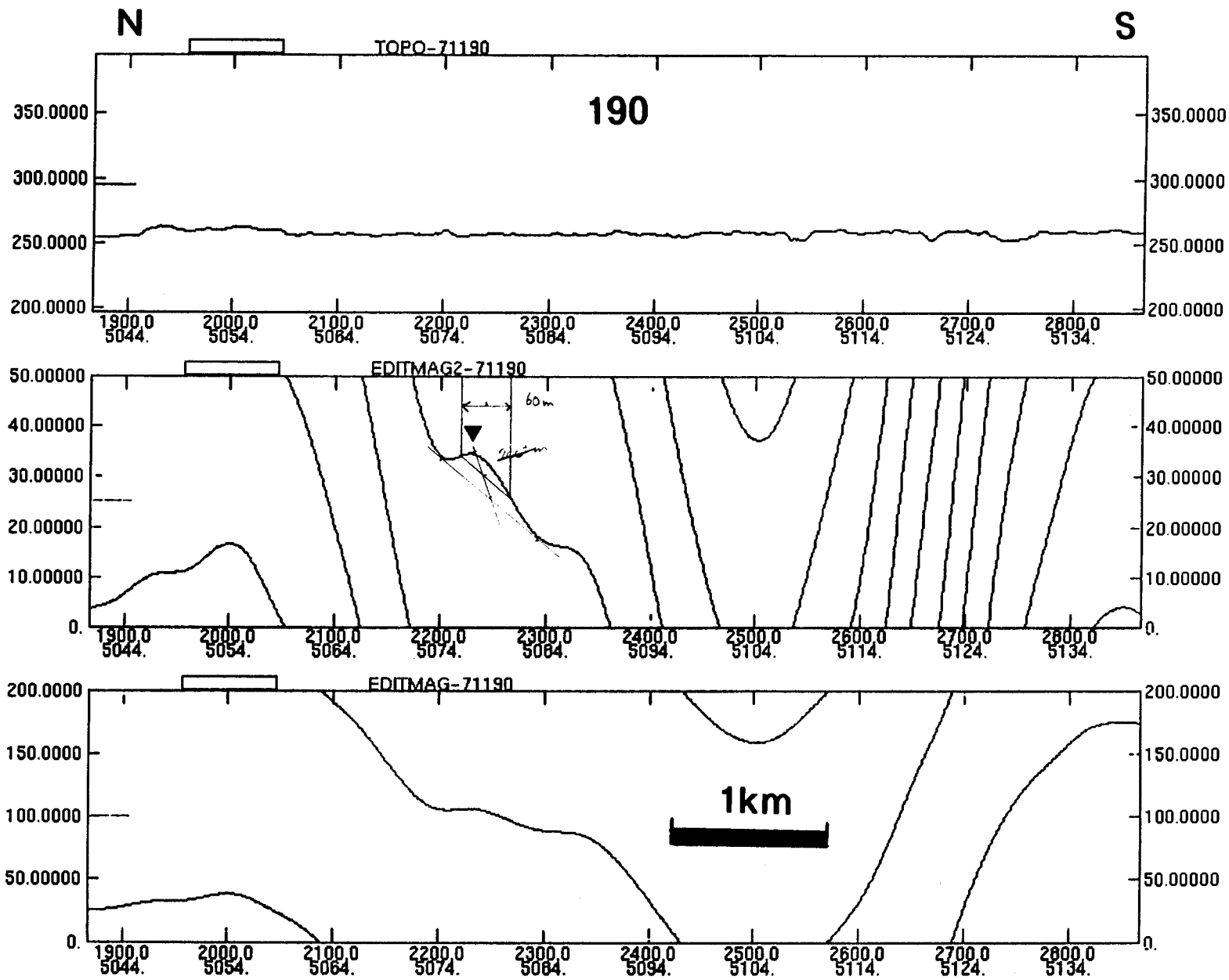

E
W
TOPO-11170
147
350.0000
300.0000
250.0000
200.0000
5100.0 7263.
5150.0 7266.
5200.0 7273.
5250.0 7276.
5300.0 7283.
5350.0 7286.
5400.0 7293.
5450.0 7296.
5500.0 7303.
5550.0 7306.
EDITMAG2-11170
10.00000
8.000000
6.000000
4.000000
2.000000
0.
EDITMAG-11170
200.0000
150.0000
100.0000
50.00000
0
100 m
200 m
500m

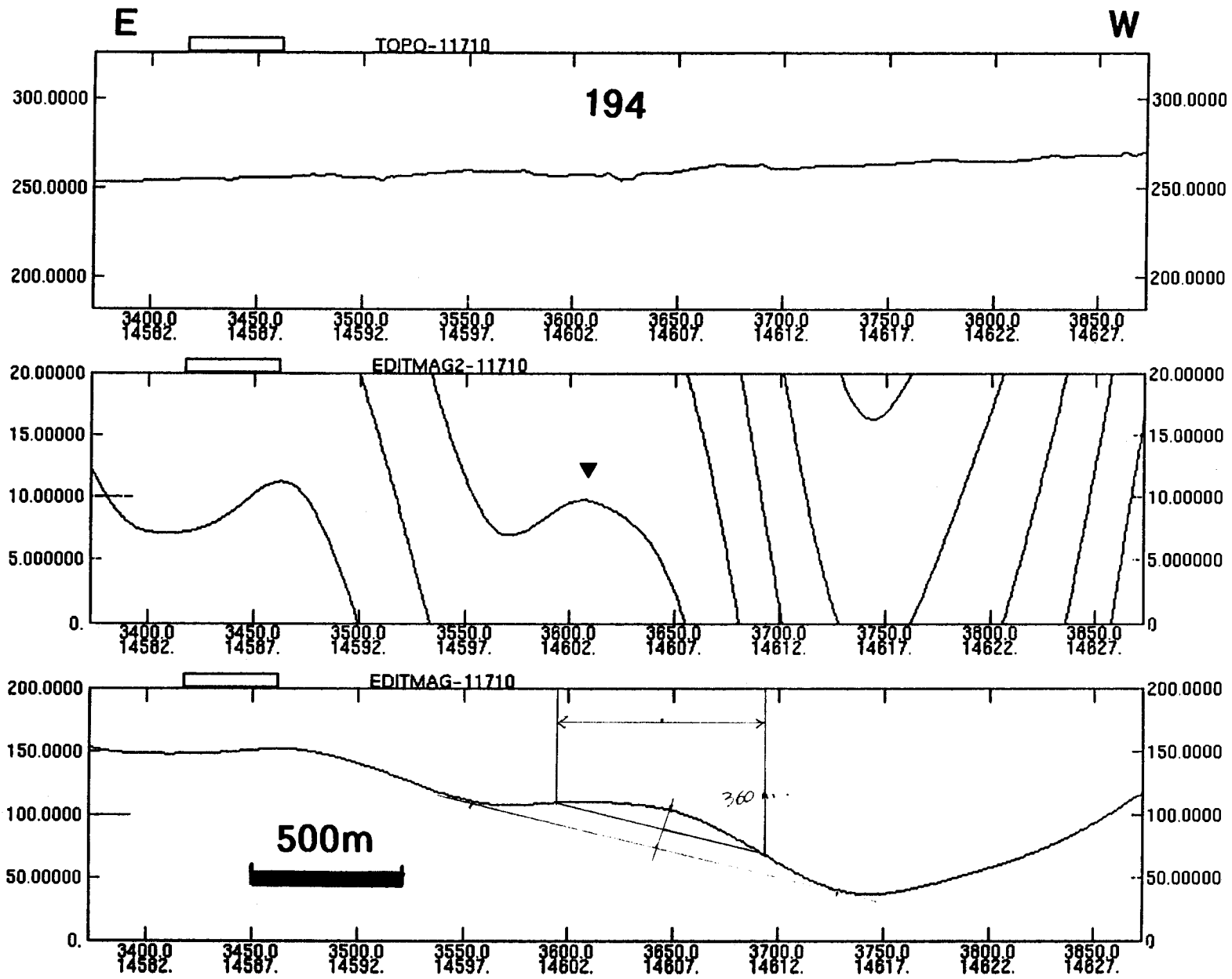

W
E
TOPO-11993
166
250.0000
200.0000
1400.0 5495.
1500.0 5505.
1600.0 5515.
1700.0 5525.
1800.0 5535.
1900.0 5545.
2000.0 5555.
2100.0 5565.
2200.0 5575.
2300.0 5585.
EDITMAG2-11993
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11993
150.0000
100.0000
130m
200m
1km

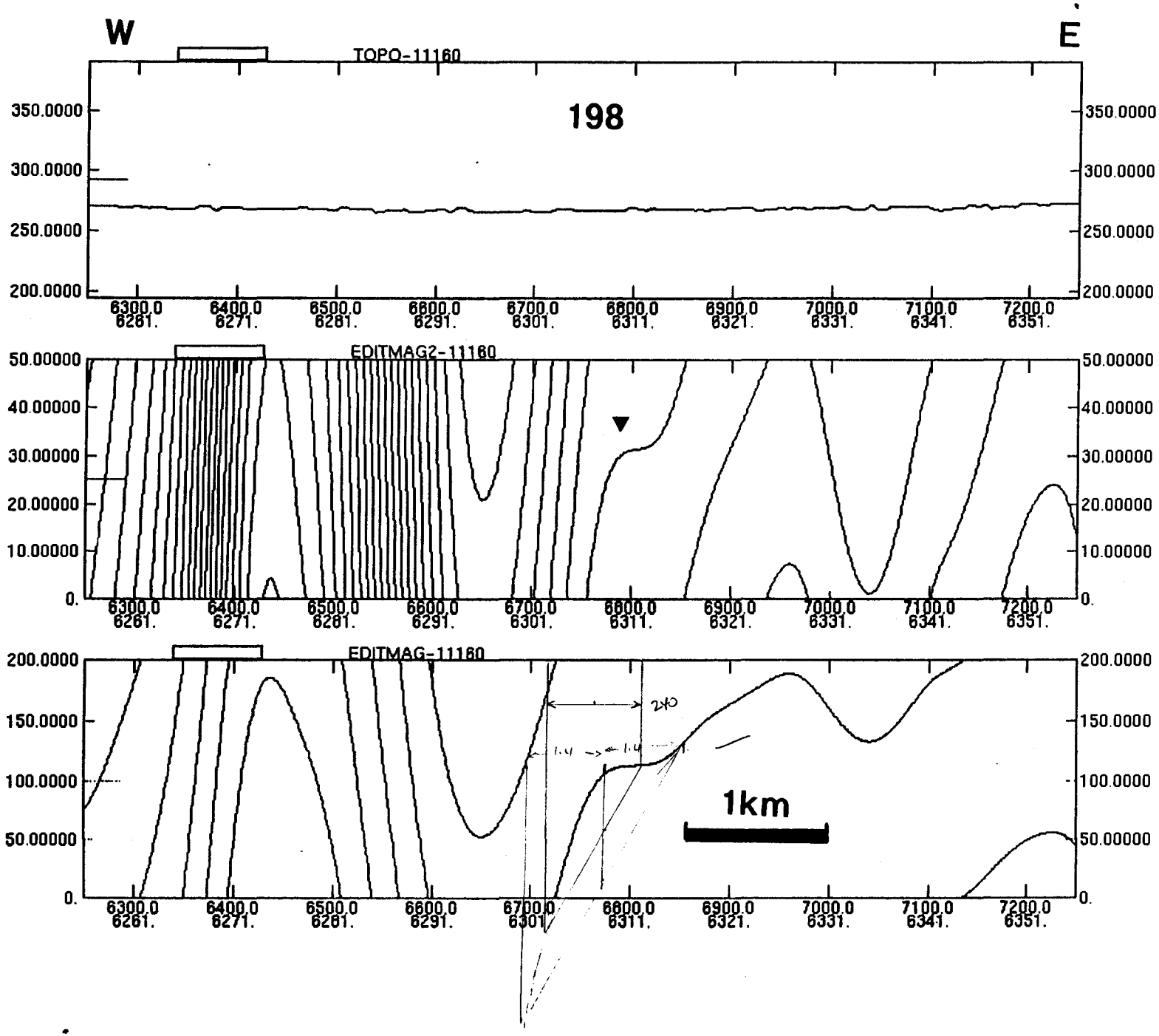

W
E
TOPO-12070
168
280.0000
260.0000
240.0000
220.0000
200.0000
1300.0 2321.
1400.0 2331.
1500.0 2341.
1600.0 2351.
1700.0 2361.
1800.0 2371.
1900.0 2381.
2000.0 2391.
2100.0 2401.
2200.0 2411.
EDITMAG2-12070
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-12070
200.0000
150.0000
100.0000
50.00000
0.
1km

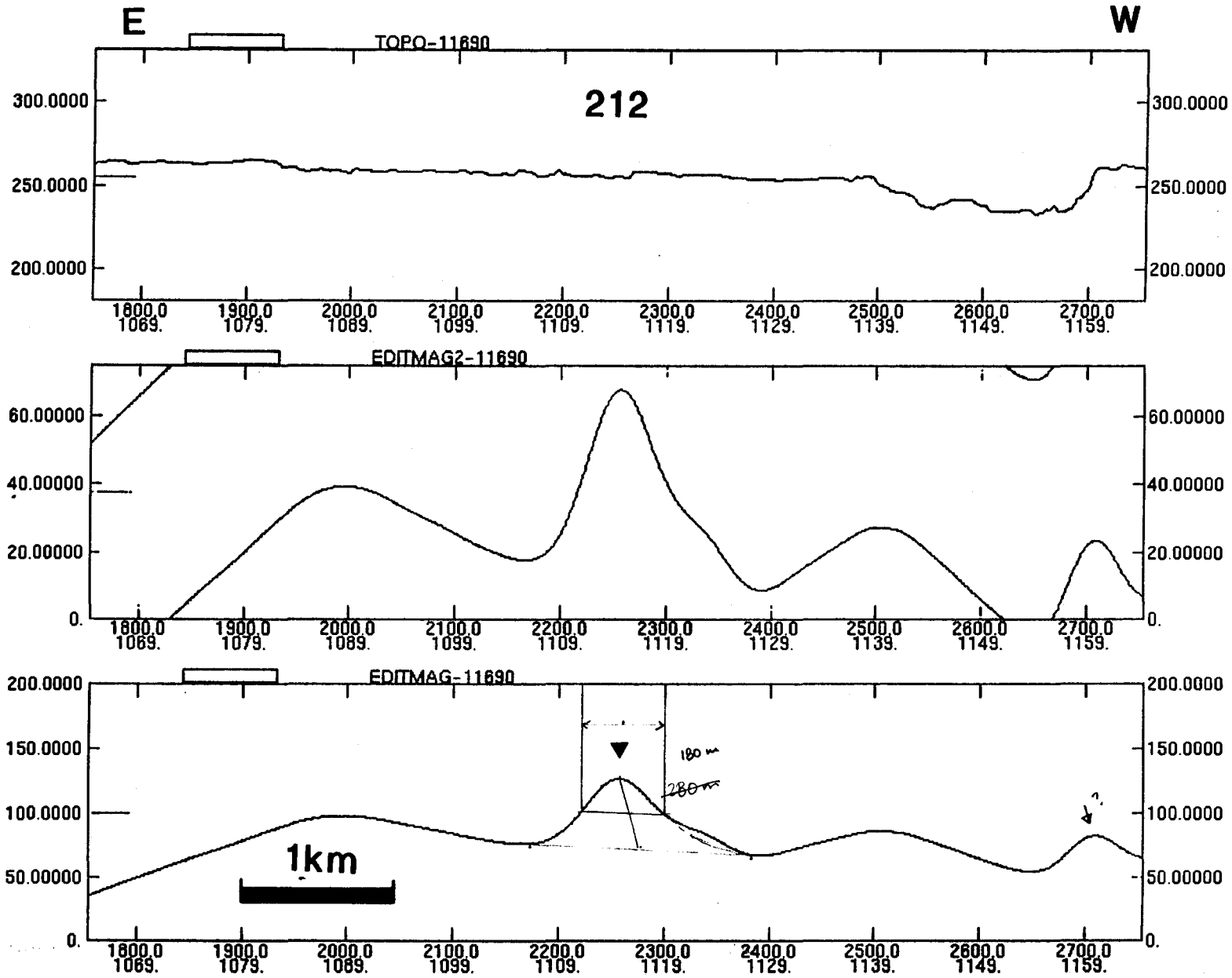

W
E
TOPO-11950
183
250.0000
200.0000
4600.0 3126.
4700.0 3136.
4800.0 3146.
4900.0 3156.
5000.0 3166.
5100.0 3176.
5200.0 3186.
5300.0 3196.
5400.0 3206.
5500.0 3216.
EDITMAG2-11950
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11950
150.0000
100.0000
1km
20m
160m

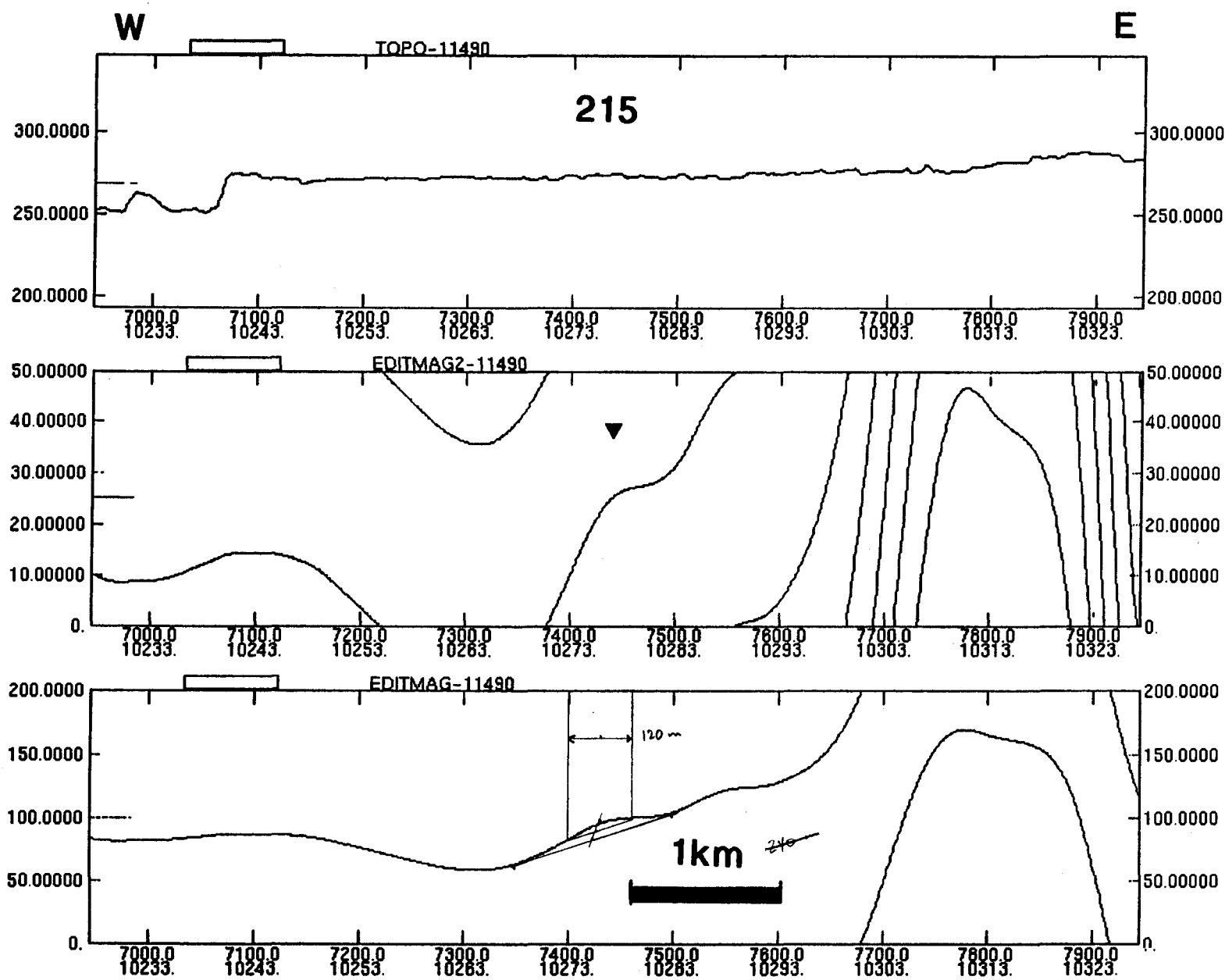

W
E
TOPO-11940
183
250.0000
200.0000
4600.0 2144.
4700.0 2154.
4800.0 2164.
4900.0 2174.
5000.0 2184.
5100.0 2194.
5200.0 2204.
5300.0 2214.
5400.0 2224.
5500.0 2234.
EDITMAG2-11940
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11940
200.0000
150.0000
100.0000
50.00000
0.
1km

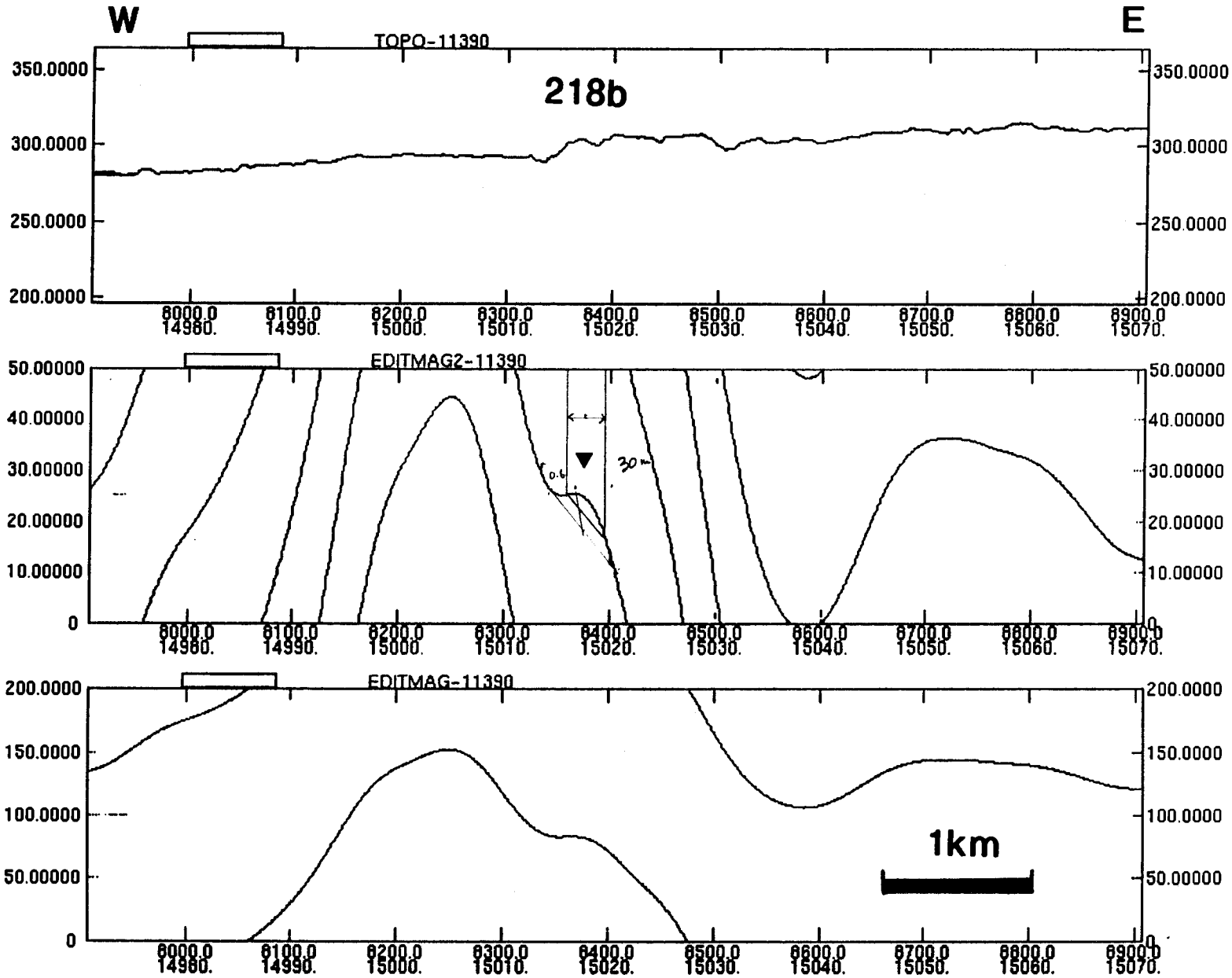

N
S
TOPO-71190
190
350.0000
300.0000
250.0000
200.0000
1900.0 5044.
2000.0 5054.
2100.0 5064.
2200.0 5074.
2300.0 5084.
2400.0 5094.
2500.0 5104.
2600.0 5114.
2700.0 5124.
2800.0 5134.
EDITMAG2-71190
60m
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-71190
150.0000
100.0000
1km

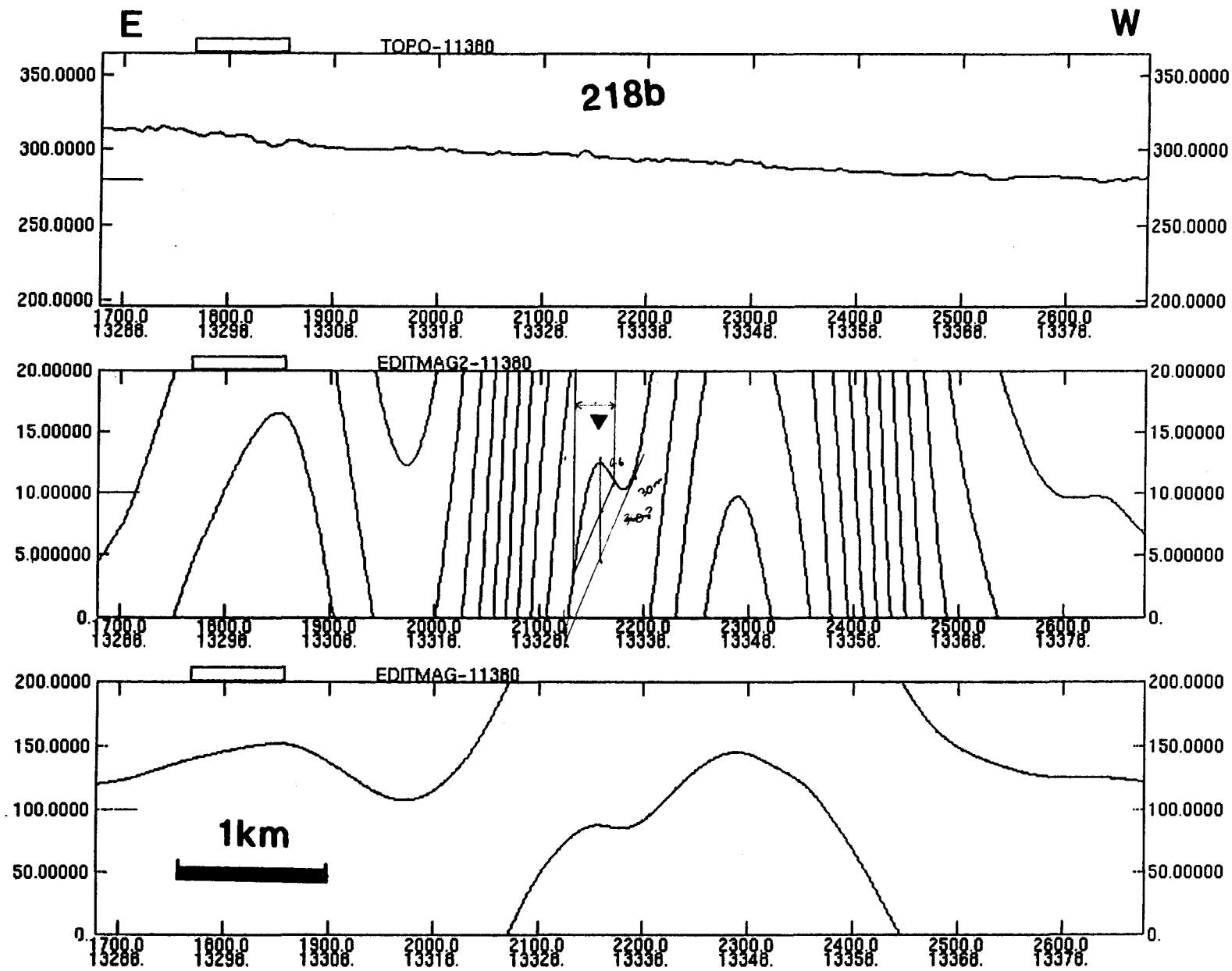

E
W
TOPO-11710
194
300.0000
250.0000
200.0000
3400.0 14582.
3450.0 14587.
3500.0 14592.
3550.0 14597.
3600.0 14602.
3650.0 14607.
3700.0 14612.
3750.0 14617.
3800.0 14622.
3850.0 14627.
EDITMAG2-11710
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-11710
200.0000
150.0000
100.0000
50.00000
0.
500m
360

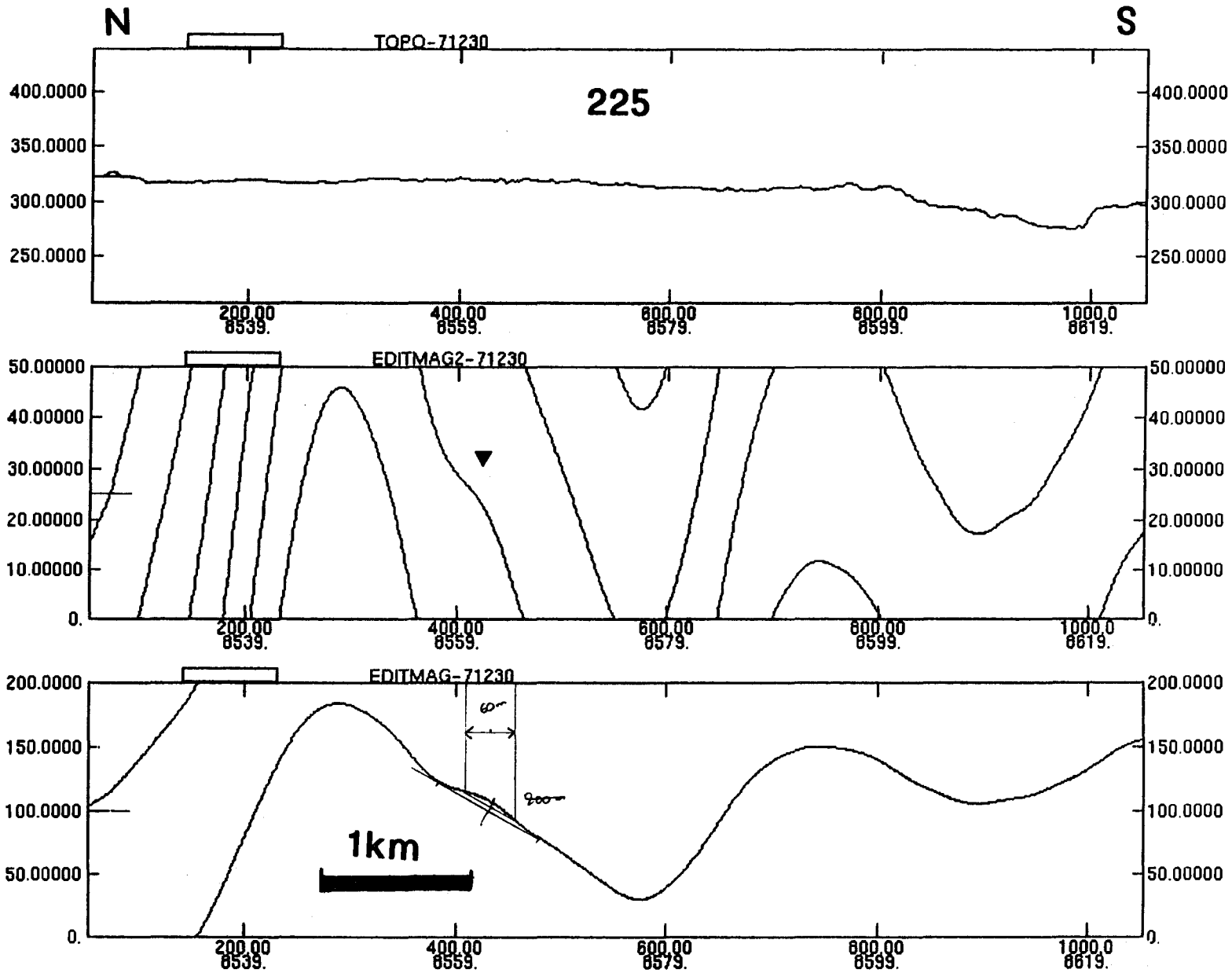

W
E
TOPO-11160
198
350.0000
300.0000
250.0000
200.0000
6300.0 6261.
6400.0 6271.
6500.0 6281.
6600.0 6291.
6700.0 6301.
6800.0 6311.
6900.0 6321.
7000.0 6331.
7100.0 6341.
7200.0 6351.
EDITMAG2-11160
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11160
200.0000
150.0000
100.0000
50.00000
0.
1km

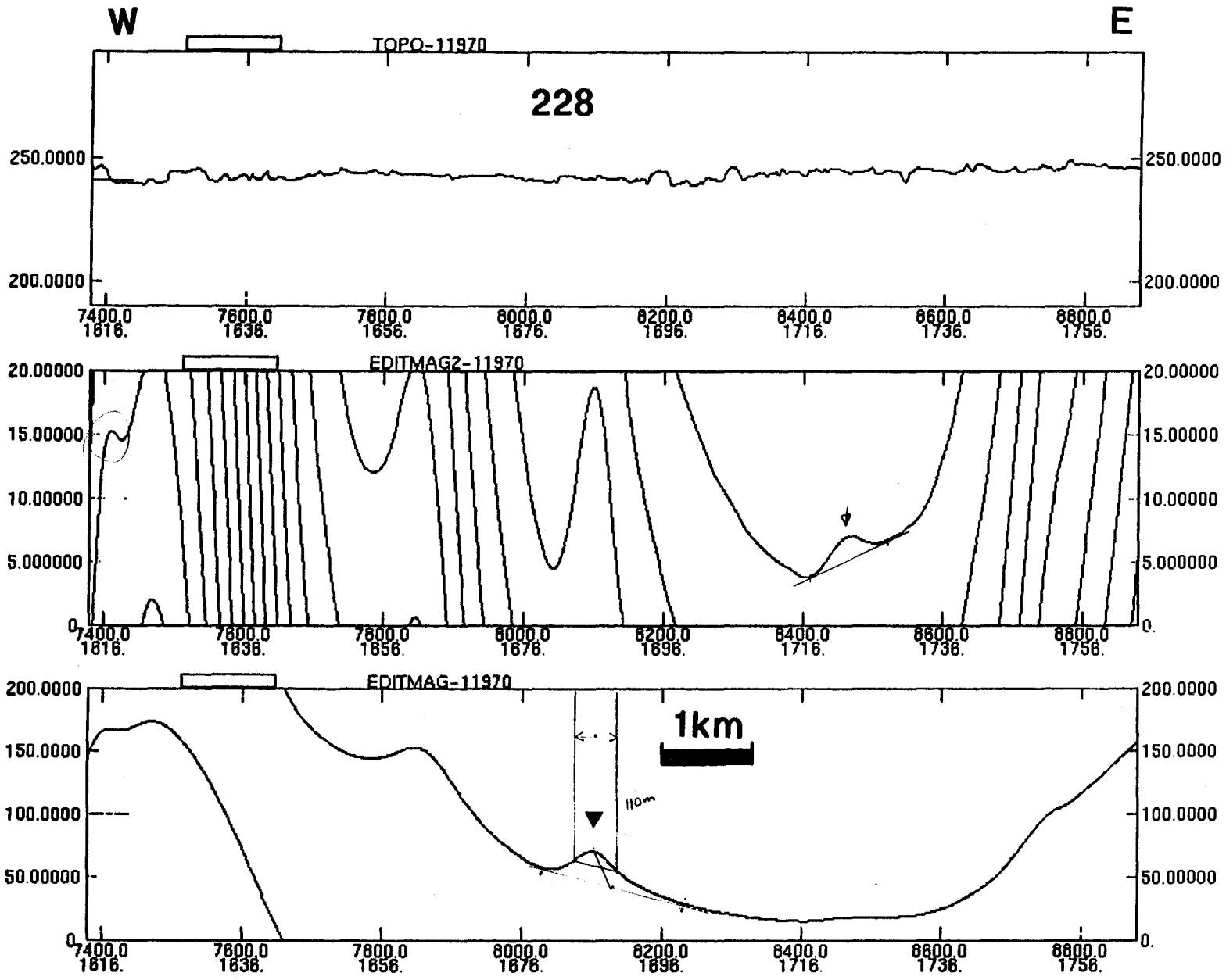

E
W
TOPO-11690
212
300.0000
250.0000
200.0000
1800.0 1069.
1900.0 1079.
2000.0 1089.
2100.0 1099.
2200.0 1109.
2300.0 1119.
2400.0 1129.
2500.0 1139.
2600.0 1149.
2700.0 1159.
EDITMAG2-11690
60.00000
40.00000
20.00000
0.
EDITMAG-11690
200.0000
150.0000
100.0000
50.00000
0.
180 m
~~280 m~~
1km

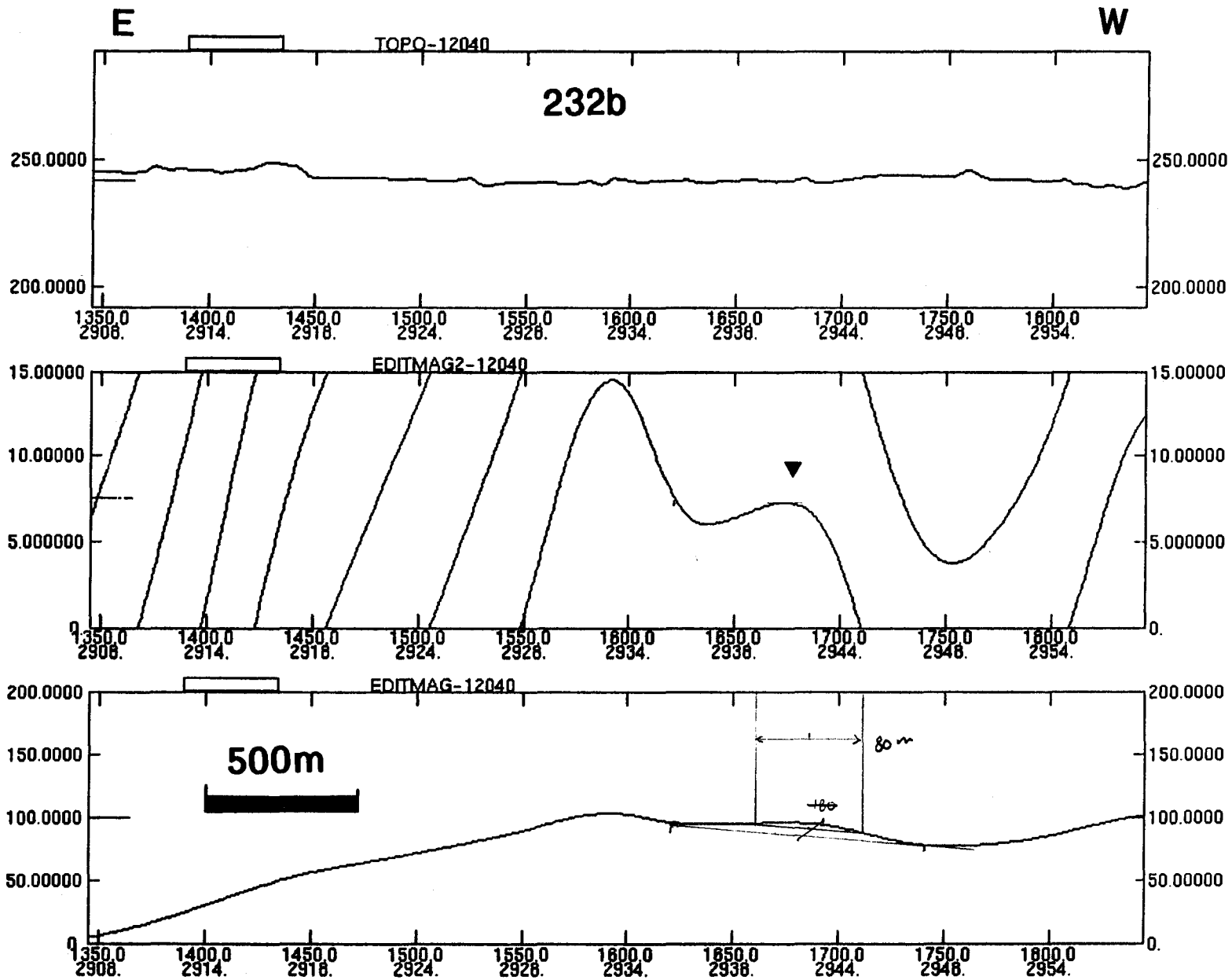

W
E
TOPO-11490
215
300.0000
250.0000
200.0000
7000.0 10233.
7100.0 10243.
7200.0 10253.
7300.0 10263.
7400.0 10273.
7500.0 10283.
7600.0 10293.
7700.0 10303.
7800.0 10313.
7900.0 10323.
EDITMAG2-11490
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11490
200.0000
150.0000
100.0000
50.00000
0.
120 m
1km


W
E
TOPO-11390
218b
350.0000
300.0000
250.0000
200.0000
6000.0 14980.
6100.0 14990.
6200.0 15000.
6300.0 15010.
6400.0 15020.
6500.0 15030.
6600.0 15040.
6700.0 15050.
6800.0 15060.
6900.0 15070.
EDITMAG2-11390
50.00000
40.00000
30.00000
20.00000
10.00000
0
0.6
30
EDITMAG-11390
200.0000
150.0000
100.0000
50.00000
0
1km

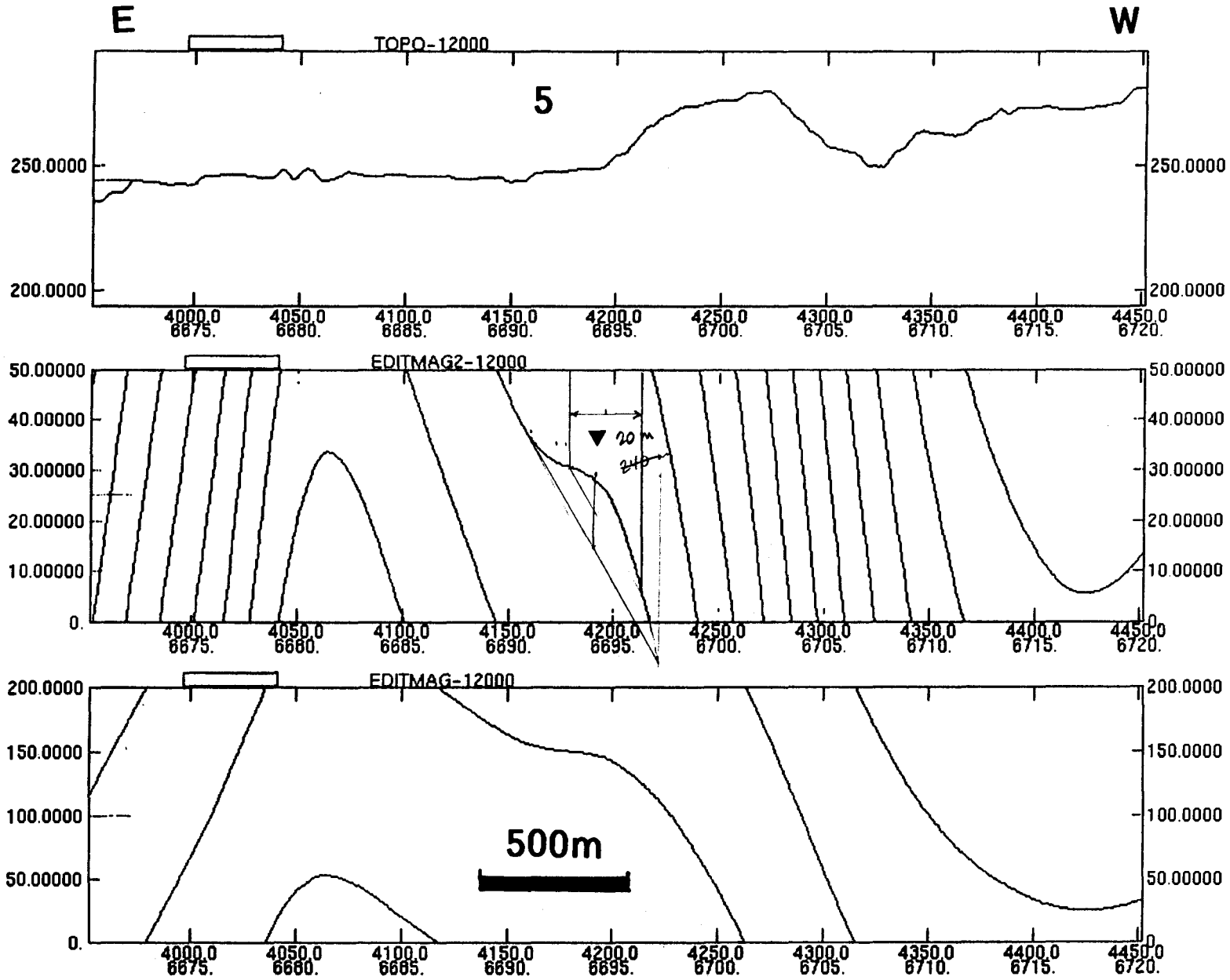

E
W
TOPO-11380
218b
350.0000
300.0000
250.0000
200.0000
1700.0
1800.0
1900.0
2000.0
2100.0
2200.0
2300.0
2400.0
2500.0
2600.0
EDITMAG2-11380
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-11380
150.0000
100.0000
50.00000
1km

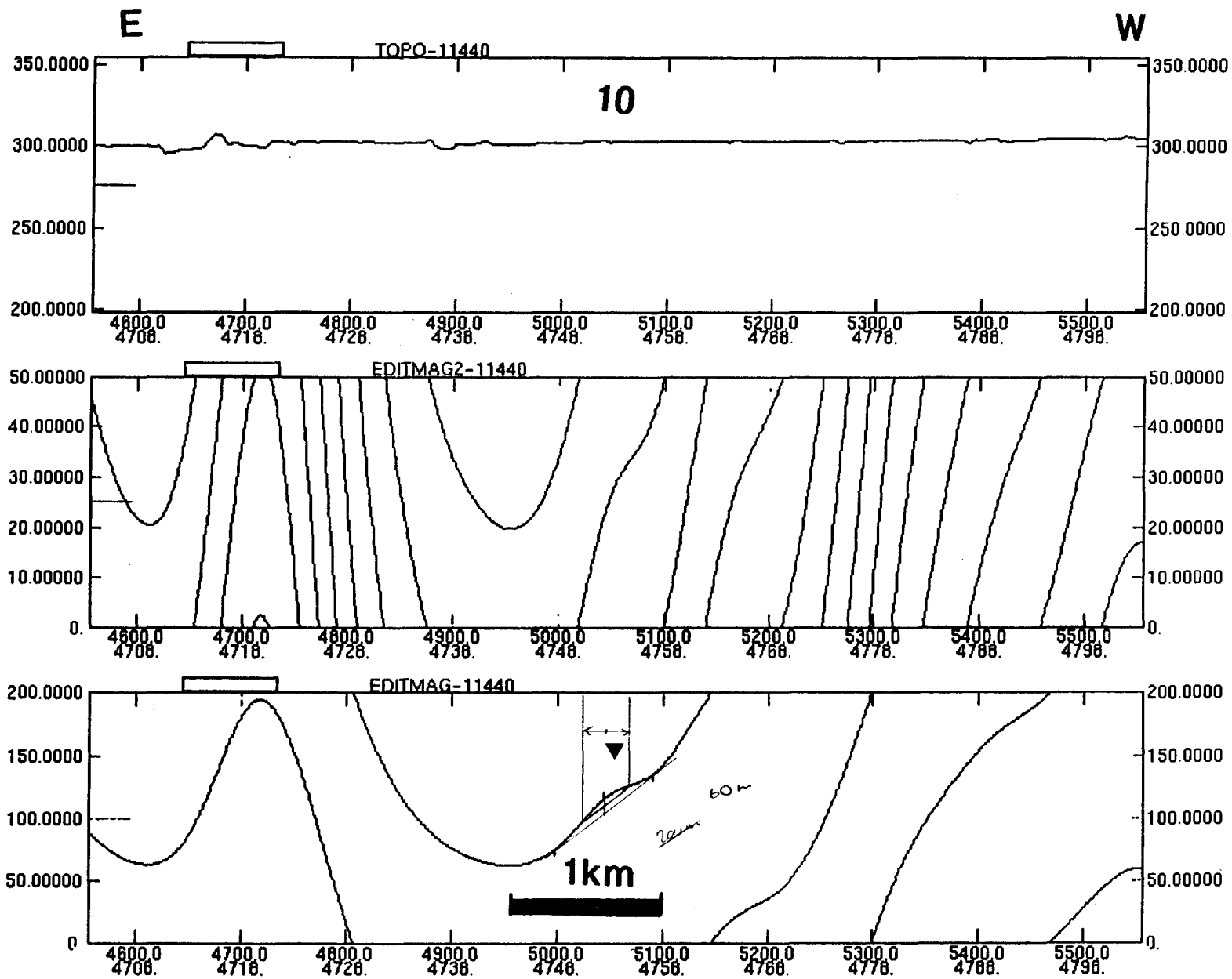

N
S
TOPO-71230
225
400.0000
350.0000
300.0000
250.0000
200.00
6539.
400.00
6559.
600.00
6579.
800.00
6599.
1000.0
6619.
EDITMAG2-71230
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-71230
200.0000
150.0000
100.0000
50.00000
0.
1km

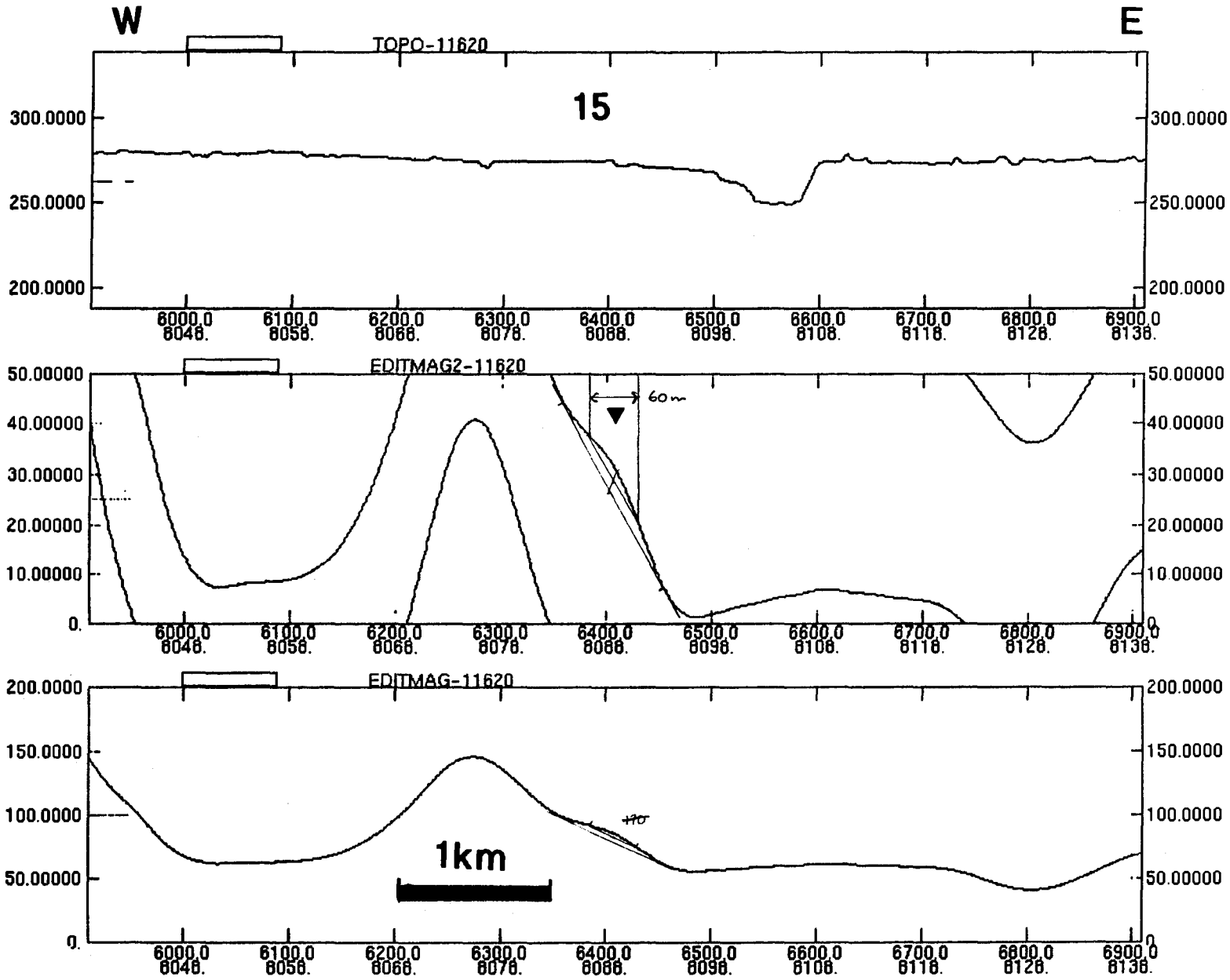

W
E
TOPO-11970
228
250.0000
200.0000
7400.0 1616.
7600.0 1636.
7800.0 1656.
8000.0 1676.
8200.0 1696.
8400.0 1716.
8600.0 1736.
8800.0 1756.
EDITMAG2-11970
20.00000
15.00000
10.00000
5.000000
0
EDITMAG-11970
150.0000
100.0000
50.00000
1km
110m

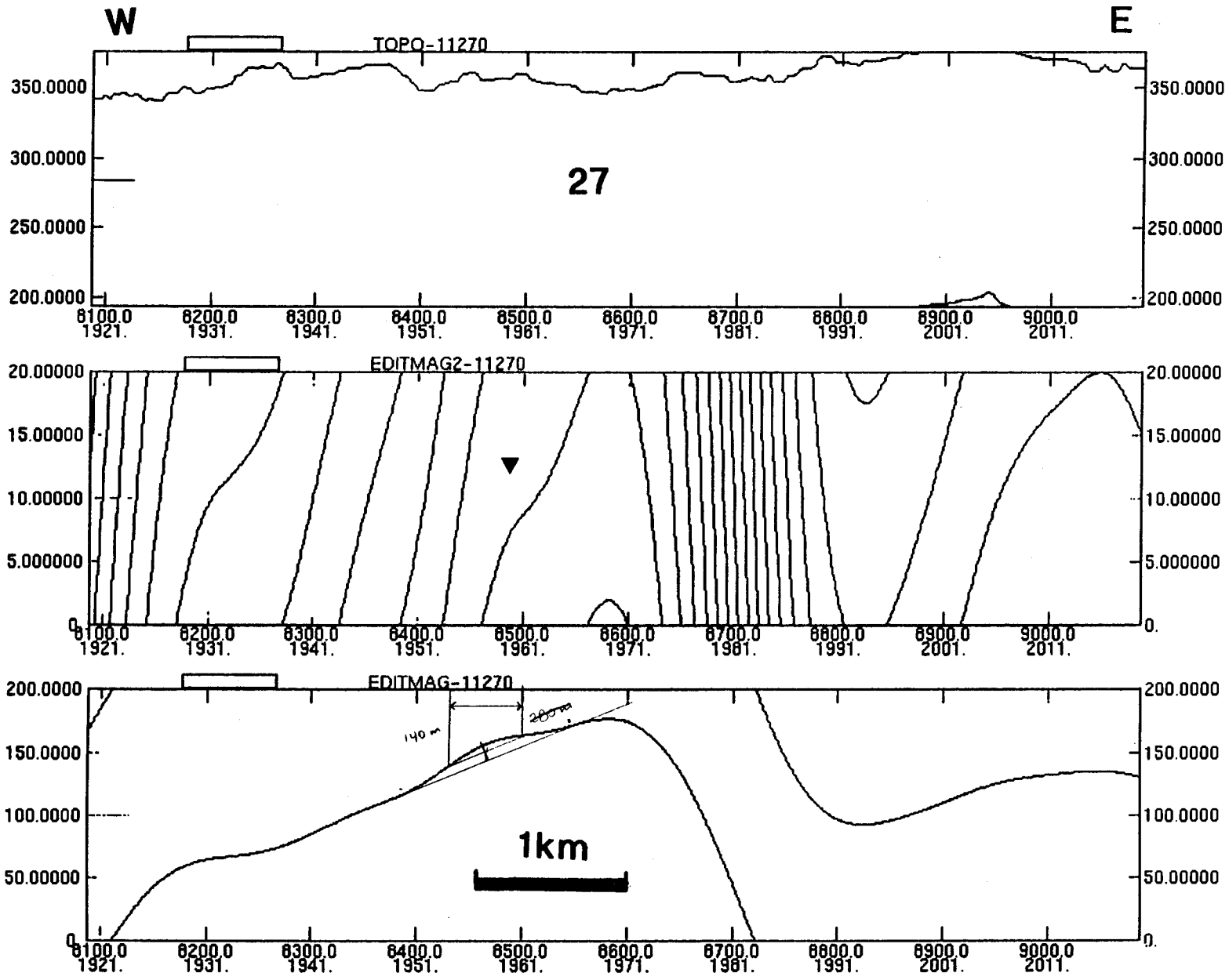

E
W
TOPO-12040
232b
250.0000
200.0000
1350.0 2908.
1400.0 2914.
1450.0 2918.
1500.0 2924.
1550.0 2928.
1600.0 2934.
1650.0 2938.
1700.0 2944.
1750.0 2948.
1800.0 2954.
EDITMAG2-12040
15.00000
10.00000
5.000000
0.
EDITMAG-12040
200.0000
150.0000
100.0000
50.00000
0.
500m
80 m

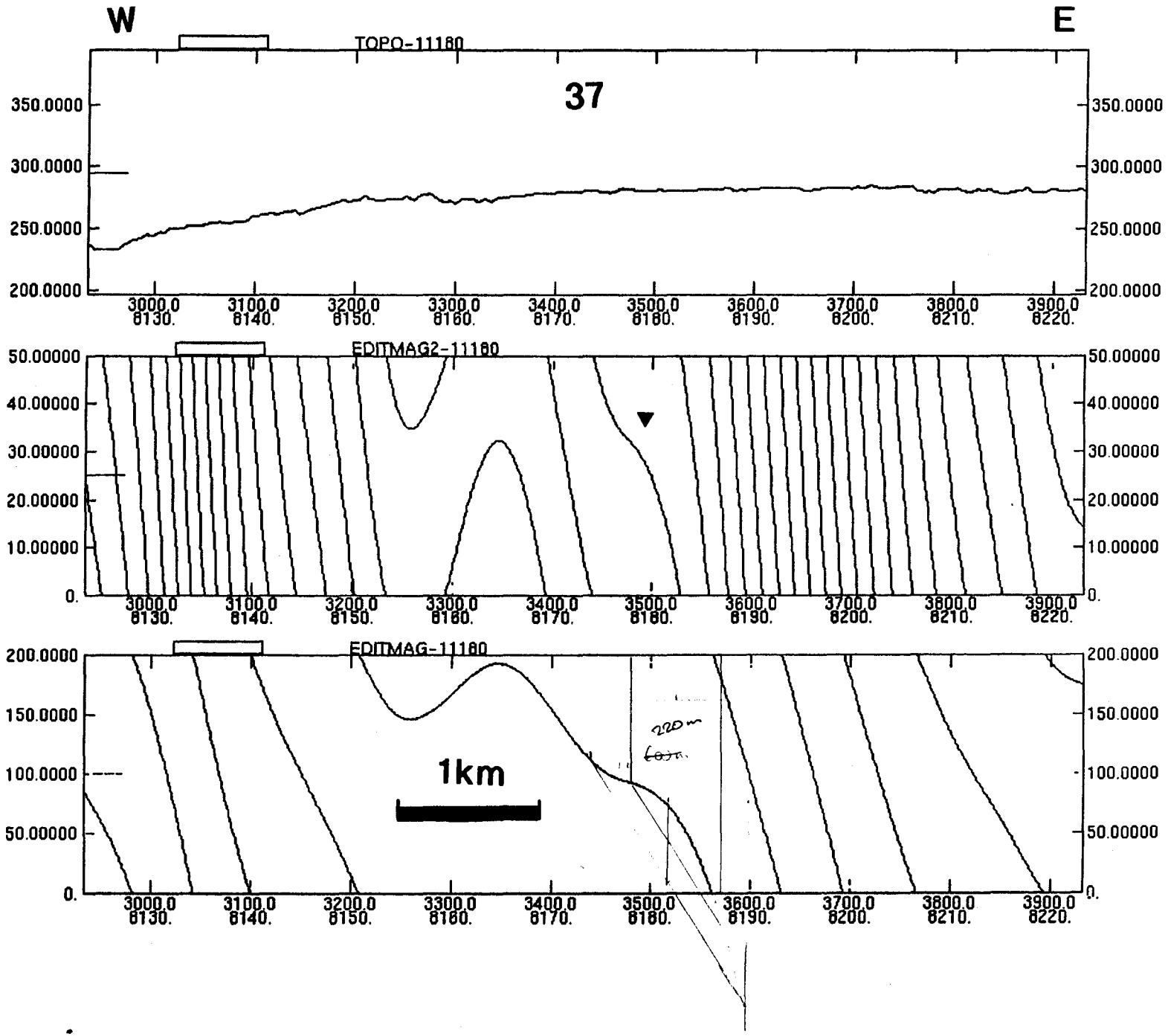
PRIORITY III

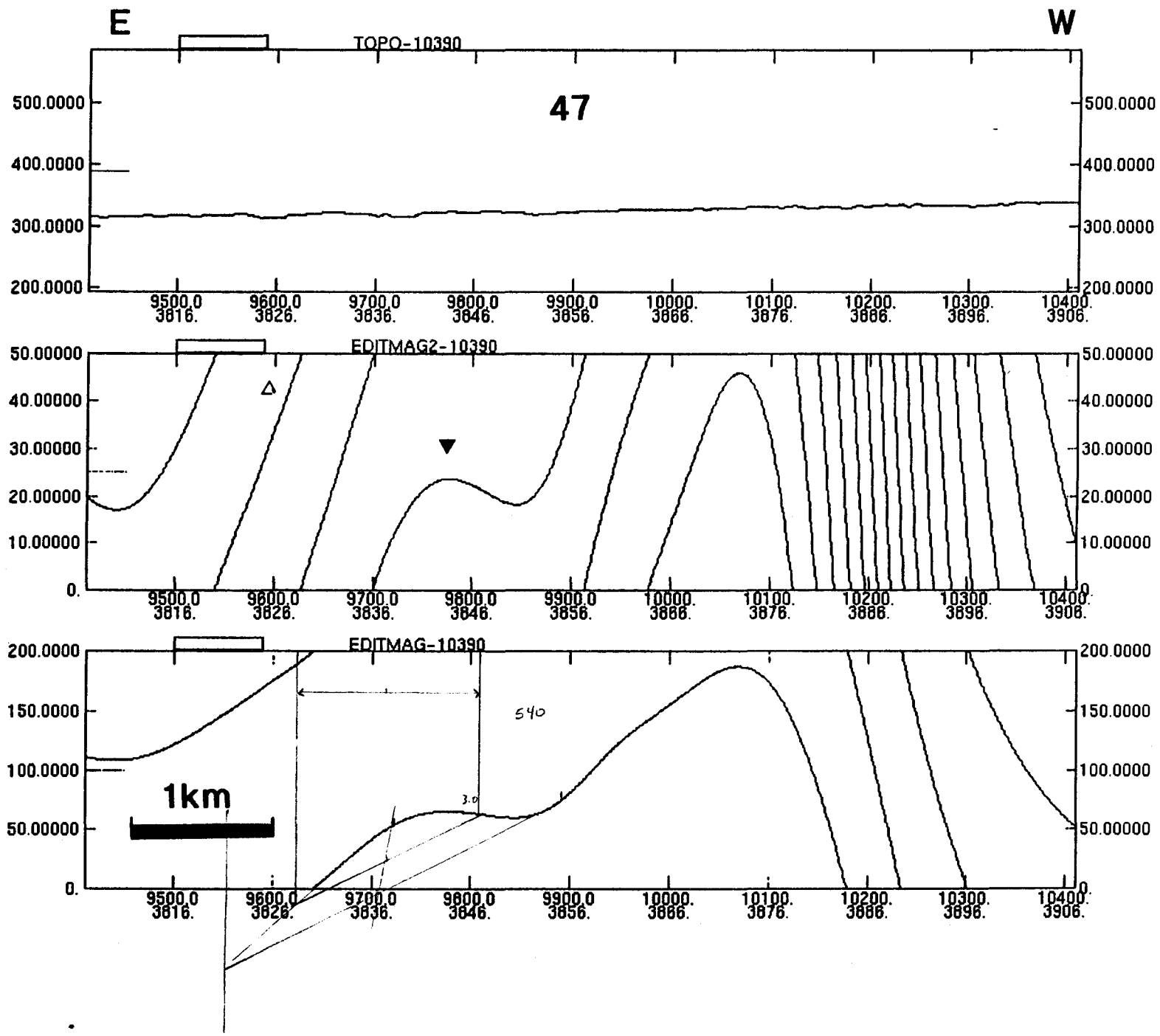

E
W
TOPO-12000
5
250.0000
200.0000
4000.0 6675.
4050.0 6680.
4100.0 6685.
4150.0 6690.
4200.0 6695.
4250.0 6700.
4300.0 6705.
4350.0 6710.
4400.0 6715.
4450.0 6720.
EDITMAG2-12000
50.00000
40.00000
30.00000
20.00000
10.00000
0.
20 m
240
EDITMAG-12000
200.0000
150.0000
100.0000
50.00000
0.
500m

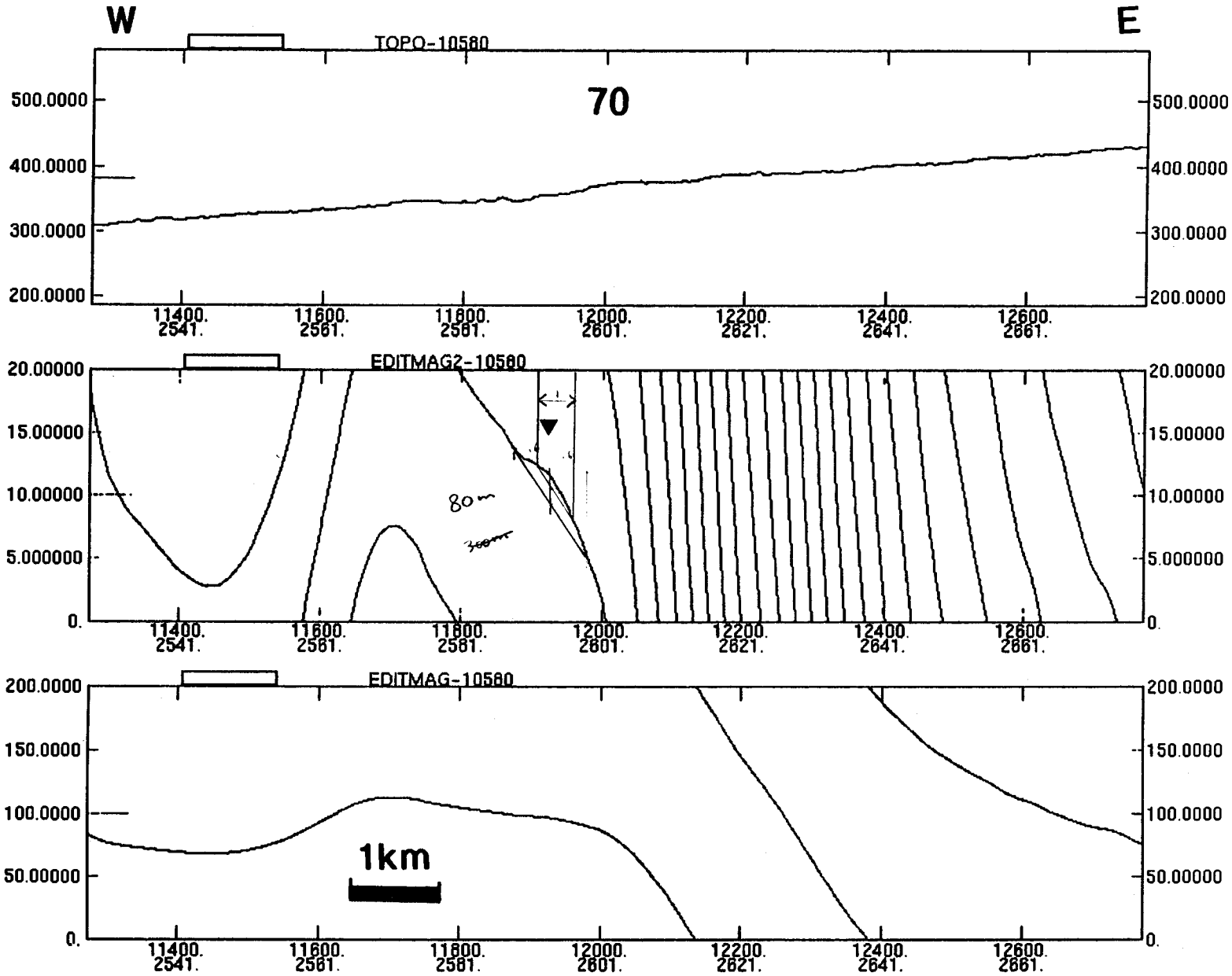

E
W
TOPO-11440
10
350.0000
300.0000
250.0000
200.0000
4600.0 4706.
4700.0 4716.
4800.0 4726.
4900.0 4736.
5000.0 4746.
5100.0 4756.
5200.0 4766.
5300.0 4776.
5400.0 4786.
5500.0 4796.
EDITMAG2-11440
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11440
200.0000
150.0000
100.0000
50.00000
0
1km
60m

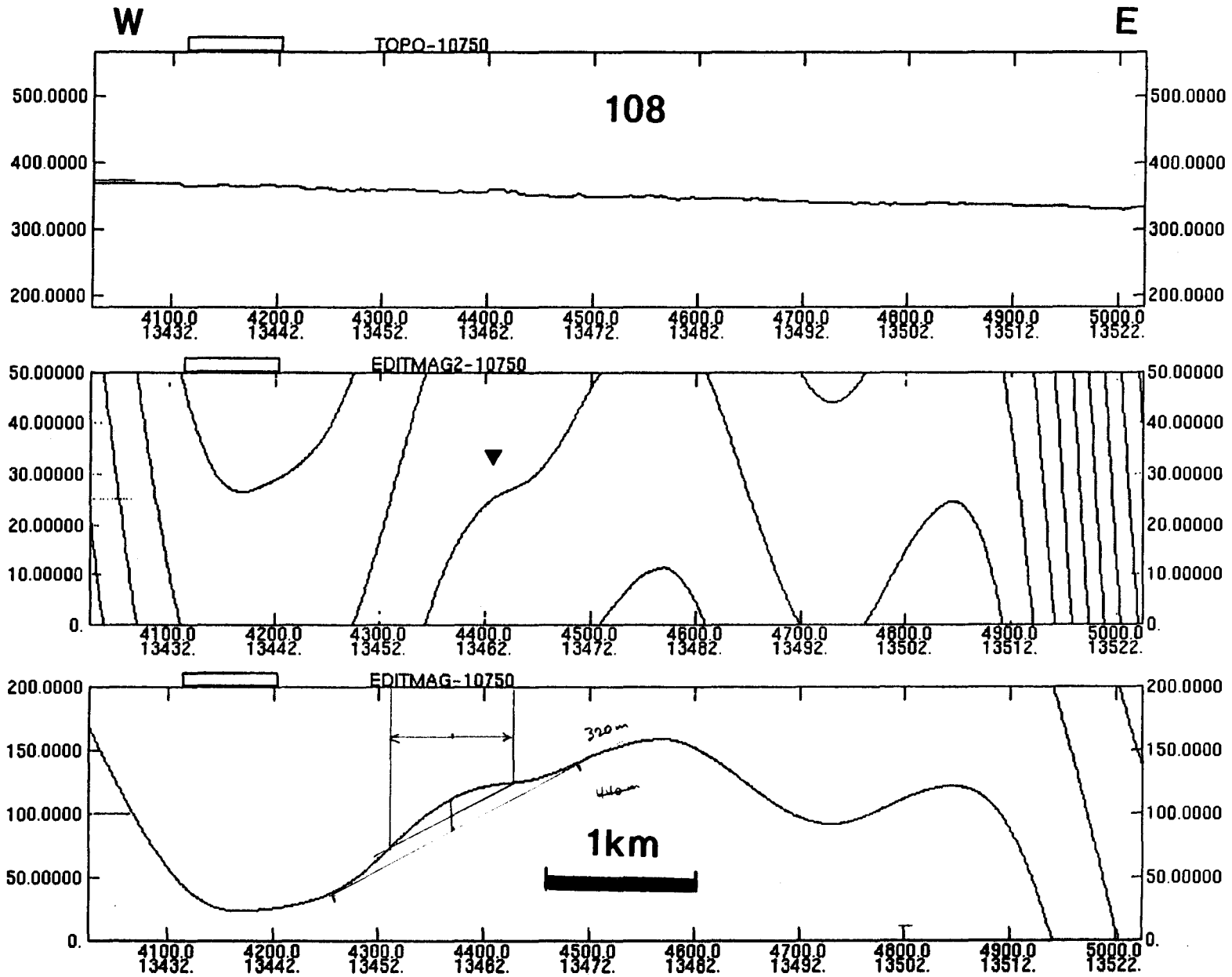

W
E
TOPO-11620
15
300.0000
250.0000
200.0000
6000.0
6100.0
6200.0
6300.0
6400.0
6500.0
6600.0
6700.0
6800.0
6900.0
EDITMAG2-11620
50.00000
40.00000
30.00000
20.00000
10.00000
0.
60m
EDITMAG-11620
200.0000
150.0000
100.0000
50.00000
0.
1km

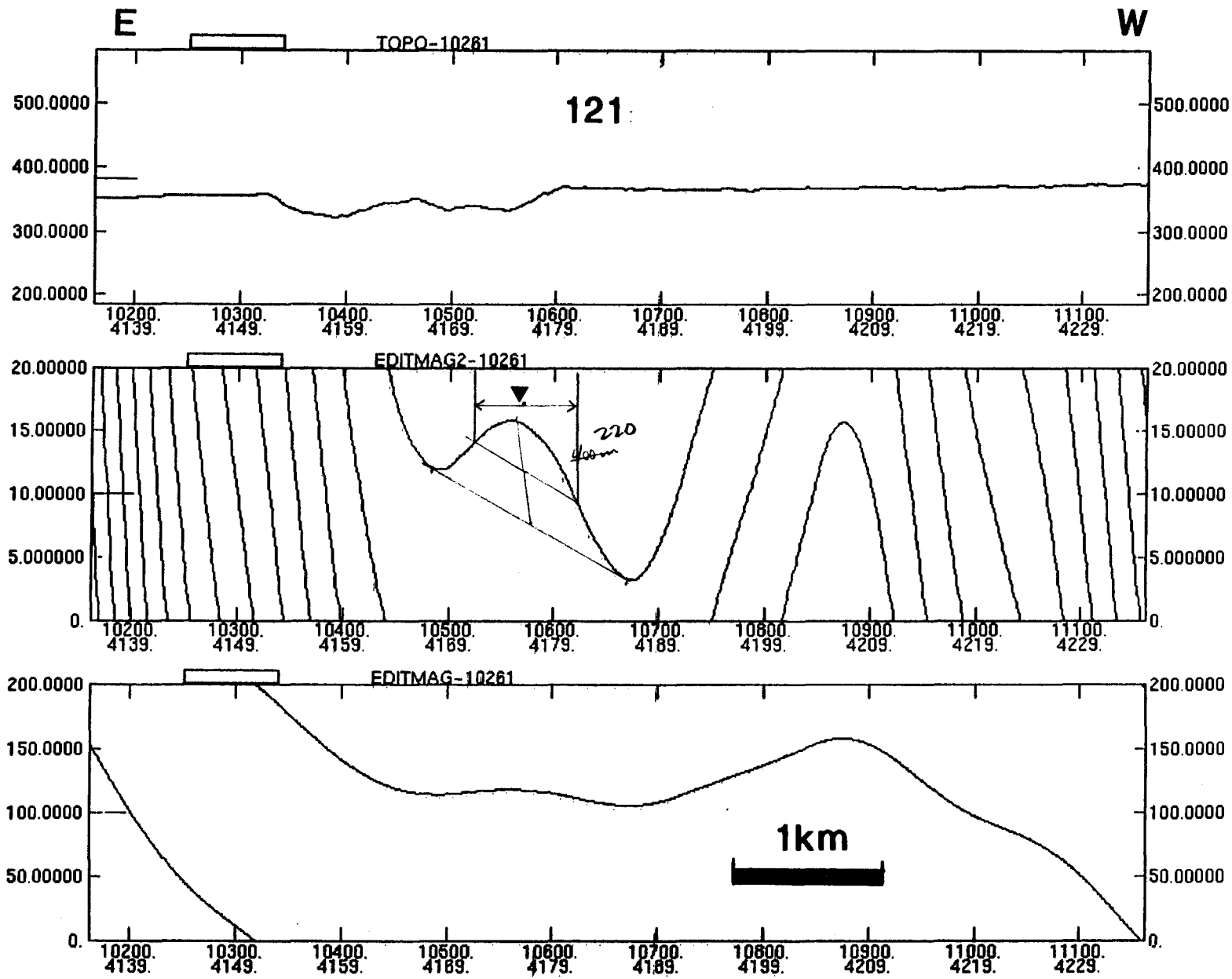

W
E
TOPO-11270
27
350.0000
300.0000
250.0000
200.0000
8100.0 1921.
8200.0 1931.
8300.0 1941.
8400.0 1951.
8500.0 1961.
8600.0 1971.
8700.0 1981.
8800.0 1991.
8900.0 2001.
9000.0 2011.
EDITMAG2-11270
20.00000
15.00000
10.00000
5.000000
0.
EDITMAG-11270
200.0000
150.0000
100.0000
50.00000
140 m
1km

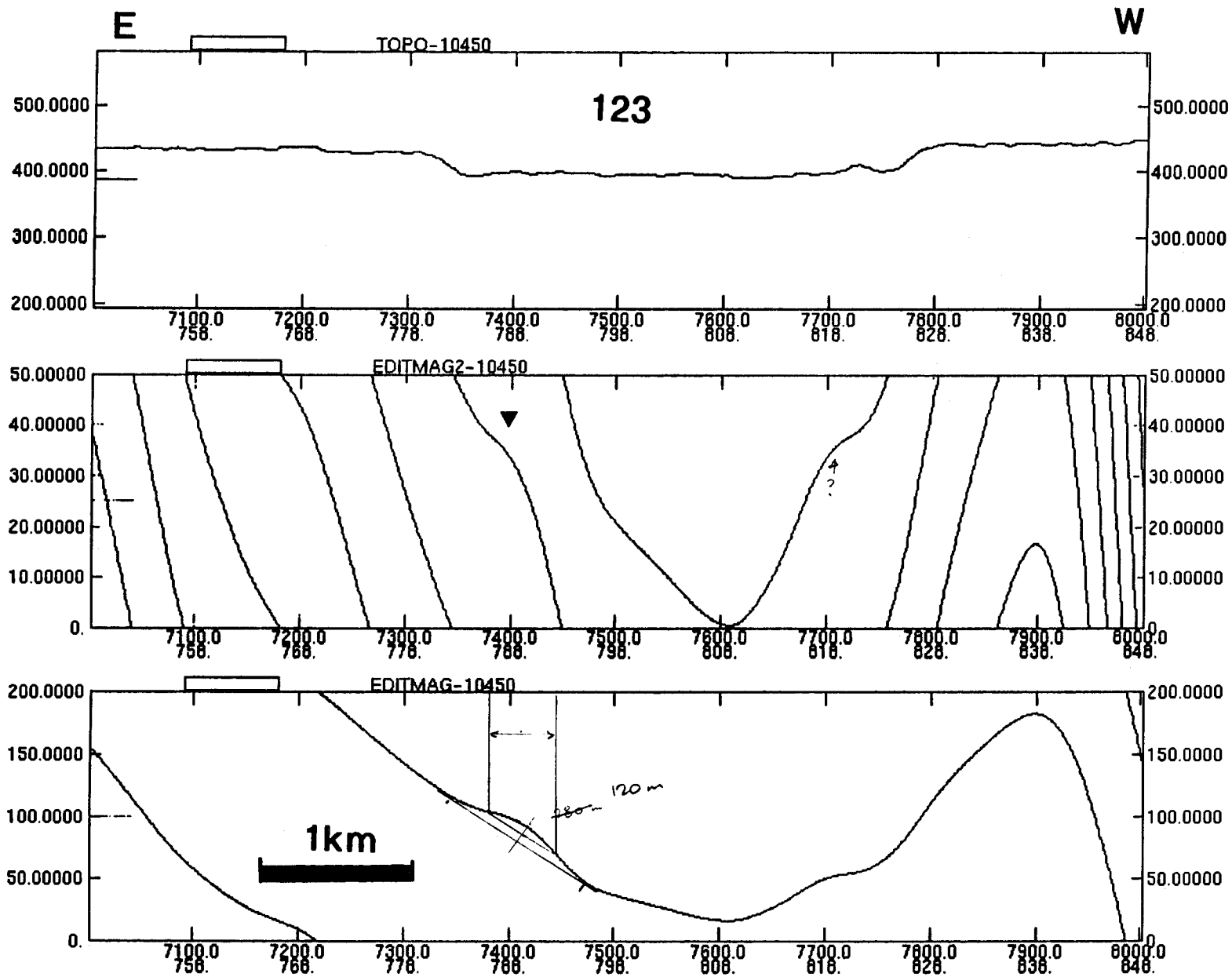

W
E
TOPO-11180
37
350.0000
300.0000
250.0000
200.0000
3000.0 3100.0 3200.0 3300.0 3400.0 3500.0 3600.0 3700.0 3800.0 3900.0
6130. 6140. 6150. 6160. 6170. 6180. 6190. 6200. 6210. 6220.
EDITMAG2-11180
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11180
150.0000
100.0000
1km
220m

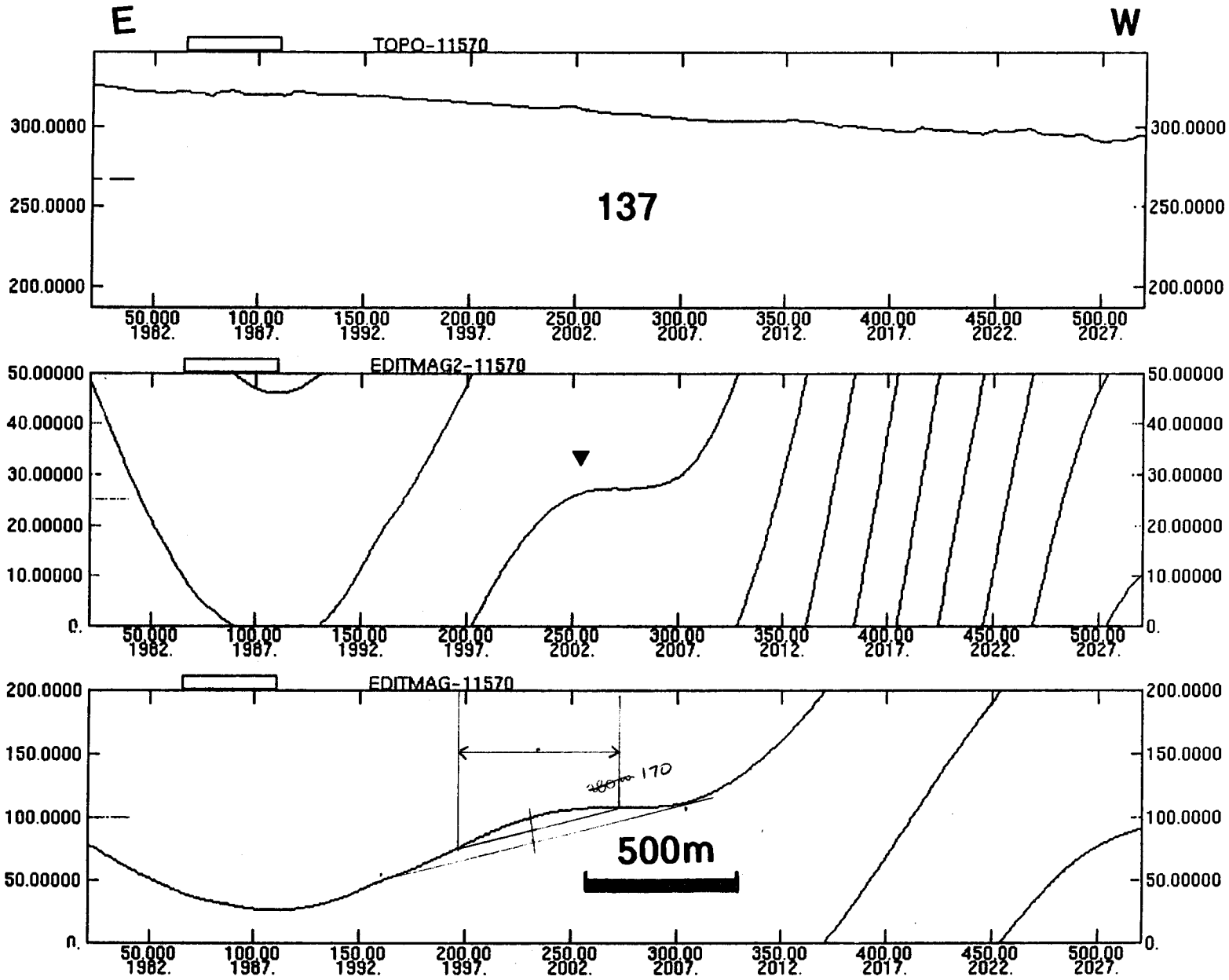

E
W
TOPO-10390
47
500.0000
400.0000
300.0000
200.0000
9500.0 3816.
9600.0 3826.
9700.0 3836.
9800.0 3846.
9900.0 3856.
10000. 3866.
10100. 3876.
10200. 3886.
10300. 3896.
10400. 3906.
EDITMAG2-10390
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10390
150.0000
100.0000
1km
540

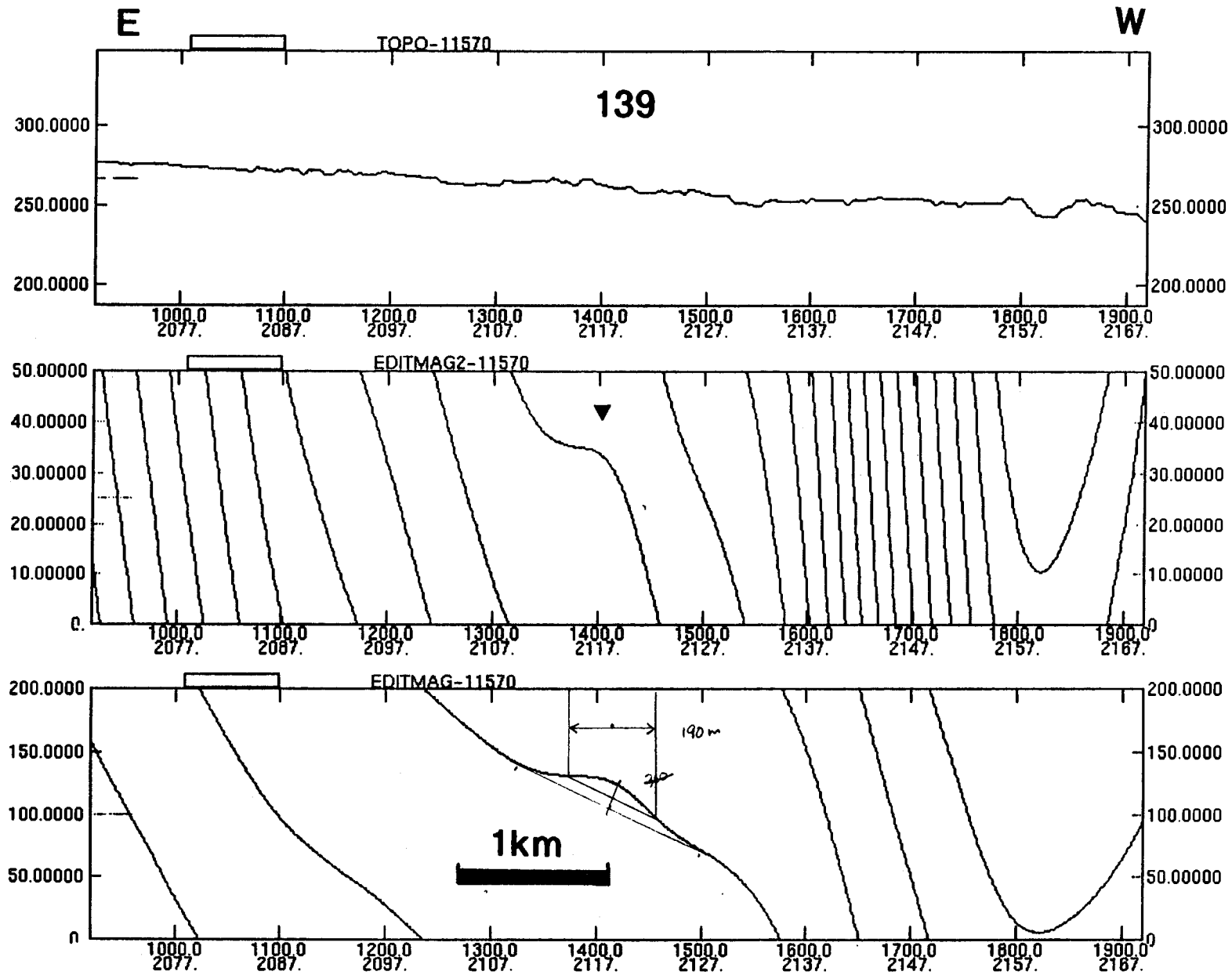

W
E
TOPO-10580
70
500.0000
400.0000
300.0000
200.0000
11400. 2541.
11600. 2561.
11800. 2581.
12000. 2601.
12200. 2621.
12400. 2641.
12600. 2661.
EDITMAG2-10580
20.00000
15.00000
10.00000
5.000000
0.
80m
EDITMAG-10580
200.0000
150.0000
100.0000
50.00000
0.
1km

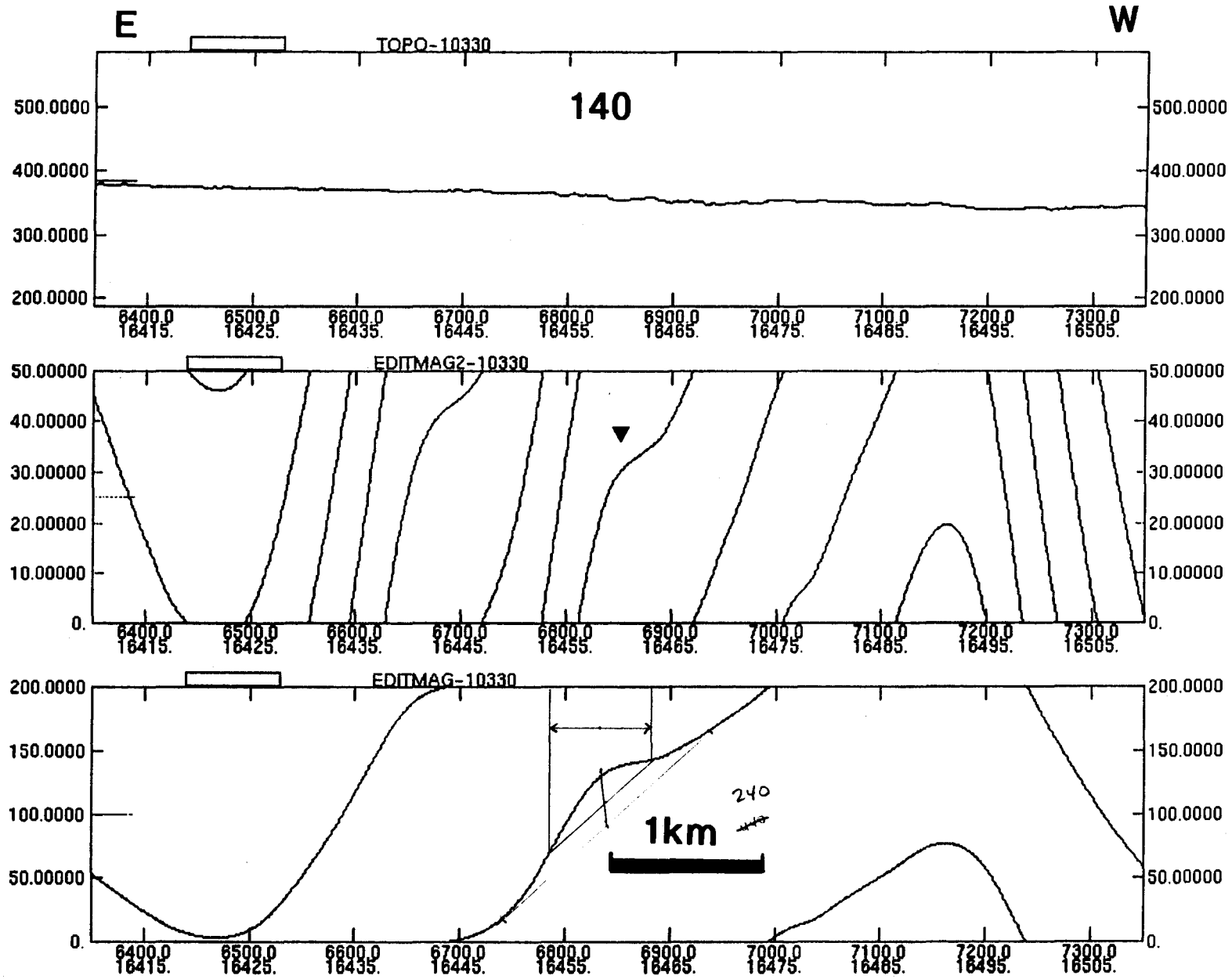

W
E
TOPO-10750
108
500.0000
400.0000
300.0000
200.0000
4100.0 13432.
4200.0 13442.
4300.0 13452.
4400.0 13462.
4500.0 13472.
4600.0 13482.
4700.0 13492.
4800.0 13502.
4900.0 13512.
5000.0 13522.
EDITMAG2-10750
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10750
200.0000
150.0000
100.0000
50.00000
0.
320 m
410 m
1km

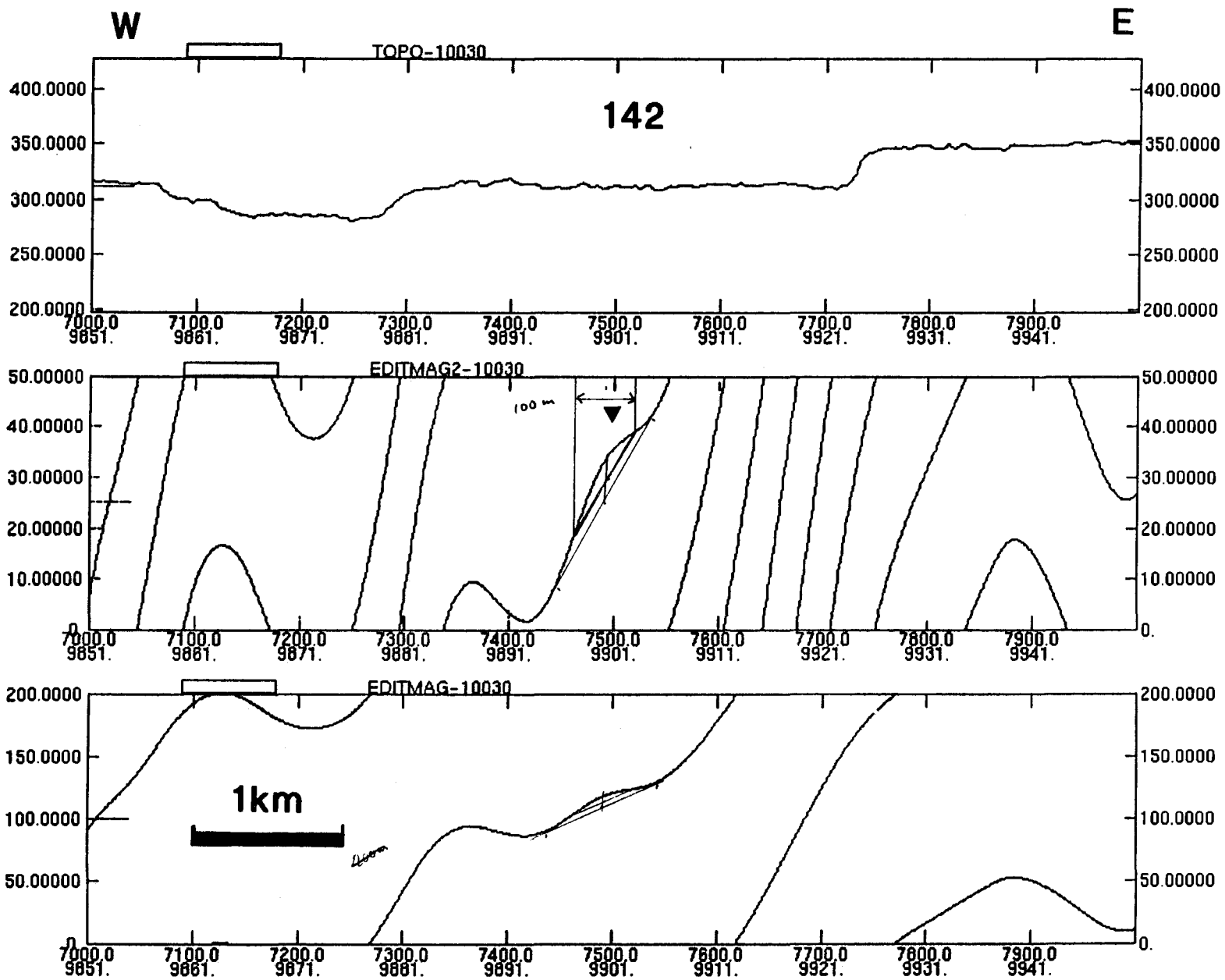

E
W
TOPO-10261
121
500.0000
400.0000
300.0000
200.0000
10200. 4139.
10300. 4149.
10400. 4159.
10500. 4169.
10600. 4179.
10700. 4189.
10800. 4199.
10900. 4209.
11000. 4219.
11100. 4229.
EDITMAG2-10261
20.00000
15.00000
10.00000
5.000000
0.
220
400m
EDITMAG-10261
200.0000
150.0000
100.0000
50.00000
0.
1km

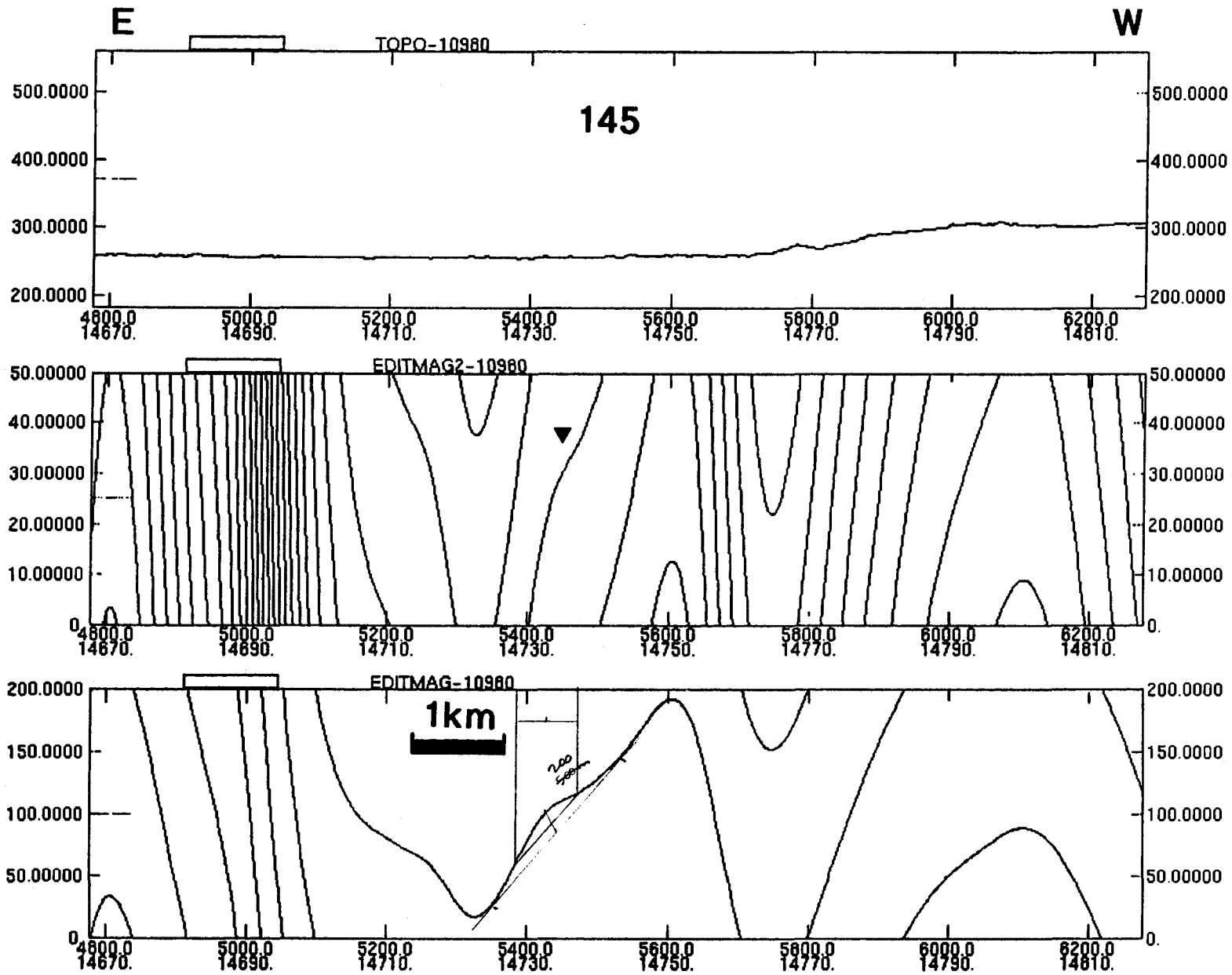

E
W
TOPO-10450
123
500.0000
400.0000
300.0000
200.0000
7100.0 756.
7200.0 766.
7300.0 776.
7400.0 786.
7500.0 796.
7600.0 806.
7700.0 816.
7800.0 826.
7900.0 836.
8000.0 846.
EDITMAG2-10450
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10450
200.0000
150.0000
100.0000
50.00000
0.
1km
120 m

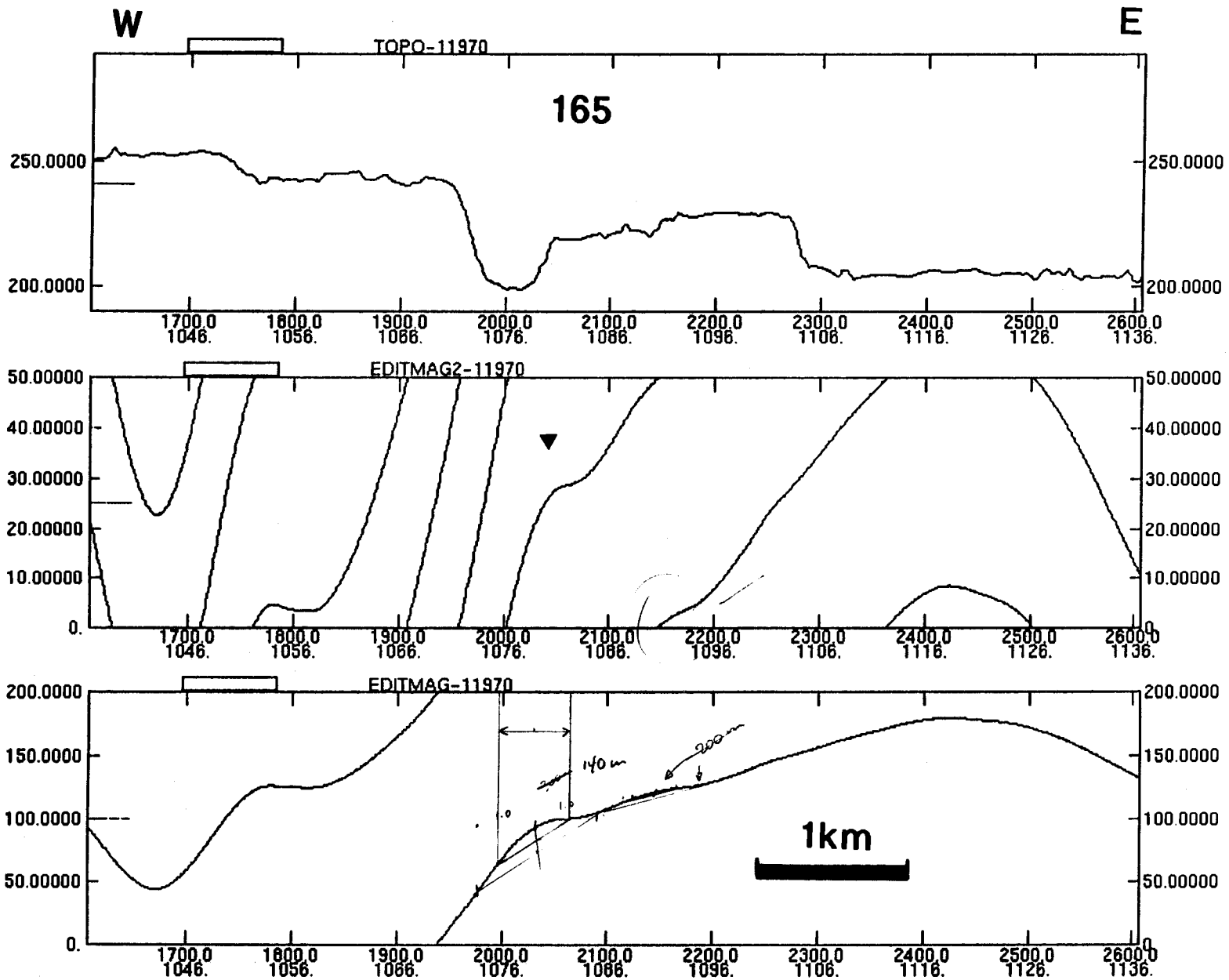

E
W
TOPO-11570
300.0000
250.0000
200.0000
137
50.000 1982.
100.00 1987.
150.00 1992.
200.00 1997.
250.00 2002.
300.00 2007.
350.00 2012.
400.00 2017.
450.00 2022.
500.00 2027.
EDITMAG2-11570
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11570
200.0000
150.0000
100.0000
50.00000
0.
170
500m

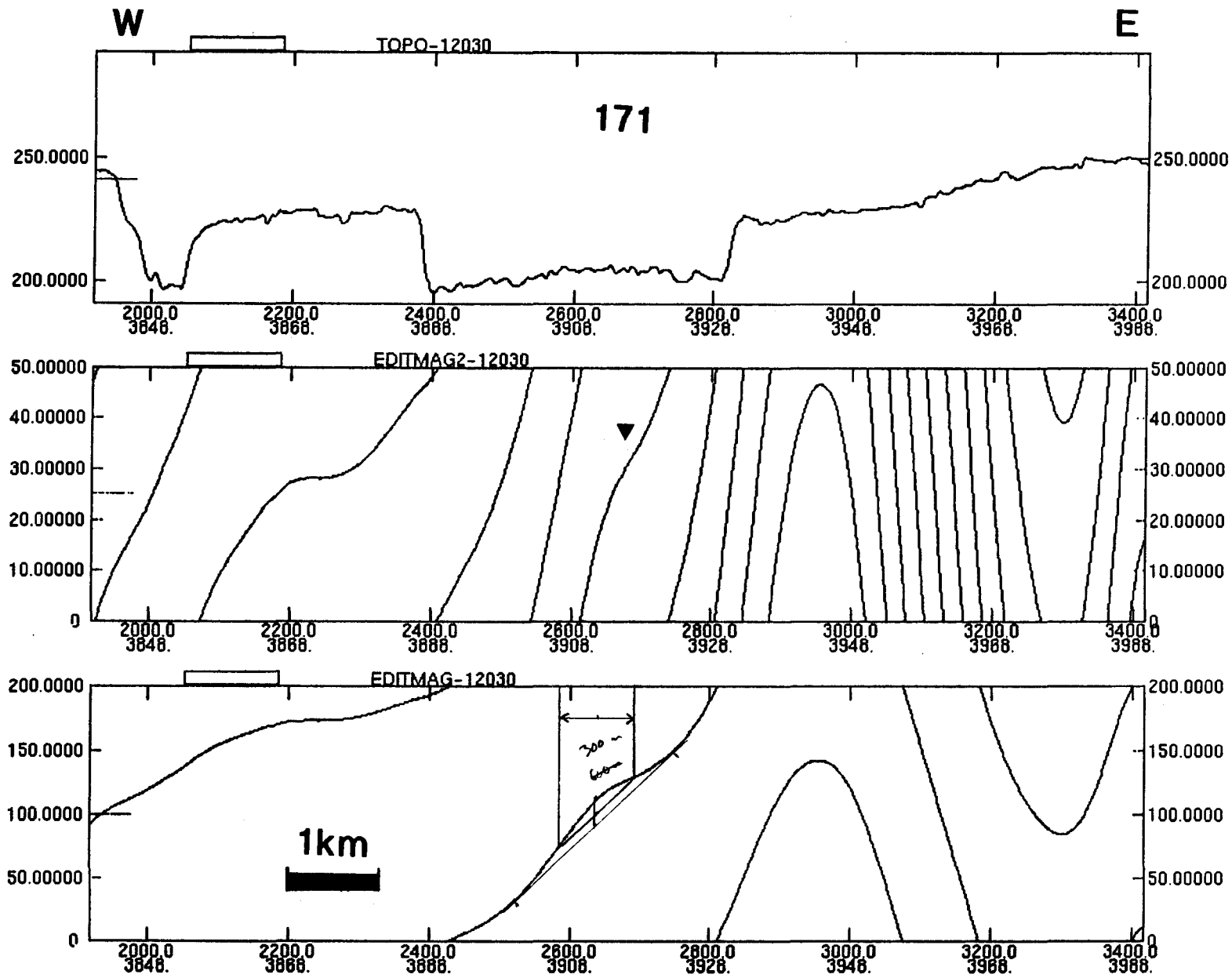

E
W
TOPO-11570
139
300.0000
250.0000
200.0000
1000.0 2077.
1100.0 2087.
1200.0 2097.
1300.0 2107.
1400.0 2117.
1500.0 2127.
1600.0 2137.
1700.0 2147.
1800.0 2157.
1900.0 2167.
EDITMAG2-11570
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11570
200.0000
150.0000
100.0000
50.00000
0
190 m
1km

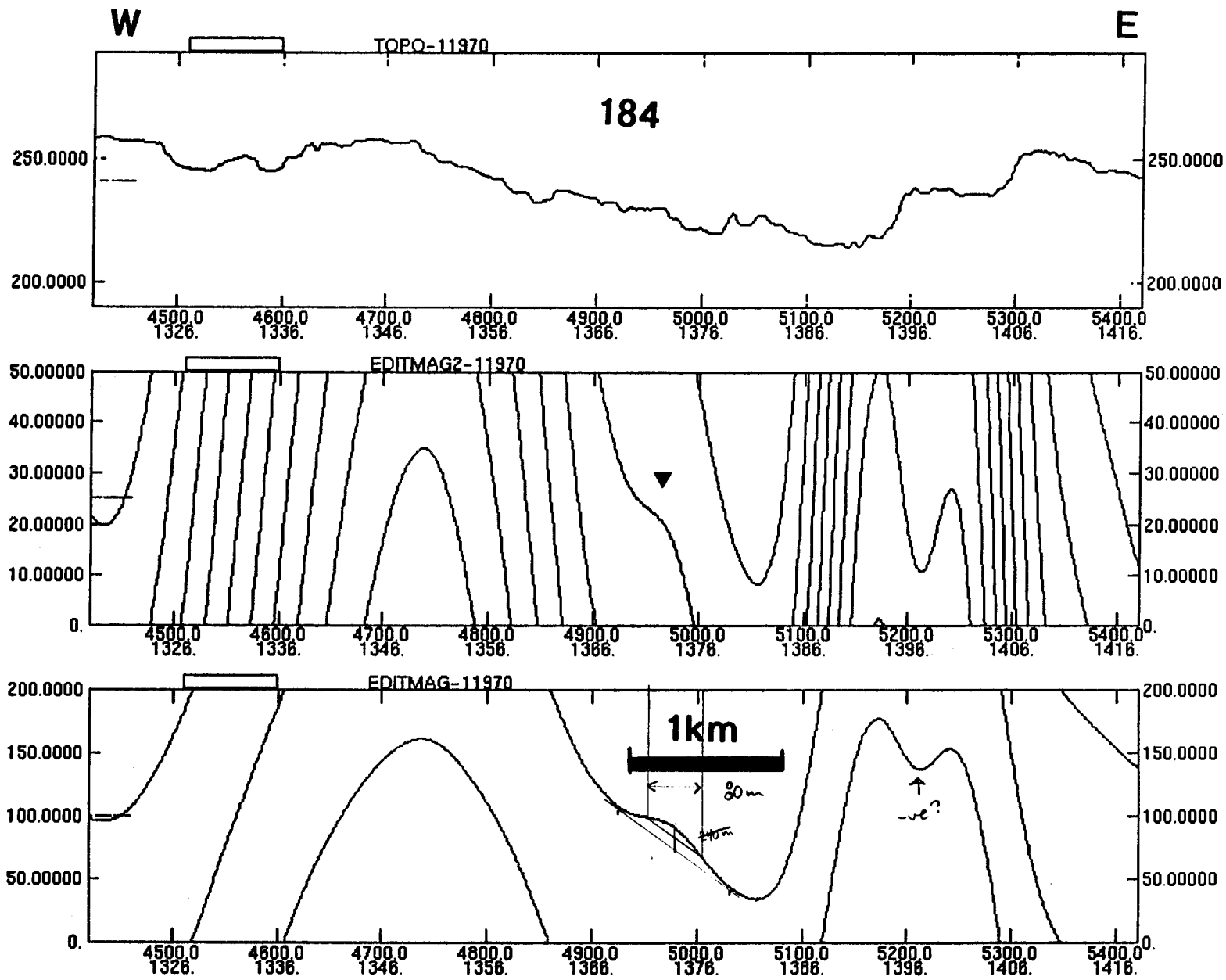

E
W
TOPO-10330
140
500.0000
400.0000
300.0000
200.0000
6400.0 16415.
6500.0 16425.
6600.0 16435.
6700.0 16445.
6800.0 16455.
6900.0 16465.
7000.0 16475.
7100.0 16485.
7200.0 16495.
7300.0 16505.
EDITMAG2-10330
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10330
200.0000
150.0000
100.0000
50.00000
0.
1km
240


W
E
TOPO-10030
142
400.0000
350.0000
300.0000
250.0000
200.0000
7000.0 9851.
7100.0 9861.
7200.0 9871.
7300.0 9881.
7400.0 9891.
7500.0 9901.
7600.0 9911.
7700.0 9921.
7800.0 9931.
7900.0 9941.
EDITMAG2-10030
100 m
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10030
200.0000
150.0000
100.0000
50.00000
1km


E
W
TOPO-10980
145
500.0000
400.0000
300.0000
200.0000
4800.0
14670.
5000.0
14690.
5200.0
14710.
5400.0
14730.
5600.0
14750.
5800.0
14770.
6000.0
14790.
6200.0
14810.
EDITMAG2-10980
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-10980
1km
200.0000
150.0000
100.0000
50.00000
0.


W
E
TOPO-11970
165
250.0000
200.0000
1700.0 1046.
1800.0 1056.
1900.0 1066.
2000.0 1076.
2100.0 1086.
2200.0 1096.
2300.0 1106.
2400.0 1116.
2500.0 1126.
2600.0 1136.
EDITMAG2-11970
50.00000
40.00000
30.00000
20.00000
10.00000
0.
EDITMAG-11970
150.0000
100.0000
140 m
200 m
1km


W
E
TOPO-12030
171
250.0000
200.0000
2000.0
2200.0
2400.0
2600.0
2800.0
3000.0
3200.0
3400.0
EDITMAG2-12030
50.00000
40.00000
30.00000
20.00000
10.00000
0
EDITMAG-12030
150.0000
100.0000
1km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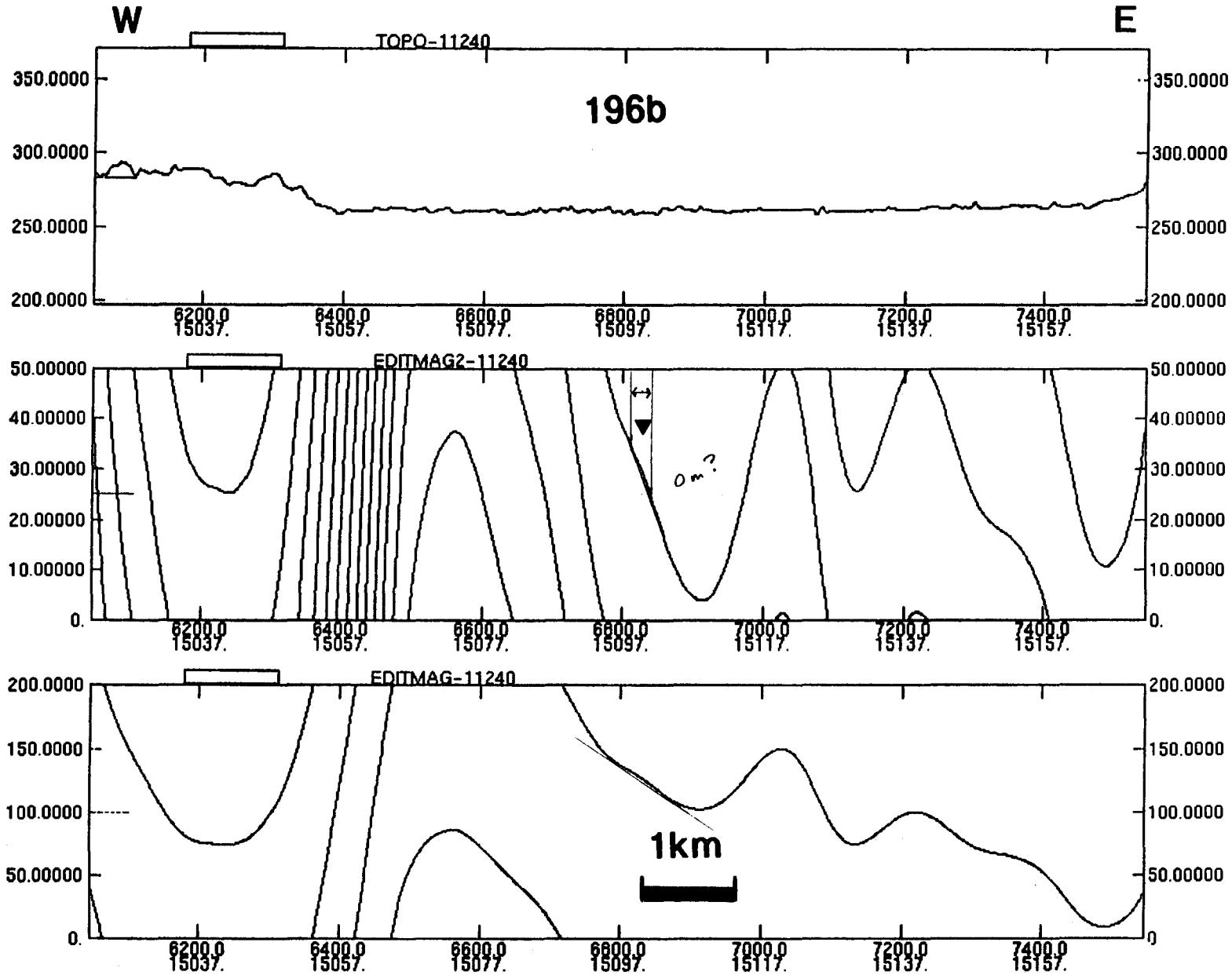
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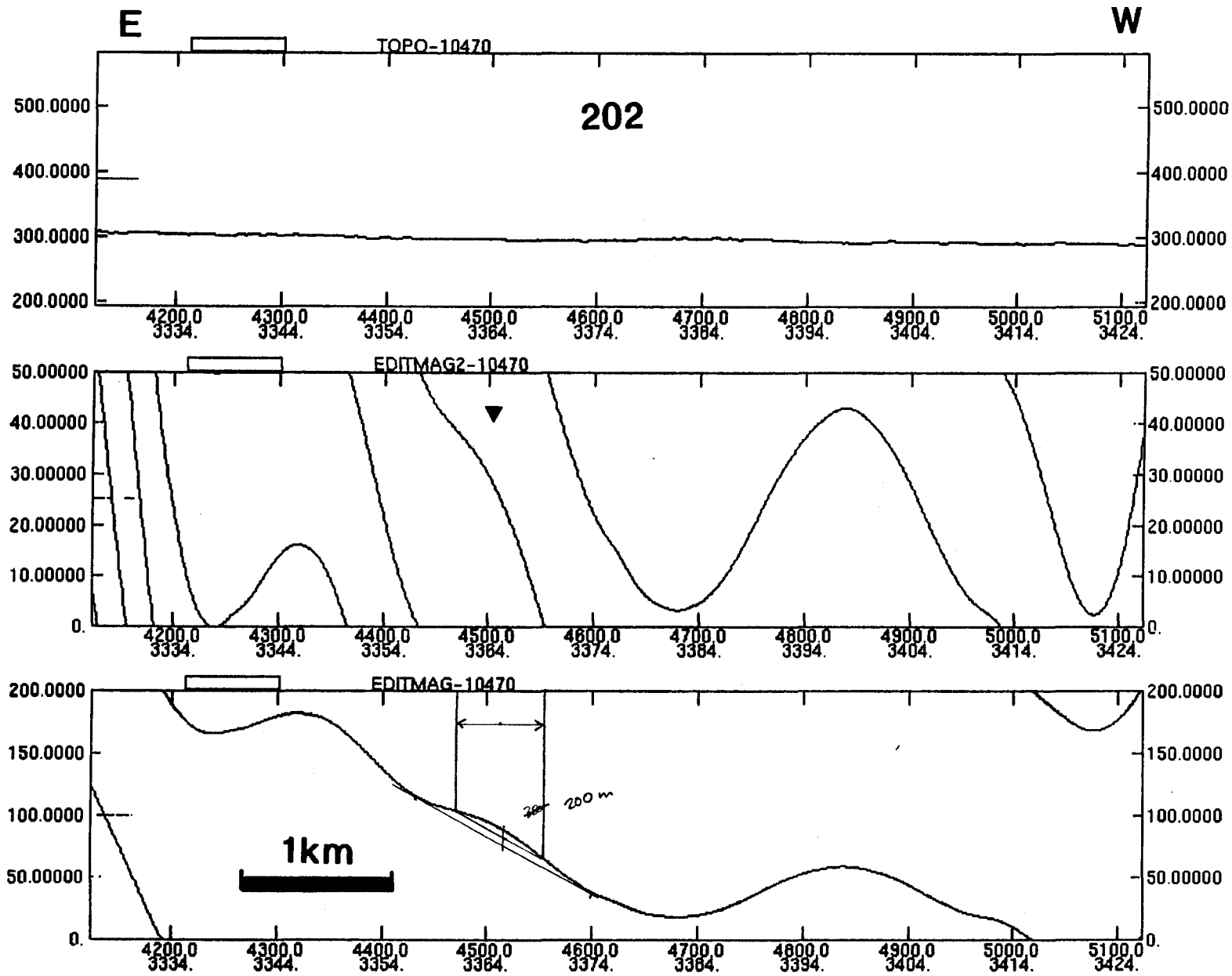
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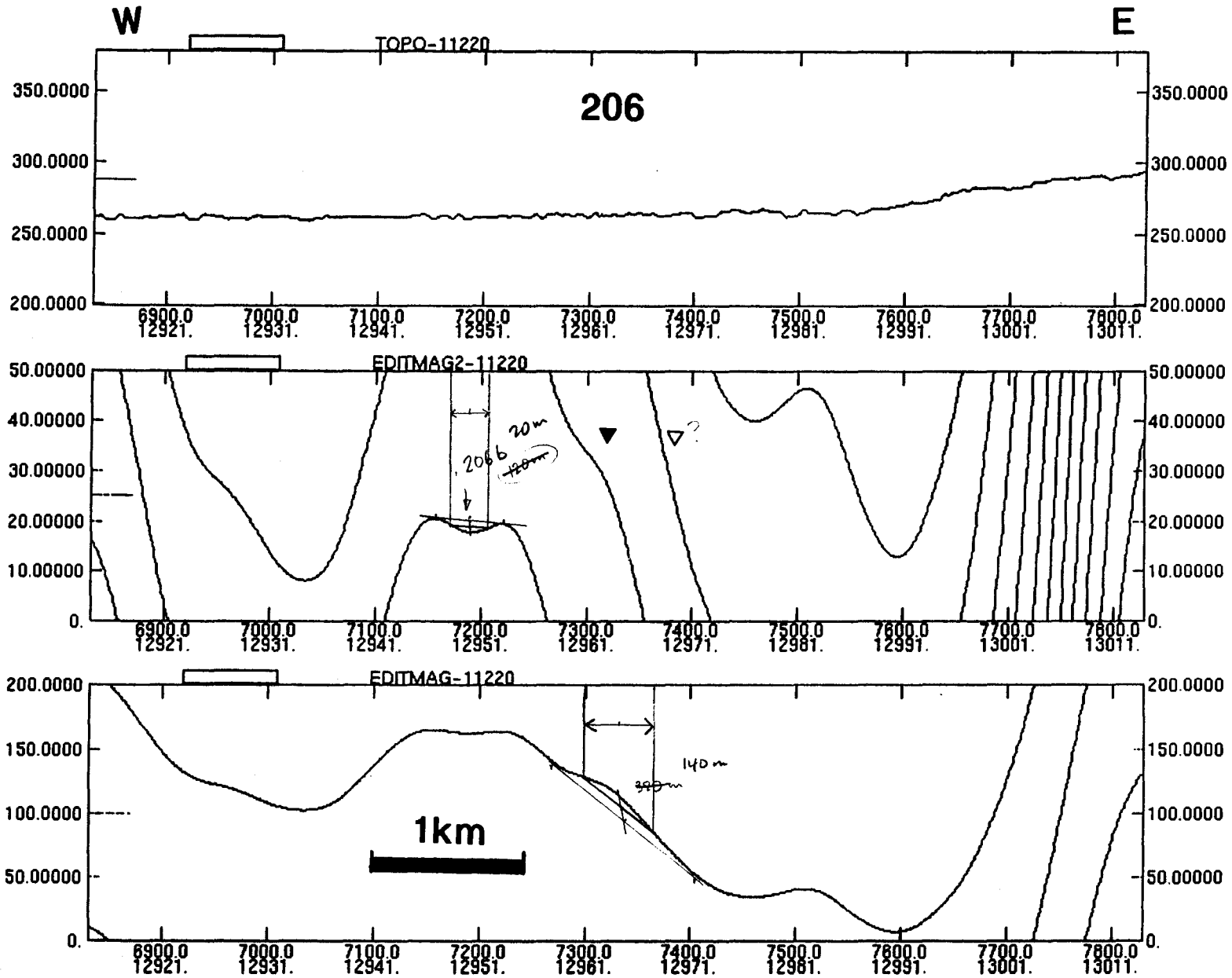
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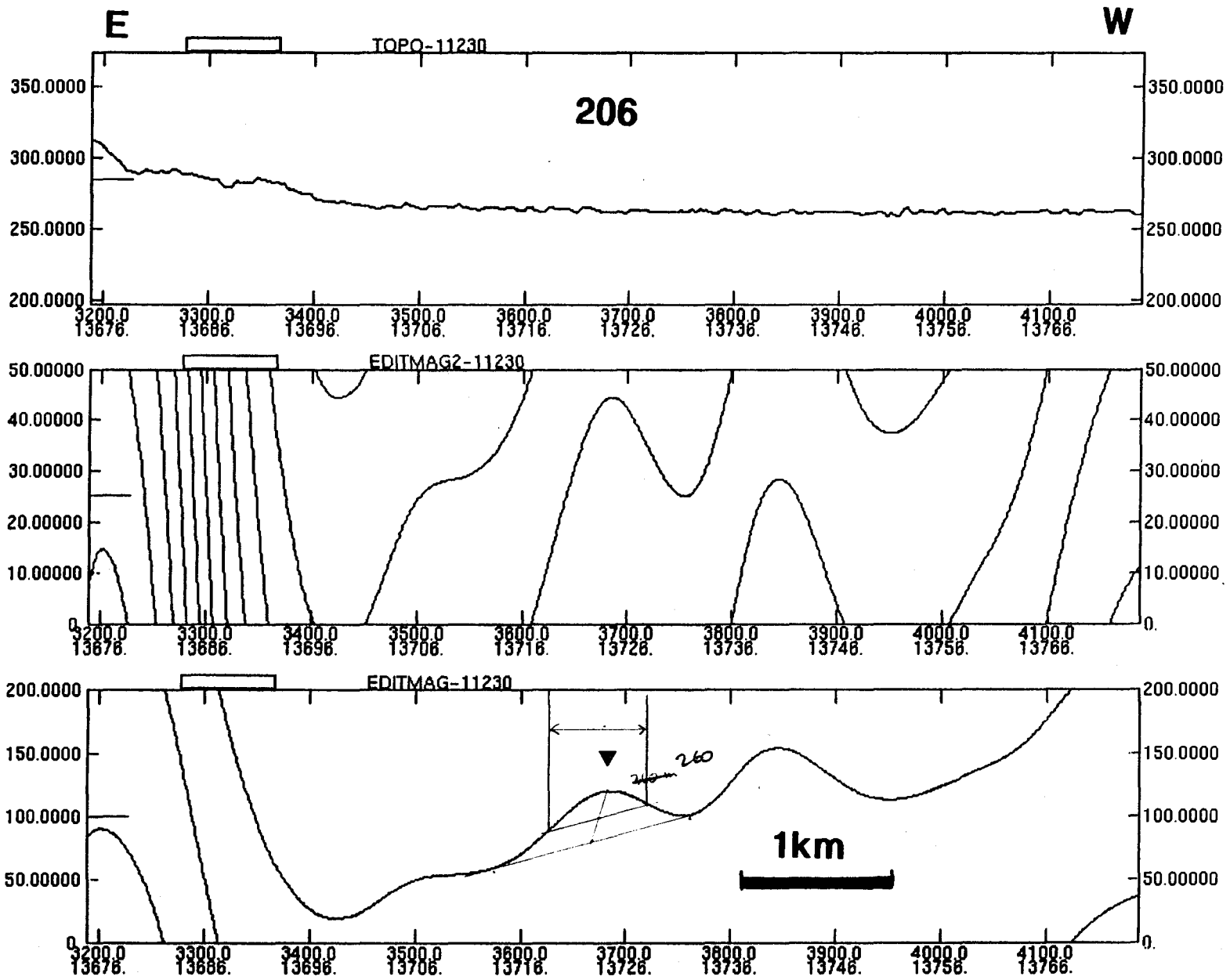
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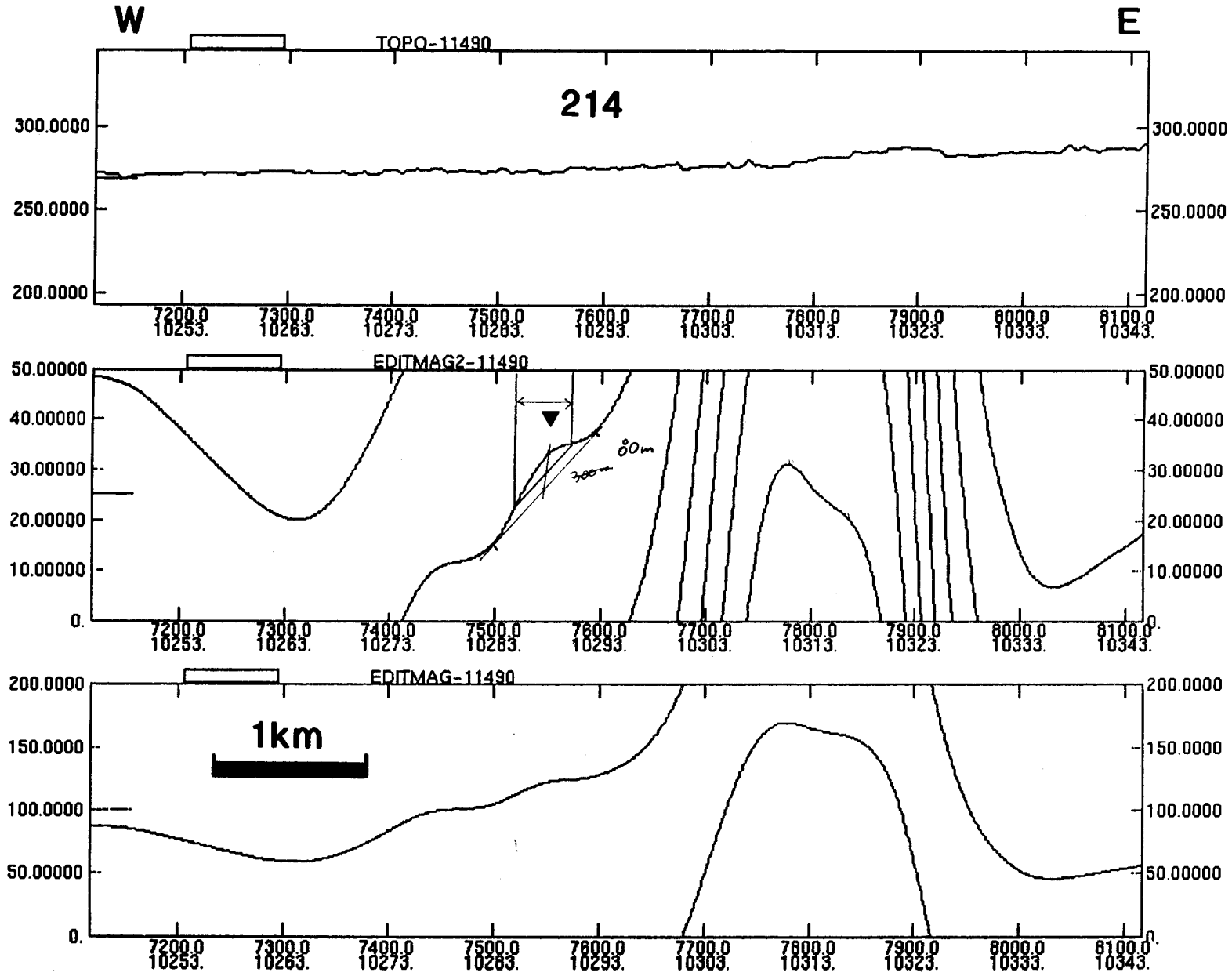
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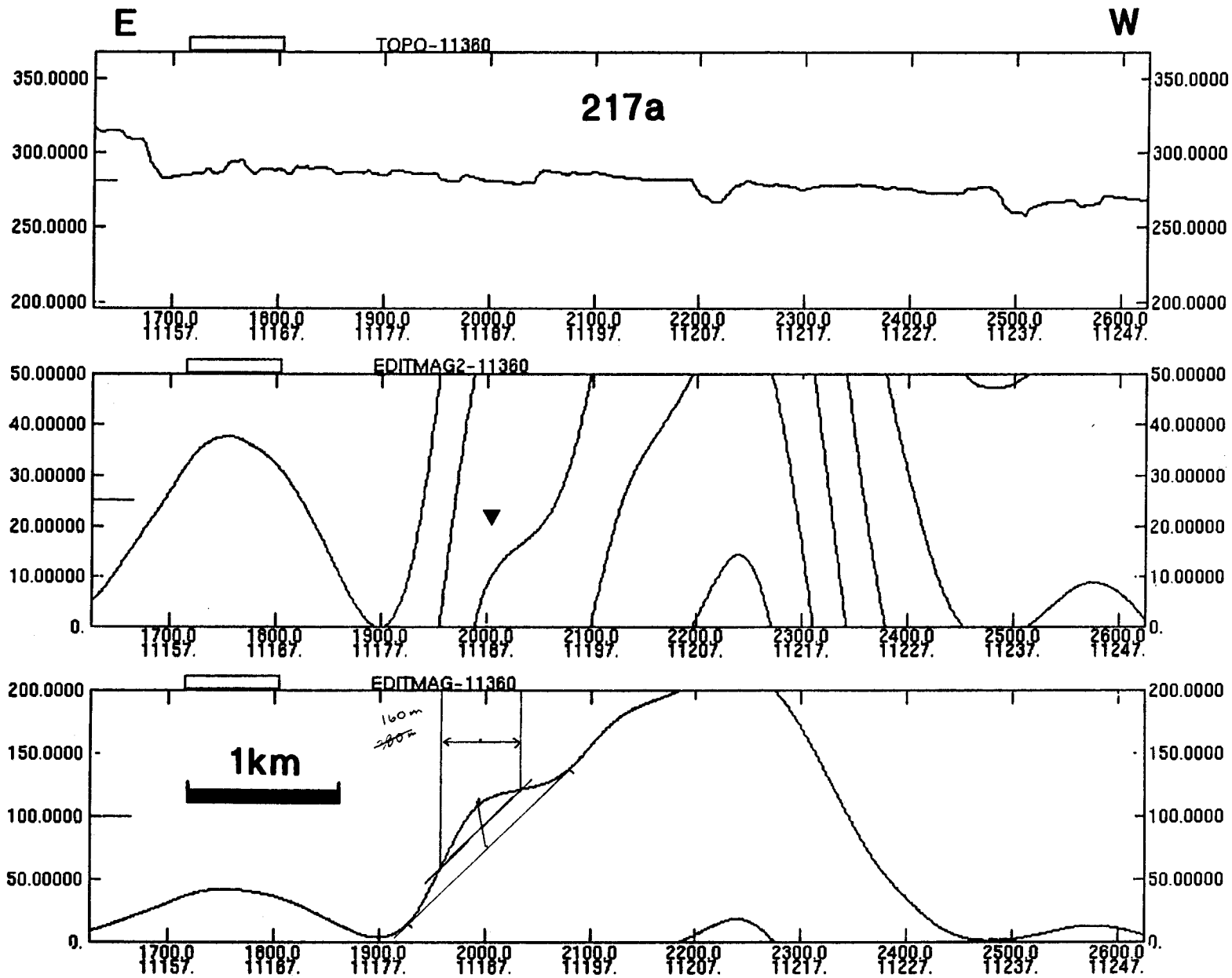
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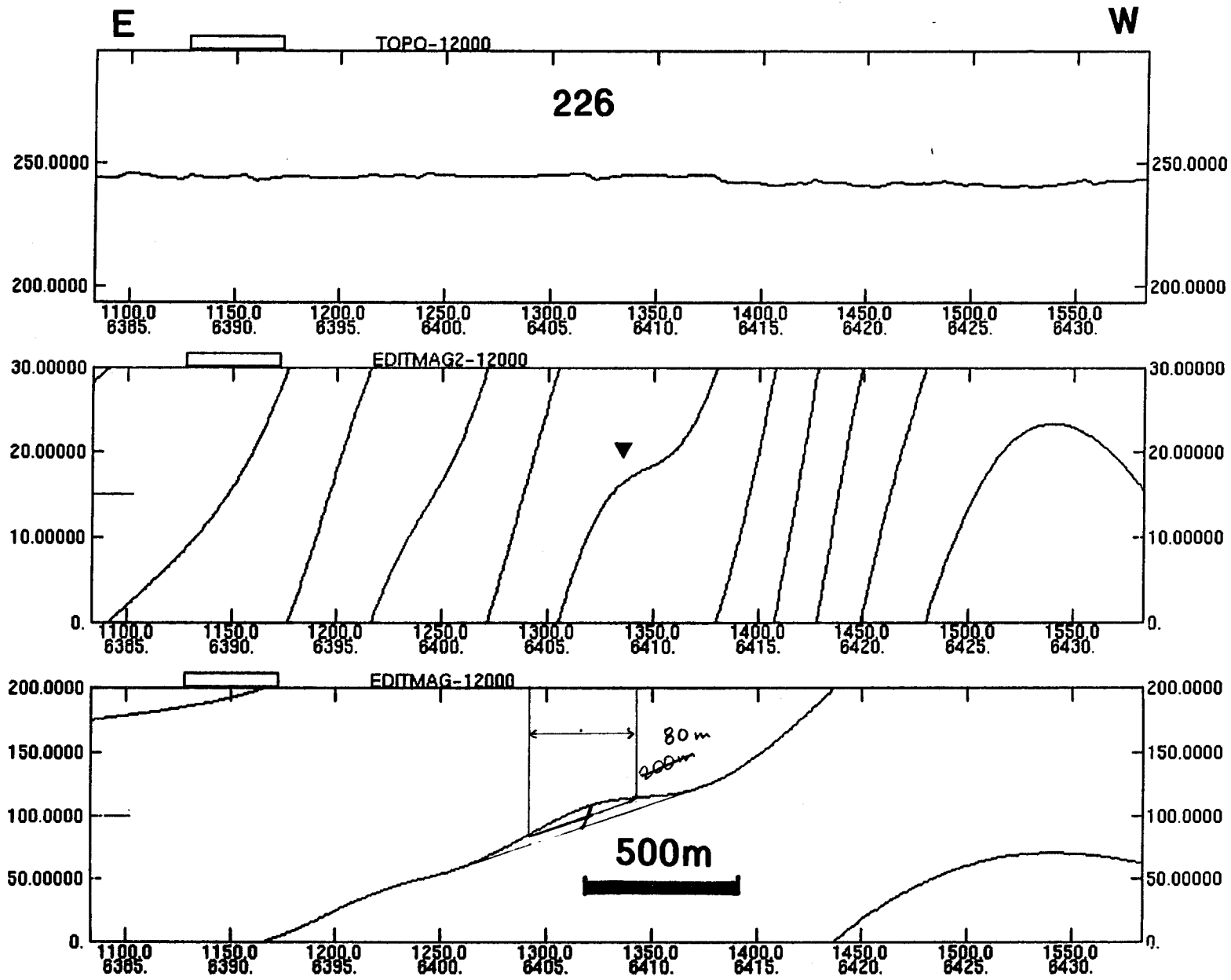
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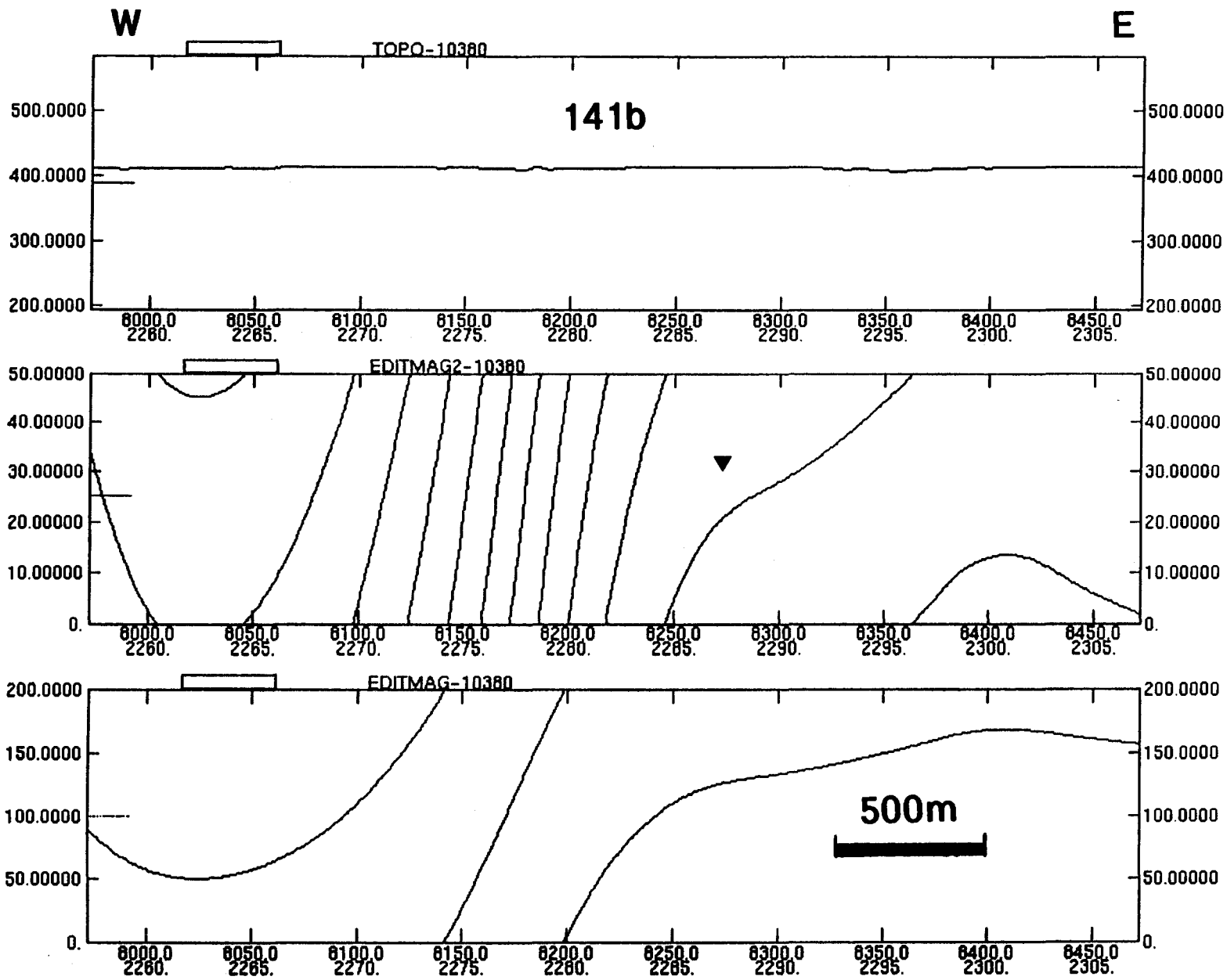
PRIORITY IV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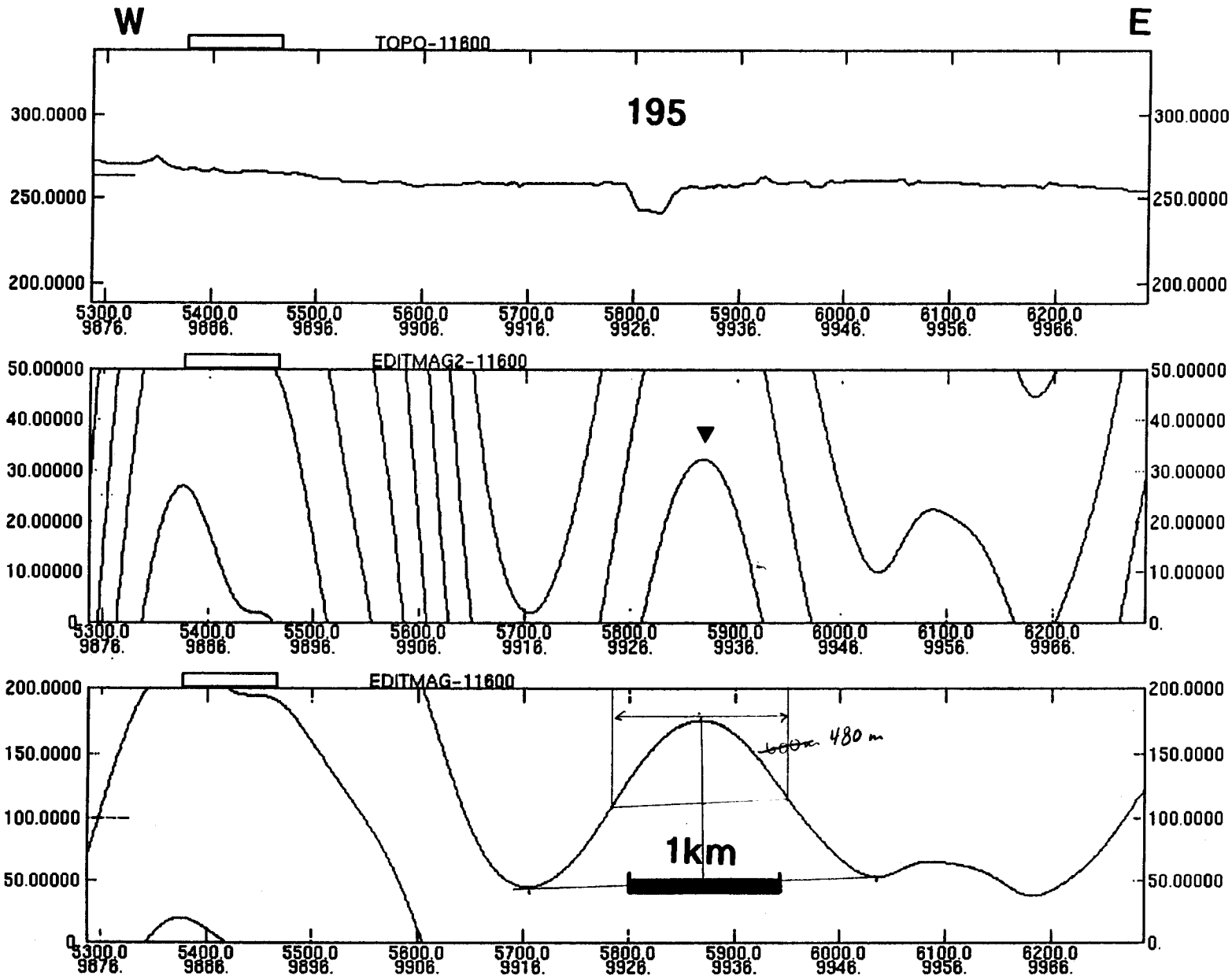
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0.
EDITMAG-11600
150.0000
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480 m
1km

Appendix D

Ground Magnetic Surveys

Appendix D.1.

Komex International Magnetometer Surveys

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KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

CANADA'S 50 BEST MANAGED PRIVATE COMPANIES

GROUND MAGNETIC SURVEY OF NINE AIRBORNE ANOMALIES, IN THE VICINITY OF FORT MACKAY

PREPARED FOR:

BIRCH MOUNTAIN RESOURCES LTD.

KI-4762

MAY 1998

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1. INTRODUCTION

Komex International Ltd. was requested by Birch Mountain Resources Ltd. to carry out geophysical exploration on pre-selected sites within a specified area approximately 90 km north of Fort McMurray, Alberta (Figure 1). The sites were provisionally located from data provided by an airborne magnetic survey. The use of ground magnetics, employed by Komex, was required to provide more detailed information on the location and nature of the airborne anomalies. The aim of the survey was to identify the anomalies that could be the result of shallow kimberlitic diatreme features, and thus provide viable targets for a drilling program.

The stratigraphy at all the sites comprises approximately 200 m of Paleozoic, Mesozoic, and Quaternary sediments overlying Precambrian basement. Distinguishing between features that intrude into the sediment, such as diatremes, and variations in basement topography and magnetic susceptibility is a significant problem for regional magnetic field interpretation in such areas where the Precambrian is shallow.

In total, nine anomalies were investigated. They are all located on relatively flat terrain bordered to the south and west by the higher topography of the Muskeg Mountains and Birch Mountains respectively (Figure 2). The Athabasca, Muskeg, and Firebag rivers flow through the general area. Seven of the nine sites were investigated using survey lines laid out in a grid pattern centered over the anomalies. The number of survey lines within these grids varied from 8 to 10. Where possible, all lines were 1000 m in length. In areas of dense vegetation, the lines were cut prior to the survey in order to allow easy access. Sites 16 and 221 were located in remote sections of the field area (Figure 2), and were approached by helicopter. On these two grids, only two perpendicular lines centered over each anomaly were surveyed.

Field work was carried out during the period of 11 February to 1 March 1998. Throughout this period, the weather was unusually mild. The warm temperatures allowed for comfortable working conditions, but caused problems with access to some of the sites due to the premature melting of ice bridges.

2. GEOPHYSICAL THEORY, FIELD METHODS AND DATA PRESENTATION

2.1 MAGNETIC THEORY

Magnetic anomalies caused by rocks are localized effects superimposed on the normal magnetic field of the Earth (geomagnetic field). Most common rock forming minerals owe their magnetic character to the generally small proportion of magnetic minerals that they contain. By far the most common of these is magnetite. Although the size, shape and dispersion of the magnetite grains within a rock affect its magnetic character, it is reasonable to classify the magnetic behavior of rocks by their magnetite content (Telford et al., 1991).

The geomagnetic field is measured in nanoTeslas (nT) and varies in intensity from about 25,000 nT in equatorial regions to about 70,000 nT at the poles. Within the general survey area, the magnetic intensity is approximately 60,000 nT. Other aspects of the geomagnetic field to consider are its inclination (angle with respect to the horizontal), declination (angle between the magnetic and geographical poles) and temporal changes due to solar activity, electrical storms and the Earth's rotation (diurnal variation). The regional magnetic field at any point on the Earth's surface is referred to as the International Geomagnetic Reference Field (IGRF). In magnetic surveying, variations from the IGRF are mapped in order to provide information about the magnetic properties of the rocks in the top 0 - 5 km.

Magnetic methods are widely used for exploring for intrusive rocks due to the contrast in magnetic properties between the intrusion and its host. In a sedimentary basin, the host sediments are generally weakly magnetic, whereas the igneous rocks may be moderately to strongly magnetic. Igneous and metamorphic rocks of the Precambrian basement can have a wide range of magnetic properties (Telford et al., 1991).

2.2 INSTRUMENTATION

Instrumentation for the survey consisted of two identical GSM-19 Overhauser magnetometer/ gradiometers. One instrument was set up as a base station, on or near the grid, to monitor variations in the geomagnetic field due to diurnal changes and magnetic storms. The second instrument was used in the mobile mode and carried by an operator walking the survey lines. Total magnetic field and vertical magnetic gradient data were acquired by the roving instrument. The vertical gradient is simply the difference in magnetic intensity measured by two vertically separated sensors, divided by the separation distance. Vertical gradient data can be useful in determining the relative depths of magnetic anomalies. In most surveys, the vertical gradient is derived mathematically from the horizontal gradients of the total field.

The total magnetic field data collected by the mobile magnetometer reflects both the anomalies caused by changes in geology and the temporal changes in the magnetic field. The gradiometer data are insensitive to the temporal changes. The base station data are used to remove the temporal variations leaving only the anomalies due to the geology of the survey area. Base station data were collected every 2 seconds during the mobile magnetometer survey. The plots of the total magnetic field versus time for the base station on each day are presented in Appendix I. Temporal variations in the field as recorded by the base station, varied from over 50 nT on active days, to as little as10 nT on magnetically quiet days.

Magnetic susceptibility measurements were made on a core collected by Birch Mountain Resources at Site 14, to support the magnetic modelling component of the survey. The Exploranium KT9 meter was used for this part of the survey.

2.3 SURVEYING AND GRID DESIGN

The locations of the anomalies were picked from the airborne magnetic data. These locations were placed on topographical maps, and a grid was designed over each target. A typical grid layout consisted of 8 to 10 survey lines, each of approximately 1000 m in length. A baseline and at least one tieline of similar lengths were cut perpendicular to the survey lines. The layout for each grid is shown in the site plans, and is also shown on the colour contoured maps of the magnetic field.

A surveying company (Stewart Weir & Co. Ltd.) was employed to locate the center of each grid on the ground using a modern Global Positioning System (accuracy = +/- 0.1 m). The surveying crew established a baseline and flagged the location of the survey lines. Line cutters then prepared shoulder width cutline on all survey, base, and tie lines. **All locations in this report are given in Universal Transverse Mercator (UTM) co-ordinates (Zone 12, North American Datum 1927).**

After the grids were established, the geophysics crew set up a magnetometer base station. Care was taken to set up the instrument away from potential sources of noise such as passing vehicles. Only one sensor is used when operating in base station mode. On the grid, magnetic field data were collected at 12.5 m intervals along survey lines spaced 100 m apart. Data were also collected on at least one baseline or tieline. These cross-lines are necessary to perform levelling of the survey lines.

2.4 DATA PROCESSING AND PRESENTATION

The magnetic field data are processed using the following steps:

1. Removal of base station variations.
2. Statistical levelling of tielines.
3. Full levelling of survey lines to tielines.
4. Gridding of survey lines.
5. Translation from grid to UTM co-ordinates.
6. Reduction to the IGRF.
7. Removal of a regional field (second order polynomial fit to total field).

In the case of grids 16 and 221, high resolution airborne data were available over the grids, and these data have been processed in an identical manner to the ground data.

The data are displayed primarily as maps of the magnetic field over the grid. The total magnetic field on each grid is shown in Appendix II. All of the grids contained some regional trends, so the anomalies are best viewed as total field residual maps (Figures 4, 6, 8, 10, 12, 14, 16, 18, and 20). All of the maps are presented using an equal-area colour scale to show the full dynamic range of the data. Two perpendicular profiles (NS and EW) were extracted from each residual grid and are presented in Appendix III. The vertical gradients measured in the field were close to the detection level of the instrument and showed no significant geological information. These data have not been presented in this report.

3. MAGNETOMETER SURVEY RESULTS

3.1 GENERAL OBSERVATIONS

The results for individual grids are discussed below. Generally, each grid contained a significant magnetic anomaly (> 20 nT), with a similar form as the anomalies identified in the airborne data. On grids 112 and 42, the anomaly was masked by strong regional gradients. The centers of the anomalies are listed in Table 1.

3.2 GRID 14

Data were collected over three days : 12, 13, and 22 February. Coverage on the northern part of the grid was limited to two cut lines, and the eastern edge of the grid is truncated by the Firebag river (Figure 3). The total magnetic field (Appendix II) and the residual map (Figure 4) show the presence of a large positive anomaly trending in a NS direction. Profiles in the NS and EW directions (Appendix III) show an anomaly of approximately 25 nT above the local background value. The EW profile shows a reasonably symmetrical single peak. Borehole BMR98-14 was sited on the top of the scarp close to the center of this anomaly. Appendix IV shows the lithologies encountered in the well and the magnetic susceptibilities measured on the core.

3.3 GRID 112

Data were collected over two days : 14, and 15 February. The total field in the vicinity of this grid has a strong horizontal gradient from west to east, essentially masking the anomaly. A second order regional trend was removed from the grid to show a residual anomaly with a magnitude of approximately 28 nT (Figure 6). The anomaly is broad and flat-topped with no particular trend (see profiles in Appendix III). Two minor peaks are evident on the EW profile.

3.4 GRID 42

Data were collected over two days : 20 and 21 February. As with grid 112, the total field contains a strong horizontal gradient masking the anomaly (Appendix II). The data were processed to produce a second order residual map (Figure 8). The profiles from this map indicate an anomaly of some 20 nT above the background. The EW profile shows a broad anomaly with low gradients on the flanks (Appendix III). The anomaly has a similar appearance in the NS direction, but is complicated by the presence of a metallic feature, possibly a well casing. Figure 7 shows the location of known wells on the grid.

3.5 GRID 210

Data were collected over four days : 18, 19, 20 February. The total field is shown in Appendix II. A simple first order regional (west-east dipping plane) was removed from the data to produce a first order residual map (Figure 10). The profiles from this map indicate an anomaly of some 35 nT above the background with a single asymmetrical peak in the EW direction (Appendix III). The NS profile shows three small peaks (10 nT amplitude) superimposed on the larger anomaly.

3.6 GRID 16

Two profiles were collected over this anomaly on the 23rd of February. Raw airborne data were supplied by Canagrad Ltd. over the same area. A linear trend was removed from the ground data to produce two residual profiles (Appendix III). The airborne data were processed in an identical manner to the ground data. A second order residual was removed from the total field to produce the anomaly map shown in Figure 12. The profiles from this map indicate an anomaly of some 20 nT above the background, while the ground data show a more substantial 50 nT anomaly (Appendix III). Both the NS and EW profiles show a very symmetrical bell shaped anomaly characteristic of a moderately shallow discrete body.

3.7 GRID 221

Profiles across the anomaly were collected on the 23rd of February. The profile data were processed to produce a residual using the same method as on grid 16 (Appendix III). The airborne data were levelled, and an area over the anomaly was extracted from the grid (Figure 14). The profiles from this map indicate an anomaly of some 18 nT above the background (Appendix III). The ground profiles show anomalies with amplitudes of 30 nT. The EW profile shows a very symmetrical anomaly, suggesting a body similar to that postulated for grid 16. However, the map in Figure 14 shows that the profile may be across the flank of the anomaly.

3.8 GRID 29

Data were collected over two days : 25 and 26 February. The total field map shows an isolated anomaly close to the centre of the grid. The data were processed to produce a residual map (Figure 16). The profiles from this map indicate an anomaly of some 40 nT above the background (Appendix III). A body comparable to that suggested for the previous two sites (16 and 221) would be suitable for this feature.

3.9 GRID 169

Data were collected over two days : 27 and 28 February. The data were processed to produce a residual map (Figure 18). The profiles from this map indicate an anomaly of some 25 nT above

background (Appendix III). The EW profile shows a single, symmetrical peak. The anomaly is asymmetrical in the NS direction, displaying two subsidiary peaks on the southern flank.

3.10 GRID 189

Data were collected on the 28th of February. The data were processed to produce a residual map (Figure 20). The profiles from this map indicate an anomaly of some 55 nT above the background (Appendix III). The EW profile shows slopes of a moderate gradient leading to a broad central peak. In the NS direction, there are two main peaks with a central saddle at about 10 nT below the maximum reading.

4. MODELING RESULTS

All modeling was undertaken using the GM-SYS ™ interactive potential field modeling package. At the request of the client, simple pipe geometrys (pipe shaped bodies with a flared top) were used as templates during the processing. These models are based on the proposed geometry of kimberlite pipes discovered some 300 km to the west of this survey area. Potential field modeling is notoriously non-unique. In an attempt to minimize the number of unknowns, the geometry of the bodies was restricted to variations on the pipe body.

The magnetic susceptibilities of the background lithologies were derived from the log at BMR98-14 (Appendix IV). In general, the susceptibilites of the sedimentary rocks are close to the minimum detection level on the susceptibility meter (0.01×10^{-3} SI) The major unknown in the background model is the susceptibility of the Precambrian basement. Given the location of the study area over a range of basement tectonic terranes, basement susceptibilites may be highly variable. The susceptibility of the pipe was based on values derived from previously published reports on kimberlites, and inhouse data from Lytton Minerals Ltd.. An attempt was also made to model the data using a much lower susceptibility value for the body, derived from known kimberlite pipes in the NWT. The lower susceptibilites required placing the bodies at improbably shallow depths, leading to the conclusion that the causative bodies in the Fort McMurray area must have higher magnetic susceptibility values. Remanent magnetisation was assumed to be negligible in both the sedimentary host and the body.

The results of the modelling for grids 14, 16, 29, 169, 189, 210, and 221 are shown in Appendix V and Table 2. In general, it is possible to get a rough fit with a simple pipe. Improving the fit to the observed profiles would be possible by varying the shape of the top of the body. However, given the uncertainty in the susceptibilities used, further modelling was not performed. The bodies are significantly broader than originally proposed. The width is required to fit the wavelength of the anomalies.

5. CONCLUSIONS

The use of ground magnetic surveying has proved to be useful in defining the plan view, extent and relative magnitude of anomalies initially located by airborne surveys. The first vertical derivative plots of the regional airborne data accurately identified locations of the magnetic anomalies. The high resolution airborne data was particularly useful in areas of poor access. However the ground magnetic profiles still provided significantly more detailed delineation of the anomalies.

The low vertical gradients measured in the field were confirmed by the lack of noticeable gradient changes between ground and airborne data. Low vertical gradients suggest the bodies are at a greater depth than initially proposed based solely on the airborne data.

The use of modeling techniques to predict the nature and emplacement of the causative bodies has proved to be inconclusive in this case due to the lack of well defined limiting parameters. Nevertheless, modeling has been useful for presenting a selection of possible emplacement scenarios.

6. REFERENCES

Telford, W. M. , Geldart L. P., and Sheriff, R. E., 1991: Applied Geophysics. (second edition). Cambridge University Press.

7. DISCLAIMER

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The pertinent information reviewed by Komex has been included in this report. The information provided by others is believed to be accurate but cannot be guaranteed. Any questions concerning the information or its interpretation should be directed to Dr. Richard Kellett or Mr. Dennis Croxall.

Respectfully,

KOMEX INTERNATIONAL LTD.

[redacted]

for Richard Kellett, Ph.D. P.Geoph.

[redacted]

Dennis Croxall, B.Sc. Paul Bauman, M.Sc., P. Eng.

J:\4762\reports\APR98.doc

TABLES

Grid Name	UTM Center	Data types	IGRF		
			Intensity	Inclination	Declination
Grid 112	450786E 6360197N	Grid	59932.94	79.34	20.00
Grid 29	478145E 6388073N	Grid	59932.39	79.33	20
Grid 169	475324E 6388060N	Grid	59928.50	79.32	20.03
Grid 189	489885E 6375993N	Grid	59936.34	79.30	19.80
Grid 210	491740E 6379966N	Grid	59942.58	79.33	19.79
Grid 42	467028E 6346234N	Grid	59872.86	79.05	19.91
Grid 14	494660E 6379940N	Grid	59946.37	79.34	19.76
Grid 16	497714E 6371807N	Line+Airborne	59942.08	79.30	19.68
Grid 221	498978E 6384613N	Line+Airborne	59956.71	79.38	19.74

BIRCH MOUNTAIN RESOURCES Ltd.

GRID DETAILS

TABLE 1

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762

Grid	Profile Orientation		Magnetic Susceptibility Values (SI)			
	Origin	Azimuth	Basement	Paleozoic and Cretaceous	Quaternary	Pipe
Grid 29	478140E, 6387720N	000	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	5.0×10^{-3}
Grid 169	475320E, 6387560N	000	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	2.5×10^{-3}
Grid 189	489650E, 6375720N	052	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	6.0×10^{-3}
Grid 210	491500E, 6379870N	068	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	3.0×10^{-3}
Grid 14	494370E, 6379790N	090	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	3.0×10^{-3}
Grid 16	497770E, 6371310N	353	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	3.0×10^{-3}
Grid 221	498970E, 6384120N	001	0.4×10^{-3}	0.2×10^{-3}	0.25×10^{-3}	3.0×10^{-3}

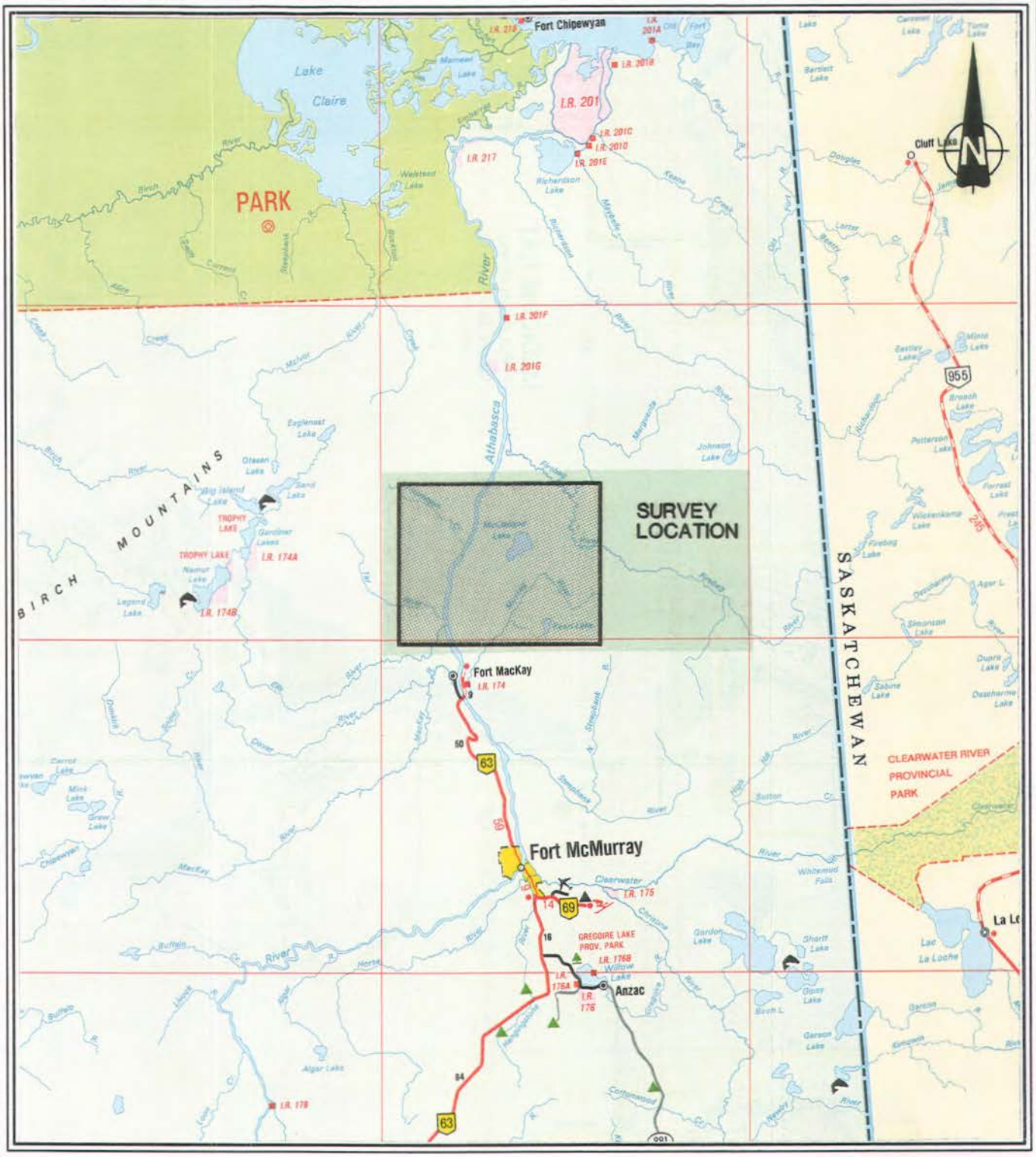
BIRCH MOUNTAIN RESOURCES Ltd.

MAGNETIC SUSCEPTIBILITY VALUES

TABLE 2

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762

FIGURES



SCALE 1 : 1,500,000

BIRCH MOUNTAIN RESOURCES LTD.
GROUND MAGNETIC SURVEYS

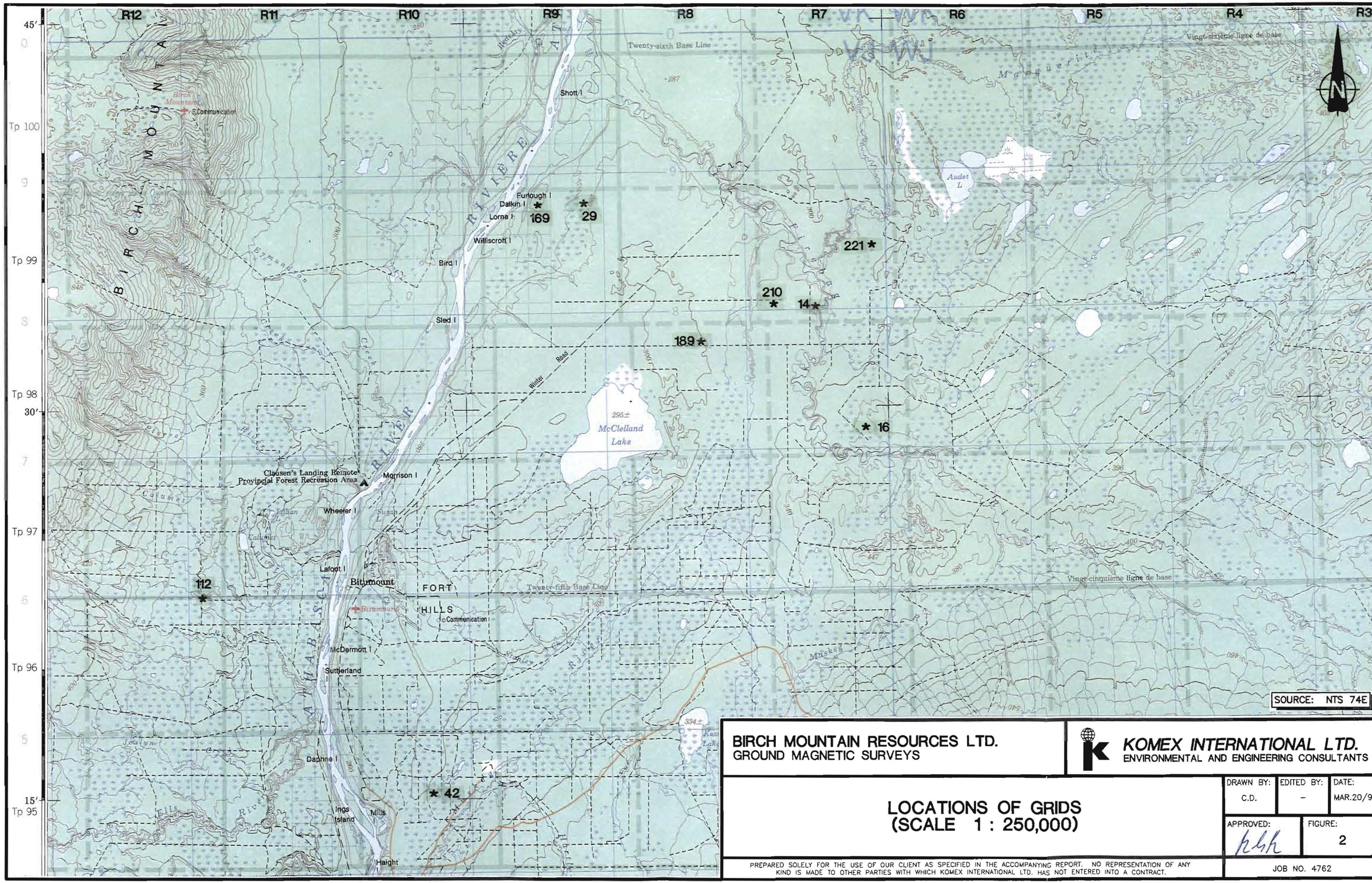
KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE LOCATION MAP

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.20/98
APPROVED:	FIGURE:	
	1	

PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH KOMEX INTERNATIONAL LTD. HAS NOT ENTERED INTO A CONTRACT.

JOB NO. 4762



SOURCE: NTS 74E

BIRCH MOUNTAIN RESOURCES LTD.
GROUND MAGNETIC SURVEYS

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

LOCATIONS OF GRIDS
(SCALE 1 : 250,000)

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.20/98

APPROVED:	FIGURE:
kgh	2

JOB NO. 4762

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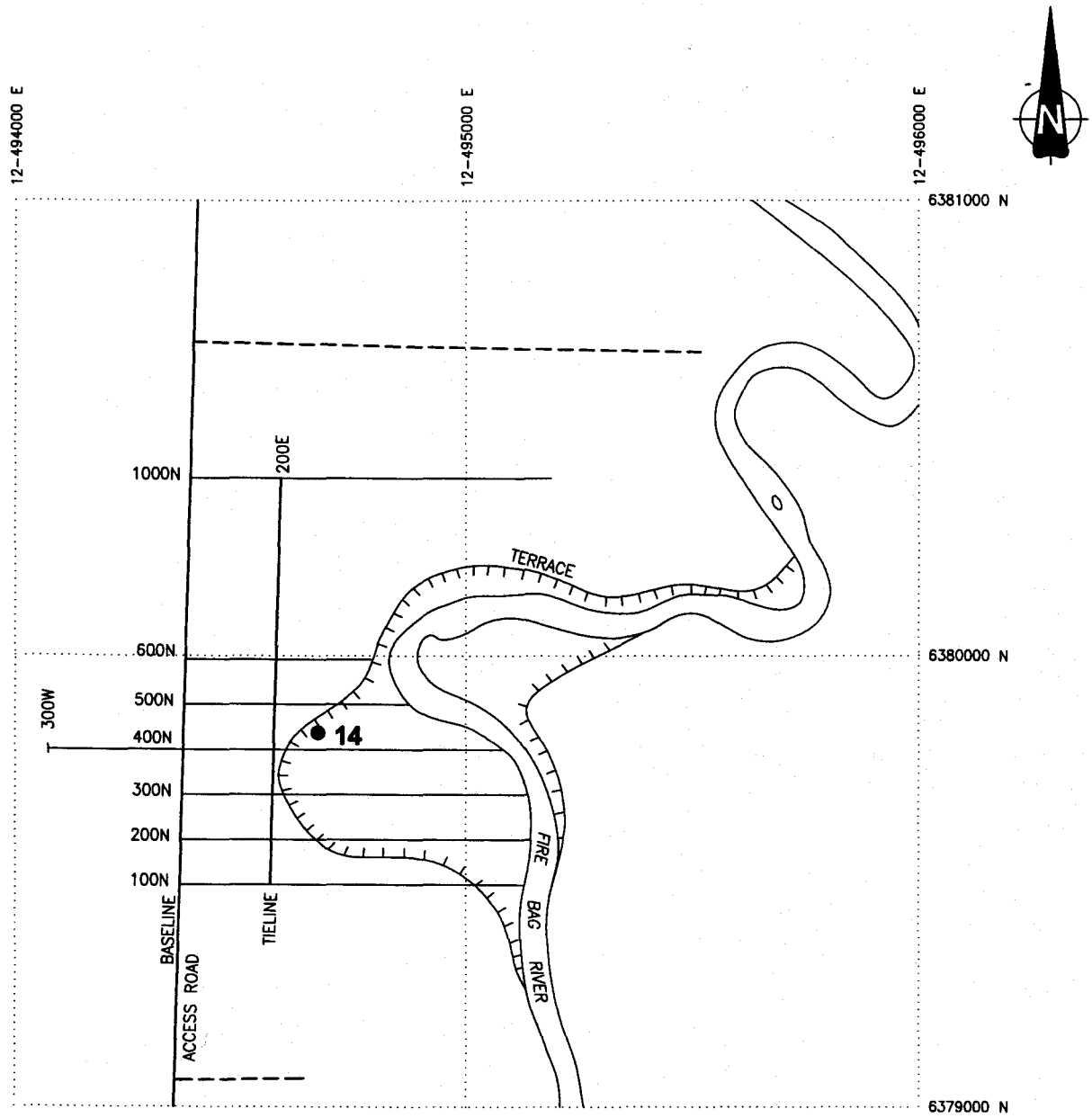

LEGEND

● 14 AIRBORNE ANOMALY #14

— — — PREVIOUS CUT SEISMIC LINE

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #14

DRAWN BY:	EDITED BY:	DATE:
C.D.	J.P.	MAY 8/98

APPROVED:	FIGURE:
RLP	3

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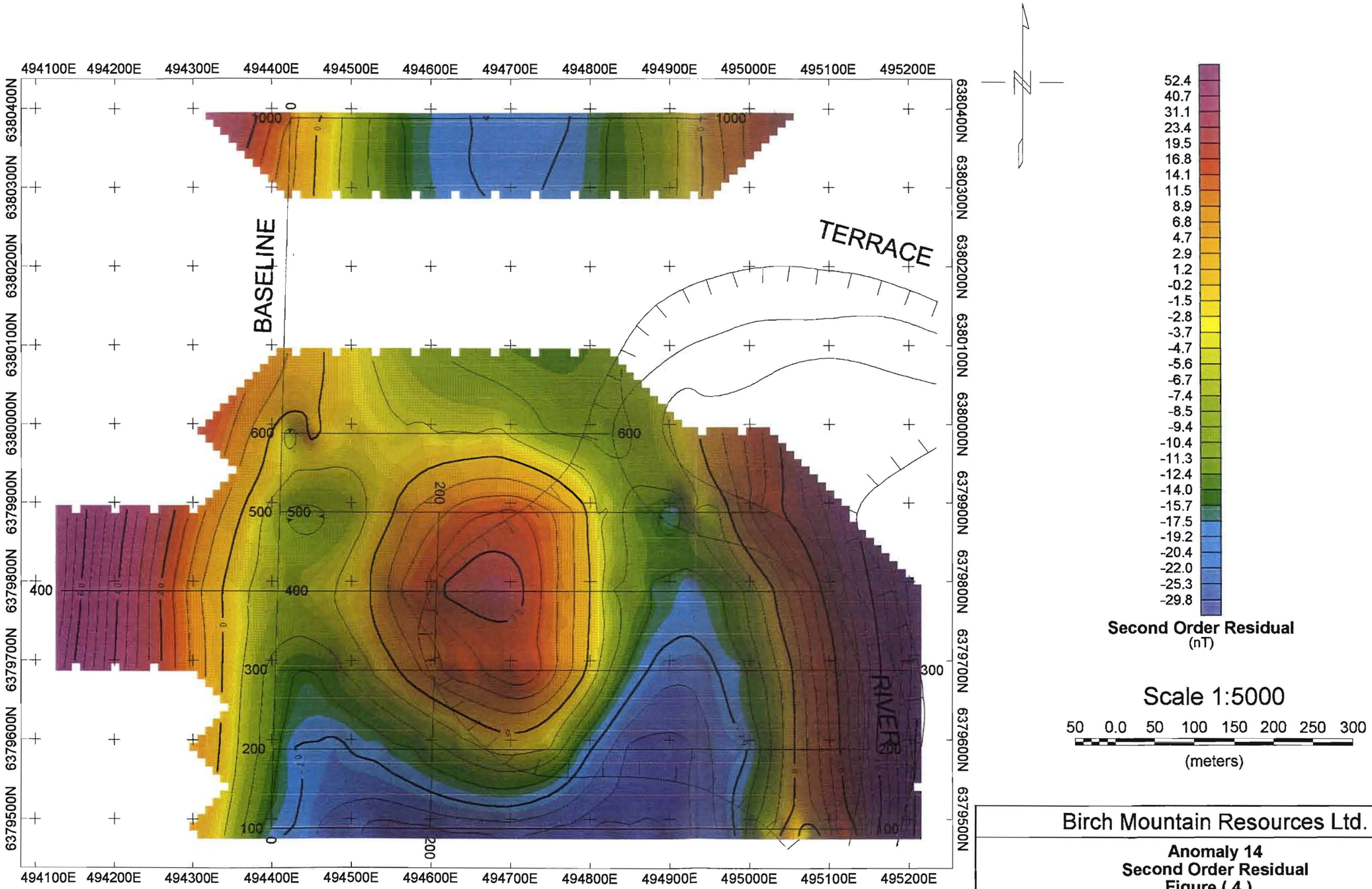
FILE: J:\4762\ANOM-14.dwg

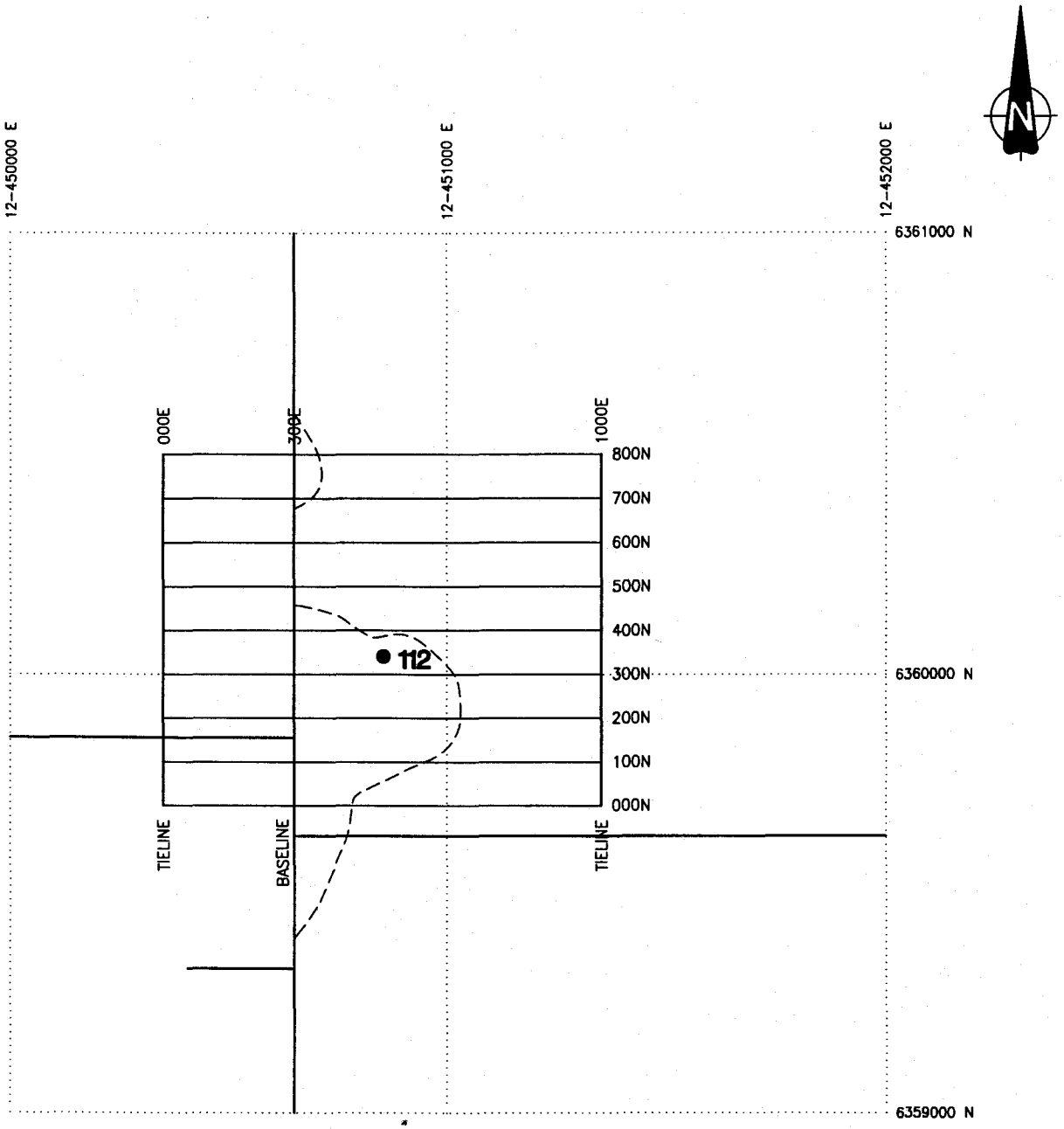


Birch Mountain Resources Ltd.

Anomaly 14
Second Order Residual
Figure (4)

Data collected 12, 13, 22 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● 112 AIRBORNE ANOMALY #112

– – – TRAIL

——— SEISMIC LINE

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #112

DRAWN BY:	EDITED BY:	DATE:
C.D.	C.D.	APR.09/98

APPROVED: RK

FIGURE: 5

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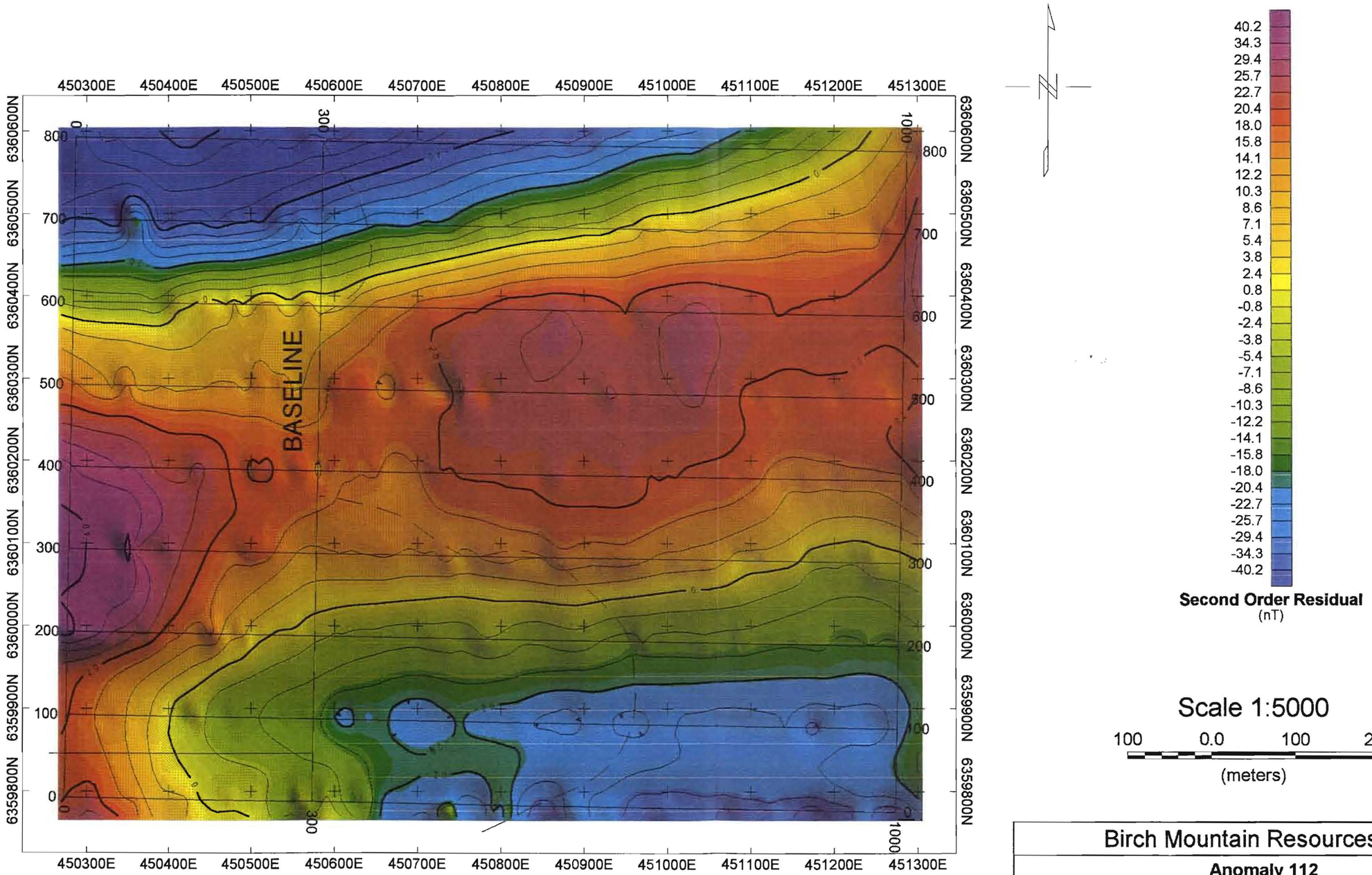
FILE: J:\4762\ANOM-112.dwg

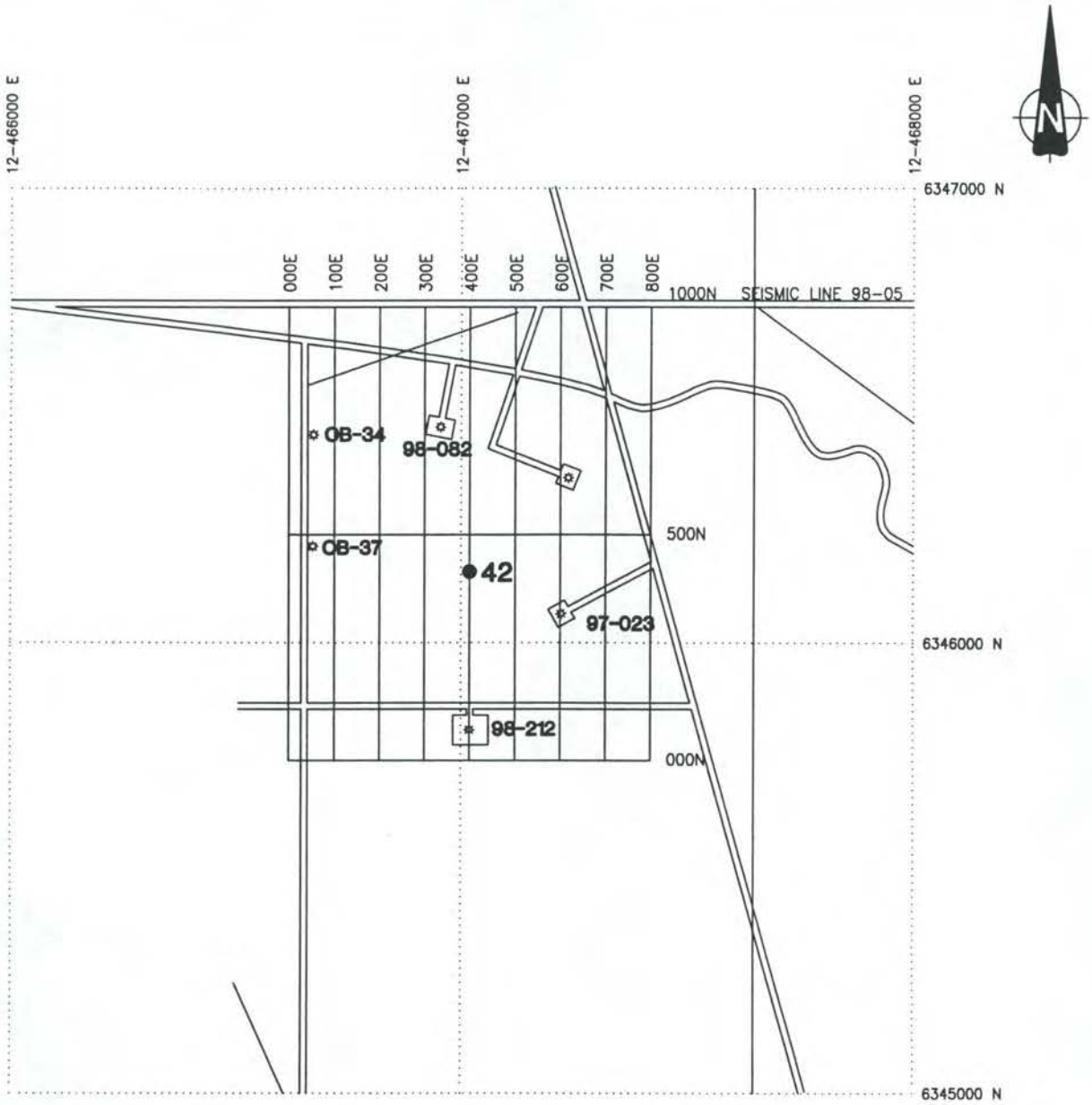


Birch Mountain Resources Ltd.

Anomaly 112
Second Order Residual
Figure (6)

Data collected 15 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● 42	AIRBORNE ANOMALY #42
═══	SEISMIC LINE
○	WELL
⬠	WELL PAD

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

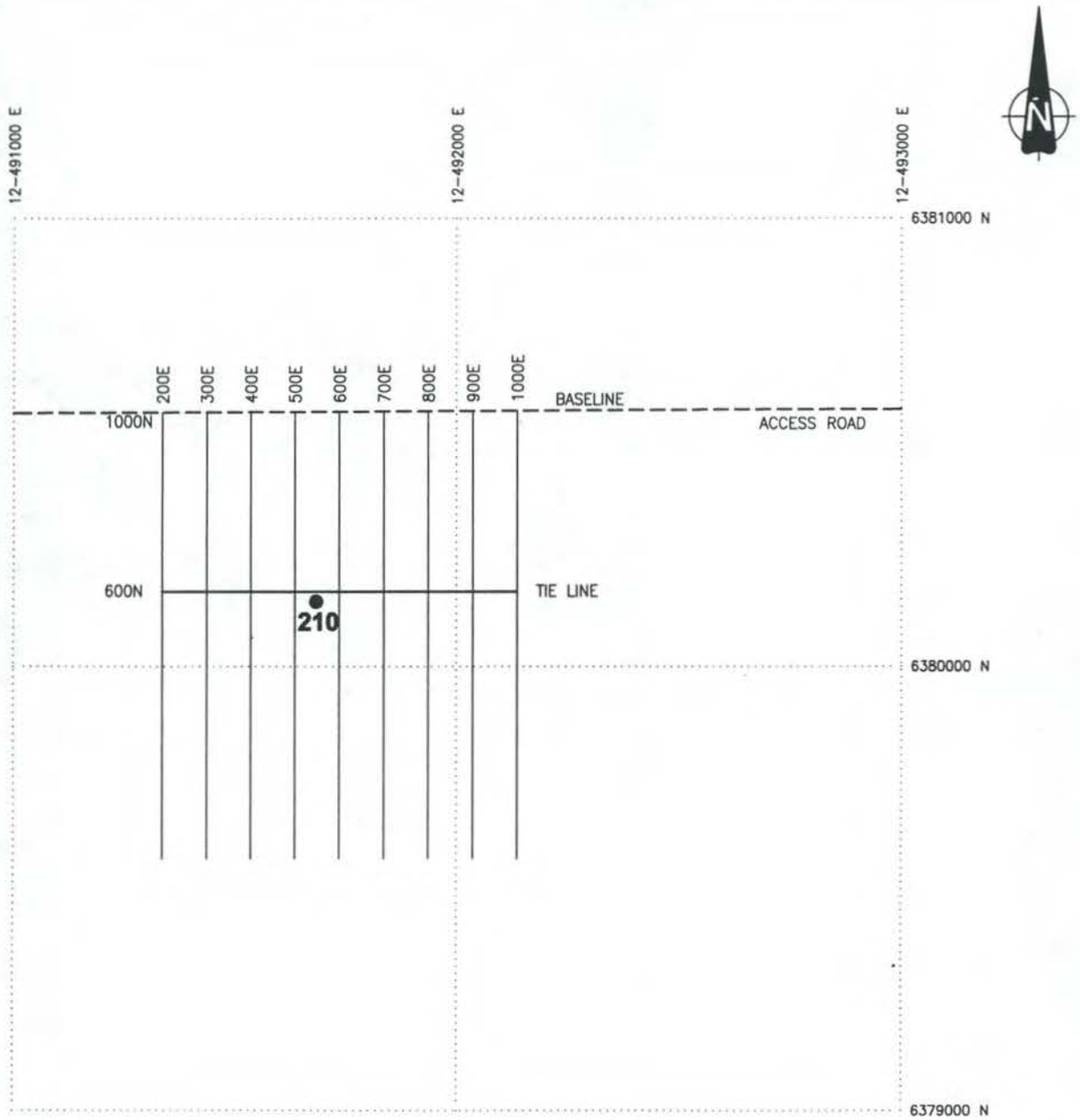
SITE PLAN
AIRBORNE ANOMALY #42

DRAWN BY:	EDITED BY:	DATE:
C.D.	C.D.	APR.09/98

APPROVED:	FIGURE:
KAL	7

PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH KOMEX INTERNATIONAL LTD. HAS NOT ENTERED INTO A CONTRACT.

FILE: J:\4762\ANOM-42.dwg



LEGEND

● **210** AIRBORNE ANOMALY #210

— — — PREVIOUS CUT SEISMIC LINE

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #210

DRAWN BY:	EDITED BY:	DATE:
C.D.	J.P.	MAY 8/98

APPROVED:	FIGURE:
[illegible]	9

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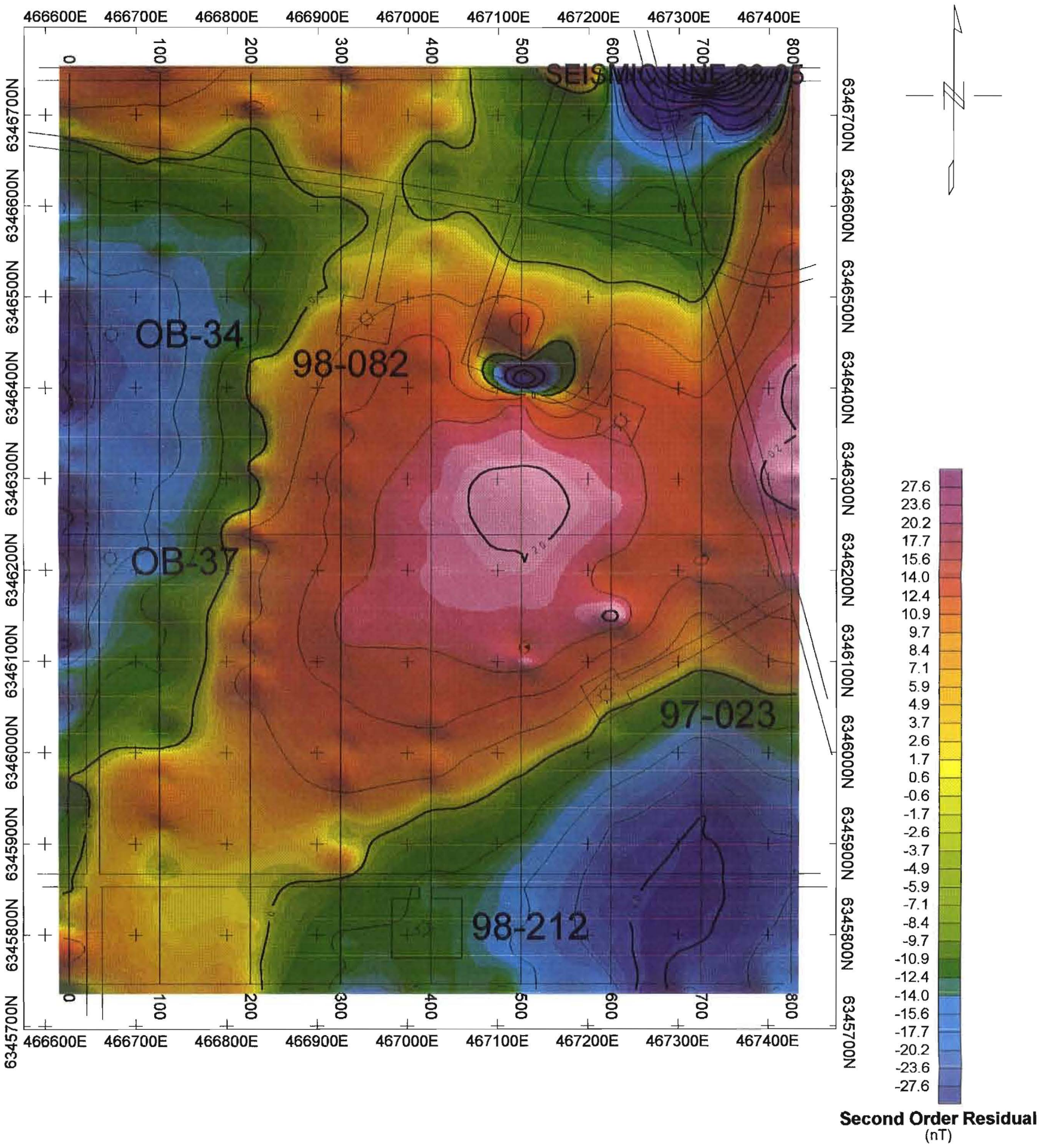
FILE: J:\4762\ANOM-210.dwg

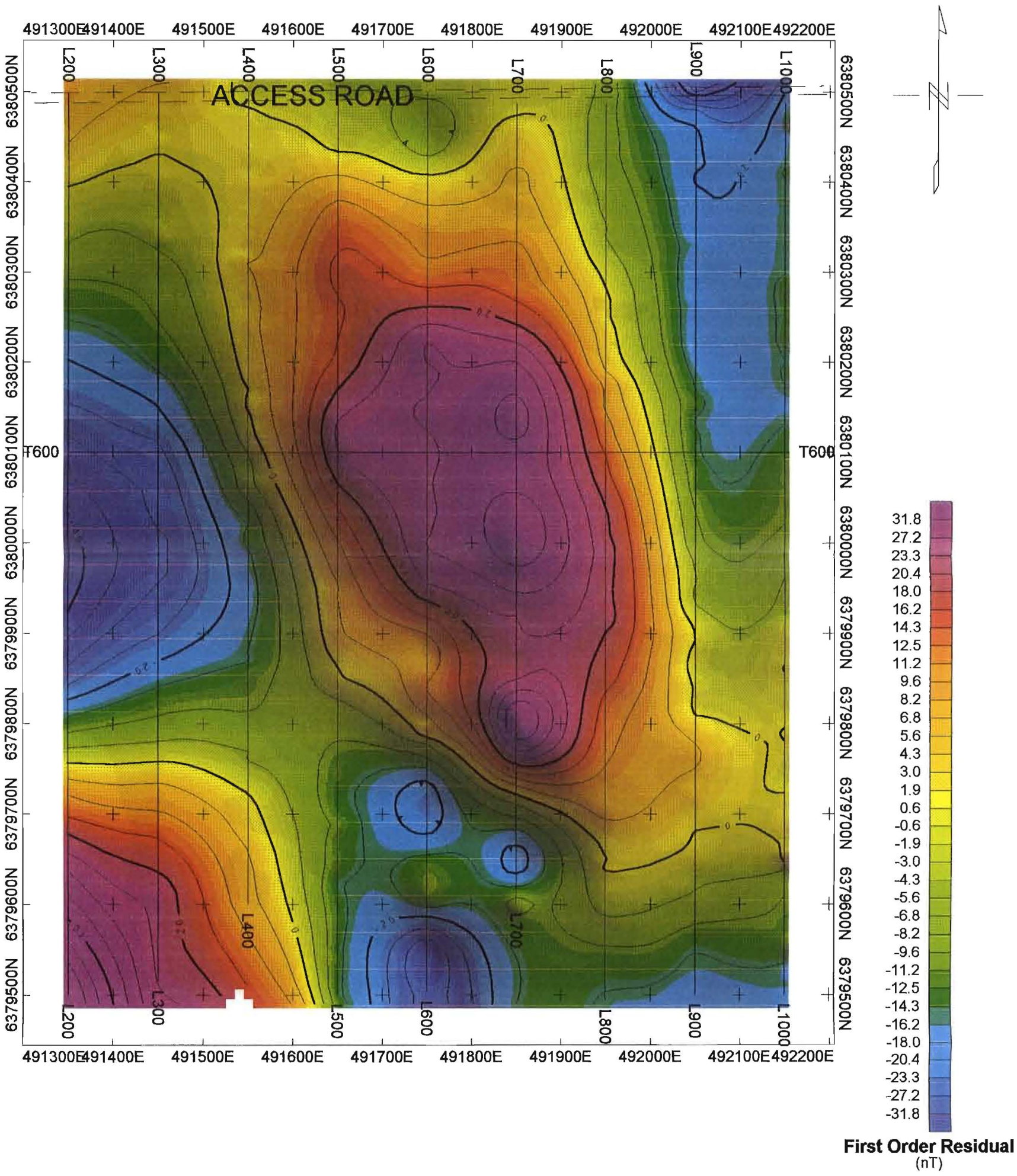


Scale 1:5000

50 0.0 50 100 150 200

(meters)

Birch Mountain Resources Ltd.
Anomaly 42 **Second Order Residual** **Figure (8)**
Data collected 20, 21 February 1998 Line Spacing 100 m : Station Spacing 12.5 m
KOMEX International Ltd. : KI98-4762

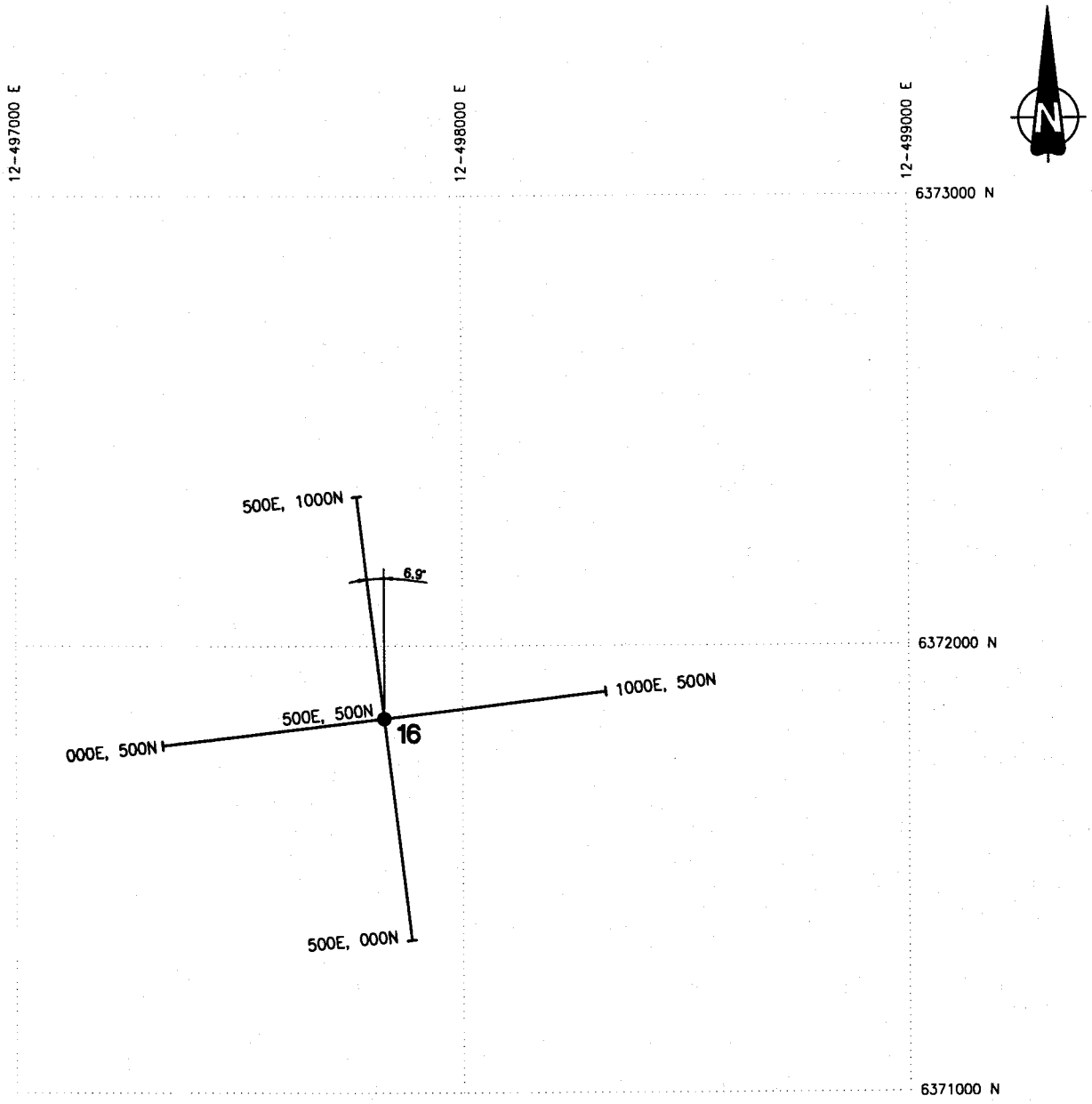


Scale 1:5000

50 0.0 50 100 150

(meters)

Birch Mountain Resources Ltd.
Anomaly 210 **First Order Residual** **Figure (10)**
Data collected 18, 19, 20 February 1998 Line Spacing 100 m : Station Spacing 12.5 m
KOMEX International Ltd. : KI98-4762



LEGEND

● 16 AIRBORNE ANOMALY #16

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #16

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.18/98

APPROVED: L.A.K.

FIGURE: 11

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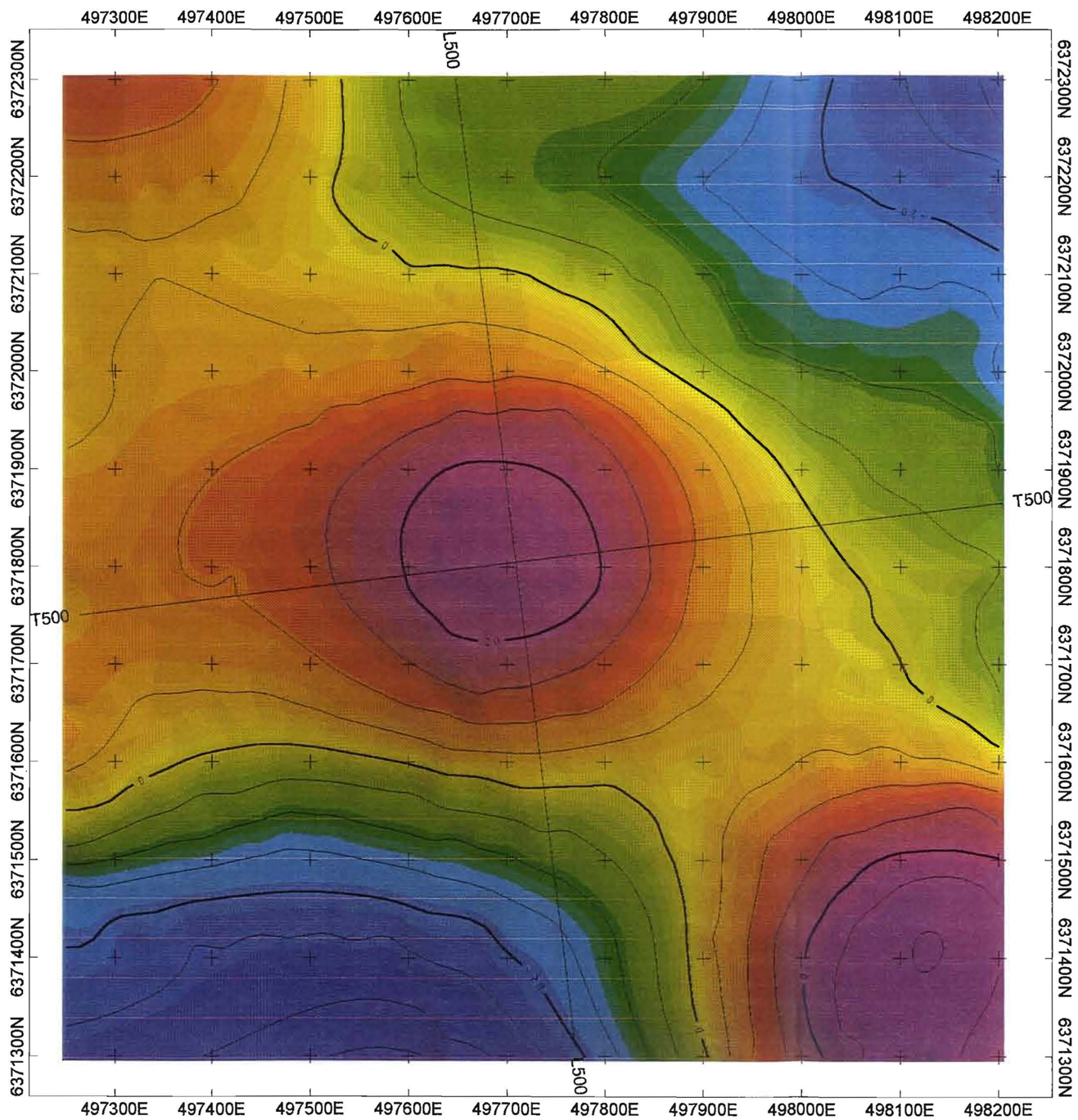
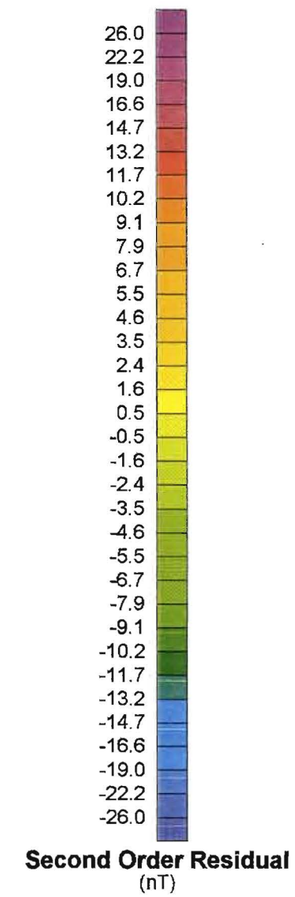
FILE: J:\4762\ANOM-16.dwg





Scale 1:5000

100 0.0 100 200

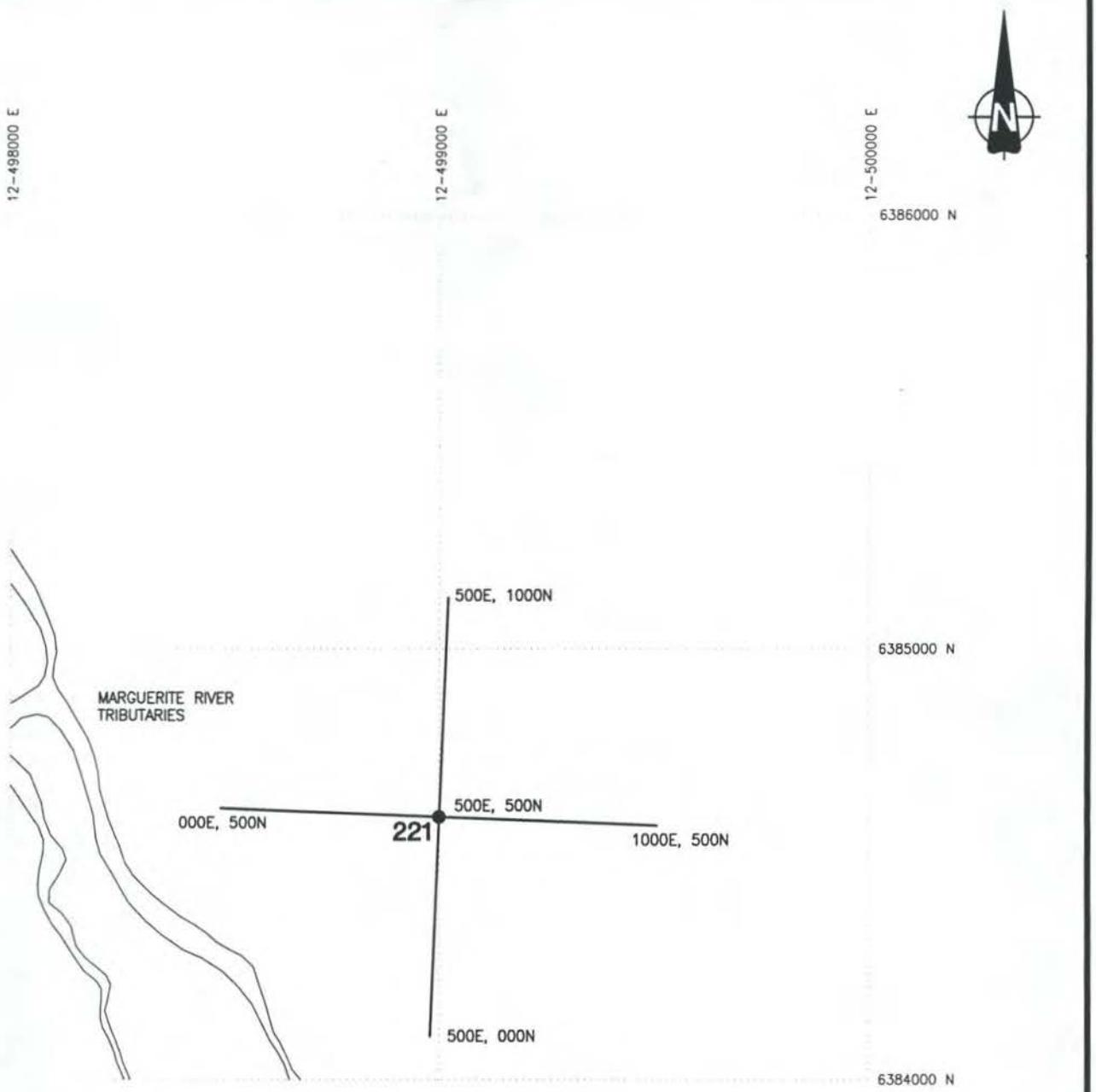
(meters)

Birch Mountain Resources Ltd.

Anomaly 16
Second Order Residual
Figure (12)

Ground Data collected 23 February 1998
Ground Profiles Station Spacing 12.5 m
Airborne Data Elevation 45 m : Line Spacing 100 m : Station Spacing 5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● 221 AIRBORNE ANOMALY #221

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #221

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.18/98

APPROVED:	FIGURE:
LLK	13 –

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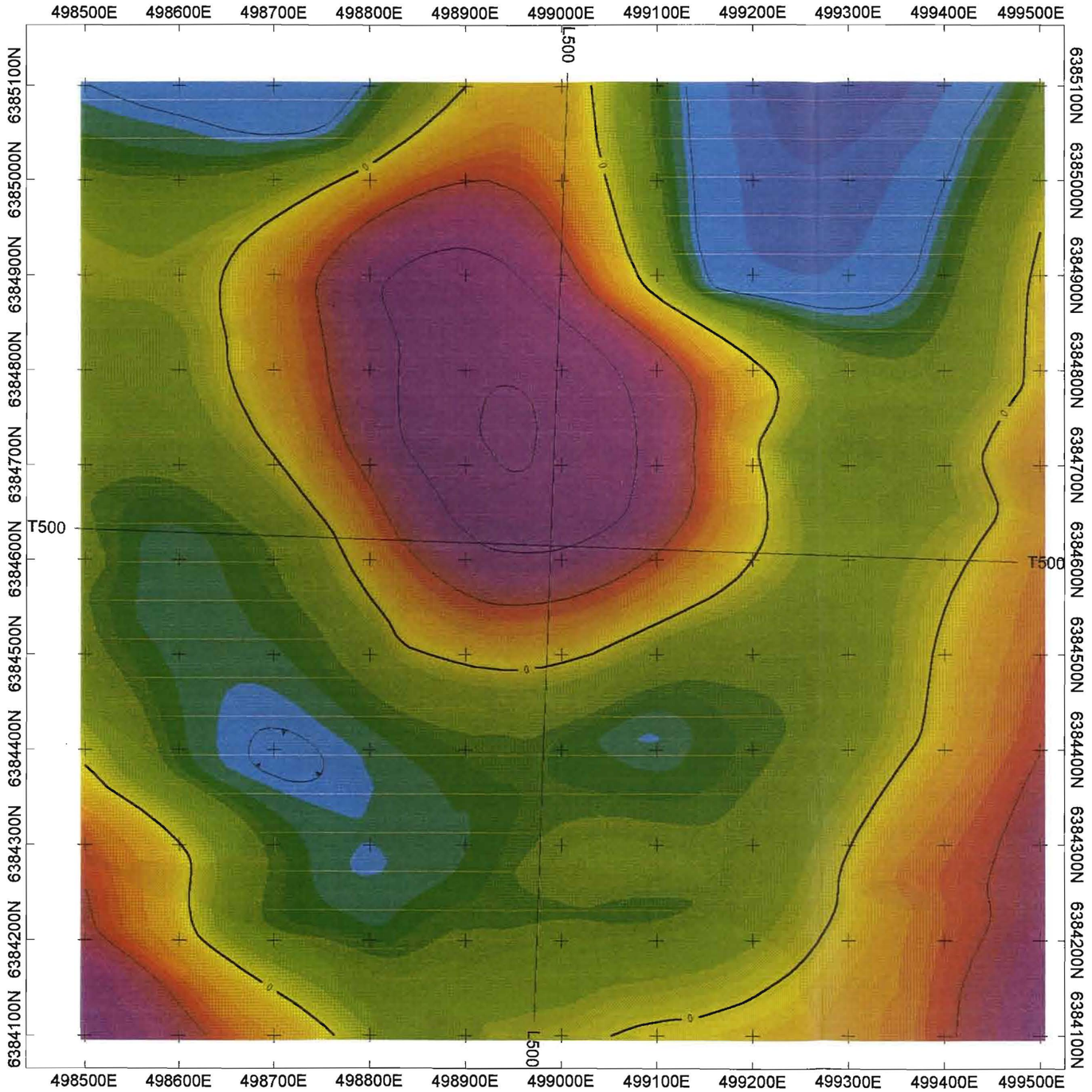
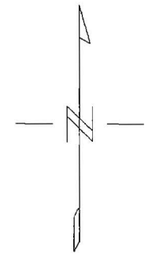
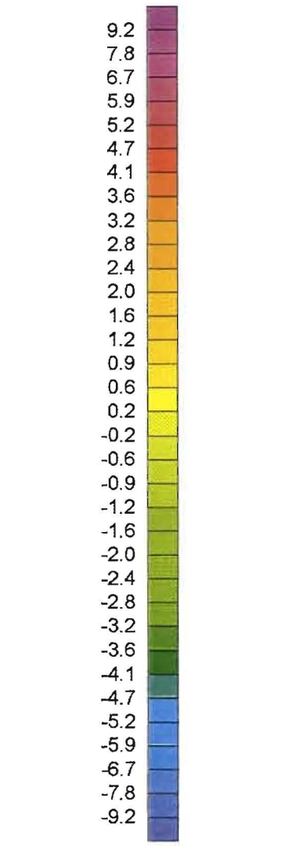
FILE: J:\4762\ANOM-221.dwg







Second Order Residual
(nT)

Scale 1:5000

100 0.0 100 200

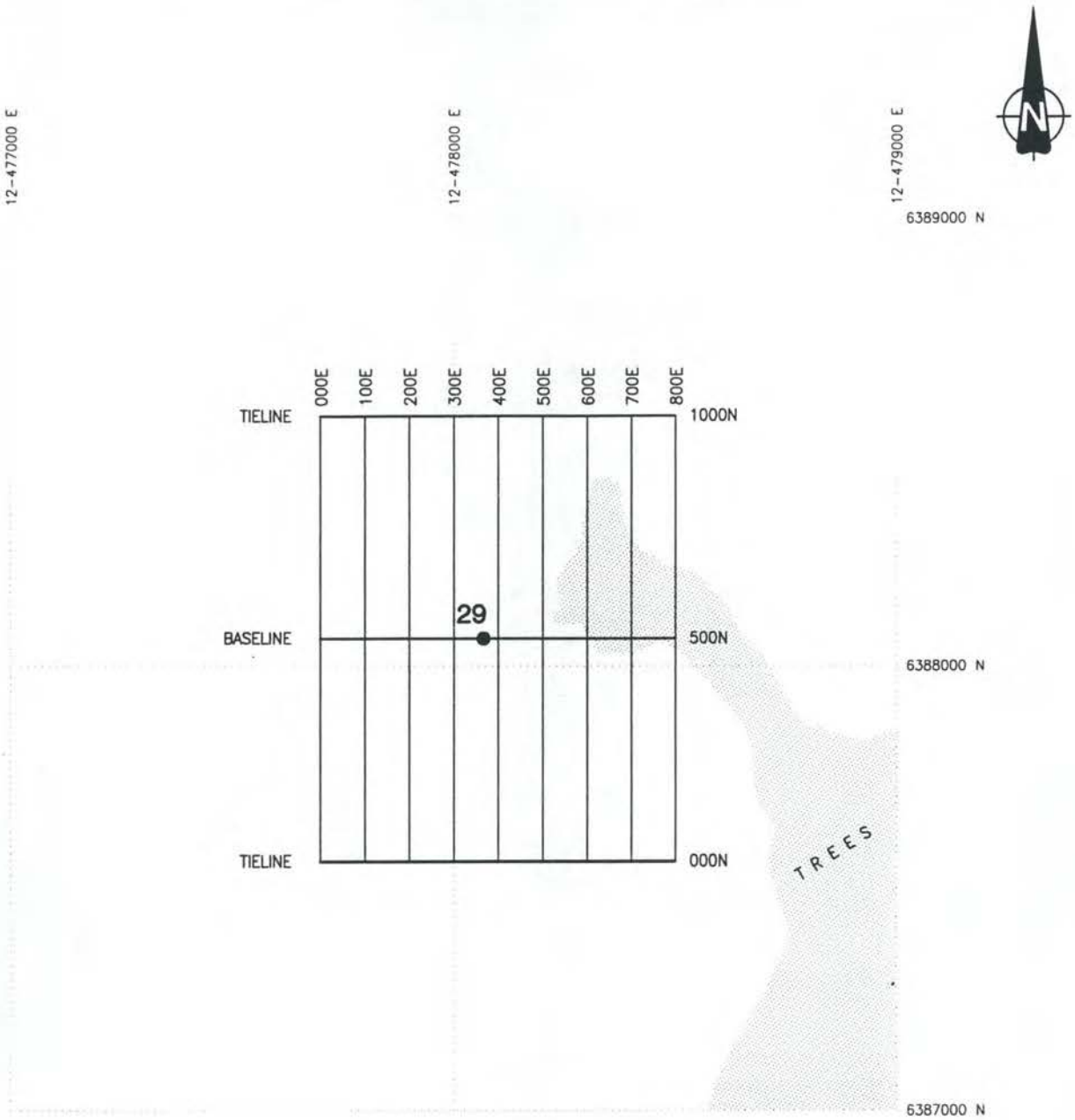
(meters)

Birch Mountain Resources Ltd.

Anomaly 221
Second Order Residual
Figure (14)

Ground Data collected 24 February 1998
Ground Profiles Station Spacing 12.5 m
Airborne Data Elevation 45 m : Line Spacing 100 m : Station Spacing 5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● 29 AIRBORNE ANOMALY #29

NOTE: ACCESS ROAD NOT SHOWN

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #29

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.18/98
APPROVED:	FIGURE:	
	15	

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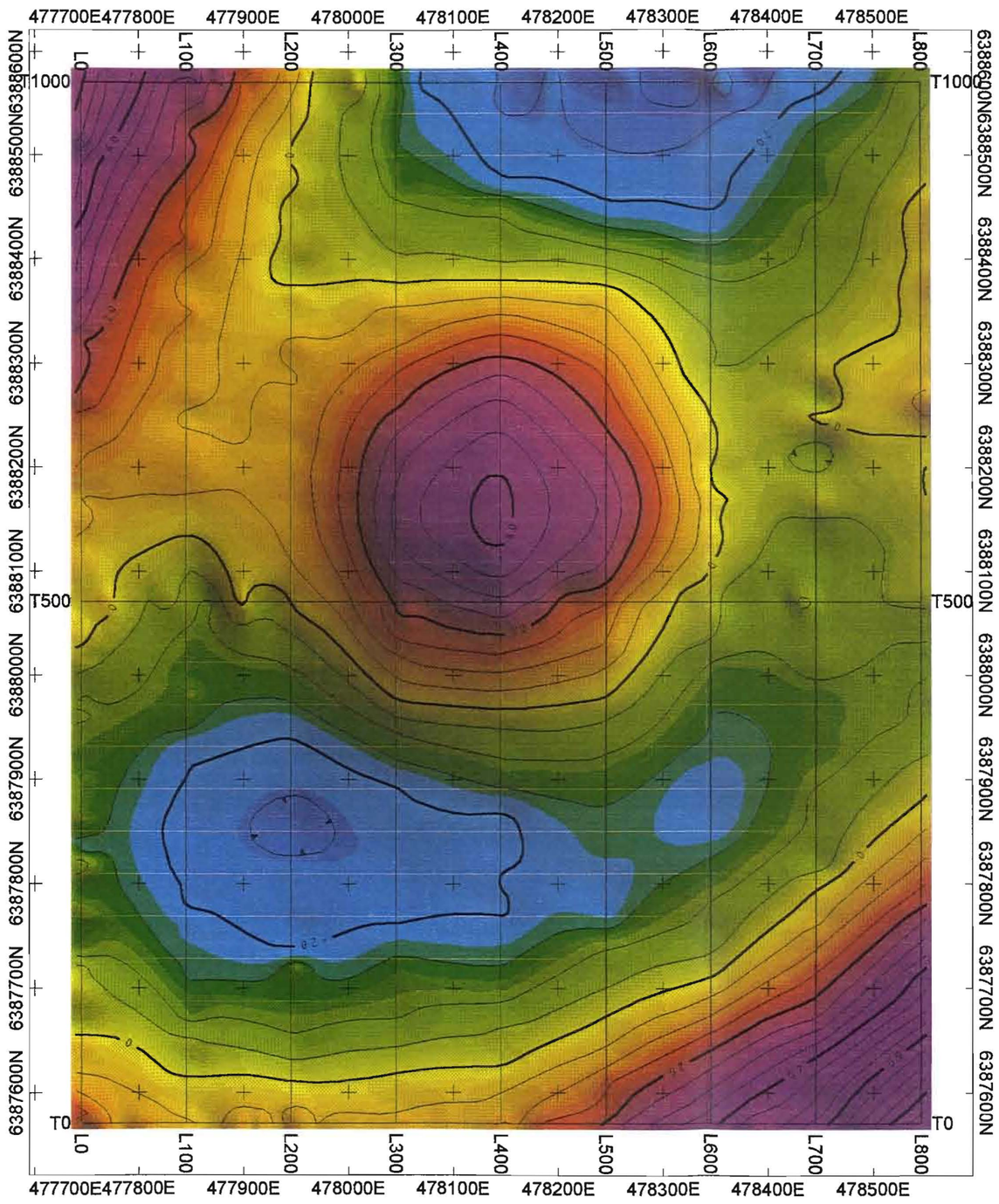
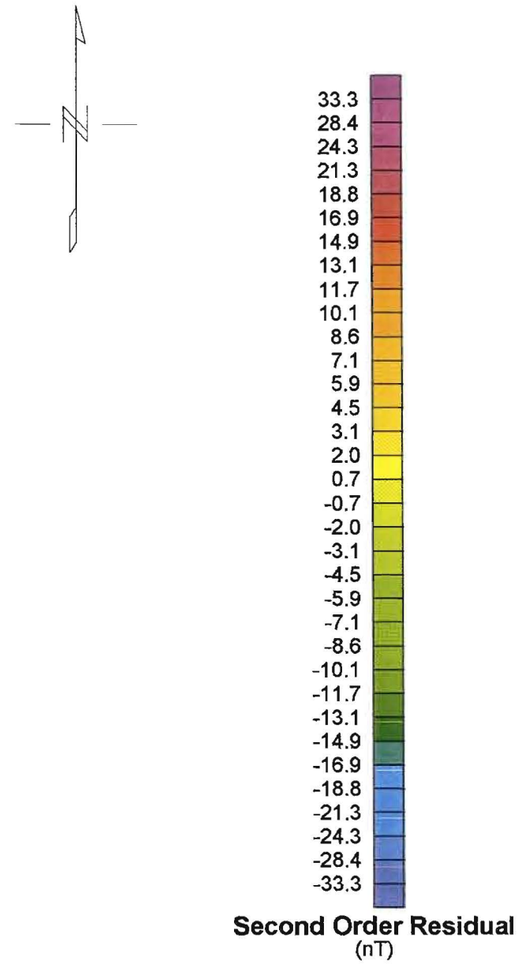
FILE: J:\4762\ANOM-29.dwg





Scale 1:5000

50 0.0 50 100 150 200 250

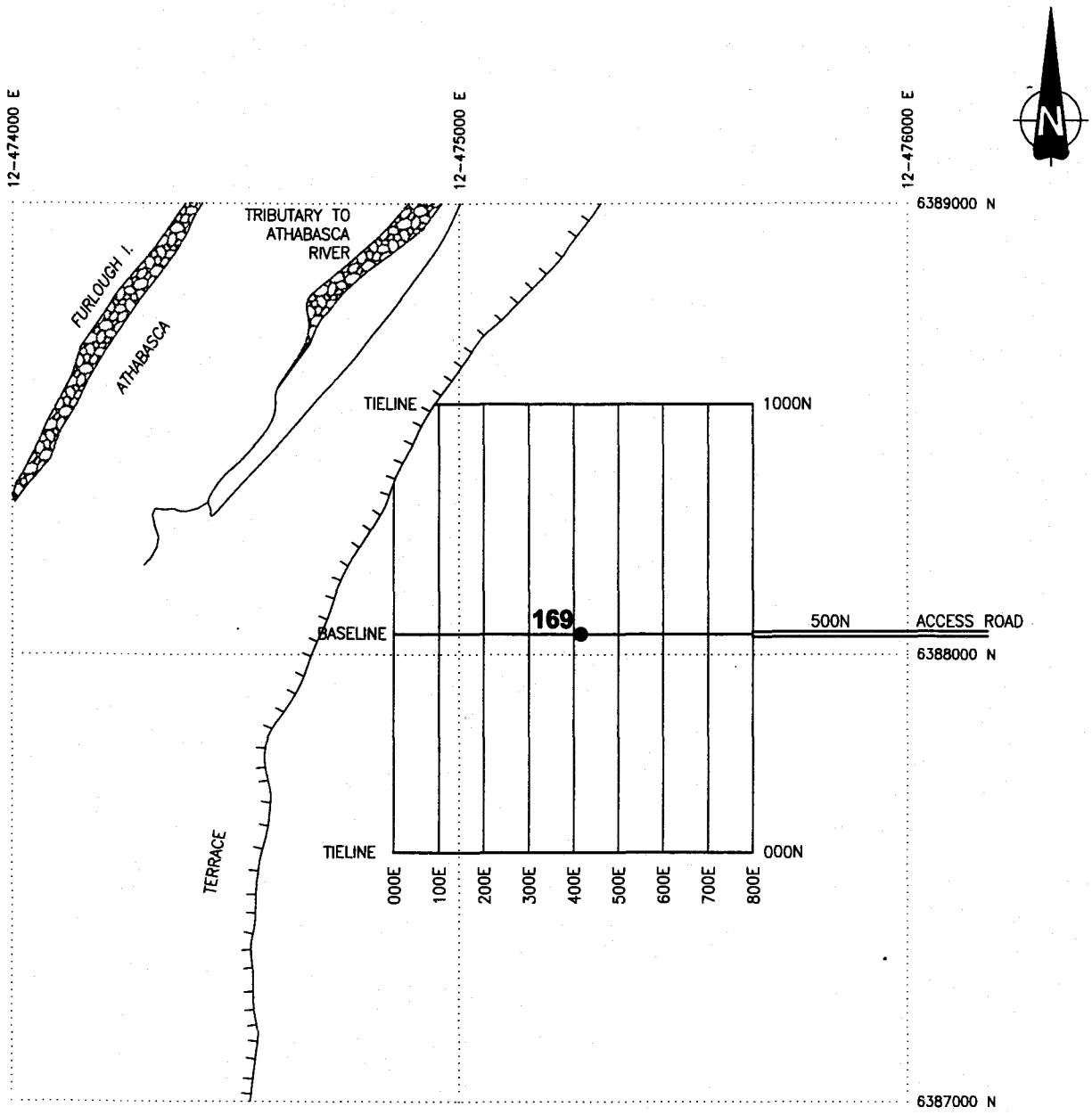
(meters)

Birch Mountain Resources Ltd.

Anomaly 29
Second Order Residual
Figure (16)

Data collected 25, 26 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● **169** AIRBORNE ANOMALY #169

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #169

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.18/98

APPROVED:	FIGURE:
	17

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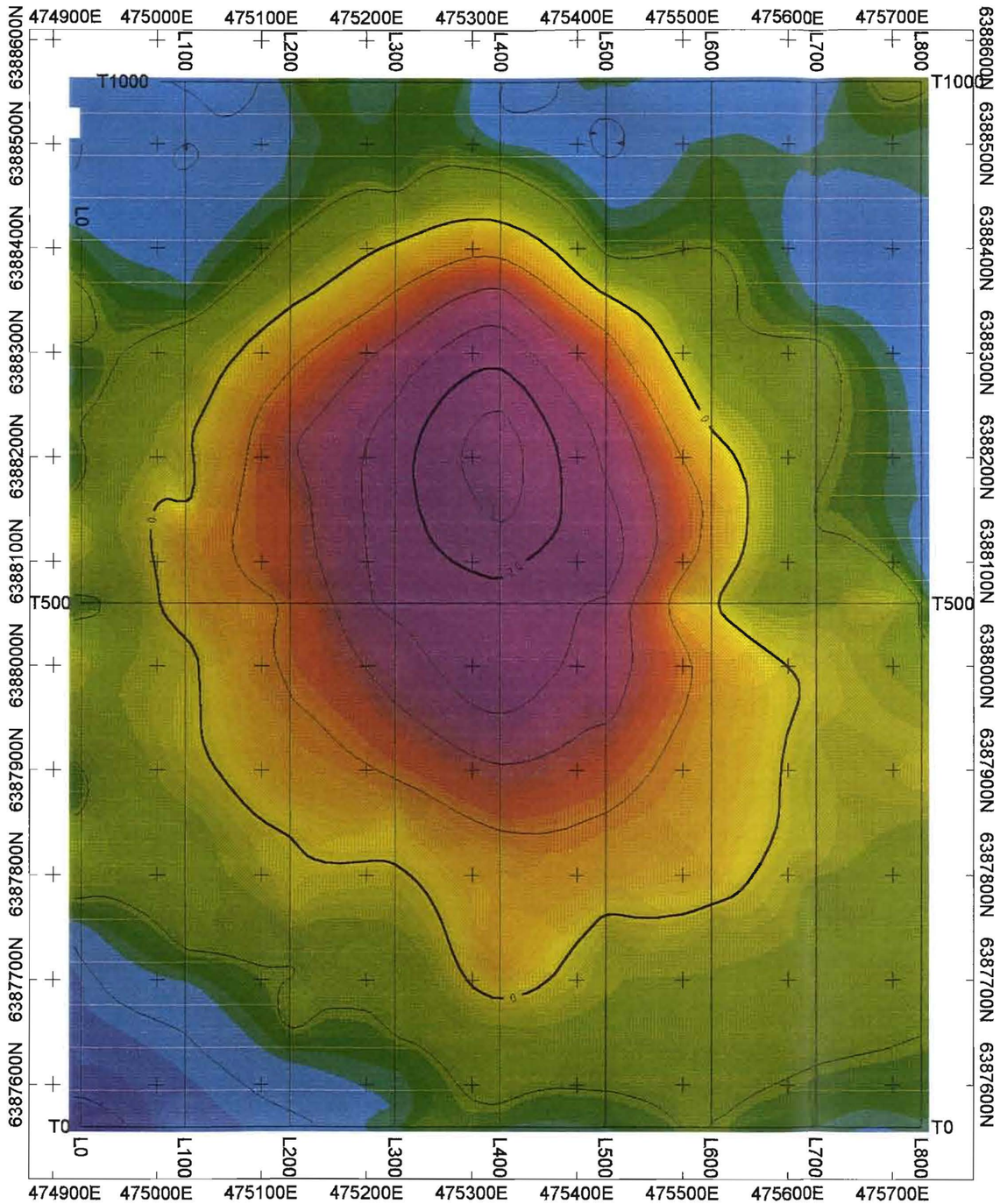
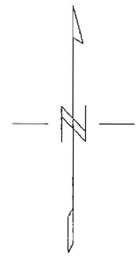
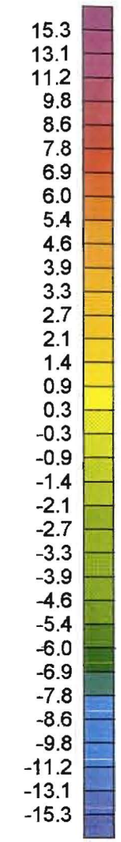
FILE: J:\4762\ANOM-169.dwg







Second Order Residual
(nT)

Scale 1:5000

50 0.0 50 100 150 200 250

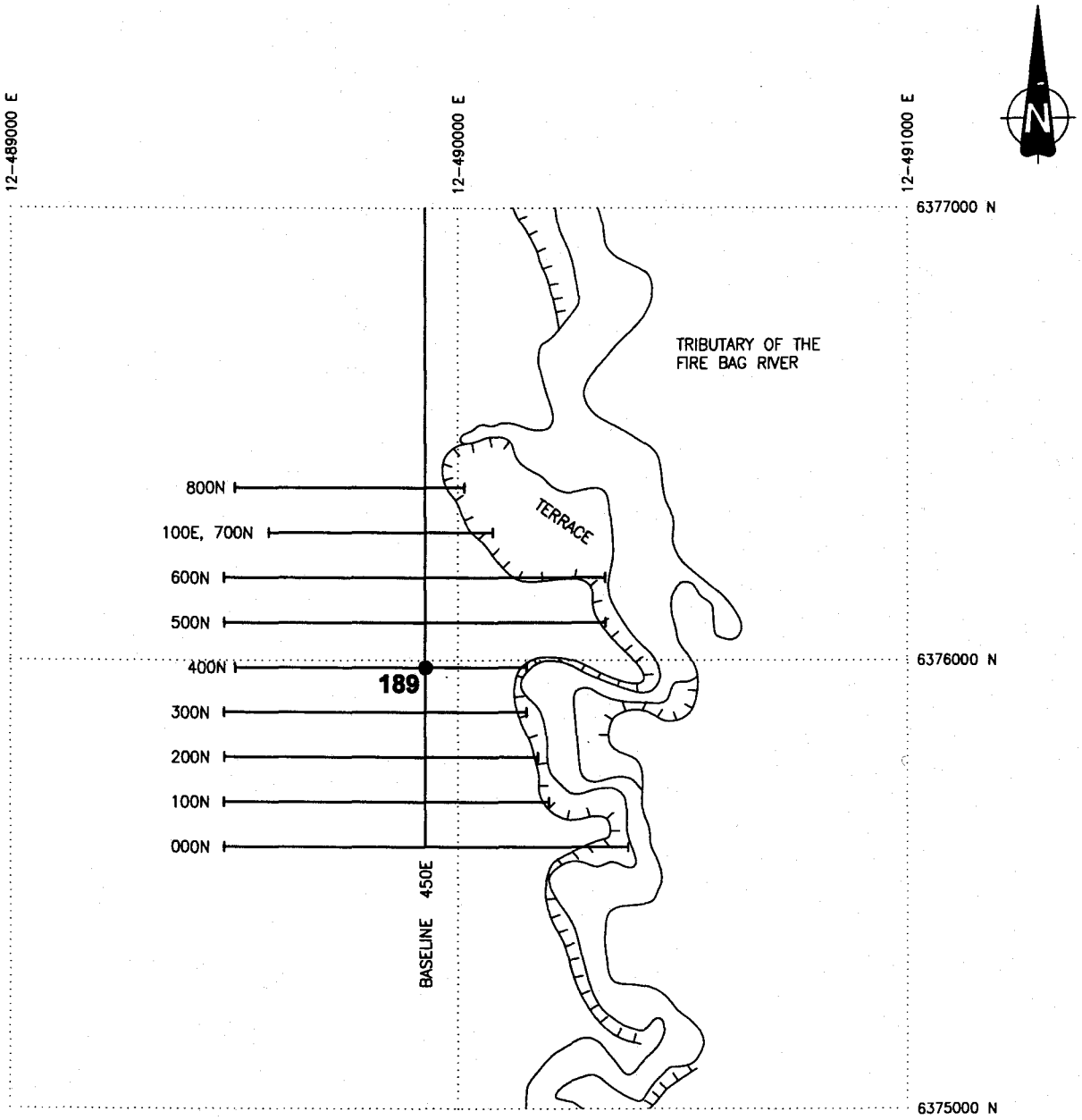
(meters)

Birch Mountain Resources Ltd.

Anomaly 169
Second Order Residual
Figure (18)

Data collected 27, 28 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762



LEGEND

● **189** AIRBORNE ANOMALY #189

0 250 500 750m

SCALE 1 : 15,000

BIRCH MOUNTAIN RESOURCES LTD.
AIRBORNE ANOMALY

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN
AIRBORNE ANOMALY #189

DRAWN BY:	EDITED BY:	DATE:
C.D.	–	MAR.18/98

APPROVED:	FIGURE:
RCK	19

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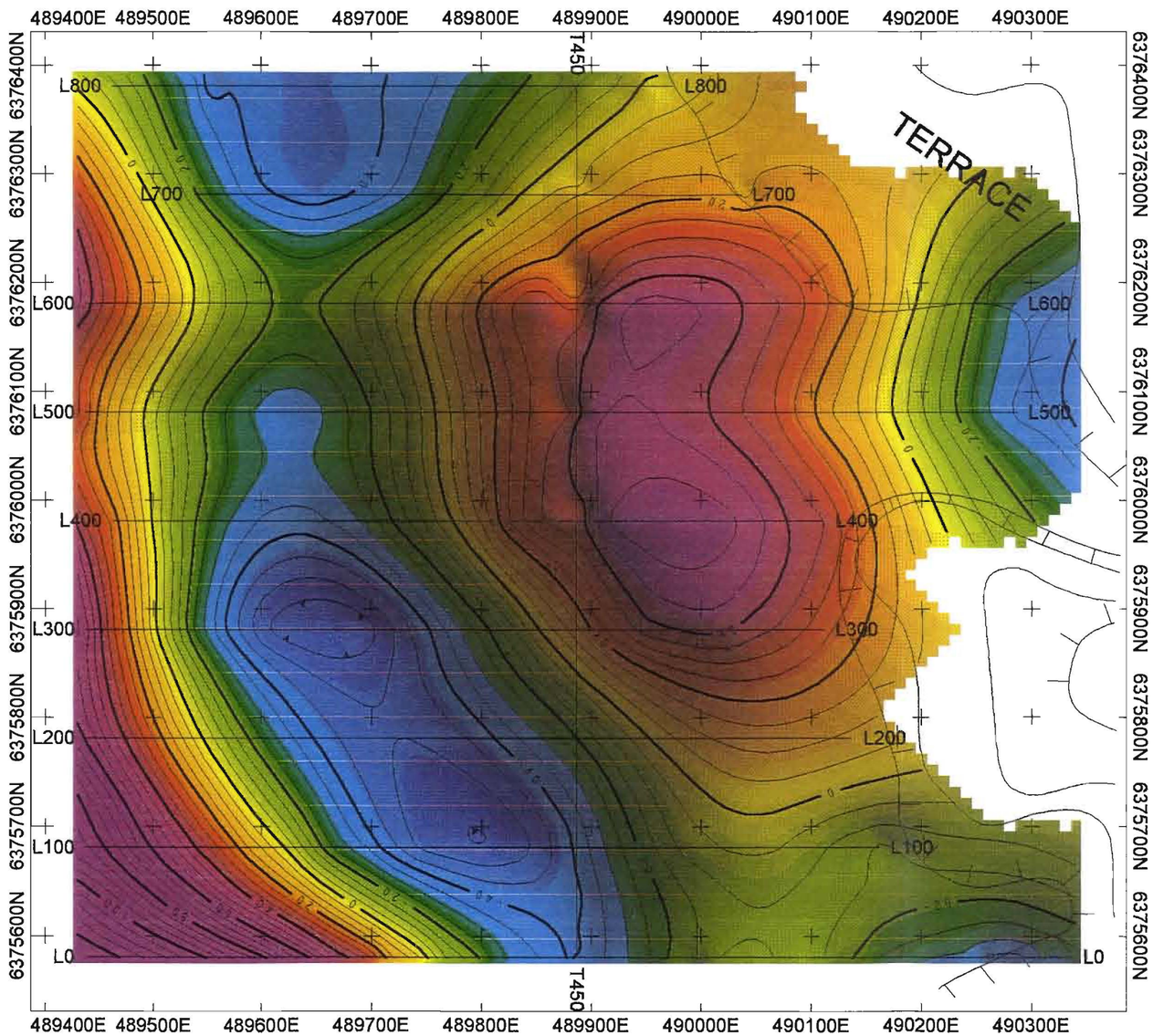
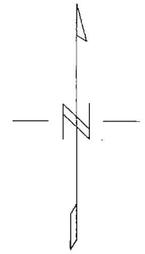
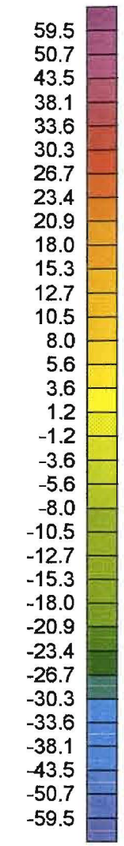
FILE: J:\4762\ANOM-189.dwg







Second Order Residual
(nT)

Scale 1:5000

50 0.0 50 100 150 200 250 300

(meters)

Birch Mountain Resources Ltd.

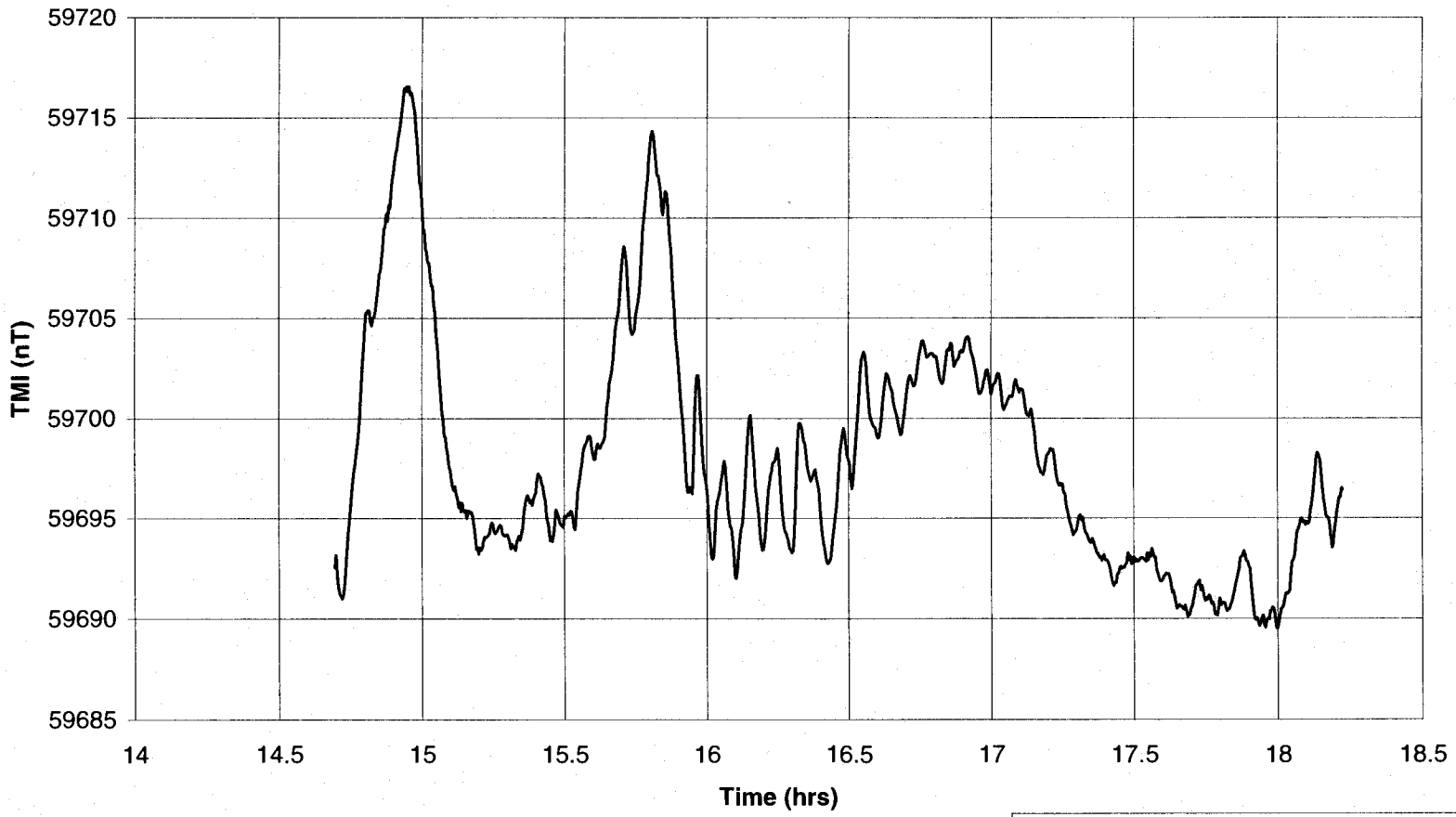
Anomaly 189
Second Order Residual
Figure (20)

Data collected 28 February 1998
Line Spacing 100 m : Station Spacing 12.5 m

KOMEX International Ltd. : KI98-4762

APPENDIX I

BASE STATION TIME-SERIES PLOTS



BIRCH MOUNTAIN RESOURCES Ltd.

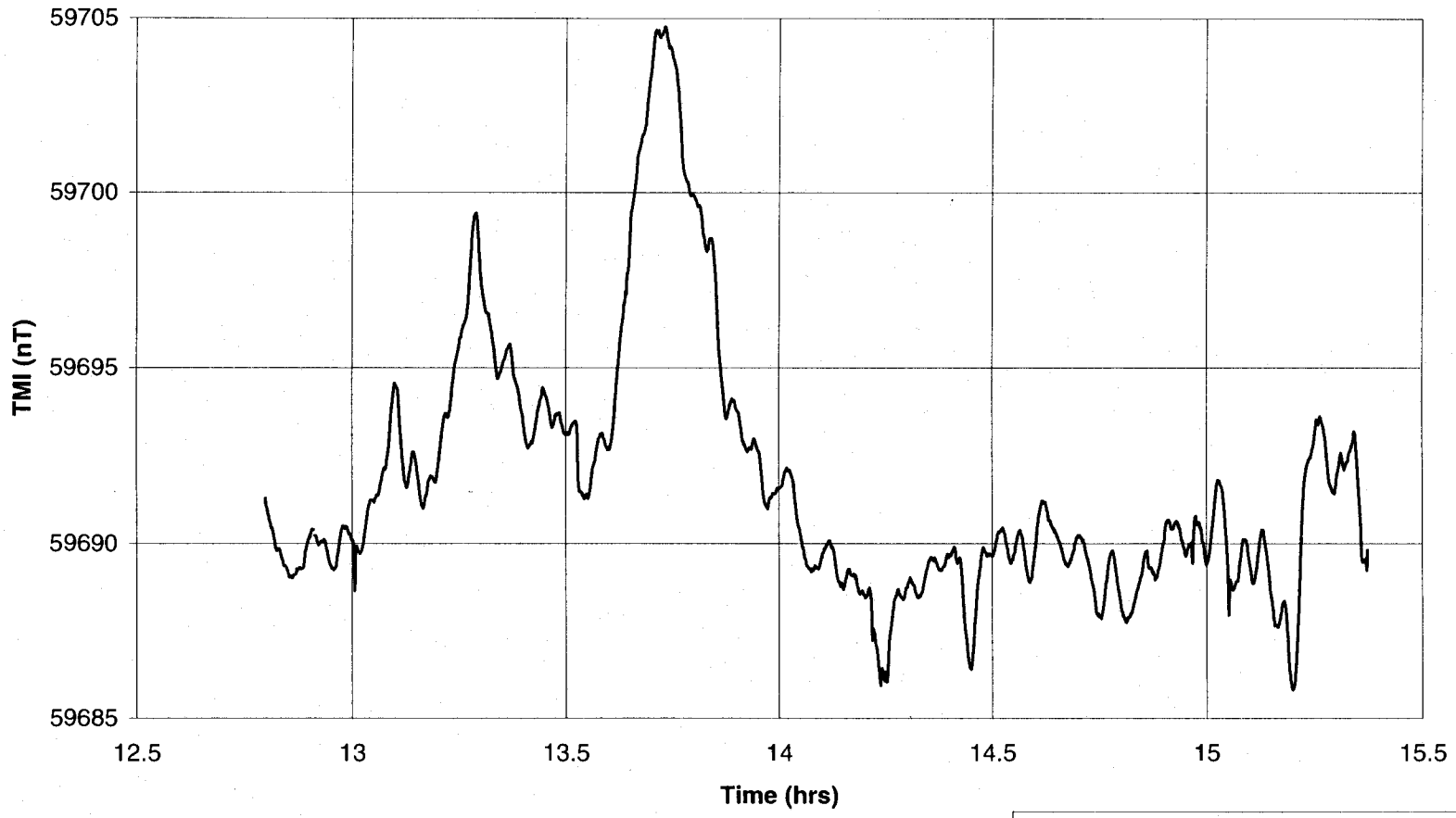
Base Station TMI

GRID 14

Date Collected February 13, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

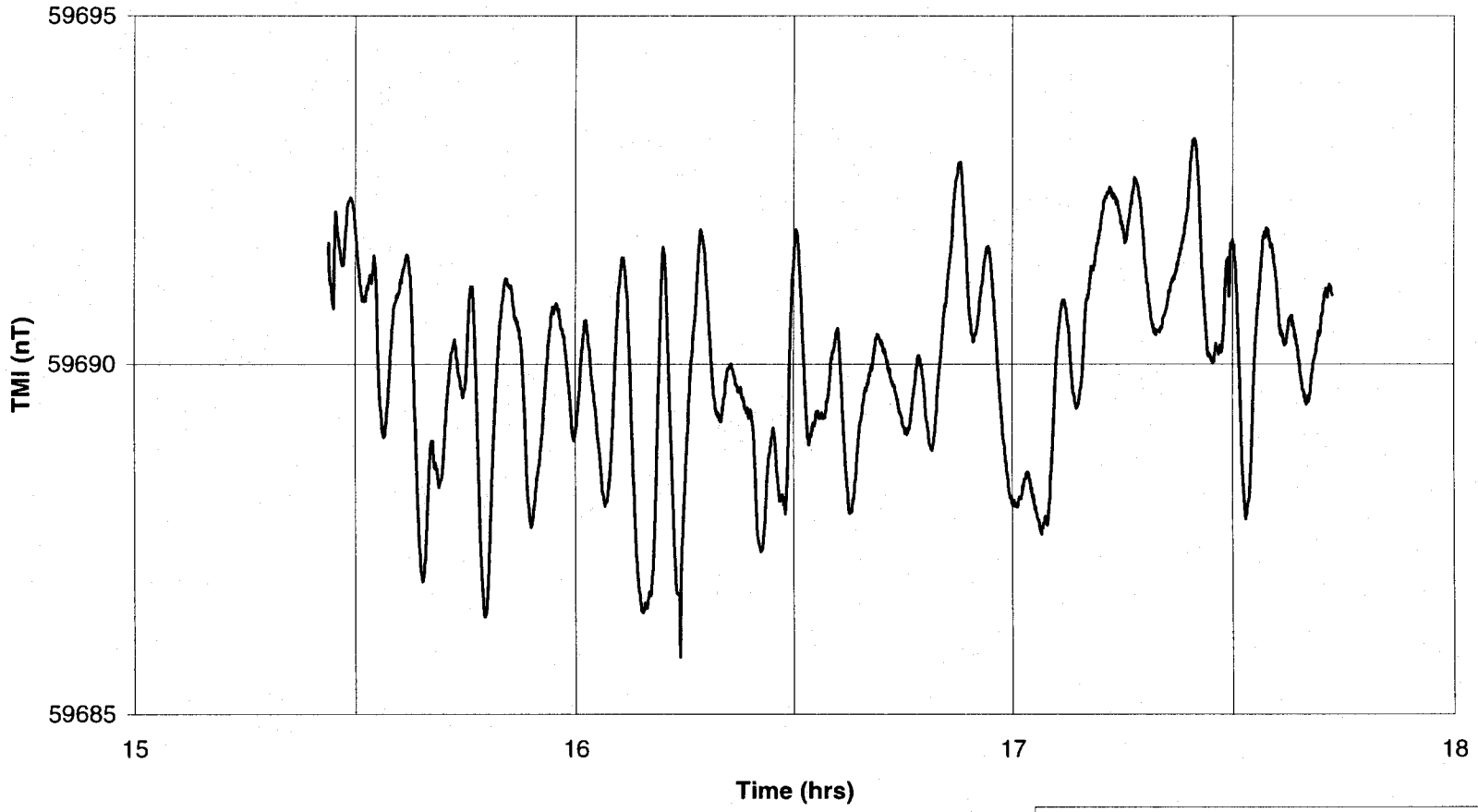
Base Station TMI

GRID 14

Date Collected February 22, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

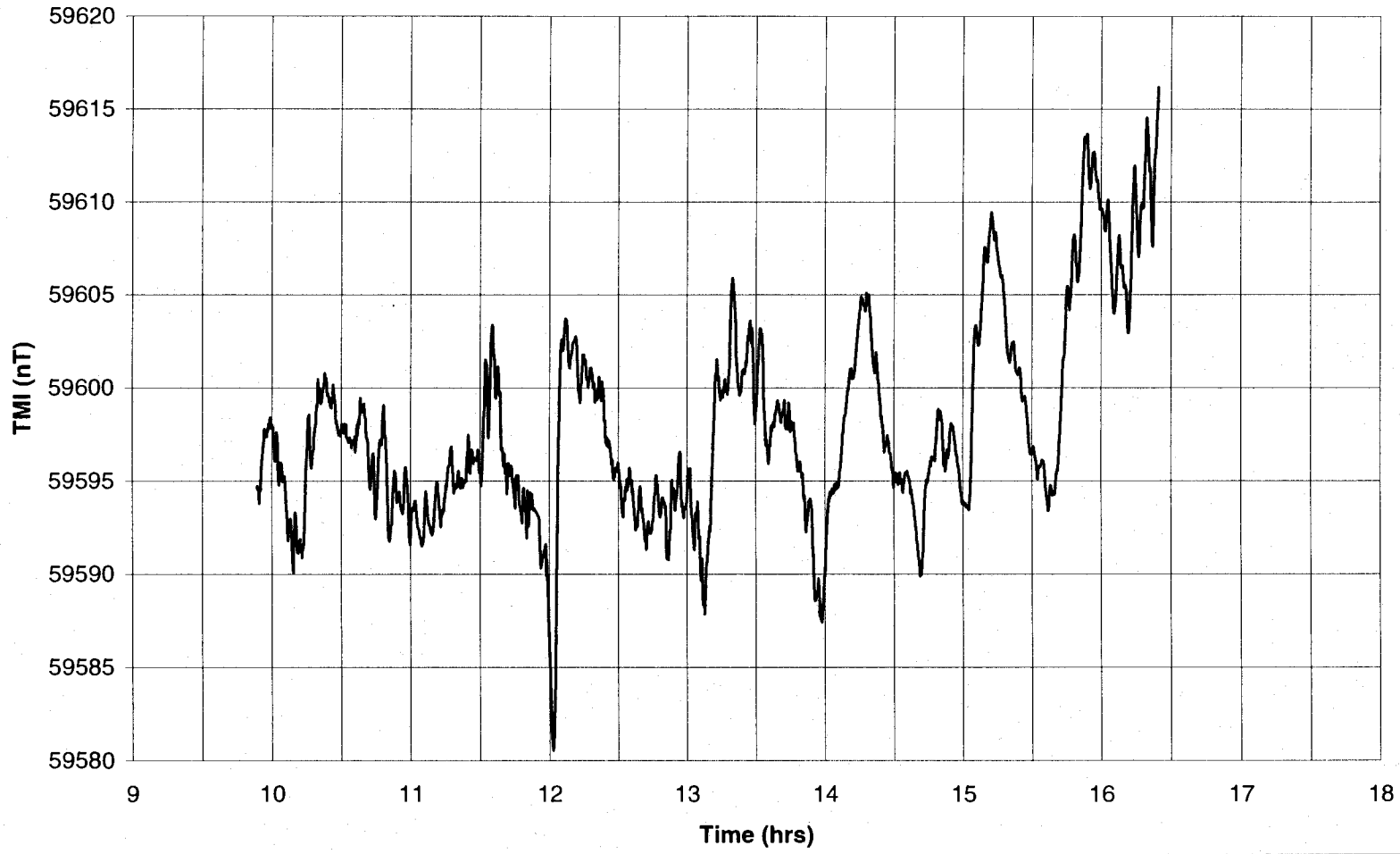
Base Station TMI

GRID 14

Date Collected February 22, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

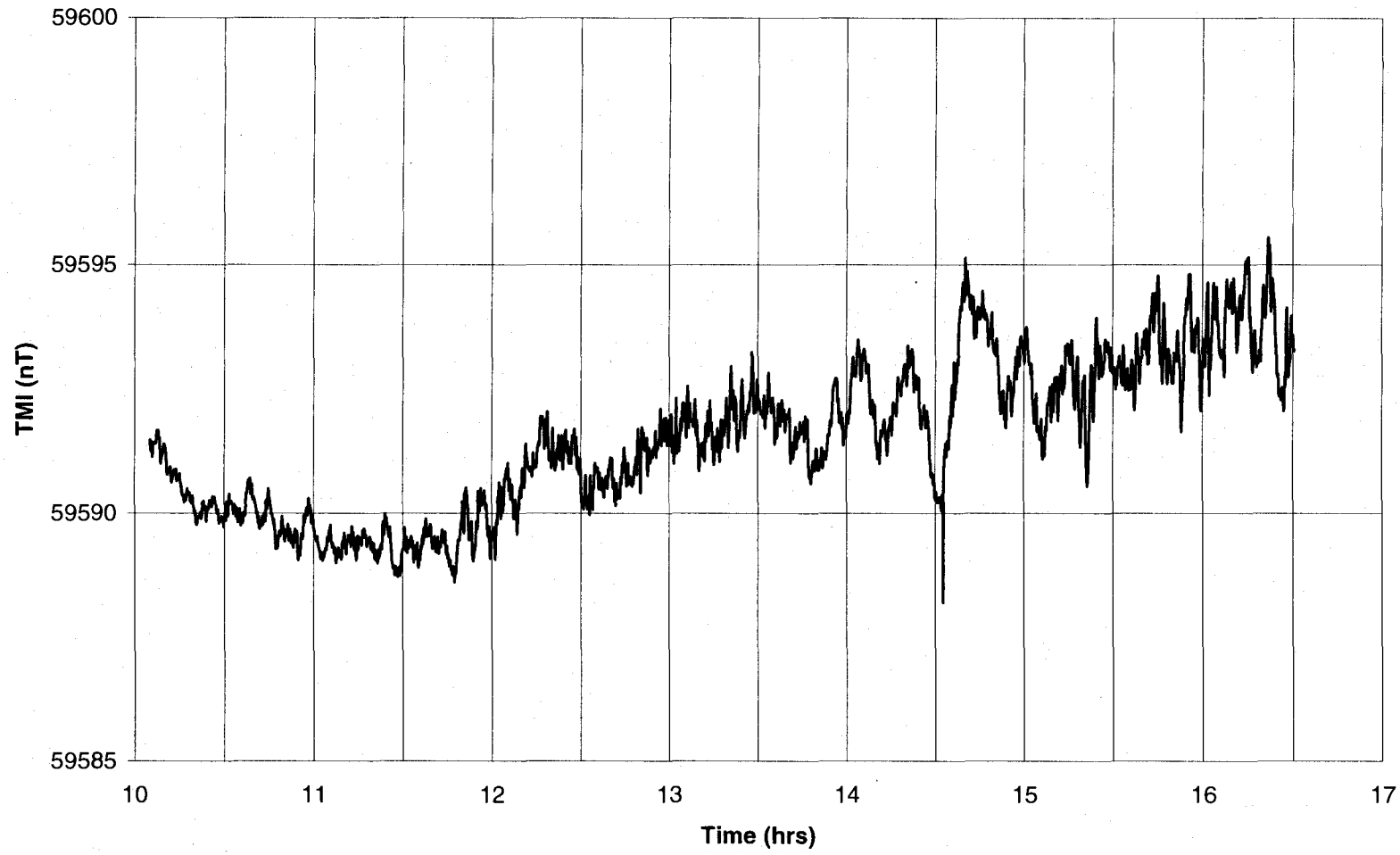
Base Station TMI

GRID 112

Date Collected February 14, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

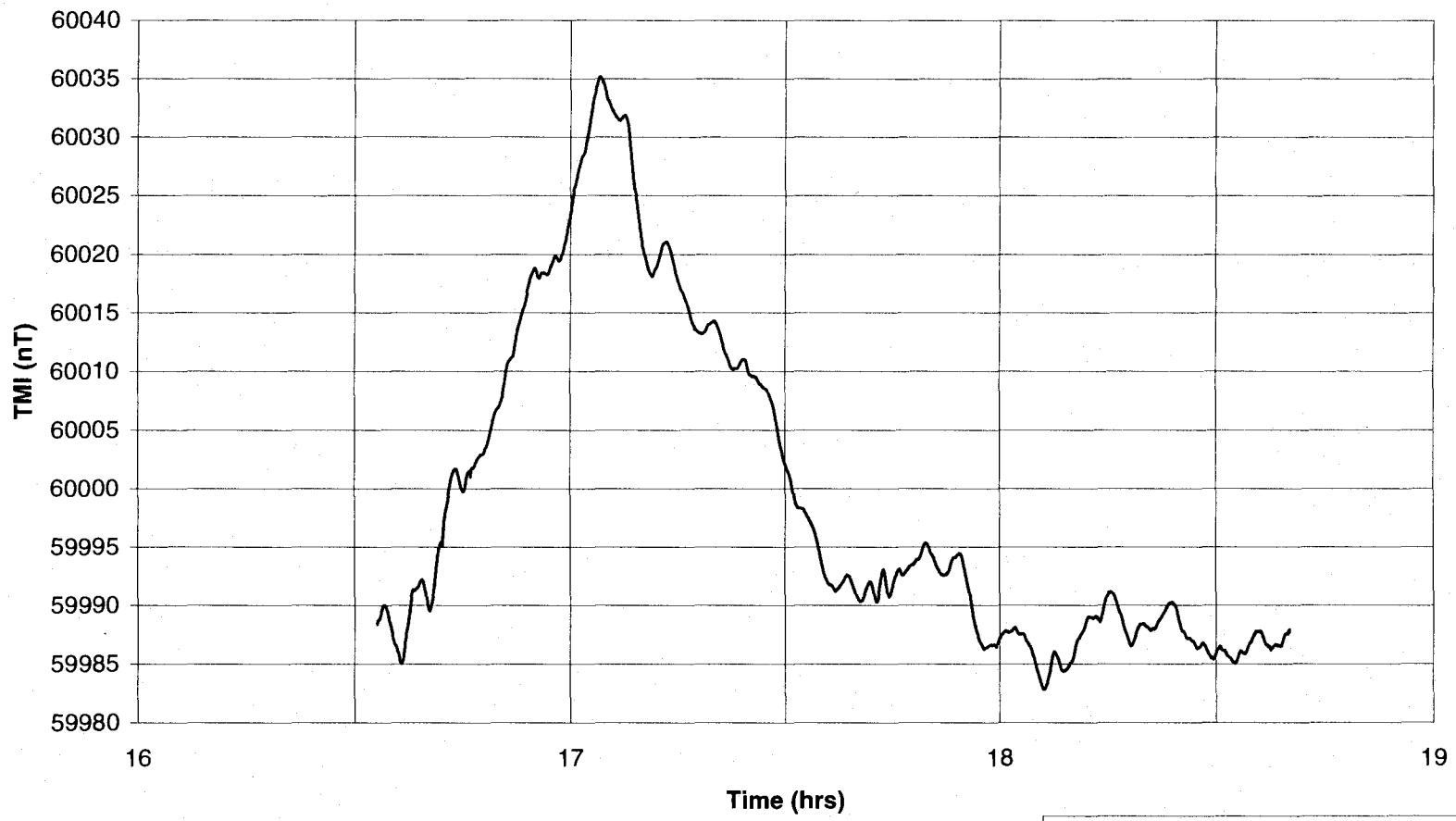
Base Station TMI

GRID 112

Date Collected February 15, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

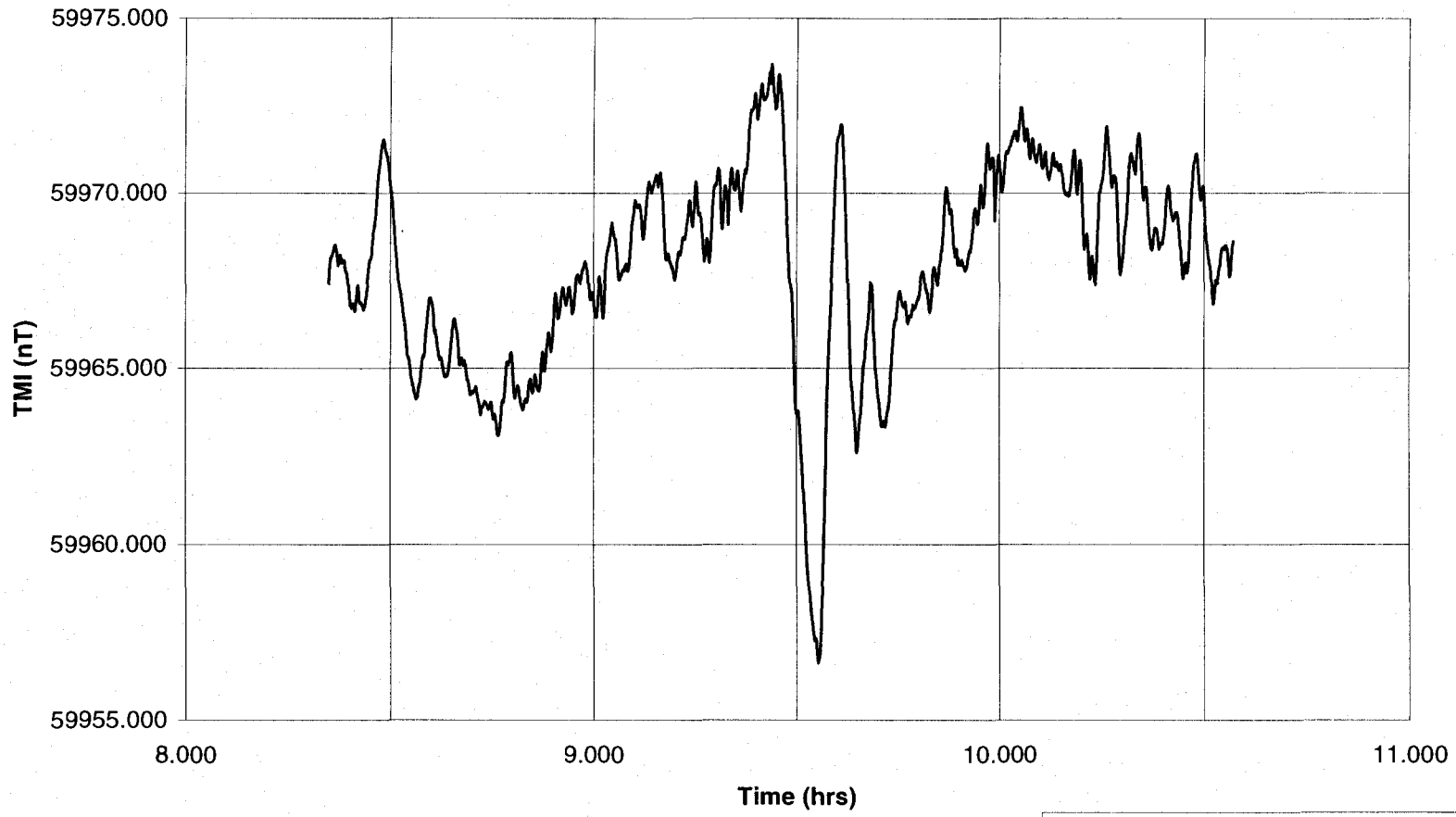
Base Station TMI

GRID 42

Date Collected February 20, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

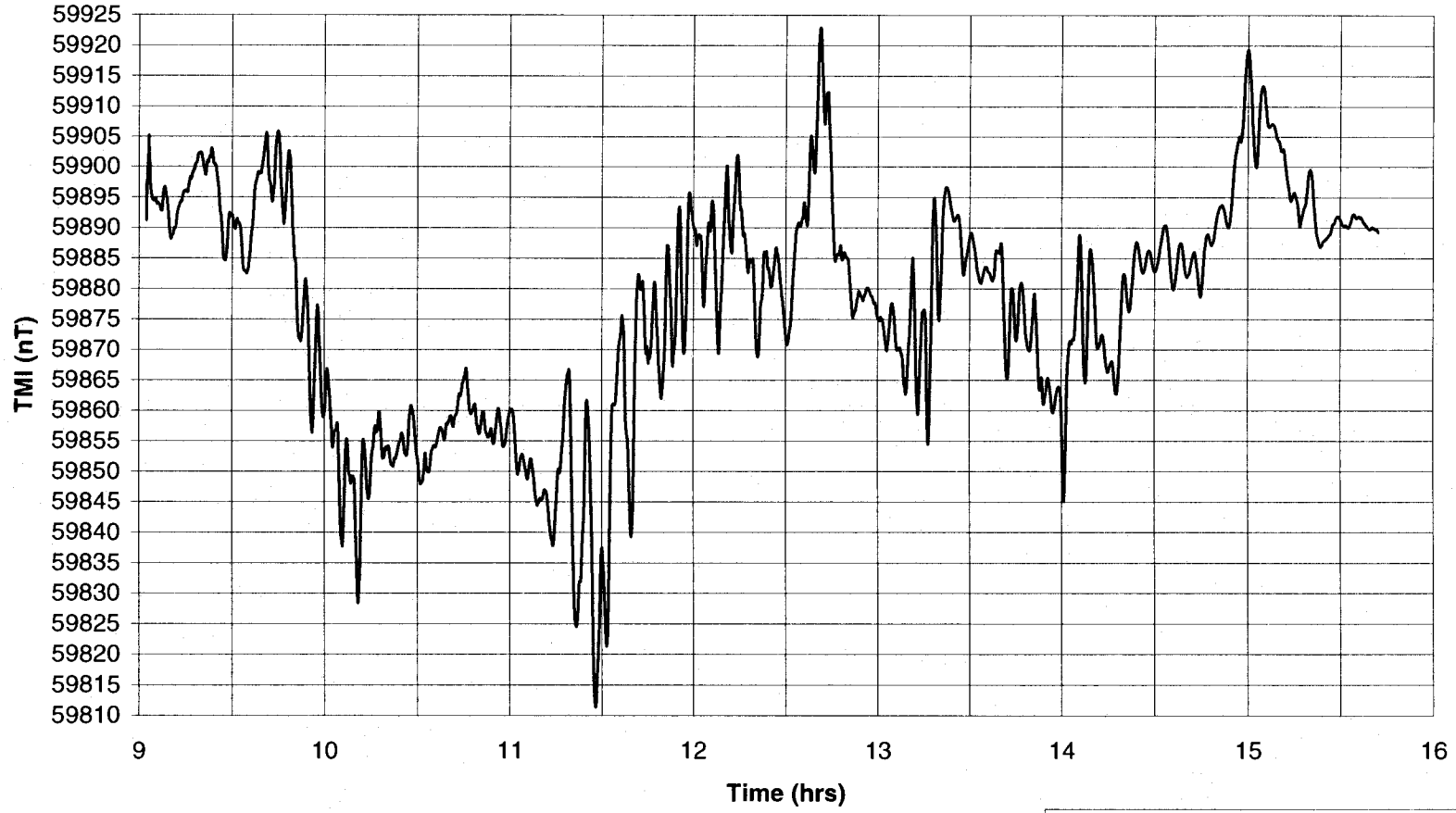
Base Station TMI

GRID 42

Date Collected February 21, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

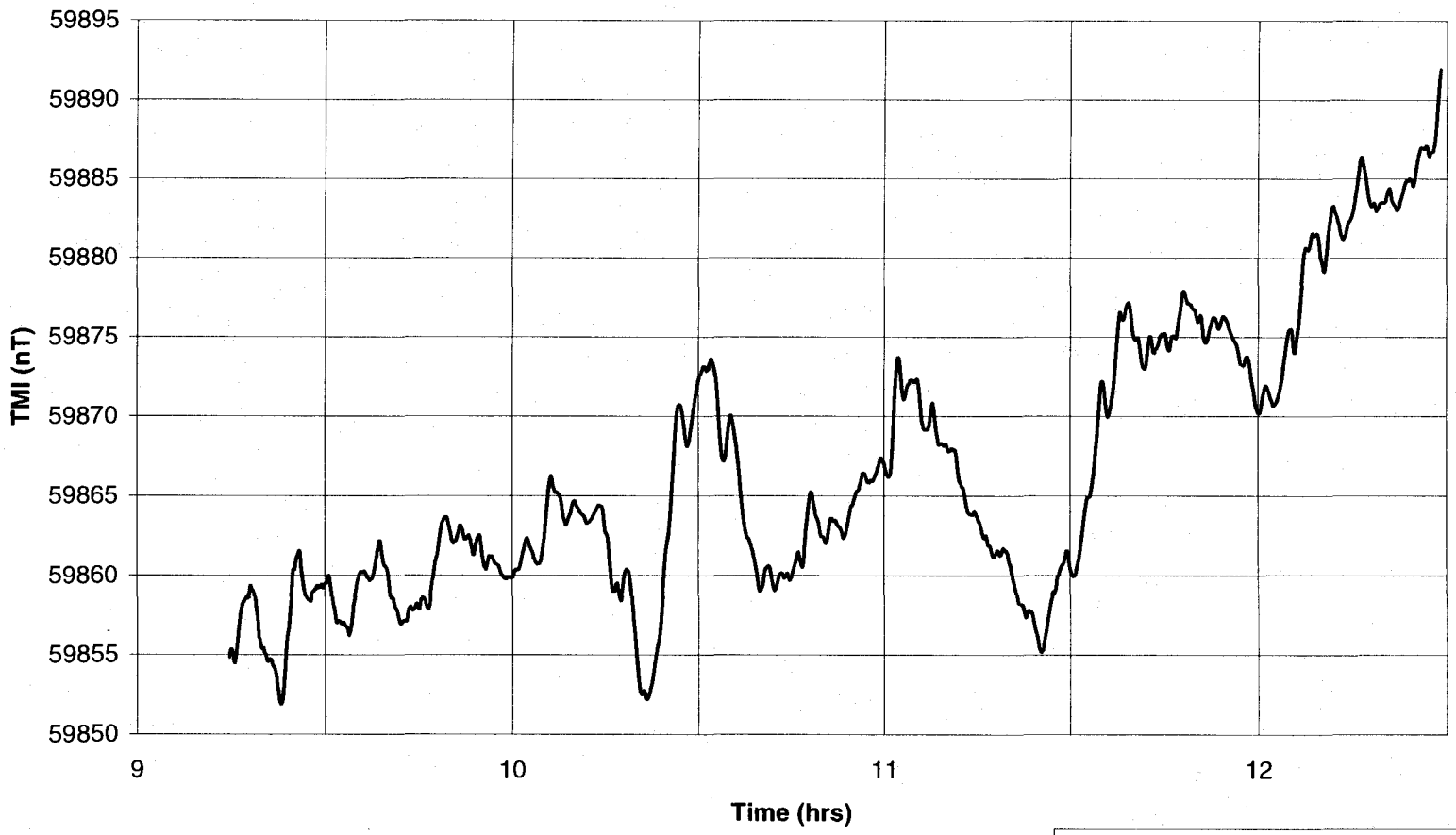
Base Station TMI

GRID 210

Date Collected February 18, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

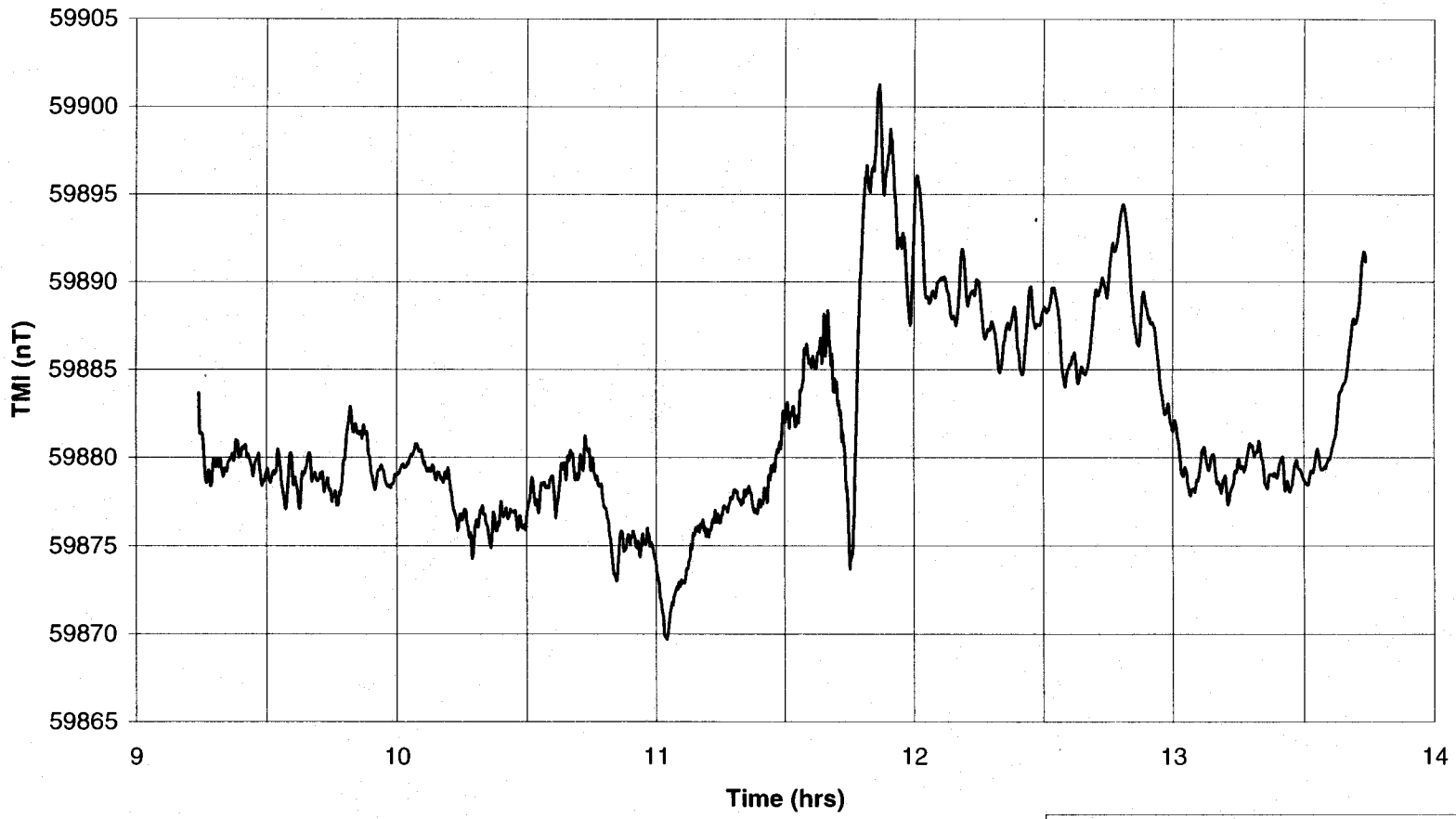
Base Station TMI

GRID 210

Date Collected February 19, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

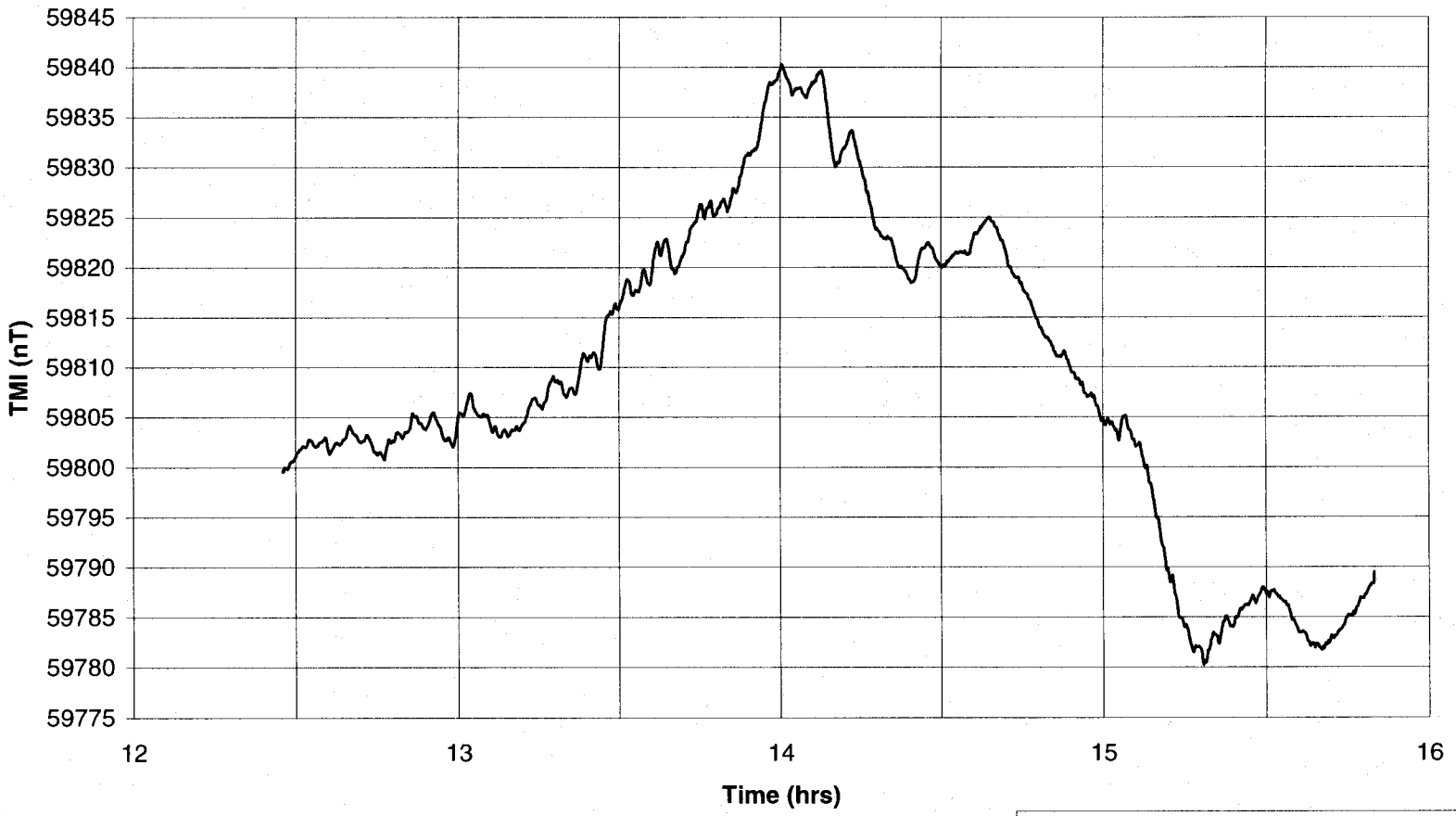
Base Station TMI

GRID 210

Date Collected February 20, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

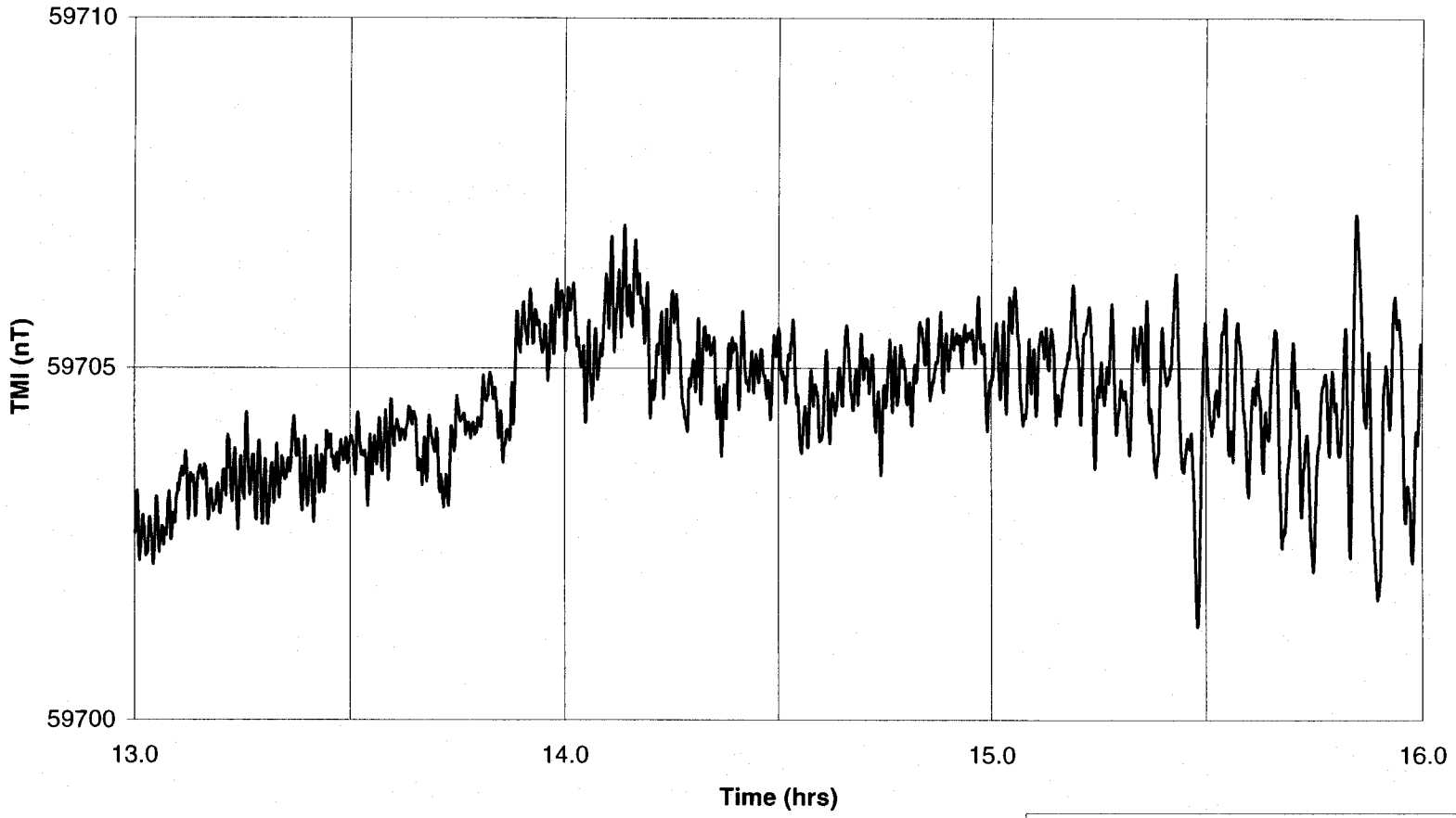
Base Station TMI

GRID 16

Date Collected February 23, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

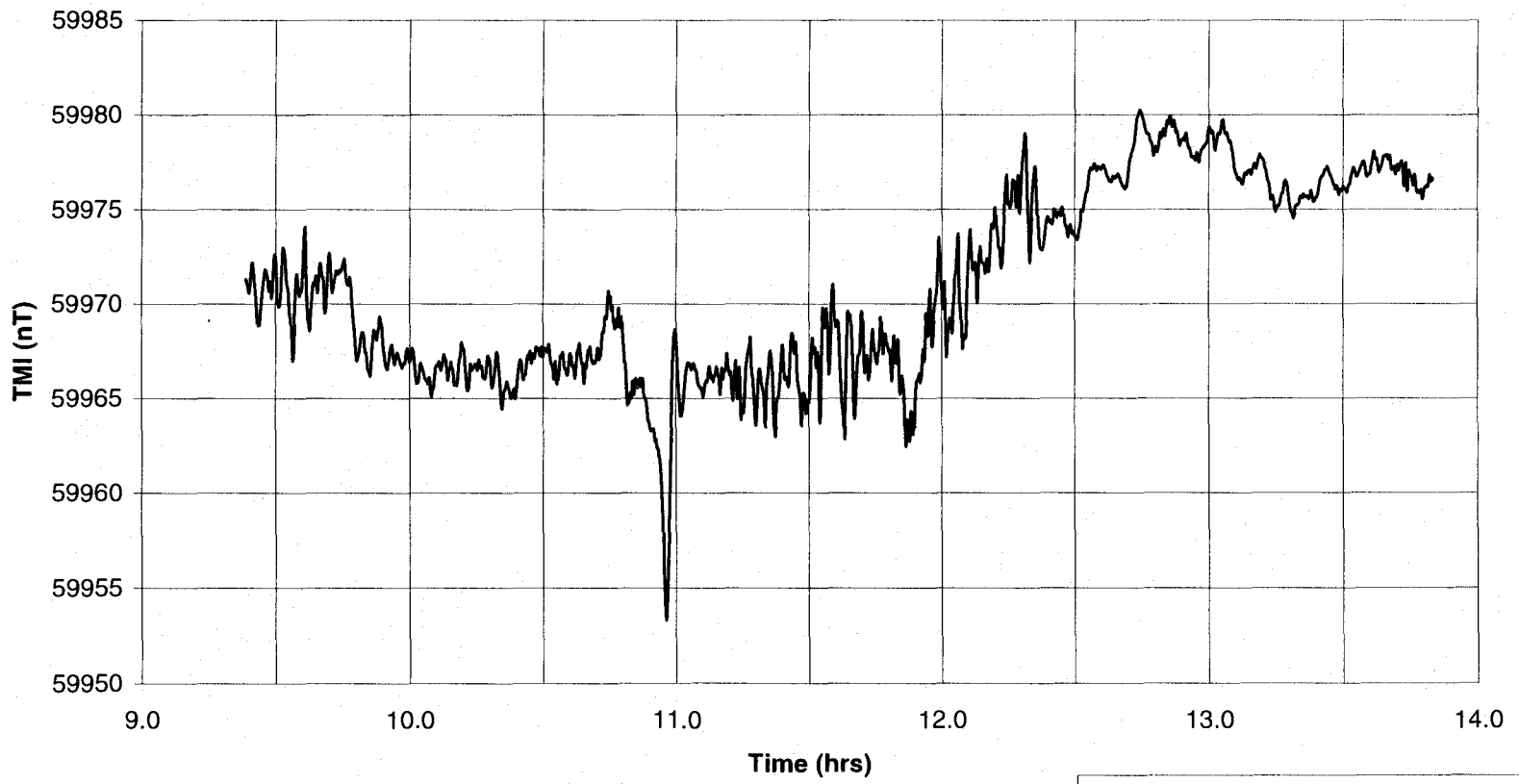
Base Station TMI

GRID 221

Date Collected February 24, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

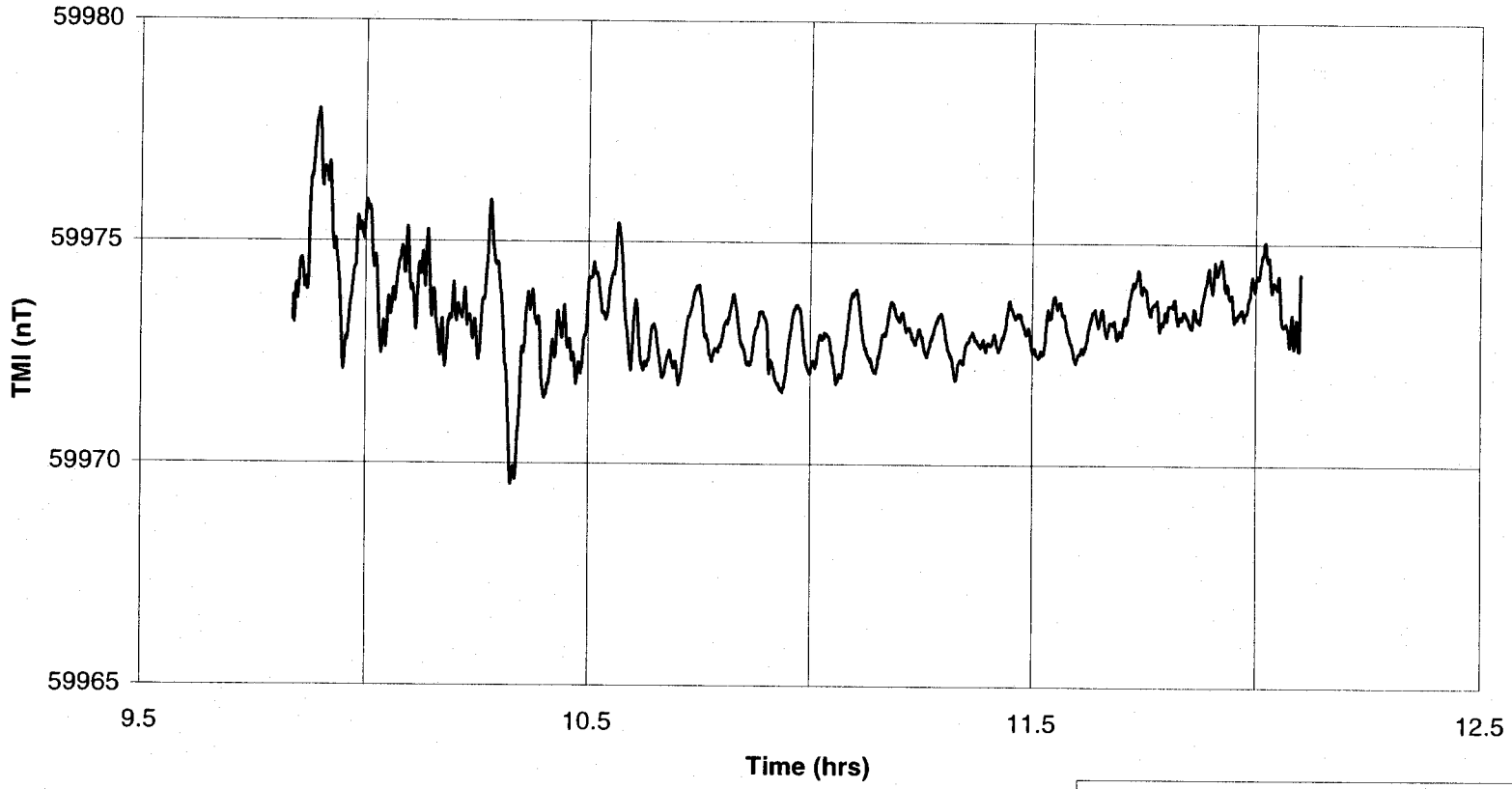
Base Station TMI

GRID 29

Date Collected February 25, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

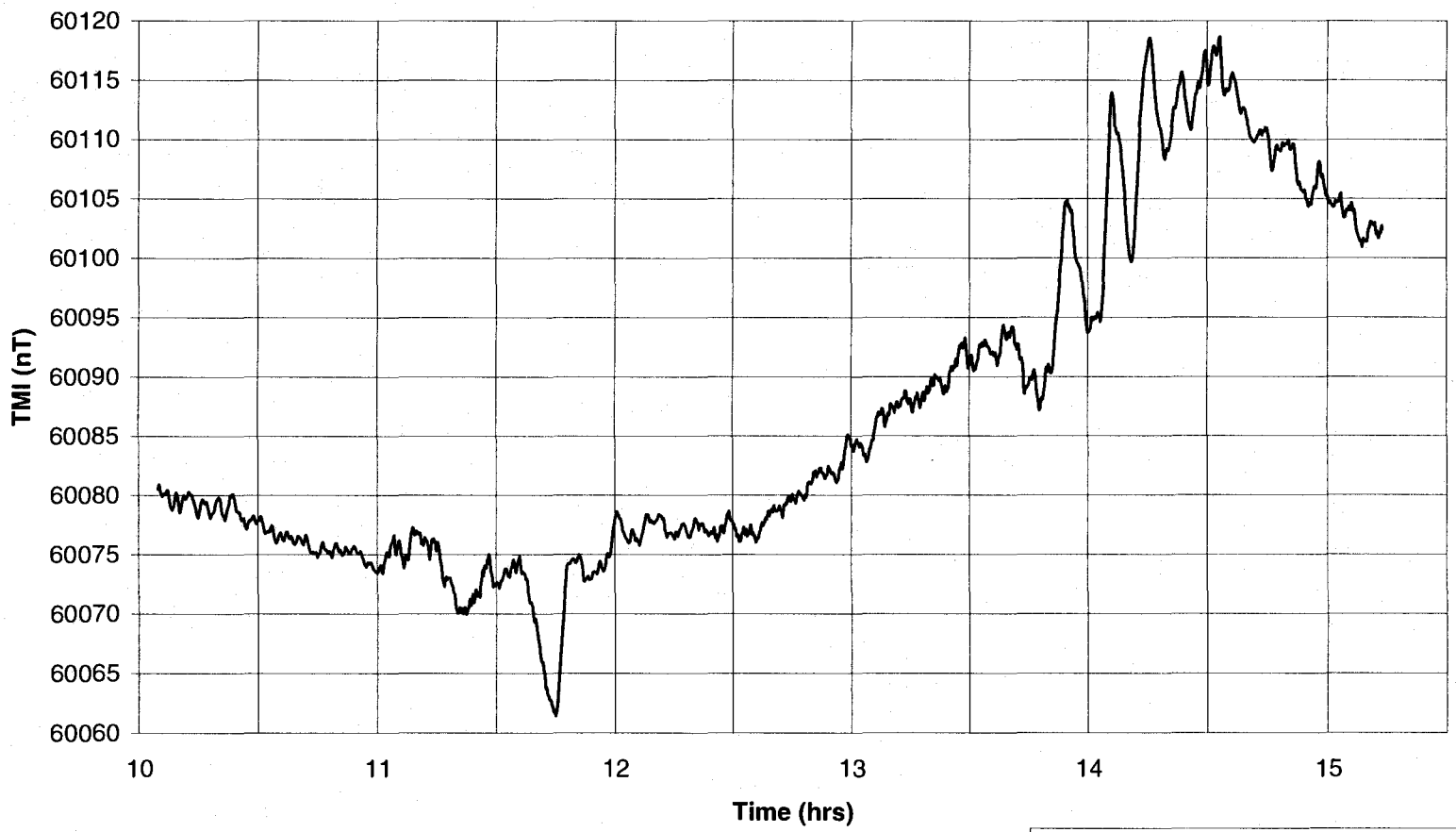
Base Station TMI

GRID 29

Date Collected February 26, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

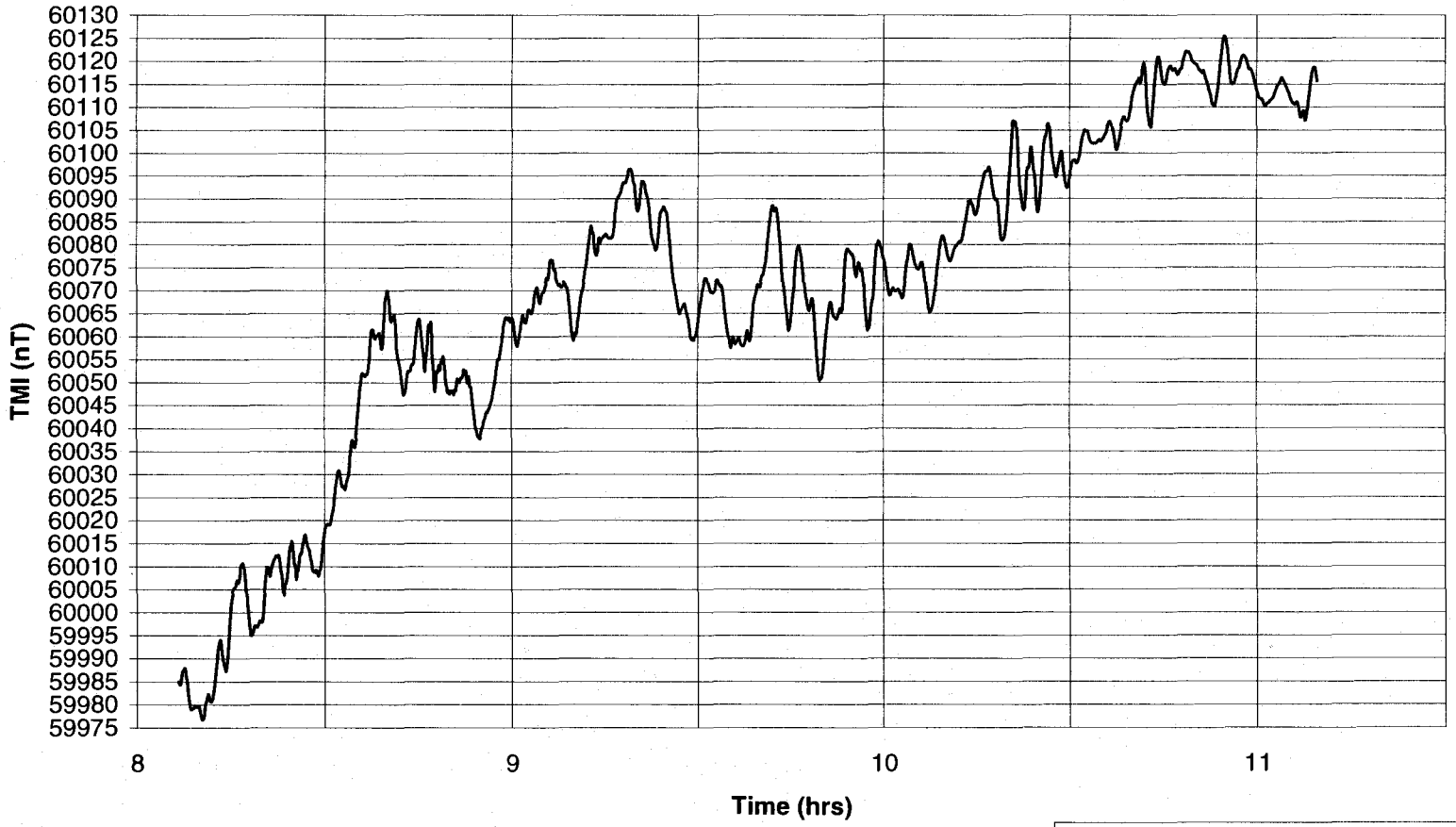
Base Station TMI

GRID 169

Date Collected February 27, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

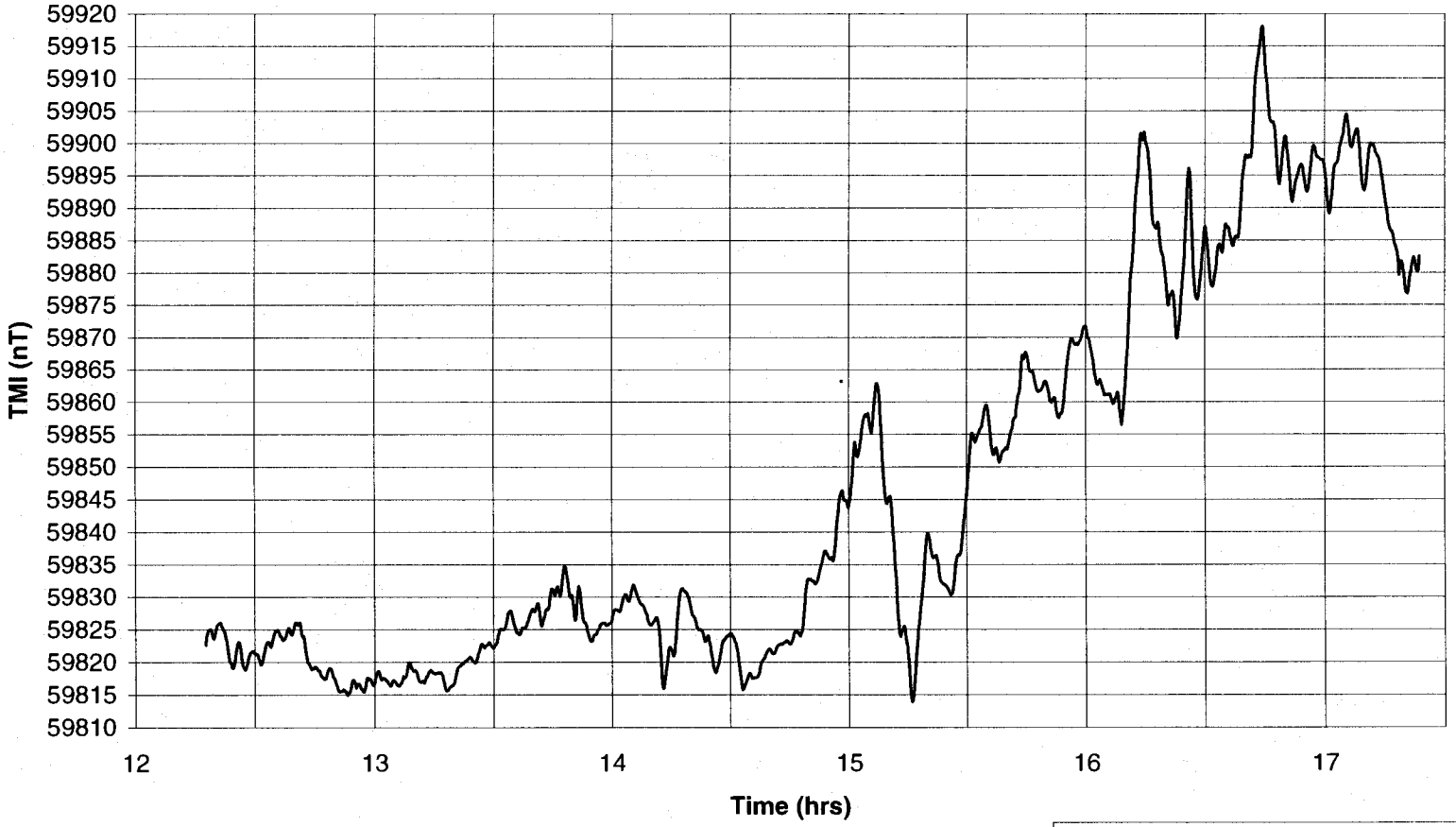
Base Station TMI

GRID 169

Date Collected February 28, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762



BIRCH MOUNTAIN RESOURCES Ltd.

Base Station TMI

GRID 189

Date Collected February 28, 1998

Figure

KOMEX INTERNATIONAL Ltd. FILE: KI98-4762

APPENDIX II

TOTAL MAGNETIC FIELD MAPS

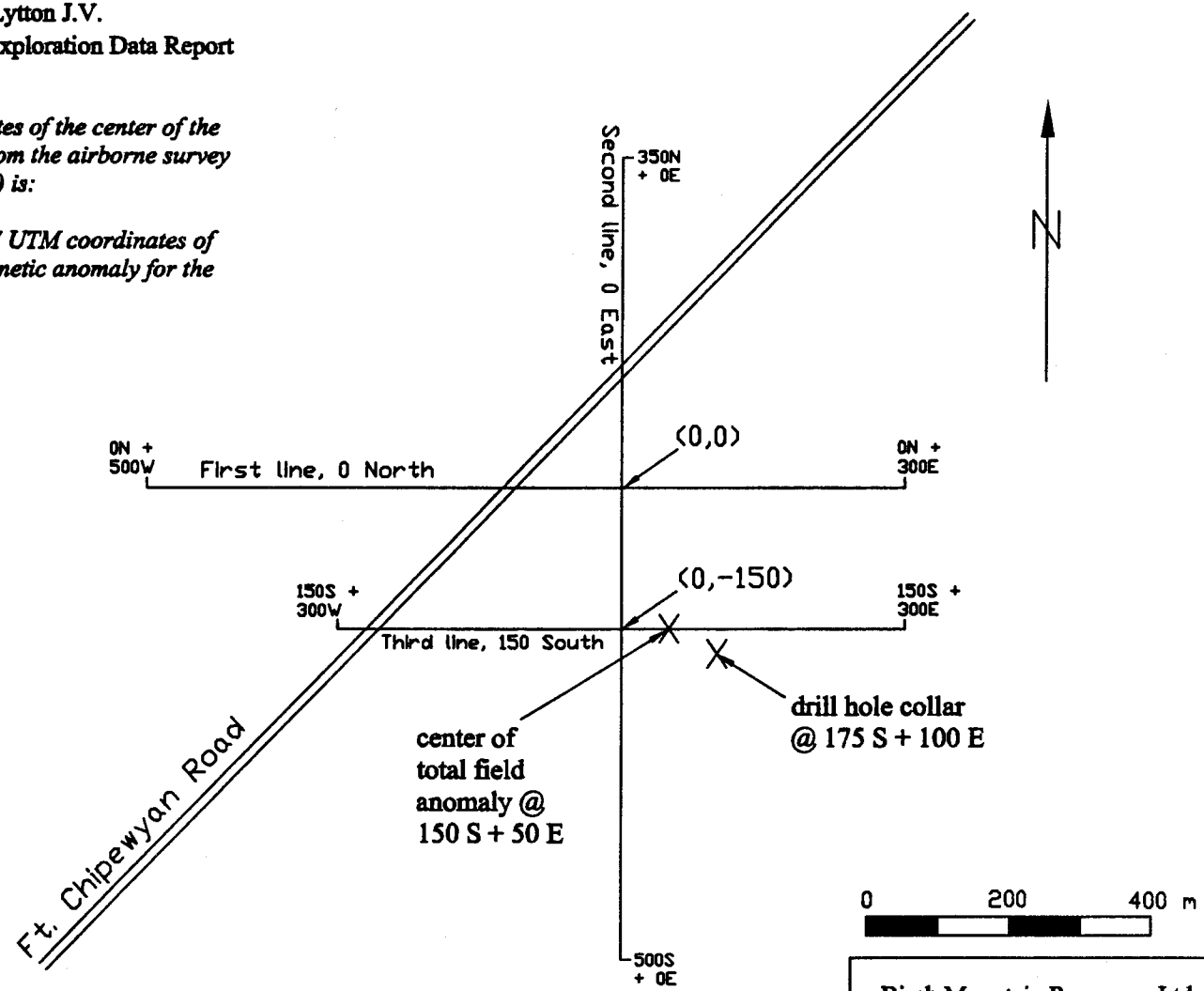
Appendix D.2.

Birch Mountain Resources Magnetic Survey Results

Sketch Map of Ground Magnetic Survey Anomaly #6

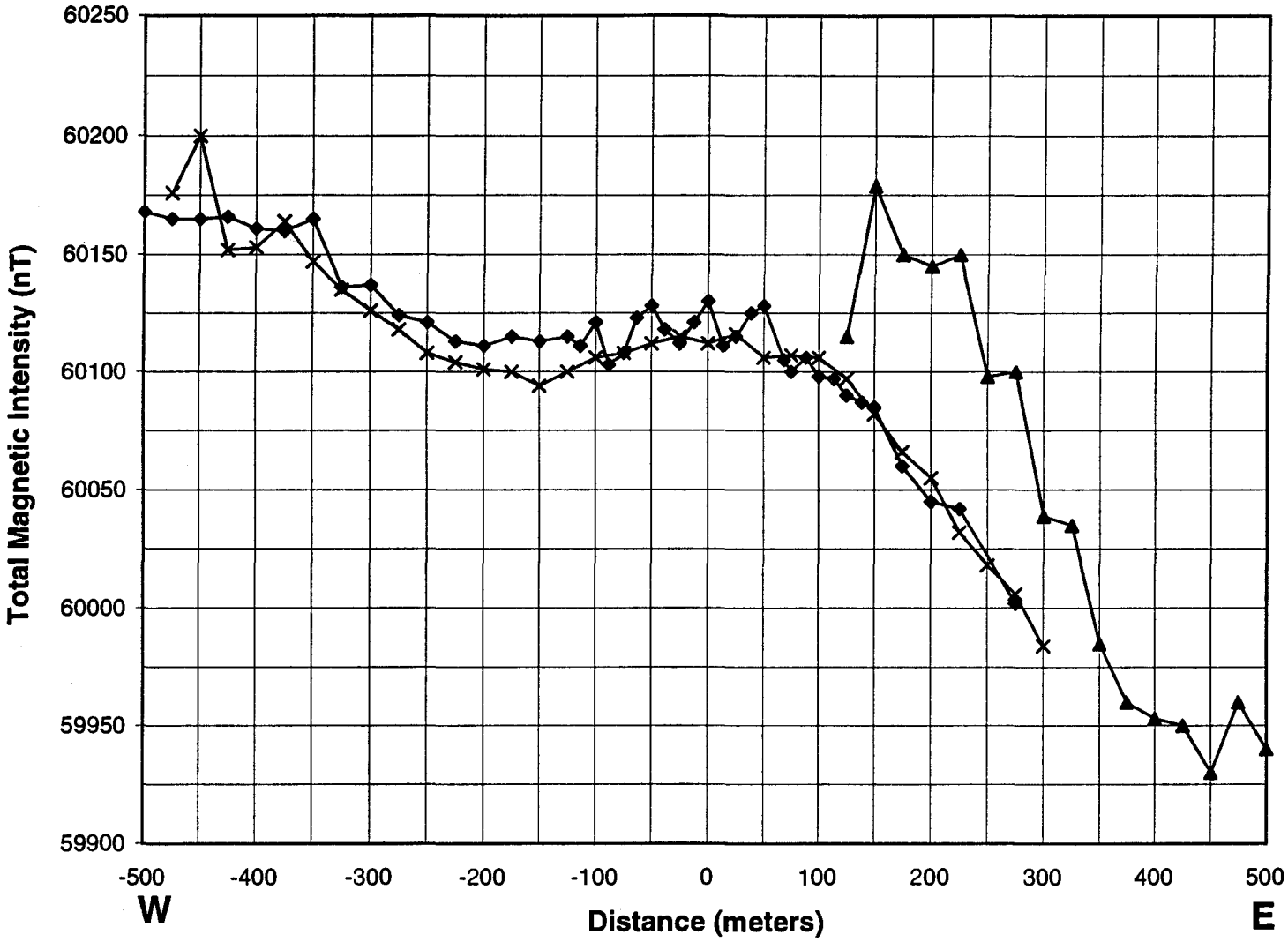
Birch Mountain/Lytton J.V.
First Quarter 1998 Diamond Exploration Data Report

NOTE: NAD27 UTM coordinates of the center of the total field magnetic anomaly from the airborne survey (Canagrad Surveys, Kai Hedin) is:
6382138N 483171E,
which is taken to be the NAD27 UTM coordinates of the center of the total field magnetic anomaly for the ground magnetic survey.



Birch Mountain Resources Ltd.	
DRAWN BY: Glen De Paoli	
SCALE: 1:7500	DATE: May 12, 1998

Profile of east-west line @ 0 meters north (first line)
Anomaly #6, Ground Magnetic Survey



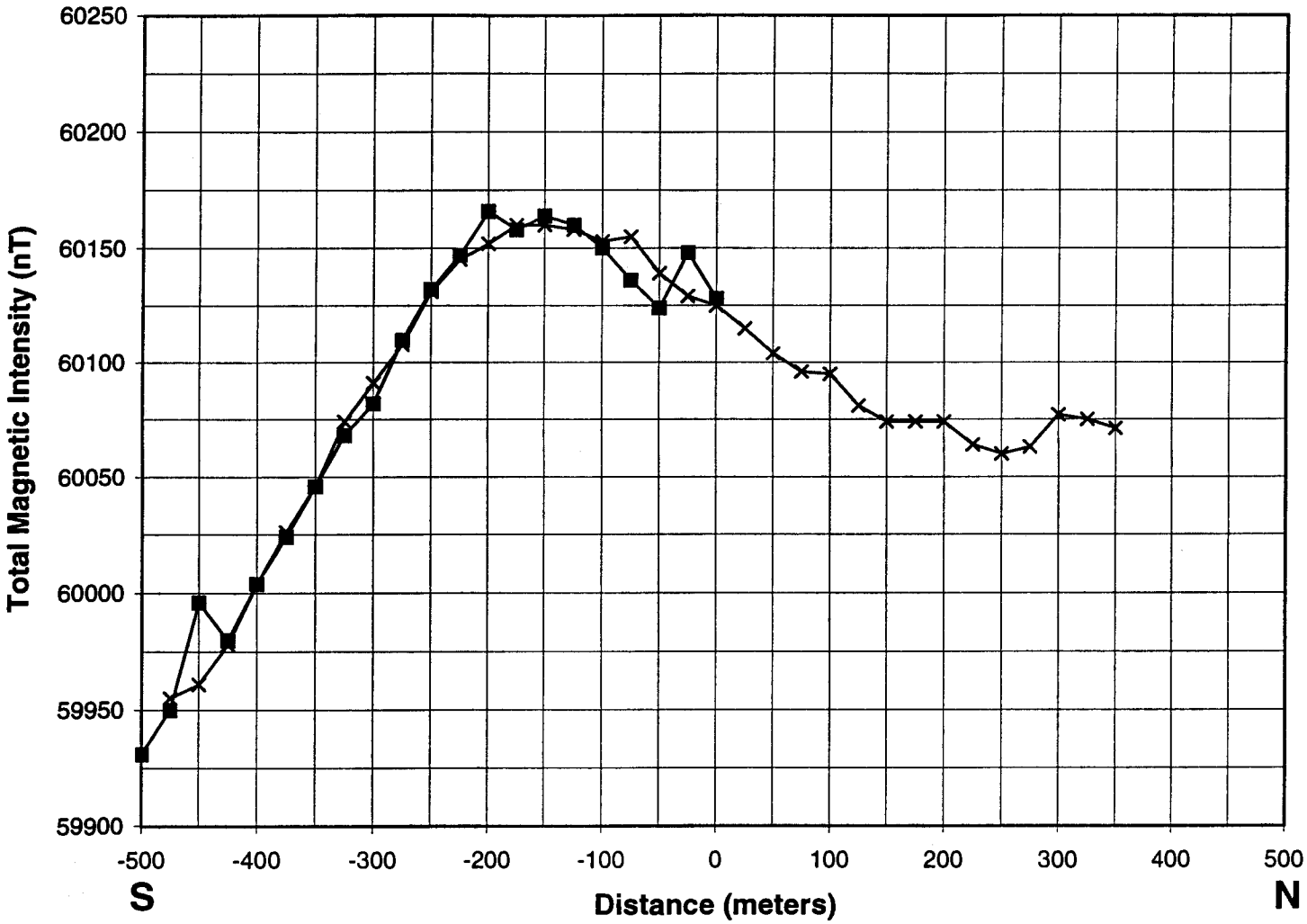
Traveling West
Traveling East
March 21 Data

Data collected on March 21 is included to show eastern extent of anomaly.

Center of anomaly on this line picked at 0 East.

Birch Mountain/Lytton J.V.
First Quarter 1998
Athabasca Diamond Exploration

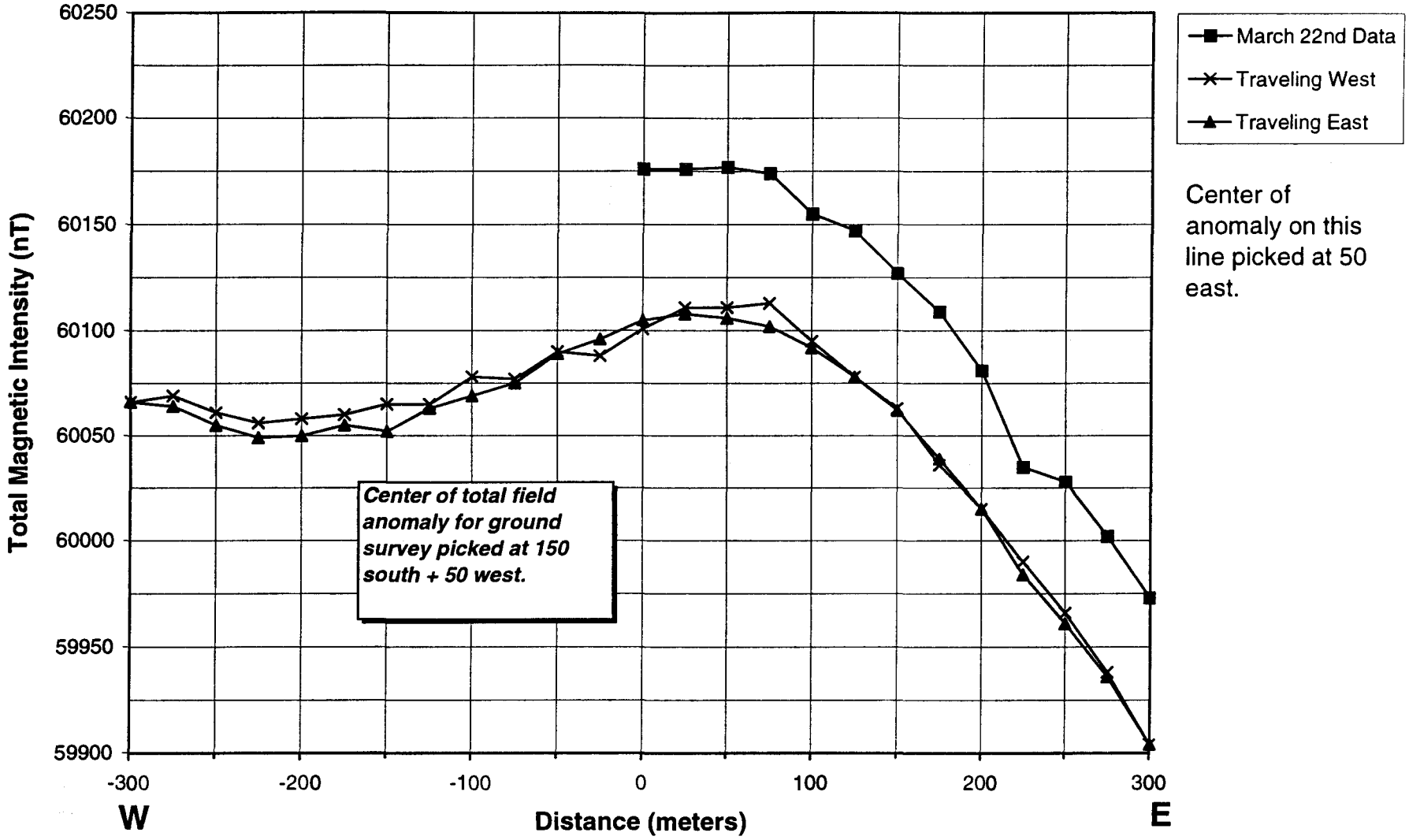
Profile of north-south line @ 0 meters east (second line)
Anomaly #6, Ground Magnetic Survey



Center of anomaly on this line picked at 150 south (-150).

Birch Mountain/Lytton J.V.
First Quarter 1998
Athabasca Diamond Exploration

Profile of east-west line @ 150 meters south (third line)
Anomaly #6, Ground Magnetic Survey



Birch Mountain/Lytton J.V.
First Quarter 1998
Athabasca Diamond Exploration

Raw data for east-west line
@ 0 meters north (first line).
Anomaly #6, Ground Magnetic Survey

Stations West of (0,0)
are given as negative
(i.e. 100 West = -100).

	Data from March 22nd survey					Data from March 21st survey		
station	traveling	reading	station	traveling	reading	station	traveling	reading
-500	west	60168	-475	east	60176	125	east	60115
-475	west	60165	-450	east	60200	150	east	60179
-450	west	60165	-425	east	60152	175	east	60150
-425	west	60166	-400	east	60153	200	east	60145
-400	west	60161	-375	east	60164	225	east	60150
-375	west	60160	-350	east	60147	250	east	60098
-350	west	60165	-325	east	60135	275	east	60100
-325	west	60136	-300	east	60126	300	east	60039
-300	west	60137	-275	east	60118	325	east	60035
-275	west	60124	-250	east	60108	350	east	59985
-250	west	60121	-225	east	60104	375	east	59960
-225	west	60113	-200	east	60101	400	east	59953
-200	west	60111	-175	east	60100	425	east	59950
-175	west	60115	-150	east	60094	450	east	59930
-150	west	60113	-125	east	60100	475	east	59960
-125	west	60115	-100	east	60106	500	east	59940
-113.5	west	60111	-75	east	60108			
-100	west	60121	-50	east	60112			
-88.5	west	60103	-25	east	60115			
-75	west	60108	0	east	60112			
-63.5	west	60123	25	east	60116			
-50	west	60128	50	east	60106			
-38.5	west	60118	75	east	60107			
-25	west	60112	100	east	60106			
-12.5	west	60121	125	east	60097			
0	west	60130	150	east	60082			
13.5	west	60111	175	east	60066			
25	west	60115	200	east	60055			
38.5	west	60125	225	east	60032			
50	west	60128	250	east	60018			
68.5	west	60105	275	east	60006			
75	west	60100	300	east	59984			
88.5	west	60106						
100	west	60098						
113.5	west	60097						
125	west	60090						
138.5	west	60087						
150	west	60085						
175	west	60060						
200	west	60045						
225	west	60042						
275	west	60002						

Raw data for north-south line
@ 0 meters east (second line).
Anomaly #6, Ground Magnetic Survey

Stations South of (0,0)
are given as negative
(i.e. 100 south = -100)

station	traveling	reading	station	traveling	reading
0	south	60128	-475	north	59955
-25	south	60148	-450	north	59961
-50	south	60124	-425	north	59978
-75	south	60136	-400	north	60004
-100	south	60150	-375	north	60026
-125	south	60160	-350	north	60046
-150	south	60164	-325	north	60074
-175	south	60158	-300	north	60091
-200	south	60166	-275	north	60108
-225	south	60147	-250	north	60131
-250	south	60132	-225	north	60145
-275	south	60110	-200	north	60152
-300	south	60082	-175	north	60160
-325	south	60068	-150	north	60160
-350	south	60046	-125	north	60158
-375	south	60024	-100	north	60153
-400	south	60004	-75	north	60155
-425	south	59980	-50	north	60139
-450	south	59996	-25	north	60129
-475	south	59950	0	north	60125
-500	south	59931	25	north	60115
			50	north	60104
			75	north	60096
			100	north	60095
			125	north	60081
			150	north	60074
			175	north	60074
			200	north	60074
			225	north	60064
			250	north	60060
			275	north	60063
			300	north	60077
			325	north	60075
			350	north	60071

Raw data for east-west line
@ 150 meters south (third line).
Anomaly #6, Ground Magnetic Survey

Stations West of (0,0)
are given as negative
(i.e. 100 West = -100)

March 22nd data								
east-west line on 150 south				March 24th data, east-west line on 150 south				
station	traveling	reading	station	traveling	reading	station	traveling	reading
0	east	60176	300	west	59904	300	east	59904
25	east	60176	275	west	59938	275	east	59936
50	east	60177	250	west	59966	250	east	59961
75	east	60174	225	west	59990	225	east	59984
100	east	60155	200	west	60015	200	east	60015
125	east	60147	175	west	60036	175	east	60039
150	east	60127	150	west	60063	150	east	60062
175	east	60109	125	west	60078	125	east	60078
200	east	60081	100	west	60095	100	east	60092
225	east	60035	75	west	60113	75	east	60102
250	east	60028	50	west	60111	50	east	60106
275	east	60002	25	west	60111	25	east	60108
300	east	59973	0	west	60101	0	east	60105
			-25	west	60088	-25	east	60096
			-50	west	60090	-50	east	60089
			-75	west	60077	-75	east	60075
			-100	west	60078	-100	east	60069
			-125	west	60065	-125	east	60063
			-150	west	60065	-150	east	60052
			-175	west	60060	-175	east	60055
			-200	west	60058	-200	east	60050
			-225	west	60056	-225	east	60049
			-250	west	60061	-250	east	60055
			-275	west	60069	-275	east	60064
			-300	west	60066	-300	east	60066

Appendix E

Aeromagnetic Surveys

Appendix E.1. Canagrad Surveys Limited Report

REPORT

April 14, 1998

Fort McMurray Aeromagnetic Survey

Phase I & II .

Kaj Hedin

Canagrad Surveys Limited.

Canagrad Surveys was commissioned by Birch Mountain Resources on behalf of the Lytton Minerals - Birch Mountain Joint Venture to follow-up several magnetic targets identified primarily from interpretation by GEDCO and APEX of the Athabaska HRAM survey flown by World GeoScience in 1997 as well as two targets picked from G.S.C. data; 'Doberman Lakes'.

The survey tasks were defined as follows;

1. Confirm anomalies picked from G.S.C. data.
2. Confirm, improve location and resolution of anomalies picked from HRAM data.
3. Provide comparison with KOMEX ground survey of selected targets.
4. Evaluate replacement of traditional ground magnetic survey with detailed aeromagnetic survey in remote areas.

The survey was conducted in 2 parts; Phase-I & II. The aircraft was returned to Calgary due to weather and to allow evaluation of the first 5 targets. Changes to the data acquisition system and processing software were also made during the standby period.

Phase-I

A Canagrad Cessna 310 long-range survey aircraft presently equipped for combined gravity and magnetic survey was used for Phase-I of the project. In the short time available, the gravity and magnetic system installed was used without further modification. A high resolution counter operated at 25Hz sampling rate was used to collect the magnetic information. Precise GPS velocity data as well as inertial data was collected in addition to the magnetometer data. A GPS precise velocity measuring receiver was deployed as a ground reference station located in a multi-path free environment on the roof of the Brown's hangar at the McMurray Airport.

Data acquisition parameters:

GPS L1 carrier phase (aircraft):	20Hz
GPS L1 carrier phase (ground):	20Hz
Inertial data:	100Hz
Gravity sensor:	125Hz
Magnetometer:	25Hz
Analog data:	100Hz
Laser altimeter:	1Hz

The aircraft and all systems were tested locally in Calgary before mobilization to Fort McMurray. More than 10 hours of crew training (at gross weight) were provided during tests in the Turner Valley area. Special attention was given to low-level flying at low speeds; typically 220 - 240 km/h. The aircraft has been modified with vortex generators for improved slow flight performance which provided the safety margin required for this type of flying.

All flights conducted with 2 crew, pilot and navigator/operator. The flying height above ground was maintained at or below 65 m typically depending on terrain. Safe low level operation precluded morning and late afternoon in East/West directions due to sun glare.

Phase-I survey was terminated early due to poor weather in the Fort McMurray region. The aircraft, crew and all equipment was de-mobilized to Calgary before completion of all targets. Re-deployment was subject to weather and survey data results.

The data were processed in Calgary. Due to long baselines, the GPS data were corrected using precise ephemerides and clock corrections purchased from NRCAN instead of the GPS L1 base station data. The data corrected using this method are accurate to less than 5m. Residuals noted were typically 0.3 - 0.5m from most satellites used in the solution.

Corrected GPS and magnetometer data were merged using the ORBIT-PPS program and mapped with Geosoft MONTAJ. The preliminary leveled data were shipped via e-mail to KOMEX and Birch Mountain for further evaluation.
Data are archived in geosoft xyz (.xyz) and geosoft binary (.gbn) format.

Phase-II
The following changes were made to the data acquisition system support equipment before mobilizing back to Fort McMurray:

1. Removed gravity sensors.
2. Replaced acquisition software adding 2000 Hz laser altimeter capability.
3. Replaced Philips counter with a standard Picodas 1000 series PC-card.
4. Added linear power supply for magnetometer sensor (previously operated from aircraft 28V).
5. Change the ORBIT-PPS program to include merging of 2000Hz laser data.
6. GPS reference station not installed.
7. Geosoft MONTAJ field processing system included.

Data acquisition parameters:

GPS L1 carrier phase (aircraft):	4Hz
Inertial data:	100Hz
Magnetometer:	10Hz
Analog data:	100Hz
Laser altimeter:	2000Hz

The Fort McMurray flying operations were resumed on completion of system tests in Calgary.

The high speed laser altimeter provided excellent ground tracking through vegetation and allowed precise flying at lower elevation; 25-40m AGL. Line/tieline intersections in terms of elevation miss-ties less than 10m.

The geomagnetic field was unsettled, active & quiet with active periods during most of the Phase-II flying. The operation was continued without shutdown for magnetics with little or no effect noticed on the final leveled grids. The results are attributed to good signal to noise ratio with respect to the targets, tight tieline spacing, small areas and proportionally high aircraft flying speed with respect to the rate of change of the earth's magnetic field.

The aircraft navigation was based on real-time GPS without corrections which provides navigation accuracy of +-30m typ. The success rate maintaining 100m +- 25m is about 70% for the small blocks, improving to 80-85% for areas the size of the Doberman Lakes. The improvement on larger areas is attributed to the flying technique where the pilot can afford longer a turn-around and lead-in on the larger areas.

All systems worked well during the project. All aircraft maintenance was performed in Calgary without unscheduled events.

Data processing was performed in the field and preliminary tie-line leveled products were delivered via e-mail to KOMEX and Birch Mountain in Calgary. Processed grids were made available for display on site.

The data were compiled for final delivery to KOMEX for further micro-leveling and interpretation. The data were delivered as Geosoft binary (.gbn) to KOMEX on CD and as Geosoft xyz (.xyz) to Birch Mountain.

Conclusion:

All areas were completed as specified.

The survey method met all goals specified:
1. Enhanced and confirmed GSC anomaly picks.
2. Confirmed HRAM anomalies with enhancement in resolution and location.
3. Compares favorably with KOMEX ground data.
4. Low-level flying was found to be a cost effective replacement of conventional ground magnetic surveys.

The laser system provided excellent ground reference. Lineaments with vertical displacement of 0.3-0.5m were mapped on several grids which correlated well with magnetic basement features identified on first vertical derivative grids.

Recommendations:
1. 300-400m line spacing sufficient to follow up anomalies picked from G.S.C. data.
2. Use real-time corrected GPS for future surveys with line spacing less than 150m.
3. Plan flight line layout to favor N/S directions to avoid hazards flying into the sun during morning and late afternoon.
4. Consideration must be given with respect to the predicted increase in the earth's field magnetic variation due to increased solar storm activity when planning future activities. The year 1998 represents the beginning of the increase in activity based on the 11-year solar cycle. An example of monthly G.S.C. predictions attached.

Attachments:
1. Survey & technical specifications
2. Lytton - Birch Mountain targets
3. Production summary
4. Logistics report
5. G.S.C Geomagnetic activity plots.
6. Target map
7. Total Magnetic Field contour maps (preliminary field data)
8. 1:250,000 scale project map insert.

k.h.

Survey and Technical Specifications

Survey:	Aeromagnetic
Location:	50 -130 km North of Fort McMurray, Alberta
Size:	1.5 X 2.5km (typical)
Orientation:	Various
Traverse line spacing:	100m (typical)
Tie-line spacing:	500m (typical)
Total line km:	1,300 est.

<u>Specifications:</u>

Flying method:	Tight drape @ 65 m AGL, (40m typical)
Flying speed:	<220 - 240 km/h
Magnetic data spatial resolution:	<10m @ 0.01nT, 2Hz bandwidth
Magnetic variation:	Not specified
Navigation:	Post-mission Precise Point Solution L-1 GPS <5m accuracy
Ground clearance:	Laser with resolution of better than 0.05m
Compensation:	Inertial and vector magnetic neural network continuous solution

<u>Equipment:</u>

Aircraft:	Cessna T310R
Data acquisition system:	INDAS-II-IC
Compensator:	Kinematix 3D
Magnetometer:	Scintrex CS-2
Inertial measuring unit:	Phalanx strap-down IMU
Vector magnetometer:	Develco 2002 3-axis fluxgate magnetometer
GPS:	Novatel 3151R and 951R
Ground station magnetometer:	Not provided
Field Processing Equipment:	ORBIT Precise Position GPS correction and data merge prog. Geosoft MONTAGE: OASIS, LEVELLING, FFT1D & MAGMAP 300Mhz Pentium-II computer system

Lytton - Birch Mountain
Winter Diamond Project
Aeromagnetic Survey Targets

UTM E UTM N	LON (W)	LAT (N)	ANOMALY	SURVEY
Phase I				
497701 6371743	111.038349	57.490192	16	16
467015 6346156	111.546772	57.259165	42	42
450855 6360039	111.817383	57.382408	112	112
498989 6384616	111.016918	57.605826	221	221
494004 6404363	111.100822	57.783161	Doberman	Doberman
Phase II				
483742 6382254	111.271897	57.584323	6	6
466335 6364858	111.560597	57.427103	37	7
468750 6341060	111.517372	57.213509	57	8
492766 6348688	111.11999	57.283043	61	3
491370 6346550	111.143071	57.263808	70	3
468744 6339212	111.517239	57.196911	140	8
473967 6373091	111.434388	57.501554	156	4
464951 6383627	111.58634	57.595585	162	13
475266 6388048	111.414236	57.635982	169	5
472456 6385403	111.460995	57.612057	170	9
475575 6390164	111.409275	57.654999	171	5
475647 6387166	111.407767	57.628079	172	5
487673 6387686	111.206432	57.63324	183	1
488289 6388292	111.196146	57.638699	184	1
490517 6377913	111.158424	57.545524	190	10
490514 6377297	111.15845	57.539988	195	10
487157 6366391	111.21395	57.441942	196	12
489437 6365780	111.175941	57.436507	206	12
499544 6369926	111.007603	57.473873	217	11
498664 6369914	111.022276	57.473763	217	11
499029 6370817	111.016193	57.481881	218	11
498785 6389412	111.020356	57.648907	223	2
496043 6389724	111.066299	57.651694	224	2
492977 6389245	111.117655	57.647358	225	2
473487 6369888	111.442049	57.47276	301	301
472614 6348795	111.454256	57.28324	304	304
472765 6386307	111.455925	57.620196	305	9
440543 6337945	111.98356	57.182745	308	308
491599 6376833	111.140311	57.535837	309	10
469605 6365291	111.5062	57.431226	315	315
473921 6385027	111.436436	57.608764	327	9

Canagrad Surveys Limited - Fort McMurray Survey
Production Summary

Phase I, February 22 - 26, 1998.

Anomaly	Date	Area (km^2)	Line Km (approx)
Doberman Lakes	Feb. 25-26	54	300
A-16	Feb. 26	4.5	60
A-42	Feb.25	4.5	60
A-112	Feb. 25	4.5	60
A-221	Feb. 25	4.5	60
		Total	540 Km

Phase II, March 9 - 17, 1998

Area/Anomalies	Date	Area (km^2)	Line Km (approx)
1/A-5, A-183, A-184	Mar. 10	8.2	105
2/A-223, A-224, A-225	Mar. 10	11.3	150
3/A-60, A-71	Mar. 9	9.5	120
4/A-156	Mar. 11	4.5	60
5/A-169, A-171, A-172	Mar. 13	8.1	105
6/A-6	Mar.13	4.5	60
7/A-37	Mar. 13	4.5	60
8/A-57, A-140	Mar. 11	4.5	60
9/A-327	Mar.13	4.5	60
10/A-190, A-195	Mar. 10	3.6	50
11/A-217a,b; A-218a,b	Mar. 10	4.5	60
12/A-196b, A-206	Mar. 17	6.4	85
13/A-162	Mar. 10	3.6	50
301/A-301	Mar. 15	3.6	50
304/A-304	Mar. 15	3.6	50
308/A-308	Mar. 17	3.6	50
315/A-315	Mar. 15	3.6	50
327/A-327	Mar. 15	4.5	60
		Total	1,285 Km

Canagrad Surveys Limited - Fort McMurray Aeromagnetic Survey
Logistics Report

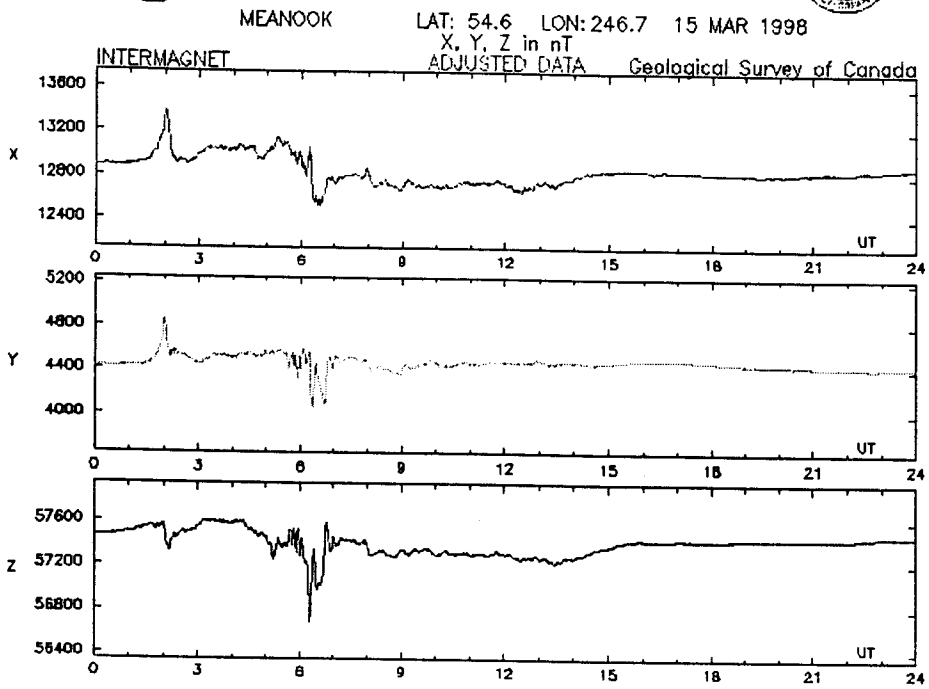
Operator:	Birch Mountain Resources Ltd.
Report for period:	February 22 - March 19, 1997
Aircraft:	Cessna 310
Pilot:	Jerry Wolski
Navigator:	Kaj Hedin

Activity Summary:
(local time)

980221	Prepare survey blocks. Generate CSL co-ordinates as .lin.		
980222	Mobilize aircraft & crew from Calgary to Fort McMurray.		
980223	Down for weather:	Perform system calibrations West of airport.	
980224	Down for weather:	Perform compensation flight N.W. airport.	
980225	Flight 1:	Doberman:	incomplete.
		Area 221:	complete.
	Flight 2:	Area 42:	complete.
		Area 112:	complete.
980226	Flight 3:	Doberman:	complete.
		Area 16:	complete.
980227	Down for weather:	Standby	
980228	Down for weather:	Demobilize all equipment & crew to Calgary.	
980301	In Calgary, prepare data for processing.		
980302	In Calgary, meeting at Birch. Discuss data compilation. Huanqi Sun consulting re; GPS processing of Birch data. Purchase 10 credits for precise clock & ephemerides. Process 980226 (UTC) GPS data.		
980303	Process 980224, 980225, 980227 (UTC) GPS data.		
980304	Process magnetometer data. Trim and level raw data.		
980305	Process data. Finish mapping. E-mail data to KOMEX and Birch.		
980306	Standby for additional survey targets.		
980307	Install Picodas magnetometer counter in aircraft system. Modify data acquisition software for Picodas counter. Add 2000 Hz data acquisition software for laser altimeter.		
980308	Continue work on aircraft data acquisition system software. Receive boundary co-ordinates from Birch for additional flying. Generate CSL co-ordinates as .lin files and .xyz formats. Produce test plot of all areas in Geosoft and verify locations.		

980309	Mobilize aircraft and crew from Calgary to Fort McMurray.		
	Flight 1:	Area 3:	incomplete.
		Perform compensation flight in survey area.	
980310	Flight 2:	Area 1:	complete.
		Area 2:	complete.
			process data.
	Flight 3:	Area 10:	complete.
		Area 11:	complete.
980311	Flight 4:	Area 13:	complete.
		Area 3:	complete.
	Flight 5:	Area 4:	complete.
		Area 8:	complete.
			process data.
980312	Down for weather:	Standby:	process data.
980313	Flight 6:	Area 5:	complete.
		Area 9:	complete.
		Area 6:	complete.
		Area 7:	complete.
			process data.
980314	Down for weather:	Standby:	process data.
		Receive additional targets (Lytton).	
		Prepare CSL co-ordinates & .lin files.	
		Verify locations in Geosoft.	
980315	Flight 7:	Area 327:	complete.
		Area 301:	complete.
		Area 315:	complete.
		Area 304:	complete.
			process data.
980316	Down for weather:	Standby:	process data.
980317	Down for weather:	Standby in the morning.	
	Flight 8:	Area 12:	complete.
		Area 308:	complete.
	All targets completed:		process data.
980318	Aircraft depart to Manning on CSL project.		
	Data processing equipment and 1 data processor remain on site.		
	Continue to process data.		
	Purchase 6 credits from NRCAN re; GPS post-processing.		
980319	Continue to process data. Complete processing of priority areas.		
	Presentation of data for Birch & Lytton staff.		
	Aircraft return from Manning.		
	Demobilize aircraft, crew and equipment to Calgary.		

ONE MINUTE VARIATION OF GEOMAGNETIC FIELD



EXAMPLE FROM N. EDMONTON GSC MAG.

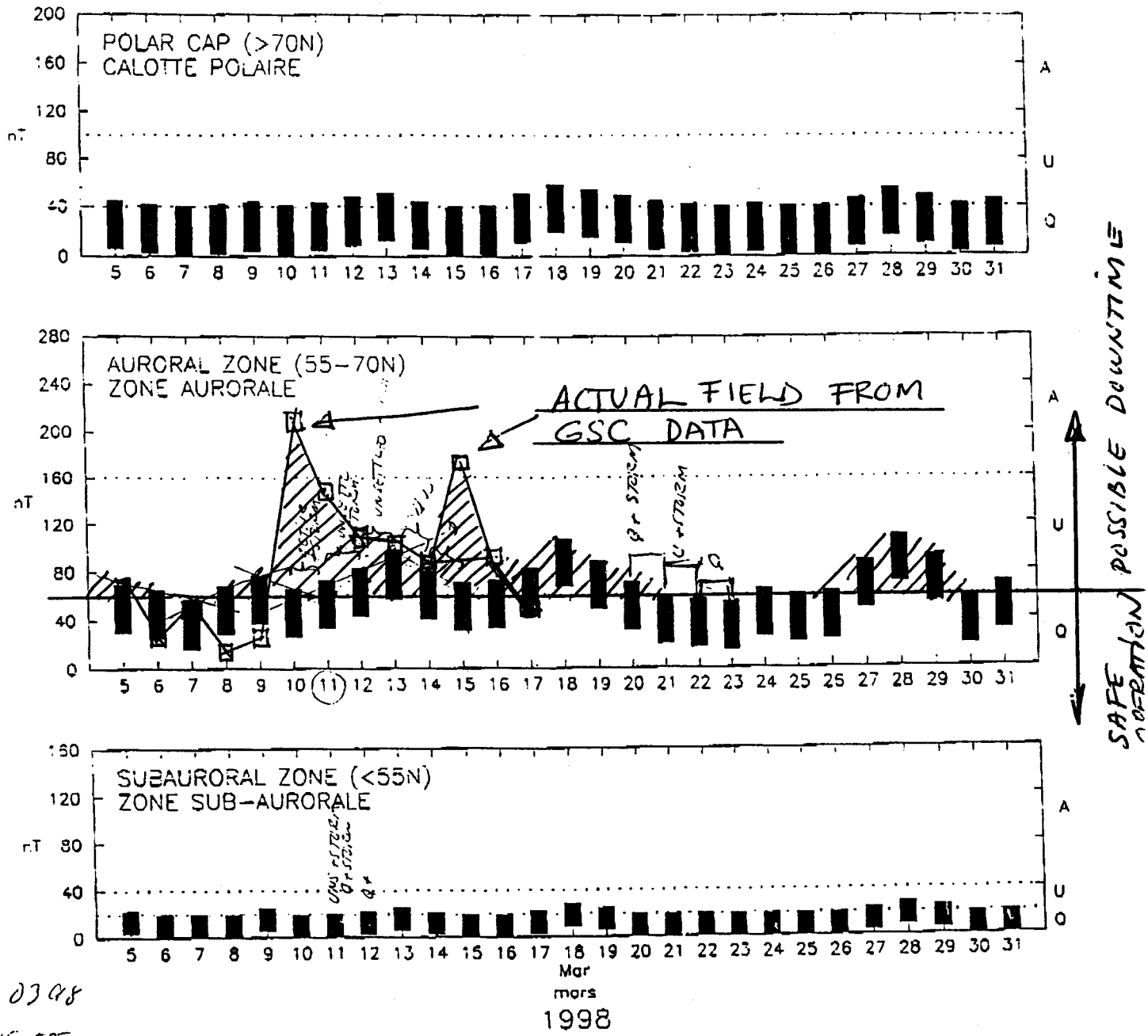
ON MARCH 15, 1998.

Natural Resources Canada
Geological Survey of Canada

Ressources naturelles Canada
Commission géologique du Canada

GEOMAGNETIC ACTIVITY — ACTIVITE GEOMAGNETIQUE

FORECAST OF DAILY MEAN OF HOURLY RANGES (DRX)
PREVISION DE LA MOYENNE QUOTIDIENNE DES PLAGES HORAIRES (DRX)



21/03/98
17:15 EST

Q, U, and A represent quiet, unsettled, and active conditions.
Q, U, et A représentent des conditions calmes, agitées, et actives.

For short–term voice forecasts, dial:
Pour les prévisions vocales à court terme, composer: 1–613–992–1299

24 q+storm
24 uns+storm
24 QUIET

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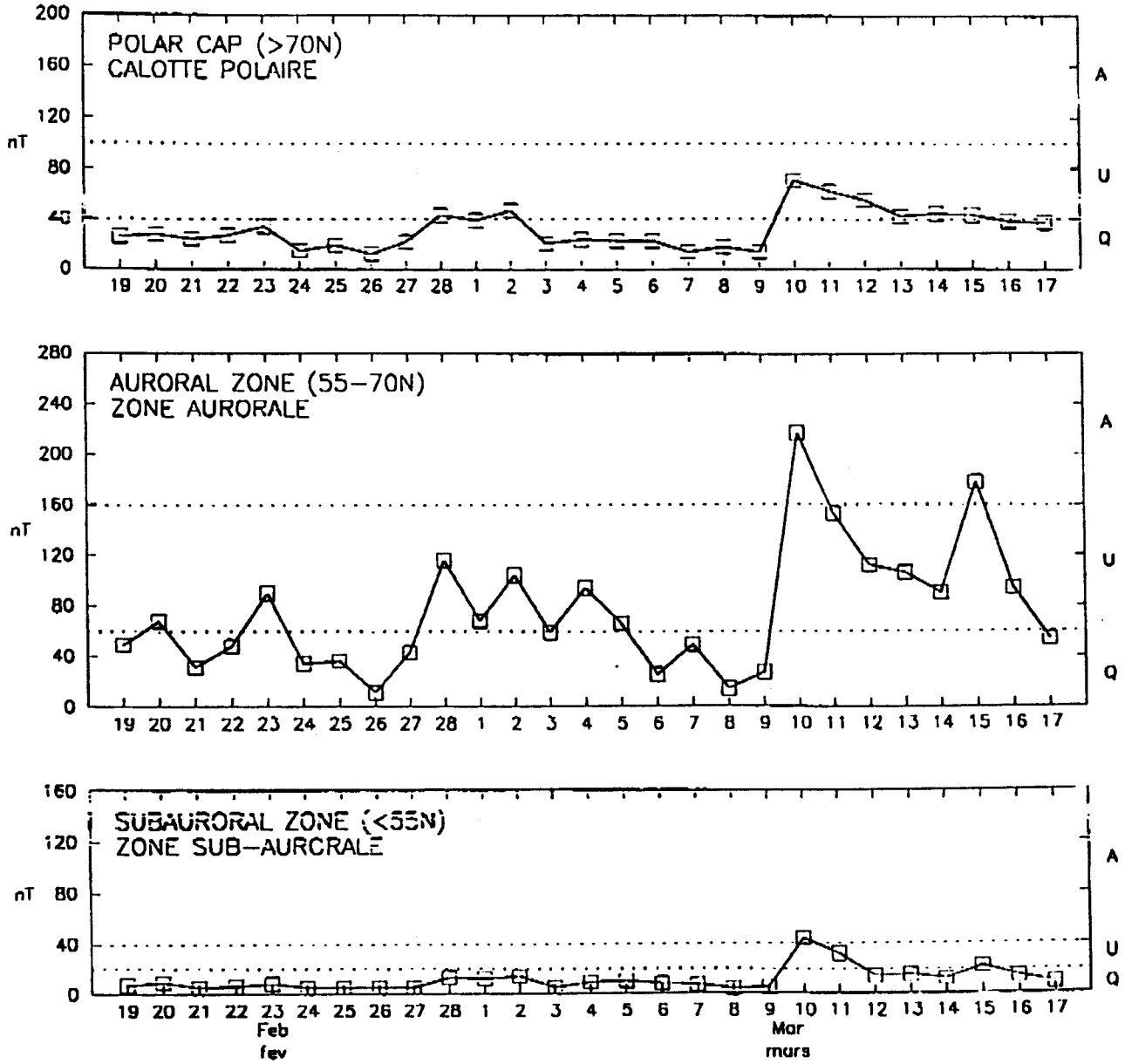
GEOMAGNETIC ACTIVITY

ACTIVITE GEOMAGNETIQUE

REVIEW OF DAILY MEAN OF HOURLY RANGES (DRX)
COMPTE RENDU DE LA MOYENNE QUOTIDIENNE DES PLAGES HORAIRES (DRX)

Rotation 2247



1998

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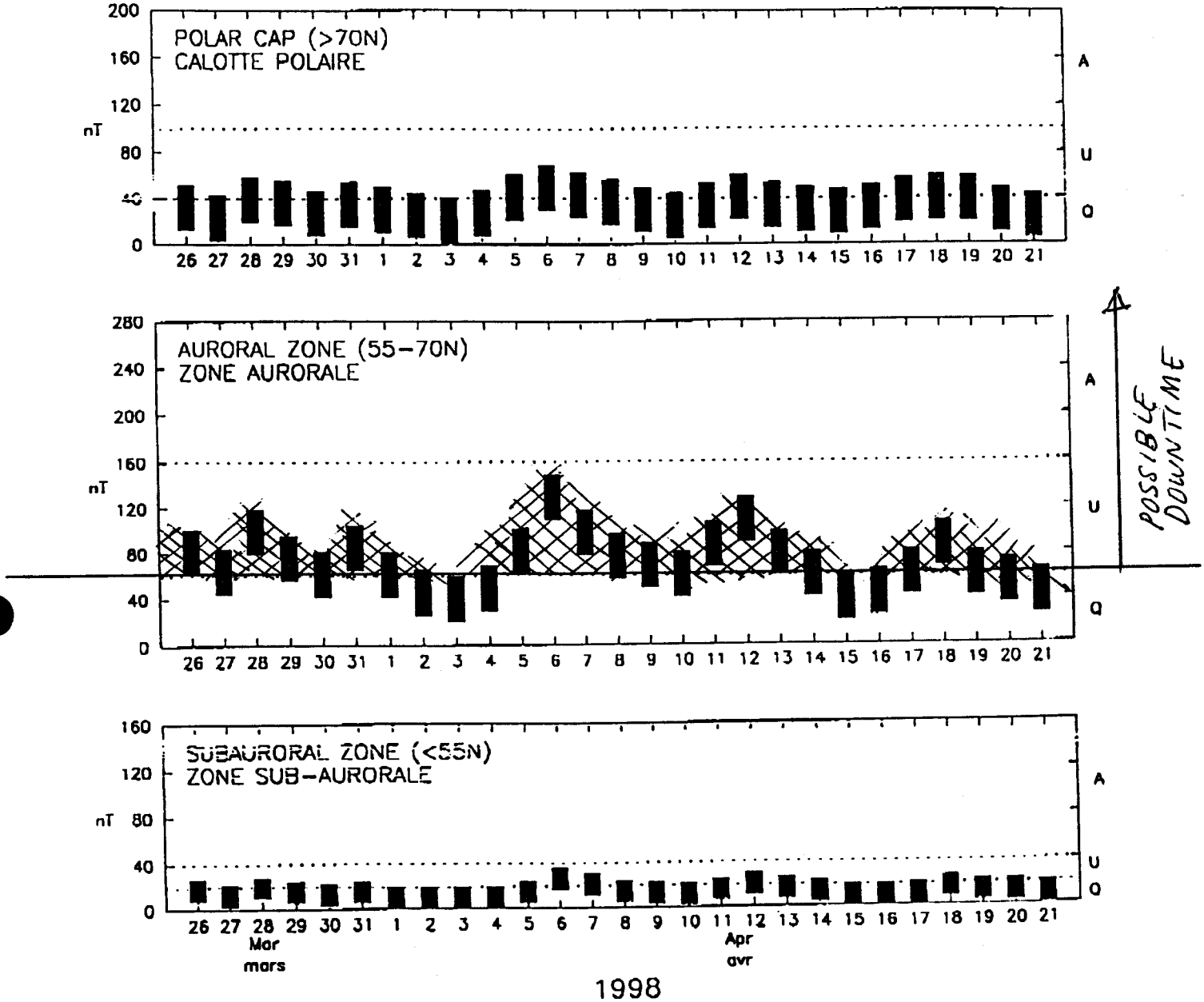
GEOMAGNETIC ACTIVITY — ACTIVITE GEOMAGNETIQUE

FORECAST OF DAILY MEAN OF HOURLY RANGES (DRX)
PREVISION DE LA MOYENNE QUOTIDIENNE DES PLAGES HORAIRES (DRX)



1998

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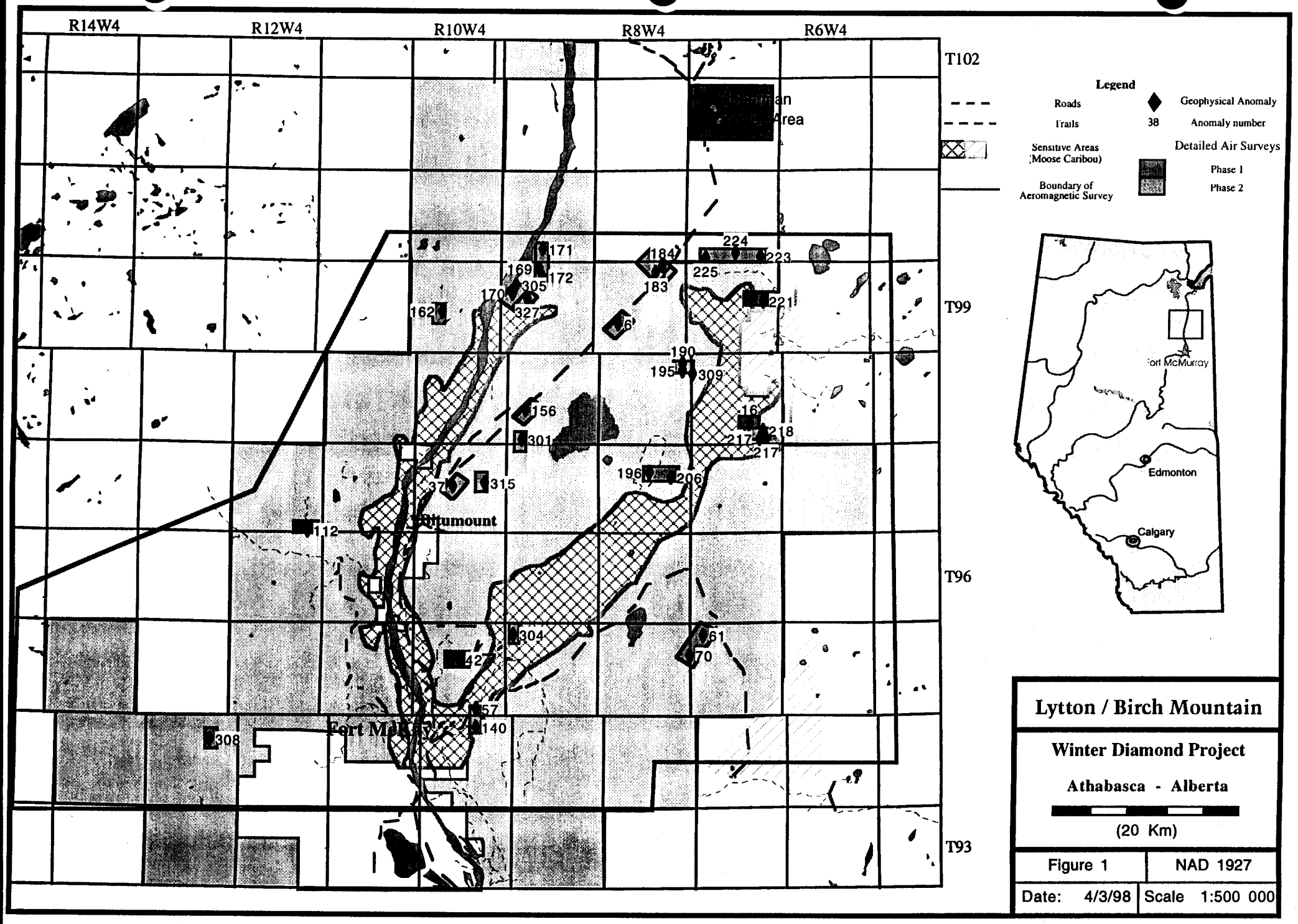
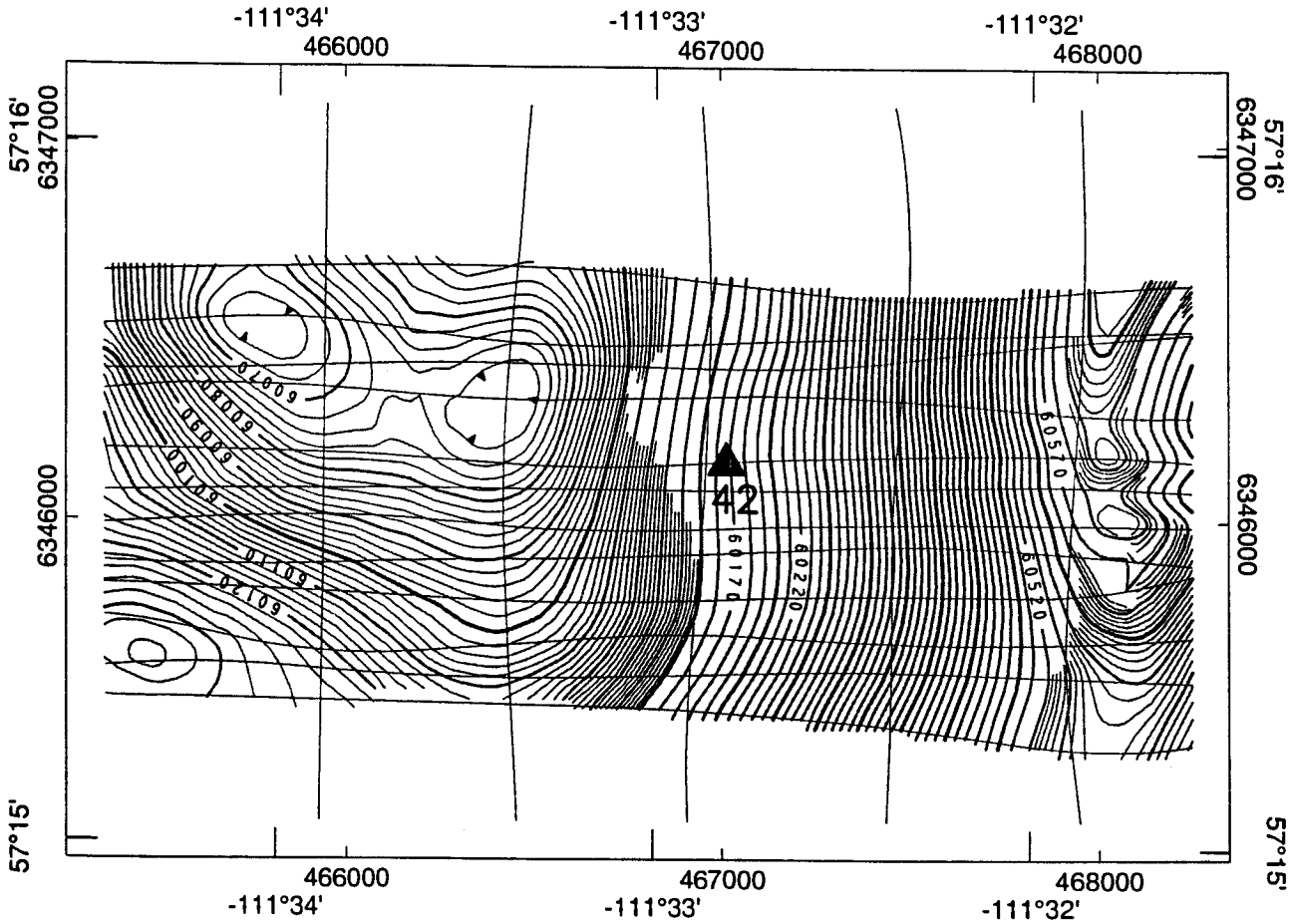

R14W4
R12W4
R10W4
R8W4
R6W4
T102
T99
T96
T93
Area
Bitumount
Fort McKay
Legend
Roads
Trails
Sensitive Areas (Moose Caribou)
Boundary of Aeromagnetic Survey
Geophysical Anomaly
38 Anomaly number
Detailed Air Surveys
Phase 1
Phase 2
Fort McMurray
Edmonton
Calgary
Lytton / Birch Mountain
Winter Diamond Project
Athabasca - Alberta
(20 Km)
Figure 1
NAD 1927
Date: 4/3/98
Scale 1:500 000



Scale 1:20000

250 0.0 250

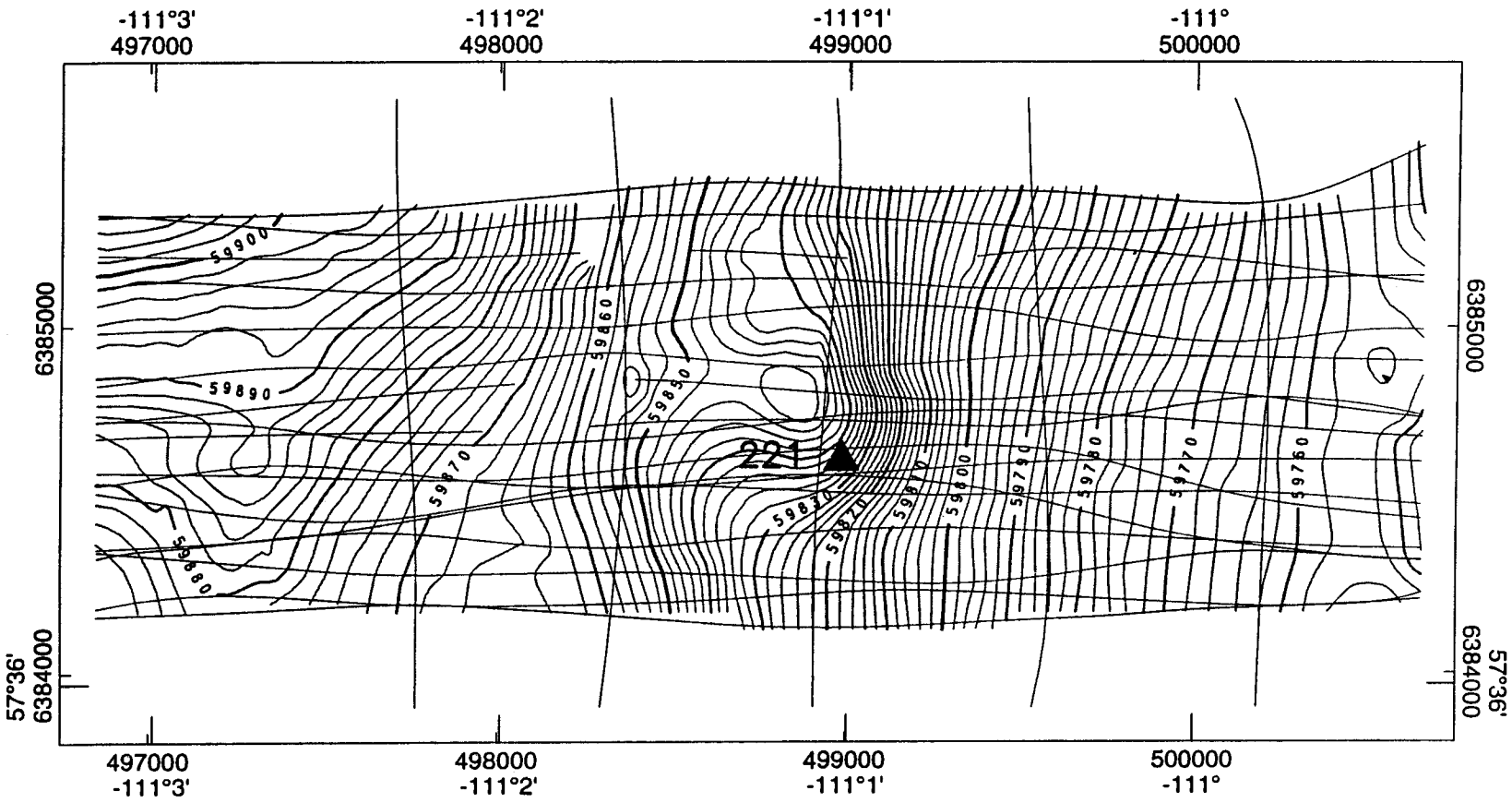
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey, Phase I
AREA: 42, Anomaly: 42

Flight Path
Total Field Contours
Contour Interval: 2-10-50 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



Scale 1:20000

250 0.0 250 500

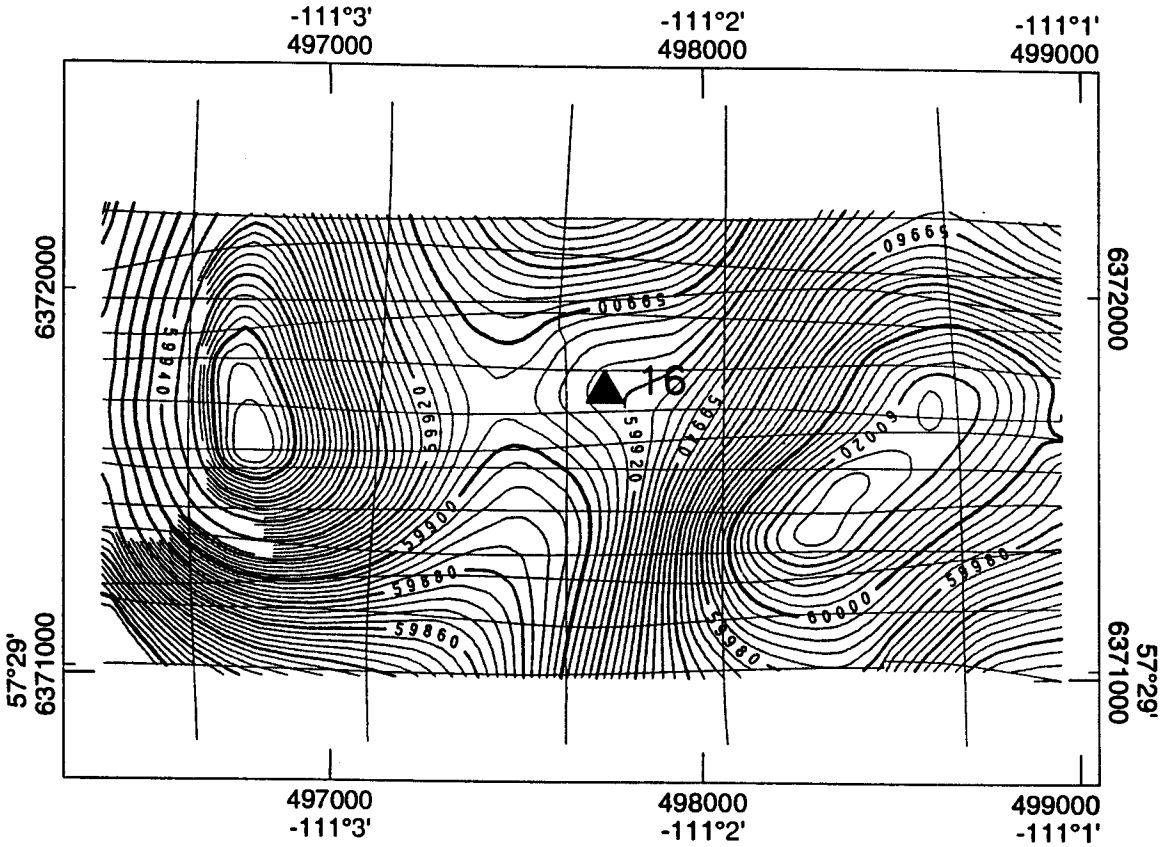
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey, Phase I
AREA: 221, Anomaly: 221

Flight Path
Total Field Contours
Contour Interval: 2-10-50 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



Scale 1:20000

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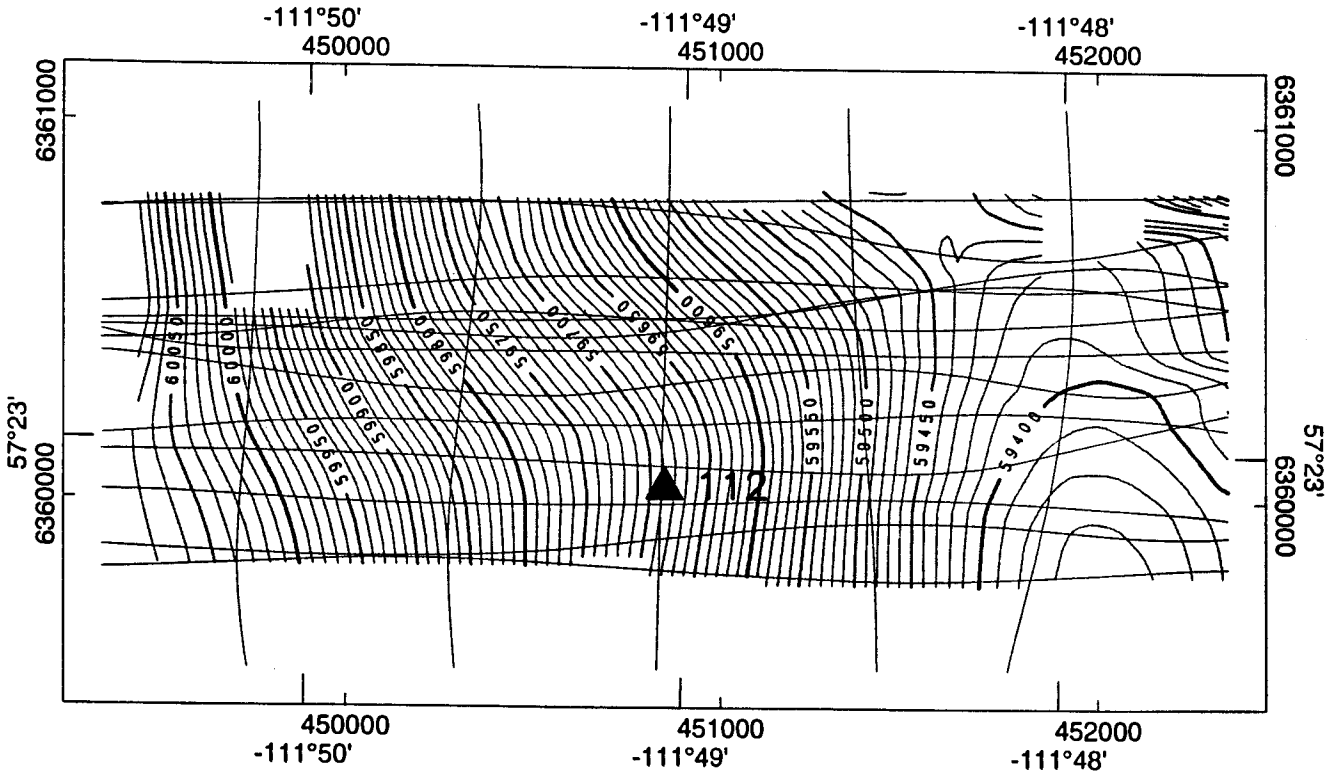
(meters)

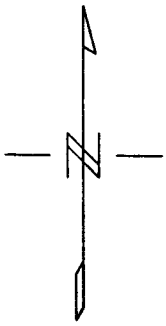
Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey, Phase I
AREA: 16, Anomaly: 16

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03





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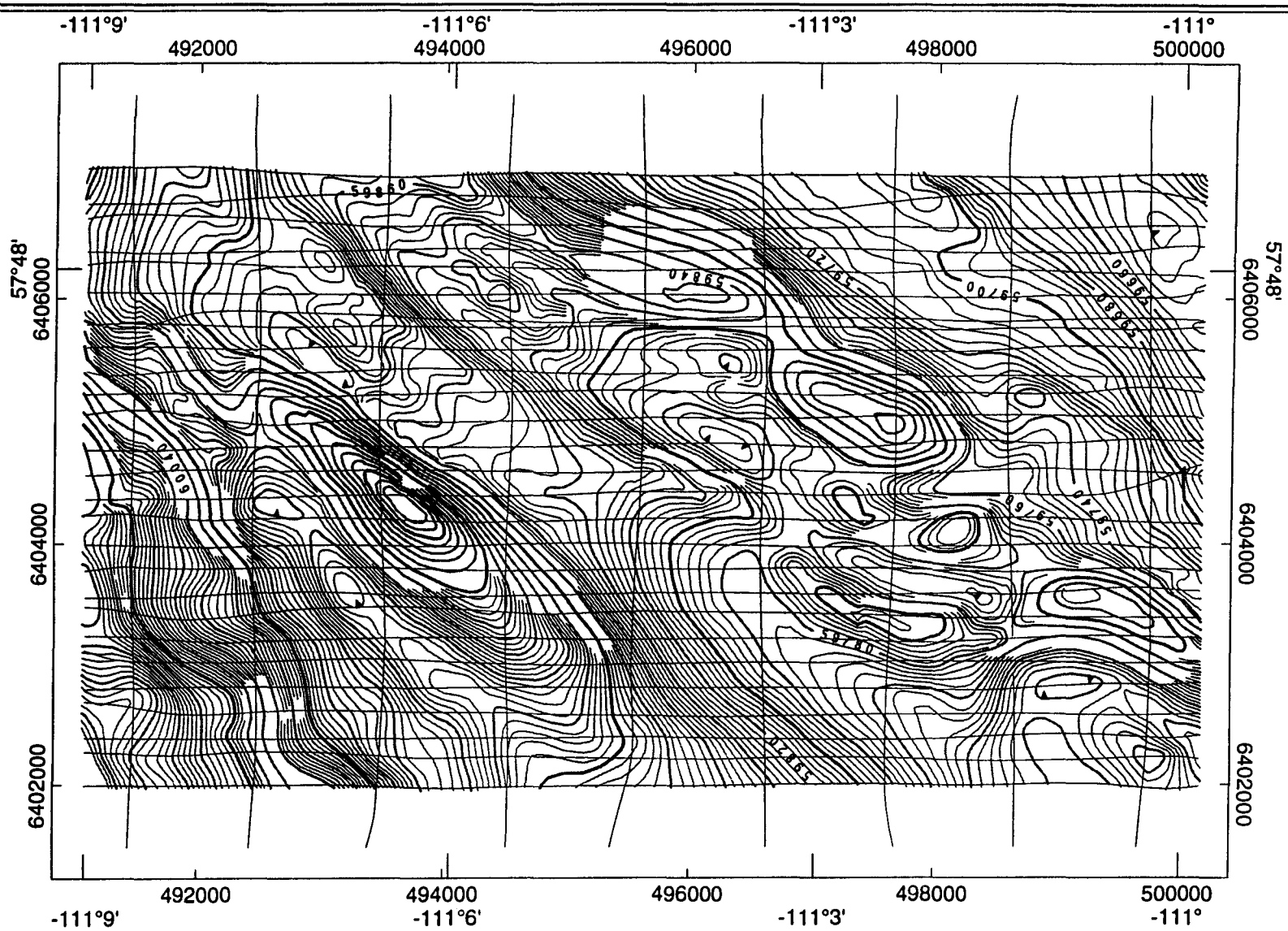
(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey, Phase I** **AREA: 112, Anomaly: 112**
Flight Path Total Field Contours Contour Interval: 10-50-200 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:50000

500 0.0 500 1000 1500

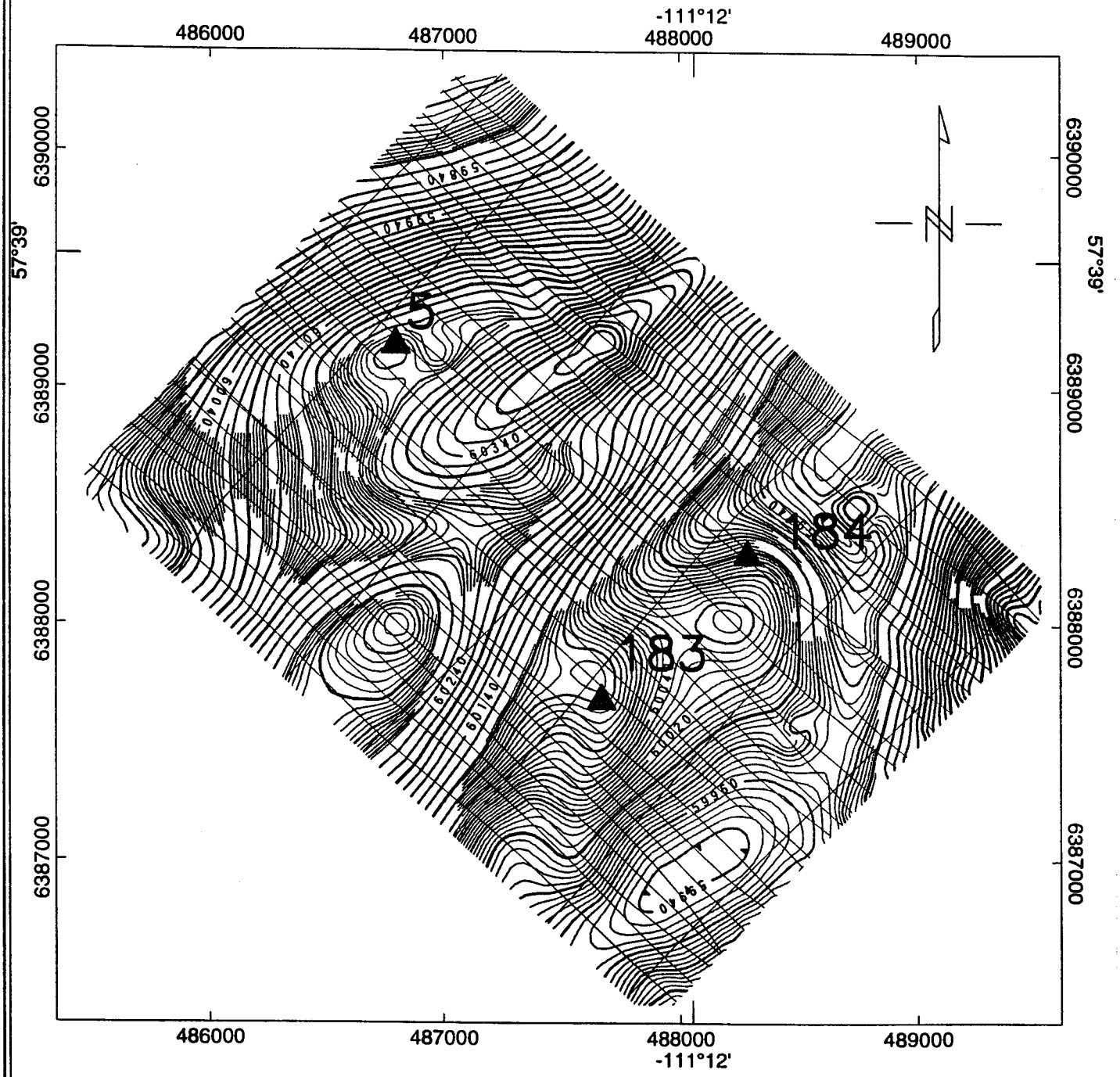
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey, Phase I
AREA: Doberman, Anomaly: From GSC data

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



Scale 1:25000

500 0.0

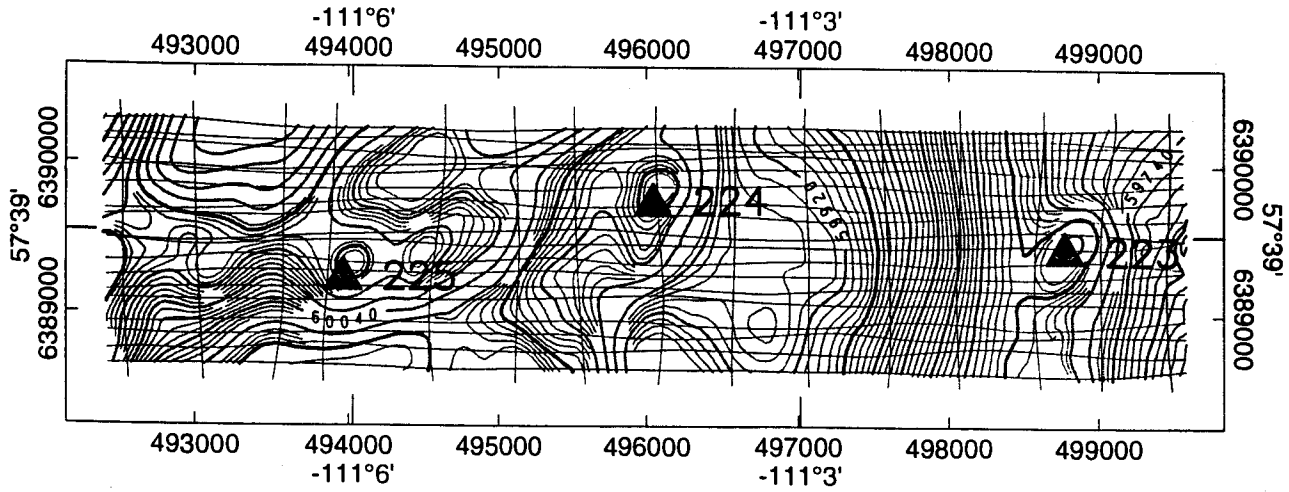
(meters)

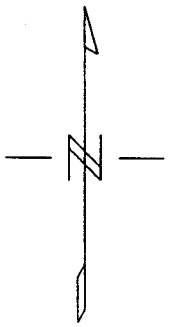
Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 1: anomaly 5, 183, 184

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03





Scale 1:50000

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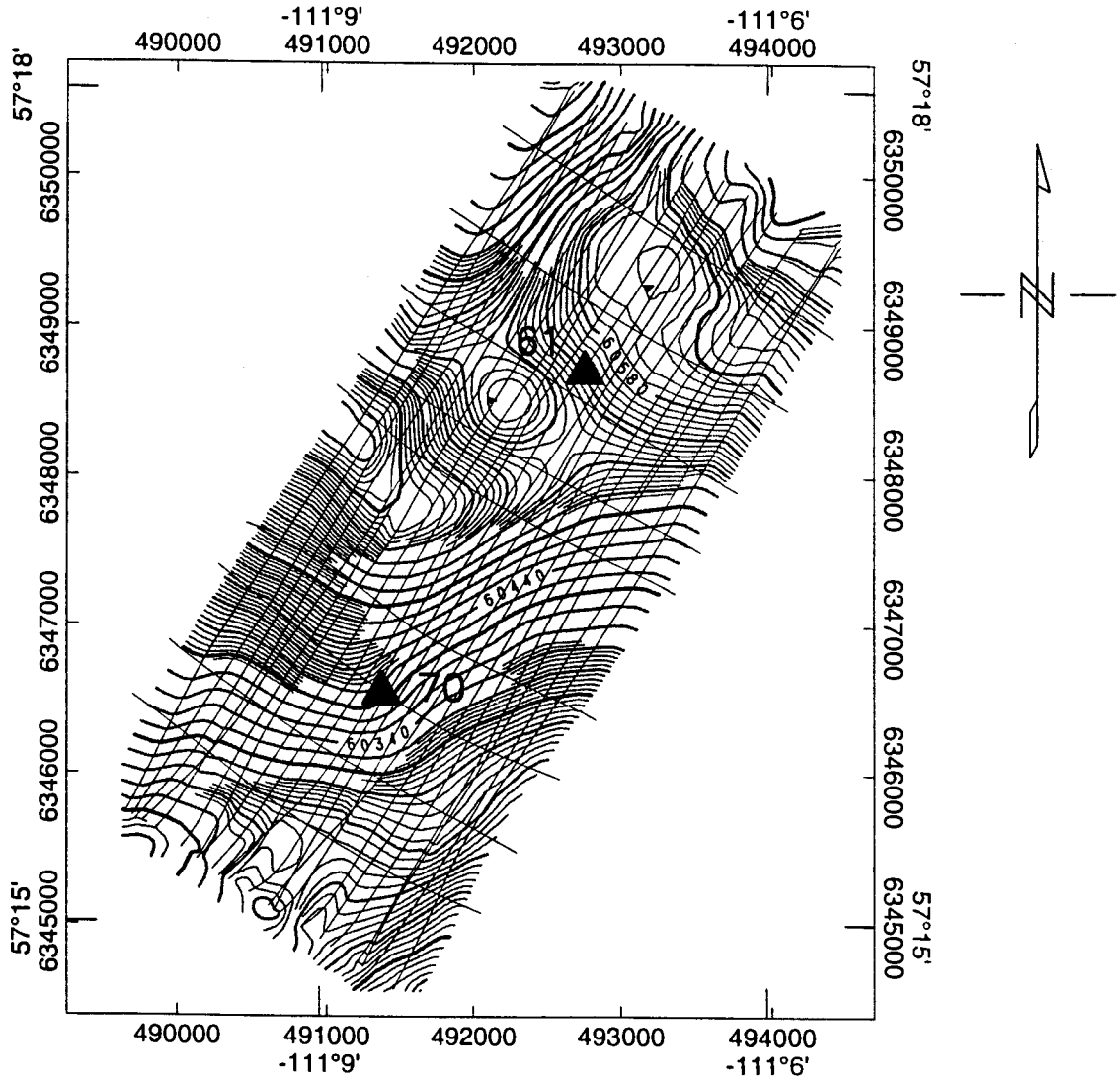
(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 2: anomaly 223, 224, 225**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:50000

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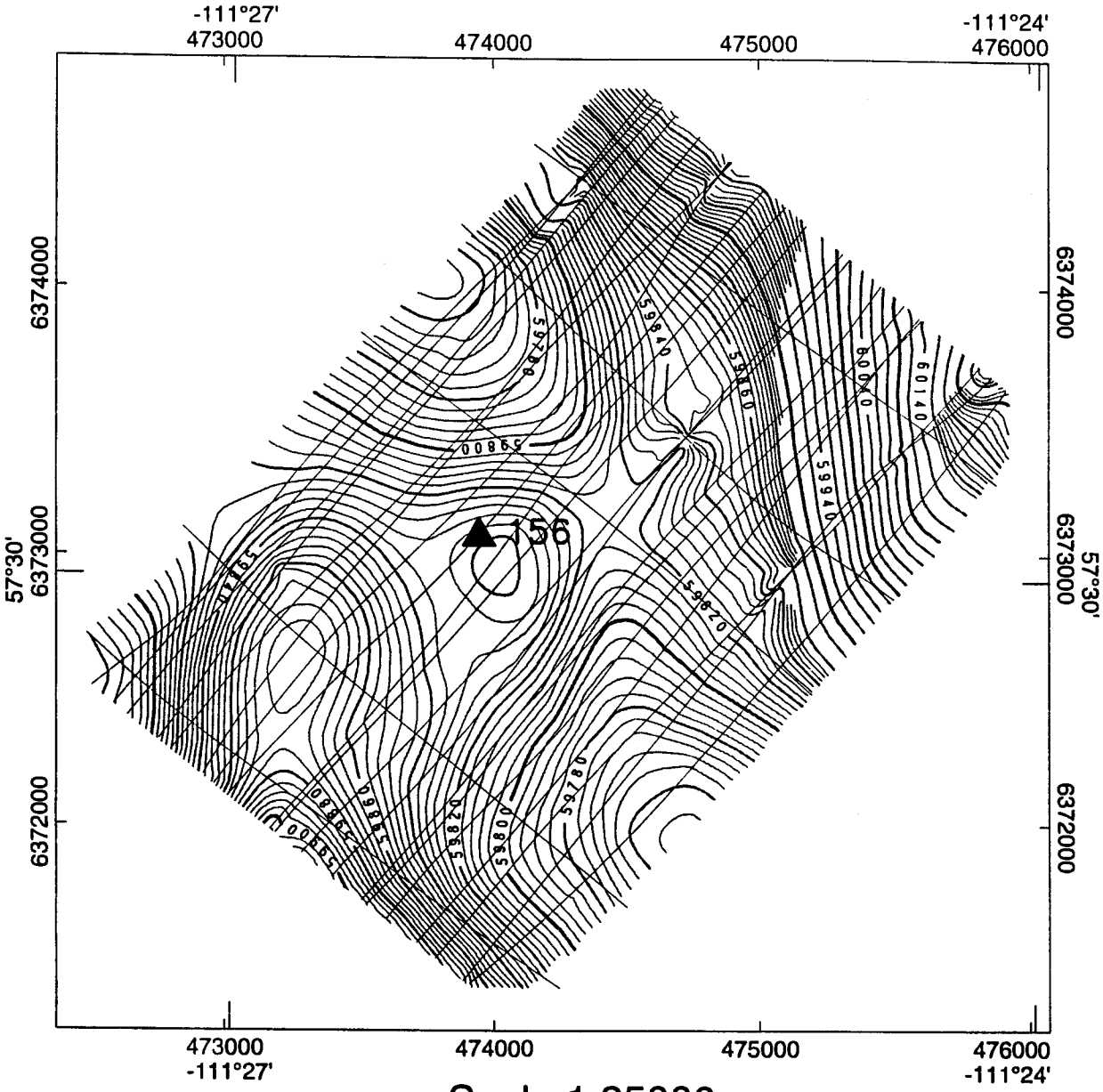
(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 3: anomaly 61, 70**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:25000

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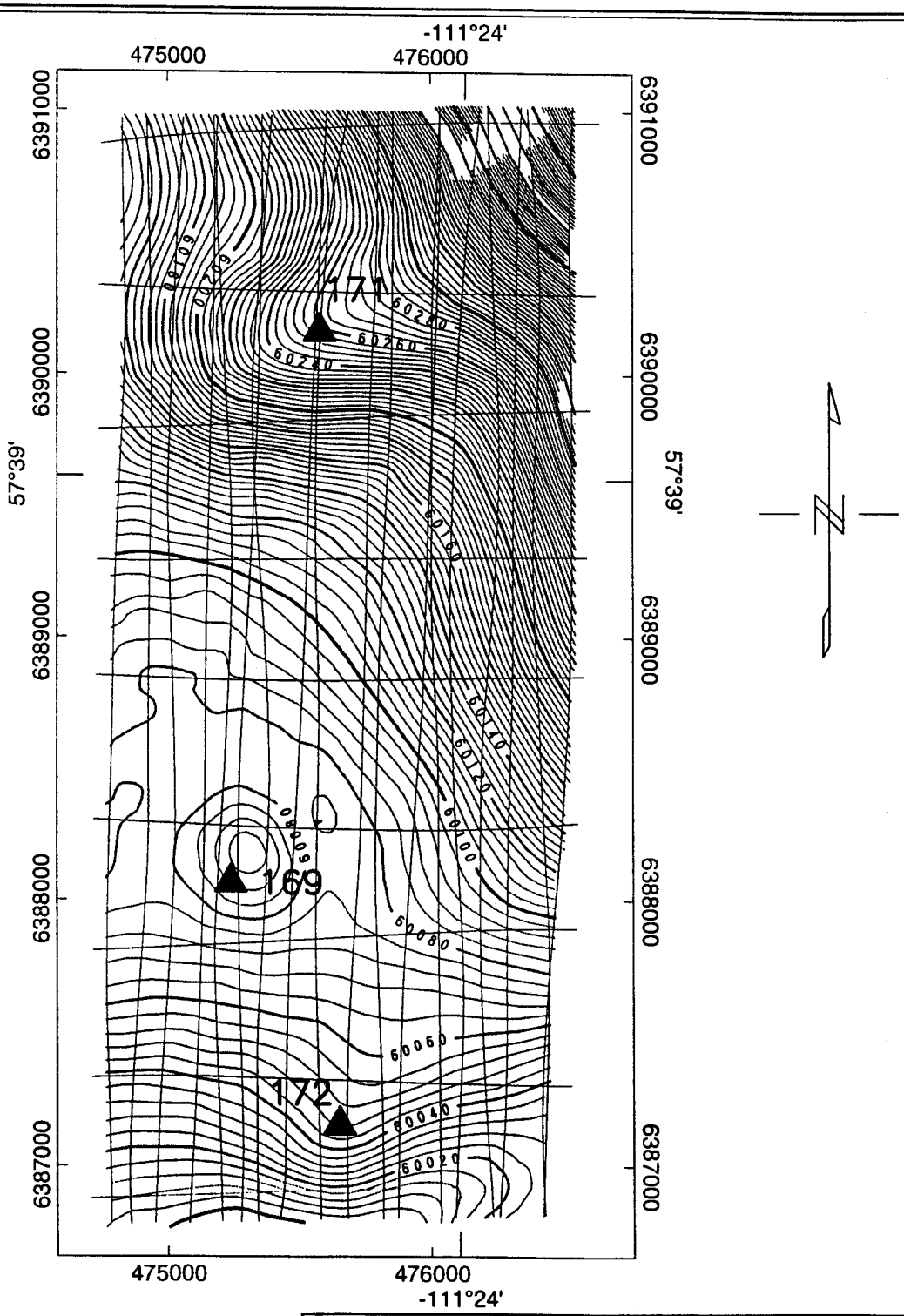
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 4: anomaly 156

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

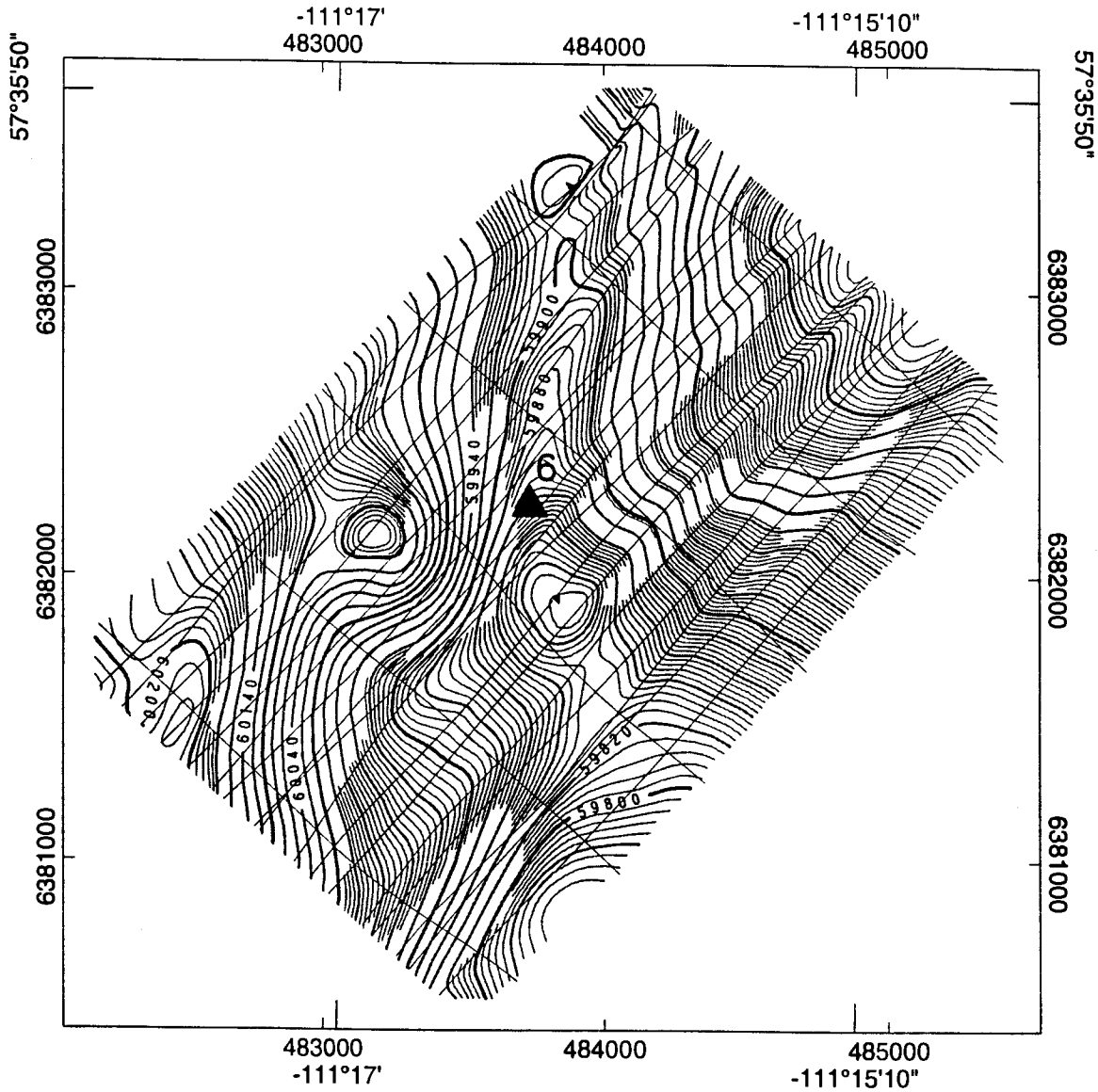


Scale 1:25000

250 0.0 250 500

(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 5: anomaly 169, 171, 172**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:25000

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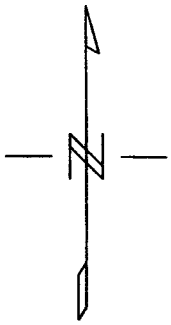
(meters)

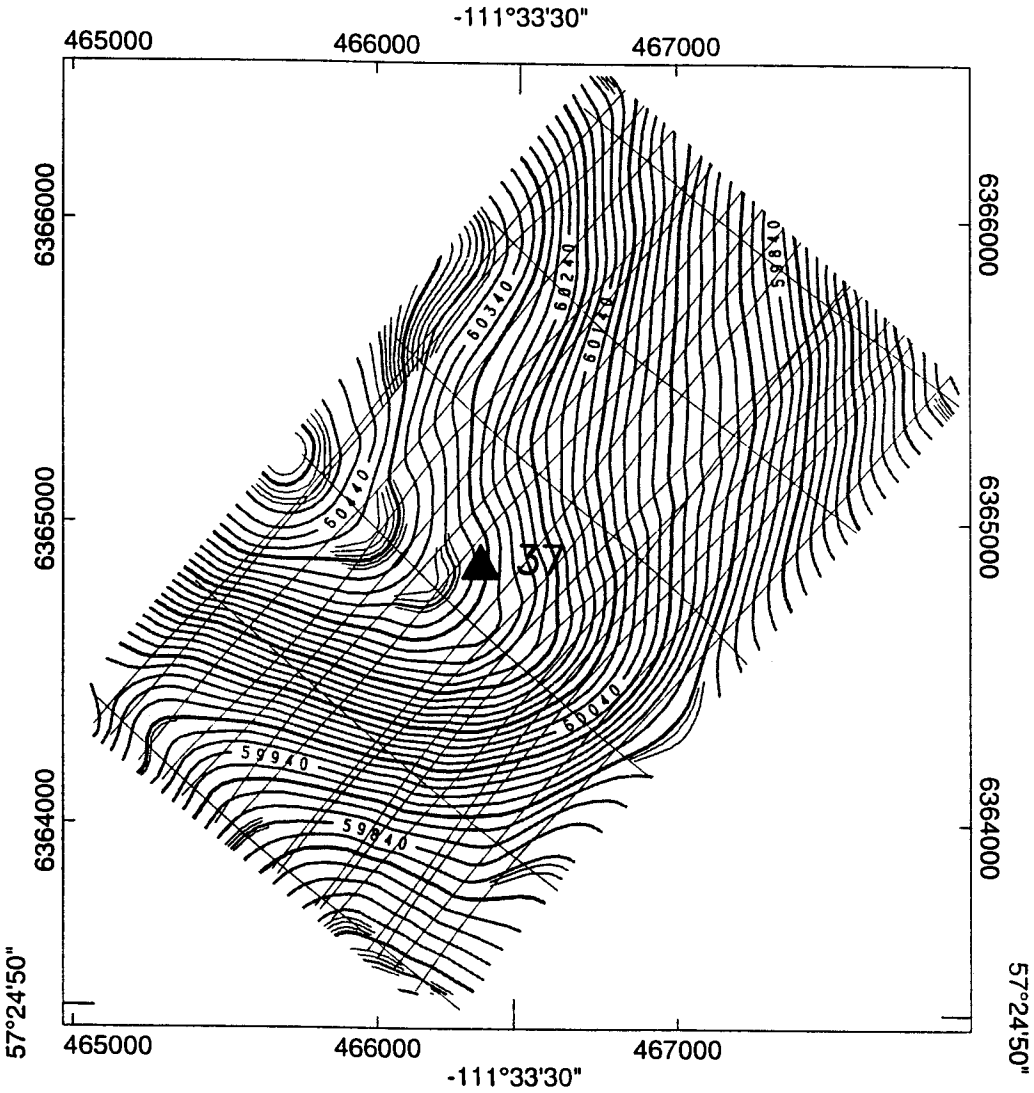


Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 6: anomaly 6

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



Scale 1:25000

250 0.0 250 500

(meters)

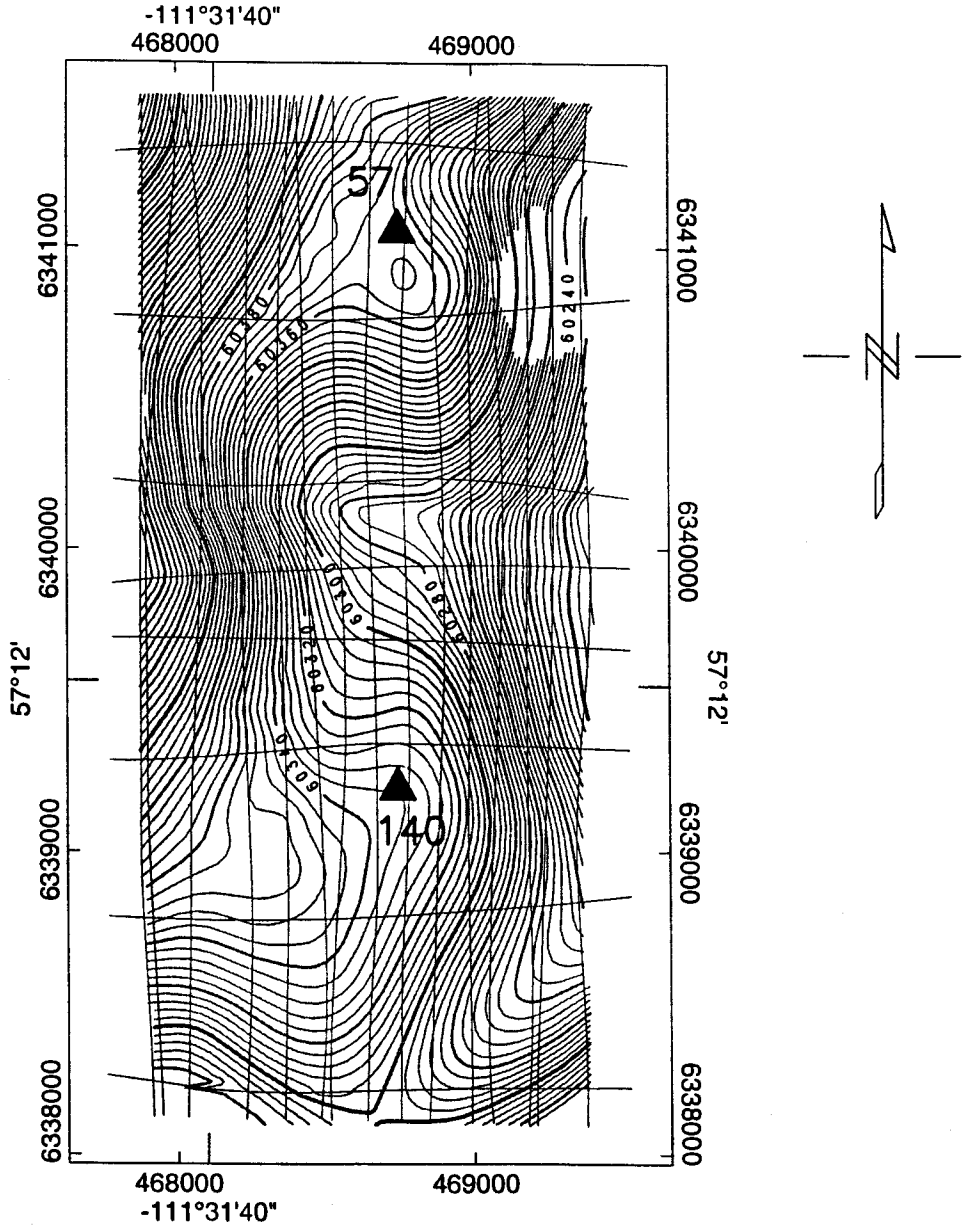
N

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 7: anomaly 37

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



Scale 1:25000

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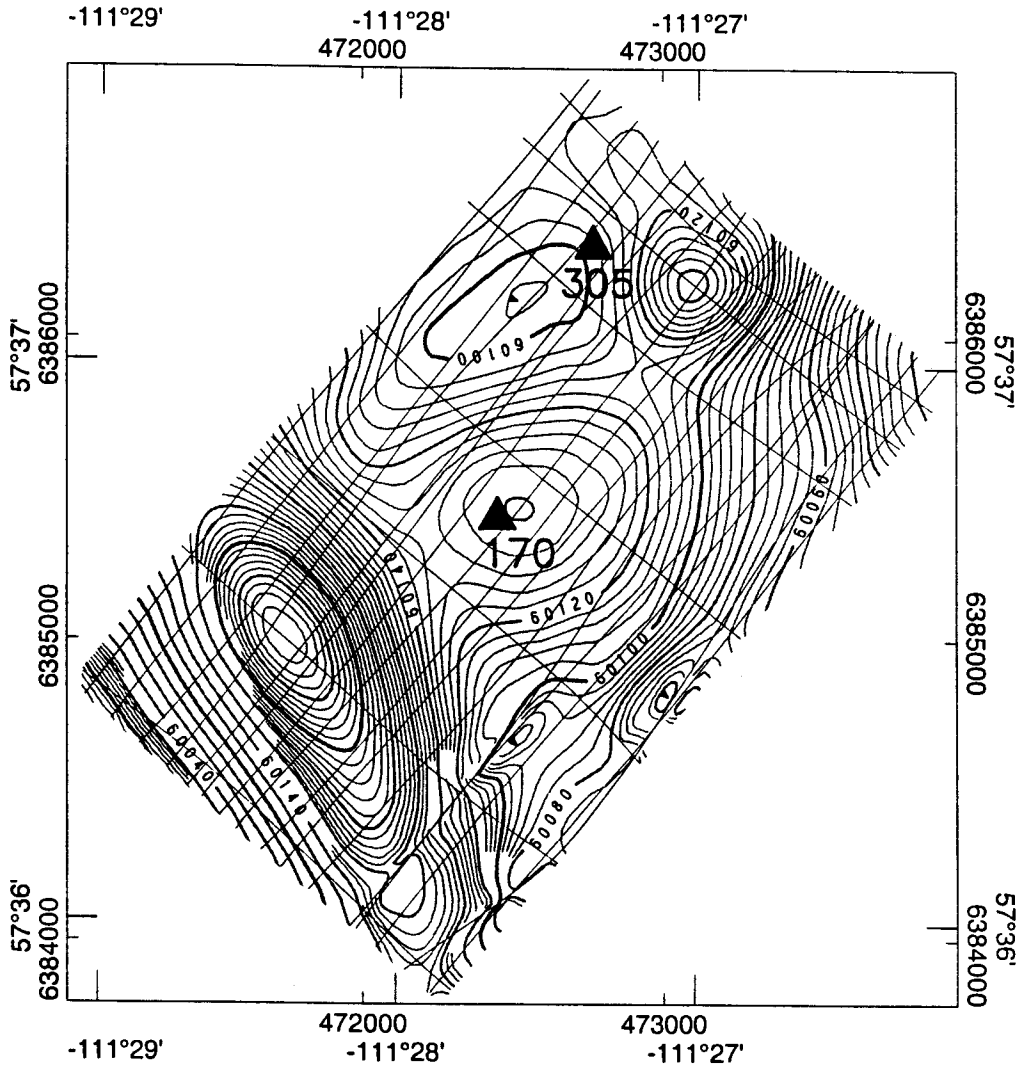
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 8: anomaly 57, 140

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

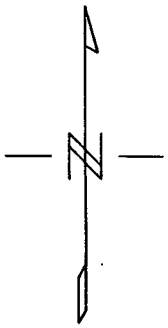
Canagrad Surveys Limited 1998-03



Scale 1:25000

250 0.0 250 500

(meters)

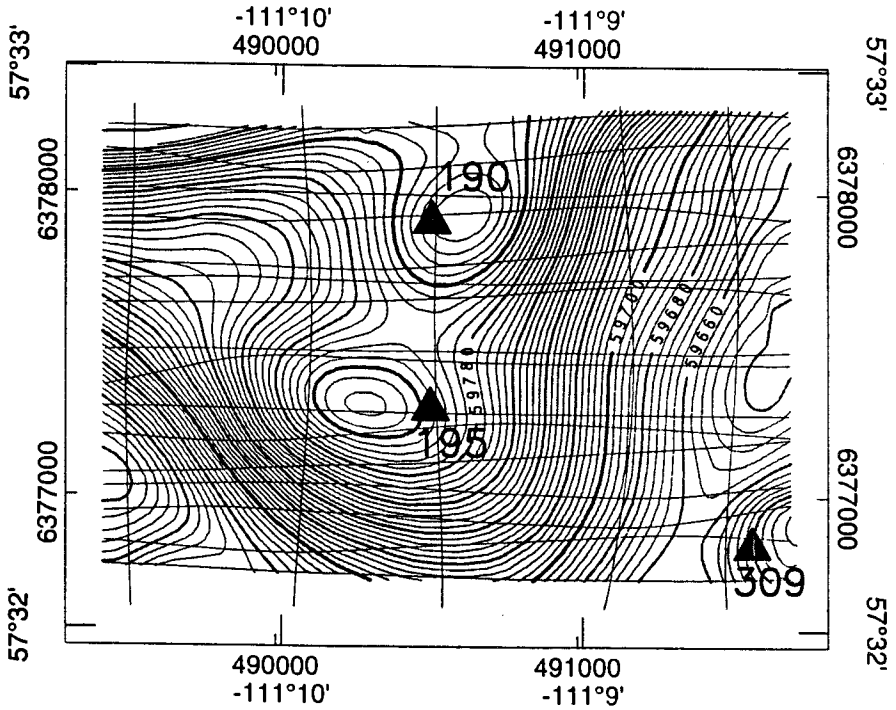


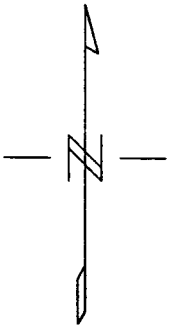
Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 9: anomaly 170, 305

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03



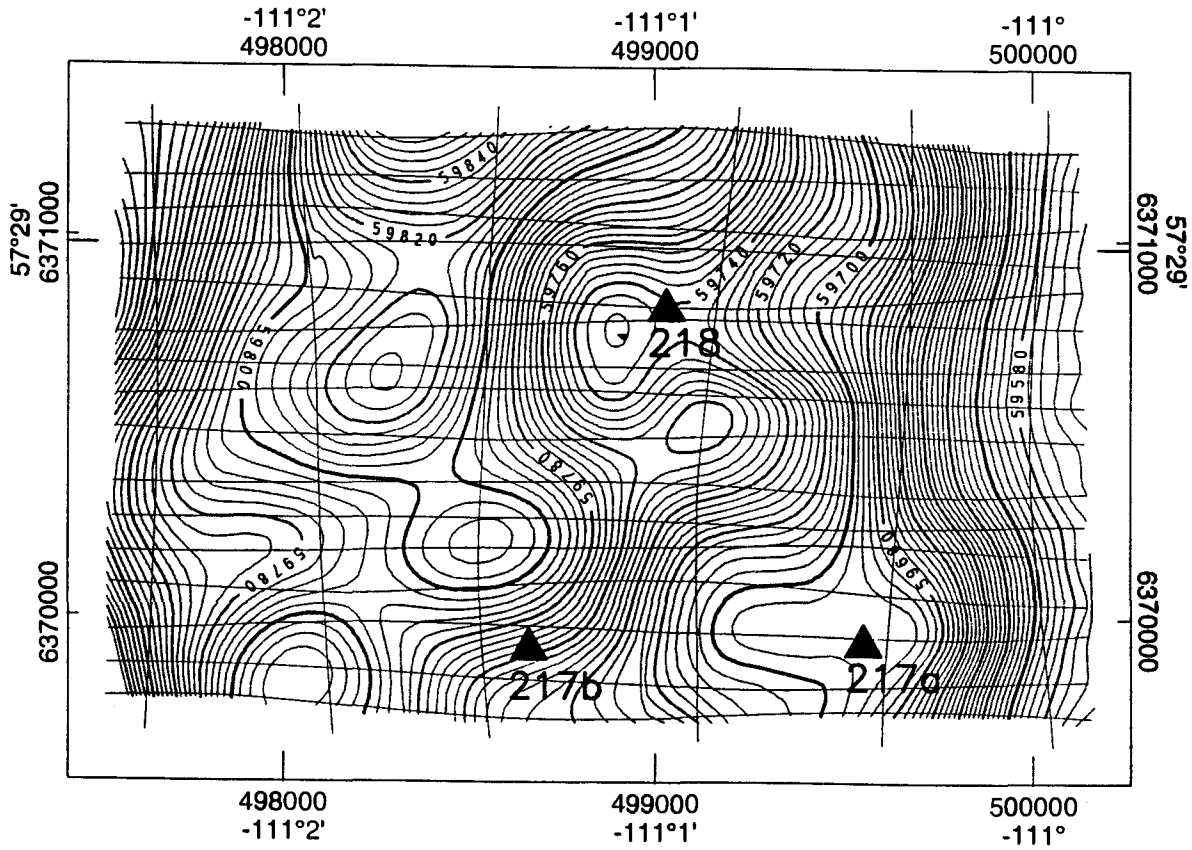


Scale 1:25000

500 0.0

(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 10: anomaly 190, 195, 309**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:20000

250 0.0 250

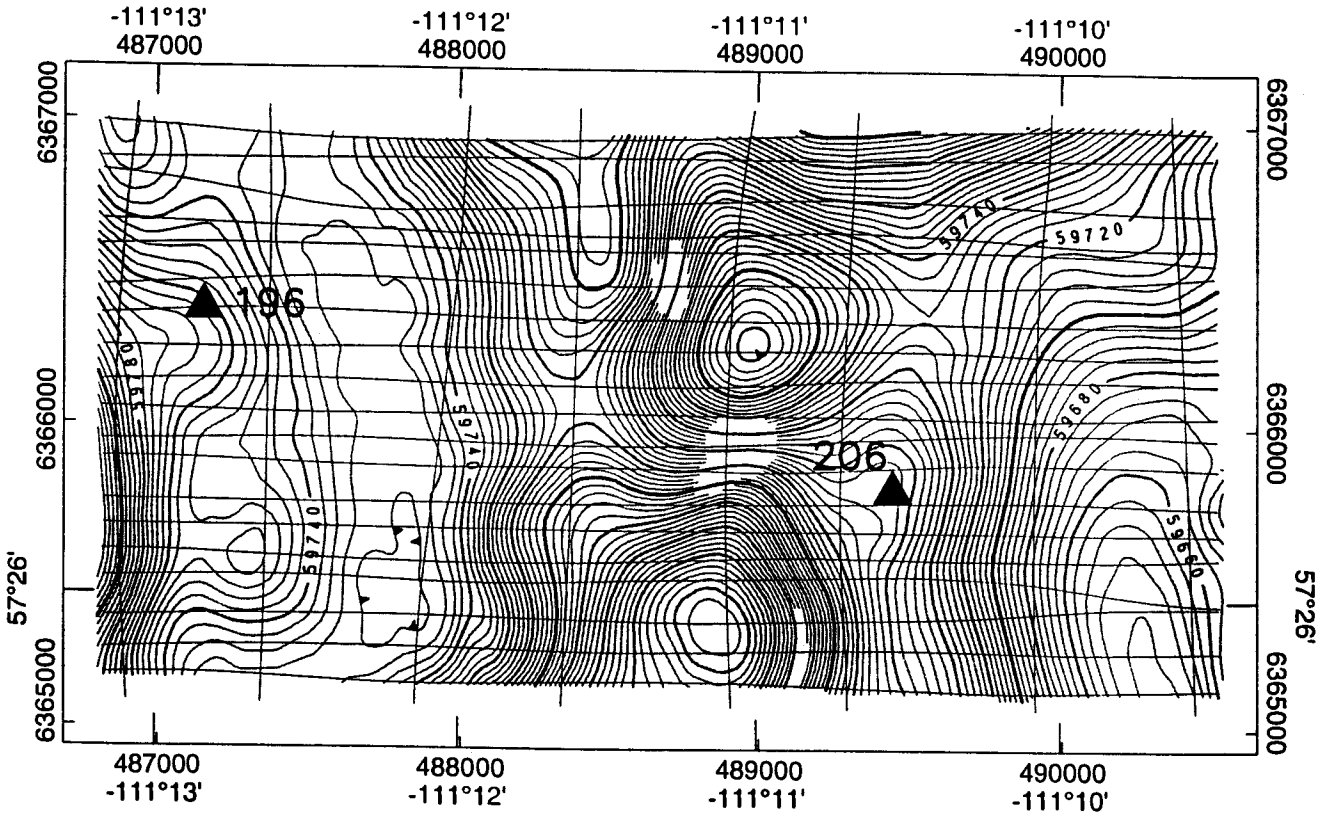
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 11: anomaly 217a, 217b, 218

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

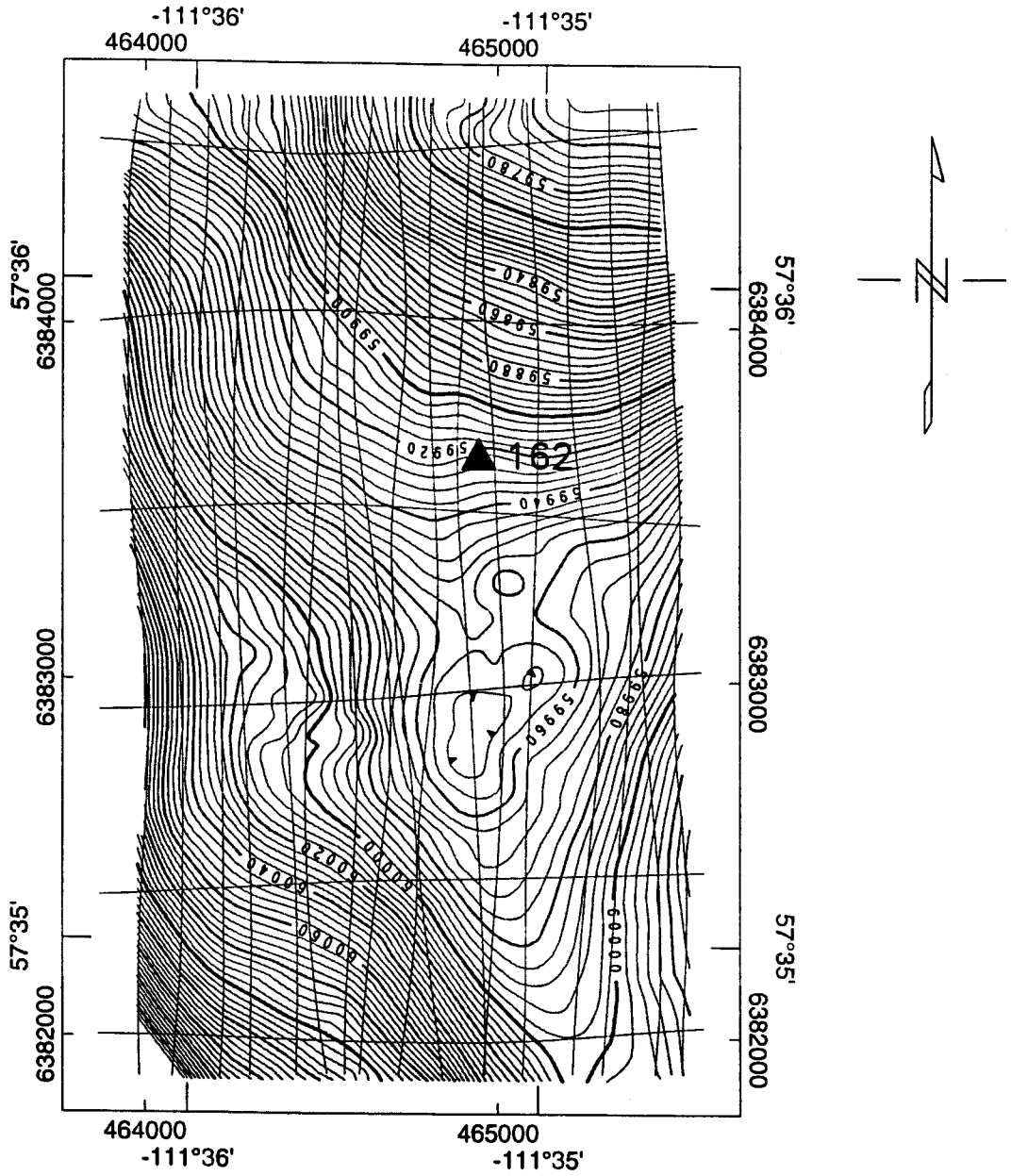


Scale 1:25000

250 0.0 250 500

(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 12: anomaly 196, 206**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:20000

250 0.0 250

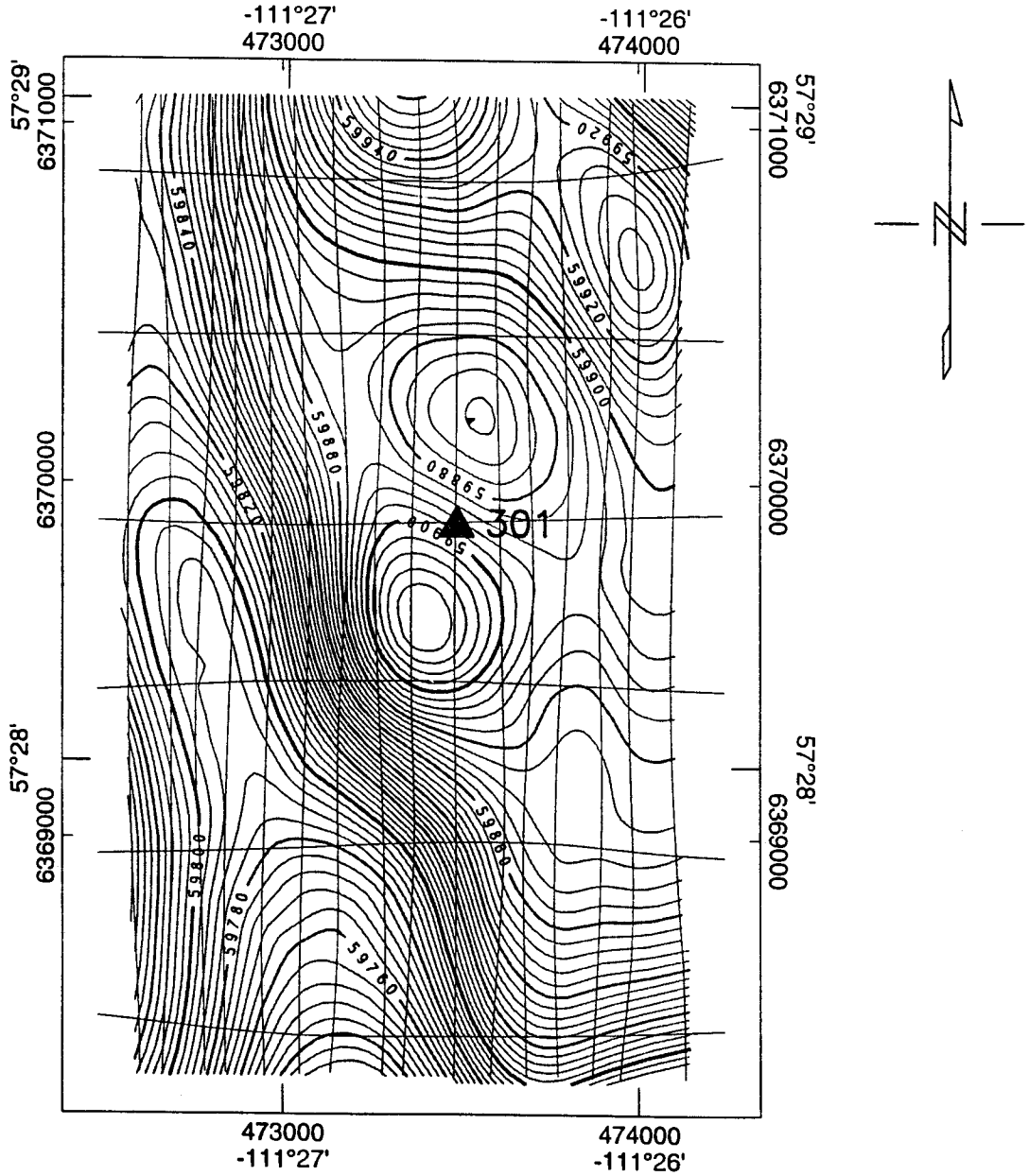
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 13: anomaly 162

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

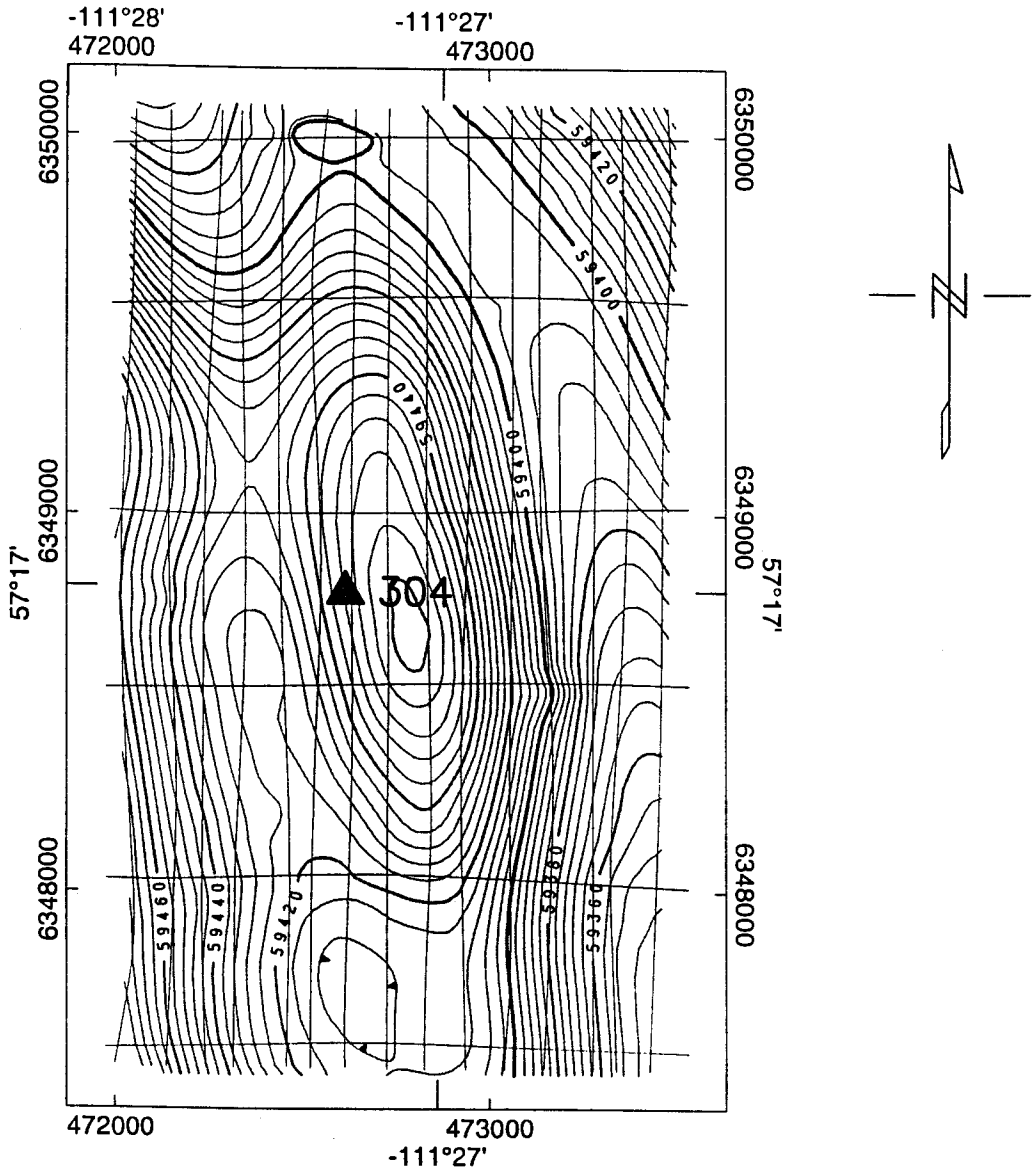


Scale 1:20000

250 0.0 250

(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 301: anomaly 301**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:20000

250 0.0 250

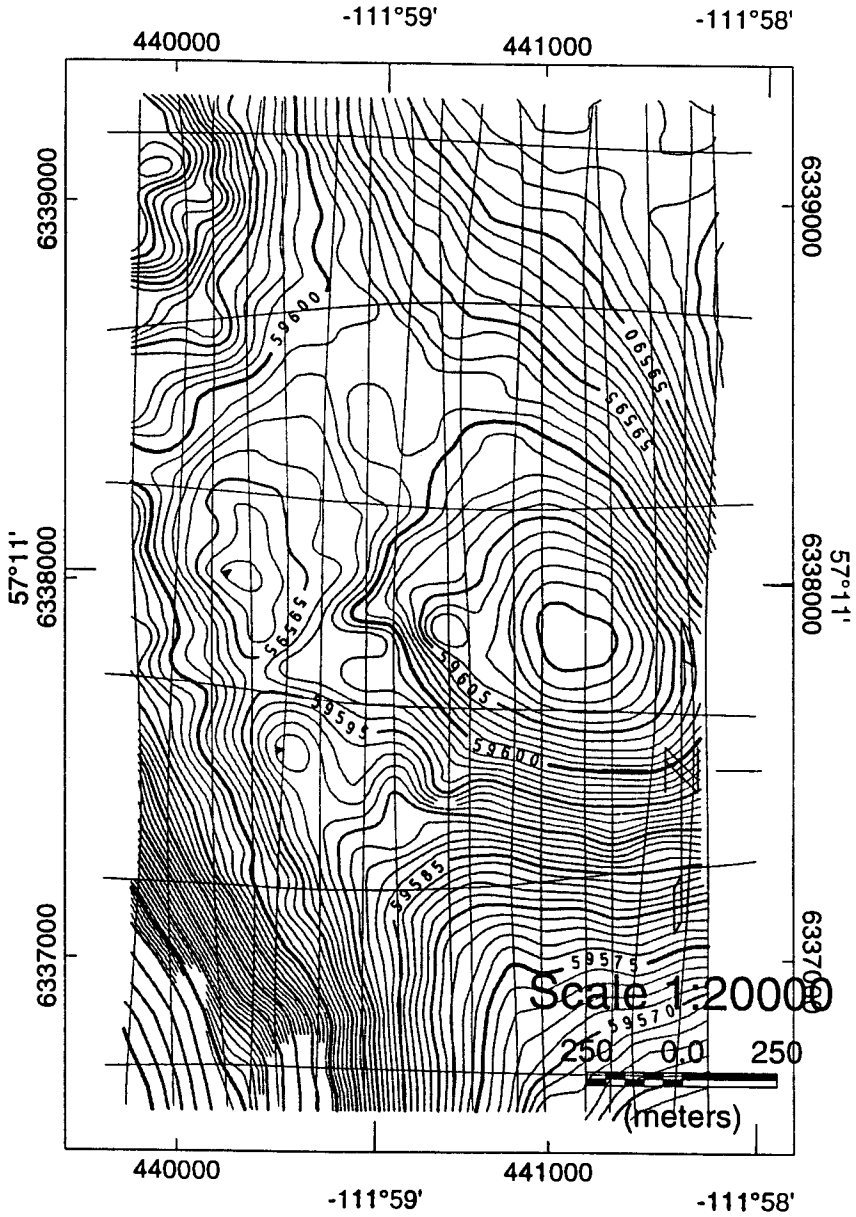
(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 304: anomaly 304

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

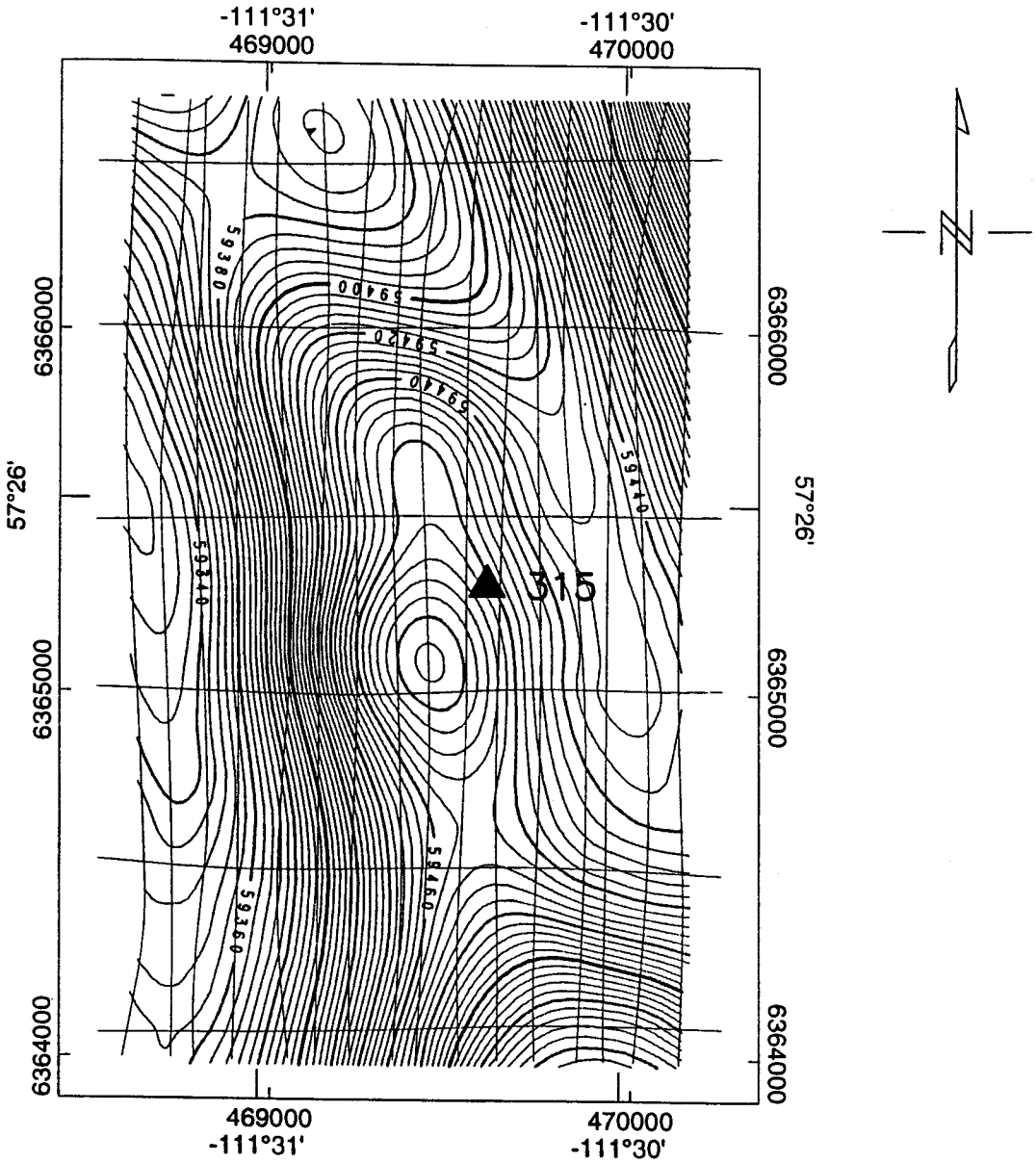


Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 308: anomaly 308

Flight Path
Total Field Contours
Contour Interval: 1-5-25 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

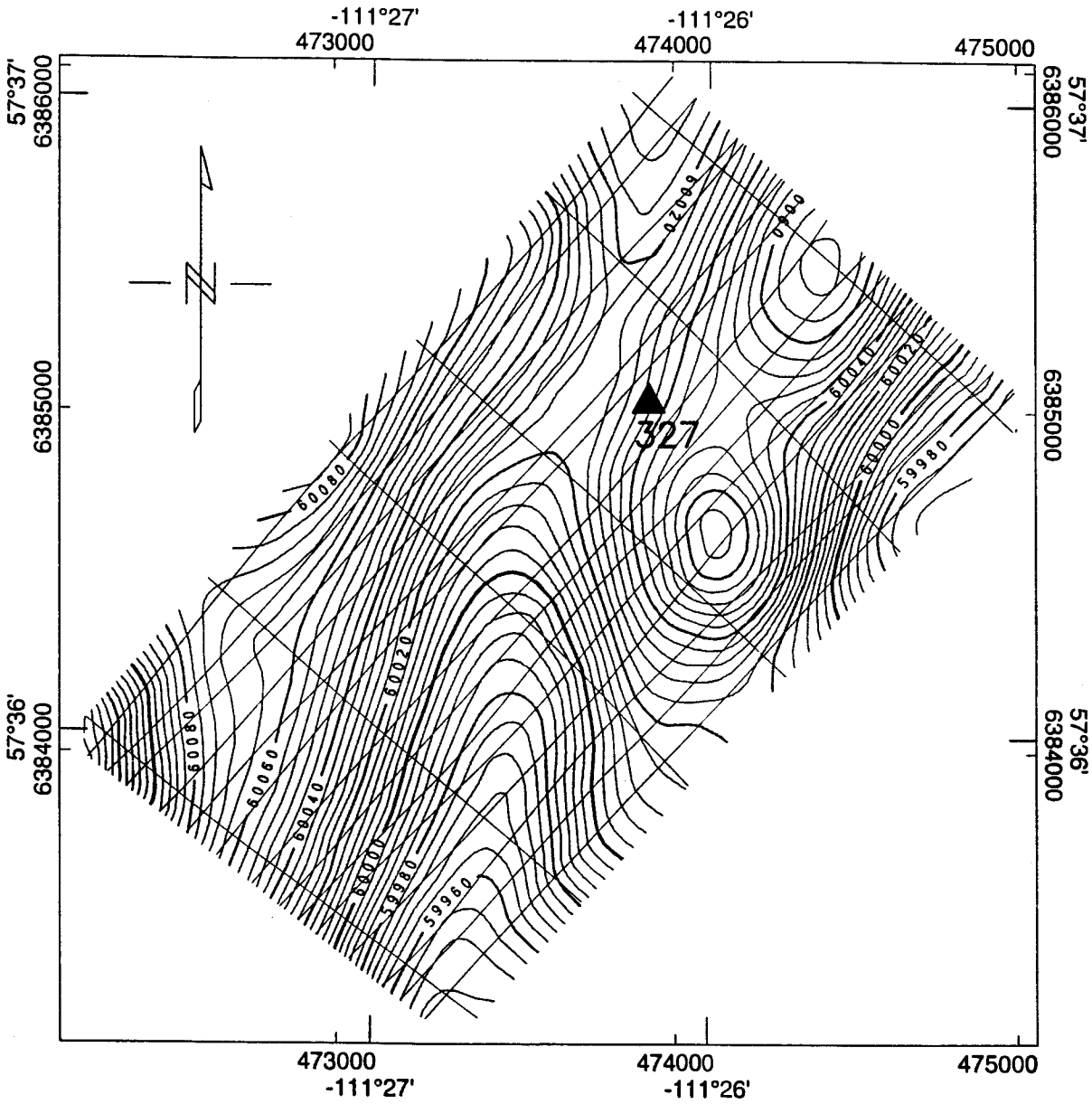


Scale 1:20000

250 0.0 250

(meters)

Lytton / Birch Mountain
Athabaska - Alberta - Diamond Project **Detailed Aeromagnetic Survey** **AREA 315: anomaly 315**
Flight Path Total Field Contours Contour Interval: 4-20-100 nT. Simple tie-line levelling applied
Canagrad Surveys Limited 1998-03



Scale 1:20000

250 0.0 250

(meters)

Lytton / Birch Mountain

Athabaska - Alberta - Diamond Project
Detailed Aeromagnetic Survey
AREA 327: anomaly 327

Flight Path
Total Field Contours
Contour Interval: 4-20-100 nT.
Simple tie-line levelling applied

Canagrad Surveys Limited 1998-03

Appendix E.2. Data Reduction Phase 1 & 2,

Low Level Aeromagnetic Survey

Komex International

Suite 100, 4500 - 16th Avenue N.W.
Calgary, Alberta, Canada T3B 0M6
Telephone: (403) 247-0200
Fax: (403) 247-4811 or 247-0779
e-mail: komex@komex.com
web: www.komex.com

KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

CANADA'S 50 BEST MANAGED PRIVATE COMPANIES

June 1st, 1998

OUR FILE: KI98-4762A

Birch Mountain Resources Ltd.
3100, 205 Fifth Avenue S. W.
Calgary, Alberta
T2P 2V7

Attention: Hugh Abercrombie

Dear Hugh:

Re: ***Airborne Data, maps and profiles***

Please find enclosed the profiles you requested. There are two profiles for each anomaly, the locations of which can be found by reference to the included maps. You will notice that most of the profiles are taken over second order residual anomalies. The exception to this occurs where a first or third order residual has given a better indication of the geometry and extent of an anomaly. Please also note that some areas have not been windowed if they contain only one, obvious anomaly.

In general the processing steps were as follows:

- production of Total Magnetic Intensity (TMI) maps.
- anomalies located from given coordinates.
- area centered around each anomaly was "windowed" to isolate data to approximately 500 m in any direction from the center of the area.
- regional trends were removed from the windowed areas to produce residual anomalies.
- profiles were extracted over these anomalies in a general WE and SN direction.

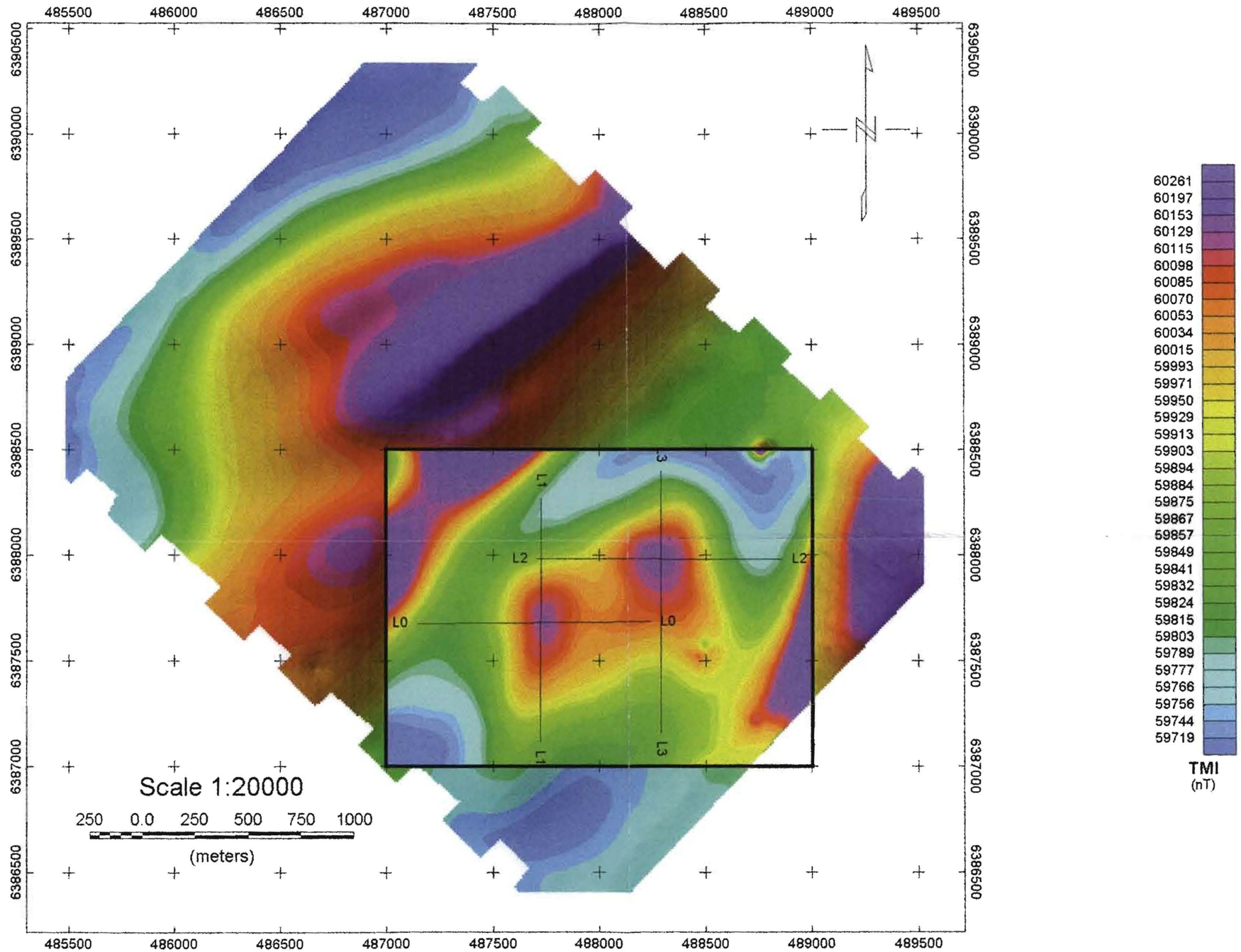
Athabasca Diamond Exploration Q1/98

Section 6.2 Maps

Map	Scale	Anomalies
Area 1	1:20,000	183, 184
Area 2	1:25,000	223, 224, 225
Area 3	1:25,000	61, 70
Area 4	1:15,000	156
Area 5	1:15,000	169, 171, 172
Area 6	1:15,000	6
Area 7	1:15,000	37
Area 8	1:15,000	57,140
Area 9	1:15,000	170, 305
Area 10	1:8,000	190, 195
Area 11	1:15,000	217a, 217b, 218
Area 12	1:15,000	196, 206
Area 13	1:15,000	162
Area 301	1:15,000	301
Area 304	1:20,000	304
Area 308	1:20,000	308
Area 315	1:20,000	315
Area 327	1:20,000	327

Maps prepared by Komex Canada from data flown by Canagrad Surveys.

Originals sent to S. Lopatka, Lytton Minerals
98.07.06.



Airborne Data: 10 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 45 m
Flight line orientation SE-NW
Tie line orientation SW-NE

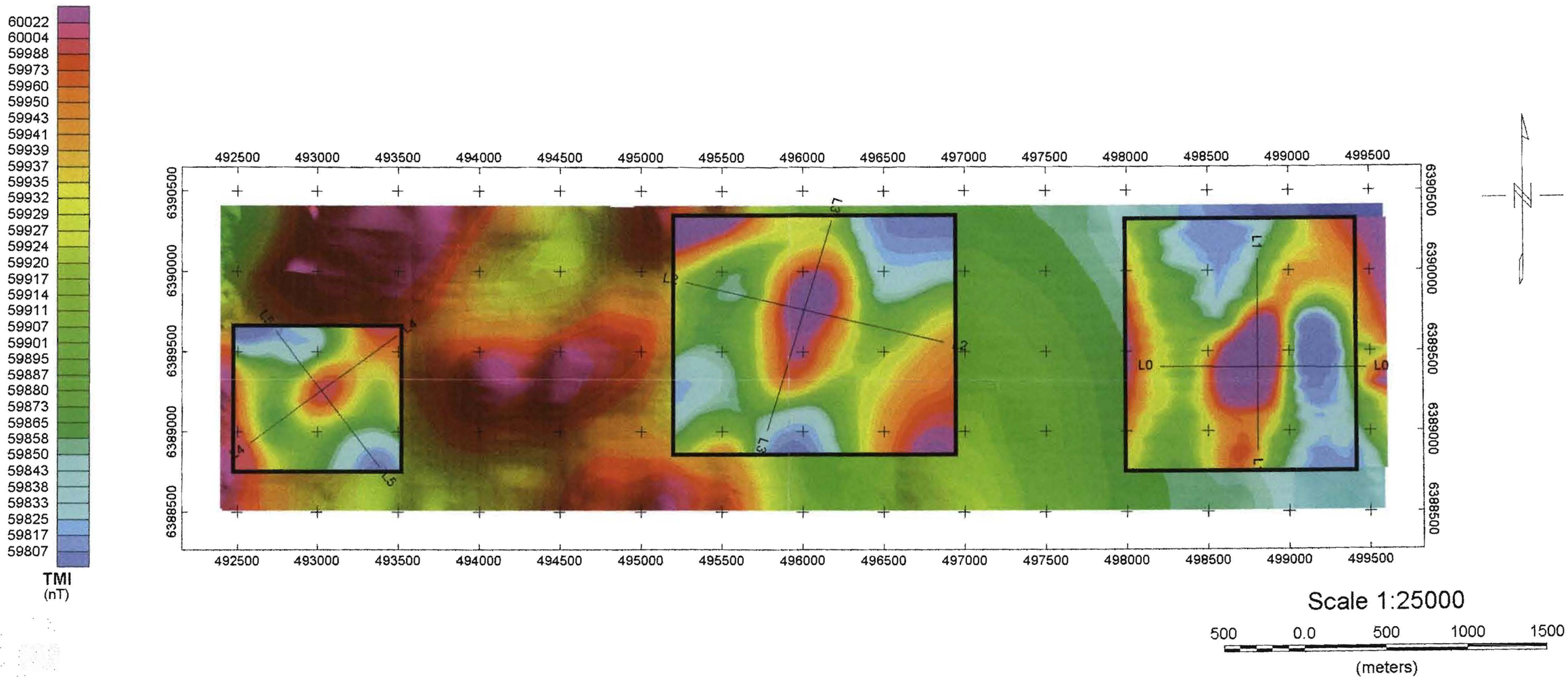
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 315

BIRCH MOUNTAIN RESOURCES LTD.

Area 1: Total Magnetic Intensity

Inset area shows profile lines over 2nd order residual anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A



Airborne Data: 13 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation NE-SW
Tie line orientation NW-SE

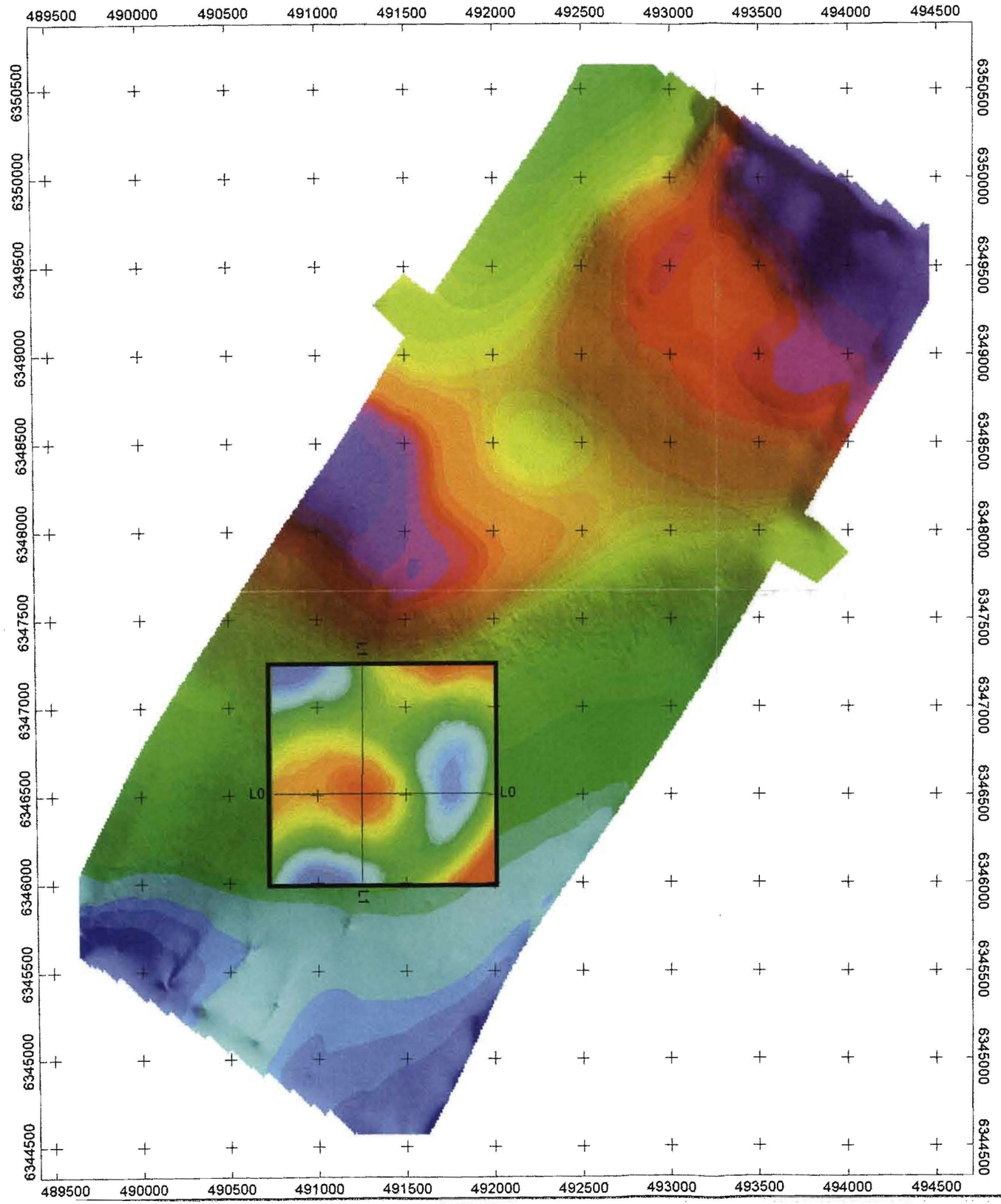
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

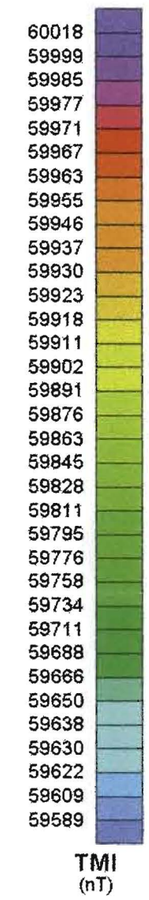
BIRCH MOUNTAIN RESOURCES LTD.

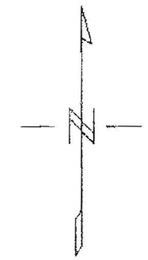
Area 2: Total Magnetic Intensity

Inset areas show profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A







Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

Airborne Data: Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation SW-NE
Tie line orientation SE-NW

Scale 1:25000

500 0.0 500 1000 1500

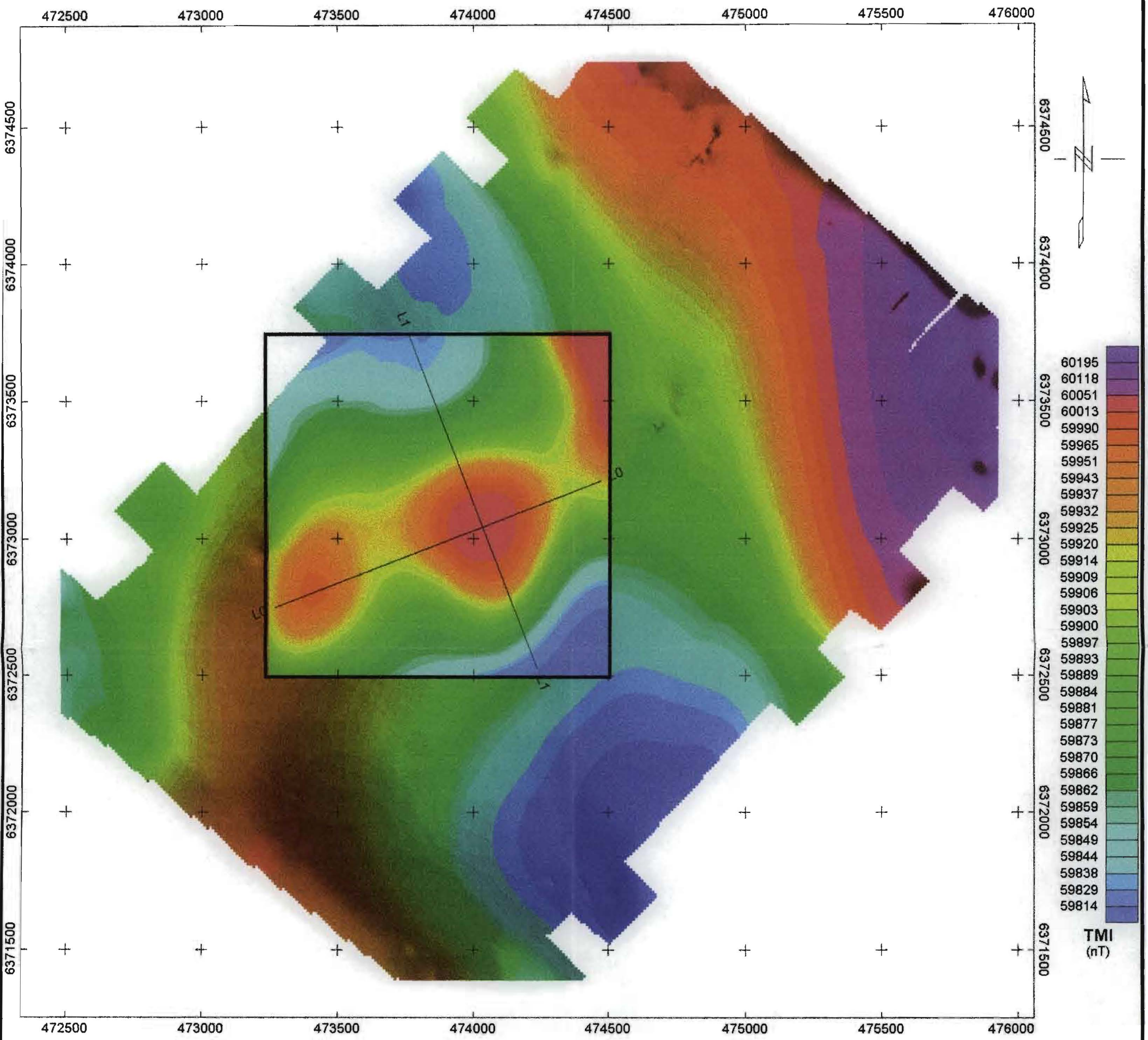
(meters)

BIRCH MOUNTAIN RESOURCES LTD.

Area 3 Total Magnetic Intensity

Inset areas show profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A

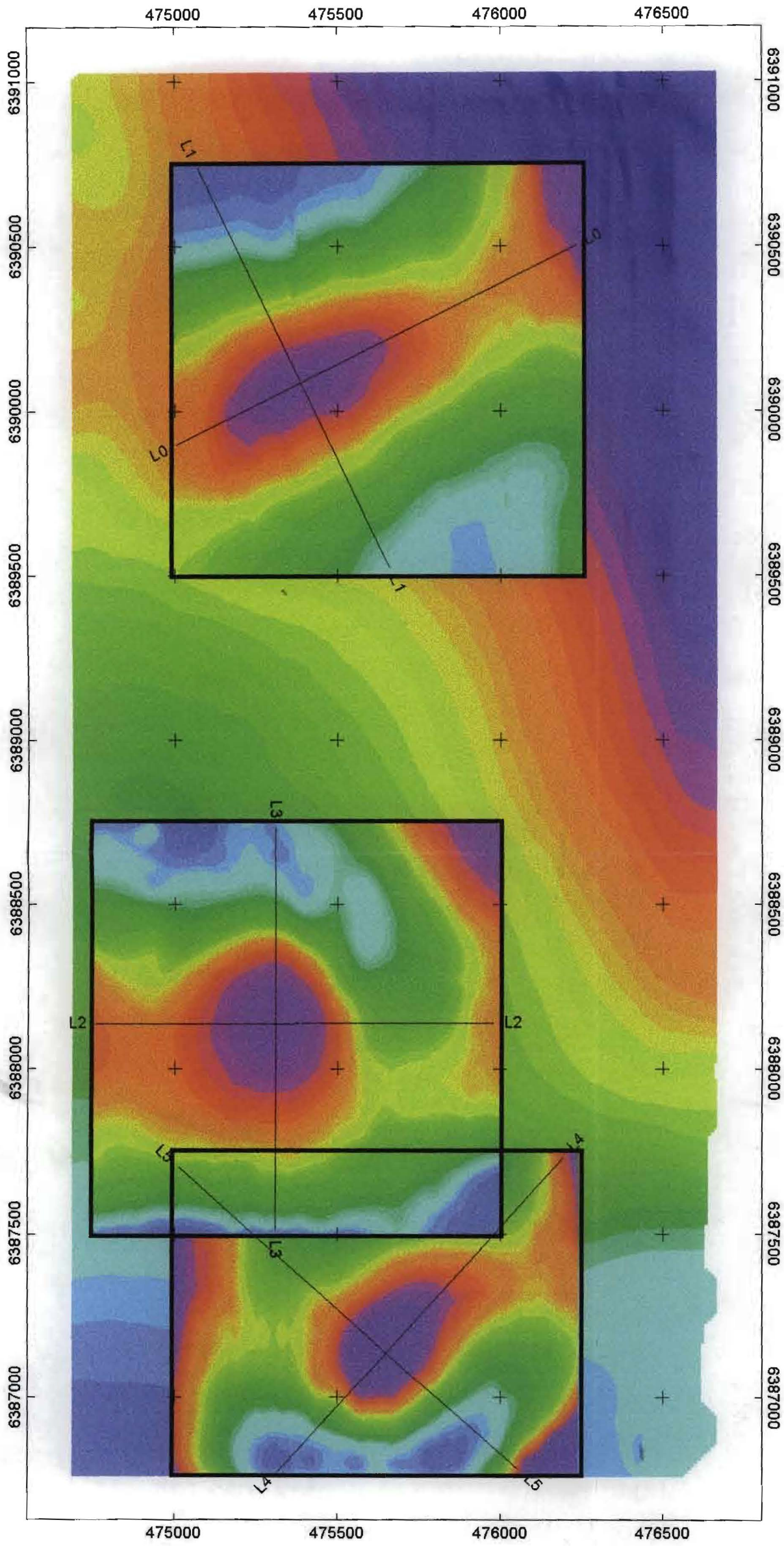


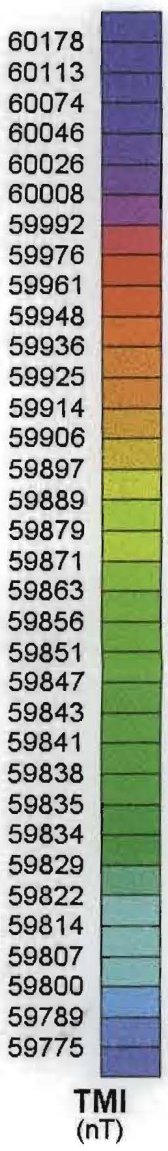
Scale 1:15000

250 0.0 250 500 750

(meters)

Airborne Data: 11 Mar 98	Statistical Levelling of tielines	BIRCH MOUNTAIN RESOURCES LTD.
Line spacing: 100 m	Full levelling of survey lines	**Area 4: Total Magnetic Intensity**
Station spacing: 5 m	Reduction to IGRF	**Inset Shows profile lines centered over 2nd Order Residual Anomaly**
Elevation: 60 m	Shaded relief	Fort MacKay Area
Flight line orientation NE-SW	Inclination 45	Map Projection: UTM, Zone 12, NAD27
Tie line orientation NW-SE	Azimuth 225	KOMEX INTERNATIONAL LTD. KI98-4762A





Scale 1:15000

250 0.0 250 500

(meters)

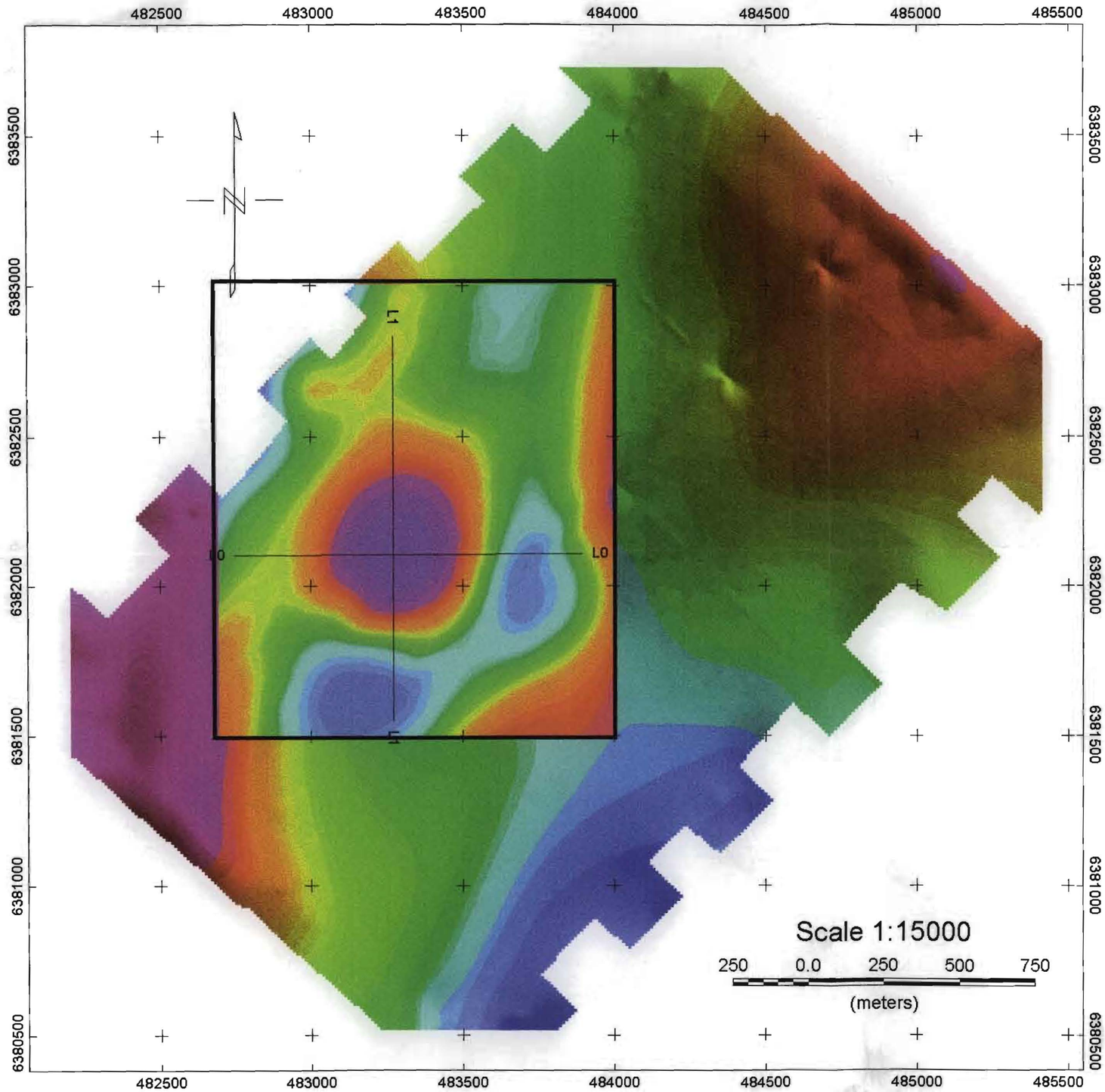
Airborne Data: 13 Mar 98	Statistical Levelling of tielines
Line spacing: 100 m	Full levelling of survey lines
Station spacing: 5 m	Reduction to IGRF
Elevation: 50 m	Shaded relief
Flight line orientation N-S	Inclination 30
Tie line orientation E-W	Azimuth 00

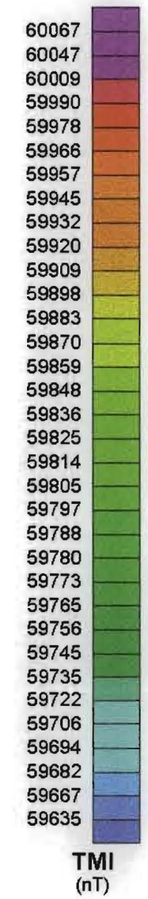
BIRCH MOUNTAIN RESOURCES LTD.

Area 5: Total Magnetic Intensity

Inset areas show profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A





Airborne Data: 13 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation NE-SW
Tie line orientation NW-SE

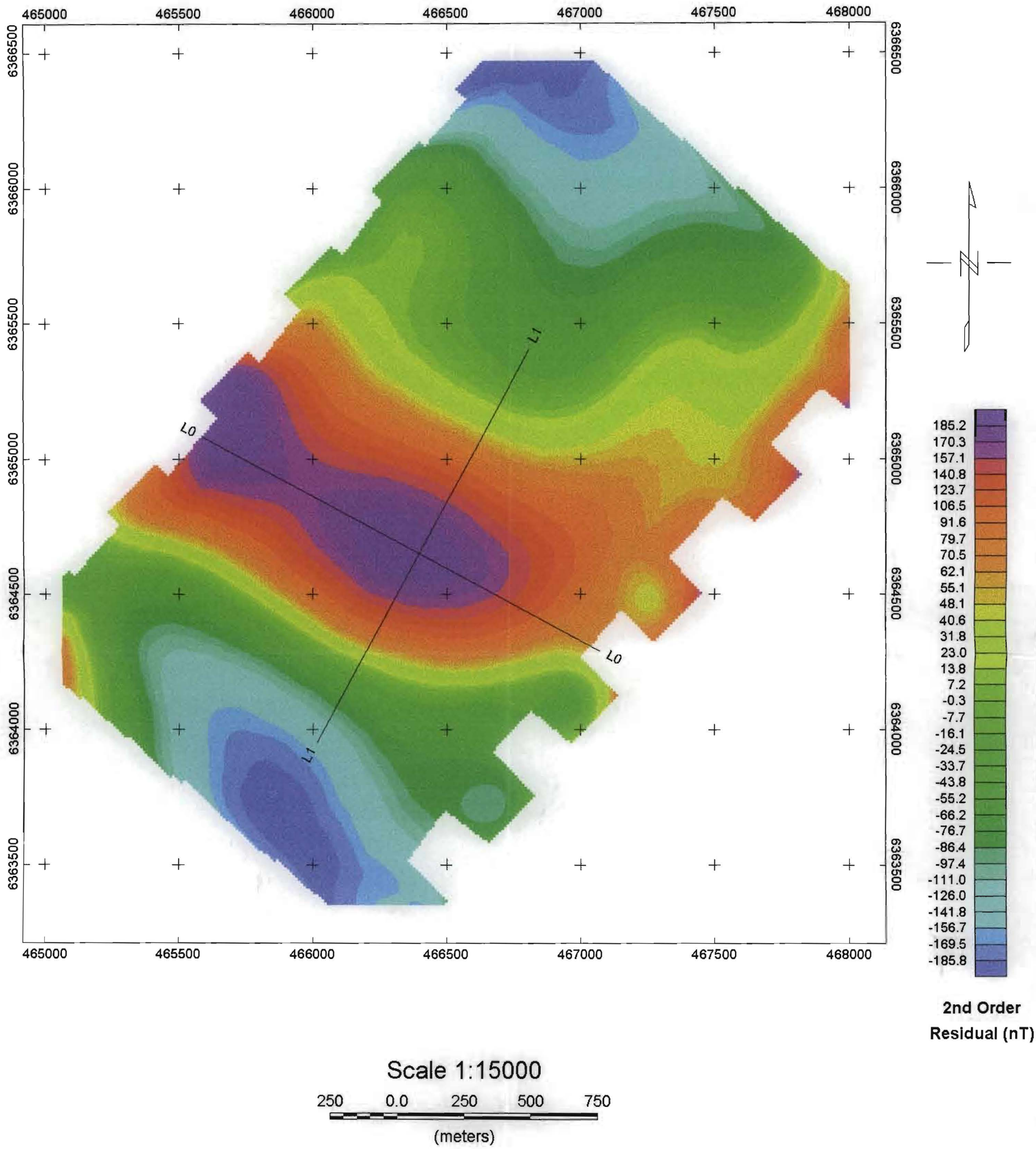
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

BIRCH MOUNTAIN RESOURCES LTD.

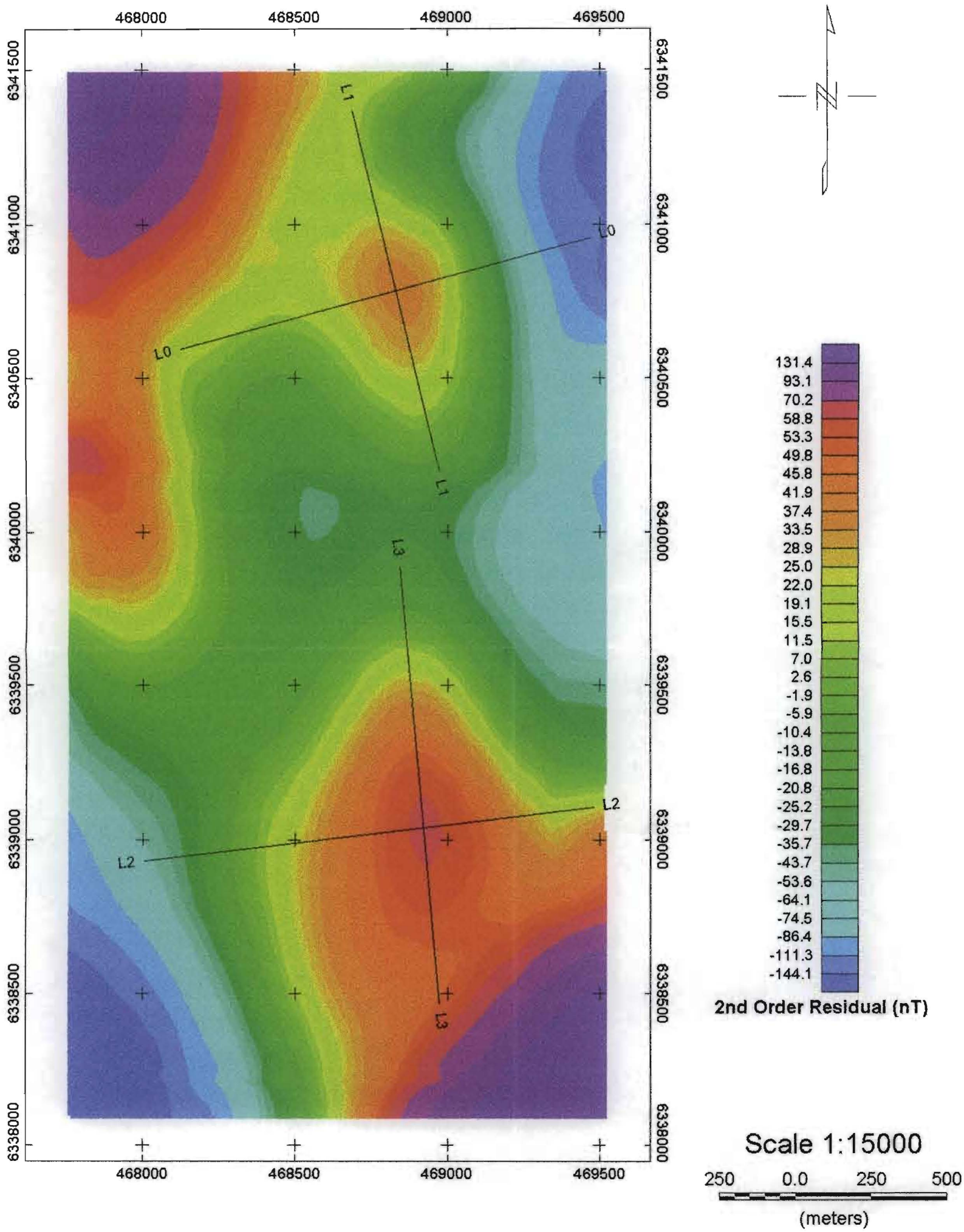
Area 6: Total Magnetic Intensity

Inset shows profile lines centered over 2nd Order Residual Anomaly

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A



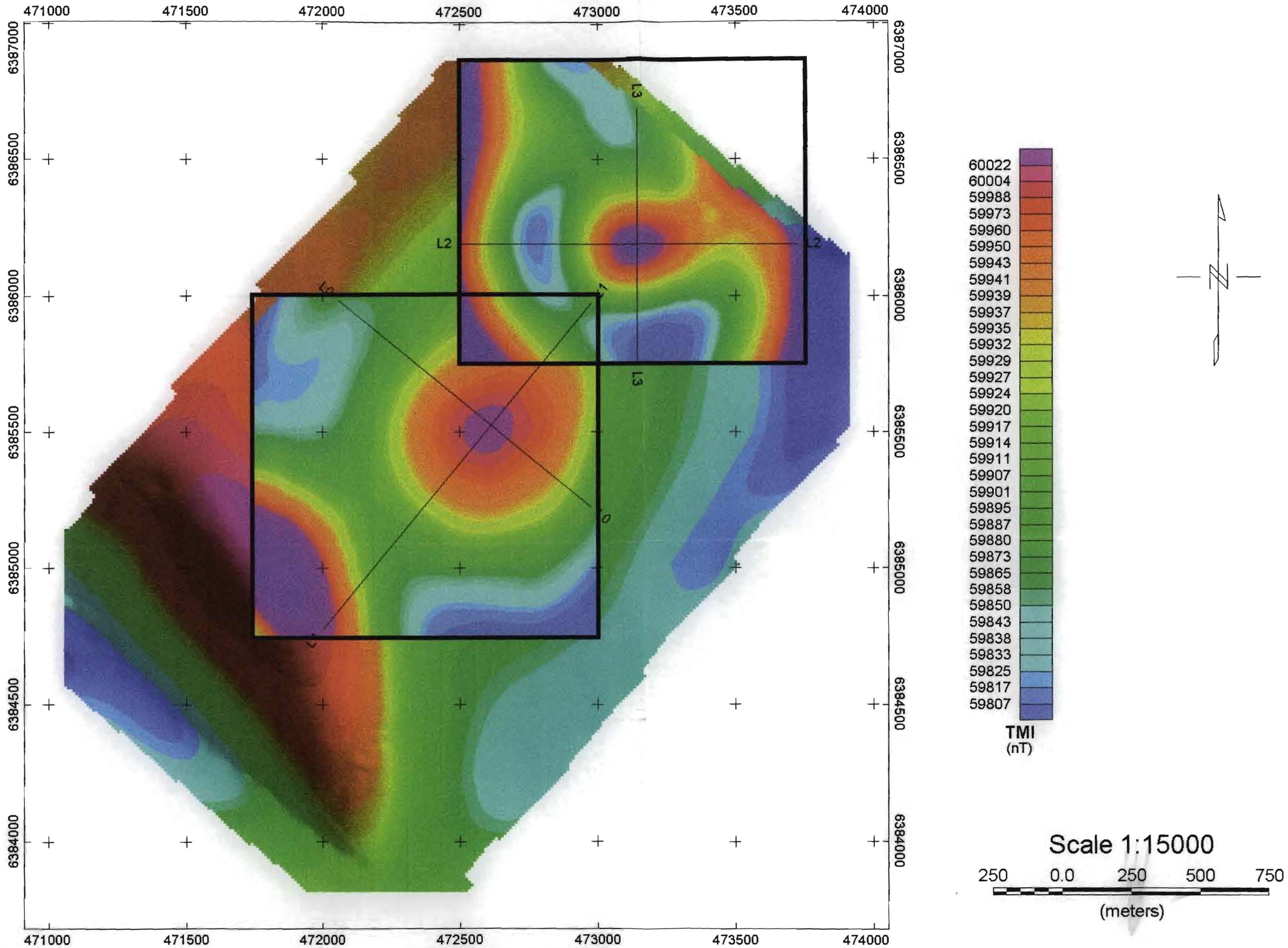
Airborne Data: 13 Mar 98	Statistical Levelling of tielines	BIRCH MOUNTAIN RESOURCES LTD.
Line spacing: 100 m	Full levelling of survey lines	**Area 7**
Station spacing: 5 m	Reduction to IGRF	**2nd Order Residual**
Elevation: 50 m	Shaded relief	Fort MacKay Area
Flight line orientation NE-SW	Inclination 45	Map Projection: UTM, Zone 12, NAD27
Tie line orientation NW-SE	Azimuth 45	KOMEX INTERNATIONAL LTD. KI98-4762A



BIRCH MOUNTAIN RESOURCES LTD.

Area 8
2nd Order Residual

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A



Airborne Data: 13 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation NE-SW
Tie line orientation NW-SE

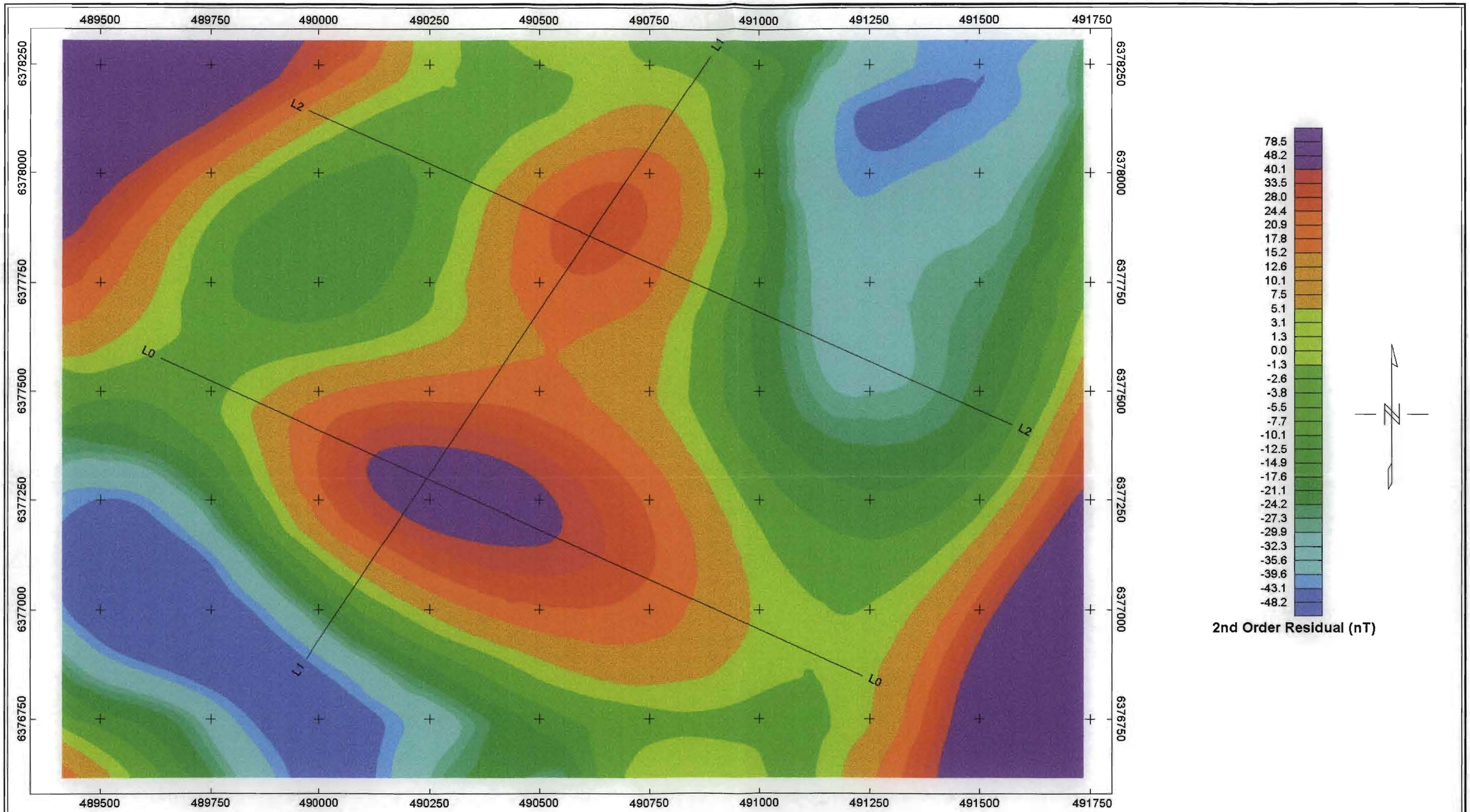
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

BIRCH MOUNTAIN RESOURCES LTD.

Area 9:Total Magnetic Intensity

Inset shows profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A



Airborne Data: 10 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation E-W
Tie line orientation N-S

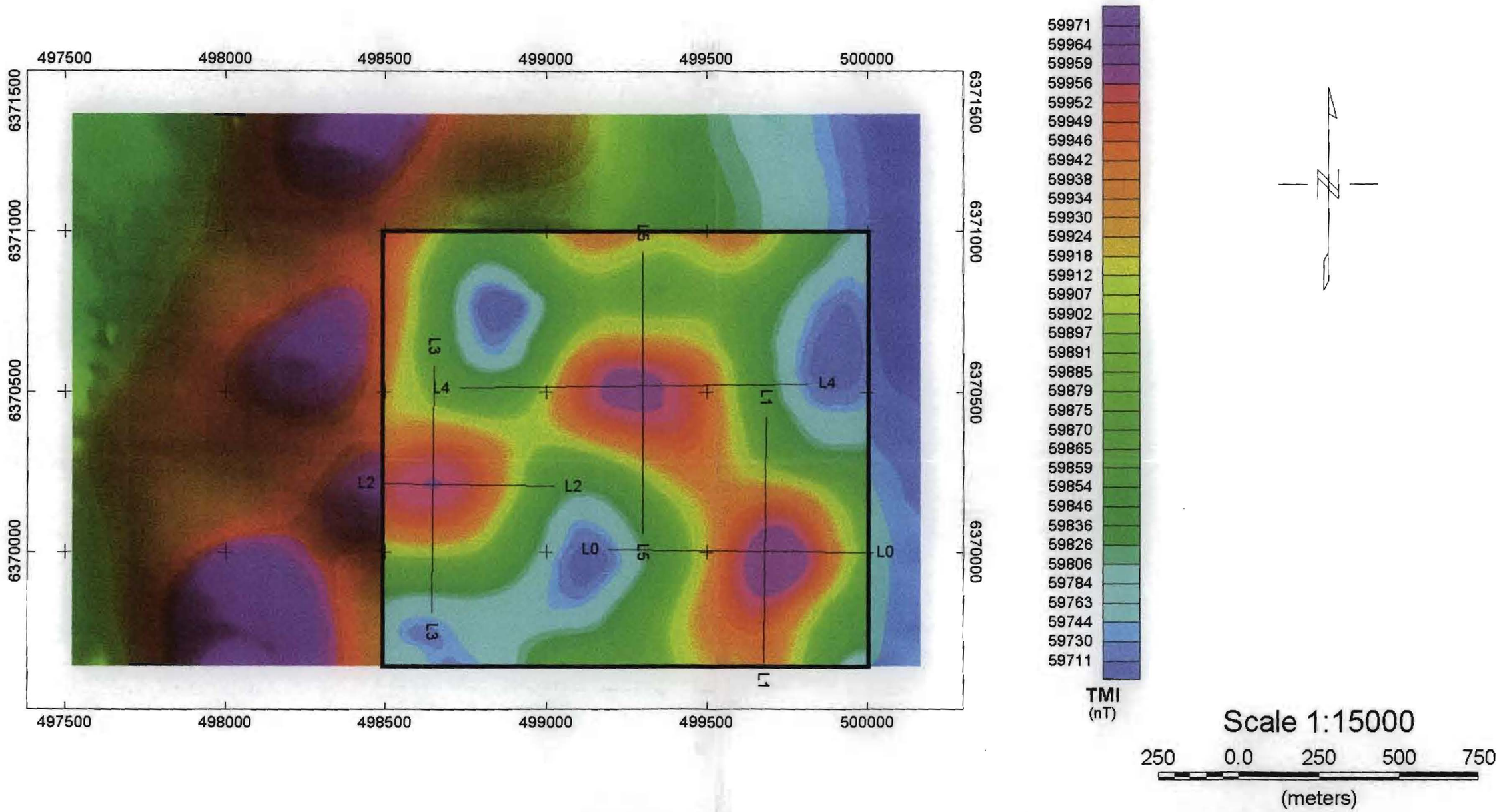
Scale 1:8000

100 0.0 100 200 300 400 500 600 700

(meters)

Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

Birch Mountain Resources Ltd.
Area 10 **Profile lines centered over 2nd Order Residual Anomalies**
Fort MacKay Area Map projection: UTM 12, NAD27
KOMEX INTERNATIONAL LTD., KI98-4762A



Airborne Data: 11 Mar 98	
Line spacing: 100 m	
Station spacing: 5 m	
Elevation: 50 m	
Flight line orientation E-W	
Tie line orientation N-S	

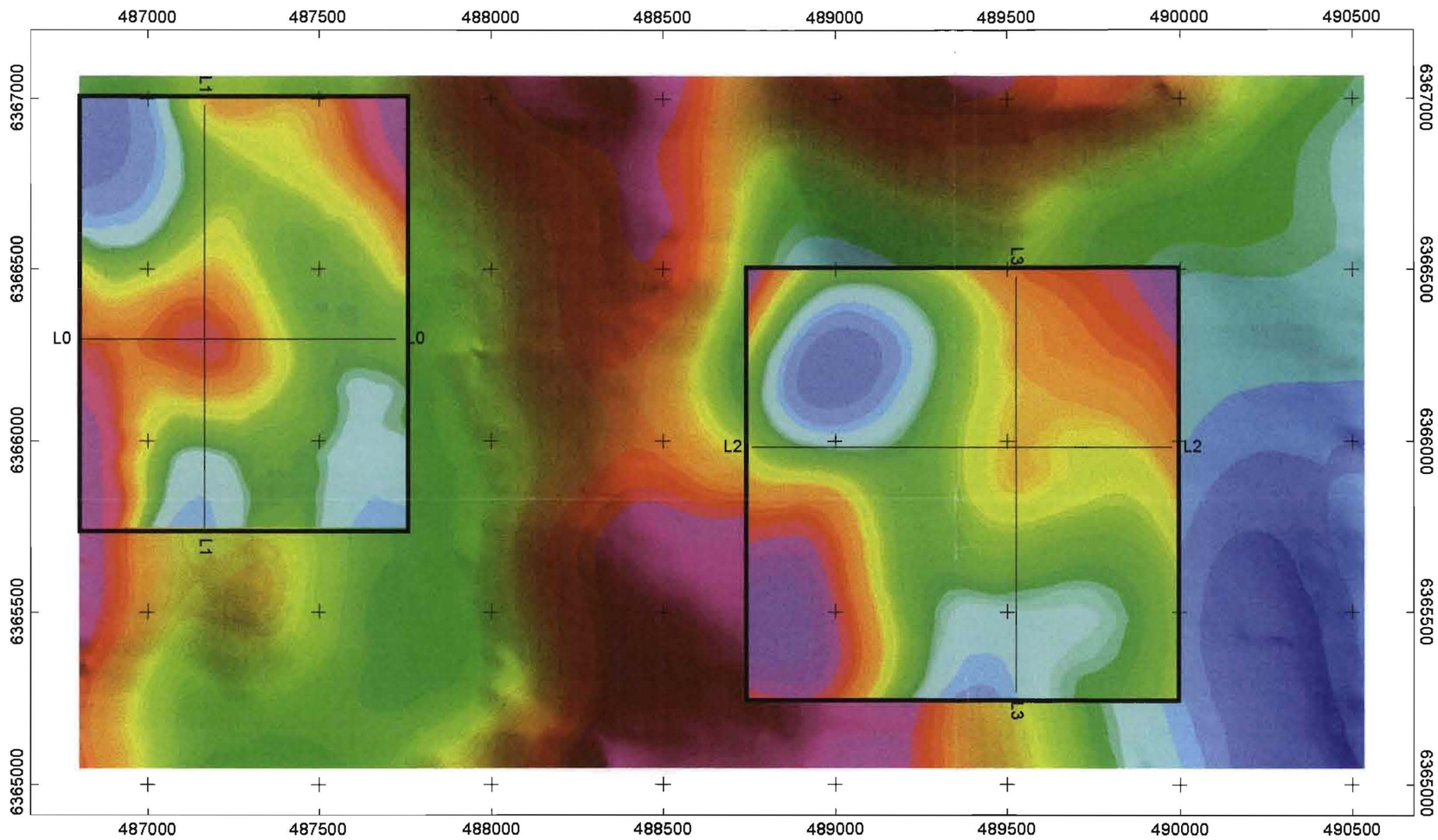
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

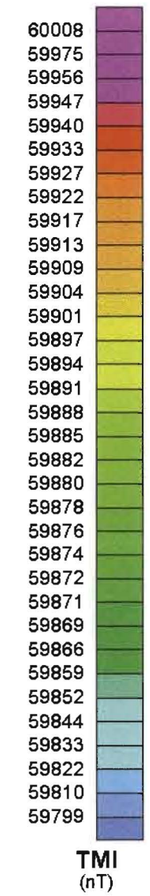
BIRCH MOUNTAIN RESOURCES LTD.

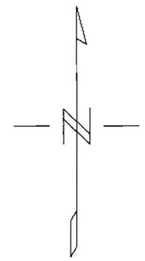
Area 11: Total Magnetic Intensity

Inset shows profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A







Scale 1:15000

250 0.0 250 500 750

(meters)

Airborne Data: 17 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 30 m
Flight line orientation E-W
Tie line orientation N-S

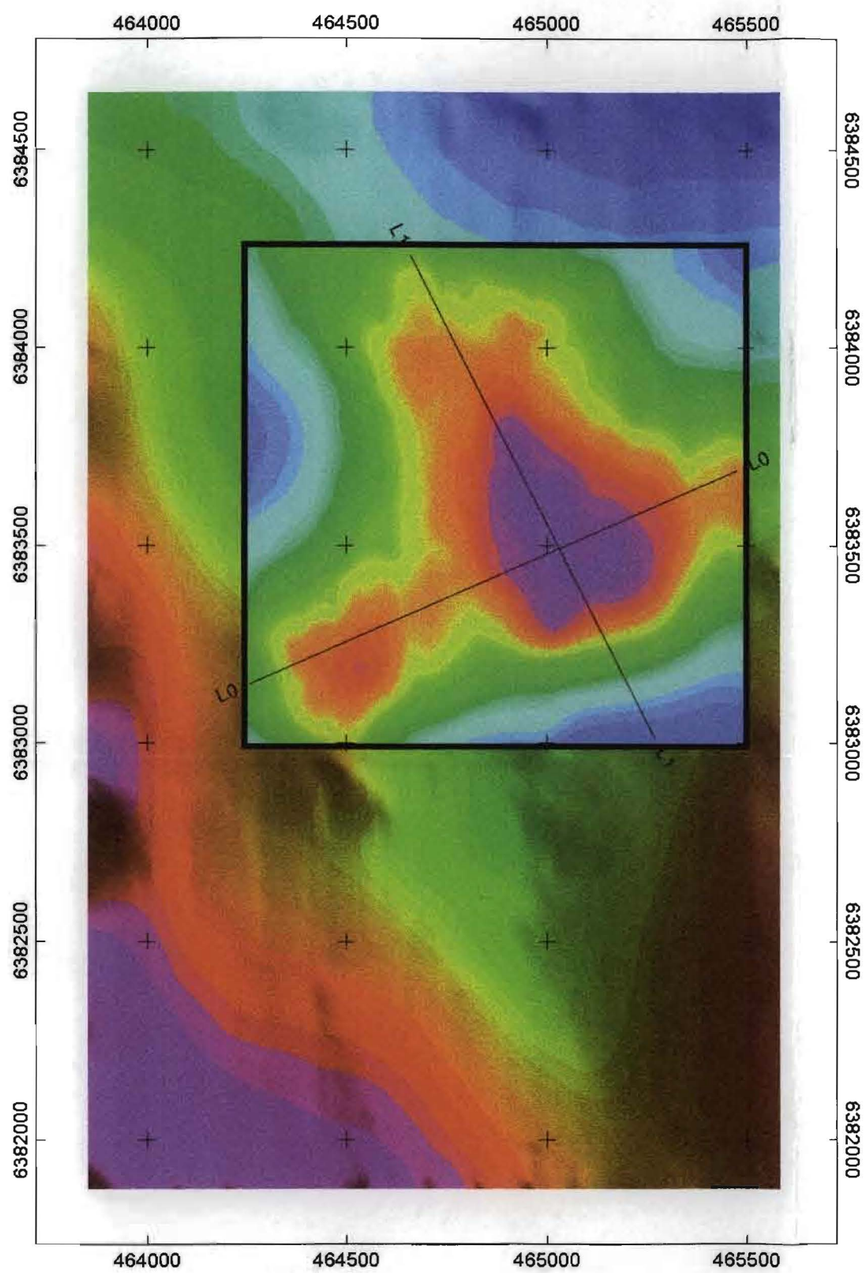
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 315

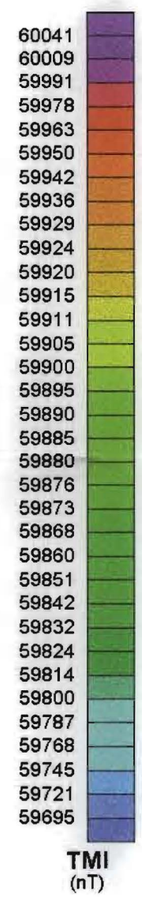
BIRCH MOUNTAIN RESOURCES LTD.

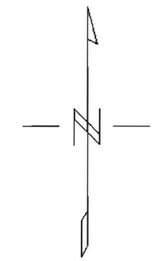
Area 12: Total Magnetic Intensity

Inset areas show profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A







Scale 1:15000

250 0.0 250 500 750

(meters)

Airborne Data: 11 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation N-S
Tie line orientation E-W

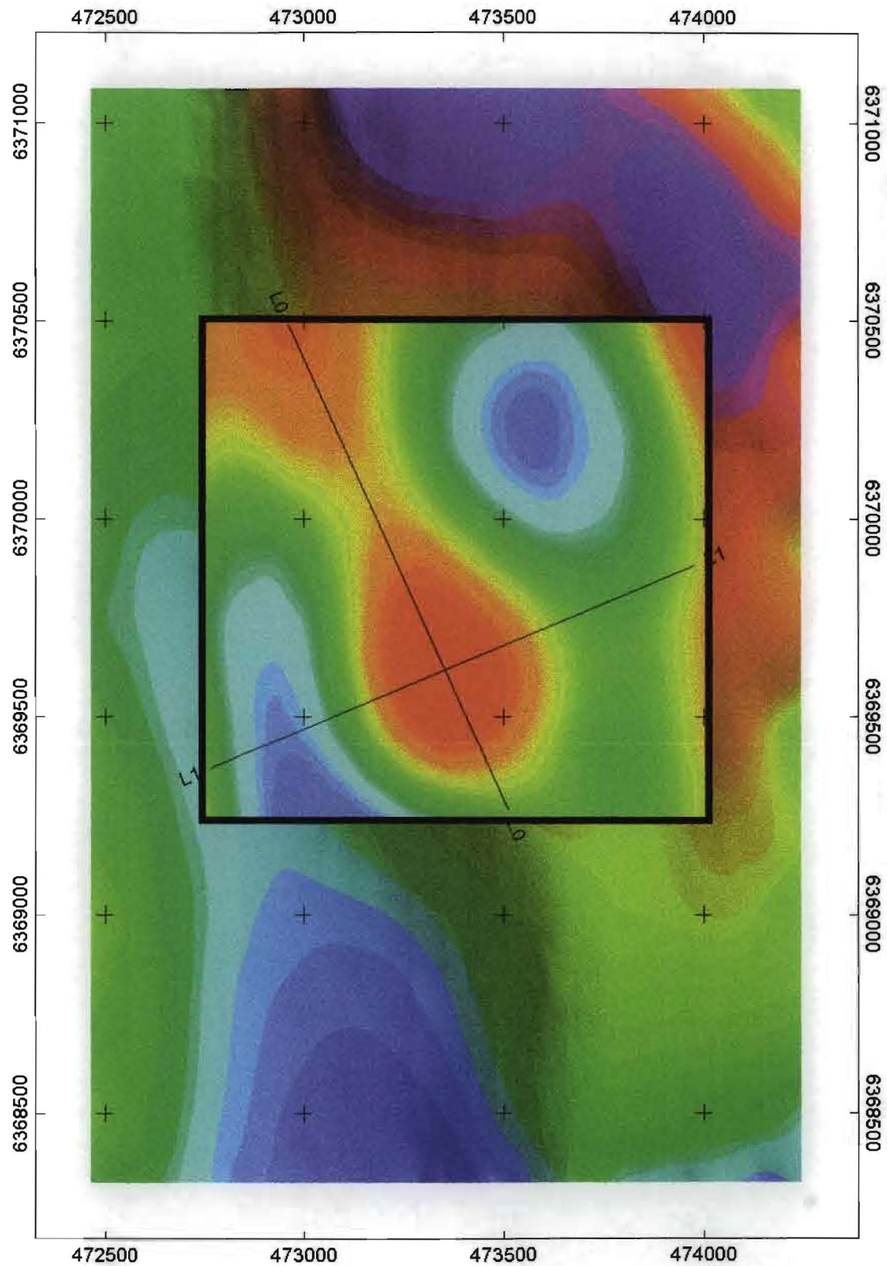
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

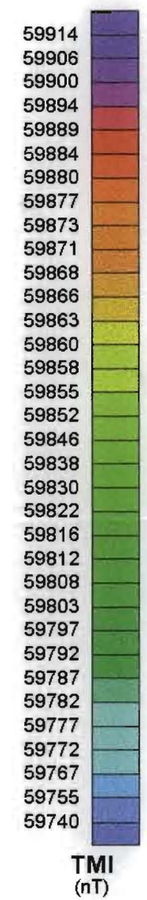
BIRCH MOUNTAIN RESOURCES LTD.

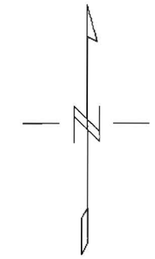
Area 13: Total Magnetic Intensity

Inset area shows profile lines centered over 3rd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A







Scale 1:15000

250 0.0 250 500 750

(meters)

Airborne Data: 15 Mar 98
Line spacing: 100 m
Station spacing: 5 m
Elevation: 50 m
Flight line orientation N-S
Tie line orientation E-W

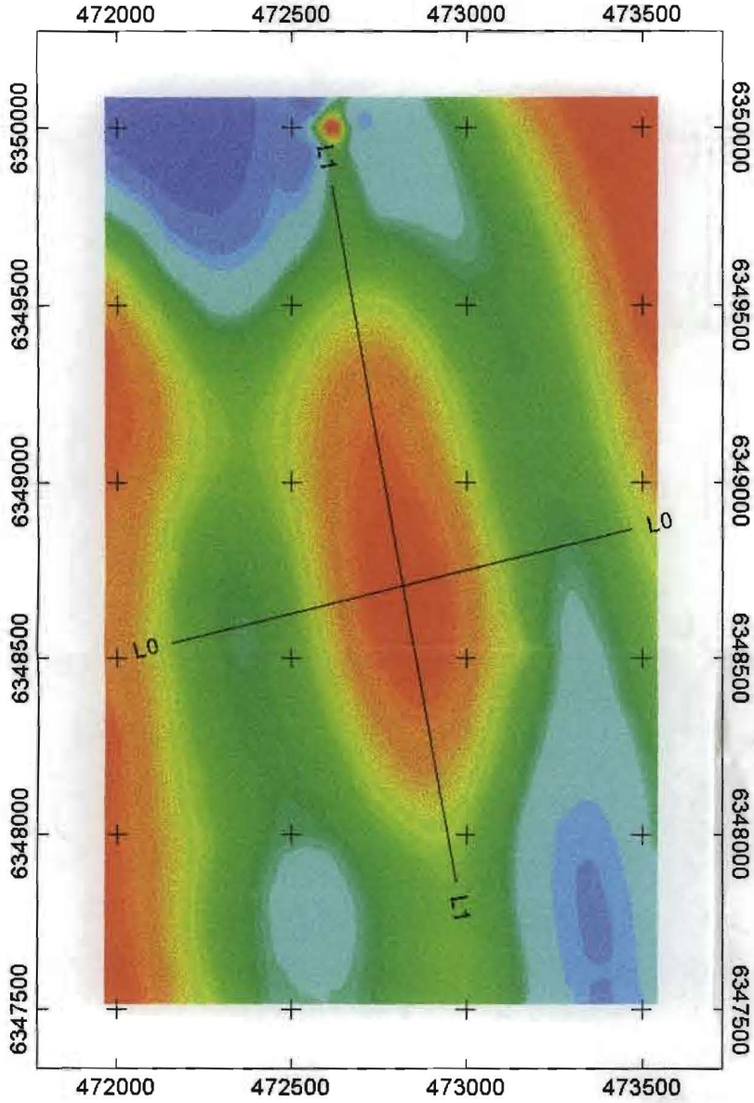
Statistical Levelling of tielines
Full levelling of survey lines
Reduction to IGRF
Shaded relief
Inclination 45
Azimuth 45

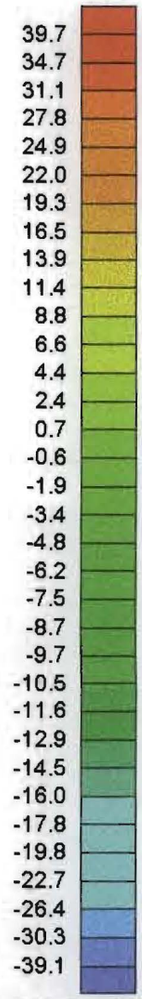
BIRCH MOUNTAIN RESOURCES LTD.

Area 301: Total Magnetic Intensity

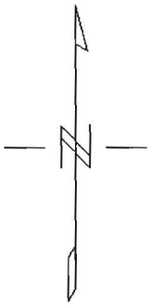
Inset areas show profile lines centered over 2nd Order Residual Anomalies

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A





2nd Order Residual (nT)



Scale 1:20000

250 0.0 250 500

(meters)

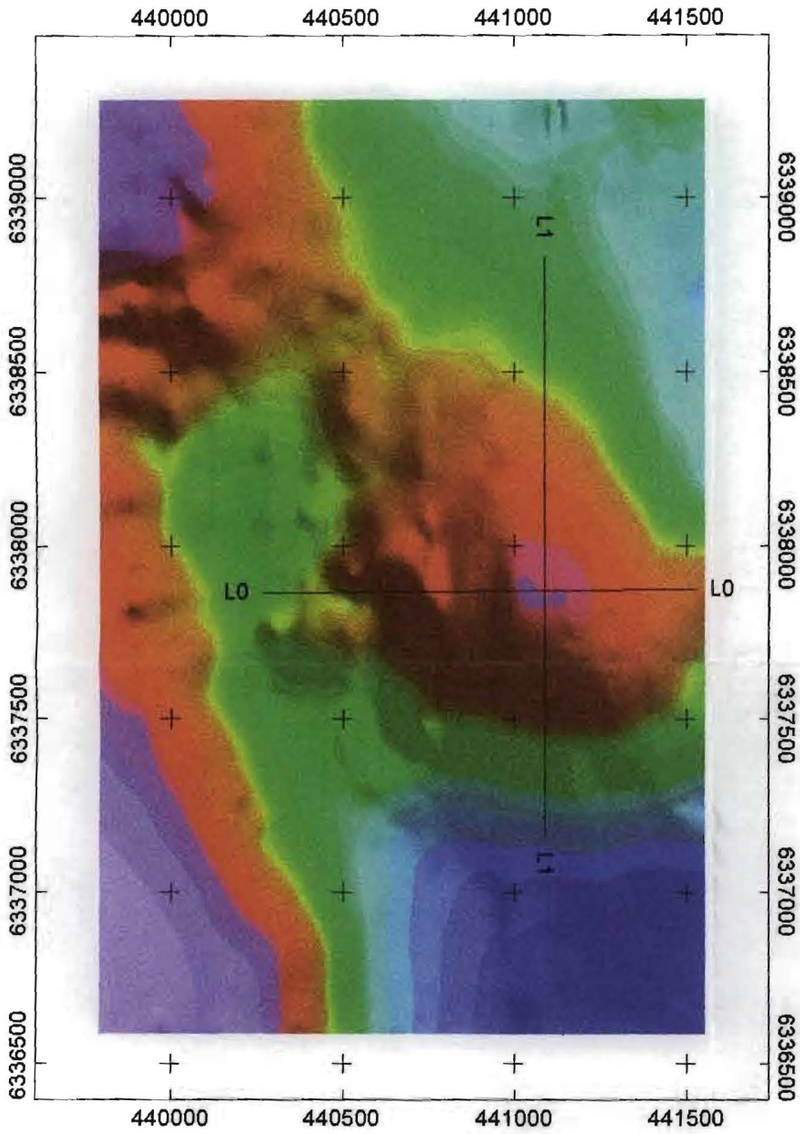
Airborne Data: 13 Mar 98	Statistical Levelling of tielines
Line spacing: 100 m	Full levelling of survey lines
Station spacing: 5 m	Reduction to IGRF
Elevation: 50 m	Shaded relief
Flight line orientation N-S	Inclination 45
Tie line orientation E-W	Azimuth 45

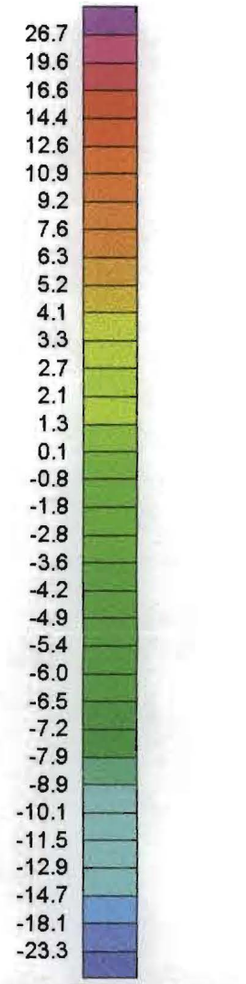
BIRCH MOUNTAIN RESOURCES LTD.

Area 304

Profile lines centered over 2nd Order Residual Anomaly

Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A





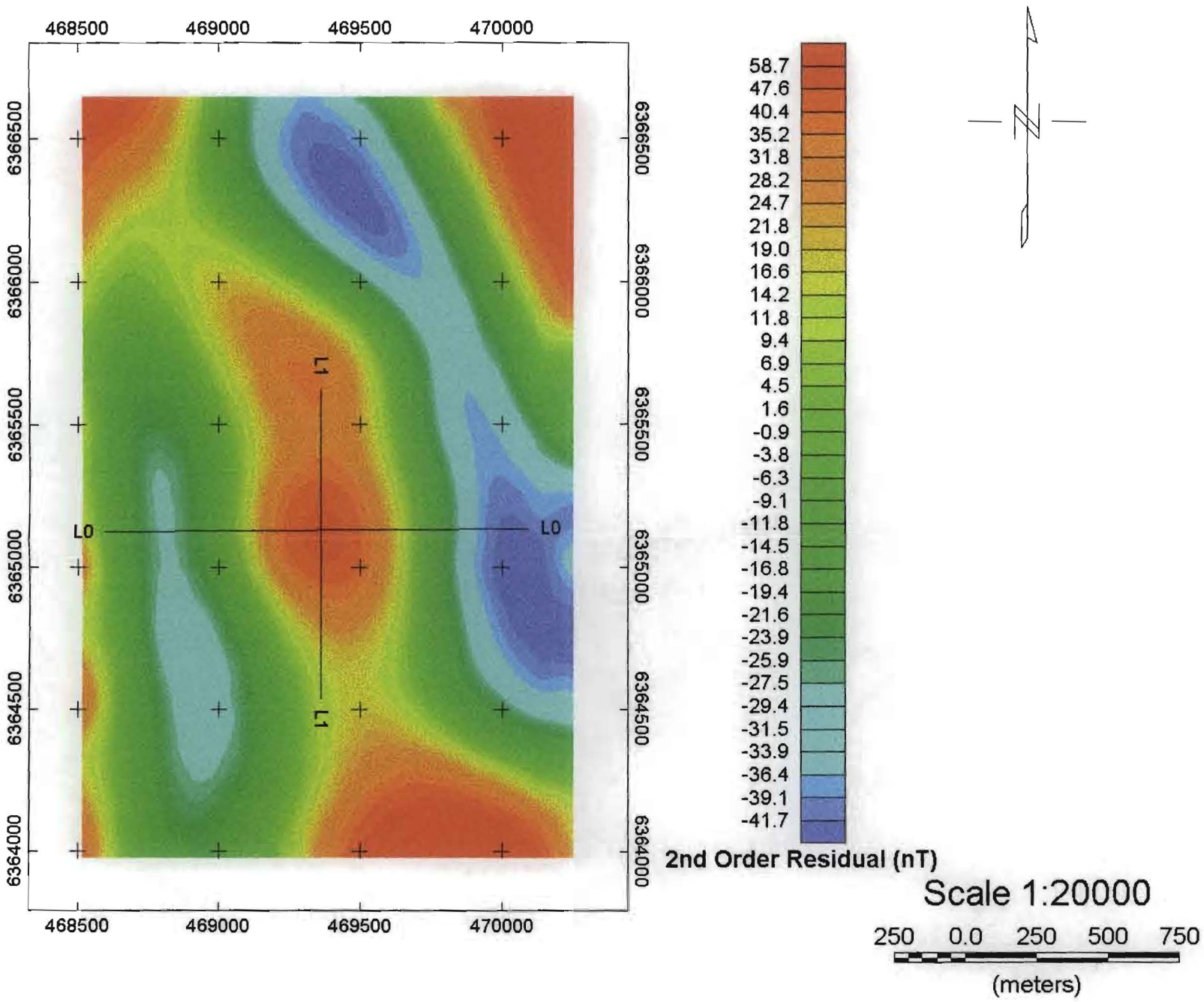
2nd Order Residual (nT)

Scale 1:20000

250 0.0 250 500 750

(meters)

Airborne Data: 17 Mar 98	Statistical Levelling of tielines	BIRCH MOUNTAIN RESOURCES LTD.
Line spacing: 100 m	Full levelling of survey lines	**Area 308**
Station spacing: 5 m	Reduction to IGRF	**2nd Order Residual**
Elevation: 55 m	Shaded relief	
Flight line orientation N-S	Inclination 45	Fort MacKay Area
Tie line orientation E-W	Azimuth 45	Map Projection: UTM, Zone 12, NAD27
		KOMEX INTERNATIONAL LTD. KI98-4762A



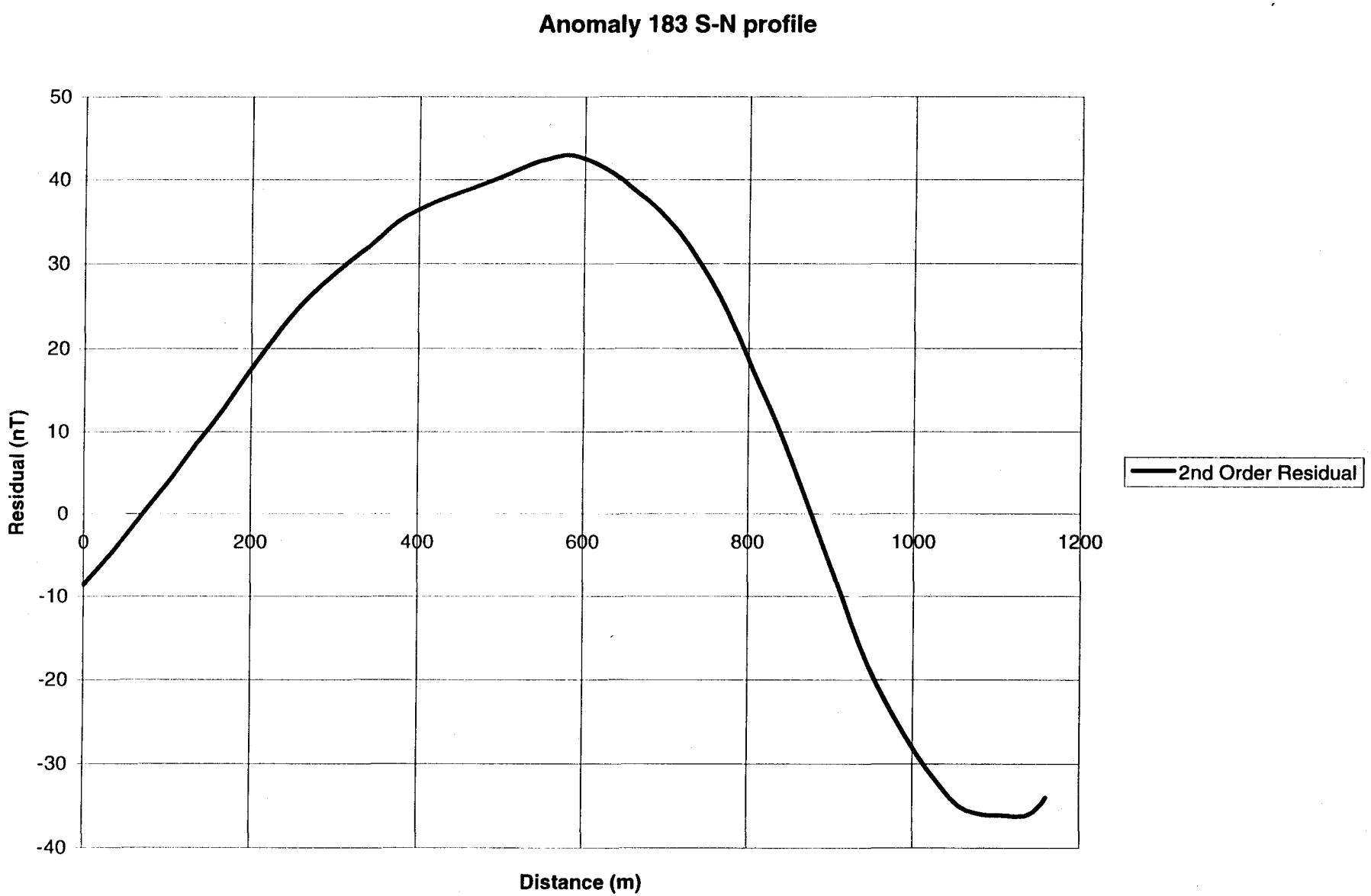
Airborne Data: 15 Mar 98	Statistical Levelling of tielines
Line spacing: 100 m	Full levelling of survey lines
Station spacing: 5 m	Reduction to IGRF
Elevation: 60 m	Shaded relief
Flight line orientation N-S	Inclination 45
Tie line orientation E-W	Azimuth 45

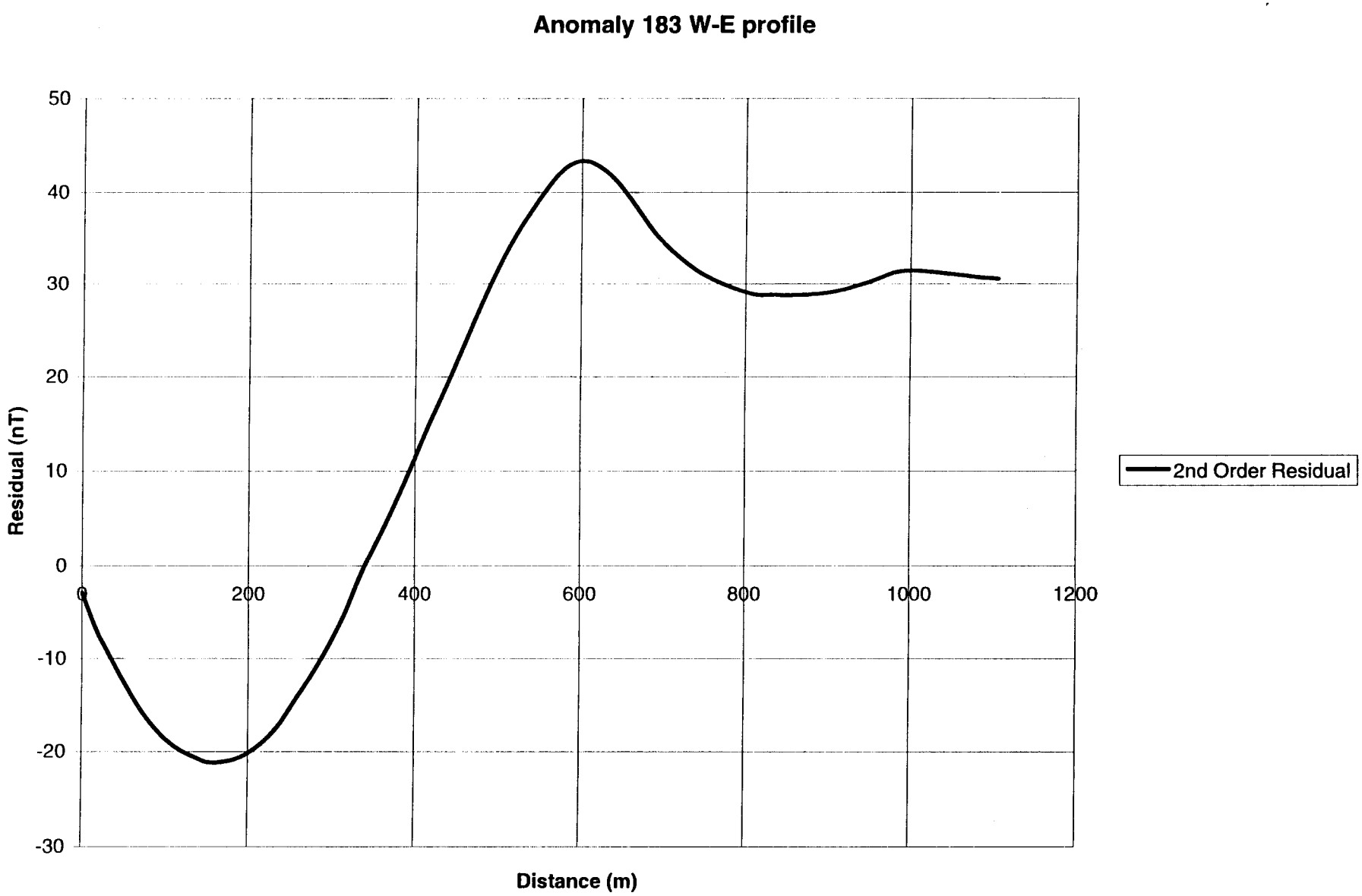
BIRCH MOUNTAIN RESOURCES LTD.

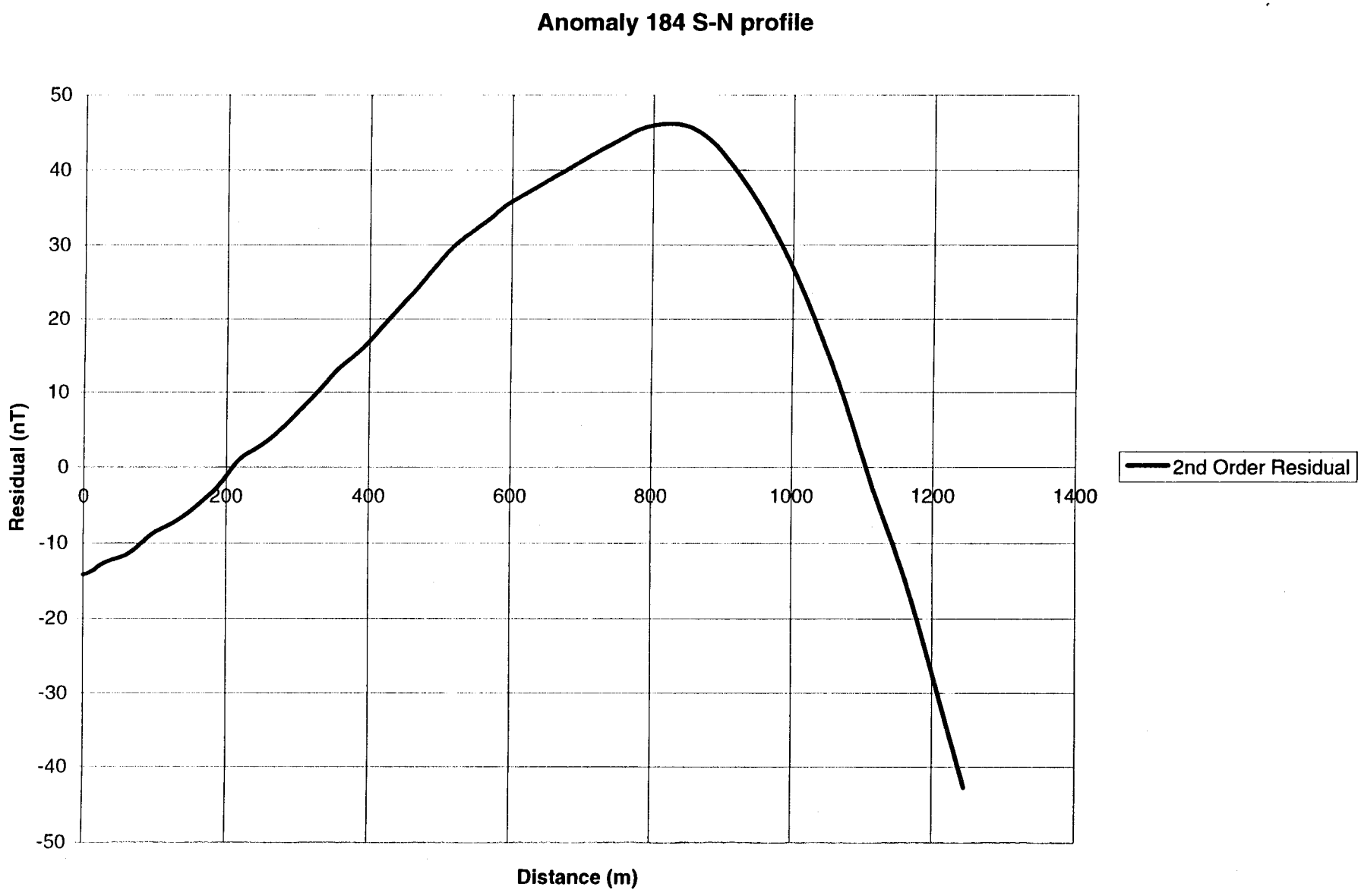
Area 315

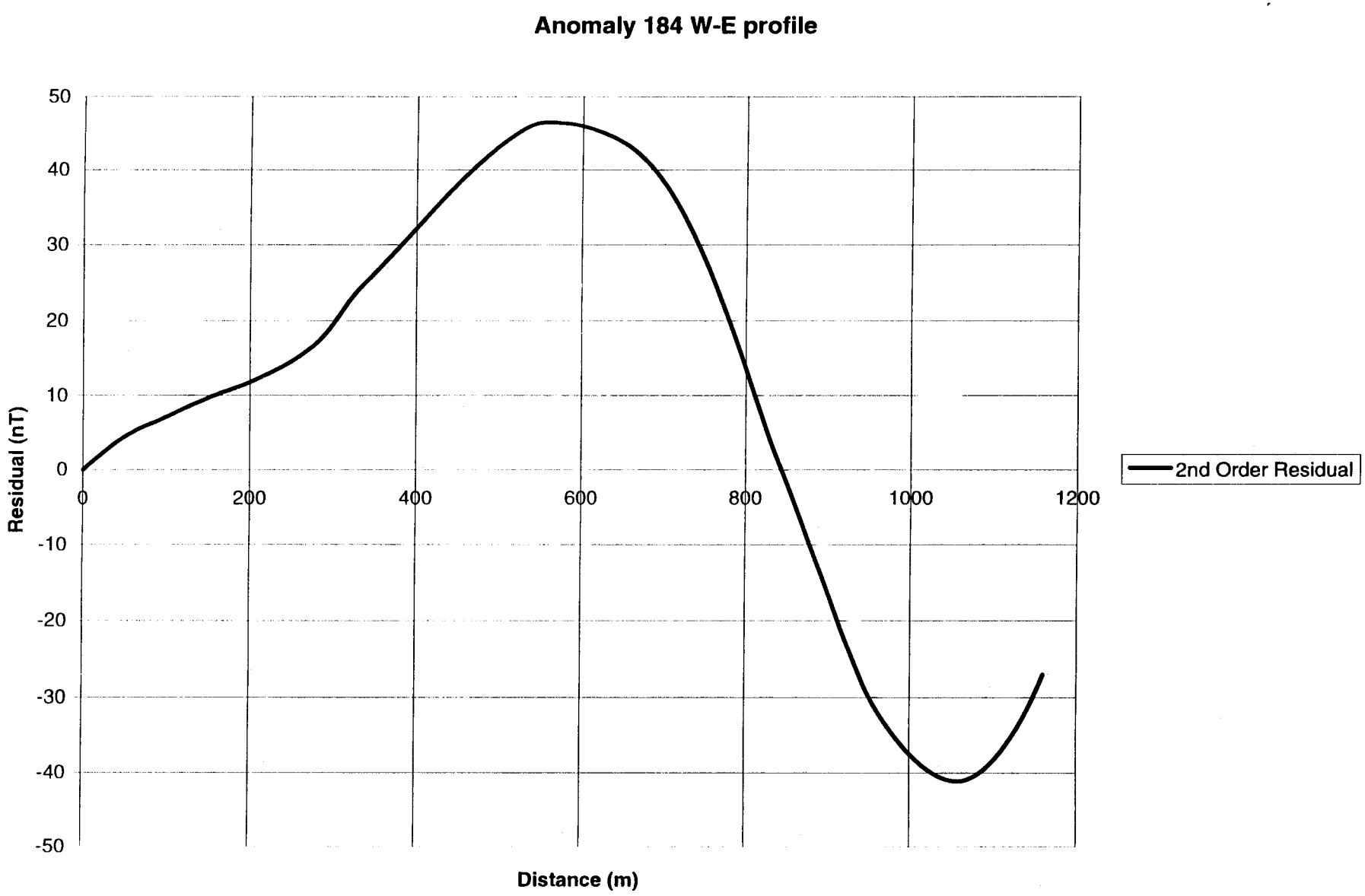
Profile lines centered over 2nd Order Residual Anomaly

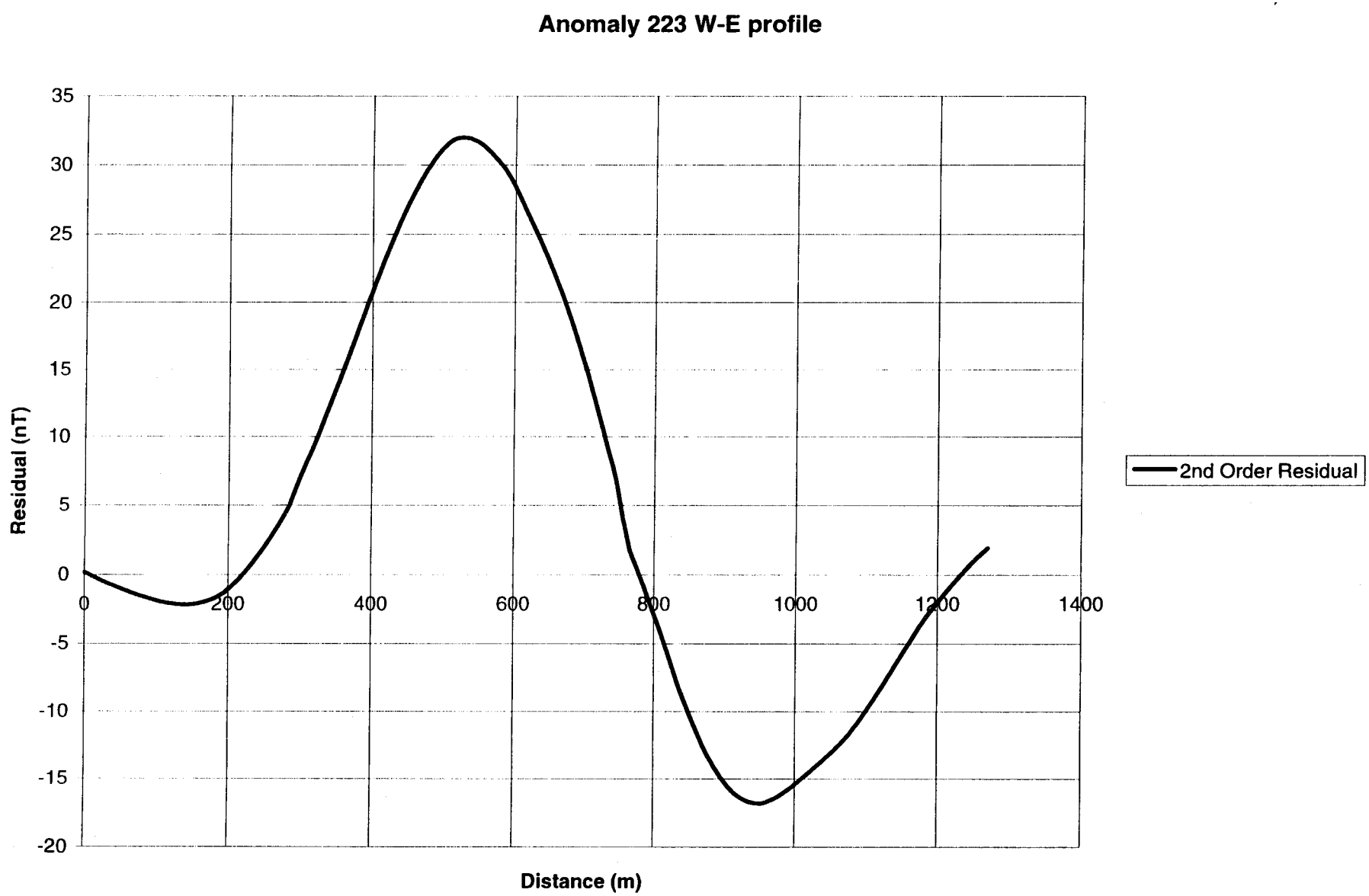
Fort MacKay Area
Map Projection: UTM, Zone 12, NAD27
KOMEX INTERNATIONAL LTD. KI98-4762A

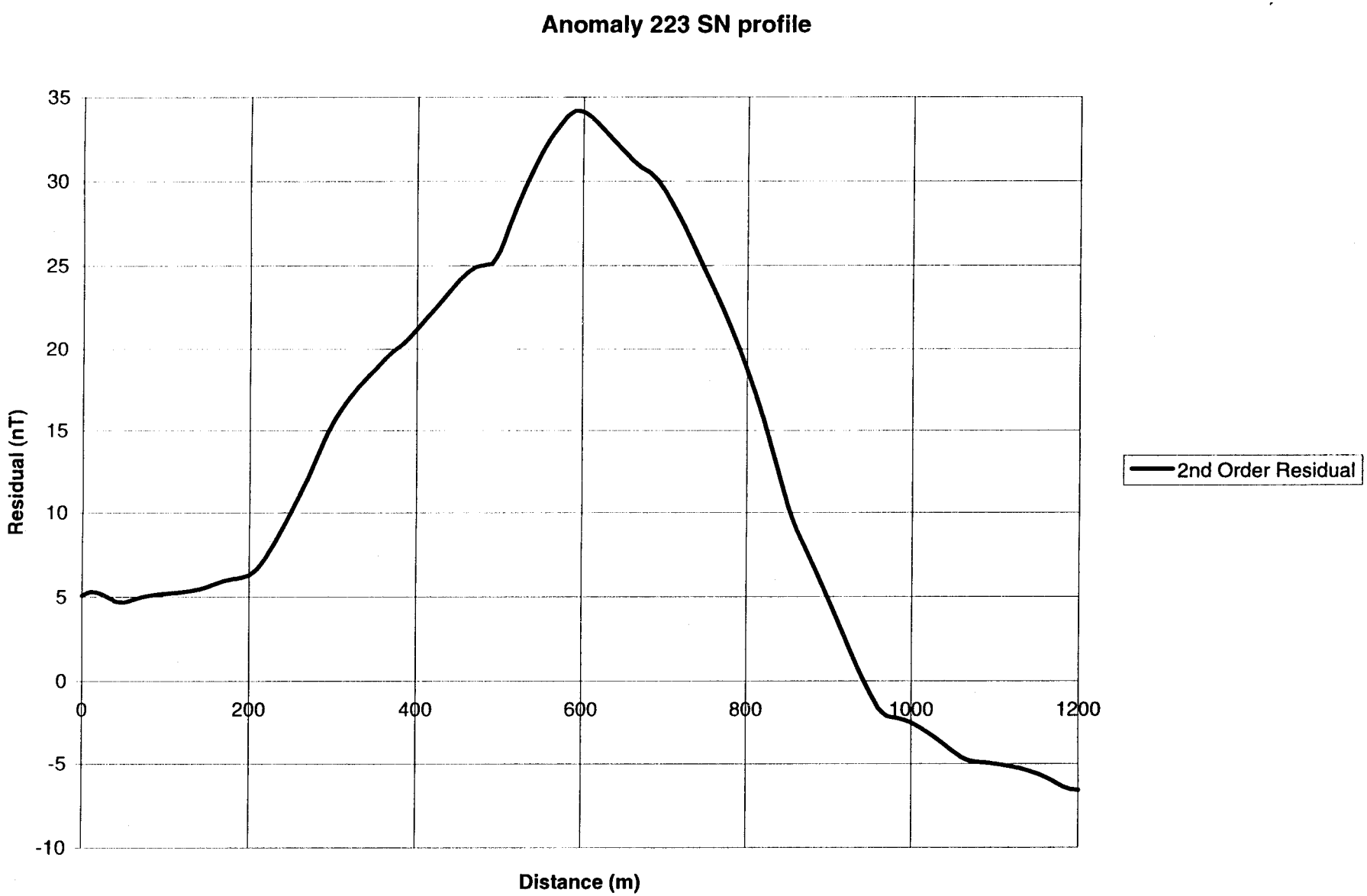

Anomaly 183 S-N profile
50
40
30
20
10
0
-10
-20
-30
-40
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual

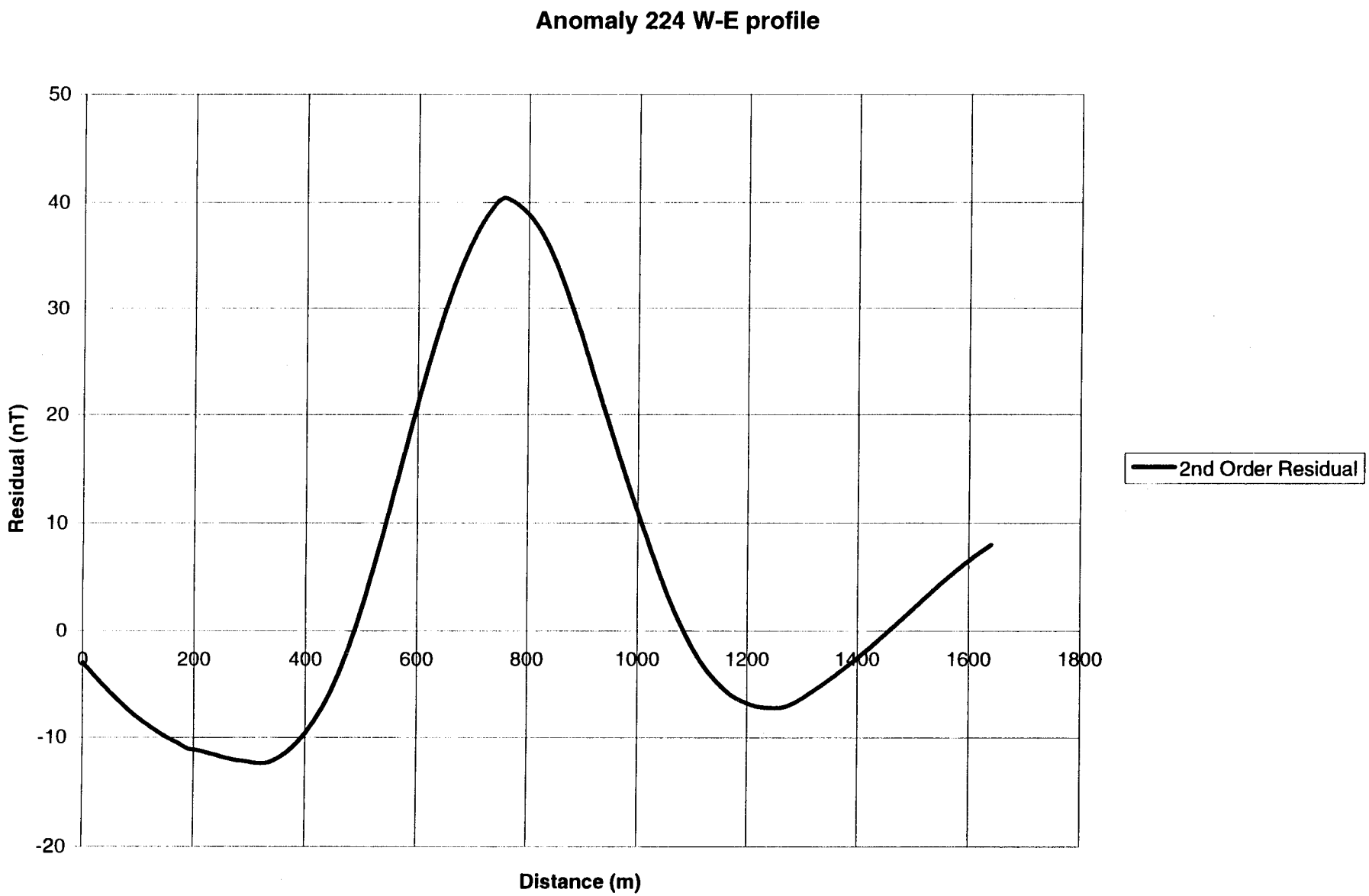

Anomaly 183 W-E profile
50
40
30
20
10
0
-10
-20
-30
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual

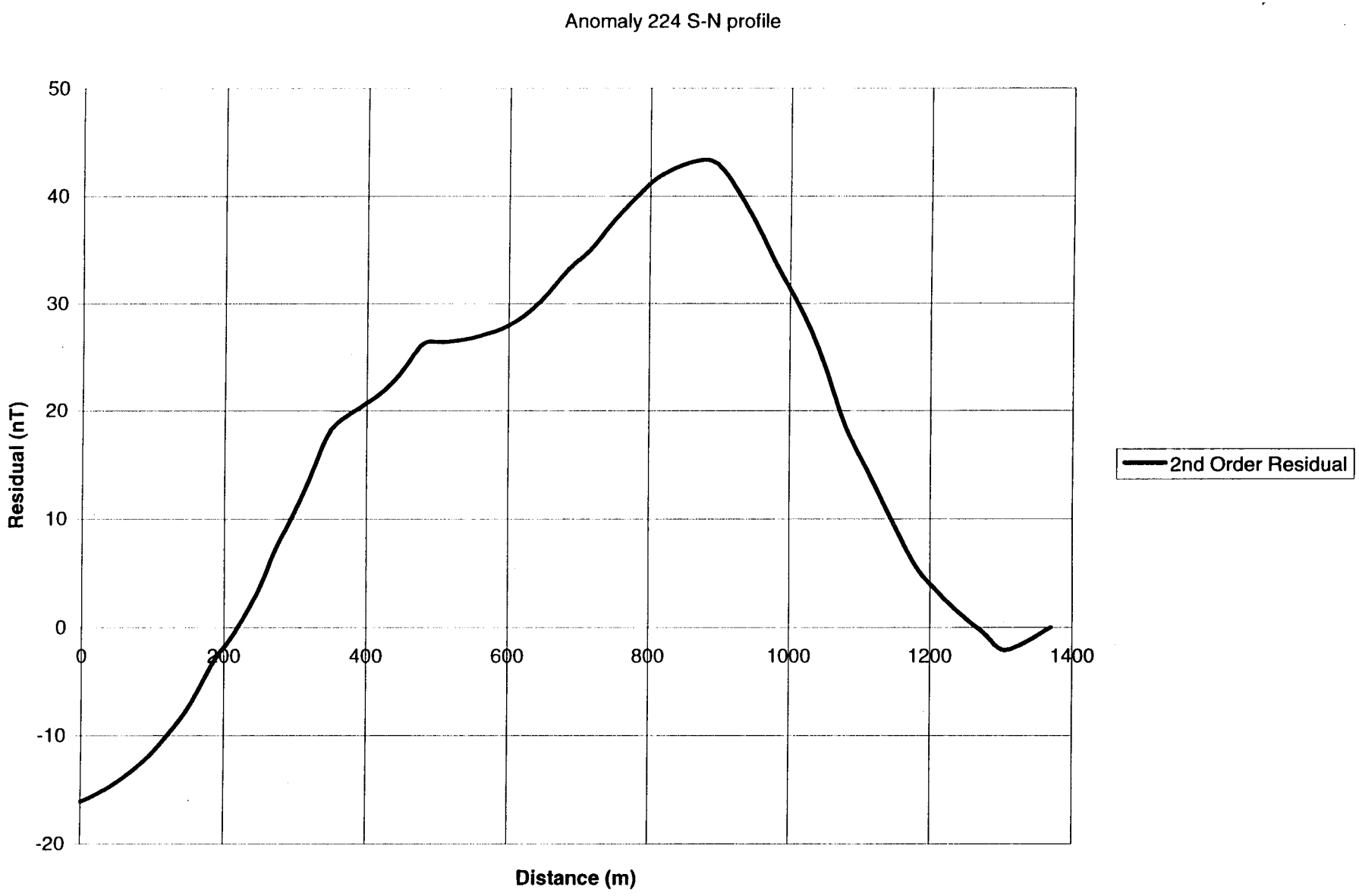

Anomaly 184 S-N profile
50
40
30
20
10
0
-10
-20
-30
-40
-50
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual


Anomaly 184 W-E profile
50
40
30
20
10
0
-10
-20
-30
-40
-50
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual

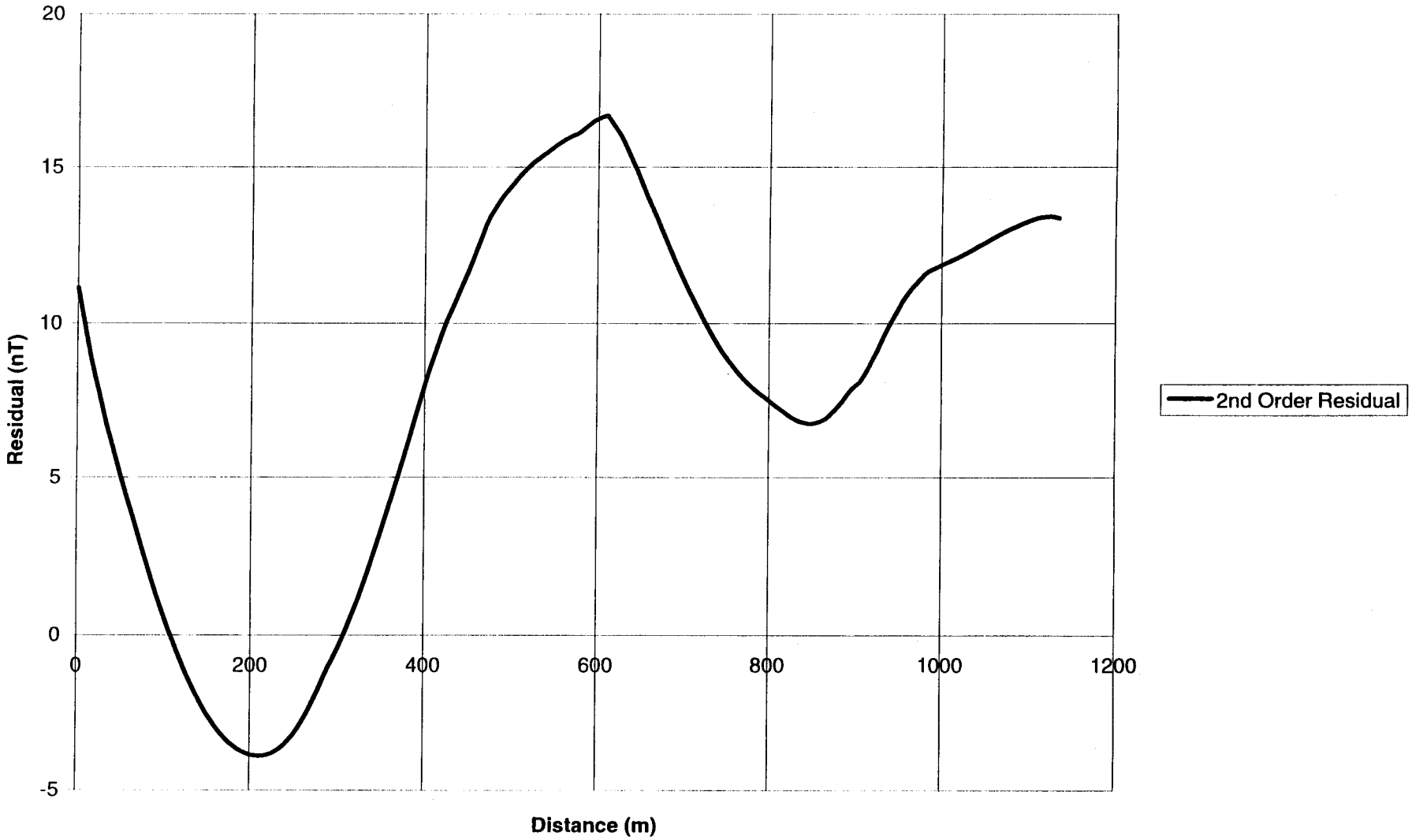

Anomaly 223 W-E profile
Residual (nT)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual

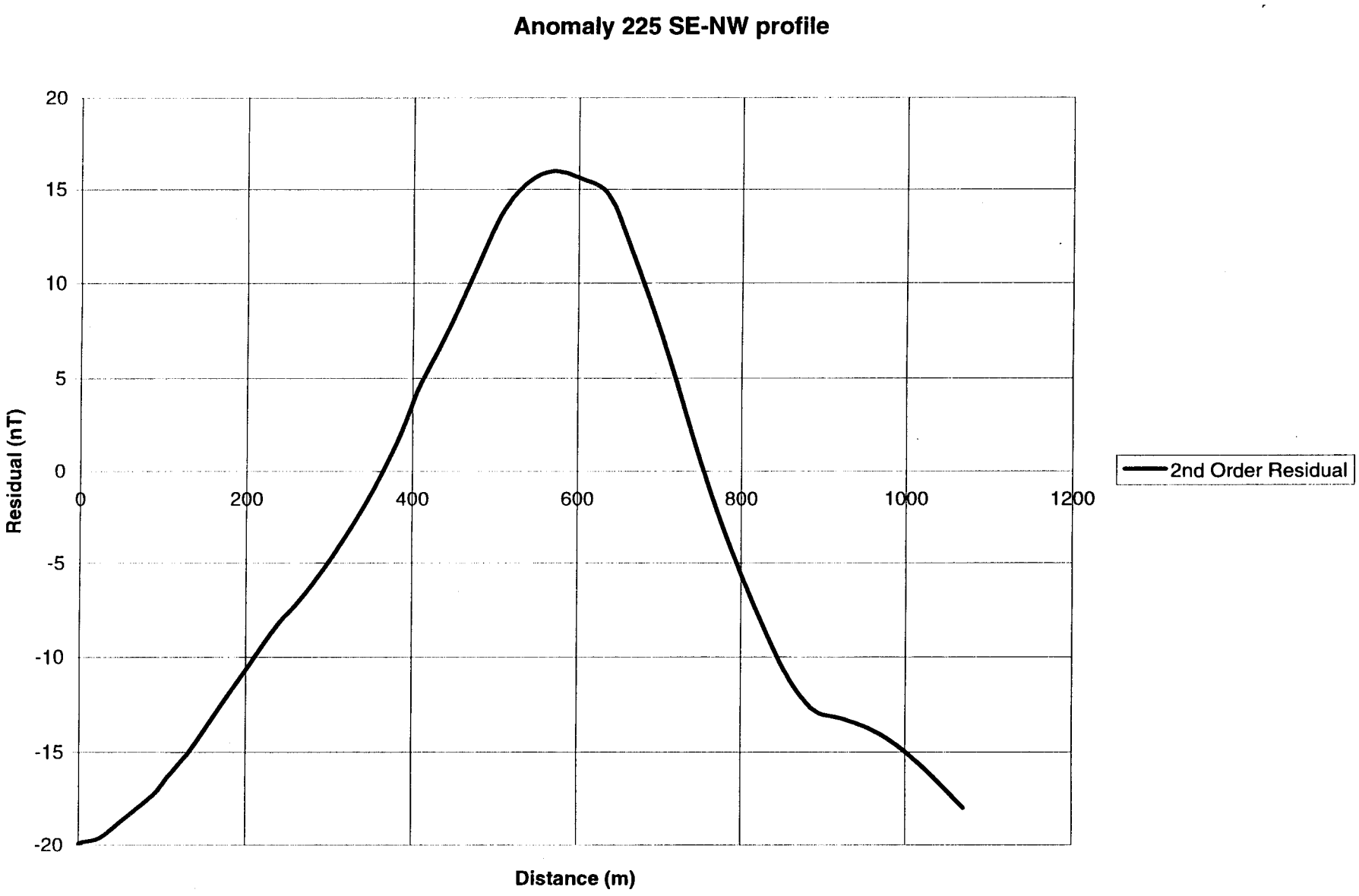

Anomaly 223 SN profile
35
30
25
20
15
10
5
0
-5
-10
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual

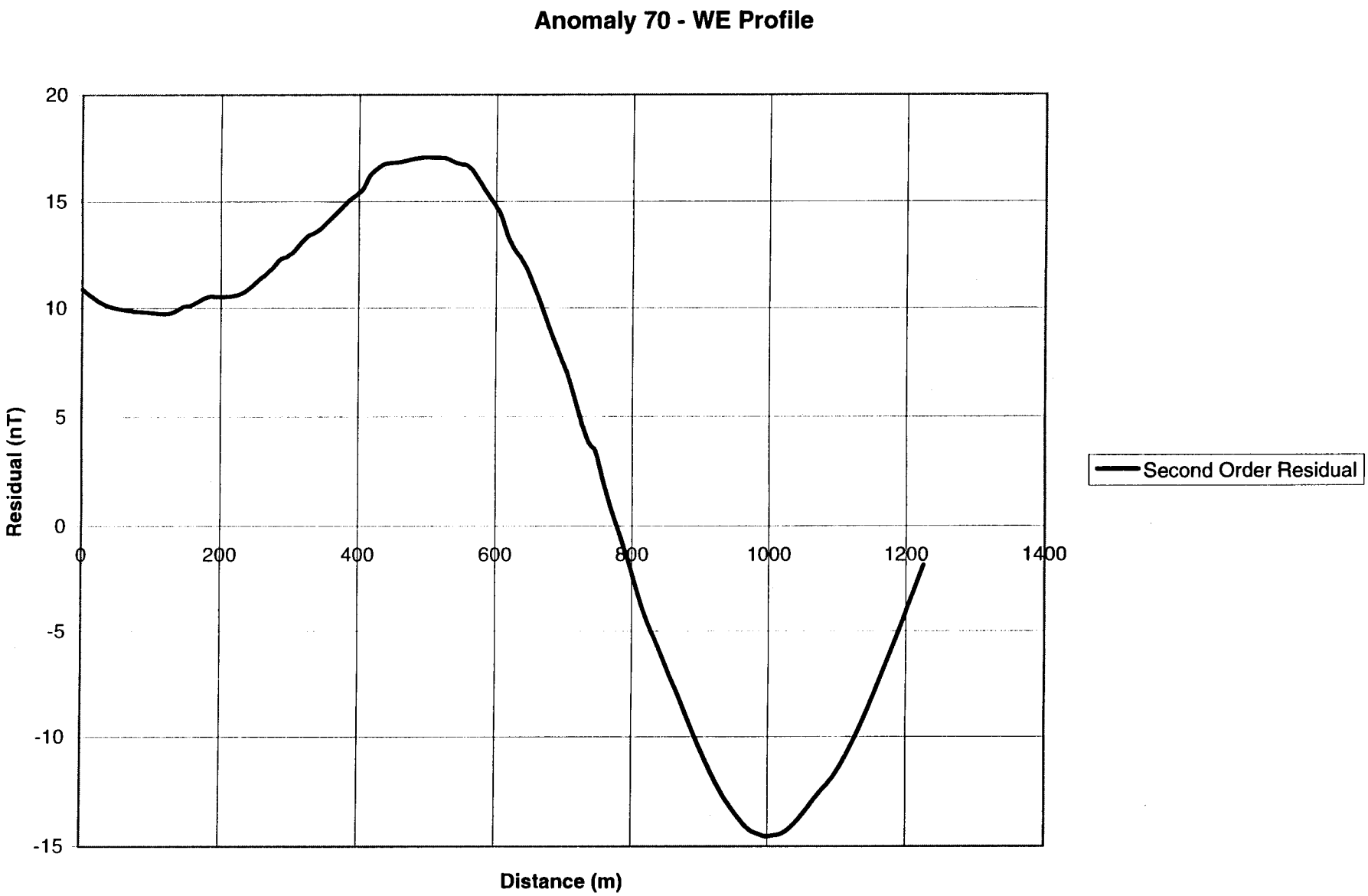

Anomaly 224 W-E profile
50
40
30
20
10
0
-10
-20
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

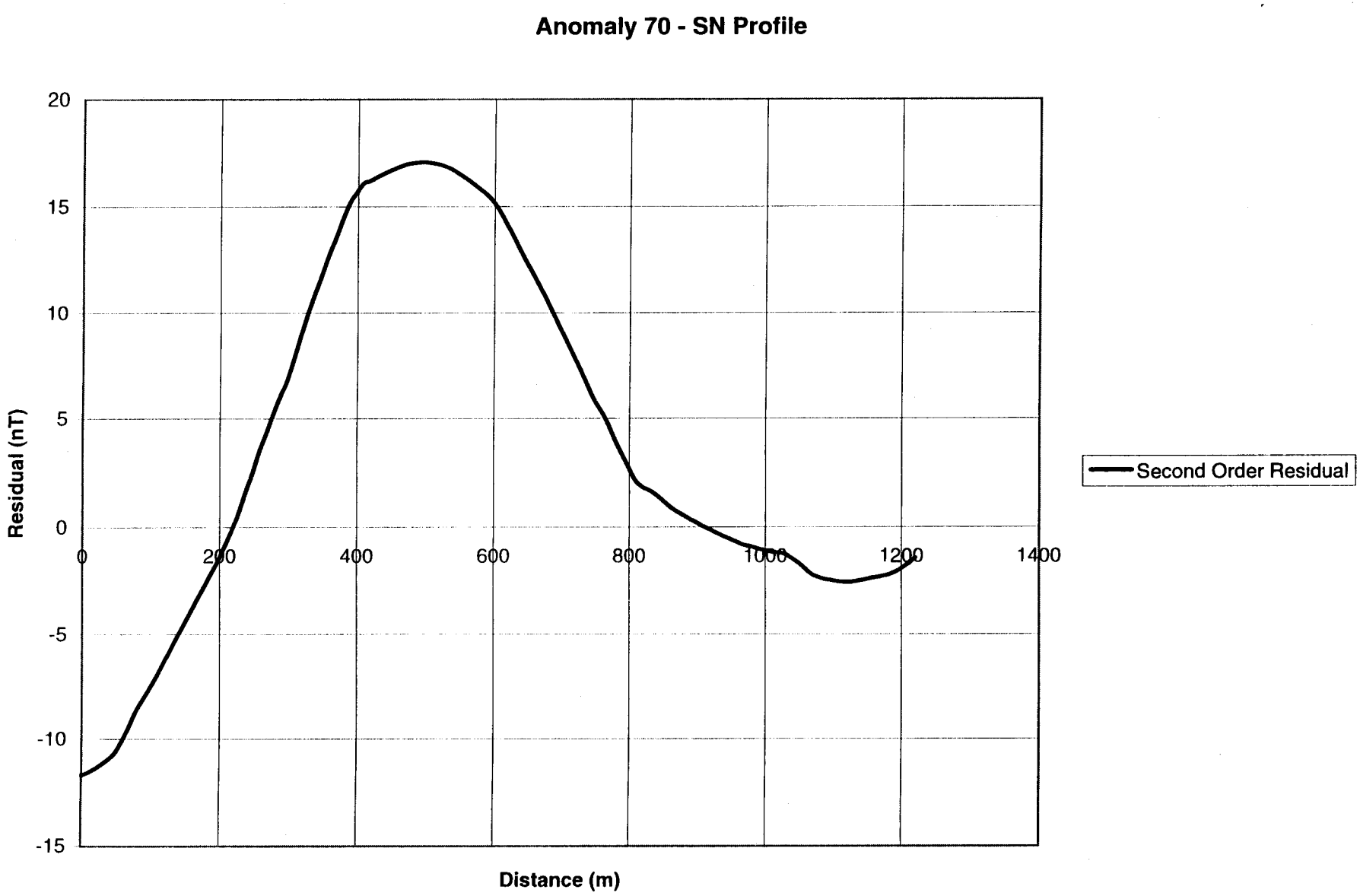

Anomaly 224 S-N profile
50
40
30
20
10
0
-10
-20
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual

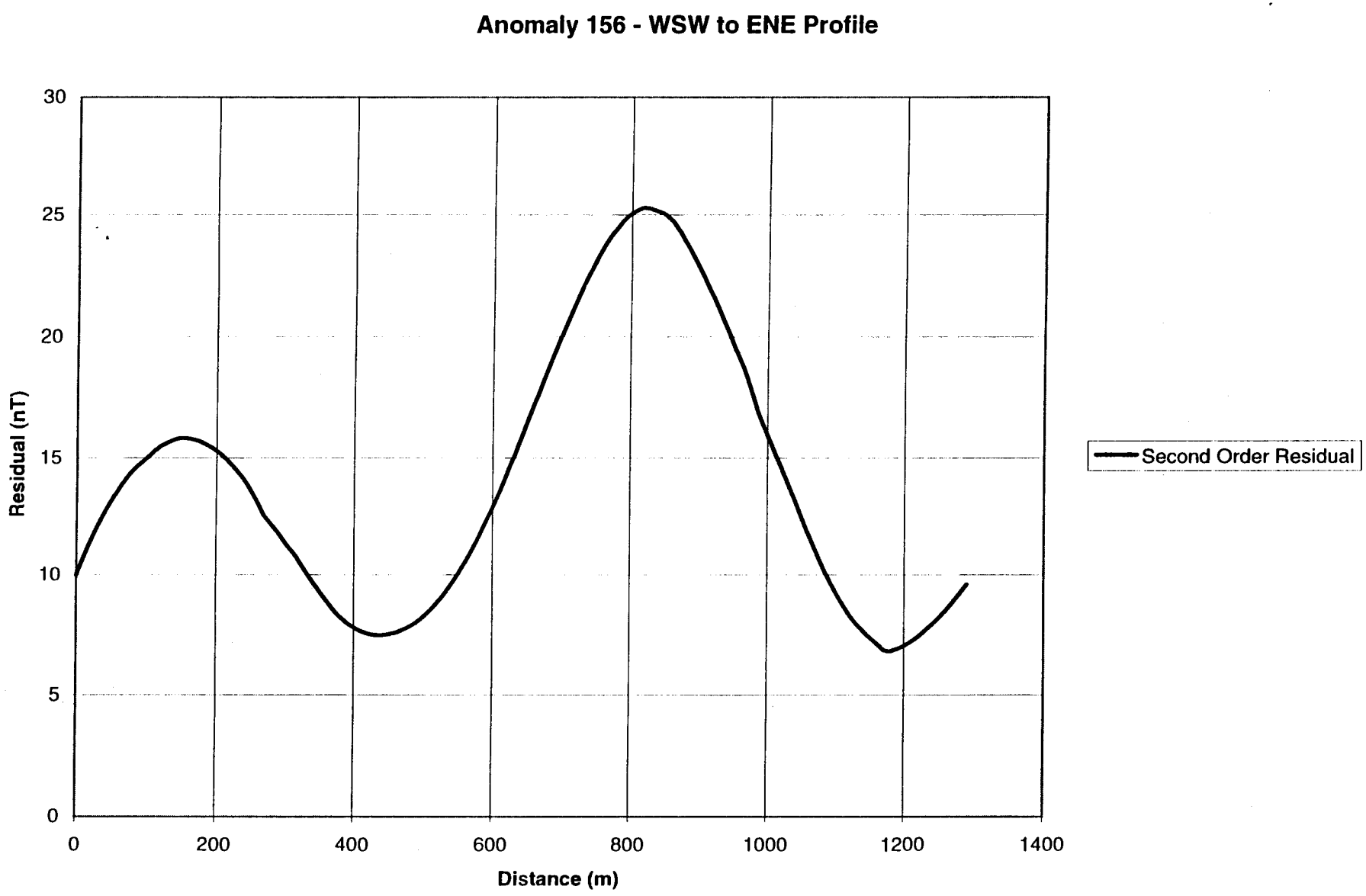
Anomaly 225 SW-NE profile

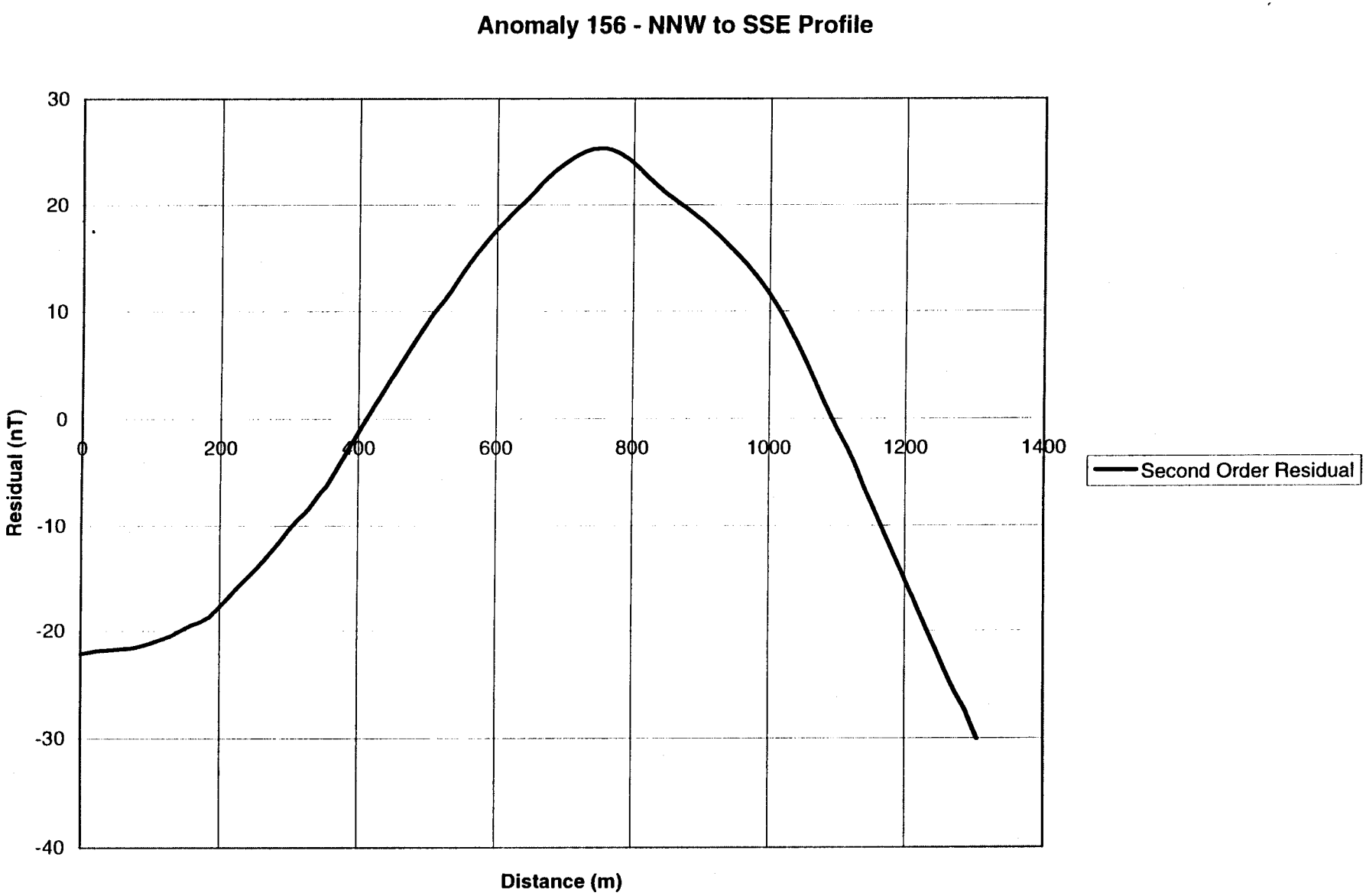


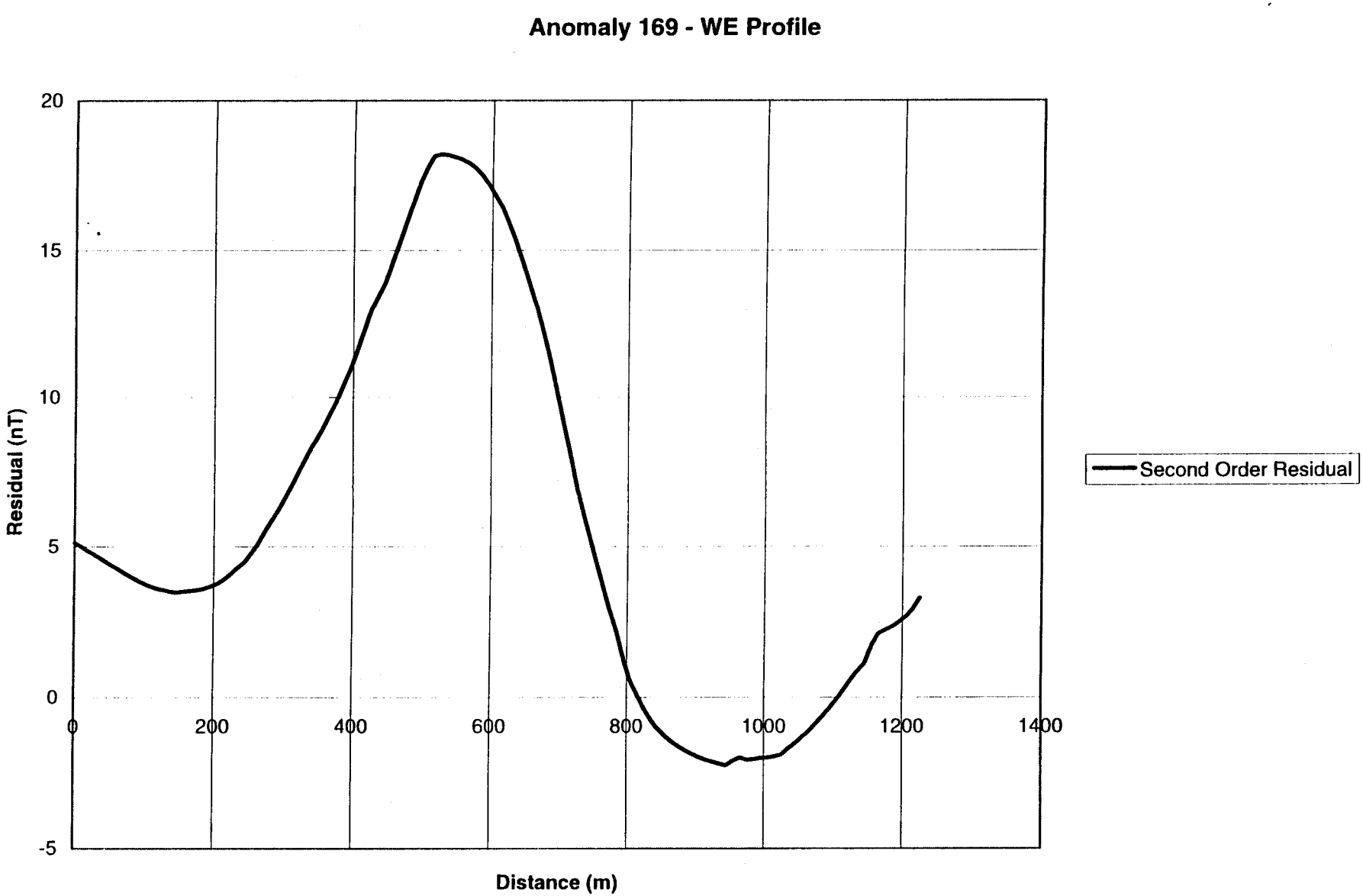

Anomaly 225 SE-NW profile
20
15
10
5
0
-5
-10
-15
-20
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual


Anomaly 70 - WE Profile
20
15
10
5
0
-5
-10
-15
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

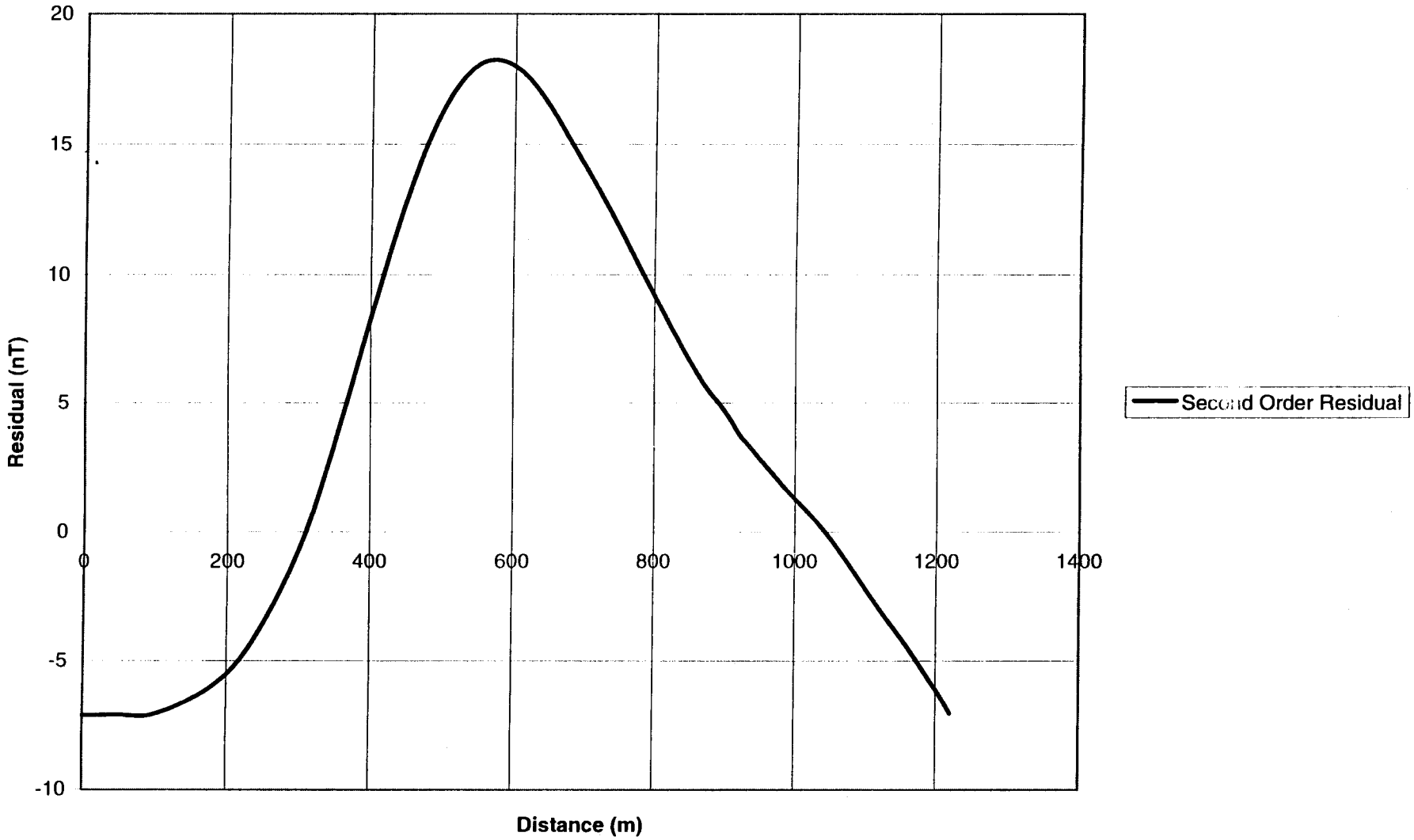

Anomaly 70 - SN Profile
20
15
10
5
0
-5
-10
-15
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

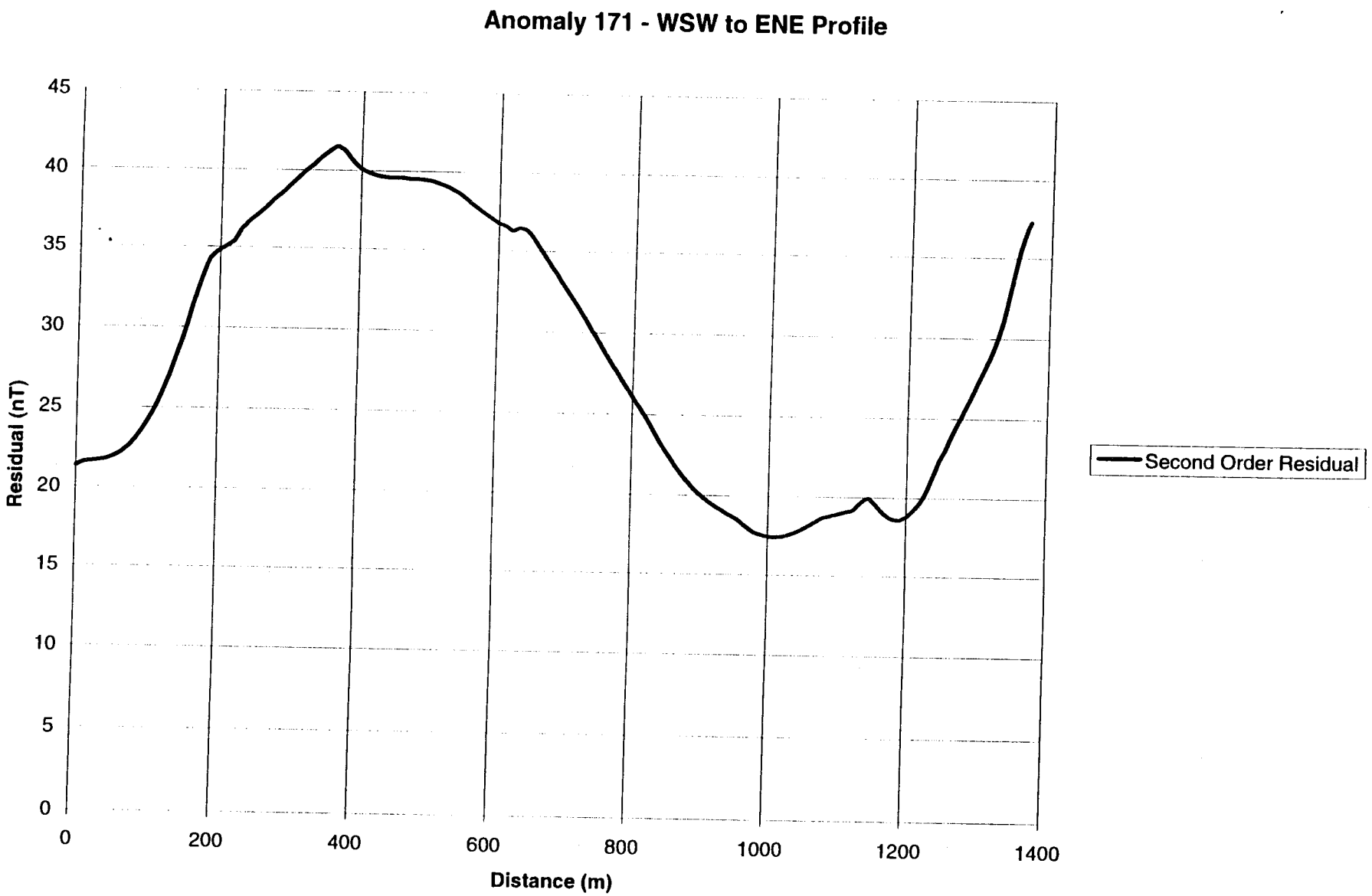

Anomaly 156 - WSW to ENE Profile
Residual (nT)
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

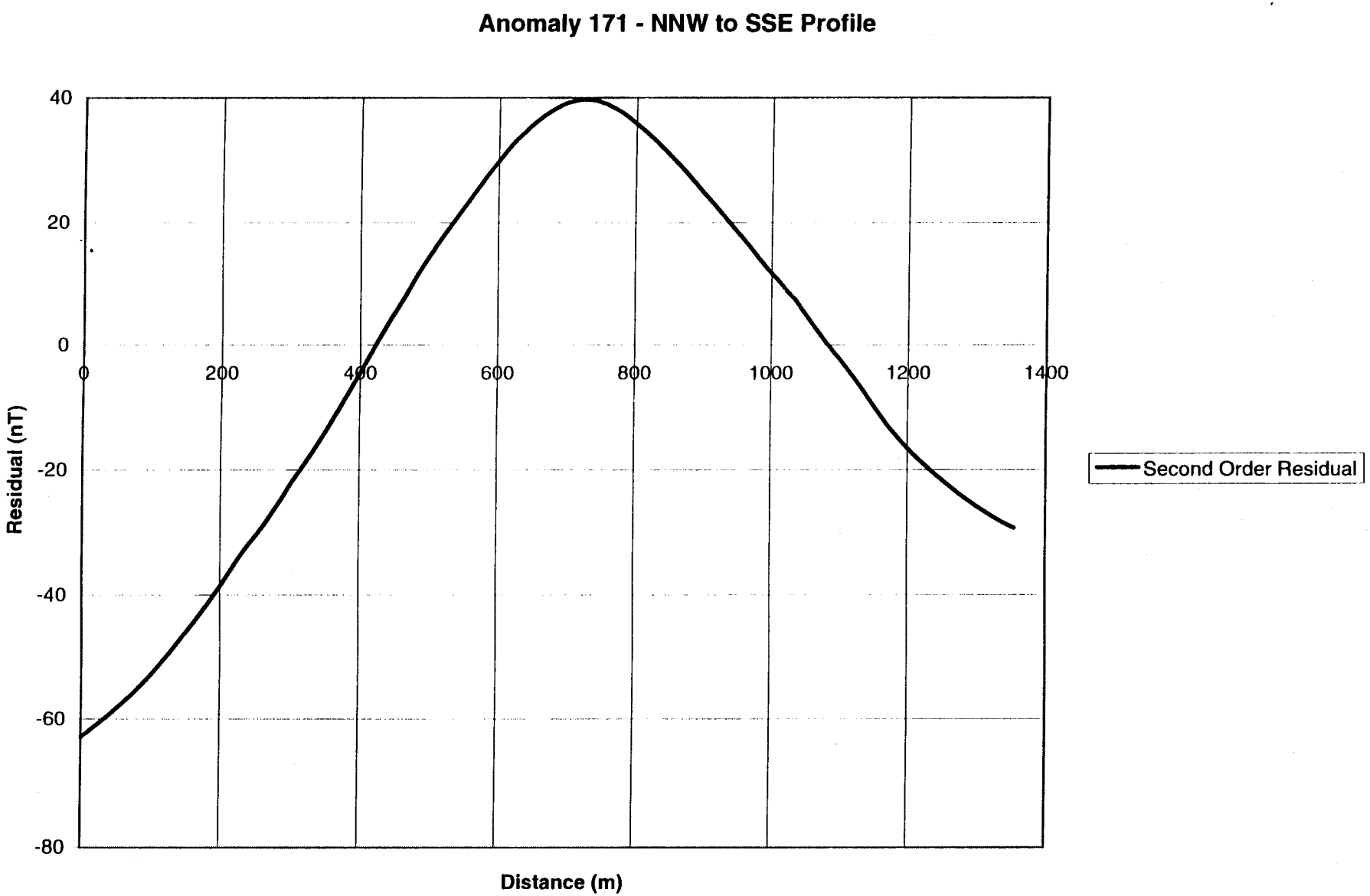

Anomaly 156 - NNW to SSE Profile
30
20
10
0
-10
-20
-30
-40
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

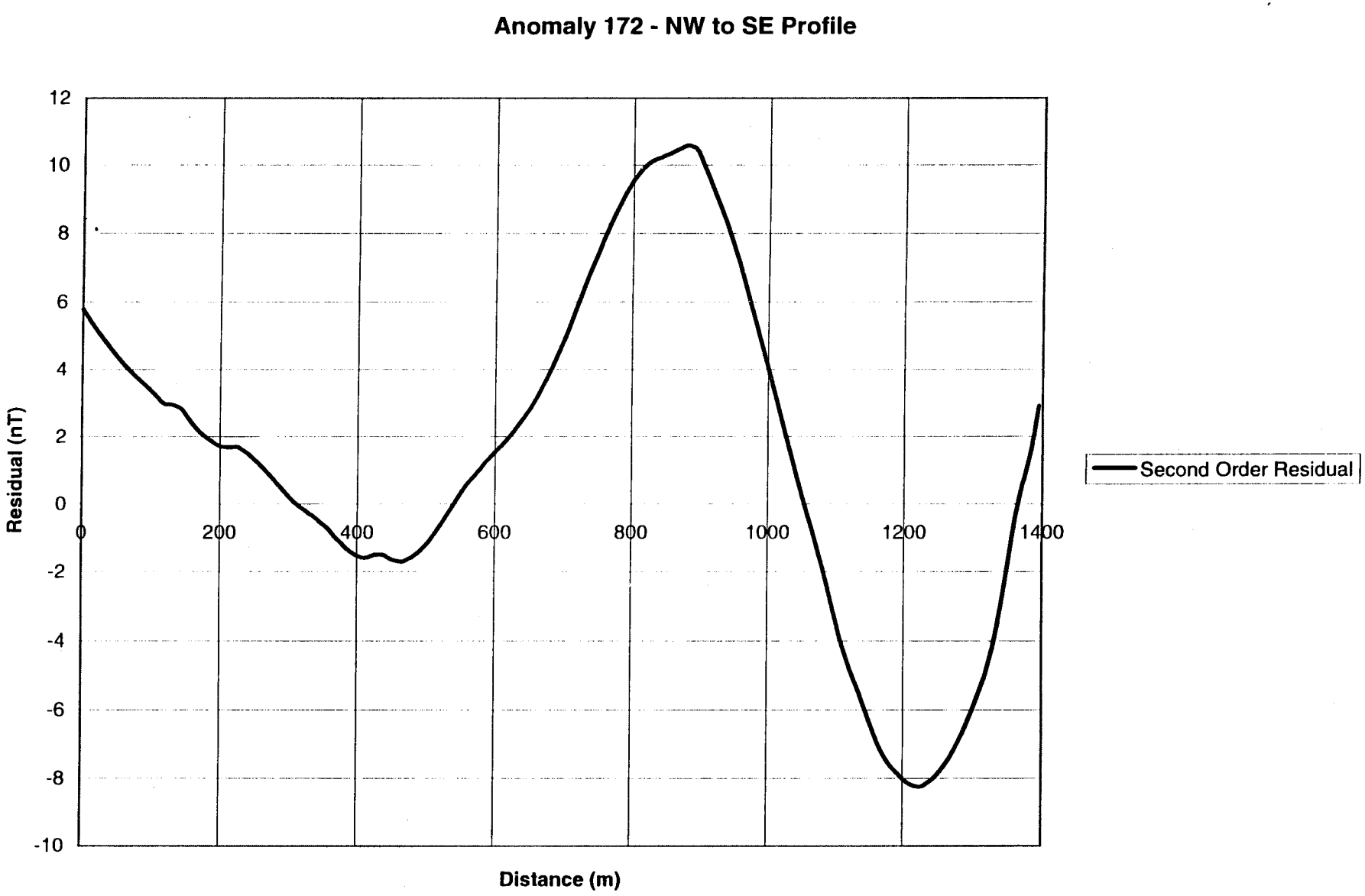

Anomaly 169 - WE Profile
20
15
10
5
0
-5
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

Anomaly 169 - SN Profile

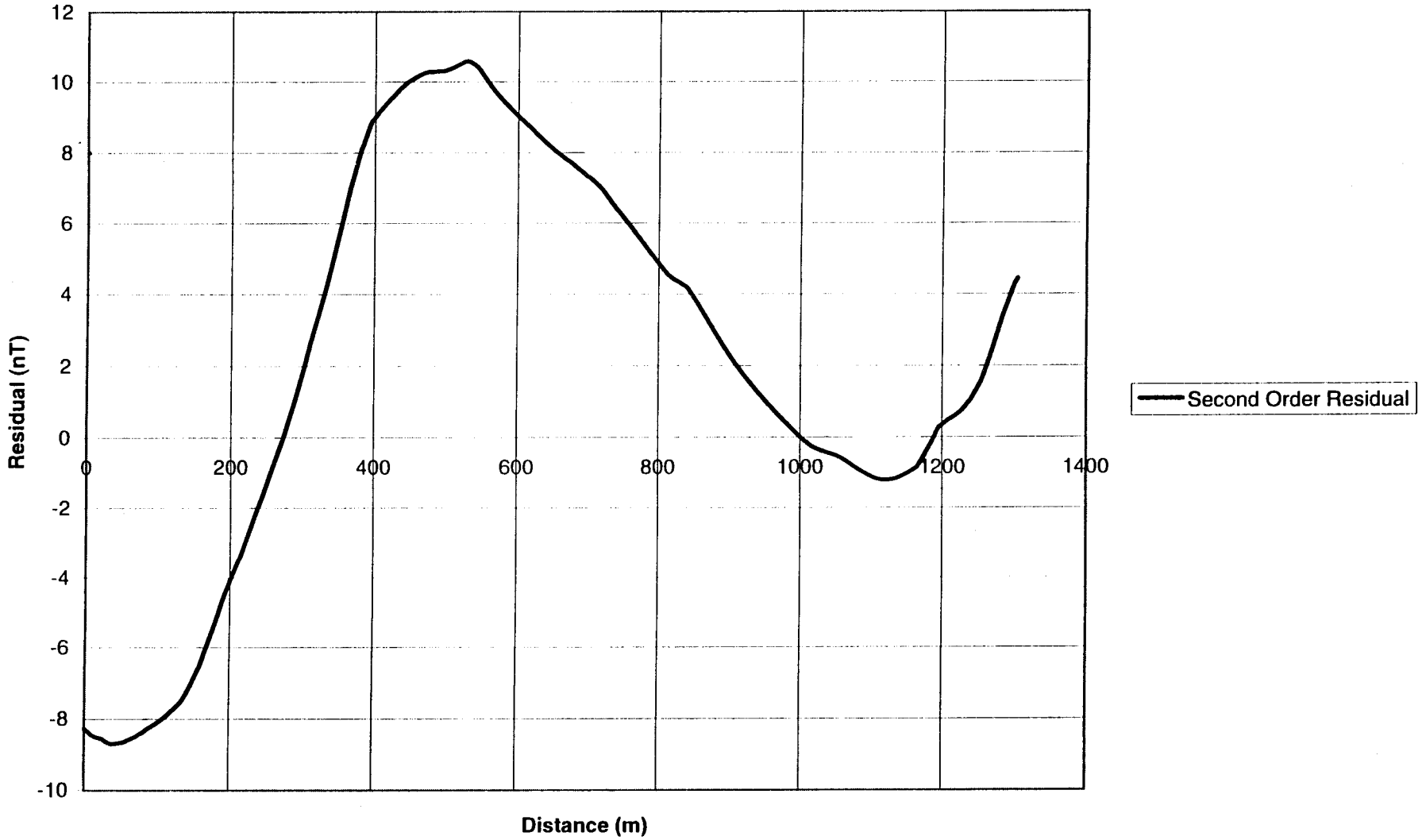


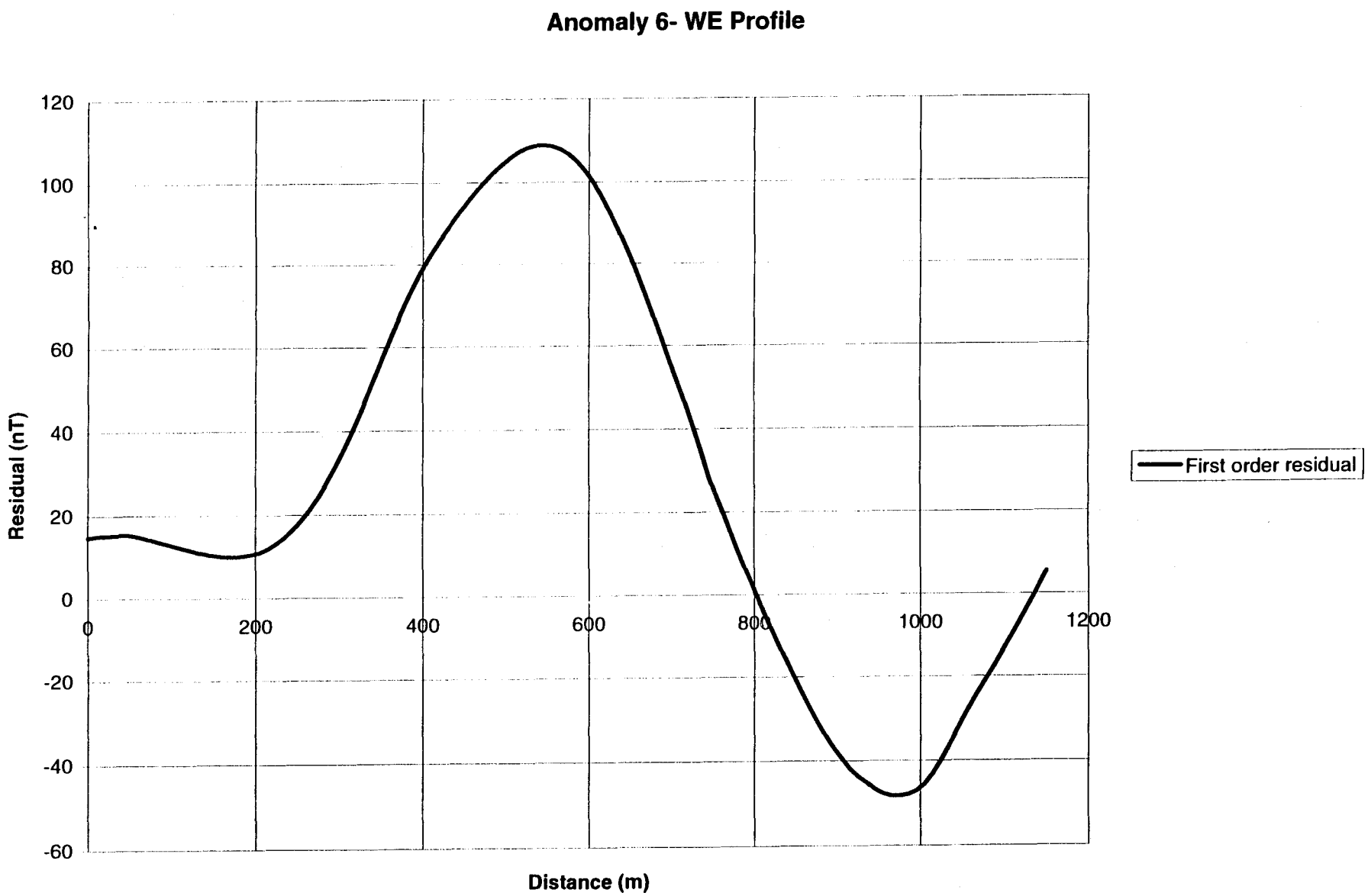

Anomaly 171 - WSW to ENE Profile
Residual (nT)
45
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual


Anomaly 171 - NNW to SSE Profile
40
20
0
-20
-40
-60
-80
0
200
400
600
800
1000
1200
1400
Residual (nT)
Distance (m)
Second Order Residual

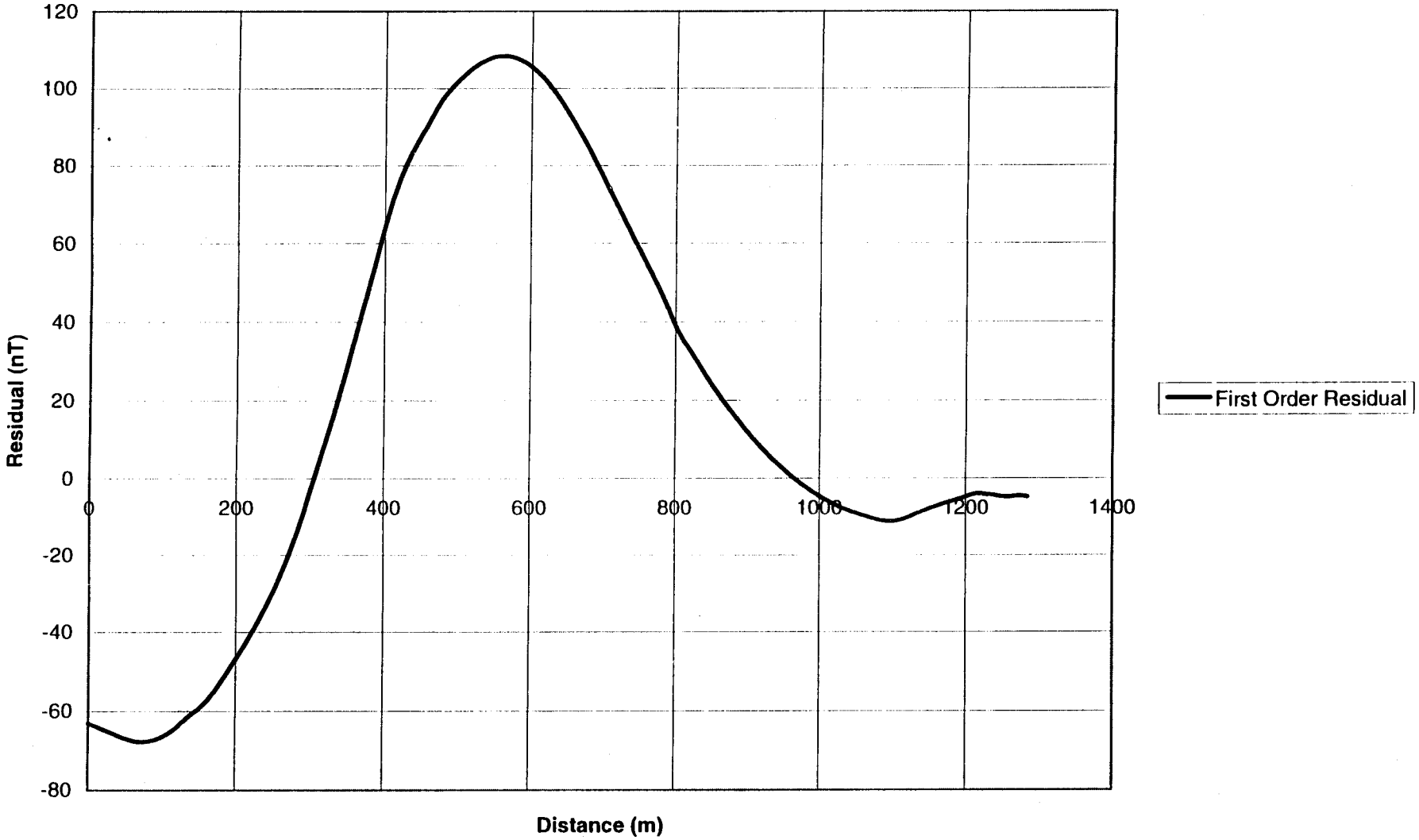

Anomaly 172 - NW to SE Profile
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

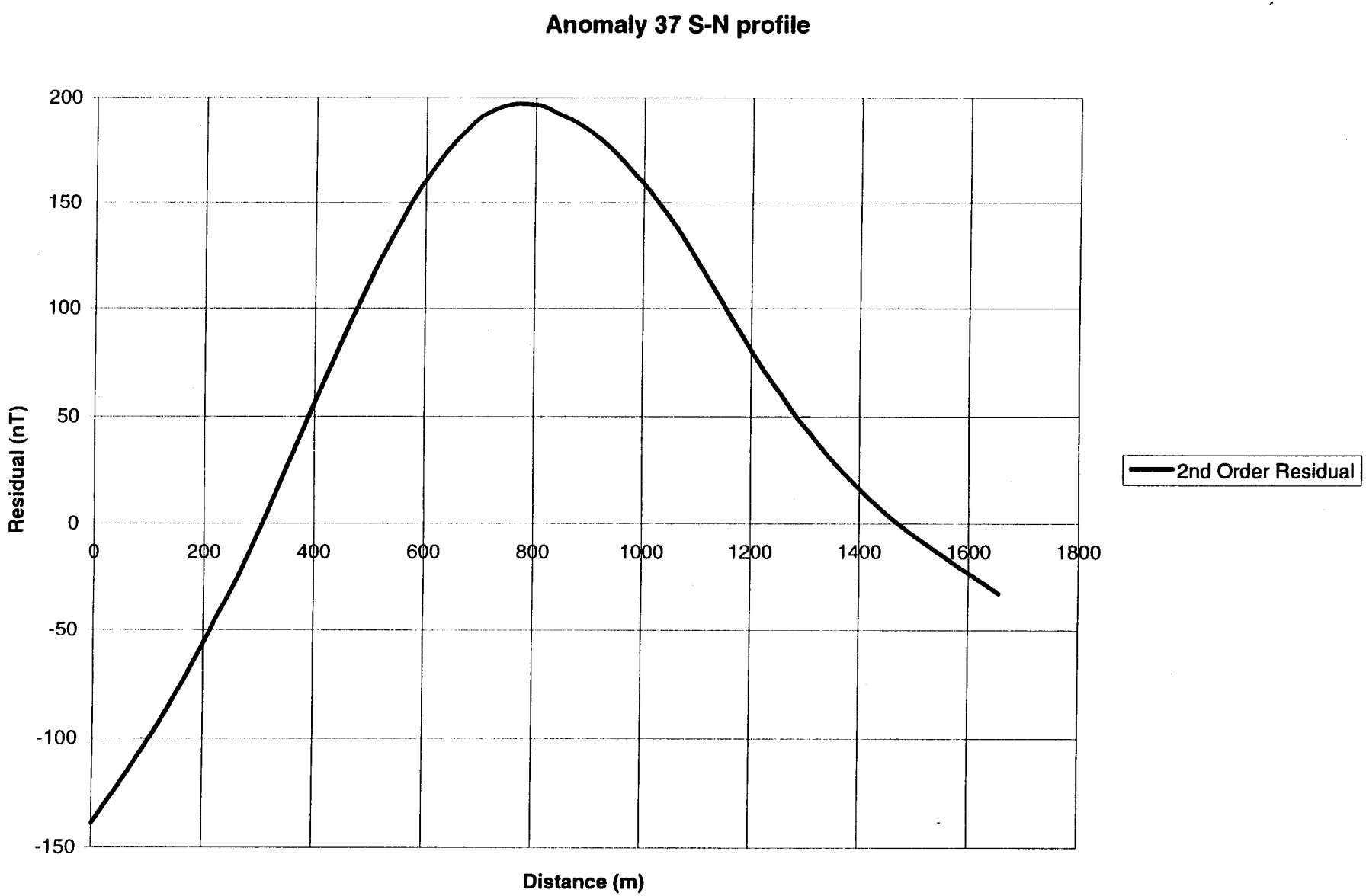
Anomaly 172 - SW to NE Profile

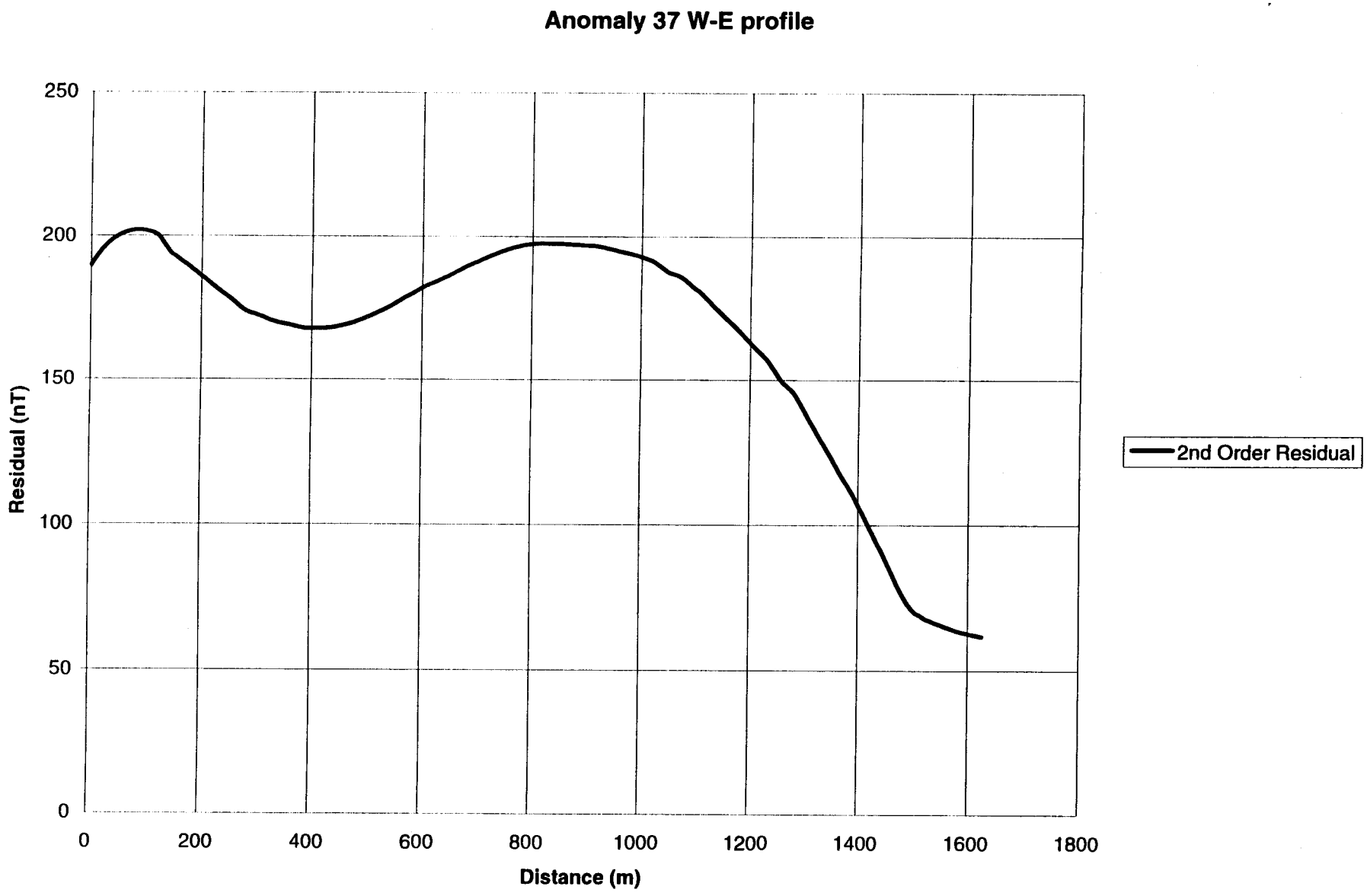


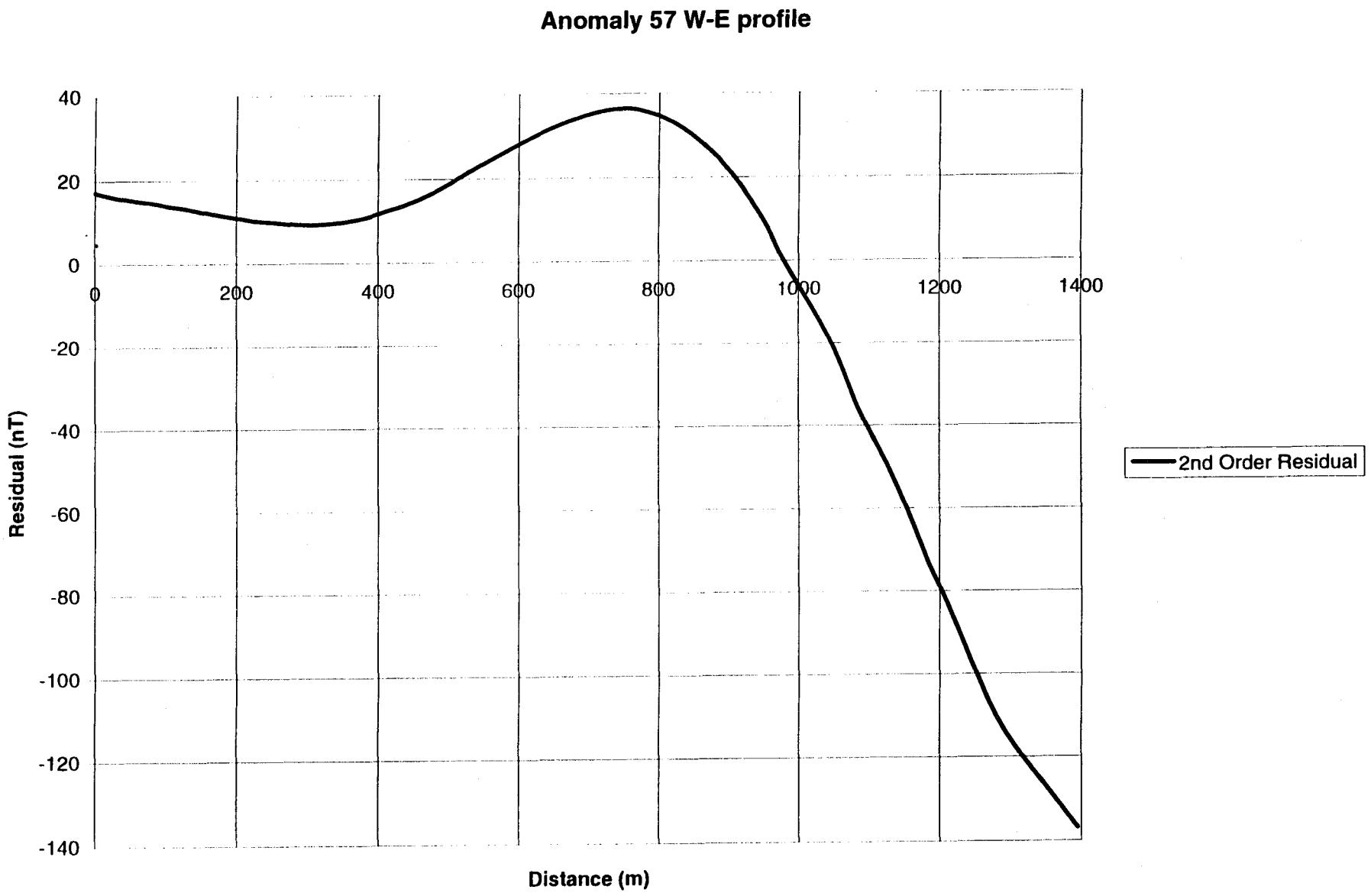

Anomaly 6- WE Profile
120
100
80
60
40
20
0
-20
-40
-60
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
First order residual

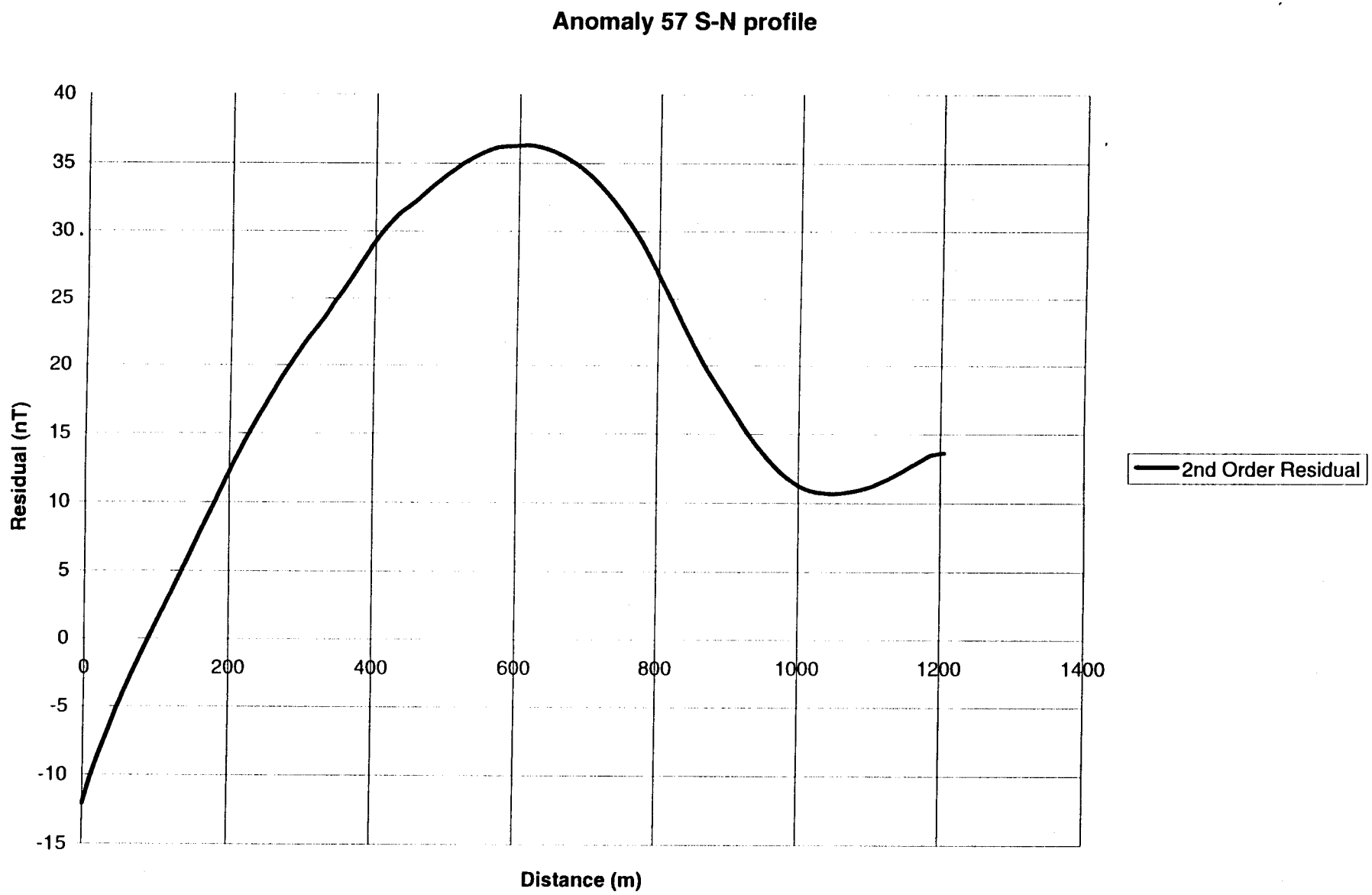
Anomaly 6 - SN Profile

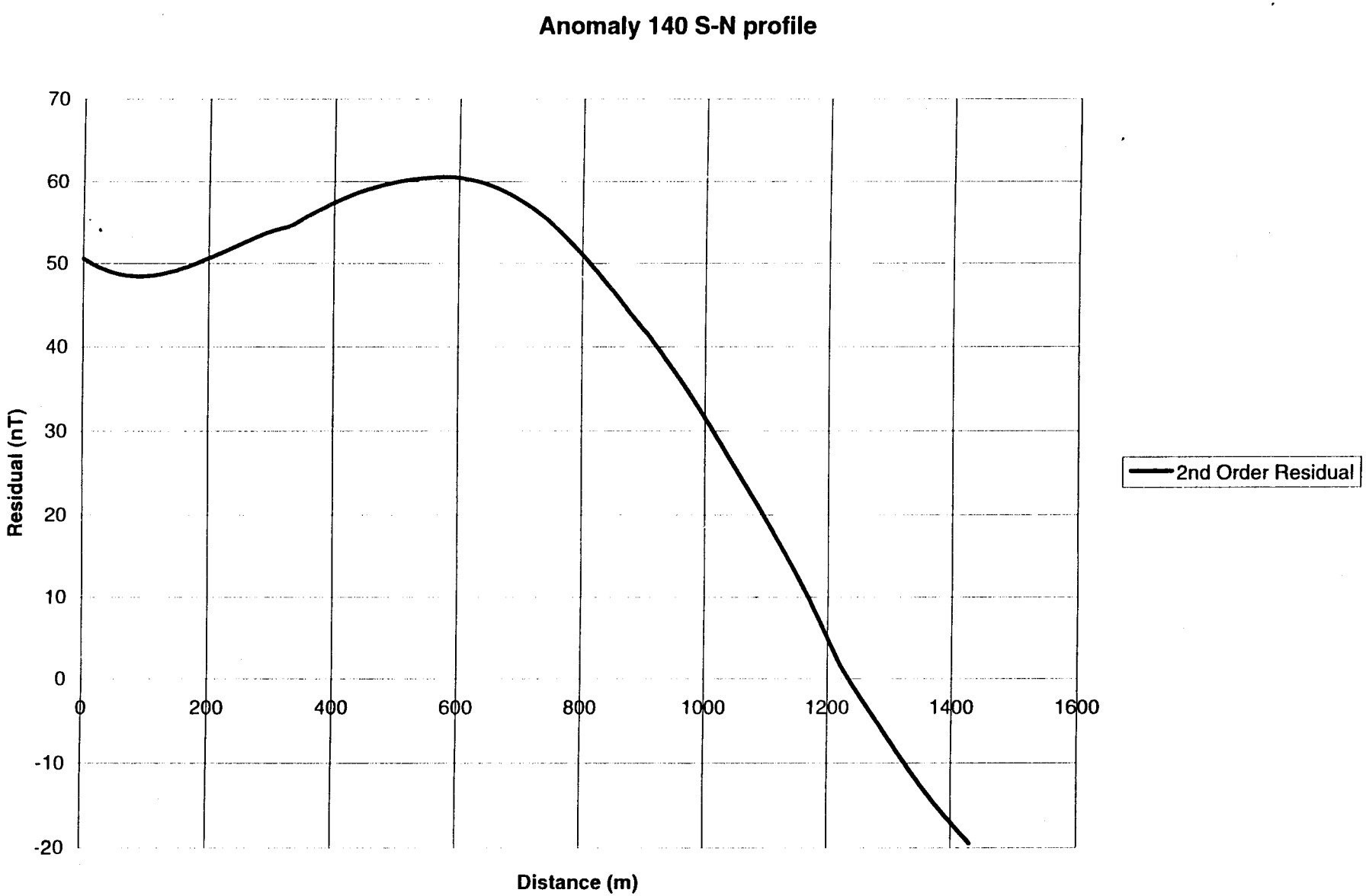


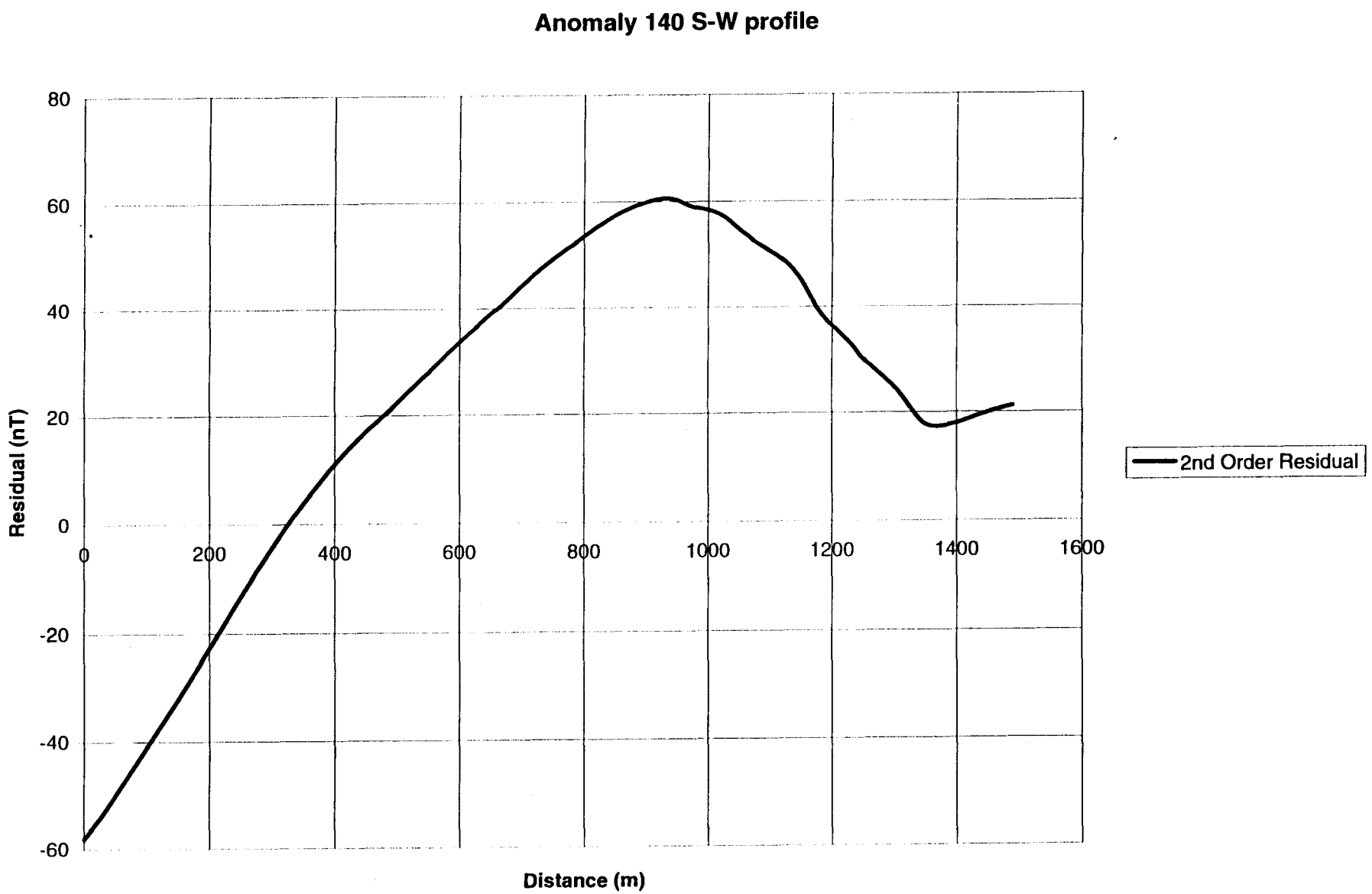

Anomaly 37 S-N profile
200
150
100
50
0
-50
-100
-150
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

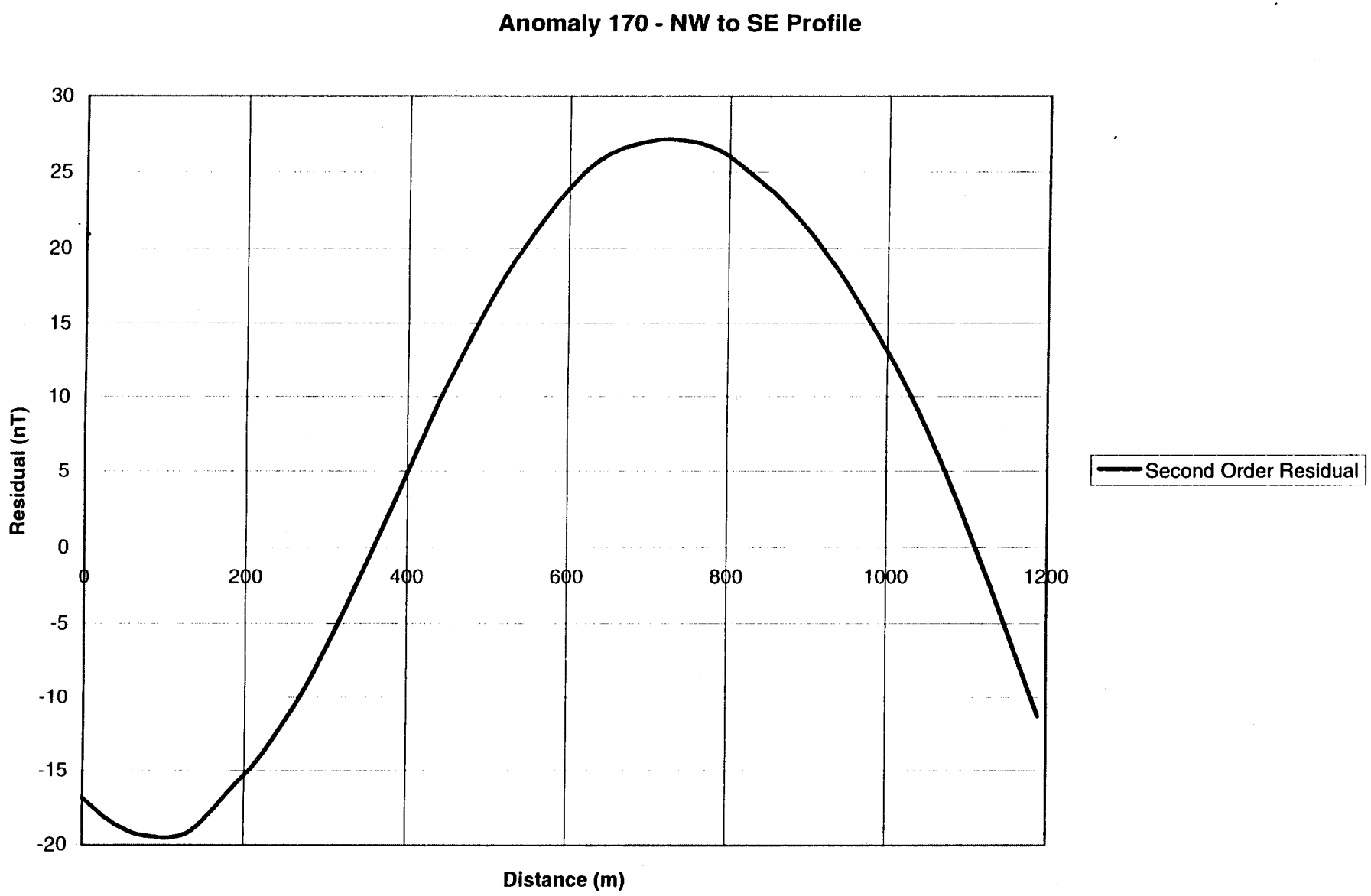

Anomaly 37 W-E profile
250
200
150
100
50
0
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

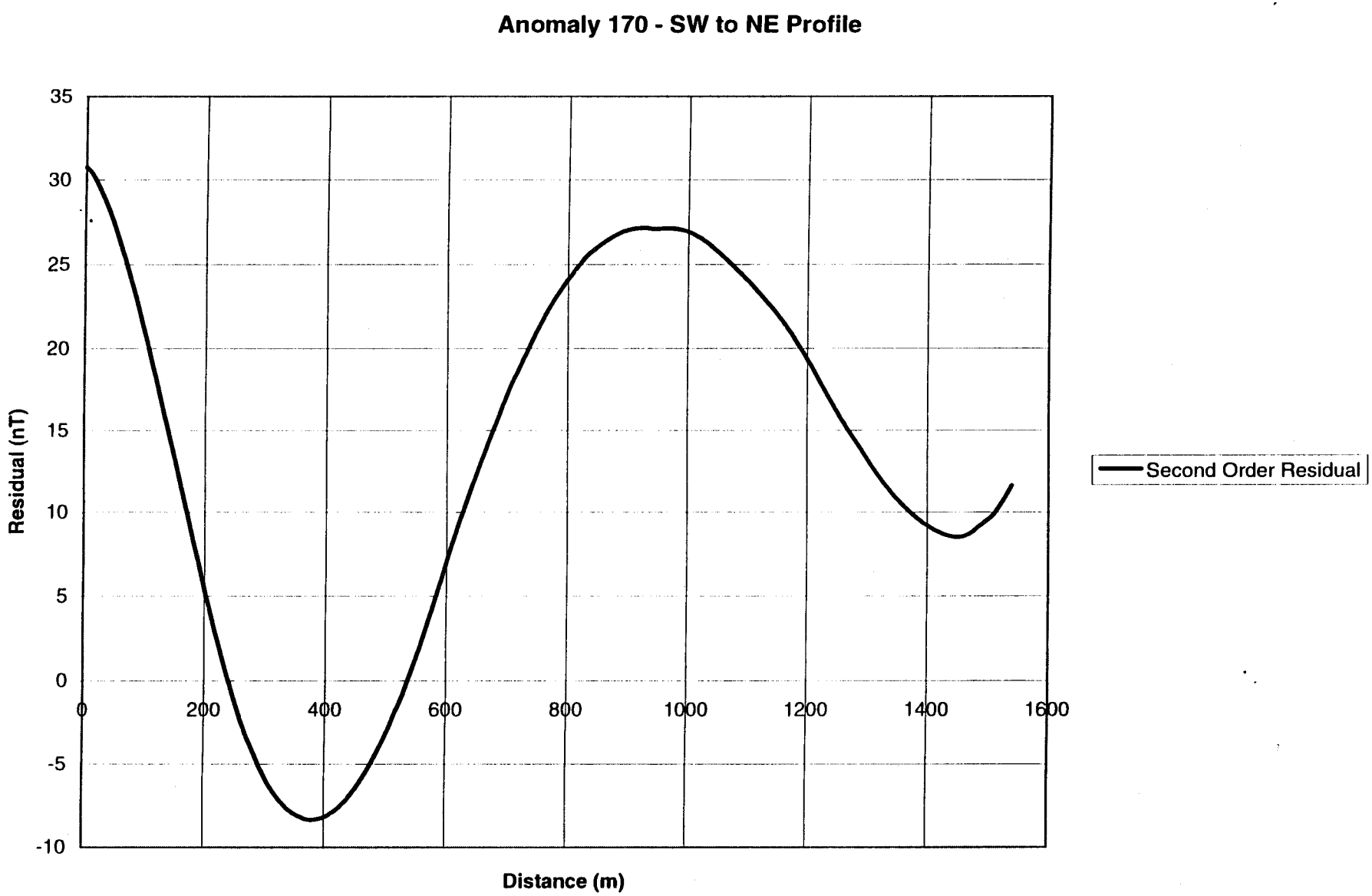

Anomaly 57 W-E profile
40
20
0
-20
-40
-60
-80
-100
-120
-140
0
200
400
600
800
1000
1200
1400
Residual (nT)
Distance (m)
2nd Order Residual

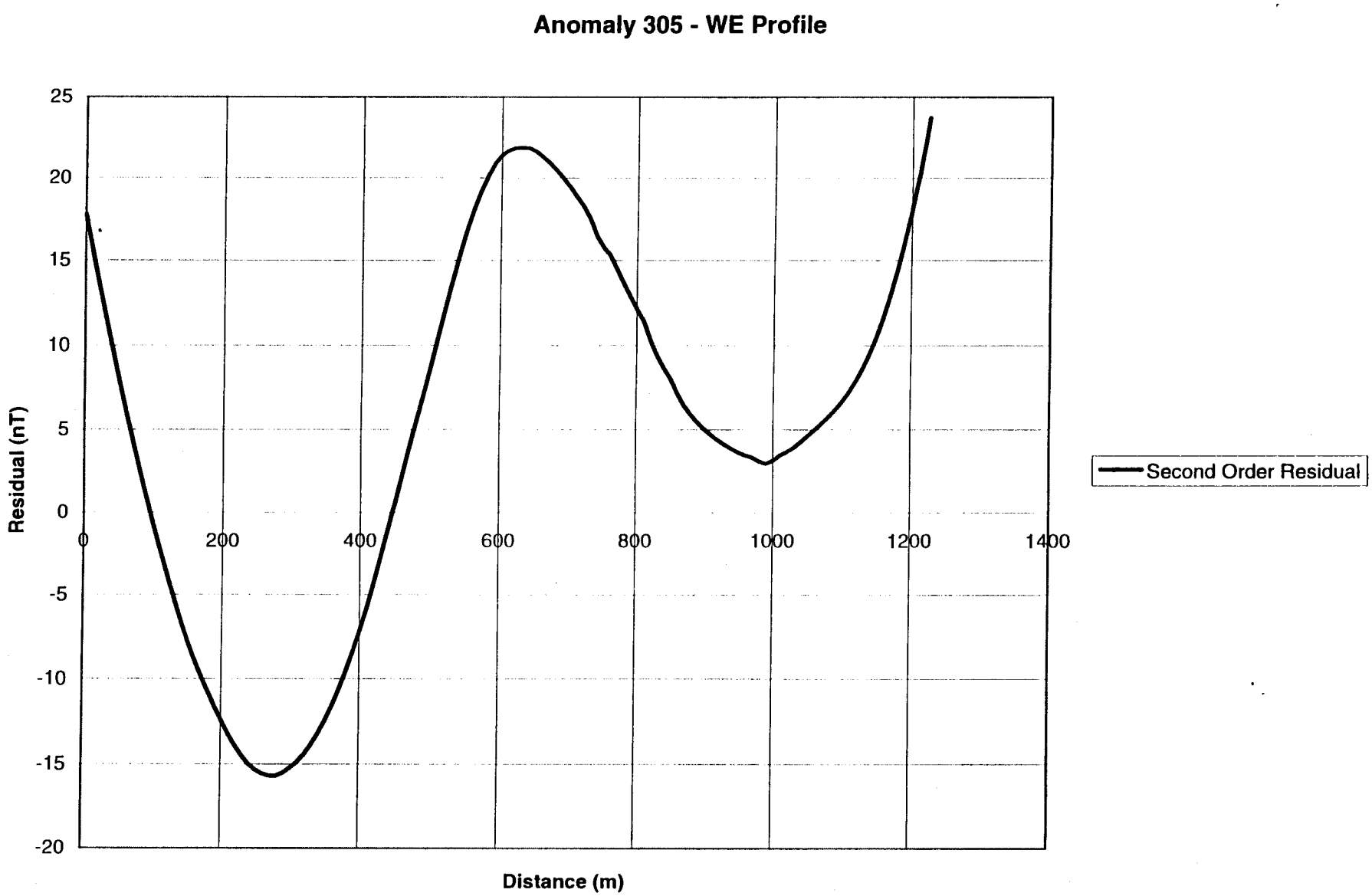

Anomaly 57 S-N profile
Residual (nT)
40
35
30
25
20
15
10
5
0
-5
-10
-15
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual


Anomaly 140 S-N profile
70
60
50
40
30
20
10
0
-10
-20
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
Distance (m)
2nd Order Residual

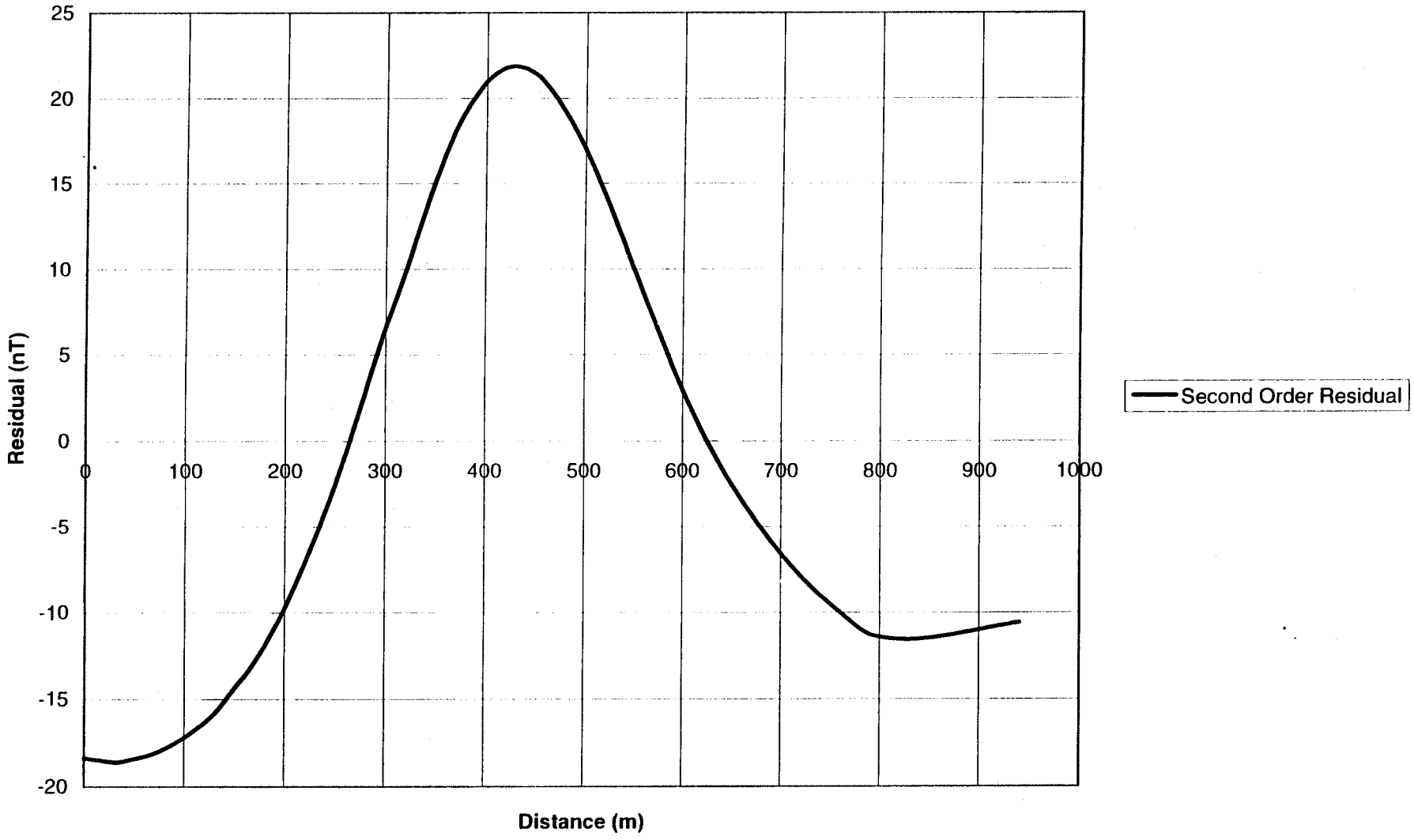

Anomaly 140 S-W profile
80
60
40
20
0
-20
-40
-60
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
Distance (m)
2nd Order Residual

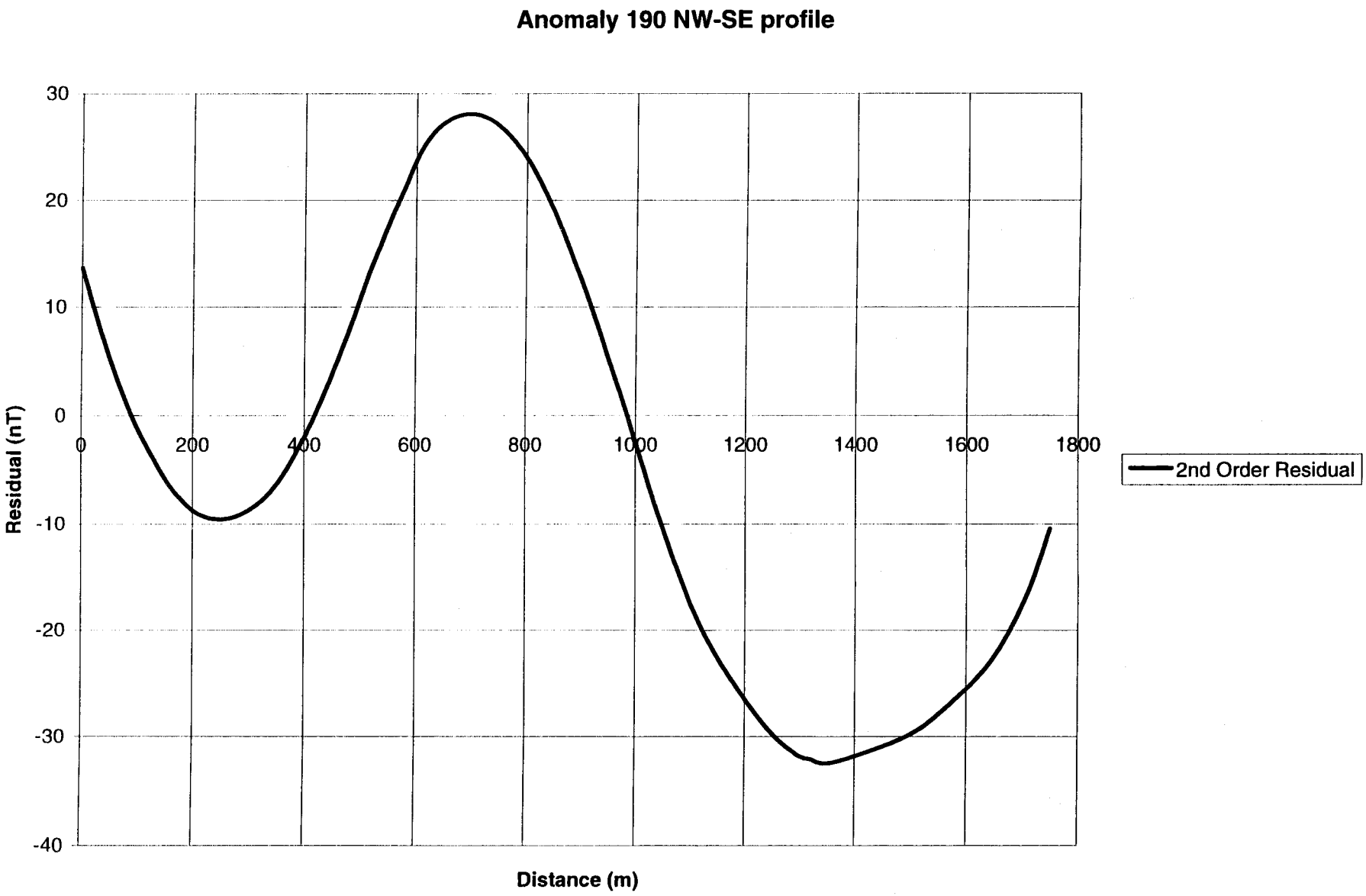

Anomaly 170 - NW to SE Profile
30
25
20
15
10
5
0
-5
-10
-15
-20
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
Second Order Residual

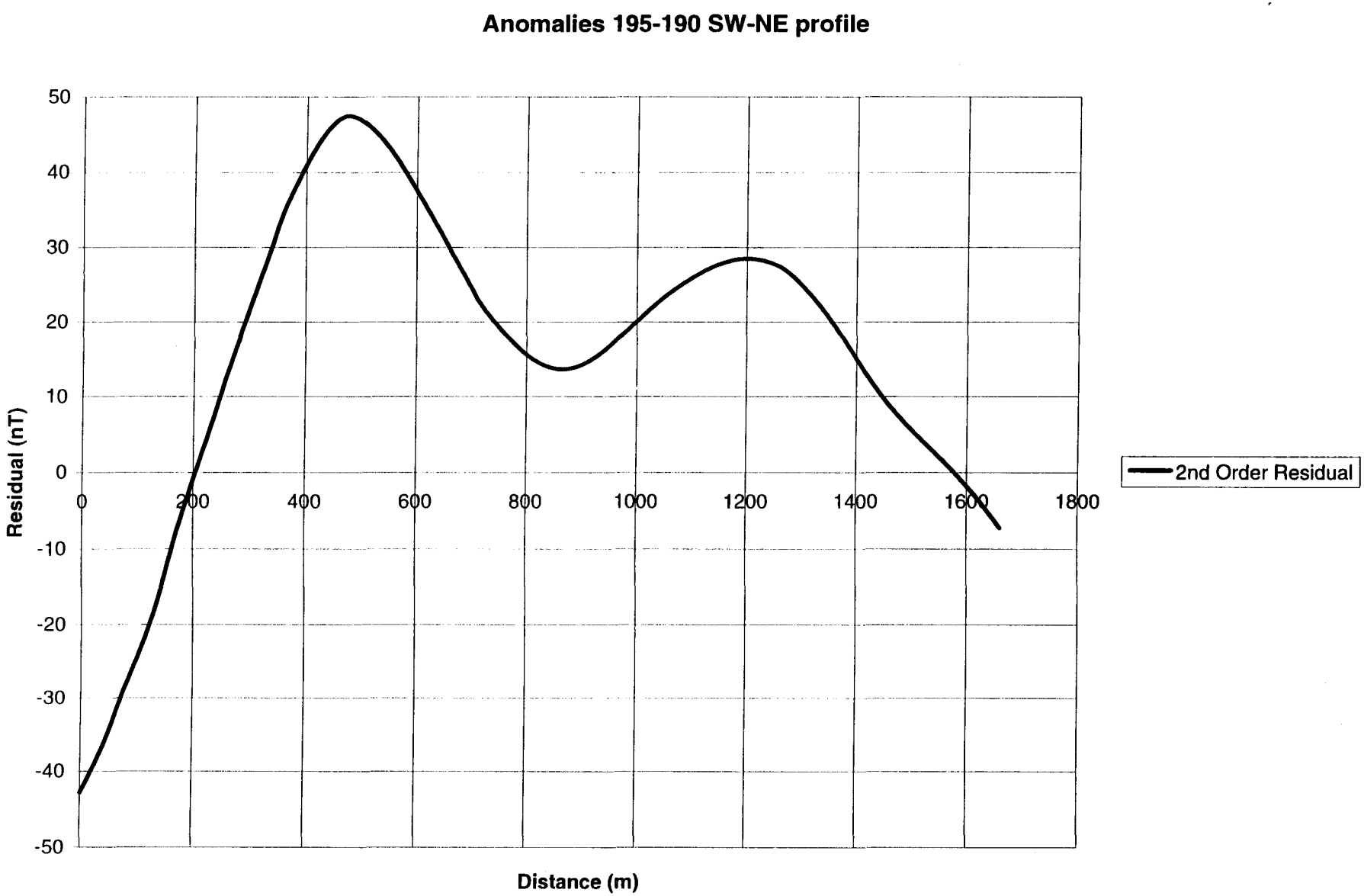

Anomaly 170 - SW to NE Profile
35
30
25
20
15
10
5
0
-5
-10
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
Distance (m)
Second Order Residual

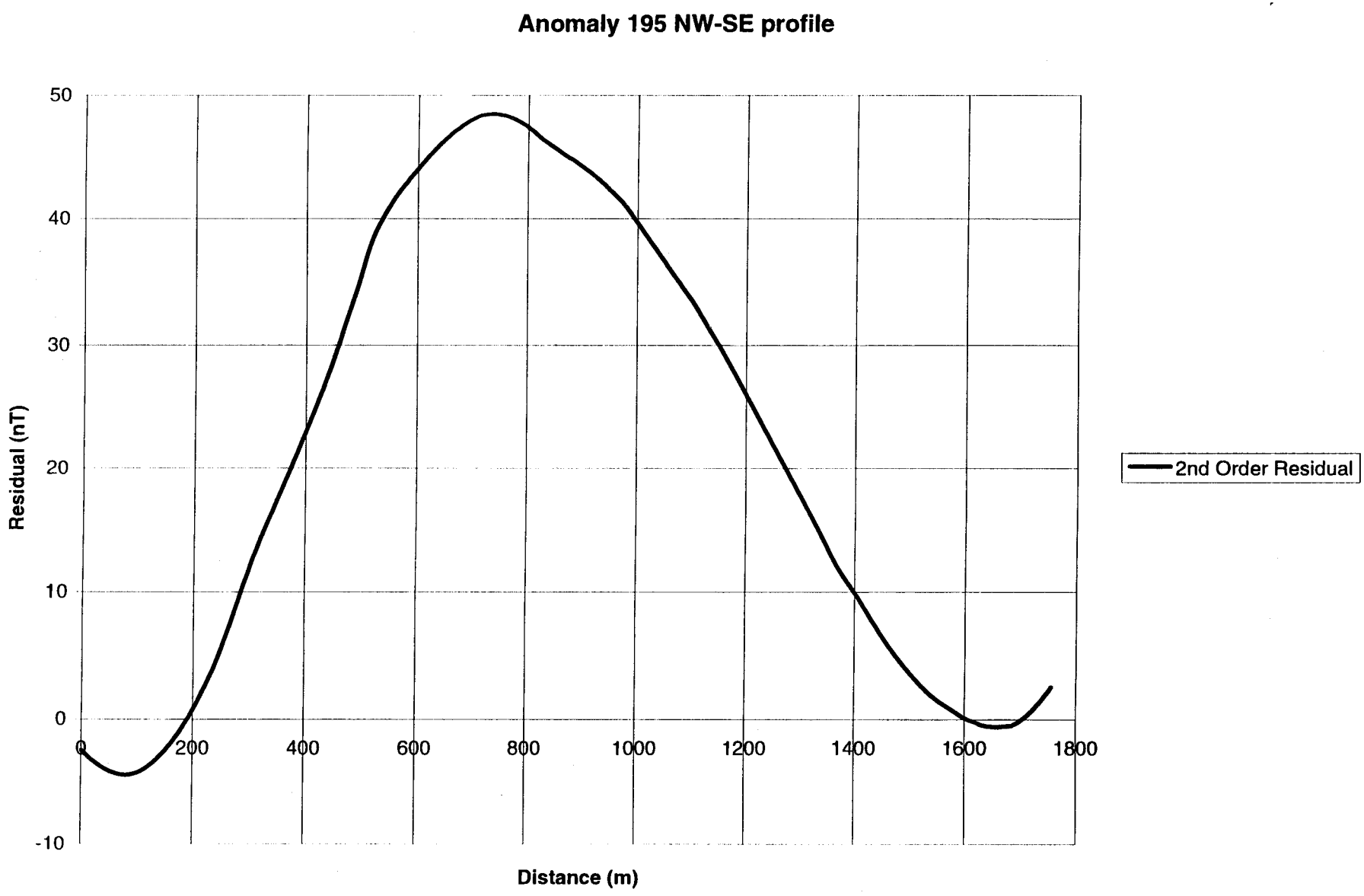

Anomaly 305 - WE Profile
25
20
15
10
5
0
-5
-10
-15
-20
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

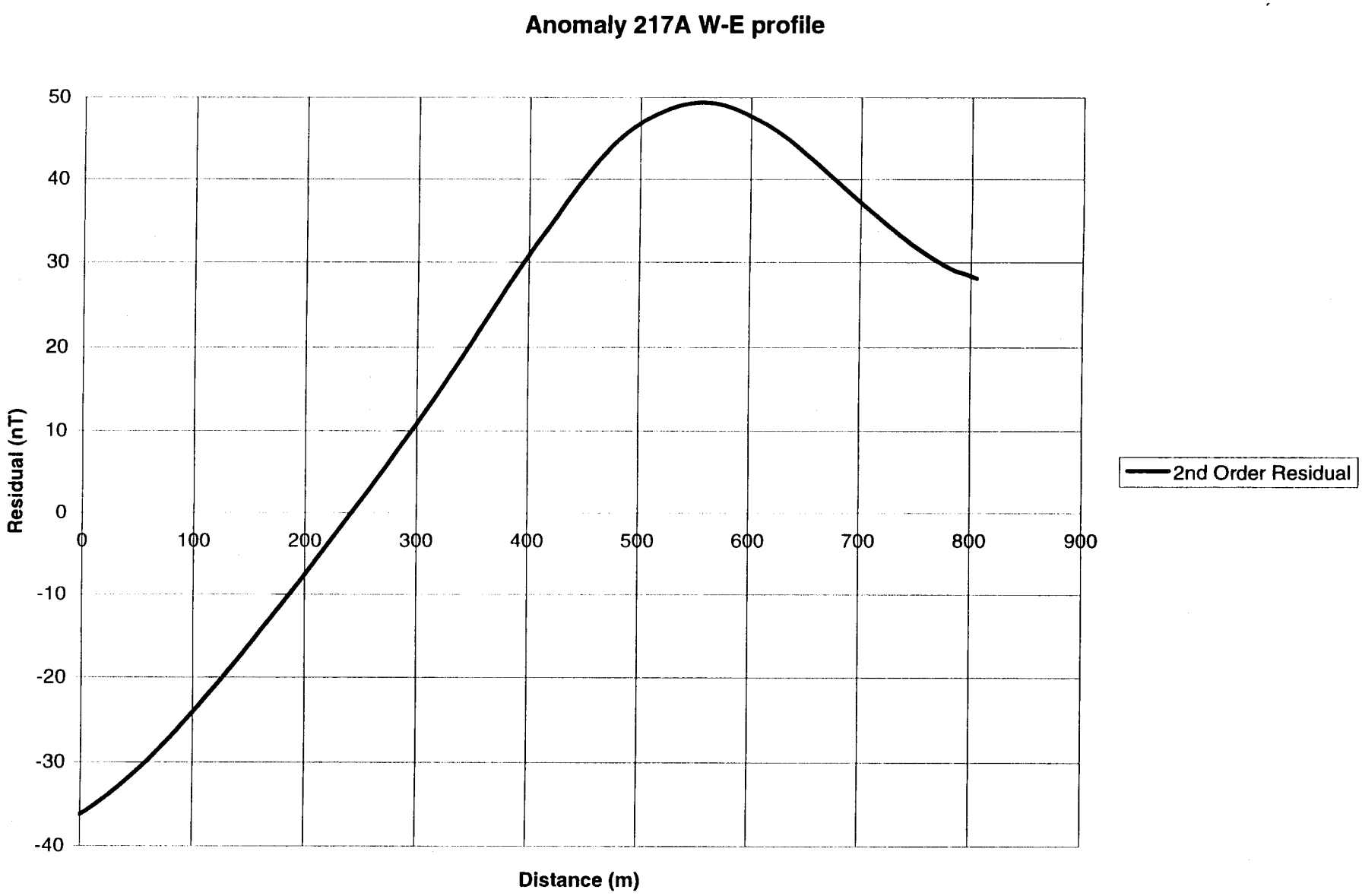
Anomaly 305 - SN Profile

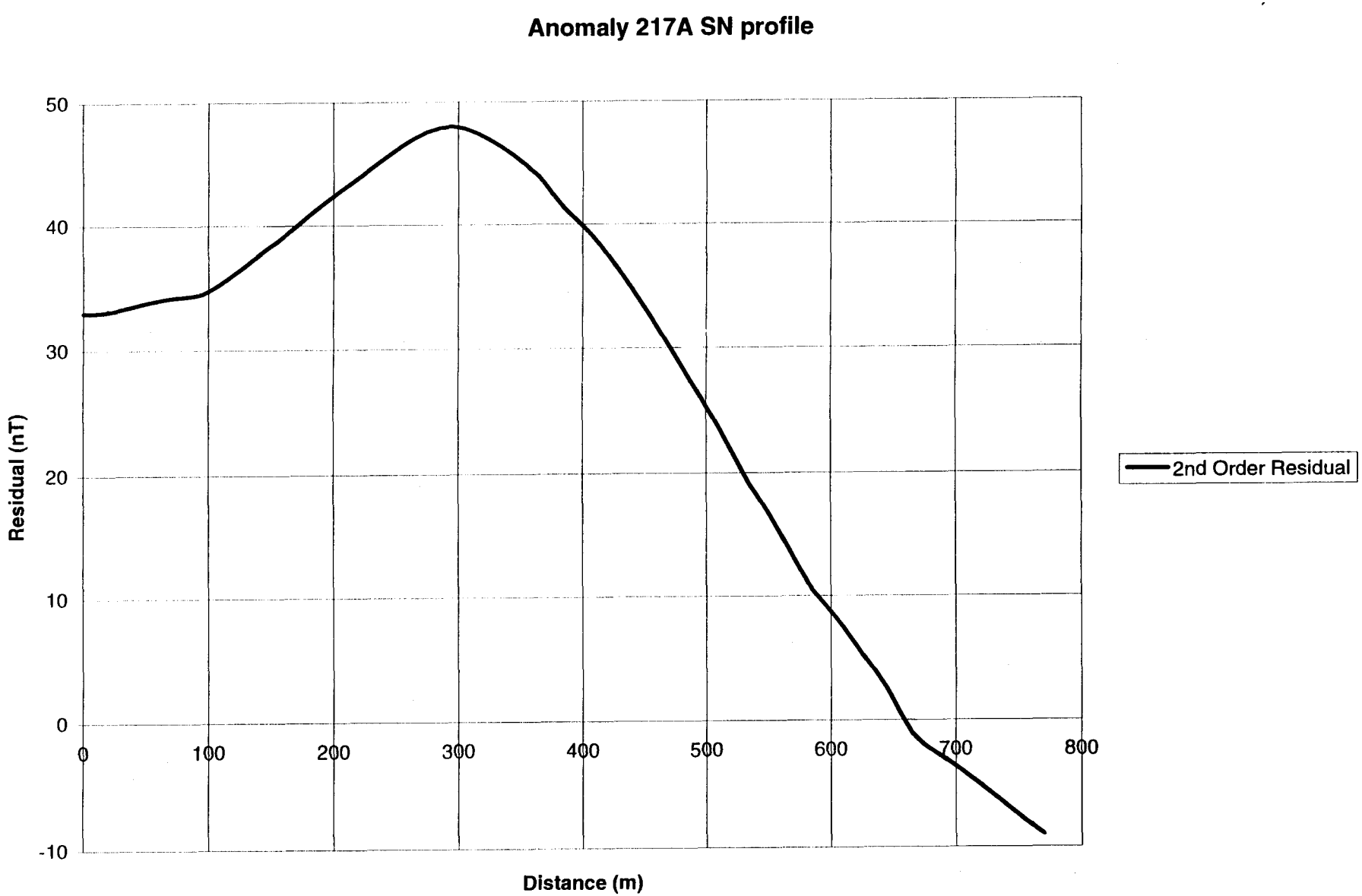


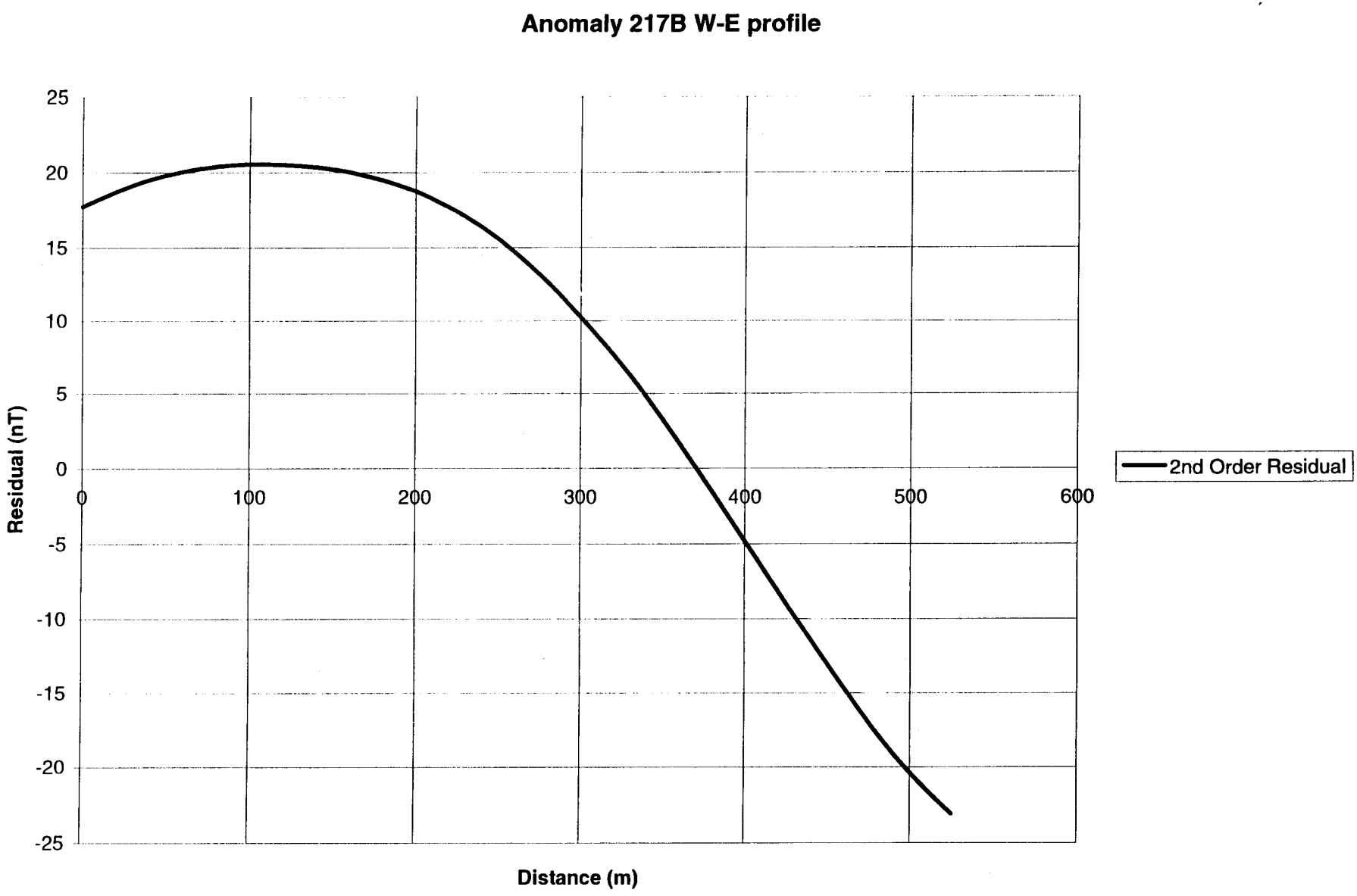

Anomaly 190 NW-SE profile
30
20
10
0
-10
-20
-30
-40
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

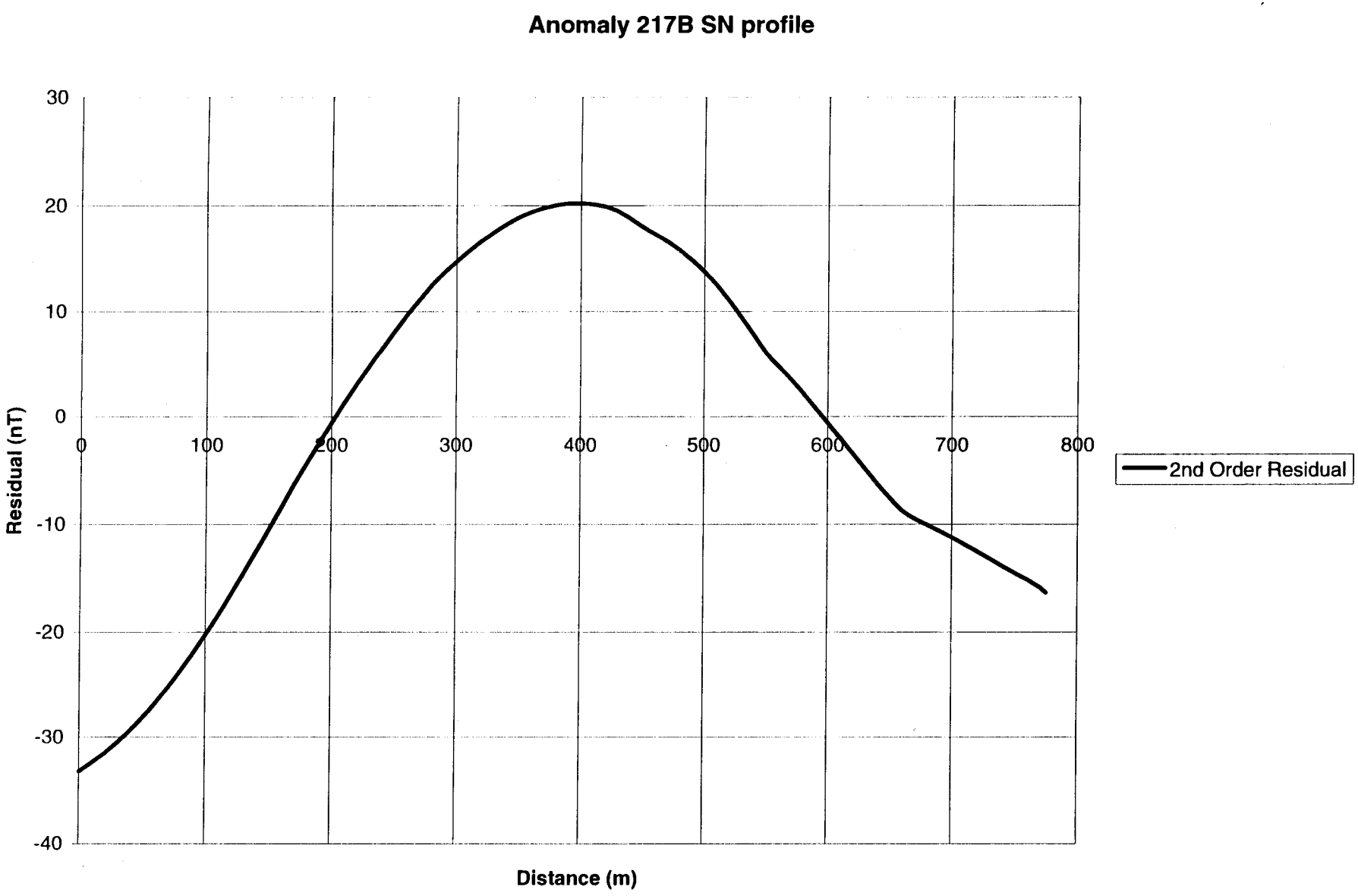

Anomalies 195-190 SW-NE profile
Residual (nT)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

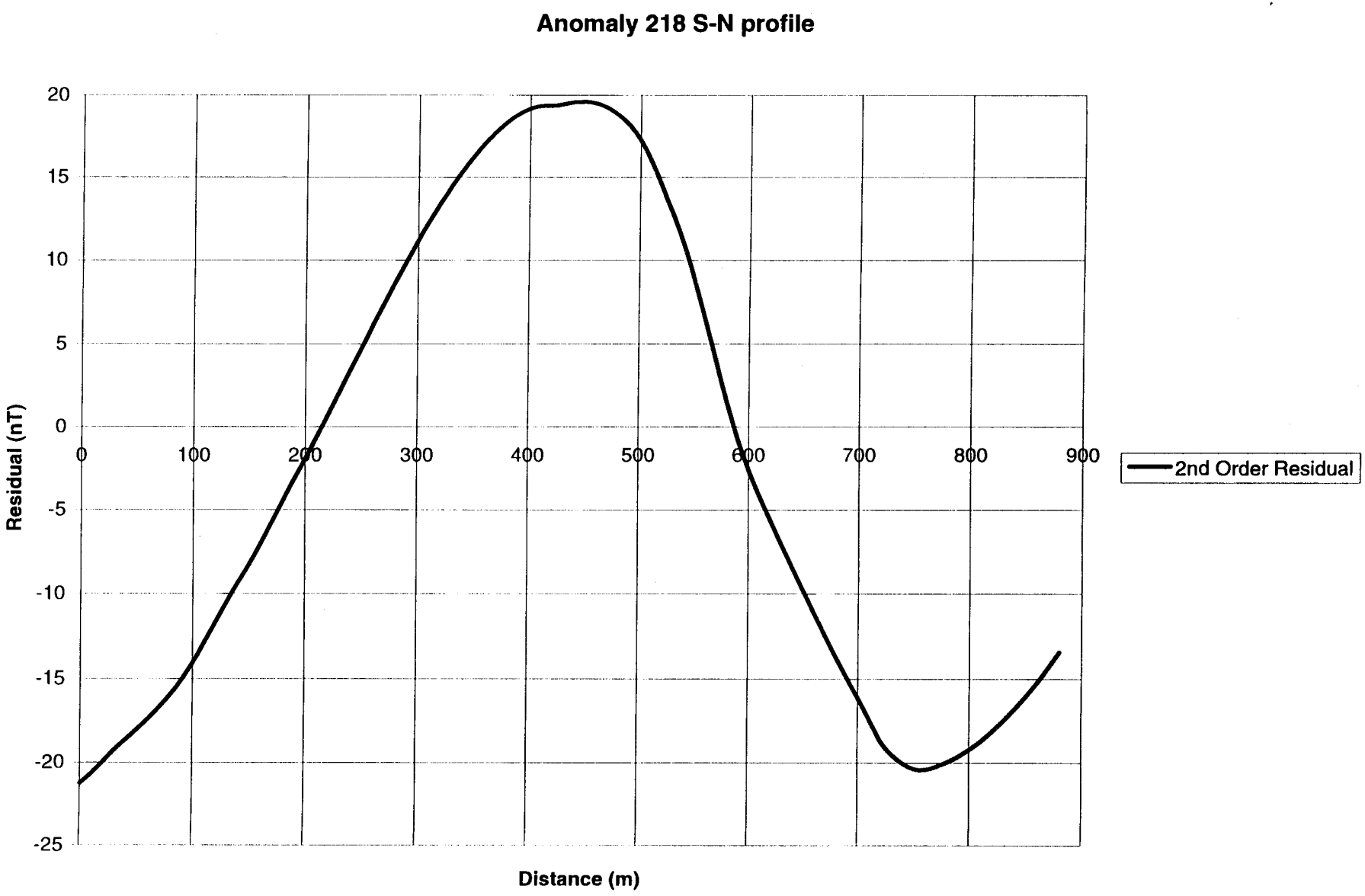

Anomaly 195 NW-SE profile
Residual (nT)
50
40
30
20
10
0
-10
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

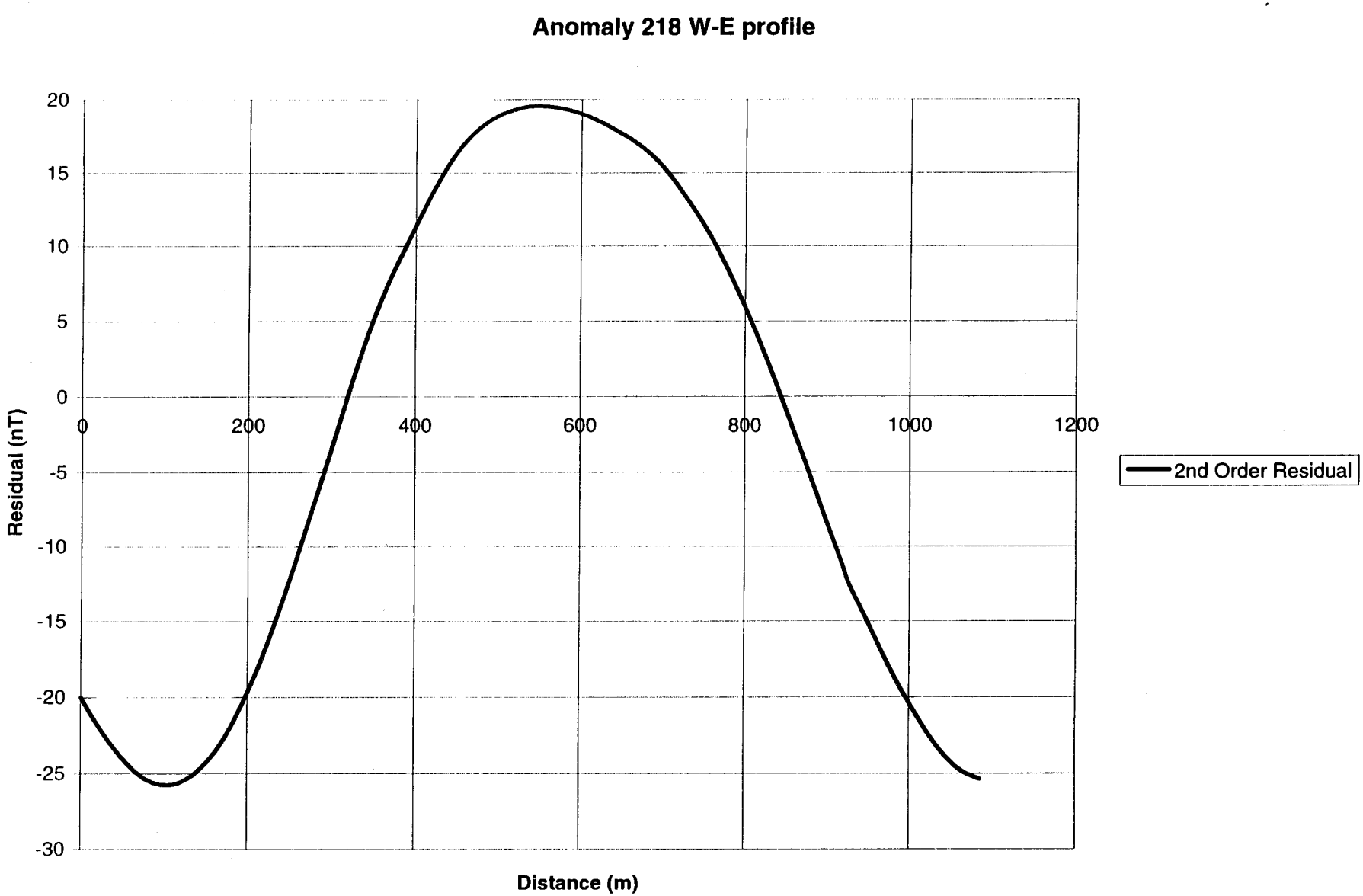

Anomaly 217A W-E profile
Residual (nT)
50
40
30
20
10
0
-10
-20
-30
-40
0
100
200
300
400
500
600
700
800
900
Distance (m)
2nd Order Residual

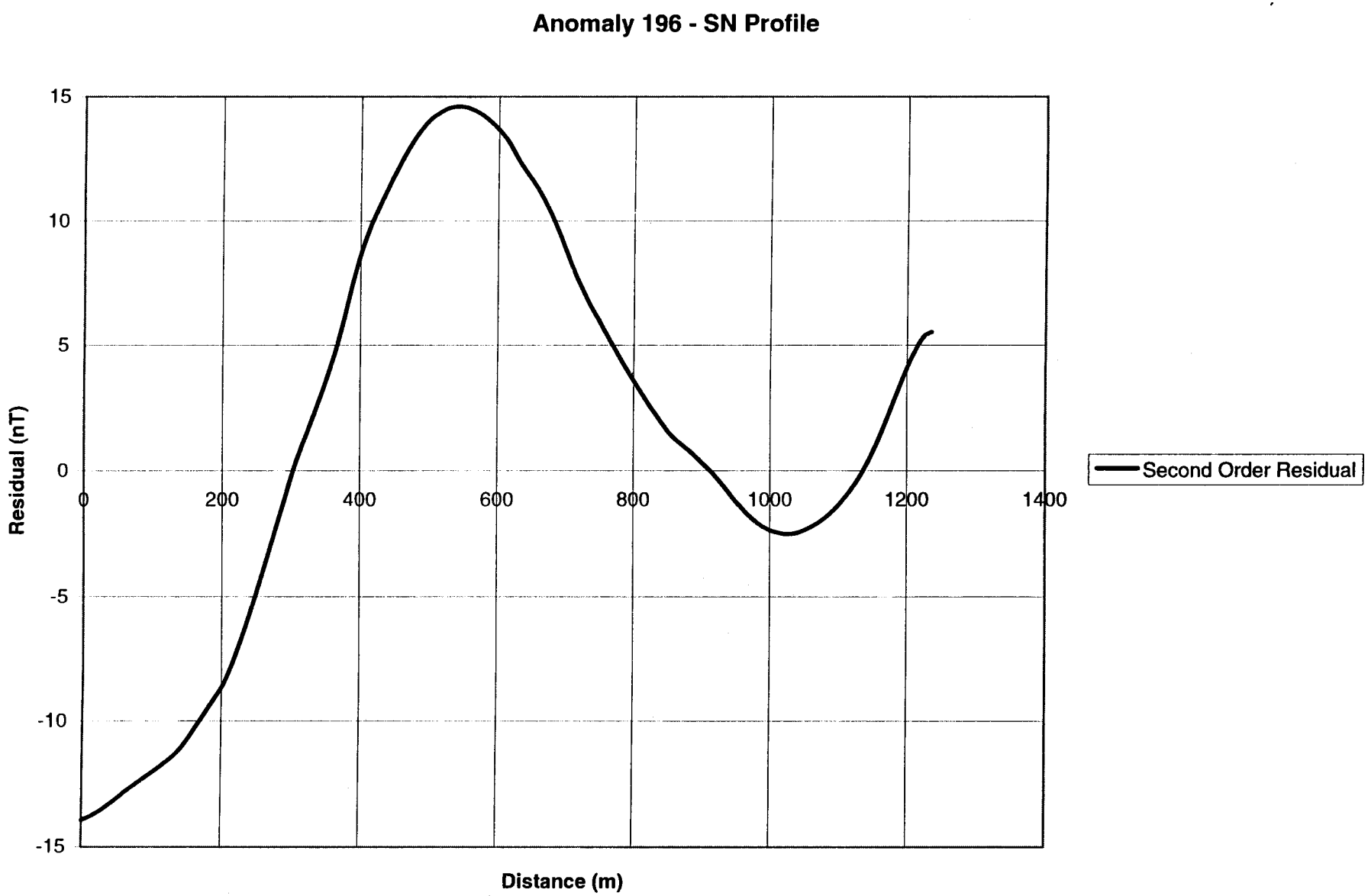

Anomaly 217A SN profile
50
40
30
20
10
0
-10
Residual (nT)
0
100
200
300
400
500
600
700
800
Distance (m)
2nd Order Residual


Anomaly 217B W-E profile
25
20
15
10
5
0
-5
-10
-15
-20
-25
Residual (nT)
0
100
200
300
400
500
600
Distance (m)
2nd Order Residual

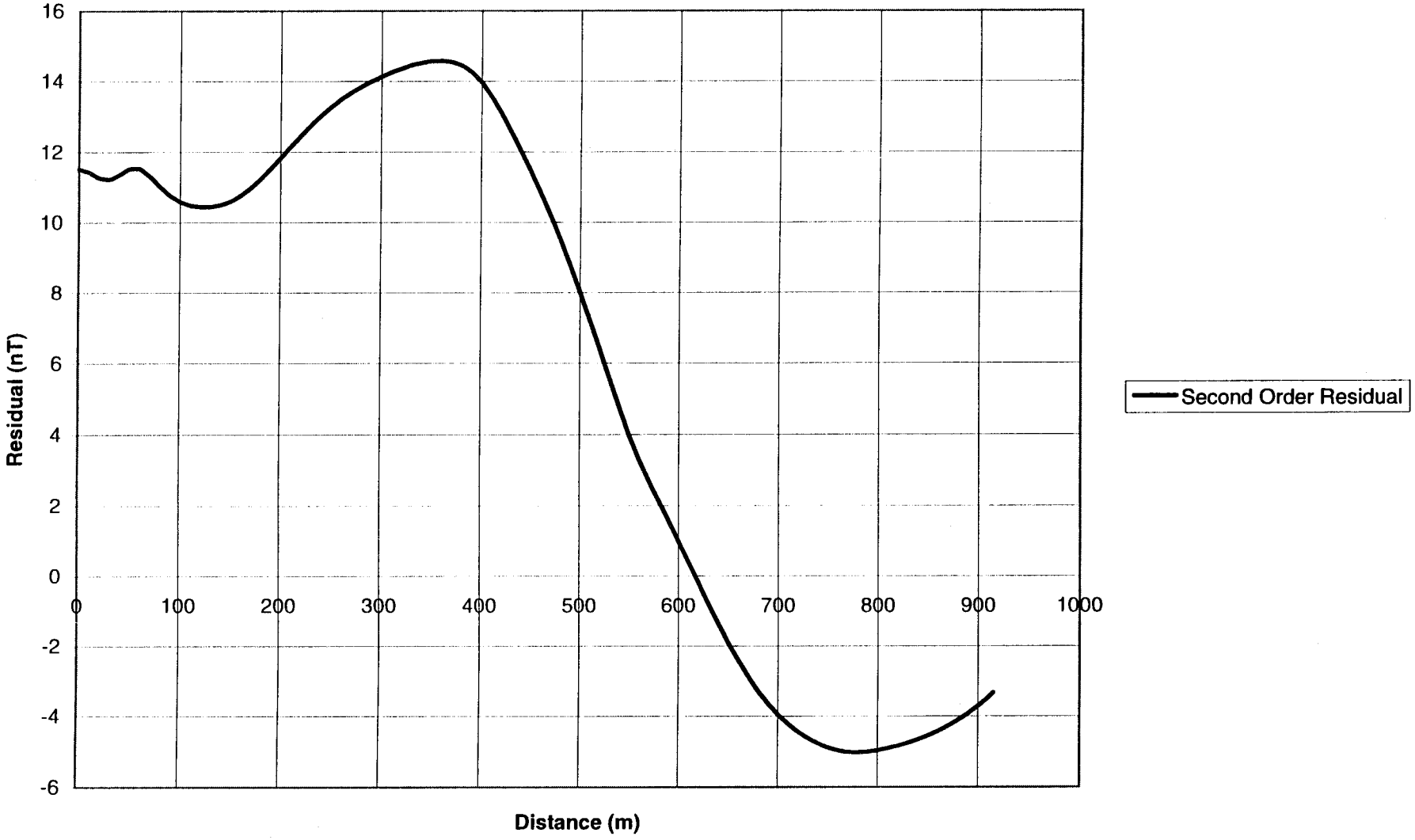

Anomaly 217B SN profile
30
20
10
0
-10
-20
-30
-40
Residual (nT)
0
100
200
300
400
500
600
700
800
Distance (m)
2nd Order Residual

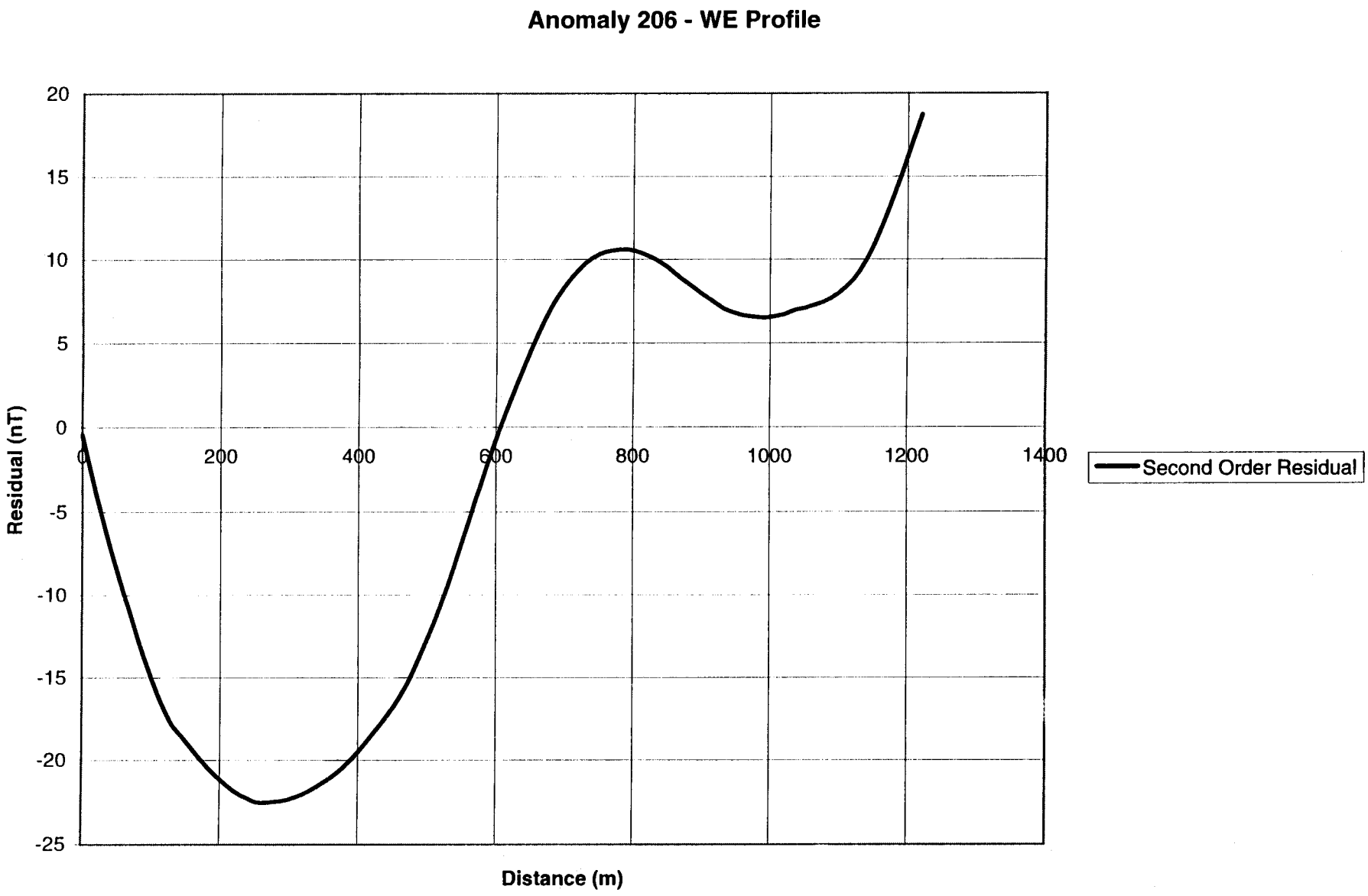

Anomaly 218 S-N profile
Residual (nT)
20
15
10
5
0
-5
-10
-15
-20
-25
0
100
200
300
400
500
600
700
800
900
Distance (m)
2nd Order Residual

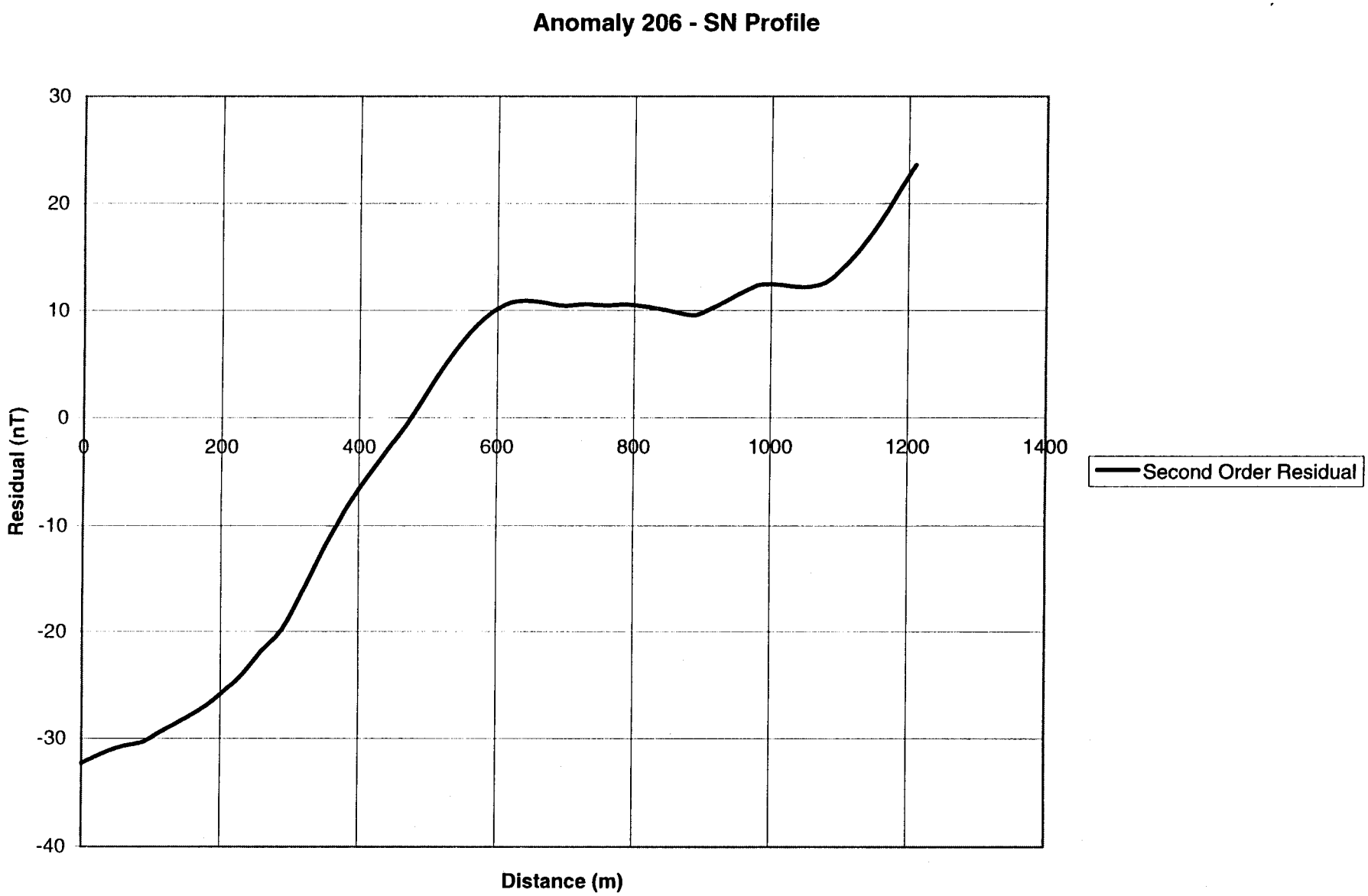

Anomaly 218 W-E profile
20
15
10
5
0
-5
-10
-15
-20
-25
-30
Residual (nT)
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual


Anomaly 196 - SN Profile
15
10
5
0
-5
-10
-15
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

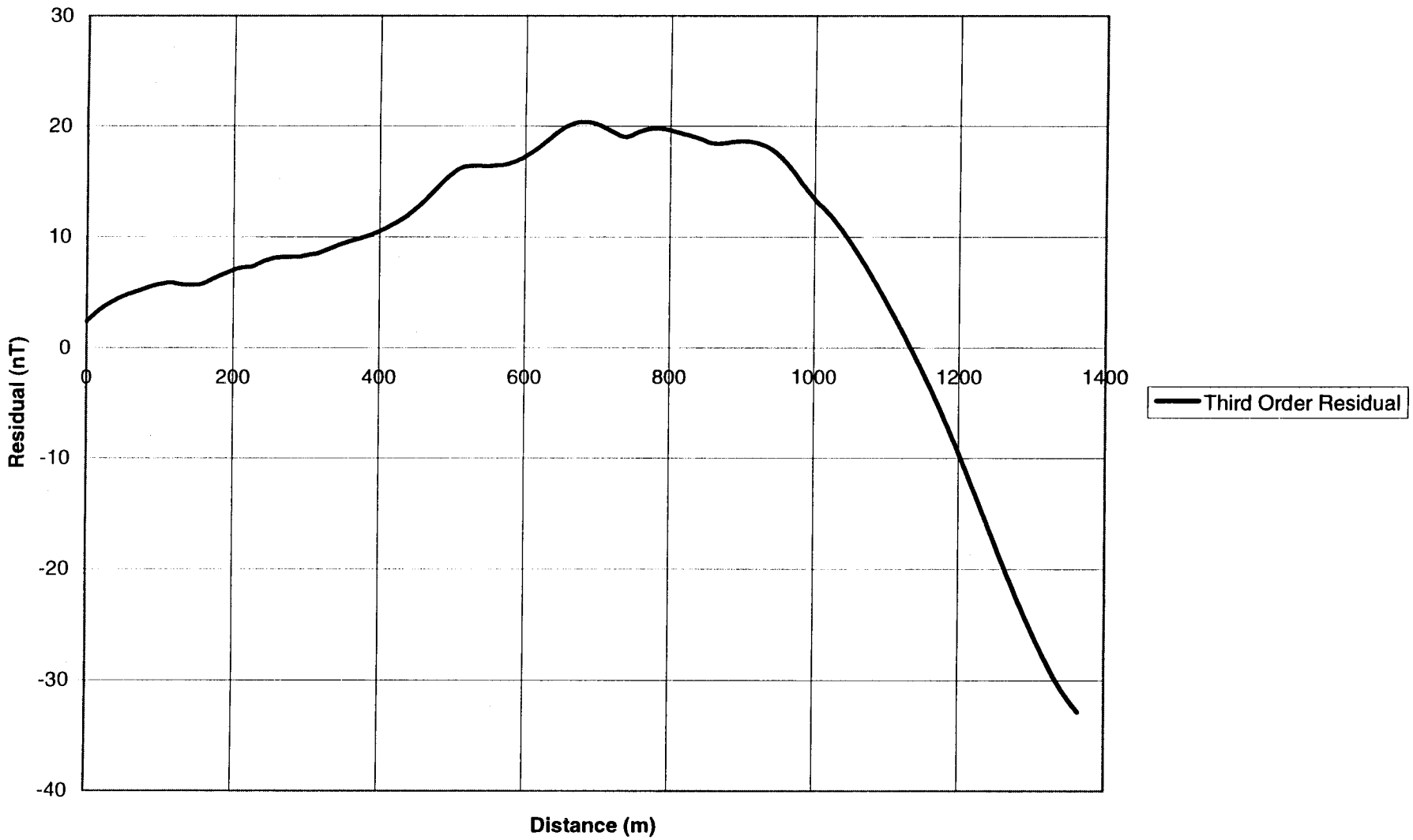
Anomaly 196 - WE Profile



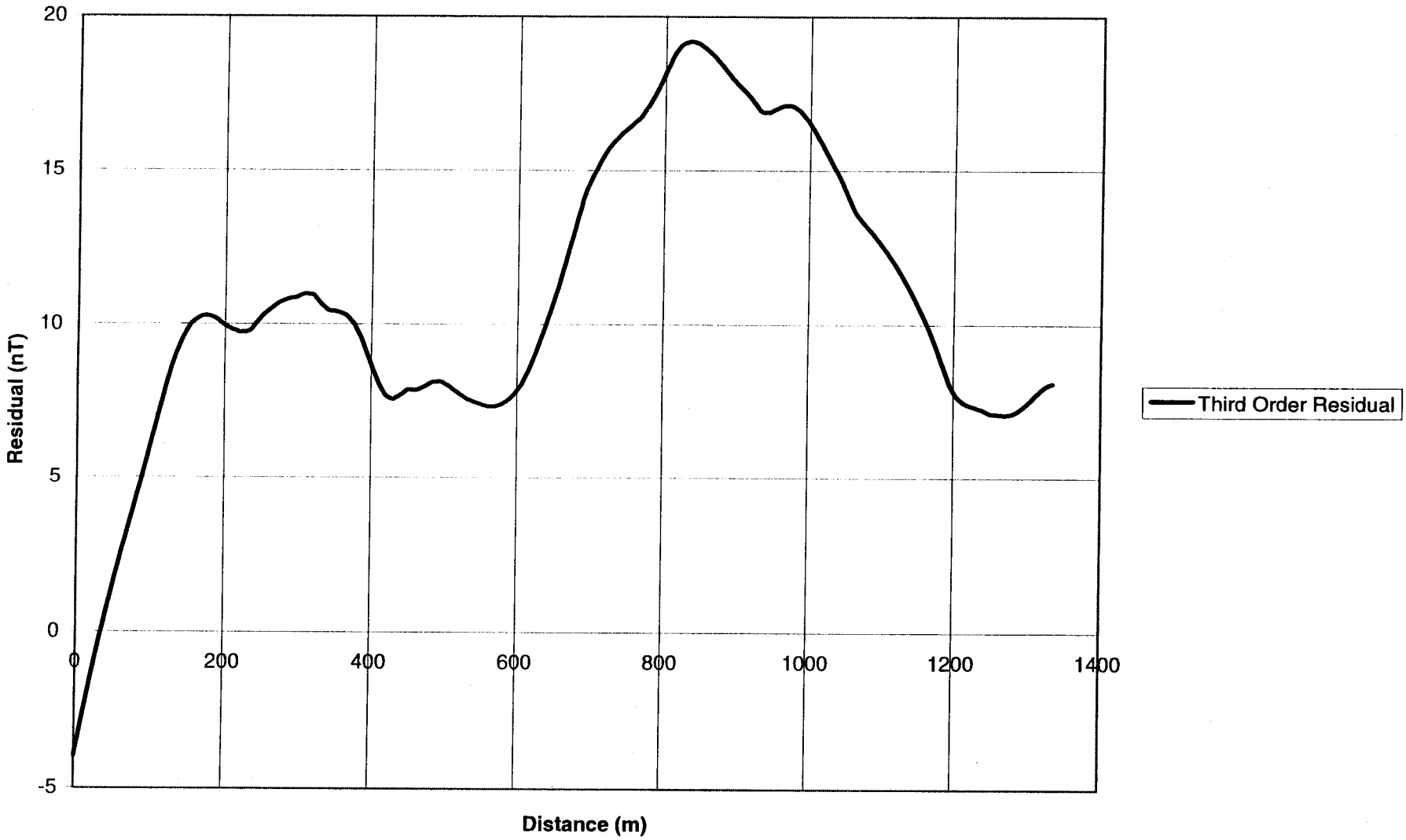

Anomaly 206 - WE Profile
20
15
10
5
0
-5
-10
-15
-20
-25
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

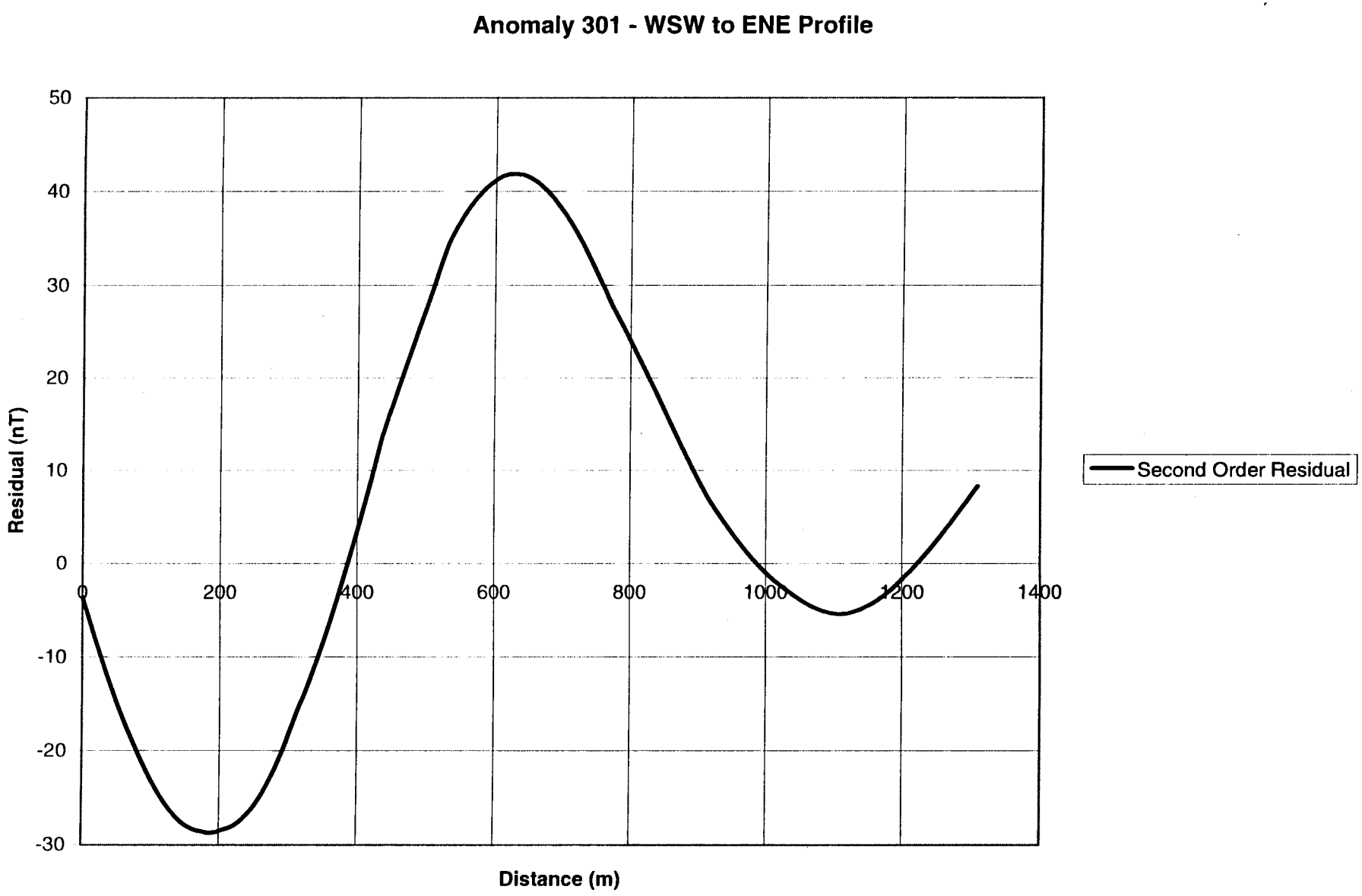

Anomaly 206 - SN Profile
30
20
10
0
-10
-20
-30
-40
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

Anomaly 162 - NNW to SSE Profile

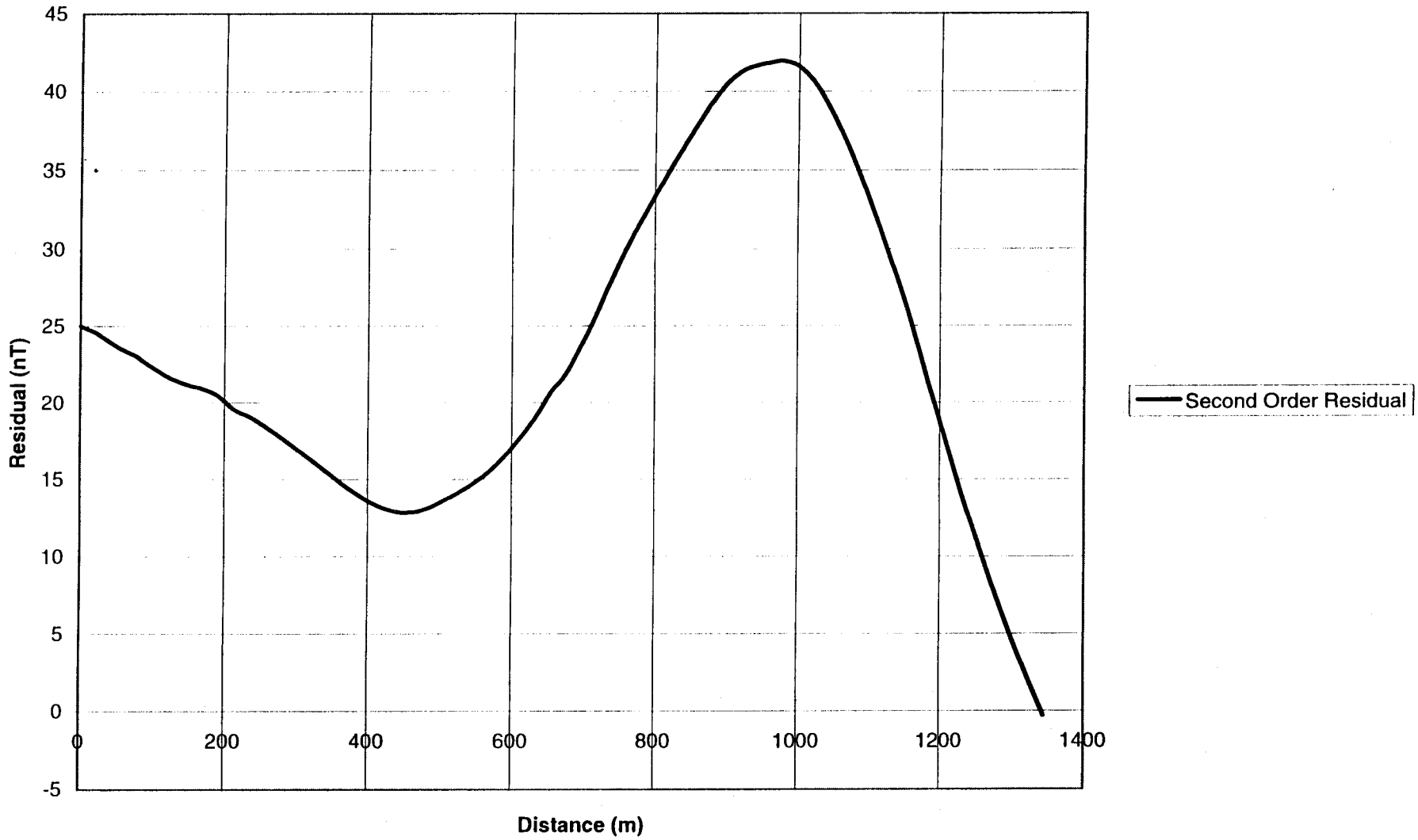


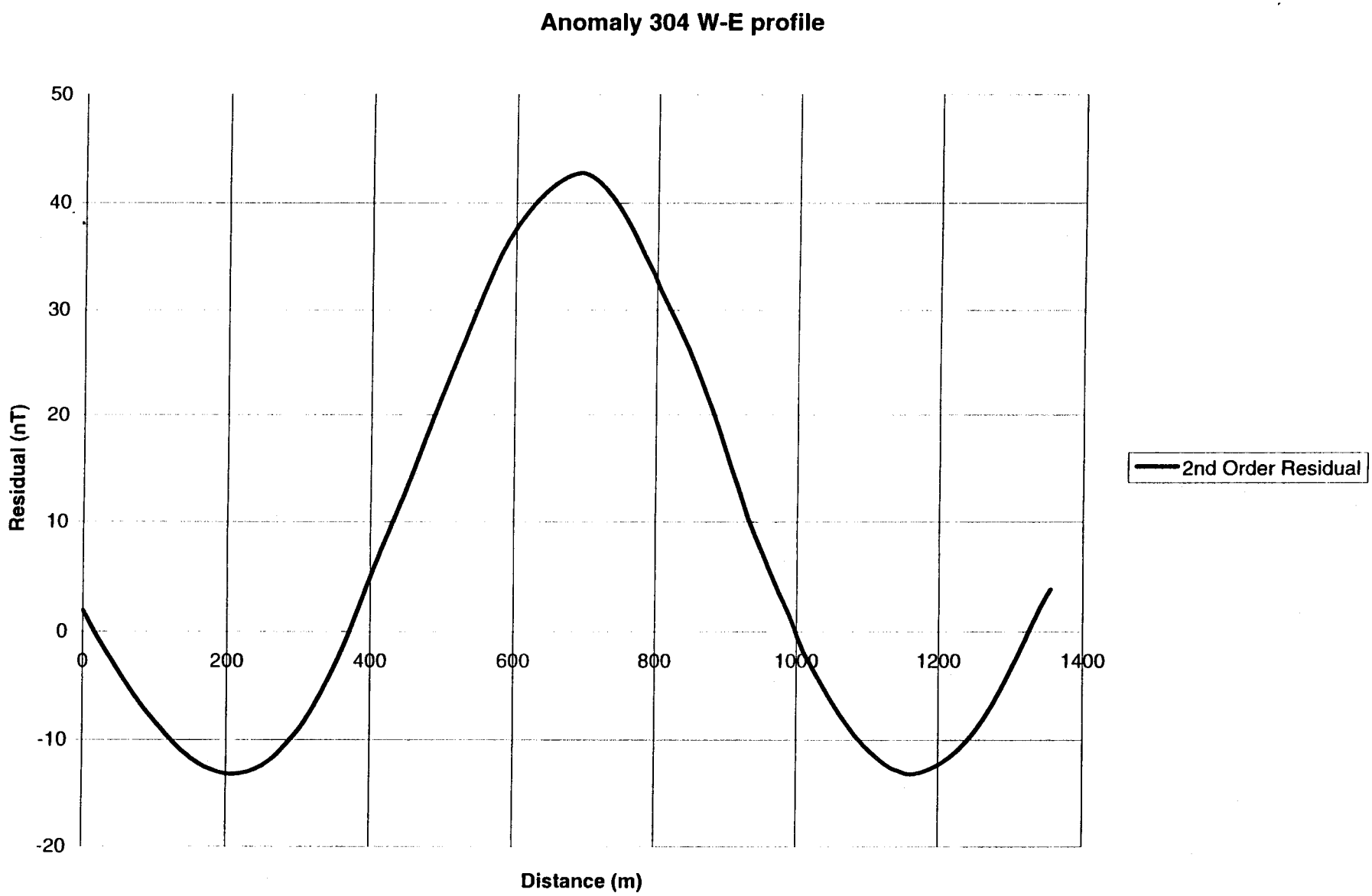
Anomaly 162 - WSW to ENE Profile

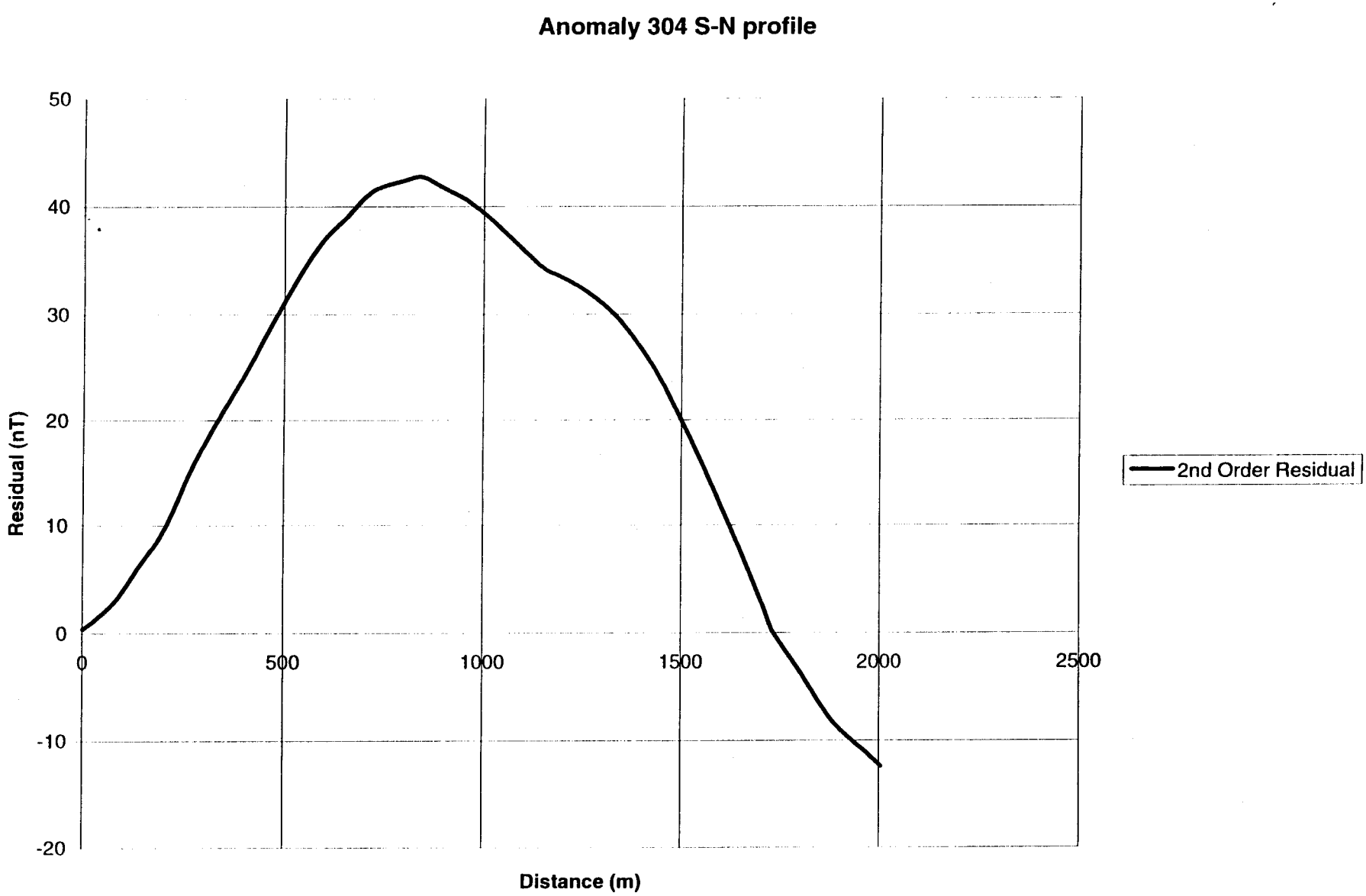


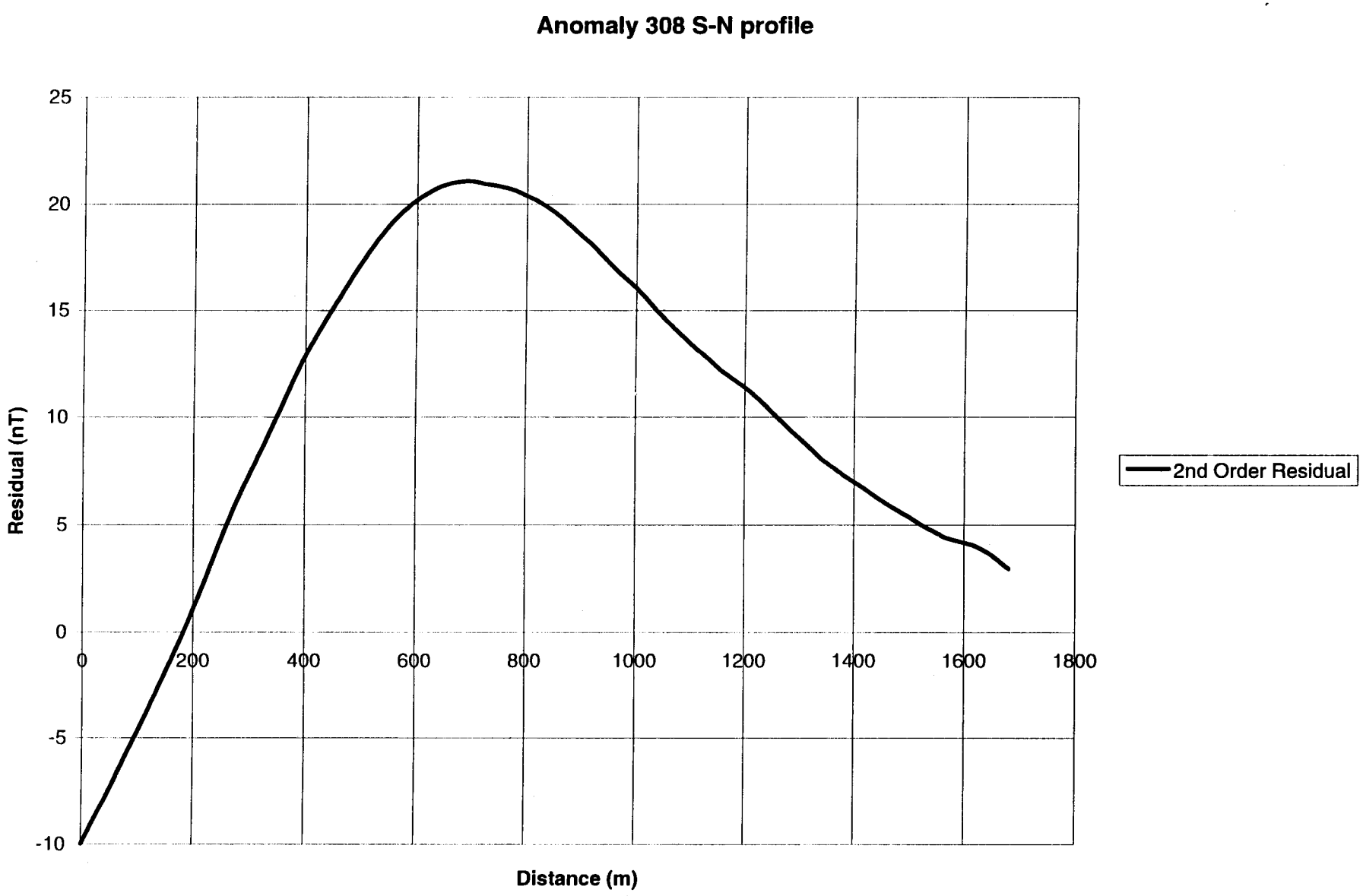

Anomaly 301 - WSW to ENE Profile
50
40
30
20
10
0
-10
-20
-30
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
Second Order Residual

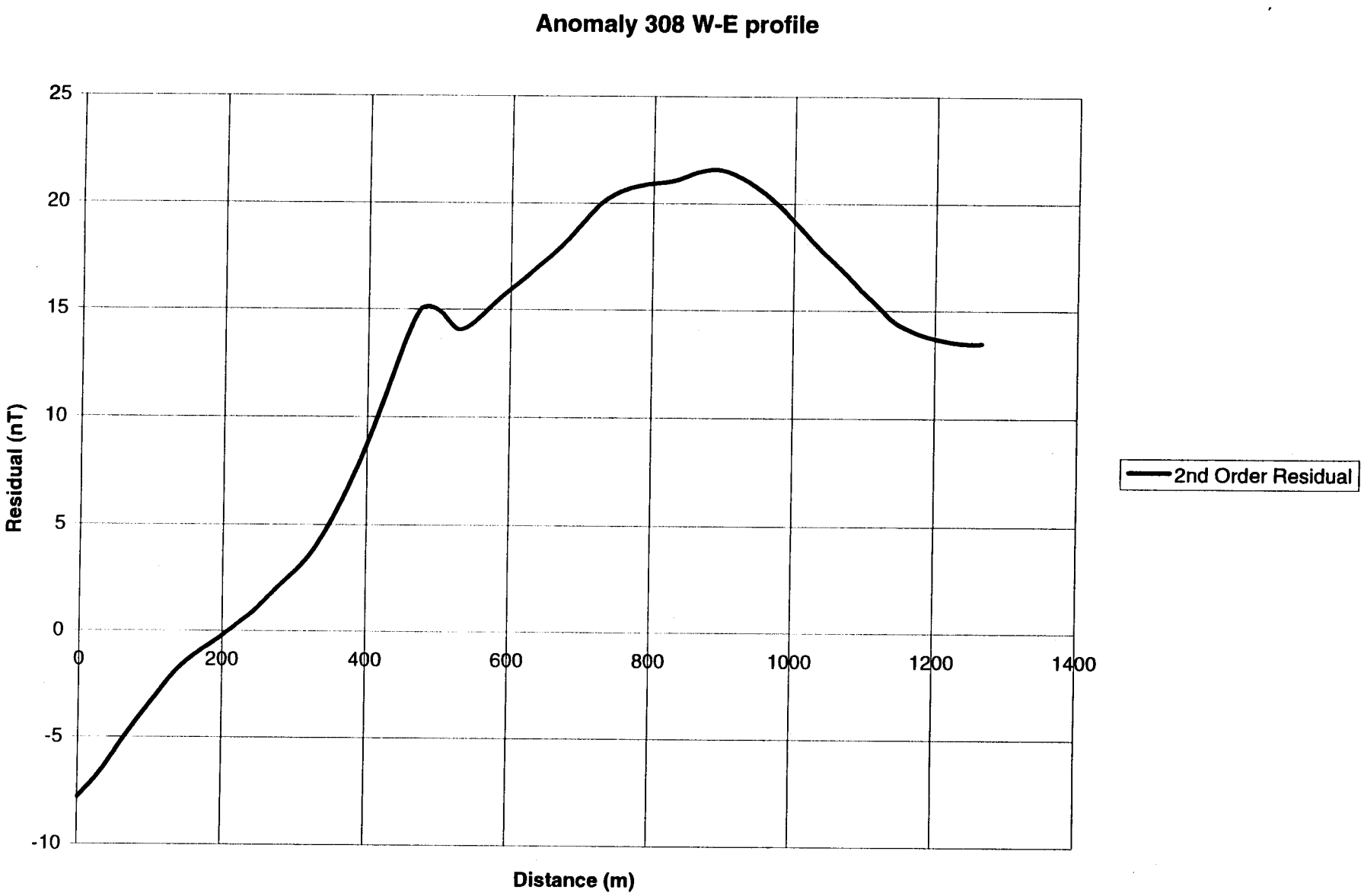
Anomaly 301 - NNW to SSE Profile

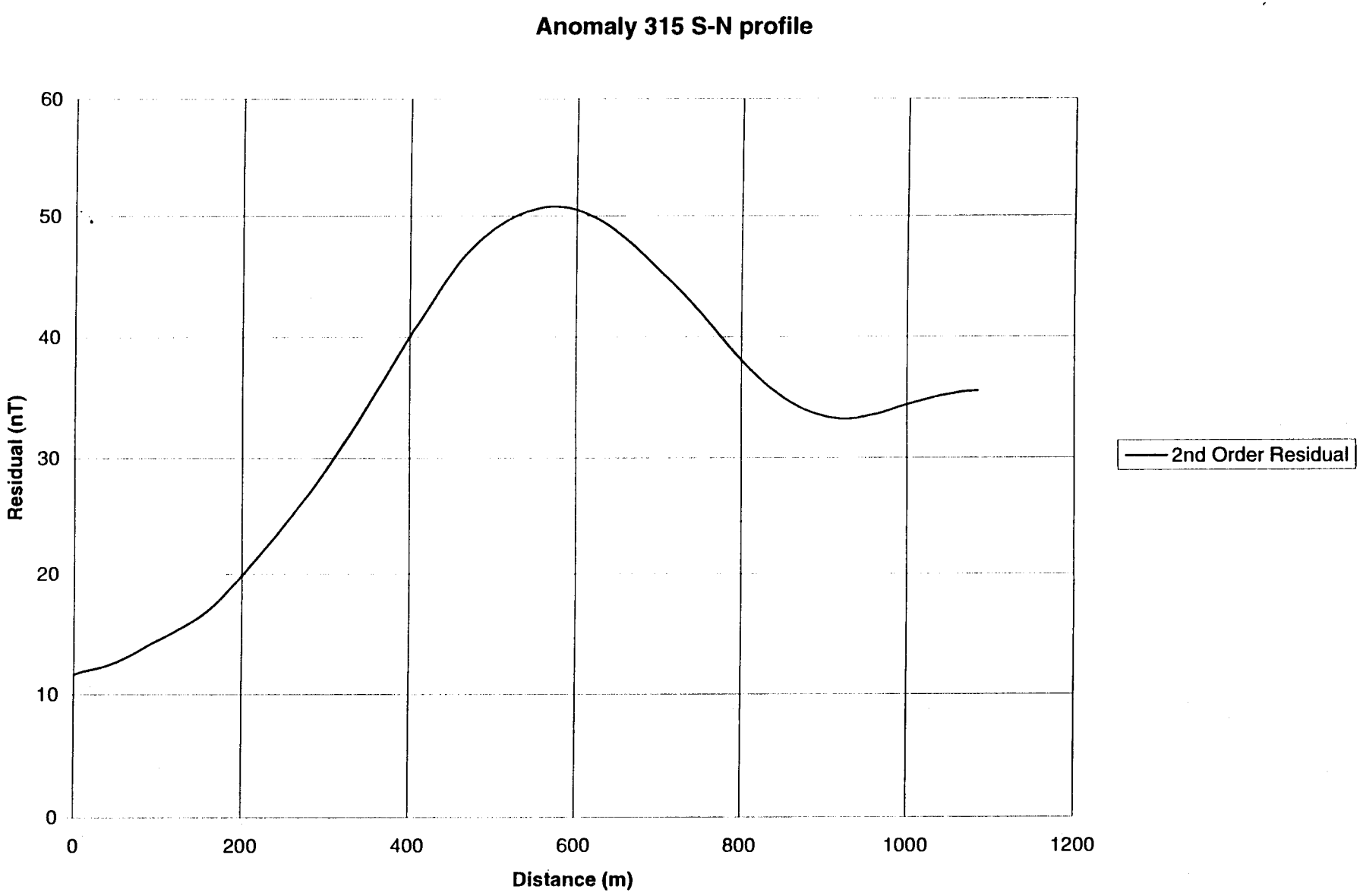


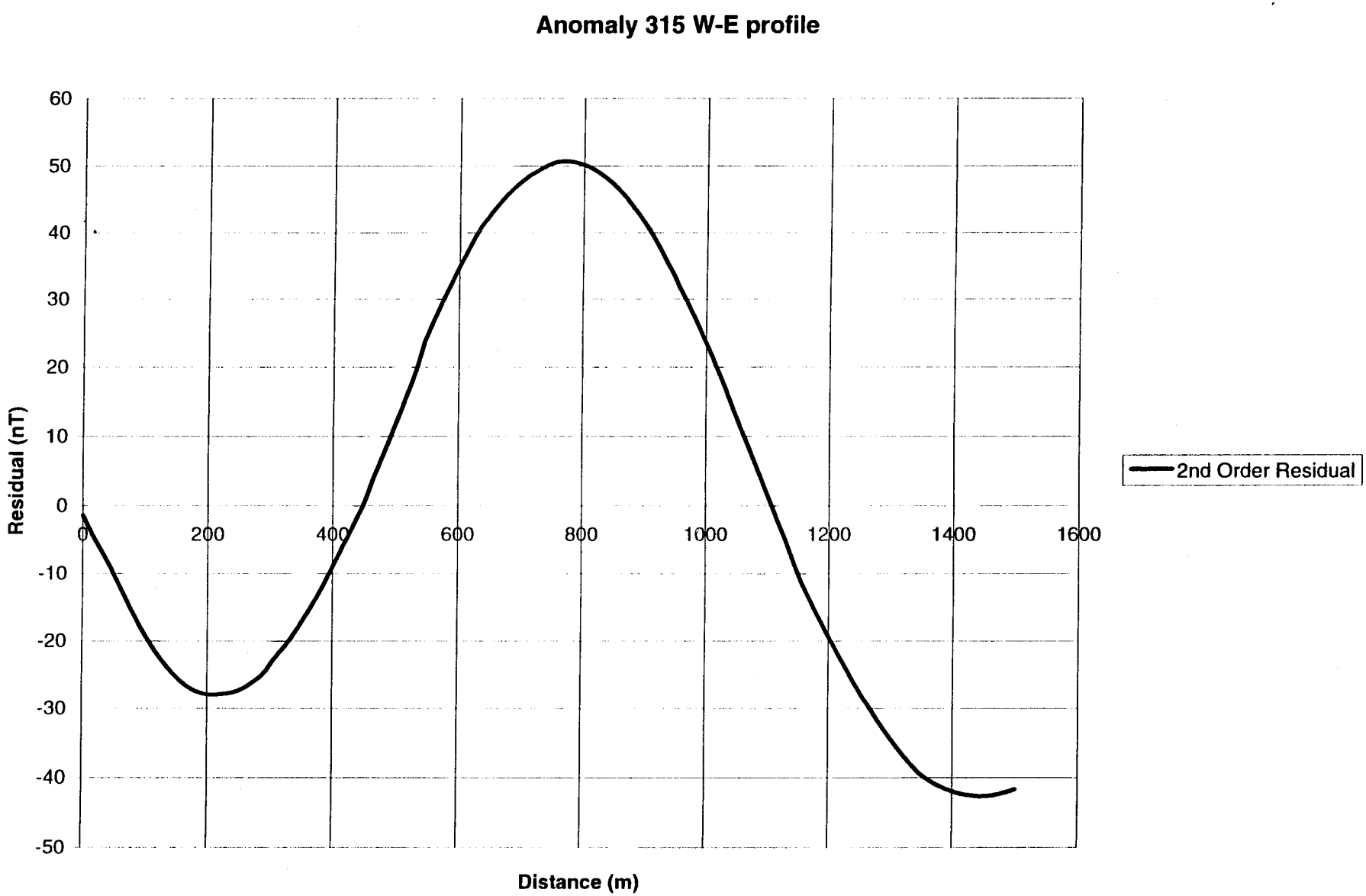

Anomaly 304 W-E profile
50
40
30
20
10
0
-10
-20
Residual (nT)
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual

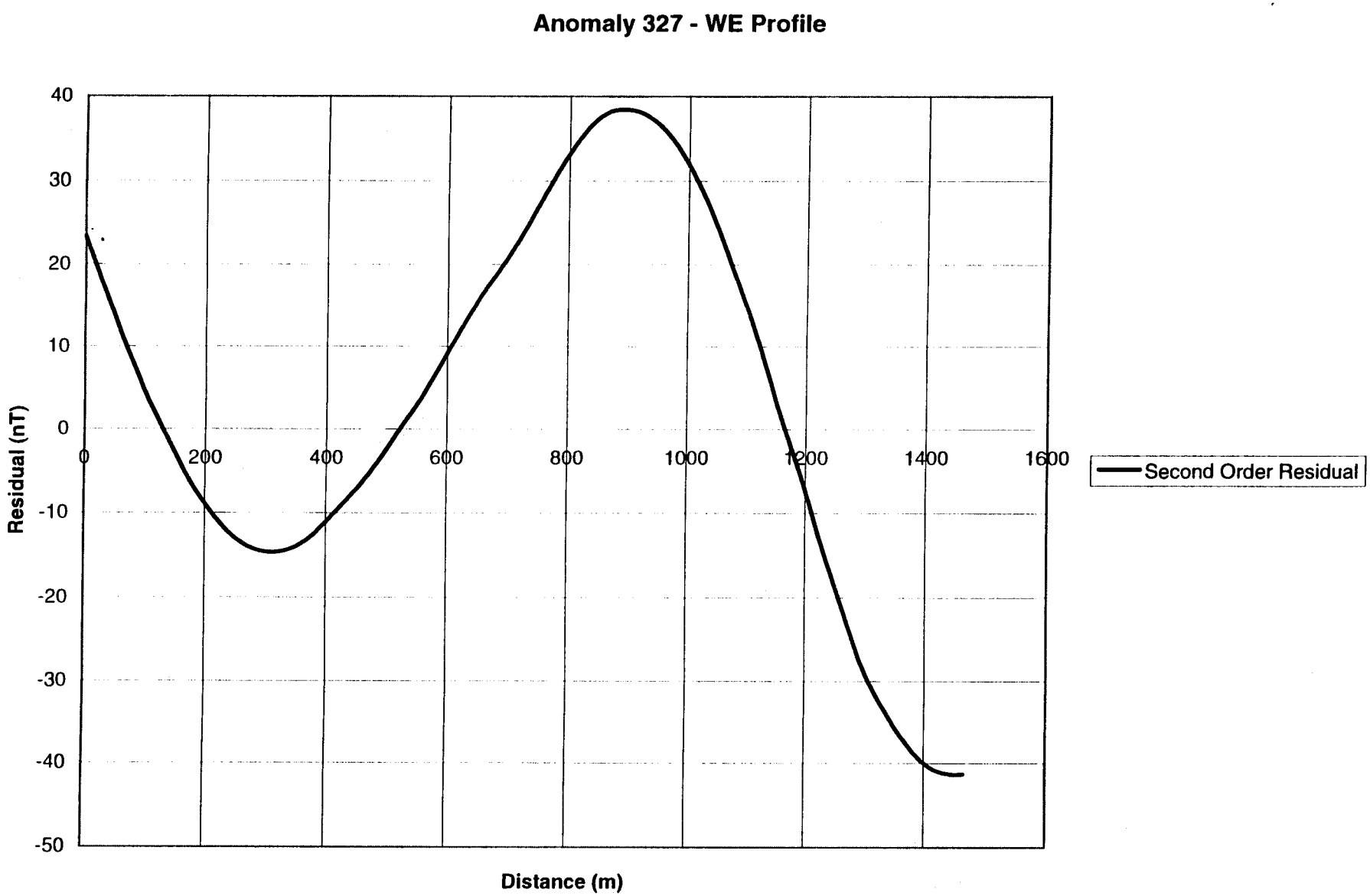

Anomaly 304 S-N profile
50
40
30
20
10
0
-10
-20
Residual (nT)
0
500
1000
1500
2000
2500
Distance (m)
2nd Order Residual


Anomaly 308 S-N profile
Residual (nT)
25
20
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200
1400
1600
1800
Distance (m)
2nd Order Residual

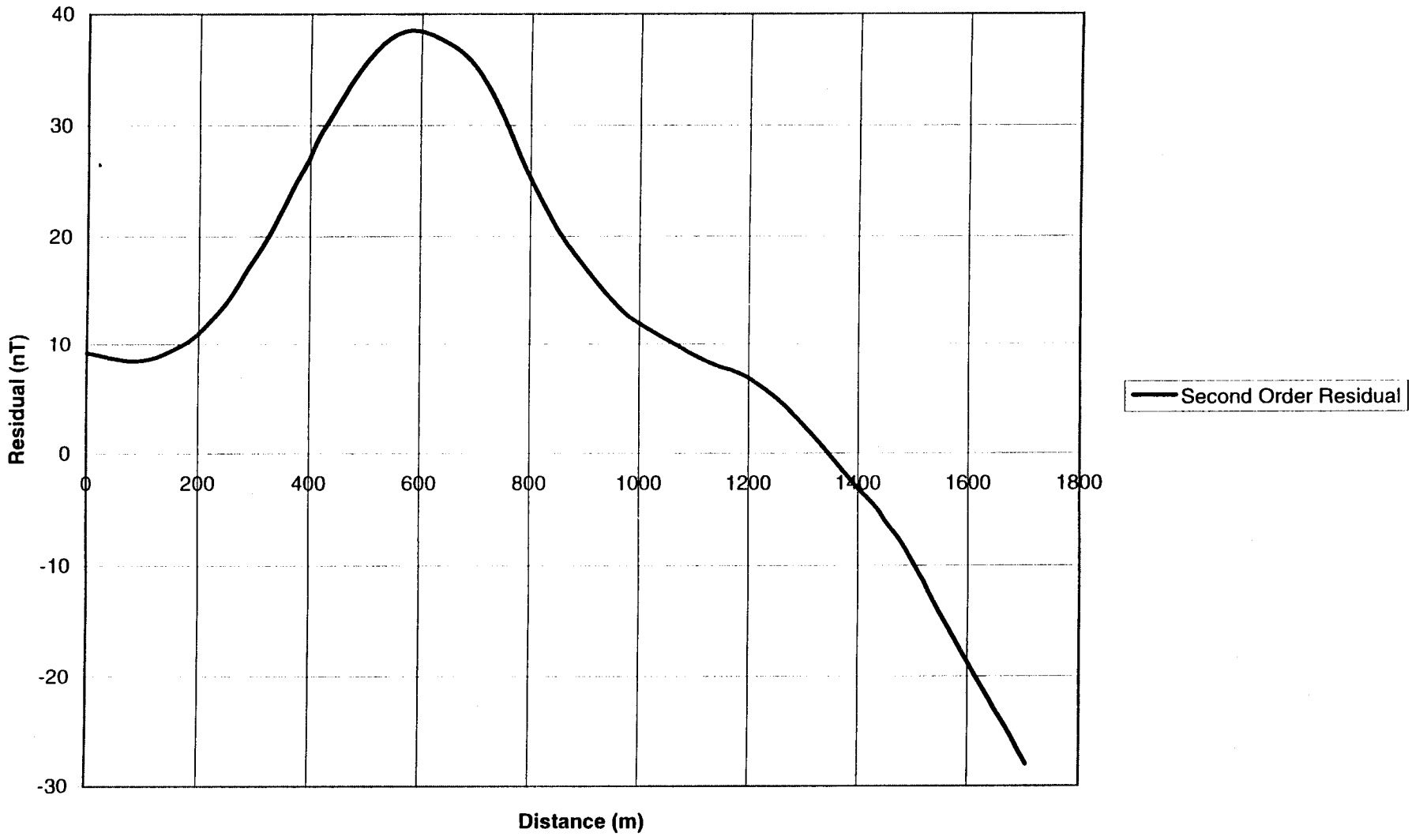

Anomaly 308 W-E profile
Residual (nT)
25
20
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200
1400
Distance (m)
2nd Order Residual


Anomaly 315 S-N profile
Residual (nT)
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
Distance (m)
2nd Order Residual


Anomaly 315 W-E profile
Residual (nT)
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
200
400
600
800
1000
1200
1400
1600
Distance (m)
2nd Order Residual


Anomaly 327 - WE Profile
40
30
20
10
0
-10
-20
-30
-40
-50
Residual (nT)
0
200
400
600
800
1000
1200
1400
1600
Distance (m)
Second Order Residual

Anomaly 327 - SN Profile



Appendix F

1998 Drill Program

F.1. Lithological Core Logs

Lithological Log BMRD-98-14
Logged by Glen De Paoli
February 27, 1998
(all units in meters)

Anomaly #14

Grid location: 374N + 282E
NAD27 location: 6379864N + 494624E
Elevation: 290 m (from topo map)

From	To	Width	Lithology	Rock Unit	Sample	From	To	Width	Missing core within sample
0.00	15.50	15.50	no core, sand and clay reported on recovery sheets	Quaternary outwash sand	BJ98-003, surface sample				
15.50	16.15	0.65	pink mud	Quaternary lake sediments	GDP98-001	15.50	16.15	0.65	
16.15	31.40	15.25	dark grey mud	Quaternary lake sediments	GDP98-002	16.15	20.50	4.35	17.00 - 17.70, 19.20 - 20.50
					GDP98-003	20.50	27.40	6.90	22.25 - 23.20, 23.15 - 23.90, 25.30 - 27.40
					GDP98-004	27.40	31.40	4.00	scattered 10 - 20 cm sections.
31.40	35.90	4.50	no core, clay reported on recovery sheets	Quaternary lake sediments					
35.90	40.55	4.65	dark grey/light grey shale	McMurray Fm.	GDP98-005	35.90	36.10	0.20	
					GDP98-005A	36.10	40.55	4.45	
40.55	41.40	0.85	missing core						
41.40	60.20	18.80	tar sands	McMurray Fm.	GDP98-006	41.40	48.00	6.60	
					GDP98-007	48.00	55.00	7.00	
					GDP98-008	55.00	60.20	5.20	
60.20	71.00	10.80	limey shale, no pyrrhotite observed	Firebag Member of the Waterways Fm.					
71.00	82.00	11.00	limestone	Slave Point Fm.					
82.00	101.20	19.20	shale/lms/dol.	Ft. Vermilion/Watt Mt. Fm.					
101.20	126.00	24.80	dolomite	Methy Fm.					
126.00	145.00	19.00	green shale/gypsum	Mclean R. Fm. (Red beds)					
145.00	152.89	7.89	red sandstone/gypsum	La Loche Fm. (Red Beds)					
E.O.H. @ 152.89									

Lithological Log BMRD-98-210A
Logged by Glen De Paoli
February 29, 1998
(all units in meters)

Anomaly #210A

Grid location: 615N + 470E
NAD27 location: 6380234N + 491641E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
0.00	19.80	19.80	0%	no core, recovery sheets report sand.	Quaternary outwash sand	BJ98-002, surface sample			
19.80	20.00	0.20	100%	pink mud	Quaternary lake sediments	GDP98-016	19.80	20.00	0.20
20.00	25.20	5.20	0%	no core					
25.20	25.90	0.70	50%	pink mud	Quaternary lake sediments	GDP98-017	25.20	25.90	0.70
25.90	27.40	1.50	50%	dark grey mud	Quaternary lake sediments	GDP98-018	25.90	27.40	1.50
27.40	30.49	3.09	0%	no core					
30.49	33.50	3.01	80%	dark grey mud	Quaternary lake sediments	GDP98-019	30.49	33.50	3.01
33.50	44.40	10.90	5%	poor recovery, boulders	Quaternary till				
44.40	44.90	0.50	100%	pink mud	Quaternary lake sediments	GDP98-020	44.40	44.90	0.50
44.90	50.30	5.40	5%	poor recovery, boulders	Quaternary lake sediments				
50.30	54.00	3.70	70%	tar sand	McMurray Fm.	GDP98-021	50.30	54.00	3.70
54.00	72.50	18.50	75%	limey shale, no pyrrhotite observed	Firebag Member of the Waterways Fm.				
72.50	82.00	9.50	50%	limestone	Slave Point Fm.				
82.00	105.50	23.50	90%	shale/lms/dol.	Ft. Vermilion/Watt Mt. Fm.				
105.50	118.50	13.00	85%	dolomite	Methy Fm.				
E.O.H. @ 118.50									

Lithological Log BMRD-98-210B
Logged by Glen De Paoli
March 1, 1998
(all units in meters)

Anomaly # 210B

Grid location: 615N + 615E
NAD27 location: 6380234N + 491786E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
0.00	23.13	23.13	0%	sand, no core	Quaternary outwash sand	BJ-001, surface sample			
23.13	24.60	1.47	100%	pink/dark grey mud	Quaternary Lake sediments	GDP98-009	23.13	28.00	4.87
24.60	30.75	6.15	100%	dark grey mud	Quaternary Lake sediments				
30.75	32.30	1.55	0%	no core					
32.30	32.60	0.30	100%	dark grey/brown mud	Quaternary Lake sediments	GDP98-010	28.00	33.80	5.80
32.60	33.50	0.90	0%	no core					
33.50	33.80	0.30	100%	dark grey/brown mud	Quaternary Lake sediments				
33.80	39.60	5.80	0%	no core					
39.60	40.00	0.40	100%	dark grey/brown mud	Quaternary Lake sediments	GDP98-011	39.60	44.60	5.00
40.00	41.45	1.45	0%	no core					
41.45	43.00	1.55	100%	dark grey/brown mud	Quaternary Lake sediments				
43.00	44.50	1.50	0%	no core					
44.50	44.60	0.10	100%	dark grey/brown mud	Quaternary Lake sediments				
44.60	45.80	1.20	50%	varved pink mud	Quaternary Lake sediments	GDP98-012	44.60	45.80	1.20
45.80	47.50	1.70	0%	no core					
47.50	47.70	0.20	100%	silty grey mud	Quaternary Lake sediments	GDP98-013	47.50	47.70	0.20
47.70	55.00	7.30	90%	tar sand	McMurray Fm.	GDP98-014	47.70	52.00	4.30
						GDP98-015	52.00	55.00	3.00
55.00	80.10	25.10	90%	limey shale, no pyrrhotite observed	Firebag Member of the Waterways Fm.				
80.10	88.50	8.40	90%	limestone	Slave Point Fm.				
88.50	107.00	18.50	100%	lms/shale/dolomite	Ft. Vermilion/Watt Mt. Fm.				
107.00	133.00	26.00	90%	dolomite	Methy Fm.				
133.00	157.00	24.00	80%	green shale/gypsum	McLean River Fm. (red beds)				
157.00	164.00	7.00	100%	red sandstone	La Loche Fm. (red beds)				
164.00	177.15	13.15	100%	granitoid gniess	Basement				
E.O.H @ 177.15									

Lithological log BMRD-98-112
Logged by Glen De Paoli
March 3, 1998
(all units in meters)

Anomaly #112

Grid location: 512N + 535E
NAD27 location: 6360208N + 450847E
Elevation: 325 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Samples on following pages		
0.00	14.30	14.30	0%	no core, recovery sheets report boulders.	Quaternary till			
14.30	15.50	1.20	100%	grey mud	Quaternary lake sediments			
15.50	17.40	1.90	10%	boulders, poor recovery	Quaternary till			
17.40	48.90	31.50	80%	black mudstone	Clearwater Fm.			
48.90	75.85	26.95	85%	fine grained tar sand/shale	Clearwater Fm.			
75.85	82.00	6.15	95%	light grey shale	Clearwater Fm.			
82.00	100.25	18.25	95%	fine grained tar sand/shale	Clearwater Fm.			
100.25	131.26	31.01	55%	tar-rich sand	McMurray Fm.			
131.26	143.30	12.04	65%	water sand	McMurray Fm.			
143.30	149.05	5.75	70%	limey shale	Firebag Member of the Waterways Fm.			
E.O.H. @ 149.05								

Samples for
BMRD-98-112

sample#	from	to	width	lithology	missing core
BJ98-004	surface			organic-rich till	
GDP98-022	14.30	15.50	1.20	grey mud	
	15.50	17.40	1.90	no core	
GDP98-023	17.40	22.40	5.00	black mudstone	
GDP98-024	22.40	28.20	5.80	black mudstone	26.75 - 27.75
GDP98-025	28.20	33.35	5.15	black mudstone	28.20 - 28.60
	33.35	34.90	1.55	no core	
GDP98-026	34.90	36.40	1.50	black mudstone	34.90 - 35.20
	36.40	39.44	3.04	no core	
GDP98-027	39.44	44.44	5.00	black mudstone	
GDP98-028	44.44	48.90	4.46	black mudstone	
GDP98-029	48.90	54.70	5.80	tar sand	49.13 - 50.4
GDP98-030	54.70	58.70	4.00	tar sand	
GDP98-031	58.70	62.70	4.00	tar sand	
GDP98-032	62.70	66.70	4.00	tar sand	
GDP98-033	66.70	67.40	0.70	light grey shale	
GDP98-034	67.40	70.75	3.35	shale/tar sand	
GDP98-035	70.75	74.20	3.45	shale/tar sand	
GDP98-036	74.20	78.90	4.70	light grey shale	
GDP98-037	78.90	82.00	3.10	light grey shale	
GDP98-038	82.00	86.50	4.50	shale/tar sand	
GDP98-039	86.50	89.55	3.05	shale/tar sand	
GDP98-040	89.55	95.50	5.95	shale/tar sand	92.60 - 92.88
GDP98-041	95.50	100.25	4.75	shale/tar sand	
GDP98-042	100.25	101.80	1.55	tar sand	
	101.80	103.30	1.50	no core	
GDP98-043	103.30	106.35	3.05	tar sand	
GDP98-044	106.35	107.85	1.50	tar sand	
	107.85	112.45	4.60	no core	
GDP98-045	112.45	115.50	3.05	tar sand	
	115.50	120.25	4.75	no core	
GDP98-046	120.25	121.60	1.35	tar sand	
	121.60	122.00	0.40	no core	
GDP98-047	122.00	124.65	2.65	tar sand	
	124.65	125.12	0.47	no core	
GDP98-048	125.12	127.70	3.05	tar sand	
	127.70	130.07	2.37	no core	
GDP98-049	130.70	131.26	0.56	tar sand	
GDP98-050	131.26	133.80	2.54	water sand	
	133.80	135.30	1.50	no core	
GDP98-051	135.30	138.40	3.10	water sand	
GDP98-052	138.40	141.90	3.50	water sand	
	141.90	142.95	1.05	no core	
GDP98-053	142.95	143.30	0.35	water sand	

Lithological Log BMRD-98-189A
Logged by Glen De Paoli
March 13, 1998
(all units in meters)

Anomaly #189A

Grid location: 390N + 570E
NAD27 location: 6375974N + 489942E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
0.00	18.00	18.00	0%	no core, recovery sheets indicate sand.	Quaternary outwash sand	BJ98-005, surface sample			
18.00	18.30	0.30	100%	brown mud	Quaternary lake Sediments	GDP98-054	18.00	18.30	0.30
18.30	19.80	1.50	0%	no core					
19.80	20.10	0.30	100%	brown mud	Quaternary lake Sediments	GDP98-055	19.80	20.10	0.30
20.10	21.35	1.25	0%	no core					
21.35	21.65	0.30	100%	brown mud	Quaternary lake Sediments	GDP98-056	21.35	21.65	0.30
21.65	22.90	1.25	0%	no core					
22.90	24.40	1.50	100%	brown mud	Quaternary lake Sediments	GDP98-057	22.90	24.40	1.50
24.40	29.00	4.60	0%	no core					
29.00	30.50	1.50	100%	brown mud	Quaternary lake Sediments	GDP98-058	29.00	30.50	1.50
30.50	36.35	5.85	0%	no core, recovery sheets indicate rocks/clay					
36.35	36.60	0.25	100%	brown mud	Quaternary lake Sediments	GDP98-059	36.35	36.60	0.25
36.60	39.00	2.40	0%	no core					
39.00	39.65	0.65	100%	brown/pink mud	Quaternary lake Sediments	GDP98-060	39.00	39.65	0.65
39.65	41.50	1.85	0%	no core					
41.50	42.65	1.15	100%	pink mud	Quaternary lake Sediments	GDP98-061	41.50	42.65	1.15

Lithological Log BMRD-98-189A
Logged by Glen De Paoli
March 13, 1998
(all units in meters)

Anomaly #189A

Grid location: 390N + 570E
NAD27 location: 6375974N + 489942E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
42.65	44.22	1.57	90%	Very fine grained light grey slickensided (phyllitic sheen on broken surfaces) shale with soapy-talc feel. 10% fine grained disseminated pyrite in 10 cm nodule @ 46.00.	McMurray Fm.	GDP98-062	42.65	44.22	1.57
44.22	44.75	0.53	0%	no core					
44.75	46.30	1.55	100%	Light grey/brown shale with slight phyllitic sheen on fracture surfaces. Abundant wood fragments 44.75 - 45.20. Becomming silty and bitumen stained downward.	McMurray Fm.	GDP98-063	44.75	46.30	1.55
46.30	47.80	1.50	100%	Interbedded light grey silty shale and bitumen stained shale/siltstone.	McMurray Fm.	GDP98-064	46.30	47.80	1.50
47.80	63.30	15.50	0%	No core, recovery sheets indicate "drilled out rocks".					

Lithological Log BMRD-98-189A
Logged by Glen De Paoli
March 13, 1998
(all units in meters)

Anomaly #189A

Grid location: 390N + 570E
NAD27 location: 6375974N + 489942E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
63.30	69.00	5.70	60%	Interbedded lms-limey shale. Bedding @ 20 - 30 degrees to horizontal. Core is mildly fractured throughout. No pyrrhotite observed.	Firebag member of the Waterways Fm.				
69.00	87.30	18.30	90%	Limey shale. Bedding @ 20 - 30 degrees to horizontal. Core is fractured and mildly brecciated throughout. No pyrrhotite observed. 60% recovery 69.00 - 73.40, 100% recovery 73.40 - 87.00.	Firebag member of the Waterways Fm.				
87.30	99.00	11.70	10%	Light brown limestone and bituminous limestone. NOTE: only 10% recovery from 87.00 102.00, core consists mostly of clasts of limestone to 10 cm rounded by drilling. Bedding @ 20 - 30 degrees to horizontal.	Slave Point Fm.				
99.00	102.00	3.00	5%	2 - 5 cm clasts of brown lms rounded by drilling. 5% recovery.	Ft. Vermilion Fm.				
E.O.H. @ 102.00									

Lithological Log BMRD-98-189B
Logged by Glen De Paoli
March 16, 1998
(all units in meters)

Anomaly #189B

Grid location: 395N + 564E
NAD27 location: 6375979N + 489936E
Elevation: 290 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
0.00	35.40	35.40	0%	drilled throught till, not cored.	Quaternary outwash sand and lake sediments	see surface sample for 189A			
35.40	39.00	3.60	15%	Pink mud, becomming grey/brown upward. Bedding horizontal.	Quaternary lake sediments	GDP98-065	35.40	39.00	3.60
39.00	42.00	3.00	5%	1-5 cm clasts of granite, pink granitic gneiss, red qtzite, and dolomite, rounded by drilling.	Quaternary till				
42.00	45.00	3.00	40%	Light grey shale, slight phyllitic sheen on broken surfaces. 5 cm pyrite nodule @ 43.00 m. Sharp lower contact with wood fragment rich shale.	McMurray Fm.	GDP98-066	42.00	45.00	3.00
45.00	52.70	7.70	10% - 70%	Interbedded light grey silty shale and bitumen stained fine grained sandstone. Beds average 2 - 3 cm. Bedding sub-horizontal. Abundant wood fragments 45.00 - 43.10.	McMurray Fm.	GDP98-067	45.00	52.70	7.70
52.70	62.80	10.10	35%	Water sand. No core recovered, but a five gallon pail of sand was recovered from the mud tanks (sample GDP98-068)	McMurray Fm.	GDP98-068	52.70	62.80	10.10
62.80	64.00	1.20	100%	De-calcified limey shale.	Firebag member of the Waterways Fm				

64.00	82.00	18.00	40%	Interbedded lms and limey shale. Core consists of 5 - 10 cm pieces rounded by drilling. Bedding @ 20 - 30 degrees to horizontal. Minor fracturing observed. No pyrrhotite observed.	Firebag member of the Waterways Fm.				
82.00	98.00	16.00	40%	Limey shale. Bedding @ 20 - 30 degrees to horizontal. Scattered fractures at 10 - 20 degrees to vertical. Core moderately fractured. No pyrrhotite observed.	Firebag member of the Waterways Fm				
98.00	109.00	11.00	100% - 10%, decreasing downward	Light brown limestone and bituminous limestone. Abundant soft sediment deformation. Core moderately fractured with scattered 1 cm wide calcite veins.	Slave Point Fm.				
109.00	115.20	6.20	10% - 20%	Core consists of 5 - 10 cm pieces rounded by drilling. Lithology of core pieces includes brown lms, green and brown shale. Shale intervals are highly brecciated.	Ft. Vermilion Fm.				
E.O.H. @ 115.20									

Lithological Log BMRD-98-29
Logged by Glen De Paoli
March 23th, 1998
(all units in meters)

Anomaly #29

Grid location: 585N + 400E
NAD27 location: 6388159N + 478079E
Elevation: 265 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Sample	From	To	Width
0.00	33.80	33.80	0%	no core, recovery sheets report sand.		BJ98-006, surface sample			
33.80	56.00	22.20	65%	Mixed pink/grey mud. Mostly pink mud 33.80 - 34.80 and 47.00 - 51.20. Missing core 45.50 - 47.03. Lms and red ss boulders, rounded by drilling, and 10% recovery 51.20 - 55.80. Sandy pink mud 55.80 - 56.00.	Quaternary lake sediments and till	GDP98-069	33.80	36.60	2.80
						GDP98-070	36.60	39.70	3.10
						GDP98-071	39.70	42.50	2.80
						GDP98-072	42.50	45.50	3.00
						NO CORE	45.50	47.03	1.53
						GDP98-073	47.03	49.70	2.67
						GDP98-074	49.70	51.20	1.50
						GDP98-075	55.80	56.00	0.20
56.00	66.00	10.00	90%	Interbedded shale, lms, and dolomite. Abundant calcite veining. Core brecciated 64.50 - 66.00, with calcite matrix.	Ft. Vermilion Fm.				
66.00	147.18	81.18	90%	Dolomite. Minor calcite veining. Minor bituminous laminations. Native sulphur on fractures and vugs 136.00 - 142.00.	Methy Fm.				
E.O.H. @ 147.18									

Lithological Log BMRD-98-6
Logged by Glen De Paoli
April 2nd, 1998
(all units in meters)

Anomaly #6

Grid location: 175S + 100E
NAD27 location: 6832138N + 483171E
Elevation: 305 m (from topo map)

From	To	Width	Recovery	Lithology	Rock Unit	Samples on following pages
0.00	51.80	51.80	0%	No core, recovery sheets report sand. One 5 gallon pail of sand extracted from mud tanks across interval 45.72 - 47.25.	Quaternary outwash sand	
51.80	105.12	53.32	50%	Mixed pink/brown mud. Mostly brown mud 50.30 - 80.72. mostly pink mud 80.72 - 92.28. Mostly dark brown mud 92.28 - 105.12. Scattered white qtzite drop stones.	Quaternary Lake Sedments	
105.12	111.22	6.10	50%	Interbedded calcite cemented sandstone and shale. Sandstone is white, fine to medium grained qtz sand cemented by calcite. Shale is finely interbedded (mm scale) light green/dark brown silty shale and occures in scattered 20 - 40 cm sections.	McMurray Fm.	
111.22	120.31	9.09	0%	Water sand. Nothing recovered in core but two 5 gallon pails of sand recovered from mud tanks.	McMurray Fm.	
120.31	123.41	3.10	60%	White medium to coarse grained calcite cemented sandstone.	McMurray Fm.	
123.41	128.00	4.59	0%	Water sand. Nothing recovered in core but one 5 gallon pail of sand recovered from mud tanks.	McMurray Fm.	
128.00	138.40	10.40	60%	White medium to coarse grained calcite cemented sandstone. Scattered 5 - 10 cm green/brown silty shale beds. Moderate soft sediment deformation and bedding inclined up to 20 - 30 degrees in shale.	McMurray Fm.	

Lithological Log BMRD-98-6
Logged by Glen De Paoli
April 2nd, 1998
(all units in meters)

Anomaly #6

Grid location: 175S + 100E
NAD27 location: 6832138N + 483171E
Elevation: 305 m (from topo map)

138.40	141.68	3.28	70%	Brecciated limey shale with a calcite cemented coarse grained sandstone matrix. 50/50 clasts/matrix. Limey shale clasts are angular, generally rectangular in shape, oriented from horizontal to vertical, and range in size up to 10 cm thick.	Firebag member of the Waterways Fm.	
				Clasts are decalcified over top 30 cm. Sand matrix is of the same lithology as McMurray unit above. Unit is predominantly matrix supported. Well cemented, competent unit.		
141.68	**144.17**	**2.49**	**0%**	**No core. Rods stuck @ 141.68. Casing set to 132.00. Coring resumed @ 144.17.**		
144.17	159.40	15.23	90%	Highly brecciated limey shale. Well cemented unit, no open voids. Clasts are predominantly angular light green limey shale in a lime mud matrix. Abundant qtz sand in matrix in places. Bedding in clasts oriented from horizontal to vertical.	Firebag member of the Waterways Fm.	
				Scattered angular clasts of light brown siltstone and calcite cemented sandstone, numerous light tan colored limestone clasts to 3 cm over a 20 cm interval @ 157.90.		
				General trend downward of decrease in clast size, increase in sand content, and change from light green to dark grey color.		
				From 156.37 - 159.40 the rock consists of 30% coarse grained qtz sand/limey mud and 70% small (1 - 2 cm) light green to light brown limey shale clasts, all of which have been re-deposited in sub-horizontal cm-scale beds (internal sedimentaton).		

Lithological Log BMRD-98-6
Logged by Glen De Paoli
April 2nd, 1998
(all units in meters)

Anomaly #6

Grid location: 175S + 100E
NAD27 location: 6832138N + 483171E
Elevation: 305 m (from topo map)

159.40	163.82	4.42	70%	Light grey limestone. Increasing degree of brecciation downward. Breccia consists of angular clasts to 2 cm cemented in a grey lime mud matrix. Stylolite @ 163.30 post-dates brecciation.	Slave Point Fm.	
				Increasing vuggy porosity and fracturing downward. Open calcite-lined vugs to 3 cm. Fracturing is subvertical. Bottom meter of core consists of 2 - 10 cm pieces. Grey mud/sand in some vugs.		
				Scattered native sulphur in vugs and fractures.		
E.O.H. @ 163.82						

Samples for
BMRD-98-6

sample#	from	to	width	lithology	missing core (m)
BJ98-007	surface sample			sand	
GDP98-094	45.72	47.50	1.78	water sand	sampled mud tanks
GDP98-076	51.80	53.32	1.52	brown mud	0.87
m.c.	53.32	56.36	3.04		
GDP98-077	56.36	59.40	3.04		1.54
GDP98-078	59.40	60.92	1.52		
GDP98-079	60.92	63.97	3.05		2.13
m.c.	63.97	65.49	1.52		
GDP98-080	65.49	67.01	1.52		1.15
m.c.	67.01	68.53	1.52		
GDP98-081	68.53	70.05	1.52		0.52
GDP98-082	70.05	73.10	3.05		1.84
GDP98-083	73.10	77.00	3.90		1.57
GDP98-084	77.00	79.20	2.20		0.96
m.c.	79.20	80.72	1.52		
GDP98-085	80.72	83.77	3.05		1.79
m.c.	83.77	85.30	1.53		
GDP98-086	85.30	88.35	3.05		1.12
GDP98-087	88.35	92.28	3.93		
GDP98-088	92.28	94.60	2.32		0.37
GDP98-089	94.60	99.03	4.43		2.26
GDP98-090	99.03	102.40	3.37		0.35
GDP98-091	102.40	105.12	2.72		
GDP98-093	111.22	114.27	3.05	water sand	sampled mud tanks
GDP98-095	114.27	120.37	6.10	water sand	sampled mud tanks
GDP98-092	123.41	127.92	4.51	water sand	sampled mud tanks

Appendix F.2.

Stratigraphic Columns

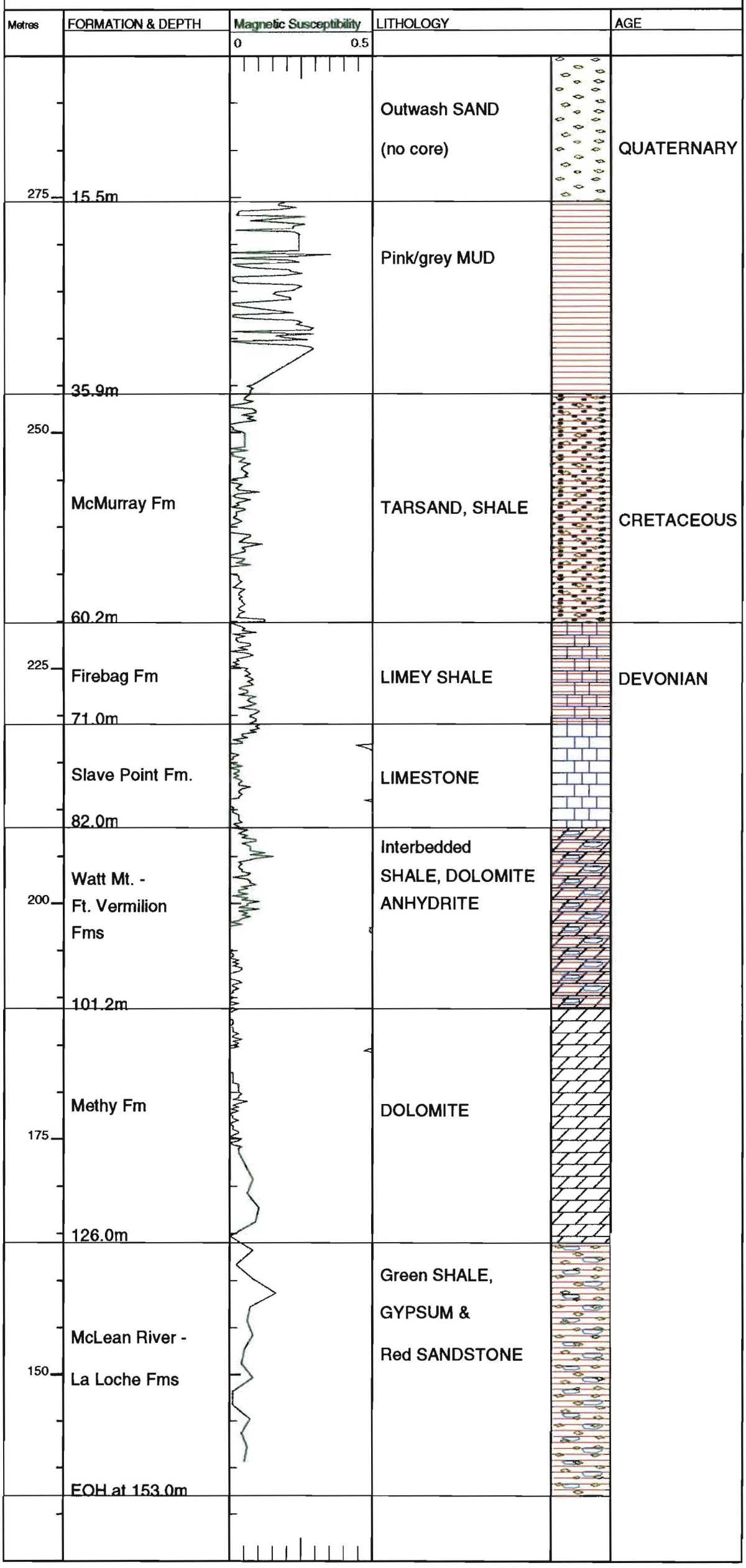
Well Name: BMRD-98-6

Elevation: 305 Reference: Ground Surface

Metres	FORMATION & DEPTH	Magnetic Susceptibility 0 – 0.8	LITHOLOGY	AGE
300			Outwash SAND (not cored)	QUATERNARY
275	51.8m			
250			Pink/grey MUD	
225				
200	105.12m			
	McMurray Fm 111.22m		Calcite-cemented SANDSTONE	CRETACEOUS
	McMurray Fm 120.31m		WATER SAND (no core)	
	McMurray Fm 123.41m		Calcite-cemented SANDSTONE	
	McMurray Fm 128.0m		WATER SAND (no core)	
175	McMurray Fm 138.4m		Calcite-cemented SANDSTONE	
	Firebag Fm 159.4m		LIMEY SHALE & SAND (brecciated)	DEVONIAN
150	Slave Point Fm EOH at 163.82m		LIMESTONE (brecciated)	

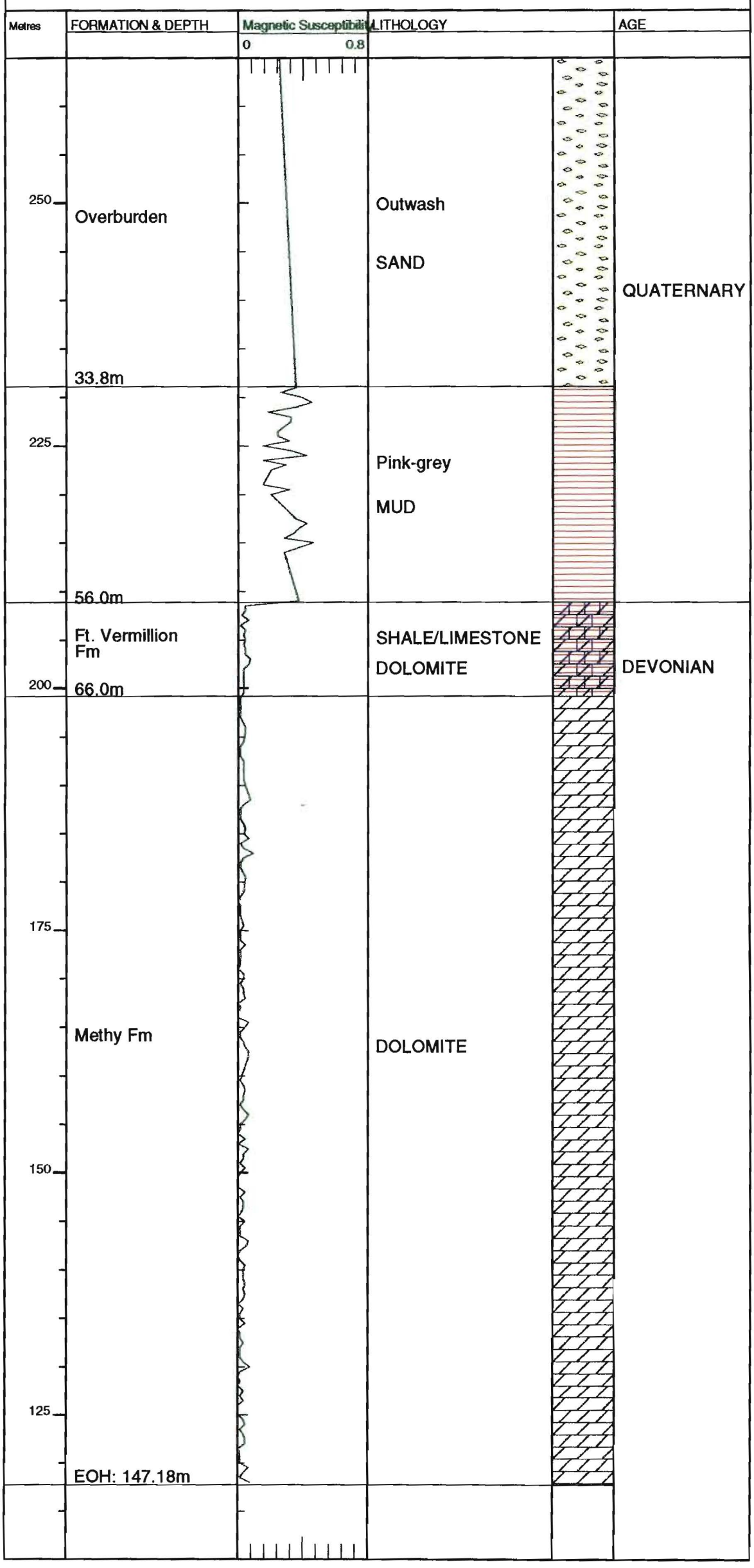
Well Name: BMRD-98-14

Elevation: 290 Reference: Ground Surface



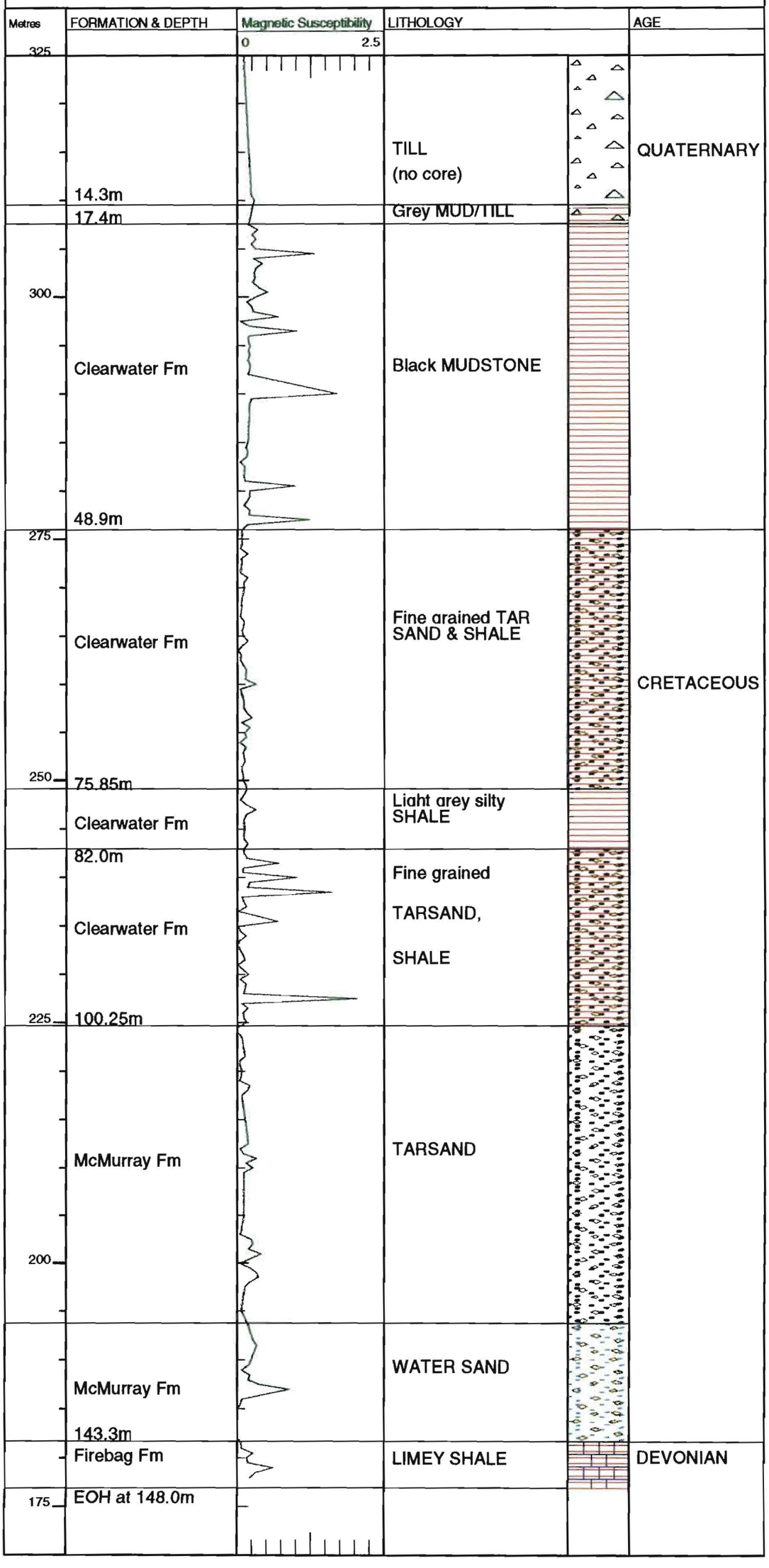
Well Name: BMRD-98-29

Elevation: 265 Reference: Ground Surface



Well Name: BMRD-98-112

Elevation: 325 Reference: Ground Surface



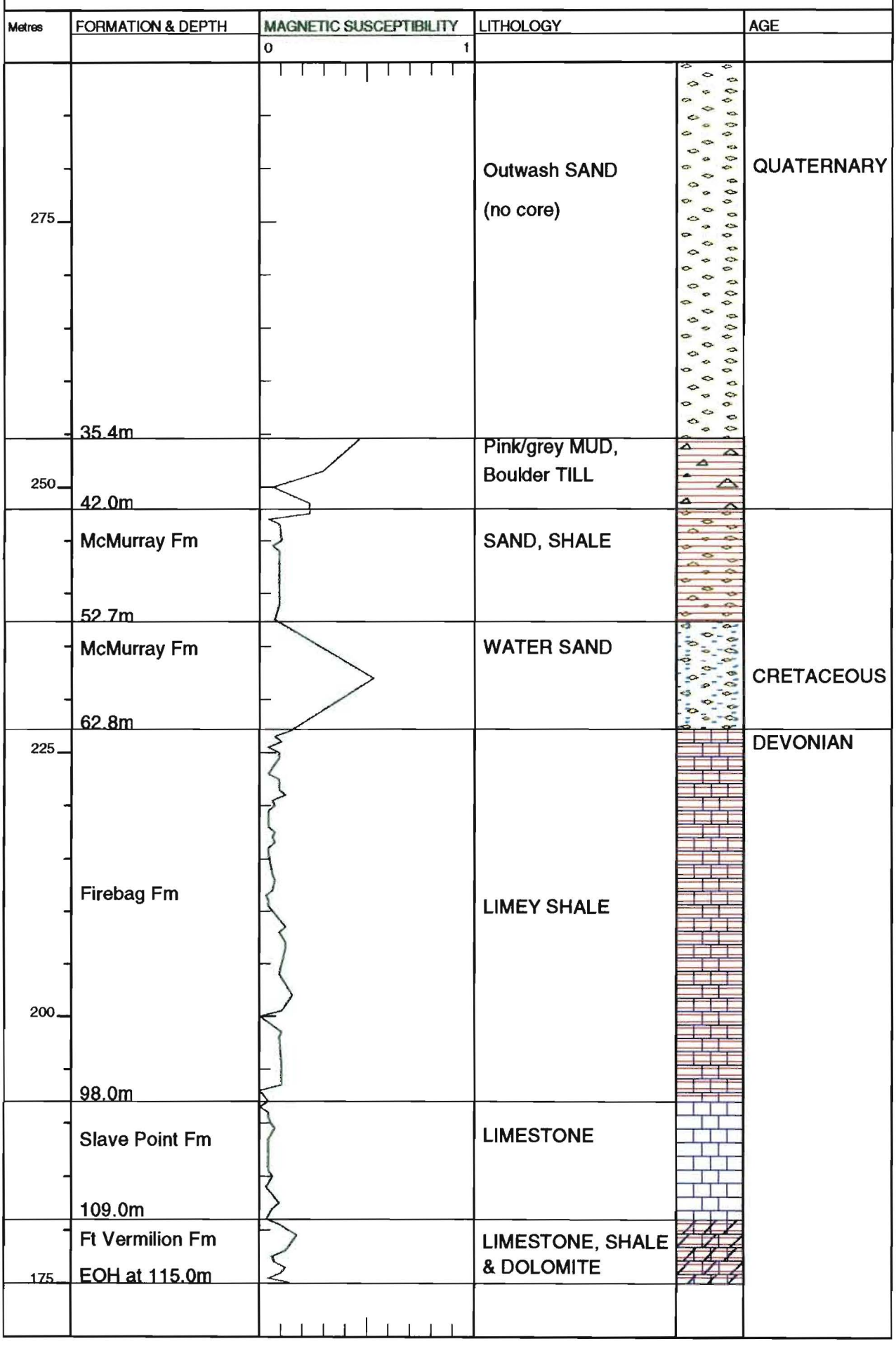
Well Name: BMRD-98-189A

Elevation: 290 Reference: Ground Surface

Metres	FORMATION & DEPTH	Magnetic Susceptibility (0 – 0.8)	LITHOLOGY	AGE
275	18.0m		Outwash SAND (no core)	QUATERNARY
250	42.65m		Pink/grey MUD, Boulder TILL (poor recovery)	
	McMurray Fm 47.8m		SAND, SHALE	CRETACEOUS
	McMurray Fm 63.3m		WATER SAND (no core)	
225	Firebag Fm 87.5m		LIMEY SHALE	DEVONIAN
200	Slave Point Fm 99.0m		LIMESTONE	
	Ft. Vermilion Fm		LIMESTONE, SHALE & DOLOMITE	
	E.O.H. @ 102.0m			

Well Name: BMRD-98-189B

Elevation: 290 Reference: Ground Surface



Well Name: BMRD-98-210A

Elevation: 290 Reference: Ground Surface

Metres	FORMATION & DEPTH	Magnetic Susceptibility (0 – 2.1)	LITHOLOGY	AGE
275	19.8m		Outwash SAND (no core)	QUATERNARY
	33.5m		Pink, Grey MUD	
250	44.4m		BOULDERS (poor recovery) Pink MUD	
	44.9m 50.3m		BOULDERS (poor recovery)	
	McMurray Fm		TARSAND,SHALE	CRETACEOUS
225	54.0m Firebag Fm 72.5m		LIMEY SHALE	DEVONIAN
	Slave Point Fm 82.0m		LIMESTONE	
200	Watt Mt.- Ft. Vermilion Fms 105.5m		Interbedded SHALE, DOLOMITE, ANHYDRITE	
175	Methy Fm EOH at 118.5m		DOLOMITE	

Well Name: BMRD-98-210B

Elevation: 290 Reference: Ground Surface

Metres	FORMATION & DEPTH	Magnetic Susceptibility (0 – 0.8)	LITHOLOGY	AGE
275	23.13m		Outwash SAND (no core)	QUATERNARY
250	47.7m		Pink/grey MUD	
	McMurray Fm 55.0m		TARSAND	CRETACEOUS
225	Firebag Fm 80.1m		LIMEY SHALE	DEVONIAN
	Slave Point Fm 88.5m		LIMESTONE	
200	Watt Mt. - Ft. Vermilion Fms 107.0m		Interbedded SHALE DOLOMITE ANHYDRITE	
175	Methy Fm 133m		DOLOMITE	
150	McLean River, La Loche Fms 164.3m		SHALE, GYPSUM, red SANDSTONE	
125	EOH at 177.15m		GRANITOID GNEISS	PRECAMBRIAN

Appendix F.3.

Core Samples

Sample	Hole	Age	Bitumen?
BJ98-001	BMRD-98-210B	Quaternary	no
BJ98-002	BMRD-98-210A	Quaternary	no
BJ98-003	BMRD-98-14	Quaternary	no
BJ98-004	BMRD-98-112	Quaternary	no
BJ98-005	BMRD-98-189A	Quaternary	no
BJ98-006	BMRD-98-29	Quaternary	no
BJ98-007	BMRD-98-6	Quaternary	no
GDP98-001	BMRD-98-14	Quaternary	no
GDP98-002	BMRD-98-14	Quaternary	no
GDP98-003	BMRD-98-14	Quaternary	no
GDP98-005	BMRD-98-14	Cretaceous	no
GDP98-005A	BMRD-98-14	Cretaceous	no
GDP98-006	BMRD-98-14	Cretaceous	yes
GDP98-007	BMRD-98-14	Cretaceous	yes
GDP98-008	BMRD-98-14	Cretaceous	yes
GDP98-009	BMRD-98-210B	Quaternary	no
GDP98-010	BMRD-98-210B	Quaternary	no
GDP98-011	BMRD-98-210B	Quaternary	no
GDP98-012	BMRD-98-210B	Quaternary	no
GDP98-013	BMRD-98-210B	Quaternary	no
GDP98-014	BMRD-98-210B	Cretaceous	yes
GDP98-015	BMRD-98-210B	Cretaceous	yes
GDP98-016	BMRD-98-210A	Cretaceous	yes
GDP98-017	BMRD-98-210A	Quaternary	no
GDP98-018	BMRD-98-210A	Quaternary	no
GDP98-019	BMRD-98-210A	Quaternary	no
GDP98-020	BMRD-98-210A	Quaternary	no
GDP98-021	BMRD-98-210A	Cretaceous	yes
GDP98-022	BMRD-98-112	Quaternary	no
GDP98-023	BMRD-98-112	Cretaceous	no
GDP98-024	BMRD-98-112	Cretaceous	yes
GDP98-025	BMRD-98-112	Cretaceous	yes
GDP98-026	BMRD-98-112	Cretaceous	yes
GDP98-027	BMRD-98-112	Cretaceous	yes
GDP98-028	BMRD-98-112	Cretaceous	yes
GDP98-029	BMRD-98-112	Cretaceous	yes
GDP98-030	BMRD-98-112	Cretaceous	yes
GDP98-031	BMRD-98-112	Cretaceous	yes
GDP98-032	BMRD-98-112	Cretaceous	yes
GDP98-033	BMRD-98-112	Cretaceous	yes
GDP98-034	BMRD-98-112	Cretaceous	yes
GDP98-035	BMRD-98-112	Cretaceous	yes
GDP98-036	BMRD-98-112	Cretaceous	yes
GDP98-037	BMRD-98-112	Cretaceous	yes
GDP98-038	BMRD-98-112	Cretaceous	yes
GDP98-039	BMRD-98-112	Cretaceous	yes
GDP98-040	BMRD-98-112	Cretaceous	yes
GDP98-041	BMRD-98-112	Cretaceous	yes
GDP98-042	BMRD-98-112	Cretaceous	yes
GDP98-043	BMRD-98-112	Cretaceous	yes
GDP98-044	BMRD-98-112	Cretaceous	yes

Sample	Hole	Age	Bitumen?
GDP98-045	BMRD-98-112	Cretaceous	yes
GDP98-046	BMRD-98-112	Cretaceous	yes
GDP98-047	BMRD-98-112	Cretaceous	yes
GDP98-048	BMRD-98-112	Cretaceous	yes
GDP98-049	BMRD-98-112	Cretaceous	yes
GDP98-050	BMRD-98-112	Cretaceous	yes
GDP98-051	BMRD-98-112	Cretaceous	yes
GDP98-052	BMRD-98-112	Cretaceous	yes
GDP98-053	BMRD-98-112	Cretaceous	yes
GDP98-054	BMRD-98-189A	Quaternary	no
GDP98-055	BMRD-98-189A	Quaternary	no
GDP98-056	BMRD-98-189A	Quaternary	no
GDP98-057	BMRD-98-189A	Quaternary	no
GDP98-058	BMRD-98-189A	Quaternary	no
GDP98-059	BMRD-98-189A	Quaternary	no
GDP98-060	BMRD-98-189A	Quaternary	no
GDP98-061	BMRD-98-189A	Quaternary	no
GDP98-062	BMRD-98-189A	Cretaceous	no
GDP98-063	BMRD-98-189A	Cretaceous	yes
GDP98-064	BMRD-98-189A	Cretaceous	yes
GDP98-065	BMRD-98-189B	Quaternary	no
GDP98-066	BMRD-98-189B	Cretaceous	no
GDP98-067	BMRD-98-189B	Cretaceous	yes
GDP98-068	BMRD-98-189B	Cretaceous	no
GDP98-069	BMRD-98-29	Quaternary	no
GDP98-070	BMRD-98-29	Quaternary	no
GDP98-071	BMRD-98-29	Quaternary	no
GDP98-072	BMRD-98-29	Quaternary	no
GDP98-073	BMRD-98-29	Quaternary	no
GDP98-074	BMRD-98-29	Quaternary	no
GDP98-075	BMRD-98-29	Quaternary	no
GDP98-076	BMRD-98-6	Quaternary	no
GDP98-077	BMRD-98-6	Quaternary	no
GDP98-078	BMRD-98-6	Quaternary	no
GDP98-079	BMRD-98-6	Quaternary	no
GDP98-080	BMRD-98-6	Quaternary	no
GDP98-081	BMRD-98-6	Quaternary	no
GDP98-082	BMRD-98-6	Quaternary	no
GDP98-083	BMRD-98-6	Quaternary	no
GDP98-084	BMRD-98-6	Quaternary	no
GDP98-085	BMRD-98-6	Quaternary	no
GDP98-086	BMRD-98-6	Quaternary	no
GDP98-087	BMRD-98-6	Quaternary	no
GDP98-088	BMRD-98-6	Quaternary	no
GDP98-089	BMRD-98-6	Quaternary	no
GDP98-090	BMRD-98-6	Quaternary	no
GDP98-091	BMRD-98-6	Quaternary	no
GDP98-092	BMRD-98-6	Cretaceous	no
GDP98-093	BMRD-98-6	Cretaceous	no
GDP98-094	BMRD-98-6	Quaternary	no
GDP98-095	BMRD-98-6	Cretaceous	no

Appendix F.4.

Magnetic Susceptibility

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
15.50	0.20	0.13	pink mud
15.70	0.17	0.17	pink mud
15.90	0.17	0.19	pink mud
16.10	0.23	0.17	pink mud
16.30	0.17	0.14	dark grey mud
16.50	0.03	0.08	dark grey mud
16.70	0.03	0.07	dark grey mud
16.90	0.02	0.09	dark grey mud
17.10	0.26	0.14	dark grey mud
17.30	0.16	0.15	dark grey mud
17.50	0.07	0.15	dark grey mud
17.70	0.17	0.17	dark grey mud
17.90	0.26	0.21	dark grey mud
18.10	0.22	0.20	dark grey mud
18.30	0.22	0.18	dark grey mud
18.50	0.02	0.16	dark grey mud
18.70	0.22	0.18	dark grey mud
18.90	0.24	0.21	dark grey mud
19.10	0.24	0.24	dark grey mud
19.30	0.24	0.25	dark grey mud
19.50	0.24	0.26	dark grey mud
19.70	0.35	0.26	dark grey mud
19.90	0.20	0.24	dark grey mud
20.10	0.21	0.21	dark grey mud
20.30	0.24	0.15	dark grey mud
20.50	0.00	0.08	dark grey mud
20.70	0.00	0.03	dark grey mud
20.90	-0.01	0.00	dark grey mud
21.10	0.00	0.00	dark grey mud
21.30	0.00	0.00	dark grey mud
21.50	0.01	0.00	dark grey mud
21.70	0.00	0.00	dark grey mud
21.90	0.00	0.01	dark grey mud
22.10	0.01	0.02	dark grey mud
22.30	0.02	0.05	dark grey mud
22.50	0.07	0.10	dark grey mud
22.70	0.21	0.16	dark grey mud
22.90	0.21	0.20	dark grey mud
23.10	0.25	0.20	dark grey mud
23.30	0.19	0.15	dark grey mud
23.50	0.01	0.08	dark grey mud
23.70	0.01	0.03	dark grey mud
23.90	0.01	0.04	dark grey mud
24.10	0.03	0.09	dark grey mud
24.30	0.23	0.17	dark grey mud
24.50	0.25	0.21	dark grey mud
24.70	0.23	0.22	dark grey mud
24.90	0.22	0.20	dark grey mud

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
25.10	0.16	0.18	dark grey mud
25.30	0.15	0.17	dark grey mud
25.50	0.18	0.18	dark grey mud
25.70	0.21	0.17	dark grey mud
25.90	0.21	0.14	dark grey mud
26.10	0.00	0.07	dark grey mud
26.30	0.01	0.04	dark grey mud
26.50	0.01	0.02	dark grey mud
26.70	0.06	0.02	dark grey mud
26.90	0.00	0.04	dark grey mud
27.10	0.00	0.06	dark grey mud
27.30	0.22	0.08	dark grey mud
27.50	0.01	0.06	dark grey mud
27.70	0.01	0.07	dark grey mud
27.90	0.05	0.10	dark grey mud
28.10	0.23	0.17	dark grey mud
28.30	0.25	0.22	dark grey mud
28.50	0.23	0.25	dark grey mud
28.70	0.26	0.26	dark grey mud
28.90	0.29	0.24	dark grey mud
29.10	0.28	0.22	dark grey mud
29.30	0.01	0.18	dark grey mud
29.50	0.29	0.19	dark grey mud
29.70	0.16	0.19	dark grey mud
29.90	0.19	0.19	dark grey mud
30.10	0.27	0.16	dark grey mud
30.30	0.00	0.12	dark grey mud
30.50	0.07	0.14	dark grey mud
30.70	0.24	0.19	dark grey mud
30.90	0.28	0.22	dark grey mud
31.10	0.29	0.19	dark grey mud
31.30	0.00	0.10	dark grey mud
31.50			no core
31.70			no core
31.90			no core
32.10			no core
32.30			no core
32.50			no core
32.70			no core
32.90			no core
33.10			no core
33.30			no core
33.50			no core
33.70			no core
33.90			no core
34.10			no core
34.30			no core
34.50			no core

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
34.70			no core
34.90			no core
35.10			no core
35.30			no core
35.50			no core
35.70			no core
35.90	0.07	0.07	dark grey/light grey shale
36.10	0.06	0.06	dark grey/light grey shale
36.30	0.05	0.06	dark grey/light grey shale
36.50	0.05	0.06	dark grey/light grey shale
36.70	0.08	0.05	dark grey/light grey shale
36.90	0.05	0.04	dark grey/light grey shale
37.10	0.00	0.03	dark grey/light grey shale
37.30	0.00	0.03	dark grey/light grey shale
37.50	0.08	0.06	dark grey/light grey shale
37.70	0.09	0.07	dark grey/light grey shale
37.90	0.09	0.08	dark grey/light grey shale
38.10	0.04	0.07	dark grey/light grey shale
38.30	0.08	0.07	dark grey/light grey shale
38.50	0.06	0.07	dark grey/light grey shale
38.70	0.09	0.06	dark grey/light grey shale
38.90	0.04	0.04	dark grey/light grey shale
39.10	0.00	0.02	dark grey/light grey shale
39.30	0.00	0.01	dark grey/light grey shale
39.50	0.01	0.01	dark grey/light grey shale
39.70	0.01	0.02	dark grey/light grey shale
39.90	0.04	0.03	dark grey/light grey shale
40.10			no core
40.30			no core
40.50			no core
40.70			no core
40.90			no core
41.10			no core
41.30	0.00	0.02	tar sands
41.50	0.05	0.02	tar sands
41.70	0.00	0.02	tar sands
41.90	0.06	0.03	tar sands
42.10	0.00	0.02	tar sands
42.30	0.01	0.02	tar sands
42.50	0.01	0.02	tar sands
42.70	0.05	0.03	tar sands
42.90	0.04	0.04	tar sands
43.10	0.03	0.05	tar sands
43.30	0.07	0.05	tar sands
43.50	0.05	0.05	tar sands
43.70	0.04	0.05	tar sands
43.90	0.04	0.05	tar sands
44.10	0.05	0.05	tar sands

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
44.30	0.06	0.05	tar sands
44.50	0.05	0.05	tar sands
44.70	0.06	0.04	tar sands
44.90	0.01	0.02	tar sands
45.10	0.00	0.01	tar sands
45.30	0.00	0.01	tar sands
45.50	0.04	0.02	tar sands
45.70	0.03	0.03	tar sands
45.90	0.02	0.04	tar sands
46.10	0.03	0.04	tar sands
46.30	0.10	0.05	tar sands
46.50	0.02	0.04	tar sands
46.70	0.01	0.03	tar sands
46.90	0.02	0.03	tar sands
47.10	0.07	0.04	tar sands
47.30	0.04	0.04	tar sands
47.50	0.02	0.03	tar sands
47.70	0.03	0.02	tar sands
47.90	0.00	0.03	tar sands
48.10	0.05	0.03	tar sands
48.20	0.05	0.03	tar sands
48.40	0.02	0.03	tar sands
48.60	0.02	0.02	tar sands
48.80	0.02	0.02	tar sands
49.00	0.01	0.02	tar sands
49.20	0.03	0.03	tar sands
49.40	0.04	0.03	tar sands
49.60	0.02	0.02	tar sands
49.80	0.00	0.01	tar sands
50.00	0.00	0.00	tar sands
50.20	0.00	0.00	tar sands
50.40	0.00	0.01	tar sands
50.60	0.00	0.02	tar sands
50.80	0.07	0.04	tar sands
51.00	0.07	0.05	tar sands
51.20	0.05	0.05	tar sands
51.40	0.04	0.05	tar sands
51.60	0.03	0.06	tar sands
51.80	0.11	0.07	tar sands
52.00	0.07	0.07	tar sands
52.20	0.04	0.06	tar sands
52.40	0.05	0.05	tar sands
52.60	0.05	0.04	tar sands
52.80	0.03	0.03	tar sands
53.00	0.00	0.02	tar sands
53.20	0.00	0.02	tar sands
53.40	0.05	0.03	tar sands
53.60	0.04	0.04	tar sands

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
53.80	0.02	0.04	tar sands
54.00	0.07	0.03	tar sands
54.20	0.00	0.02	tar sands
54.40	0.00	0.01	tar sands
54.60	0.00	0.00	tar sands
54.80	0.00	0.00	tar sands
55.00	0.00	0.01	tar sands
55.20	0.03	0.02	tar sands
55.40	0.03	0.03	tar sands
55.60	0.03	0.03	tar sands
55.80	0.04	0.03	tar sands
56.00	0.03	0.03	tar sands
56.20	0.02	0.03	tar sands
56.40	0.01	0.03	tar sands
56.60	0.05	0.03	tar sands
56.80	0.04	0.04	tar sands
57.00	0.03	0.04	tar sands
57.20	0.03	0.03	tar sands
57.40	0.04	0.03	tar sands
57.60	0.03	0.04	tar sands
57.80	0.04	0.04	tar sands
58.00	0.04	0.04	tar sands
58.20	0.05	0.04	tar sands
58.40	0.04	0.04	tar sands
58.60	0.03	0.04	tar sands
58.80	0.03	0.04	tar sands
59.00	0.05	0.04	tar sands
59.20	0.03	0.03	tar sands
59.40	0.03	0.04	tar sands
59.60	0.02	0.06	tar sands
59.80	0.12	0.07	tar sands
60.00	0.12	0.07	tar sands
60.20	0.00	0.05	limey shale
60.40	0.02	0.03	limey shale
60.60	0.04	0.03	limey shale
60.80	0.05	0.05	limey shale
61.00	0.04	0.05	limey shale
61.20	0.09	0.05	limey shale
61.40	0.01	0.04	limey shale
61.60	0.05	0.04	limey shale
61.80	0.02	0.03	limey shale
62.00	0.02	0.03	limey shale
62.20	0.03	0.04	limey shale
62.40	0.07	0.05	limey shale
62.60	0.07	0.06	limey shale
62.80	0.03	0.05	limey shale
63.00	0.06	0.04	limey shale
63.20	0.00	0.04	limey shale

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
63.40	0.06	0.05	limey shale
63.60	0.08	0.06	limey shale
63.80	0.06	0.05	limey shale
64.00	0.02	0.04	limey shale
64.20	0.03	0.03	limey shale
64.40	0.01	0.02	limey shale
64.60	0.03	0.02	limey shale
64.80	0.00	0.03	limey shale
65.00	0.06	0.04	limey shale
65.20	0.05	0.05	limey shale
65.40	0.06	0.06	limey shale
65.60	0.07	0.06	limey shale
65.80	0.05	0.06	limey shale
66.00	0.07	0.07	limey shale
66.20	0.08	0.07	limey shale
66.40	0.06	0.07	limey shale
66.60	0.07	0.07	limey shale
66.80	0.08	0.06	limey shale
67.00	0.04	0.05	limey shale
67.20	0.03	0.05	limey shale
67.40	0.06	0.05	limey shale
67.60	0.06	0.05	limey shale
67.80	0.03	0.06	limey shale
68.00	0.09	0.07	limey shale
68.20	0.07	0.07	limey shale
68.40	0.06	0.07	limey shale
68.60	0.07	0.07	limey shale
68.80	0.09	0.07	limey shale
69.00	0.07	0.07	limey shale
69.20	0.03	0.07	limey shale
69.40	0.09	0.08	limey shale
69.60	0.10	0.08	limey shale
69.80	0.09	0.09	limey shale
70.00	0.07	0.08	limey shale
70.20	0.07	0.08	limey shale
70.40	0.09	0.08	limey shale
70.60	0.09	0.08	limey shale
70.80	0.07	0.09	limey shale
71.00	0.10	0.09	limey shale
71.20	0.09	0.09	limestone
71.40	0.10	0.09	limestone
71.60	0.07	0.08	limestone
71.80	0.09	0.07	limestone
72.00	0.04	0.06	limestone
72.20	0.04	0.05	limestone
72.40	0.06	0.04	limestone
72.60	0.01	0.03	limestone
72.80	0.04	0.02	limestone

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
73.00	0.04	0.01	limestone
73.20	-0.06	0.00	limestone
73.40	-0.03	0.00	limestone
73.60	-0.01	0.00	limestone
73.80	0.00	0.00	limestone
74.00	0.00	0.01	limestone
74.20	0.03	0.01	limestone
74.40	0.01	0.01	limestone
74.60	0.01	0.01	limestone
74.80	0.00	0.00	limestone
75.00	0.00	0.01	limestone
75.20	0.01	0.01	limestone
75.40	0.04	0.02	limestone
75.60	0.00	0.02	limestone
75.80	0.03	0.02	limestone
76.00	0.03	0.02	limestone
76.20	0.01	0.02	limestone
76.40	0.03	0.02	limestone
76.60	0.01	0.02	limestone
76.80	0.03	0.03	limestone
77.00	0.04	0.03	limestone
77.20	0.03	0.04	limestone
77.40	0.03	0.04	limestone
77.60	0.07	0.05	limestone
77.80	0.04	0.04	limestone
78.00	0.03	0.04	limestone
78.20	0.03	0.03	limestone
78.40	0.04	0.03	limestone
78.60	0.03	0.03	limestone
78.60	0.00	0.01	limestone
78.80	0.03	0.01	limestone
79.00	-0.03	0.00	limestone
79.20	0.00	0.00	limestone
79.40	0.00	0.00	limestone
79.60	0.00	0.00	limestone
79.80	0.01	0.01	limestone
80.00	0.01	0.01	limestone
80.20	0.01	0.01	limestone
80.40	0.01	0.02	limestone
80.60	0.03	0.02	limestone
80.80	0.03	0.03	limestone
81.00	0.03	0.03	limestone
81.20	0.03	0.03	limestone
81.40	0.04	0.03	limestone
81.60	0.01	0.02	limestone
81.80	0.03	0.03	limestone
82.00	0.01	0.03	lms/shale/dolomite
82.20	0.06	0.04	lms/shale/dolomite

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
82.40	0.04	0.04	lms/shale/dolomite
82.60	0.03	0.04	lms/shale/dolomite
82.80	0.06	0.05	lms/shale/dolomite
83.00	0.04	0.06	lms/shale/dolomite
83.20	0.09	0.07	lms/shale/dolomite
83.40	0.09	0.07	lms/shale/dolomite
83.60	0.04	0.06	lms/shale/dolomite
83.80	0.06	0.06	lms/shale/dolomite
84.00	0.07	0.06	lms/shale/dolomite
84.20	0.07	0.07	lms/shale/dolomite
84.40	0.07	0.08	lms/shale/dolomite
84.60	0.12	0.10	lms/shale/dolomite
84.80	0.07	0.10	lms/shale/dolomite
85.00	0.15	0.11	lms/shale/dolomite
85.20	0.09	0.09	lms/shale/dolomite
85.40	0.06	0.07	lms/shale/dolomite
85.60	0.03	0.05	lms/shale/dolomite
85.80	0.04	0.04	lms/shale/dolomite
86.00	0.03	0.03	lms/shale/dolomite
86.20	0.03	0.03	lms/shale/dolomite
86.40	0.04	0.04	lms/shale/dolomite
86.60	0.04	0.05	lms/shale/dolomite
86.80	0.07	0.05	lms/shale/dolomite
87.00	0.06	0.05	lms/shale/dolomite
87.20	0.01	0.05	lms/shale/dolomite
87.40	0.06	0.05	lms/shale/dolomite
87.60	0.07	0.06	lms/shale/dolomite
87.80	0.07	0.07	lms/shale/dolomite
88.00	0.09	0.07	lms/shale/dolomite
88.20	0.04	0.06	lms/shale/dolomite
88.40	0.06	0.05	lms/shale/dolomite
88.60	0.03	0.04	lms/shale/dolomite
88.80	0.03	0.04	lms/shale/dolomite
89.00	0.06	0.04	lms/shale/dolomite
89.20	0.01	0.04	lms/shale/dolomite
89.40	0.06	0.05	lms/shale/dolomite
89.60	0.04	0.06	lms/shale/dolomite
89.80	0.10	0.07	lms/shale/dolomite
90.00	0.06	0.06	lms/shale/dolomite
90.20	0.06	0.06	lms/shale/dolomite
90.40	0.03	0.06	lms/shale/dolomite
90.60	0.10	0.06	lms/shale/dolomite
90.80	0.03	0.05	lms/shale/dolomite
91.00	0.06	0.05	lms/shale/dolomite
91.20	0.04	0.05	lms/shale/dolomite
91.40	0.07	0.05	lms/shale/dolomite
91.60	0.04	0.04	lms/shale/dolomite
91.80	0.03	0.03	lms/shale/dolomite

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
92.00	0.00	0.02	lms/shale/dolomite
92.20	0.04	0.02	lms/shale/dolomite
92.40	0.00	0.01	lms/shale/dolomite
92.60	-0.01	0.00	lms/shale/dolomite
92.80	-0.01	0.00	lms/shale/dolomite
93.00	-0.01	0.00	lms/shale/dolomite
93.20	0.00	0.00	lms/shale/dolomite
93.40	0.00	0.00	lms/shale/dolomite
93.60	0.00	0.00	lms/shale/dolomite
93.80	0.00	0.00	lms/shale/dolomite
94.00	0.00	0.00	lms/shale/dolomite
94.20	0.00	0.00	lms/shale/dolomite
94.40	0.00	0.00	lms/shale/dolomite
94.60	0.00	0.00	lms/shale/dolomite
94.80	0.00	0.00	lms/shale/dolomite
95.00	0.01	0.00	lms/shale/dolomite
95.20	0.00	0.01	lms/shale/dolomite
95.40	0.01	0.01	lms/shale/dolomite
95.60	0.01	0.01	lms/shale/dolomite
95.80	0.00	0.01	lms/shale/dolomite
96.00	0.03	0.02	lms/shale/dolomite
96.20	0.01	0.02	lms/shale/dolomite
96.40	0.03	0.02	lms/shale/dolomite
96.60	0.01	0.02	lms/shale/dolomite
96.80	0.04	0.03	lms/shale/dolomite
97.00	0.04	0.03	lms/shale/dolomite
97.20	0.03	0.02	lms/shale/dolomite
97.40	0.00	0.01	lms/shale/dolomite
97.60	0.00	0.00	lms/shale/dolomite
97.80	0.00	0.00	lms/shale/dolomite
98.00	0.00	0.01	lms/shale/dolomite
98.20	0.03	0.02	lms/shale/dolomite
98.40	0.04	0.02	lms/shale/dolomite
98.60	0.01	0.02	lms/shale/dolomite
98.80	0.01	0.02	lms/shale/dolomite
99.00	0.03	0.02	lms/shale/dolomite
99.20	0.01	0.01	lms/shale/dolomite
99.40	0.01	0.01	lms/shale/dolomite
99.60	0.00	0.00	lms/shale/dolomite
99.80	0.00	0.00	lms/shale/dolomite
100.00	0.01	0.00	lms/shale/dolomite
100.20	0.00	0.01	lms/shale/dolomite
100.40	0.00	0.01	lms/shale/dolomite
100.60	0.03	0.01	lms/shale/dolomite
100.80	0.00	0.01	lms/shale/dolomite
101.00	0.00	0.01	lms/shale/dolomite
101.20	0.03	0.01	lms/shale/dolomite
101.40	0.01	0.01	dolomite

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
101.60	0.00	0.01	dolomite
101.80	0.00	0.00	dolomite
102.00	0.00	0.00	dolomite
102.20	0.00	0.00	dolomite
102.40	0.01	0.01	dolomite
102.60	0.01	0.01	dolomite
102.80	0.01	0.01	dolomite
103.00	0.00	0.01	dolomite
103.20	0.01	0.01	dolomite
103.40	0.01	0.01	dolomite
103.60	0.01	0.01	dolomite
103.80	0.03	0.02	dolomite
104.00	0.01	0.02	dolomite
104.20	0.01	0.02	dolomite
104.40	0.04	0.02	dolomite
104.60	0.01	0.02	dolomite
104.80	0.03	0.02	dolomite
105.00	0.01	0.02	dolomite
105.20	0.03	0.01	dolomite
105.40	-0.01	0.00	dolomite
105.60	-0.03	0.00	dolomite
105.80	0.00	0.00	dolomite
106.00	0.00	0.00	dolomite
106.20	0.00	0.00	dolomite
106.40	0.00	0.00	dolomite
106.60	0.00	0.00	dolomite
106.80	0.00	0.00	dolomite
107.00	0.00	0.00	dolomite
107.20	0.00	0.00	dolomite
107.40	0.00	0.00	dolomite
107.60	0.00	0.00	dolomite
107.80	0.00	0.00	dolomite
108.00	0.01	0.01	dolomite
108.20	0.01	0.01	dolomite
108.40	0.01	0.01	dolomite
108.60	0.01	0.01	dolomite
108.80	0.01	0.01	dolomite
109.00	0.01	0.02	dolomite
109.20	0.03	0.02	dolomite
109.40	0.03	0.03	dolomite
109.60	0.03	0.03	dolomite
109.80	0.03	0.03	dolomite
110.00	0.03	0.03	dolomite
110.20	0.04	0.03	dolomite
110.40	0.03	0.03	dolomite
110.60	0.03	0.03	dolomite
110.80	0.01	0.03	dolomite
111.00	0.06	0.03	dolomite

Magnetic Susceptibility Readings
BMRD-98-14
Readings in 10^{-3} units SI

Anomaly #14

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	RAW READING	SMOOTHED	LITHOLOGY
111.20	0.03	0.03	dolomite
111.40	0.01	0.02	dolomite
111.60	0.03	0.02	dolomite
111.80	0.00	0.02	dolomite
112.00	0.03	0.02	dolomite
112.20	0.01	0.01	dolomite
112.40	0.00	0.01	dolomite
112.60	0.01	0.01	dolomite
112.80	0.01	0.01	dolomite
113.00	0.03	0.02	dolomite
113.20	0.01	0.01	dolomite
113.40	0.00	0.01	dolomite
113.60	0.01	0.01	dolomite
113.80	0.01	0.01	dolomite
114.00	0.01	0.02	dolomite
114.20	0.03	0.02	dolomite
114.40	0.03	0.02	dolomite
114.60	0.01	0.02	dolomite
114.80	0.00	0.02	dolomite
115.00	0.04	0.02	dolomite
115.20	0.03	0.02	dolomite
115.40	0.00	0.02	dolomite
115.60	0.01	0.02	dolomite
115.80	0.04	0.03	dolomite
116.00	0.03	0.03	dolomite
116.20	0.03	0.04	dolomite
116.40	0.03	0.05	dolomite
119.30	0.08	0.06	dolomite
120.80	0.06	0.08	dolomite
122.30	0.10	0.08	dolomite
123.80	0.09	0.06	dolomite
125.30	0.00	0.06	dolomite
126.80	0.08	0.03	green shale/gypsum
128.30	0.02	0.06	green shale/gypsum
129.80	0.08	0.09	green shale/gypsum
131.30	0.16	0.10	green shale/gypsum
132.80	0.07	0.10	green shale/gypsum
134.30	0.06	0.07	green shale/gypsum
135.80	0.08	0.06	green shale/gypsum
137.30	0.05	0.06	green shale/gypsum
138.80	0.04	0.06	green shale/gypsum
140.30	0.08	0.04	green shale/gypsum
141.80	0.01	0.03	green shale/gypsum
143.30	0.01	0.03	green shale/gypsum
144.80	0.07	0.04	green shale/gypsum
146.30	0.04	0.06	red sandstone
147.80	0.06	0.05	red sandstone
149.30	0.05	0.06	red sandstone

Magnetic Susceptibility Readings
BMRD-98-210A
Readings in 10^{-3} units SI

Anomaly #210A

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
test1	*14.70*	*gneiss boulder at top of 9710-158, good response to magnet*
test2	*0.14*	*McMurray shale in 9710-158*
0.01	2.01	surface sand at drill pad
19.90	0.37	pink mud
25.30	0.40	pink mud
25.50	0.35	pink mud
25.80	0.90	pink mud
26.00	0.48	dark grey mud
26.20	0.40	dark grey mud
26.40	0.40	dark grey mud
26.60	0.40	dark grey mud
26.80	0.43	dark grey mud
27.00	0.35	dark grey mud
27.40	0.37	dark grey mud
		no core
30.50	0.37	dark grey mud
30.70	0.46	dark grey mud
30.90	0.42	dark grey mud
31.10	0.42	dark grey mud
		no core
32.00	0.88	dark grey mud
32.20	0.43	dark grey mud
32.40	0.39	dark grey mud
32.60	0.39	dark grey mud
32.80	0.43	dark grey mud
33.00	0.48	dark grey mud
33.20	0.45	dark grey mud
33.40	0.45	dark grey mud
		no core
44.40	0.17	pink mud
44.60	0.28	pink mud
44.80	0.39	pink mud
44.90	0.57	siltstone boulders
		no core
50.30	0.07	tar sand
50.50	0.03	tar sand
50.70	0.07	tar sand
50.90	0.15	tar sand
51.10	0.45	tar sand
51.30	0.45	tar sand
51.50	0.12	tar sand
51.70	0.09	tar sand
		no core
52.60	0.07	tar sand
52.80	0.12	tar sand
53.00	0.14	tar sand
53.20	0.17	tar sand
53.40	0.09	tar sand

Magnetic Susceptibility Readings
BMRD-98-210A
Readings in 10^{-3} units SI

Anomaly #210A

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
53.60	0.42	tar sand
53.80	0.15	tar sand
54.00	0.09	tar sand
54.10	0.51	limey shale, very minor sulphides
54.60	0.09	limey shale
55.10	0.09	limey shale
55.60	0.18	limey shale
56.10	0.14	limey shale
56.60	0.10	limey shale
57.00	0.10	limey shale
57.50	0.15	limey shale
58.00	0.12	limey shale
58.50	0.10	limey shale
59.00	0.12	limey shale
59.50	0.18	limey shale
60.00	0.17	limey shale
60.50	0.15	limey shale
61.00	0.12	limey shale
61.50	0.10	limey shale
62.00	0.17	limey shale
62.50	0.17	limey shale
63.00	0.12	limey shale
63.50	0.14	limey shale
64.00	0.14	limey shale
64.50	0.14	limey shale
65.00	0.14	limey shale
65.50	0.15	limey shale
66.00	0.15	limey shale
66.50	0.14	limey shale
67.00	0.15	limey shale
67.50	0.14	limey shale
68.00	0.18	limey shale
68.50	0.17	limey shale
69.00	0.17	limey shale
69.50	0.17	limey shale
70.00	0.31	limey shale
70.50	0.17	limey shale
71.00	0.20	limey shale
71.50	0.14	limey shale
72.00	0.15	limey shale
72.50	0.45	limey shale/lms contact
73.00	0.10	lms
73.50	0.10	lms
74.00	0.12	lms
80.00	0.10	lms
85.00	0.01	shale/gypsum
90.00	0.09	shale/gypsum
95.00	0.08	shale/gypsum
100.00	0.10	shale/gypsum

Magnetic Susceptibility Readings
BMRD-98-210A
Readings in 10^{-3} units SI

Anomaly #210A

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
105.00	0.05	shale/gypsum
110.00	0.04	dolomite
115.00	0.09	dolomite
118.00	0.01	dolomite/bituminous laminations
E.O.H. @ 118.50		
test1	*14.80*	*gneiss boulder at top of 9710-158*
test2	*0.20*	*McMurray shale in 9710-158*

Magnetic Susceptability Readings
BMRD-98-210B
Readings in 10^{-3} units SI

Anomaly #210B

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
test1	*14.70*	*gneiss boulder at top of 9710-158, good response to magnet*
test2	*0.20*	*McMurray shale in 9710-158*
0.01	0.75	surface sand at drill pad
23.20	0.42	pink/grey mud
23.40	0.45	pink/grey mud
23.60	0.43	pink/grey mud
23.80	0.48	pink/grey mud
24.00	0.40	pink/grey mud
24.20	0.35	pink/grey mud
24.40	0.42	pink/grey mud
24.60	0.62	pink/grey mud
24.80	0.56	grey/brown mud
25.00	0.34	grey/brown mud
25.20	0.32	grey/brown mud
25.40	0.37	grey/brown mud
25.60	0.42	grey/brown mud
25.80	0.40	grey/brown mud
26.00	0.56	grey/brown mud
26.20	0.42	grey/brown mud
26.40	0.43	grey/brown mud
26.60	0.49	grey/brown mud
26.80	0.45	grey/brown mud
27.00	0.48	grey/brown mud
27.20	0.51	grey/brown mud
27.40	0.60	grey/brown mud
27.60	0.45	grey/brown mud
27.80	0.57	grey/brown mud
28.00	0.45	grey/brown mud
28.20	0.46	grey/brown mud
28.40	0.40	grey/brown mud
28.60	0.43	grey/brown mud
28.80	0.39	grey/brown mud
29.00	0.39	grey/brown mud
29.20	0.57	grey/brown mud
29.40	0.59	grey/brown mud
29.60	0.45	grey/brown mud
29.80	0.45	grey/brown mud
30.00	0.43	grey/brown mud
30.20	0.48	grey/brown mud
30.40	0.45	grey/brown mud
30.60	0.43	grey/brown mud
		no core
32.40	0.39	grey/brown mud
		no core
33.60	0.46	grey/brown mud
		no core
39.80	0.48	
		no core

Magnetic Susceptability Readings
BMRD-98-210B
Readings in 10^{-3} units SI

Anomaly #210B

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
41.50	0.37	grey/brown mud
41.70	0.37	grey/brown mud
41.90	0.28	grey/brown mud
42.10	0.28	grey/brown mud
42.30	0.35	grey/brown mud
42.50		no core
42.70	0.31	grey/brown mud
42.90	0.68	grey/brown mud
		no core
44.60	0.53	grey/brown mud
44.80	0.35	pink mud
45.00	0.21	pink mud
45.20	0.35	pink mud
45.40	0.39	pink mud
45.60	0.31	pink mud
45.80	0.37	pink mud
46.00	0.20	pink mud
		no core
47.60	0.24	silty grey mud
47.80	0.12	tar sands
48.00	0.09	tar sands
48.20	0.07	tar sands
48.40	0.12	tar sands
48.60	0.07	tar sands
48.80	0.10	tar sands
49.00	0.09	tar sands
49.20	0.10	tar sands
49.40	0.04	tar sands
49.60	0.06	tar sands
49.80	0.07	tar sands
50.00	0.07	tar sands
50.20		no core
50.40		no core
50.60	0.04	tar sands
50.80	0.09	tar sands
51.00	0.07	tar sands
51.20	0.18	tar sands
51.40	0.35	tar sands, no observable change in lithology
51.60	0.57	tar sands, no observable change in lithology
51.80	0.09	tar sands
52.00	0.06	tar sands
52.20	0.32	tar sands
52.40	0.04	tar sands
52.60	0.07	tar sands
52.80	0.06	tar sands
53.00	0.07	tar sands
53.20	0.09	tar sands
53.40	0.09	tar sands
53.60	0.21	tar sands

Magnetic Susceptability Readings
BMRD-98-210B
Readings in 10^{-3} units SI

Anomaly #210B

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
53.80	0.07	tar sands
54.00	0.15	tar sands
54.20	0.10	tar sands
54.40	0.23	tar sands
54.60	0.18	tar sands
54.80	0.40	tar sands
54.95	0.10	tar sands
55.05	0.18	limey shale
55.50	0.20	limey shale
56.00	0.10	limey shale
56.50	0.09	limey shale
57.00	0.17	limey shale
57.50	0.14	limey shale
58.00	0.18	limey shale
58.50	0.07	limey shale
59.00	0.10	limey shale
59.50	0.12	limey shale
60.00		no core
60.50		no core
61.00		no core
61.50	0.62	limey shale
62.00		no core
62.50		no core
63.00	0.12	limey shale
63.50	0.14	limey shale
64.00	0.12	limey shale
64.50	0.10	limey shale
65.00	0.15	limey shale
65.50	0.12	limey shale
66.00	0.14	limey shale
66.50	0.15	limey shale
67.00	0.15	limey shale
67.50		no core
68.00		no core
68.50	0.21	limey shale
69.00	0.12	limey shale
69.50	0.18	limey shale
70.00	0.18	limey shale
70.50	0.12	limey shale
71.00	0.17	limey shale
71.50	0.35	limey shale
72.00	0.17	limey shale
72.50	0.14	limey shale
73.00	0.15	limey shale
73.50	0.17	limey shale
74.00	0.12	limey shale
74.50	0.15	limey shale
75.00	0.18	limey shale
75.50	0.15	limey shale

Magnetic Susceptability Readings
BMRD-98-210B
Readings in 10^{-3} units SI

Anomaly #210B

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
76.00	0.17	limey shale
76.50	0.12	limey shale
77.00		no core
77.50	0.14	limey shale
78.00	0.20	limey shale
78.50	0.31	limey shale
79.00	0.15	limey shale
79.50	0.15	limey shale
80.00	0.15	limey shale
80.05	0.14	limey shale
80.15	0.09	limestone
80.50	0.07	limestone
82.00	0.03	limestone
84.00	0.04	limestone
88.00	0.04	limestone
91.00	0.04	shale
94.00	0.03	limestone
96.00	0.10	shale
100.00	0.03	limestone
105.00	0.04	lms/shale
110.00	0.03	dolomite
115.00	0.00	dolomite
120.00	0.03	dolomite
125.00	0.03	oil saturated dolomite
130.00	0.04	dolomite
135.00	0.17	shale/gypsum
140.00	0.06	gypsum
145.00	0.06	shale/gypsum
150.00	0.09	shale/gypsum
155.00	0.10	shale/gypsum
160.00	0.21	red sandstone
162.00	0.09	red sandstone
163.90	0.06	red sandstone
164.10	0.17	granitoid gneiss
164.30	0.15	granitoid gneiss
164.50	0.01	granitoid gneiss
165.00	0.17	granitoid gneiss
165.50	0.18	granitoid gneiss
166.00	0.24	granitoid gneiss
166.50	0.21	granitoid gneiss
167.00	0.15	granitoid gneiss
167.50	0.23	granitoid gneiss
168.00	0.09	granitoid gneiss
168.50	0.15	granitoid gneiss
169.00	0.15	granitoid gneiss
169.50	0.20	granitoid gneiss
170.00	0.12	granitoid gneiss
170.50	0.14	granitoid gneiss
171.00	0.03	granitoid gneiss

Magnetic Susceptability Readings
BMRD-98-210B
Readings in 10^{-3} units SI

Anomaly #210B

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
171.50	0.35	granitoid gneiss
172.00	0.10	granitoid gneiss
172.50	0.00	granitoid gneiss
173.00	0.26	granitoid gneiss
173.50	0.06	granitoid gneiss
174.00	0.29	granitoid gneiss
174.50	0.32	granitoid gneiss
175.00	0.20	granitoid gneiss
175.50	0.18	granitoid gneiss
176.00	0.24	granitoid gneiss
176.50	0.21	granitoid gneiss
177.00	0.53	granitoid gneiss
E.O.H. @ 177.15		
test1	*14.50*	*gneiss boulder at top of 9710-158*
test2	*0.18*	*McMurray shale in 9710-158*

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
test1	14.60	gneiss boulder at top of 9710-158, good response to magnet
test2	0.17	McMurray shale in 9710-158
0.01	0.10	till sample at drill pad
14.50	0.23	black mud
15.00	0.28	black mud
15.50		no core
16.00		no core
16.50		no core
17.00		no core
17.50	0.18	black mudstone
18.00	0.34	black mudstone
18.50	0.24	black mudstone
19.00	0.31	black mudstone
19.50	0.23	black mudstone
20.00	0.28	black mudstone
20.50	1.32	10 cm siltstone bed
21.00	0.26	black mudstone
21.50	0.42	black mudstone
22.00	0.31	black mudstone
22.50	0.28	black mudstone
23.00	0.29	black mudstone
23.50	0.26	black mudstone
24.00	0.35	black mudstone
24.50	0.51	black mudstone
25.00	0.31	black mudstone
25.50	0.15	black mudstone
26.00	0.24	black mudstone
26.50	0.26	black mudstone
27.00	0.70	25 cm siltstone bed
27.50	0.04	black mudstone
28.00	0.18	black mudstone
28.50	1.02	28 cm siltstone bed
29.00	0.18	black mudstone
29.50	0.18	black mudstone
30.00	0.20	black mudstone
30.50	0.18	black mudstone
31.00	0.20	black mudstone
31.50	0.17	black mudstone
32.00	0.21	black mudstone
32.50	0.20	black mudstone
33.00	0.17	black mudstone
33.50		no core
34.00		no core
34.50		no core
35.00	1.71	23 cm mudstone bed
35.50	0.24	black mudstone
36.00	0.20	black mudstone
36.50		no core

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
37.00		no core
37.50		no core
38.00		no core
38.50		no core
39.00		no core
39.50	0.18	black mudstone
40.00	0.17	black mudstone
40.50	0.14	black mudstone
41.00	0.17	black mudstone
41.50	0.15	black mudstone
42.00	0.04	black mudstone
42.50	0.12	black mudstone
43.00		no core
43.50		no core
44.00	0.10	black mudstone
44.50	0.98	siltstone bed
45.00	0.20	black mudstone
45.50	0.20	black mudstone
46.00	0.17	black mudstone
46.50	0.10	black mudstone
47.00	0.20	black mudstone
47.50	0.17	black mudstone
48.00	1.24	30 cm siltstone bed
48.50	0.17	black mudstone
49.00	0.07	fine grained tar sand
49.50		no core
50.00		no core
50.50	0.07	fine grained tar sand
51.00	0.04	fine grained tar sand
51.50	0.17	fine grained tar sand
52.00	0.06	fine grained tar sand
52.50	0.07	fine grained tar sand
53.00	0.06	fine grained tar sand
53.50	0.04	fine grained tar sand
54.00	0.17	fine grained tar sand
54.50	0.10	fine grained tar sand
55.00	0.10	fine grained tar sand
55.50	0.10	fine grained tar sand
56.00	0.07	fine grained tar sand
56.50		no core
57.00		no core
57.50	0.06	fine grained tar sand
58.00	0.04	fine grained tar sand
58.50	0.10	fine grained tar sand
59.00	0.10	fine grained tar sand
59.50	0.07	fine grained tar sand
60.00	0.09	fine grained tar sand
60.50	0.17	fine grained tar sand
61.00	0.07	fine grained tar sand

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
61.50	0.01	fine grained tar sand
62.00	0.06	fine grained tar sand
62.50	0.04	fine grained tar sand
63.00	0.09	fine grained tar sand
63.50	0.14	fine grained tar sand
64.00		no core
64.50	0.12	fine grained tar sand
65.00	0.31	cemented siltstone
65.50	0.04	fine grained tar sand
66.00	0.06	fine grained tar sand
66.50	0.09	fine grained tar sand
67.00	0.10	fine grained tar sand
67.50	0.10	fine grained tar sand
68.00	0.15	fine grained tar sand
68.50	0.24	fine grained tar sand
69.00	0.07	fine grained tar sand
69.50	0.20	fine grained tar sand
70.00	0.12	fine grained tar sand
70.50	0.14	fine grained tar sand
71.00	0.03	fine grained tar sand
71.50	0.14	fine grained tar sand
72.00	0.09	fine grained tar sand
72.50	0.10	fine grained tar sand
73.00	0.12	fine grained tar sand
73.50	0.07	fine grained tar sand
74.00	0.07	fine grained tar sand
74.50	0.09	fine grained tar sand
75.00	0.09	fine grained tar sand
75.50	0.14	fine grained tar sand
76.00	0.15	fine grained tar sand
76.50	0.10	fine grained tar sand
77.00	0.04	fine grained tar sand
77.50	0.14	fine grained tar sand
78.00	0.31	no core
78.50	0.15	fine grained tar sand
79.00	0.10	fine grained tar sand
79.50	0.10	fine grained tar sand
80.00	0.12	fine grained tar sand
80.50	0.10	fine grained tar sand
81.00	0.10	fine grained tar sand
81.50	0.17	fine grained tar sand
82.00	0.10	fine grained tar sand
82.50	0.10	fine grained tar sand
83.00	0.15	fine grained tar sand
83.50	0.71	cemented siltstone bed
84.00	0.09	fine grained tar sand
84.50	0.07	fine grained tar sand
85.00	1.02	cemented siltstone bed
85.50	0.20	fine grained tar sand

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
86.00	0.14	fine grained tar sand
86.50	1.62	siltstone bed
87.00	0.07	fine grained tar sand
87.50	0.10	fine grained tar sand
88.00	0.15	fine grained tar sand
88.50	0.00	fine grained tar sand
89.00	0.35	fine grained tar sand
89.50	0.69	cemented siltstone bed
90.00	0.01	fine grained tar sand
90.50	0.04	fine grained tar sand
91.00	0.14	fine grained tar sand
91.50	0.03	fine grained tar sand
92.00	0.00	fine grained tar sand
92.50	0.04	fine grained tar sand
93.00	0.09	fine grained tar sand
93.50	0.12	fine grained tar sand
94.00	0.00	fine grained tar sand
94.50	0.09	fine grained tar sand
95.00	0.17	fine grained tar sand
95.40	0.68	10 cm of mudstone
95.50	0.03	fine grained tar sand
96.00	0.14	fine grained tar sand
96.50	0.12	fine grained tar sand
97.00	0.06	fine grained tar sand
97.50	2.07	10 cm mudstone bed
98.00	0.07	fine grained tar sand
98.50	0.17	fine grained tar sand
99.00	0.09	fine grained tar sand
99.50	0.10	fine grained tar sand
100.00	0.15	fine grained tar sand
100.50	0.01	fine grained tar sand
101.00	0.00	fine grained tar sand
101.50	0.07	fine grained tar sand
102.00		no core
102.50		no core
103.00		no core
103.50	0.12	fine grained tar sand
104.00	0.03	fine grained tar sand
104.50	0.04	fine grained tar sand
105.00	0.07	fine grained tar sand
105.50	0.06	fine grained tar sand
106.00	0.03	fine grained tar sand
106.50	0.20	fine grained tar sand
107.00	0.17	fine grained tar sand
107.50	0.07	fine grained tar sand
108.00		no core
108.50		no core
109.00		no core
109.50		no core

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
110.00		no core
110.50		no core
111.00		no core
111.50		no core
112.00		no core
112.50	0.18	fine grained tar sand
113.00	0.04	fine grained tar sand
113.50	0.09	fine grained tar sand
114.00	0.32	fine grained tar sand
114.50	0.14	fine grained tar sand
115.00	0.26	fine grained tar sand
115.50	0.10	fine grained tar sand
116.00		no core
116.50		no core
117.00		no core
117.50		no core
118.00		no core
118.50		no core
119.00		no core
119.50		no core
120.00		no core
120.50	0.10	tar sand
121.00	0.07	tar sand
121.50	0.07	tar sand
122.00	0.04	tar sand
122.50	0.23	tar sand
123.00	0.26	tar sand
123.50	0.18	tar sand
124.00	0.40	tar sand
124.50	0.21	tar sand
125.00	0.03	tar sand
125.50	0.21	tar sand
126.00	0.32	tar sand
126.50	0.35	tar sand
127.00	0.20	tar sand
127.50	0.12	tar sand
128.00		no core
128.50		no core
129.00		no core
129.50		no core
130.00	0.06	tar sand
130.50		no core
131.00		no core
131.50	0.18	water sand
132.00	0.20	water sand
132.50	0.23	water sand
133.00	0.26	water sand
133.50	0.32	water sand
134.00		no core

Magnetic Susceptibility Readings
BMRD-98-112
Reading in 10^{-3} units SI

Anomaly #112

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
134.50		no core
135.00		no core
135.50	0.20	water sand
136.00	0.06	water sand
136.50	0.20	water sand
137.00	0.18	water sand
137.50	0.35	water sand
138.00	0.88	water sand
138.50		no core
139.00	0.07	water sand
139.50	0.04	water sand
140.00	0.01	water sand
140.50	0.01	water sand
141.00	0.01	water sand
141.50	0.00	water sand
142.00		no core
142.50		no core
143.00	0.01	water sand
143.50	0.06	limey shale
144.00	0.06	limey shale
144.50	0.26	limey shale
145.00	0.15	limey shale
145.50	0.17	limey shale
146.00	0.60	limey shale
146.50	0.29	limey shale
147.00	0.21	limey shale
147.50	0.17	limey shale
E.O.H. @ 149.05		

Magnetic Susceptibility Readings
BMRD-98-189A
Readings in 10^{-3} units SI

Anomaly #189A

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
test1	14.50	gneiss boulder at top of 9710-158, good response to magnet
test2	0.18	McMurray shale in 9710-158
18.00	0.31	brown mud
18.50		no core
19.00		no core
19.50		no core
20.00	0.37	brown mud
20.50		no core
21.00		no core
21.50	0.37	brown mud
21.60		no core
22.00		no core
22.50		no core
23.00	0.40	brown mud
23.50	0.37	brown mud
24.00	0.43	brown mud
24.50		no core
25.00		no core
25.50		no core
26.00		no core
26.50		no core
27.00		no core
27.50		no core
28.00		no core
28.50		no core
29.00	0.49	brown mud
29.50	0.43	brown mud
30.00	0.43	brown mud
30.50	0.48	brown mud
30.50		no core
31.00		no core
31.50		no core
32.00		no core
32.50		no core
33.00		no core
33.50		no core
34.00		no core
34.50		no core
35.00		no core
35.50		no core
36.00		no core
36.50	0.31	brown mud
37.00		no core
37.50		no core
38.00		no core
38.50		no core
39.00	0.40	brown mud
39.50	0.34	pink mud

Magnetic Susceptibility Readings
BMRD-98-189A
Readings in 10^{-3} units SI

Anomaly #189A

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
41.00		no core
41.50	0.28	pink mud
42.00	0.40	pink mud
42.50	0.34	pink mud
43.00	0.20	grey phyllitic/talc shale
43.50	0.23	grey phyllitic/talc shale
44.00	0.26	grey phyllitic/talc shale
44.50		no core
45.00	0.21	brown shale, wood fragments, slight phyllitic sheen
45.50	0.20	brown shale, wood fragments, slight phyllitic sheen
46.00	0.15	brown shale
46.50	0.15	brown shale
47.00	0.14	brown shale
47.50	0.20	brown shale
47.80		no core
48.00		no core
48.50		no core
49.00		no core
49.50		no core
50.00		no core
50.50		no core
51.00		no core
51.50		no core
52.00		no core
52.50		no core
53.00		no core
53.50		no core
54.00		no core
54.50		no core
55.00		no core
55.50		no core
56.00		no core
56.50		no core
57.00		no core
57.50		no core
58.00		no core
58.50		no core
59.00		no core
59.50		no core
60.00		no core
60.50		no core
61.00		no core
61.50		no core
62.00		no core
62.50		no core
63.00		no core
63.50	0.06	nod. lms
64.00	0.09	limey shale
64.50	0.10	nod. lms

Magnetic Susceptibility Readings
BMRD-98-189A
Readings in 10^{-3} units SI

Anomaly #189A

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
65.00	0.09	nod. lms
65.50	0.09	nod. lms
66.00	0.06	nod. lms
66.50		no core
67.00	0.09	nod. lms
67.50	0.09	nod. lms
68.00	0.07	nod. lms
68.50	0.07	nod. lms
69.00	0.04	nod. lms
69.50	0.06	nod. lms
71.00		no core
71.50	0.14	nod. lms
72.00	0.12	nod. lms
72.50	0.10	nod. lms
73.00	0.12	nod. lms
73.50	0.12	nod. lms
74.00	0.14	nod. lms
74.50	0.14	limey shale
75.00	0.10	limey shale
75.50	0.06	limey shale
76.00	0.06	limey shale
76.50	0.12	limey shale
77.00	0.10	limey shale
77.50	0.12	limey shale
78.00	0.06	limey shale
78.50	0.10	limey shale
79.00		no core
79.50	0.14	limey shale
80.00	0.10	limey shale
80.50	0.12	limey shale
81.00	0.10	limey shale
81.50	0.07	limey shale
82.00	0.06	limey shale
82.50	0.14	limey shale
83.00	0.12	limey shale
83.50	0.10	limey shale
84.00	0.17	limey shale
84.50	0.12	limey shale
85.00	0.12	limey shale
85.50	0.17	limey shale
86.00	0.10	limey shale
86.50	0.10	limey shale
87.50	0.06	lms
88.00	0.04	lms
95.00	0.04	lms
97.00	0.04	lms
100.00	0.04	lms
E.O.H @ 102.00		
test1	15.10	gneiss boulder at top of 9710-158

Magnetic Susceptibility Readings
BMRD-98-189A
Readings in 10^{-3} units SI

Anomaly #189A

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
test2	0.17	McMurray shale in 9710-158

Magnetic Susceptibility Readings
BMRD-98-189B
Readings in 10^{-3} units SI

Anomaly #189B

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
test1	15.40	gneiss boulder at top of 9710-158, good response to magnet
test2	0.20	McMurray shale in 9710-158
35.50	0.46	grey mud
36.00		no core
36.50		no core
37.00		no core
37.50		no core
38.00		no core
38.50	0.29	pink mud
39.00		no core
39.50		no core
40.00	0.06	red qtzite
40.50		no core
41.00	3.30	red gneiss clast
41.50	0.23	granite clast
42.00		no core
42.50	0.23	phyllitic shale
43.00	0.04	pyrite nodule
43.50	0.09	phyllitic shale
44.00		no core
44.50		no core
45.00	0.10	wood fragments in shale
45.50	0.06	shale/ss
46.00	0.09	shale/ss
46.50	0.09	shale/ss
47.00		no core
47.50		no core
48.00		no core
48.50		no core
49.00	0.09	bitumen stained sand
49.50		no core
51.00	0.09	bitumen stained sand
51.50		no core
52.00		no core
52.50	0.07	silty shale
52.70		no core, water sand in mud tanks
53.00		no core
53.50		no core
54.00		no core
54.50		no core
55.00		no core
55.50		no core
56.00		no core
56.50		no core
57.00		no core
57.50		no core
58.00	0.50	no core, water sand in mud tanks
58.50		no core

Magnetic Susceptibility Readings
BMRD-98-189B
Readings in 10^{-3} units SI

Anomaly #189B

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
59.00		no core
59.50		no core
60.00		no core
60.50		no core
61.00		no core
61.50		no core
62.00		no core
62.50		no core
63.00	0.14	de-calcified lms
63.50	0.07	de-calcified lms
64.00	0.10	de-calcified lms
64.50	0.04	lms/limey shale
65.00	0.09	lms/limey shale
65.50	0.09	lms/limey shale
67.00	0.04	lms/limey shale
67.50	0.09	lms/limey shale
68.00	0.09	10 cm brecciated lms/limey shale
68.50	0.09	lms/limey shale
69.00	0.12	lms/limey shale
69.50	0.06	lms/limey shale
70.00	0.07	lms/limey shale
70.50	0.04	lms/limey shale
71.00	0.04	lms/limey shale
71.50	0.04	lms/limey shale
72.00	0.04	lms/limey shale
72.50	0.07	lms/limey shale
73.00	0.06	lms/limey shale
73.50	0.07	lms/limey shale
74.00	0.04	lms/limey shale
74.50	0.04	lms/limey shale
75.00		no core
75.50		no core
76.00		no core
76.50	0.06	lms/limey shale
77.00	0.07	lms/limey shale
77.50		no core
78.00	0.06	lms/limey shale
78.50	0.03	lms/limey shale
79.00	0.04	lms/limey shale
79.50	0.04	lms/limey shale
80.00	0.06	lms/limey shale
80.50		no core
81.00		no core
81.50	0.12	lms/limey shale
82.00	0.09	limey shale
82.50		no core
83.00	0.12	limey shale
83.50	0.12	limey shale
84.00		no core

Magnetic Susceptibility Readings
BMRD-98-189B
Readings in 10^{-3} units SI

Anomaly #189B

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
84.50		no core
85.00		no core
85.50		no core
86.00	0.09	limey shale
86.50		no core
87.00		no core
87.50		no core
88.00	0.15	limey shale
88.50		no core
89.00		no core
89.50	0.10	10 cm section of brecciated limey shale
90.00	0.00	limey shale
91.50	0.10	limey shale
92.00	0.09	limey shale
92.50		no core
93.00		no core
93.50		no core
94.00		no core
94.50	0.10	limey shale
95.00	0.10	limey shale with sub-vertical fractures
95.50	0.10	limey shale
96.00	0.10	limey shale
96.50	0.10	limey shale
97.00	0.00	brown lms
97.50		no core
98.00	0.04	brown lms
98.50	0.00	brown lms
99.00	0.04	brown lms
99.50	0.04	brown lms
100.00	0.05	1 cm rounded clasts of lms
100.50	0.07	brown lms
101.00		no core
101.50	0.04	brown lms
102.00		no core
102.50		no core
103.00	0.04	brown lms
103.50		no core
104.00	0.04	brown lms
104.50	0.04	bituminous lms
105.00	0.06	brown lms
105.50		no core
106.00	0.03	brown lms
106.50		no core
107.00		no core
107.50	0.09	brecciated lms
108.00	0.06	brown lms
108.50		no core
109.00	0.03	brown lms
109.50	0.09	brecciated green/brown shale

Magnetic Susceptibility Readings
BMRD-98-189B
Readings in 10^{-3} units SI

Anomaly #189B

NOTE: entire core was slowly scanned with the meter set to take continous readings.

DEPTH	READING	LITHOLOGY
110.00		no core
110.50	0.17	brecciated green/brown shale
111.00		no core
111.50		no core
112.00	0.12	1 cm rounded clasts of lms
112.50	0.06	brecciated green/brown shale
113.00	0.07	brecciated green/brown shale
113.50	0.12	brecciated green/brown shale
114.00	0.10	brecciated green/brown shale
114.50	0.04	vuggy lms
115.00	0.15	brecciated green/brown shale
E.O.H. @ 115.00		
test1	15.60	gneiss boulder at top of 9710-158
test2	0.20	McMurray shale in 9710-158

Magnetic Susceptibility Readings
BMRD-98-29
Readings in 10^{-3} units SI

Anomaly #29

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
test1	15.00	gneiss boulder at top of 9710-158, good response to magnet
test2	0.20	McMurray shale in 9710-158
0.01	0.25	surface till sample from site BJ98-006
34.00	0.35	pink mud
34.50	0.26	pink mud
35.00	0.39	pink/grey mud
35.50	0.45	pink/grey mud
36.00	0.35	pink/grey mud
36.50	0.18	pink/grey mud
37.00	0.32	pink/grey mud
37.50	0.32	pink/grey mud
38.00	0.28	pink/grey mud
38.50	0.24	pink/grey mud
39.00	0.24	pink/grey mud
39.50	0.31	pink/grey mud
40.00	0.15	pink/grey mud
40.50	0.32	pink/grey mud
41.00	0.42	pink/grey mud
41.50	0.15	pink/grey mud
42.00	0.29	pink/grey mud
42.50	0.20	pink/grey mud
43.00		no core
43.50		no core
44.00	0.15	pink/grey mud
44.50	0.31	pink/grey mud
45.00	0.20	pink/grey mud
45.50		no core
46.00		no core
46.50		no core
47.00		no core
47.50	0.35	pink mud
48.00	0.42	pink mud
48.50	0.37	pink mud
49.00	0.34	pink mud
49.50	0.28	pink mud
50.00	0.46	pink mud
50.50	0.37	pink mud
51.00	0.28	pink mud
51.50		no core
52.00		no core
52.50		no core
53.00		no core
53.50		no core
54.00		no core
54.50		no core
55.00		no core
55.50		no core
56.00	0.37	shale/lms/dol.

Magnetic Susceptibility Readings
BMRD-98-29
Readings in 10^{-3} units SI

Anomaly #29

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
56.50	0.04	shale/lms/dol.
57.00	0.04	shale/lms/dol.
57.50	0.02	shale/lms/dol.
58.00	0.06	shale/lms/dol.
58.50	0.01	shale/lms/dol.
59.00	0.04	shale/lms/dol.
59.50	0.03	shale/lms/dol.
60.00	0.04	shale/lms/dol.
60.50	0.03	shale/lms/dol.
61.00	0.04	shale/lms/dol.
61.50	0.04	shale/lms/dol.
62.00	0.07	shale/lms/dol.
62.50	0.06	shale/lms/dol.
63.00	0.03	shale/lms/dol.
63.50	0.03	shale/lms/dol.
64.00	0.03	shale/lms/dol.
64.50	0.03	shale/lms/dol.
65.00	0.03	shale/lms/dol.
65.50	0.03	shale/lms/dol.
66.00	0.01	dolomite
66.50	0.01	dolomite
67.00	0.01	dolomite
67.50	0.01	dolomite
68.00	0.01	dolomite
68.50		no core
69.00	0.04	dolomite
69.50	0.04	dolomite
70.00		no core
70.50	0.03	dolomite
71.00	0.01	dolomite
71.50	0.01	dolomite
72.00	0.01	dolomite
72.50	0.03	dolomite
73.00	0.03	dolomite
73.50	0.03	dolomite
74.00	0.03	dolomite
74.50	0.03	dolomite
75.00		no core
75.50		no core
76.00		no core
76.50	0.07	dolomite
77.00	0.03	dolomite
77.50	0.01	dolomite
78.00	0.01	dolomite
78.50	0.01	dolomite
79.00	0.03	dolomite
79.50	0.04	dolomite
80.00	0.03	dolomite
80.50	0.06	dolomite

Magnetic Susceptibility Readings
BMRD-98-29
Readings in 10^{-3} units SI

Anomaly #29

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
81.00	0.01	dolomite
81.50	0.03	dolomite
82.00	0.09	dolomite
82.50	0.03	dolomite
83.00	0.01	dolomite
83.50	0.01	dolomite
84.00		no core
84.50	0.04	dolomite
85.00		no core
85.50		no core
86.00	0.03	dolomite
86.50	0.01	dolomite
87.00	0.00	dolomite
87.50	0.01	dolomite
88.00	0.01	dolomite
88.50	0.01	dolomite
89.00		no core
89.50	0.03	dolomite
90.00	0.01	dolomite
90.50	0.01	dolomite
91.00	0.01	dolomite
91.50	0.04	dolomite
92.00	0.01	dolomite
92.50	0.01	dolomite
93.00	0.01	dolomite
93.50	0.01	dolomite
94.00	0.00	dolomite
94.50	0.03	dolomite
95.00	0.03	dolomite
95.50	0.01	dolomite
96.00	0.03	dolomite
96.50	0.03	dolomite
97.00	0.04	dolomite
97.50	0.00	dolomite
98.00	0.01	dolomite
98.50	0.00	dolomite
99.00	0.00	dolomite
99.50	0.06	dolomite
100.00	0.04	dolomite
100.50	0.01	dolomite
101.00	0.01	dolomite
101.50	0.03	dolomite
102.00	0.04	dolomite
102.50	0.06	dolomite
103.00	0.06	dolomite
103.50		no core
104.00		no core
104.50		no core
105.00		no core

Magnetic Susceptibility Readings
BMRD-98-29
Readings in 10^{-3} units SI

Anomaly #29

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
105.50	0.01	dolomite
106.00	0.03	dolomite
106.50	0.04	dolomite
107.00	0.03	dolomite
107.50	0.03	dolomite
108.00	0.01	dolomite
108.50	0.03	dolomite
109.00	0.06	dolomite
109.50	0.04	dolomite
110.00	0.01	dolomite
110.50	0.01	dolomite
111.00	0.00	dolomite
111.50	0.04	dolomite
112.00	0.00	dolomite
112.50	0.06	dolomite
113.00	0.03	dolomite
113.50	0.03	dolomite
114.00	0.01	dolomite
114.50	0.04	dolomite
115.00	0.01	dolomite
115.50	0.00	dolomite
116.00	0.00	dolomite
116.50	0.00	dolomite
117.00	0.04	dolomite
117.50	0.01	dolomite
118.00	0.03	dolomite
118.50	0.03	dolomite
119.00	0.02	dolomite
119.50	0.00	dolomite
120.00	0.04	dolomite
120.50	0.01	dolomite
121.00	0.01	dolomite
121.50	0.01	dolomite
122.00	0.06	dolomite
122.50	0.05	dolomite
123.00	0.01	dolomite
123.50	0.00	dolomite
124.00	0.01	dolomite
124.50	0.04	dolomite
125.00	0.03	dolomite
125.50	0.03	dolomite
126.00	0.03	dolomite
126.50	0.04	dolomite
127.00	0.03	dolomite
127.50	0.04	dolomite
128.00	0.03	dolomite
128.50	0.00	dolomite
129.00	0.03	dolomite
129.50	0.01	dolomite

Magnetic Susceptibility Readings
BMRD-98-29
Readings in 10^{-3} units SI

Anomaly #29

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
130.00	0.01	dolomite
130.50	0.04	dolomite
131.00	0.00	dolomite
131.50	0.01	dolomite
132.00	0.01	dolomite
132.50	0.03	dolomite
133.00	0.01	dolomite
133.50	0.01	dolomite
134.00	0.01	dolomite
134.50	0.03	dolomite
135.00	0.07	dolomite
135.50	0.01	dolomite
136.00	0.00	dolomite
136.50	0.01	dolomite
137.00	0.00	dolomite
137.50	0.03	dolomite
138.00	0.01	dolomite
138.50	0.03	dolomite
139.00	0.00	dolomite
139.50	0.00	dolomite
140.00	0.00	dolomite
140.50	0.03	dolomite
141.00	0.04	dolomite
141.50	0.01	dolomite
142.00	0.03	dolomite
142.50	0.04	dolomite
143.00	0.04	dolomite
143.50	0.00	dolomite
144.00	0.01	dolomite
144.50	0.01	dolomite
145.00	0.01	dolomite
145.50	0.06	dolomite
146.00	0.03	dolomite
146.50	0.01	dolomite
147.00	0.07	dolomite
E.O.H. @ 147.18m		

Magnetic Susceptibility Readings
BMRD-98-6
Readings in 10^{-3} units SI

Anomaly #6

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
test1	15.60	gneiss boulder at top of 9710-158, good response to magnet
test2	0.23	McMurray shale in 9710-158
0.01	0.31	sand at surface of rill pad BJ98-007
52.00	0.35	glacial lake sediment
52.50	0.40	glacial lake sediment
53.00		no core
53.50		no core
54.00		no core
54.50		no core
55.00		no core
55.50		no core
56.00		no core
56.50	0.26	brown mud
57.00	0.32	brown mud
57.50	0.20	brown mud
58.00	0.29	brown mud
58.50		no core
59.00		no core
59.50	0.28	brown mud
60.00	0.35	brown mud
60.50	0.32	brown mud
61.00	0.31	brown mud
61.50	0.37	brown mud
62.00		no core
62.50		no core
63.00		no core
63.50		no core
64.00		no core
64.50		no core
65.00		no core
65.50	0.34	brown mud
66.00		no core
66.50		no core
67.00	0.29	brown mud
67.50		no core
68.00		no core
68.50		no core
69.00	0.32	brown mud
69.50		no core
70.00	0.35	brown mud
70.50		no core
71.00	0.32	brown mud
71.50	0.34	brown mud
72.00		no core
72.50	0.34	brown mud
73.00	0.24	brown mud
73.50		no core
74.00		no core

Magnetic Susceptibility Readings
BMRD-98-6
Readings in 10^{-3} units SI

Anomaly #6

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
74.50	0.39	brown mud
75.00	0.46	brown mud
75.50	0.34	brown mud
76.00	0.46	brown mud
76.50	0.40	brown mud
77.00	0.40	brown mud
77.50	0.32	brown mud
78.00	0.46	brown mud
78.50	0.42	brown mud
79.00	0.40	brown mud
79.50		no core
80.00		no core
80.50		no core
81.00	0.29	pink mud
81.50	0.24	pink mud
82.00		no core
82.50	0.26	pink mud
83.00	0.39	pink mud
83.50		no core
84.00		no core
84.50		no core
85.00		no core
85.50		no core
86.00		no core
86.50	0.32	pink mud
87.00	0.24	pink mud
87.50	0.26	pink mud
88.00	0.42	pink mud
88.50	0.40	pink mud
89.00	0.42	pink mud
89.50	0.40	pink mud
90.00	0.40	pink mud
90.50		no core
91.00	0.45	pink mud
91.50	0.32	pink mud
92.00	0.37	pink mud
92.50	0.09	dark brown mud
93.00	0.14	dark brown mud
93.50	0.10	dark brown mud
94.00	0.09	dark brown mud
94.50	0.09	dark brown mud
95.00	0.07	dark brown mud
95.50	0.07	dark brown mud
96.00	0.09	dark brown mud
96.50		no core
97.00		no core
97.50		no core
98.00		no core
98.50	0.07	dark brown mud

Magnetic Susceptibility Readings
BMRD-98-6
Readings in 10^{-3} units SI

Anomaly #6

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
99.00	0.04	dark brown mud
99.50	0.10	dark brown mud
100.00	0.09	dark brown mud
100.50	0.09	dark brown mud
101.00		no core
101.50	0.12	dark brown mud
102.00	0.09	dark brown mud
102.50	0.04	dark brown mud
103.00	0.10	dark brown mud
103.50	0.06	dark brown mud
104.00	0.06	dark brown mud
104.50	0.10	dark brown mud
105.00	0.10	dark brown mud
105.50	0.04	calcite cemented ss
106.00	0.07	calcite cemented ss
106.50	0.07	calcite cemented ss
107.00		no core
107.50		no core
108.00	0.06	calcite cemented ss
108.50	0.01	calcite cemented ss
109.00		no core
109.50		no core
110.00		no core
110.50		no core
111.00		no core
111.50	0.04	calcite cemented ss
112.00		no core
112.50		no core
113.00		no core
113.50		no core
114.00		no core
114.50		no core
115.00		no core
115.50		no core
116.00		no core
116.50		no core
117.00		no core
117.50		no core
118.00		no core
118.50		no core
119.00		no core
119.50		no core
120.00		no core
120.50	0.03	calcite cemented ss
121.00	0.03	calcite cemented ss
121.50	0.01	calcite cemented ss
122.00	0.01	calcite cemented ss
122.50		no core
123.00	0.01	calcite cemented ss

Magnetic Susceptibility Readings
BMRD-98-6
Readings in 10^{-3} units SI

Anomaly #6

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
123.50		no core
124.00		no core
124.50		no core
125.00		no core
125.50		no core
126.00		no core
126.50		no core
127.00		no core
127.50		no core
128.00	0.01	calcite cemented ss
128.50		no core
129.00		no core
129.50	0.03	calcite cemented ss
130.00		no core
130.50		no core
131.00	0.04	calcite cemented ss
131.50		no core
132.00		no core
132.50	0.10	calcite cemented ss
133.00		no core
133.50		no core
134.00		no core
134.50		no core
135.00	0.04	calcite cemented ss
135.50	0.03	calcite cemented ss
136.00	0.04	calcite cemented ss
136.50	0.06	calcite cemented ss
137.00	0.04	calcite cemented ss
137.50	0.07	calcite cemented ss
138.00	0.06	calcite cemented ss
138.50	0.04	limey shale/ calcite ss
139.00		no core
139.50		no core
140.00		no core
140.50	0.04	limey shale/ calcite ss
141.00	0.07	limey shale/ calcite ss
141.50	0.06	limey shale/ calcite ss
142.00		no core
142.50		no core
143.00		no core
143.50		no core
144.00		no core
144.50	0.09	brecciated limey shale
145.00	0.07	brecciated limey shale
145.50	0.15	brecciated limey shale
146.00	0.17	brecciated limey shale
146.50	0.14	brecciated limey shale
147.00	0.10	brecciated limey shale
147.50	0.10	brecciated limey shale

Magnetic Susceptibility Readings
BMRD-98-6
Readings in 10^{-3} units SI

Anomaly #6

NOTE: entire core was slowly scanned with the meter set to take continuous readings.

DEPTH	READING	LITHOLOGY
148.00	0.12	brecciated limey shale
148.50	0.12	brecciated limey shale
149.00	0.23	brecciated limey shale
149.50	0.10	brecciated limey shale
150.00	0.14	brecciated limey shale
150.50	0.14	brecciated limey shale
151.00	0.12	brecciated limey shale
151.50	0.10	brecciated limey shale
152.00	0.09	brecciated limey shale
152.50	0.10	brecciated limey shale
153.00	0.09	brecciated limey shale
153.50	0.10	brecciated limey shale
154.00	0.10	brecciated limey shale
154.50	0.07	brecciated limey shale
155.00	0.04	brecciated limey shale
155.50	0.09	brecciated limey shale
156.00	0.07	brecciated limey shale
156.50	0.03	brecciated limey shale/sand
157.00	0.04	brecciated limey shale/sand
157.50	0.09	brecciated limey shale/sand
158.00	0.06	brecciated limey shale/sand
158.50	0.07	brecciated limey shale/sand
159.00	0.07	brecciated limey shale/sand
159.50	0.07	limestone
160.00	0.04	limestone
160.50	0.03	limestone
161.00	0.04	limestone
161.50	0.04	limestone
162.00	0.03	brecciated lms
162.50	0.06	brecciated lms
163.00	0.01	brecciated lms
163.50	0.01	brecciated lms
E.O.H. @ 163.82		

Appendix G

Declaration of Truth of Expenditures

BIRCH MOUNTAIN RESOURCES LTD.

Declaration of Truth of Expenditures

I declare that all expenditures listed in "Table 5. Exploration expenditures", included herein, are correct and were incurred in carrying out the assessment work detailed in this report.

BIRCH MOUNTAIN RESOURCES LTD.

Per: [redacted]
Douglas J. Rowe
President and CEO

Appendix H

Statement of Qualifications

STATEMENT OF QUALIFICATIONS

Kyla M. Arden, B.Sc., M.Sc.

I, Kyla M. Arden, certify and declare that I am a graduate of the University of Manitoba, Winnipeg, Manitoba, with a B.Sc. in Geology (1993) and an M.Sc. in Geochemistry (1995).

My experience from 1991 to 1998 includes:

- conducting field geological and geochemical surveys
- planning and supervising field mineral exploration programs involving geological and geochemical programs
- planning and conducting scientific research, including publishing and presentation of results in peer-reviewed journals

Since May 1997, I have been employed as Project Geologist, Birch Mountain Resources Ltd.

I reside at:

[redacted] Calgary, Alberta T3K 2K2.

I HEREBY CERTIFY:

1. That I have visited the property described in this report;
2. That I participated in the production of this report.

Dated at Calgary, Alberta, this 9th day of February, 1999.

[redacted]

Kyla Arden, M.Sc.

STATEMENT OF QUALIFICATIONS

Glen R. De Paoli

I, Glen Robert De Paoli, hereby certify that:

1. I hold the degrees of:
   B.Sc. in Geology (University of Calgary, 1988)
   M.Sc. in Metamorphic Petrology (University of Calgary, 1994)

2. I have been a member in good standing of the Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) since March, 1997, and am registered as a Professional Geologist.

3. I have practiced as a geologist for 7 years, predominantly in the field of mineral exploration.

4. I took part in the work described in this report.

Dated at Calgary, Alberta, on this 9th day of February, 1999.

[redacted]

Glen R. De Paoli, P. Geol.

STATEMENT OF QUALIFICATIONS

Brett G. Johnson, B.Sc.

I, Brett G. Johnson, hereby certify that:

1. I am a mineral exploration geologist, and have practiced my profession since May of 1996;

2. I hold a degree of B.Sc. in Environmental Geology and Technology from the University Of North Dakota, in Grand Forks, North Dakota;

3. I have been an employee with Birch Mountain Resources since June, 1996.

4. I have worked on this property since January, 1998, and participated in the work described in this report.

Dated at Calgary, Alberta, this 9th day of February, 1999.

[redacted]

Brett G. Johnson, B.Sc.

STATEMENT OF QUALIFICATIONS

William R. Hemstock, B.Sc.

I, William R. Hemstock, certify that I am a graduate of The University of Calgary, Calgary, Alberta, and hold a B.Sc. in Environmental Biology (1974).

My experience from 1980 to 1998 includes:

- Conducting land, marine and airborne geophysical surveys;
- Conducting biogeochemical and soil exploration surveys;
- Planning and conducting scientific research, with the preparation and publication of reports, including mapping and data analysis.

I have been employed by Brougham GeoQuest, a company associated with Birch Mountain Resources Ltd. From January, 1995, I have been employed with Birch Mountain Resources Ltd. as an exploration and mapping technologist.

I reside at:

[redacted] Calgary AB T2W 4T7

I hereby certify that I took part in the work described in this report.

Dated at Calgary, Alberta, on this 9th day of February, 1999.

[redacted]

William R. Hemstock

STATEMENT OF QUALIFICATIONS

Hugh J. Abercrombie, B.Sc., M.Sc., Ph.D.

I, Hugh James Abercrombie, graduated from the University of British Columbia, Vancouver, B.C., with a B.Sc. (Hons.) in Geology in 1978, from Carleton University, Ottawa, Ontario, with a M.Sc. in Geology in 1984, and from the University of Calgary, Calgary, Alberta, with a Ph.D. in Geochemistry in 1988.

From 1978 to 1980 I was engaged in mineral exploration with Trigg, Woollett Consulting Ltd., of Edmonton, Alberta. From 1989 to 1997 I worked as a research scientist with the Geological Survey of Canada, in Calgary, Alberta. Since February, 1997, I have been employed by Birch Mountain Resources Ltd., Calgary, Alberta, initially as Manager Exploration and, since November 13, 1998, as Vice-President Exploration.

My experience includes:

- Senior management role with a junior mining company;
- Planning and supervising multiple field mineral exploration programs involving geological, geochemical, geophysical and drilling programs;
- Conducting field geological, geochemical and geophysical surveys;
- Planning and conducting scientific research and managing operations analytical geochemistry laboratories;
- Teaching and supervising graduate students as an adjunct professor.

I reside at:

[redacted], Calgary, Alberta T3A 0N1

I HEREBY CERTIFY:

1. That I visited the area discussed in this report and the work described was conducted with my participation and under my direct supervision.

2. That this report was prepared by myself and others under my direct supervision.

Dated at Calgary, Alberta, this 8th day of February, 1999.

[redacted]

Hugh J. Abercrombie