580426

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Earth Physics Branch
Direction de la physique du globe

1 Observatory Crescent
Ottawa Canada
K1A 0Y3

1 Place de l'Observatoire
Ottawa Canada
K1A 0Y3

Geothermal Service of Canada

Service géothermique du Canada

B.C. HYDRO AND POWER AUTHORITY AND ENERGY, MINES & RESOURCES CANADA JOINT VENTURE

REPORT ON 1978 FIELD WORK - MEAGER CREEK GEOTHERMAL AREA, UPPER LILLOOET RIVER, BRITISH COLUMBIA

Brian D. Fairbank, P.Eng., G.A. Shore, L.J. Werner, Andrew E. Nevin, P.Eng., and T.L. Sadlier-Brown

Work conducted under B.C. Hydro and Power Authority P.O. 848-731
Energy, Mines & Resources Contract OSB78-00163

Earth Physics Branch Open File Number 79-10

Ottawa, Canada, 1979

82 pp., 22 figures and 3 tables

Price/Prix: $38.00

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Earth Physics Branch
Direction de la physique du globe

1 Observatory Crescent
Ottawa Canada
K1A 0Y3

1 Place de l'Observatoire
Ottawa Canada
K1A 0Y3

Geothermal Service of Canada

Service géothermique du Canada

B.C. HYDRO AND POWER AUTHORITY AND ENERGY, MINES & RESOURCES CANADA JOINT VENTURE

REPORT ON 1978 FIELD WORK - MEAGER CREEK GEOTHERMAL AREA, UPPER LILLOOET RIVER, BRITISH COLUMBIA

Brian D. Fairbank, P.Eng., G.A. Shore, L.J. Werner, Andrew E. Nevin, P.Eng., and T.L. Sadlier-Brown

Work conducted under B.C. Hydro and Power Authority P.O. 848-731
Energy, Mines & Resources Contract OSB78-00163

Earth Physics Branch Open File Number 79-10

Ottawa, Canada, 1979

82 pp., 22 figures and 3 tables

Price/Prix: $38.00

ABSTRACT

Geothermal exploration at Meager Creek in 1978 provided significant and encouraging new subsurface information. Two wells were drilled and both recorded temperatures in excess of 100°C. One of these confirmed a new target area. Geophysical surveys refined earlier concepts of the boundaries of the three areas of interest and allowed a division into:

a. the South Reservoir

b. the North Reservoir

c. the Lillooet Valley resistivity anomaly.

The South Reservoir is the best-defined. It has been under specific study since 1974. Seven diamond drill holes have been put down within or near its boundaries. Exploratory work on the North Reservoir and the Lillooet Valley resistivity anomaly is not as advanced as that on the South Reservoir.

RESUME

Grâce, en 1978, à l'exploration géothermique de Meager Creek, de l'information nouvelle considérable et encourageante sur le souterrain a été produite. Deux puits furent forés et enregistrèrent plus de 100°C. L'un de ceux-ci confirma un nouvel endroit d'intérêt pour l'exploration future. Des levées géophysiques ont réformées les limites des trois endroits d'intérêt et nous permet les divisions suivantes:

a. Réservoir sud

b. Réservoir nord

c. Anomalie de résistivité de la vallée Lillooet

Le réservoir sud est plus précis puisqu'on l'étudie depuis 1974. On compte sept forage au diamant dans son environ immédiat. Le travail exploratoire sur le réservoir nord et l'anomalie de résistévité de la vallée Lillooet est moins avancé que cel du réservoir sud.

B.C. HYDRO AND POWER AUTHORITY

and

ENERGY, MINES AND RESOURCES CANADA

1978 JOINT VENTURE

REPORT ON 1978 FIELD WORK MEAGER CREEK GEOTHERMAL AREA UPPER LILLOOET RIVER, BRITISH COLUMBIA

by

Brian D. Fairbank, P.Eng.

G.A. Shore

L.J. Werner

Andrew E. Nevin, P.Eng.

T.L. Sadlier-Brown

MARCH 15, 1979

work conducted under

B.C. HYDRO AND POWER AUTHORITY P.O. 848-731

ENERGY, MINES AND RESOURCES CONTRACT OSB78-00163

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

LIST OF FIGURES (Cont'd)

LIST OF TABLES

APPENDICES

CONTRACTS

1) British Columbia Hydro and Power Authority
   Purchase Order No. 848 731
   Order Date July 10, 1978

2) Department of Energy, Mines and Resources
   Contract Serial Number .OSB78 - 00163
   Commencement Date July 27, 1978

CLIENTS' MANAGEMENT

British Columbia Hydro and Power Authority

Josef Stauder, P. Eng.	Project Engineer

Department of Energy, Mines and Resources

Dr. A. M. Jessop	Scientific Authority
Dr. J. G. Souther	Scientific Advisor
Dr. T. J. Lewis	Scientific Advisor

Department of Supply and Services

F. S. Thomas	Science Procurement Manager

NEVIN SADLIER-BROWN GOODBRAND PROJECT MANAGEMENT

Nevin Sadlier-Brown Goodbrand Ltd.

Dr. Andrew E. Nevin, P. Eng.	Senior Manager
T.L. Sadlier-Brown	Senior Manager
B.D. Fairbank, P. Eng.	Project Supervisor
L.G. Werner	Geologist

Deep Grid Analysis (1977) Ltd.

G.A. Shore	Geophysical Consultant

1.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1.1 General

Geothermal exploration at Meager Creek in 1978 provided significant and encouraging new subsurface information. Two wells were drilled and both recorded temperatures in excess of 100°C. One of these confirmed a new target sub-area. Geophysical surveys refined earlier concepts of the boundaries of the three sub-areas of interest.

The three sub-areas are referred to as:

a) the South Reservoir

b) the Possible North Reservoir

c) the Lillooet Valley resistivity anomaly.

Their locations and boundaries as conceived at the present time are shown in Figure 1.1. Each sub-area "name" implies the present degree of confidence in its boundaries and subsurface properties.

The South Reservoir is the best-defined. It has been under specific study since 1974. Seven diamond drill holes have been put down within or near its boundaries.

Exploratory work on the Possible North Reservoir and the Lillooet Valley resistivity anomaly is not as advanced as that on the South Reservoir. Parts of their boundaries are drawn tentatively, based on the most solid of the physical evidence. For example, the narrow neck in the vicinity of Pebble Creek (Figure 1.1) may be shown by future work to widen southward, merging the two sub-areas.

The leading applied exploration methods have been temperature profiling in diamond drill holes and electrical resistivity surveys, with locations indicated in Figure 1.1. Supporting work has included water geochemistry, geological mapping, self-potential surveys, percussion drilling and trace element studies.

Studies in 1978 have led to a preliminary design for continued work. A summary of recommended diamond drilling and geophysical work is given in Figure 1.2 and is detailed in the following (Sections 1.2 - 1.4). Seven wells are recommended - six of about 600 m and one of about 1500 m. Five sites (and several alternate sites) have been selected. Results of the geophysical surveys and the first wells will determine the course of action to be followed in siting and drilling subsequent wells. Concurrent studies would be short seismic profiles, detailed geologic mapping of the Lillooet Valley resistivity anomaly, ground water hydrology, and continued sampling of trace elements in rocks, soils and waters.

A preliminary environmental survey was conducted at Meager Creek in 1978 by Reid Crowther and Partners Ltd. and VTN Consolidated, Inc., and we understand that more advanced studies are planned for 1979. Of the anticipated 1979 environmental studies the slope stability and water quality aspects will be useful to the exploration team.

1.2 South Reservoir

Reservoir margins, presently defined by resistivity anomalies and drill hole information, enclose about nine square kilometres. The eastern part of the reservoir is an outflow plume. The south boundary is inferred to be sharp. The west boundary is probably sharp and related to a deep-seated structure. Other boundaries may be gradational.

Location of the north boundary is uncertain because the reservoir extends under volcanic cover of high electrical conductivity, which masks any response from underlying geothermal waters. Interest in the north boundary is scientific -- an effort to relate the reservoir to its causative volcanic features -- rather than practical. Steep cliffs and glaciers would restrict geothermal field development to the north above 1700 metres elevation.

Geothermal water, heated by sources genetically related to volcanism, occupies fractures in the crystalline basement. Extensive fracturing and faulting accompanied the intrusion, extrusion and subsidence of the initial Meager complex volcanic rocks. Important geological considerations at the South Reservoir are the position of initial volcanic vent areas, porous intrusive breccia bodies, and major fracture watercourses in the subsurface.

Seven holes have been drilled in the South Reservoir area giving information on the thermal and hydrologic regime. Temperature gradients are permissive of temperatures greater than 250°C at 1000 metres depth. The eastward outflow plume is indicated by temperature inversions in some holes. Temperatures and thermal gradients are compatible with major thermal watercourses having surface traces at the west boundary structure and the south margin, parallel to Meager Creek. Temperature gradients increase as well locations approach these features, however, this does not rule out water channelways elsewhere. Research well 78-H-2 failed to reach its bedrock target but yielded high temperatures (103.4°C), with indirect implications toward the bedrock thermal regime. Hot water must flow to bedrock surface north or west of the well.

An objective of the 1978 program was to complete work required to choose the most promising site for a deep exploratory well possibly leading to steam discovery. Although a deep well could presently be sited at the South Reservoir, it would be cost-effective to drill two to three moderately deep (500-600 metre) wells prior to deep drilling (2000 metres). This is in view of the success and wealth of information gained in research well 78-H-1 (603 metres). Three additional research wells (Figure 1.2), each with a specific purpose, are recommended:

a) site 1; a well at site 1A would fulfill a three-fold purpose: first, to determine the stratigraphy and temperature conditions near a thick sequence of intrusive basal breccia (postulated vent area); second, to add a significant north-south dimension to temperature information; and third, to aid in interpreting deep resistivity data in an area of conductive volcanic cover.

b) site 2; to obtain bedrock temperatures in an area identified as important by data from research well 78-H-2; and to gain structural information near the western resistivity cut-off.

c) site 3; to measure the thermal and hydrologic regimes at a point west of the inferred major geologic structure trending north-south across the region and the western resistivity cut-off. As yet there is no high temperature cut-off to the west.

d) alternate sites; an alternative well to 1A at site 1B would be considerably shallower and cheaper, but at present is viewed as slightly less effective in acquiring information; a non-designated site in the southwest corner of the reservoir (Figure 1.2) is a logical alternate to 2 or 3, subject to results of preceding work.

A small scale geophysical survey (for example, very-low-frequency electromagnetic survey) over the west boundary structure would be useful to pinpoint its surface trace and, with information from drill holes, determine its attitude.

The above program would yield sufficient data to spot the most promising deep well-site for discovery with a high degree of confidence. Siting considerations would be temperature values, contours and gradients, desired intersection depths with major structures, bedrock topography, and access conditions within the South Reservoir.

1.2 Possible North Reservoir

The Possible North Reservoir, on the north flank of Meager Mountain, lies within a broad north-south zone of hydrothermal alteration and relatively young volcanic centres. Only a small amount of definitive data is available; however, results to date are very encouraging. A distinct 1 km-wide anomaly, along a single line of dipole-dipole resistivity, is located at the break in slope adjacent to research well 78-H-1. The well identified high, near-surface temperatures (101.8°C at 556.6 m), high thermal gradients (eg. 210.6°C/km), and, qualitatively, high permeability and fracture porosity. A temperature inversion in the middle portion of the drill hole indicates that the site is off-center from a convection cell, or on the margin of a geothermal reservoir. The gradient obtained would permit temperatures in excess of 250°C at a depth of 1500 metres. No water could be obtained from the well for geochemical analysis, therefore, the possibility of a steam-dominated system in this area cannot be ruled out. The margins of the high temperature zone are not yet identified.

Work recommended (Figure 1.2) includes 20 line-km of dipole-dipole resistivity on both sides of the Lillooet River. The orientation of a cross-line at near right angles to the valley lines should allow interpretation of the lines over deep overburden. The proposed resistivity will determine the shape of the known anomalous zone (pipe-like or tabular), and whether or not further pole-pole surveys to the south should be considered.

At least three drill holes of 500-600 m depth are recommended. Two sites with alternates are shown (Figure 1.2):

a) site 4; site 4A is below the Affliction Creek gas vent and near the intersection of the north-south zone of alteration and volcanic centers with the Lillooet Valley resistivity anomaly.

b) site 5; designed to test Pebble Creek hot spring source directions. The Bridge River ash vent may be located in this vicinity.

c) alternates; sites 4B, 4C, and 5B are shown (Figure 1.2) as alternates to the above; two non-designated sites are shown in deep alluvium.

Research wells at sites 4 and 5, along with existing well 78-H-1, will provide initial three dimensional coverage of the temperature domain. Additional wells in the area should be located using preceding resistivity and drill hole results.

1.3 Lillooet Valley Resistivity Anomaly

A large low resistivity zone, 6 km long, up to 2 km wide, and open to depth, extends from the Lillooet Valley bottom near Pebble Creek, northwest up the sidehill of Meager Mountain. The zone may extend further northwest toward the Possible North Reservoir beyond the limits of resistivity coverage. The nature of the anomaly is unclear; it is partially or wholly within a metamorphic unit and is parallel to regional foliation. Pyrite and graphite are present locally within the metamorphic rocks. The north boundary of the anomaly appears to coincide with the contact between metamorphic rocks and other basement units. The above observations suggest that low resistivities may be mapping a graphite or pyrite-rich sub-facies of the metamorphic complex, although more detailed geological information is needed.

Temperatures obtained from shallow holes in and near the southern portions of the Lillooet Valley resistivity anomaly indicate a thermal gradient of about 50°C/km; however, these wells are not ideally located to test the geothermal potential of the anomaly. Further drilling is required for additional temperature information but this is given a low pricrity at present. Detailed geological mapping is recommended in 1979 as a pre-requisite to drilling.

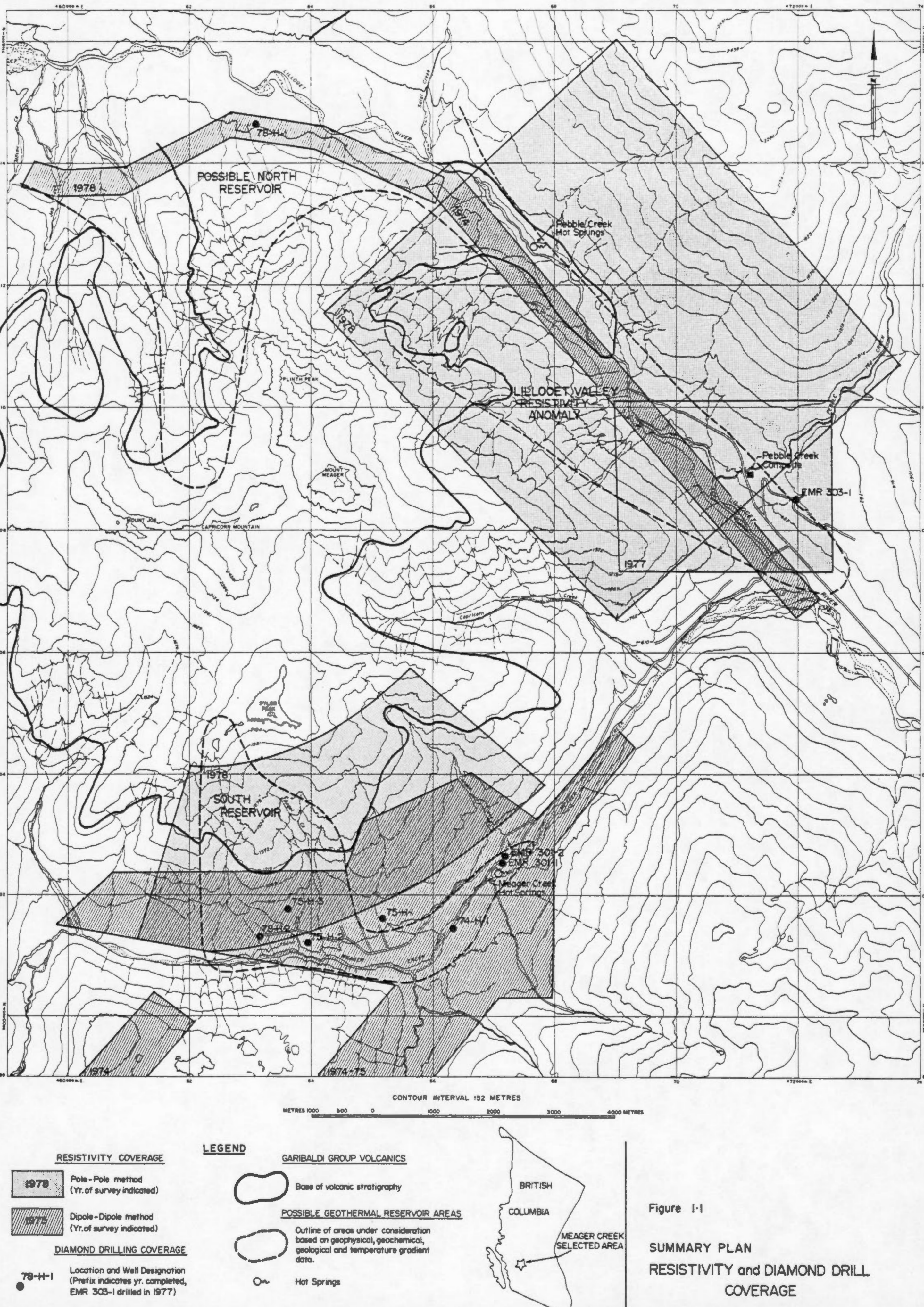


Figure 1·1

SUMMARY PLAN
RESISTIVITY and DIAMOND DRILL COVERAGE

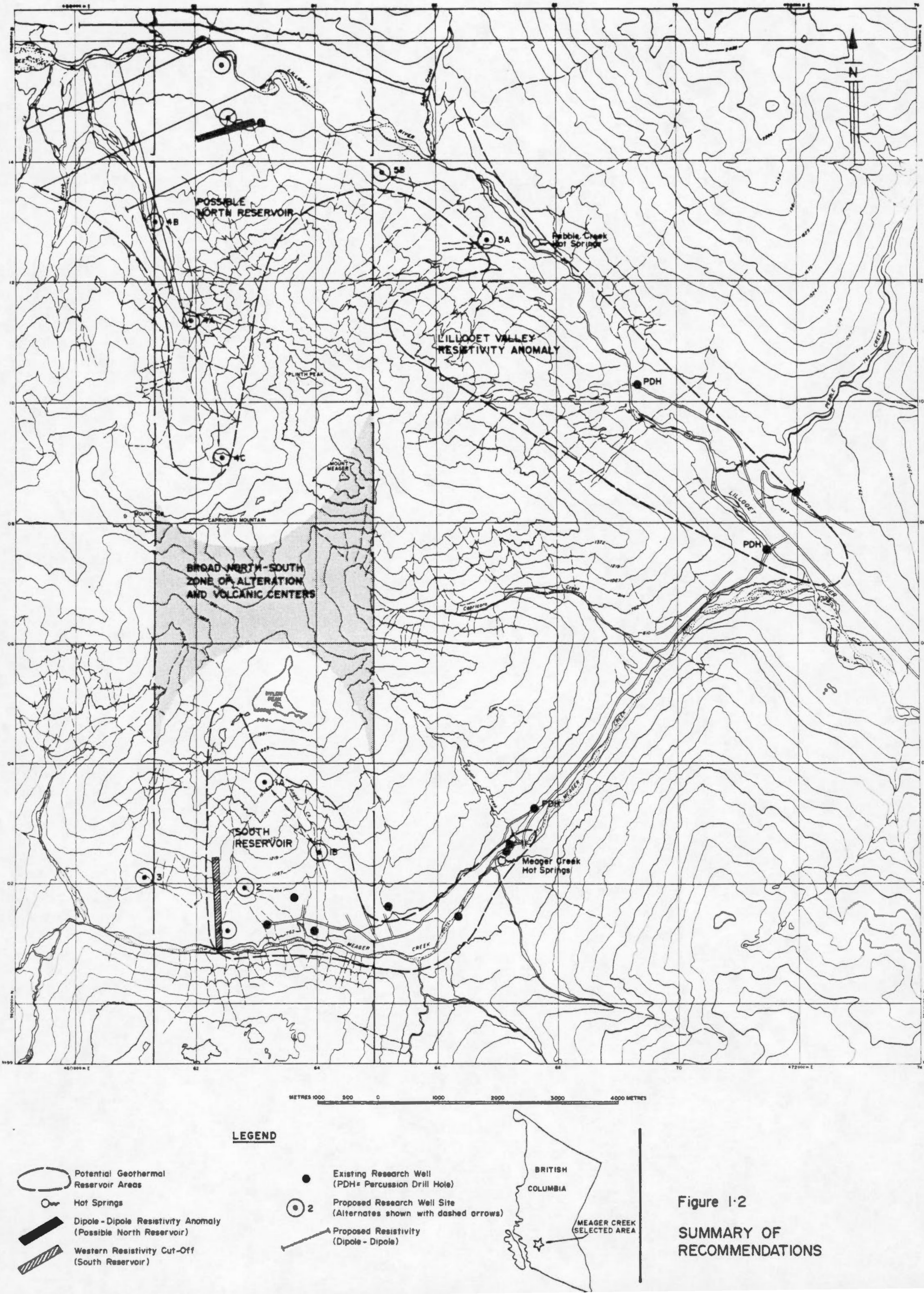


Figure 1·2

SUMMARY OF RECOMMENDATIONS

2.0 INTRODUCTION

2.1 Location and Access

The Meager Creek project area is located 160 km north-northwest of Vancouver and 60 km northwest of Pemberton, B.C. (Figure 2.1). Potential geothermal resource areas are on the flanks of the Meager Mountain volcanic complex, south of the Lillooet River and north of Meager Creek in the upper Lillooet River valley.

A good gravel-surface road to the project area, maintained by logging companies, leaves the highway 20 km northwest of Pemberton. Access within the project area is by logging road or helicopter.

2.2 Terms of Reference

Exploration for geothermal resources at Meager Creek in 1978 was a continuation of yearly investigations initiated in 1973. The 1978 work was designed to further delineate known reservoirs and geophysical anomalies, to extend exploration coverage to the north side of the volcanic complex, and to obtain deeper temperature measurements for a more complete interpretation of the thermal and hydrologic regime.

Tasks completed include resistivity surveys, diamond drilling, percussion drilling, trace element studies, and scale model construction as outlined in section 2.5.2.

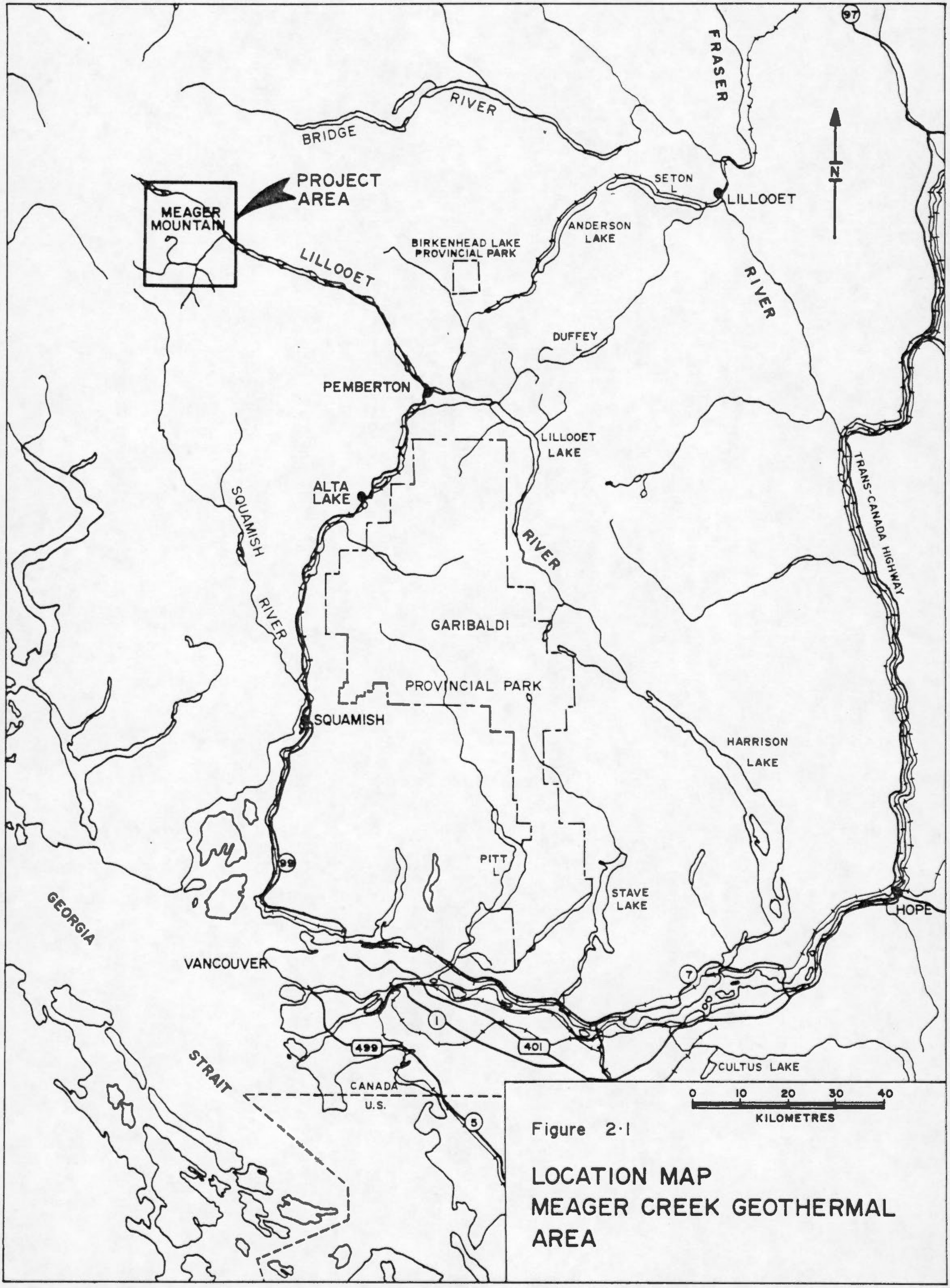


Figure 2·1

LOCATION MAP
MEAGER CREEK GEOTHERMAL AREA

2.3 Names and Presentation Maps

In past years work was concentrated in the Meager Creek drainage and the names "Meager Creek Project" and "Meager Creek Geothermal Area" evolved through continued usage to encompass the whole of the Meager Mountain volcanic complex. This broader meaning has been retained. As work has progressed it has become necessary to distinguish the three súb-areas of interest which have been identified, hence the nomenclature "South Reservoir", "Possible North Reservoir", and "Lillooet Valley resistivity anomaly", which are used throughout this report. Each name implies the current degree of confidence in its boundaries and subsurface properties.

Three base maps are used for data presentation. A base map for summary purposes at 1:80,000 scale shows the whole of the project area (Figures 1.1, 5.1). The project area is divided into two map areas for more detailed data presentation: the Meager Map Area at 1:20,000, including the South Reservoir area; and the Lillooet Map Area at 1:40,000, including the Lillooet Valley resistivity anomaly and Possible North Reservoir areas.

2.4 Previous Work

2.4.1. B.C. Hydro and Power Authority

The geothermal power potential of the Meager area was recognized in 1973 on the basis of separate evaluations by B.C. Hydro and the Department of Energy, Mines and Resources. Geological, geochemical and geophysical surveys by B.C. Hydro in 1974 (Nevin Sadlier-Brown Goodbrand, 1974) provided the initial

Table 2.1: Review of Exploration (B.C. Hydro) - Meager Geothermal Project

	Reconnaissance	South Reservoir	Lillooet Valley Resistivity Anomaly	Possible North Reservoir
1974	1) geology 2) infrared scanning 3) water geochemistry 4) dipole-dipole resistivity (McPhar)	South Reservoir identified	Lillooet Valley anomaly detected	
1975		1) dipole-dipole resistivity (DGA) 2) shallow diamond drilling 3) self-potential South Reservoir defined; open to north		
1976	1) self potential		anomaly confirmed but ambiguous	
1977			1) pole-pole resistivity anomaly identified open to west	
1978		1) pole-pole resistivity 2) moderate depth diamond drilling	1) pole-pole resistivity 2) shallow percussion drilling anomaly defined	1) dipole-dipole resistivity 2) moderate depth diamond drilling anomaly identified

impetus required for year to year applied exploration for geothermal steam centered on the Meager Mountain volcanic complex.

In 1975, dipole-dipole resistivity surveys, diamond drilling and water geochemistry were leading exploration methods used to delineate what is now referred to as the 'South Reservoir' in the Meager Creek drainage (Nevin Sadlier-Brown Goodbrand Ltd., 1975). The reservoir was identified as a tabular shaped body open to the north under Meager Mountain. Diamond drilling, temperature gradient studies and water geochemistry established that the reservoir is a water-dominated system with potential for steam generation.

In 1976, reconnaissance exploration in the Lillooet Valley on the northeastern and northern side of the volcanic complex using self-potential (SP) geophysical methods was inconclusive. SP anomalies were broadly coincident with an ambiguous 1974 resistivity anomaly (Nevin Sadlier-Brown Goodbrand Ltd., 1977).

The 1977 season was directed at resolving the Lillooet Valley anomalies and field-testing a newly-developed pole-pole resistivity method designed to overcome topographic constraints, improve depth of penetration, and enable anisotropy studies from multidirectional resistivity data (Shore, 1978). A strong resistivity low, open to the northwest and southwest, was identified near the confluence of the Lillooet River and Pebble Creek (Nevin Sadlier-Brown Goodbrand Ltd., 1978).

2.4.2 Energy, Mines and Resources Canada (EMR)

The Meager Creek main springs area was selected in 1973 by the Department of energy, Mines and Resources as the site of two 50 metre diamond drill holes, part of a broader geothermal resource study of western Canada (Lewis and Souther, 1978). Drilling was completed in Spring 1974.

Since 1974, EMR has conducted various programs in the Meager Creek area emphasizing regional analysis and supporting research. This work includes:

a) microseismicity studies in the winter of 1974-75 by G.C. Rogers of the Victoria Geophysical Observatory.

b) mapping and stratigraphic study of the Meager Mountain volcanic complex and its environs (Read, 1977; 1979).

c) magnetotelluric surveys in the Lillooet Valley between Meager Creek and Pemberton Meadows in 1976-77 by the Mineral exploration Research Institute of Montreal.

d) water geochemistry study of Meager and Pebble Creek hotsprings and surface waters (Hammerstrom and Brown, 1977)

e) seismic profiling in the upper Lillooet Valley in 1976 by Geotronics Ltd. of Vancouver.

f) diamond drilling and temperature gradient studies in 1976 in the Lillooet and Squamish Valleys (Lewis, 1977).

g) isotope studies of spring waters, stream waters and snow samples in the Meager area in 1977 by Fred Michael of the University of Waterloo.

2.4.3 Other Previous Work

Work by other companies or agencies in the Meager area having a bearing on geothermal development includes:

a) study of the 1975 Devastation Glacier slide by Patton (1976).

b) terrain inventory of Mt. Dalgleish Sheet 92J/12 by the Resource Analysis Branch of the British Columbia Ministry of the Environment.

c) multiple land use study for the British Columbia Forest Service. The resource folio includes a Terrain Unit Map and legend for the Meager Creek drainage.

2.5 B.C.Hydro and Power Authority; Energy, Mines & Resouces Canada: 1978 Joint Venture

2.5.1 Summary of Objectives

Objectives of the 1978 program were distinctly different for each of the South Reservoir, Lillooet Valley resistivity anomaly, and Possible North Reservoir. Exploration status at the South Reservoir at the start of the program was more advanced than either the Lillooet Valley resistivity anomaly near Pebble Creek or the Possible North Reservoir in the north

Lillooet Valley.

A stated objective for the South Reservoir was to complete all work required to choose the most promising site for a deep exploratory steam well. The program was designed to define the northern boundary of the low resistivity area as related to the geothermal reservoir, and to provide information on the thermal regime at moderate depths within the presently inferred lateral limits of the South Reservoir.

In the Lillooet Valley, the exploration goals were to resolve the boundaries of the pole-pole resistivity anomaly and determine its thermal significance, and to extend applied exploration coverage and geothermal knowledge to the geologically favourable north flank of the Meager Mountain volcanic complex (Possible North Reservoir) where stratigraphic and age-dating data indicate most recent eruptions have taken place.

Secondary objectives were to obtain permeability and pore pressure data from research wells, and to test radon gas and mercury trace element surveys as a detailed or regional exploration tool.

2.5.2 Work Performed in 1978

The following tasks were completed in 1978:

a) pole-pole resistivity surveys; areas covered were the northern part of the South Reservoir and both sides of the Lillooet Valley north from Pebble Creek to the Lillooet River falls (Figure 1.1). The pole-pole resistivity method was refined, which was fundamental to overcoming topographic restrictions imposed on conventional dipole-dipole resistivity methods. Work resolved and closed known resistivity anomalies.

The pole-pole survey included planning of instrumentation and operational modifications based on 1977 work, array design and field layout for optimum coverage and logistical considerations, field work, data reduction, computer programming for display purposes, and interpretation of the data. Sub-consultant for the above work was Greg Shore of Deep Grid Analysis (1977) Ltd.

b) dipole-dipole resistivity surveys; Line L was completed along the break in slope on the south side of the Lillooet Valley in the area of the Possible North Reservoir (Figure 1.1). Sub-consultant was Greg Shore of Deep Grid Analysis (1977) Ltd.

c) diamond drilling; two research wells were drilled 78-H-1 (603 m) at the Possible North Reservoir and 78-H-2 (250 m) at the South Reservoir (Figure 1.1). A change in approach to moderate penetration depths was effected to enable more complete interpretation of the subsurface temperature regime. Drilling contractor was Canadian Longyear using a Longyear 44 diamond drill. All temperature measurements were by probe equipment supplied by the Department of Energy, Mines and Resources.

d) percussion drilling; recent logging operations have provided road access to parts of the project area allowing relatively low cost percussion drilling methods to be used for the first time. Seven exploratory holes were drilled in the Lillooet Valley and five northeast of the Meager Creek main hotsprings. Of these, three holes penetrated bedrock. Piezometers were installed in all holes. Drilling contractor was Josco Mining Co. Ltd.

e) trace element surveys; radon gas and mercury surveys were conducted as a test of the method for geothermal exploration and to obtain additional information on water movement.

f) geological survey; collection of geological information and geological modelling from accumulating data was done on an ongoing basis.

g) relief model; a relief model showing surface exploration information and diagramatical cross section was constructed by Topographics from data compiled and interpreted by Nevin Sadlier-Brown Goodbrand Ltd.

In addition to the above work, supporting functions managed by Nevin Sadlier-Brown Goodbrand Ltd. included camp and equipment mobilization and maintenance, surveying, road building, and drill site preparation.

Resistivity surveys, percussion drilling, and trace element surveys were conducted from a base camp near the end of the road, at Pebble Creek between July 14 and September 5. A contract Hiller 12-E helicopter supplied by Pemberton Helicopter Services was used for field support during this phase of work.

Drill camps were established near the diamond drill sites in the north Lillooet Valley and Meager Creek areas. Diamond drilling commenced September 8 and concluded November 10.

Field work was completed with the collection of the last radon cups on November 18.

2.6 Other Current Work

Several other studies affecting the joint venture program at Meager Creek are in progress. The most significant of these are:

a) an environmental study for B.C. Hydro and Power Authority by Reid Crowther and Partners Ltd. of Vancouver and VTN Consolidated Inc. of Irvine, California, and

b) continuation of mapping, water geochemistry and isotope studies by the Department of Energy, Mines and Resources.

A study is underway by the University of British Columbia Geography Department on land mass creep at the headwaters of Job Creek (northwest corner of Figure 1.1). Survey stations were established in 1978 as part of a continuing study of bedrock movement over an area estimated one kilometre in width and four kilometres in length. No quantitative data on rate of movement is available to date.

Activity by logging companies is important in terms of access. Current developments in the Meager Creek drainage are the extension of the Meager main road to about one kilometre past Angel Creek (in the South Reservoir area) and bridging of Meager Creek at a point just east of the main springs providing access to the south side of the creek. In the Lillooet River Valley, MacMillan Bloedel plans branch roads up the sidehill in the area northwest of Pebble Creek and access roads to the south side of the Lillooet River opposite Pebble Creek (refer to Figure 1.1).

3.0 GEOLOGY

3.1 General Geology

(refer to Table 3.1, Figures 3.1, 3.2 and 3.3)

A brief description of the geology of the Meager Mountain volcanic complex is included in this report as background for sections to follow. Information is summarized from Read (1977; 1979), Souther (1976), Woodsworth (1977) and Nevin Sadlier-Brown Goodbrand Ltd. reports to B.C. Hydro.

The Meager area geothermal systems are in fractured basement rocks peripheral, and directly related to, the Meager Mountain volcanic complex. Geologically young, cooling magma chambers and deeper heat sources provide the heating mechanism for geothermal waters.

The oldest rocks in the project area are biotite hornblende quartz diorite and hornblende diorite (Kd) of the Coast Crystalline Belt and roof pendants of upper Triassic to Lower Cretaceous greenstone phyllite and amphibolite (Mmp). This metamorphic unit forms an extensive northwest trending belt in the Lillooet Valley surrounded by intrusive rocks.

Crystalline and metamorphic rocks are intruded by Miocene biotite quartz monzonite (Mqm), which forms the Fall Creek Stock on the northeast flank of Meager Mountain, and other plugs in the area. The Fall Creek Stock is exposed in the Lillooet Valley near the falls and is intersected by research well 78-H-1, indicating that it is up to 5 kilometres in diameter, largely covered by volcanic flows and alluvium. Miocene quartz monzonite plutons in the Meager area and genetically equivalent Miocene vol-

TABLE 3.1: TABLE OF FORMATIONS

	GARIBALDI GROUP
PLEISTOCENE	**MEAGER MOUNTAIN VOLCANIC COMPLEX**
Rvd	Scoriaceous dacite flow. Bridge River ash eruption
	PHASE III
TQv	Rhydacite flows and breccia
	PHASE II
TQv	Andesite flows and breccia; Subordinate dacite and basalt flows
PLEISTOCENE and PLIOCENE	PHASE I
Gva	Altered acid tuff, breccia and flows
Gbx	Basal breccia
	BASEMENT COMPLEX
MIOCENE	
Mqm	Biotite quartz monzonite
CRETACEOUS (?)	
Kd	Biotite hornblende quartz diorite and hornblende diorite.
UPPER TRIASSIC to LOWER CRETACEOUS	
Mmp	Greenstone, phyllite, amphibolite; minor greywacke

volcanoes outside the area are part of the northwest trending Pemberton Volcanic Belt (Souther 1976).

Pliocene and Pleistocene Garibaldi Group flows, breccias, dykes, and associated pyroclastics cut and unconformably overlie all other rock units in the area, forming the Meager Mountain volcanic complex. They are part of the north-south trending Garibaldi Volcanic Belt (Canadian terminology for the northern extension of the Cascade volcanic terrane in Washington, Oregon, and northern California).

Three main periods of volcanic activity, and one recent isolated event, are distinguished at Meager Mountain by Read (1977; 1979). The initial explosive eruptions in Pliocene time are marked by a basal breccia (Gbx) comprised mainly of intrusive and some aphanitic volcanic clasts in a tuffaceous matrix. The basal breccia is overlain by altered acid tuff, breccia, and flows (Gva). Phase I volcanics are exposed on the south flank of Meager Mountain. An intermediate period of volcanism produced andesite flows and breccia, with subordinate dacite and basalt flows (TQv-Phase II). This unit is extensive, occurring on all flanks of Meager Mountain. Read (1977) identifies the vicinity of the Devastator west of Pylon Peak (Figure 3.2) as a probable vent area. Other vents are suspected. The youngest major period of volcanic activity is represented by rhydocite flows and breccia (TQv-Phase III) in the northern half of the complex. Vent areas are on Mt. Meager, Plinth Peak, the north ridge of Plinth, and possibly Capricorn Mountain.

A scoriaceous dacite flow (Rvd), originating from the cirque north of Plinth Peak, and extensive

Bridge River ash in the northern most part of the project area mark the most recent volcanic events on Meager Mountain. The dacite flows are postulated to cover (and hence postdate) the Bridge River ash vent (Read, 1977). The most reliable ages on the Bridge River ash were obtained by the carbon-14 method at the Geological Survey of Canada Radiocarbon Laboratory on charcoal from specimens collected in 1977. They are 2460±60 years (Nevin Sadlier-Brown Goodbrand Ltd., company files) and 2490±50 years before present (Read, 1979).

Intrusion of the Meager Creek volcanic complex was accompanied by fracturing and faulting of the basement complex. Hot springs issue from fractured intrusive rocks in the Meager Creek drainage and at the Pebble Creek hot springs. Geochemical work on springs has been previously reported by Nevin Sadlier-brown Goodbrand Ltd. (1974), Souther (1976), Hammerstrom and Brown (1977), and Lewis and Souther (1978).

3.2 North-South Zone of Alteration and Volcanic Centres

Volcanic centres of the Meager Mountain Complex occur in a broad linear north-south zone on Meager Mountain. The "envelope" enclosing all known volcanic centres is 12 km long and 4 km wide. This zone, with extrapolations to the north and south, is shown in Figure 1.2. Nine vent areas are identified (Read, 1979) within the depicted boundaries. The Bridge River ash vent may be west of the zone (Read, 1979) although its precise location has not been determined.

Several observations suggest that the zone may be of practical importance to the project. Intermittent outcrops within the zone are locally hydrothermally altered, i.e. contain iron oxides, clay, micaceous minerals, carbonates, sulfates and other secondary minerals. The South Reservoir and the Possible North Reservoir are located along the zone at its mappable extremities and the western edge of the zone broadly coincides with the west boundary of the South Reservoir as determined by resistivity surveys. It is probable that the north-south linear trend of above features reflects a deep-seated fracture system which served as a conduit for the volcanic rocks, and subsequently as a control for past and present circulation of geothermal fluids.

3.3 Conceptual Cross Section; Meager Mountain Volcanic Complex and Geothermal Systems

Figure 3.1 shows a conceptual cross section, oriented north-south, through the centre of the volcanic complex. The cross section is parallel to and contained within the broad zone of alteration and volcanic centres discussed in the previous section. It integrates the following forms of information:

a) direct observation at surface and in drill holes
b) projected geological data
c) interpreted geophysical data
d) hypothetical representation of geology and geothermal system at depth.

The cross section is intended to put geologic, hydrologic and thermal features into perspective and to summarize concepts affecting current exploration. Important aspects of the Meager geothermal system depicted are:

a) heat sources are related to Pleistocene and Pliocene volcanism;
b) heat transfer is by conduction and convection;
c) fractures and faults provide a porous and permeable medium within basement reservoir rocks;
d) fractures and faults are associated with forceful intrusion and subsequent collapse at and near volcanic centres;
e) isotherms warp upward above the centre of convection cells;
f) fractures, lateral heat flows, and lateral ground water flows distort isotherms;
g) at the South Reservoir, the basal breccia unit, collapse faults, and the root system of initial volcanoes may be controls on the geothermal system, in that they provide a large volume of inherently permeable rock material;
h) volcanic centres progress south to north;
i) at the Possible North Reservoir, the heat source may be associated with a cooling magma system about 2400 years old.

3.4 Meager Map Area

Figure 3.2 is a detailed geologic map of the Meager Map Area including the South Reservoir. Spatial relationships between important geological features are shown.

Basal breccia (Gbx) marks the base of the oldest volcanic rocks. The breccia is described by Read (1977) as large jumbled clasts of granitic, grey or green aphanitic volcanic, and minor metamorphic blocks in a tuffaceous matrix. Basal breccia is thickest where the underlying basement is lowest at exposures in Angel Creek south of Pylon Peak. These relations suggest that the Angel Creek breccia may be close to, or part of a vent for initial explosive volcanism (Read, 1977). The vent position is considered important since related fracturing, brecciation, collapse faults and root structures may be partial controls on the geothermal system, transmitting both water and heat.

The position of the base of volcanic rocks influences the interpretation of electrical resistivity data. The altered acid tuff (Gva), at or near the base of the volcanic pile, is very conductive due to pyrite, clay and high water content. Other volcanic units, lumped together as TQv, appear less conductive than Gva but more conductive than the crystalline and metamorphic basement (refer to Section 4).

Data on bedrock is sparse in the "bench" area of Meager Creek. Quartz diorite (Kdm) is exposed below the base of volcanics on the south slope of Meager Mountain at elevations down to 900 metres. Well fractured quartz diorite occurs in outcrop almost continuously along the south side of Meager Creek and in research wells 74-H-1, 75-H-1, -2 and -3. Quartz monzonite is cut by a volcanic porphyry dike in the bottom 21 metres of 75-H-3. The crystalline basement is Cretaceous in age. Upper Triassic to Cretaceous greenstone and metasediments are exposed in the bluffs above drill hole 75-H-1 and along the road at Canyon Creek.

3.5 Lillooet Map Area

Figure 3.3 is a geology map of the Lillooet Map area which includes the Lillooet Valley resistivity anomaly and the Possible North Reservoir.

The low resistivity area extends from percussion drill hole 78-3 near the Lillooet bridge, 7 km to the northwest up the south slope of the Lillooet valley (refer to Figure 4.6). In this area, rock exposure is poor and largely unmapped. The resistivity anomaly is associated with the metamorphic unit (Mmp) and is grossly conformable to regional foliation. Rusty outcrops of massive greenstone, chlorite-sericite schist, and grey phyllite with minor greywacke and metasediments are typical.

Disseminated pyrite is present at several locations. Percussion drill hole 78-3 cuts biotite-muscovite gneiss containing 5-10 percent pyrite over 200 feet. Pyrite and graphite in the metamorphic unit may contribute to low resistivity values.

The Possible North Reservoir is located on the north flank of Meager Mountain along the north-south zone of alteration and volcanic vents. Necks and vent areas, associated with the latest major period of volcanism, and extensive rhyodacite lavas (TQv) are shown on Mount Meager, Plinth Peak, the north ridge of Plinth and on Capricorn Mountain. The most recent dacite flow, about 2400 years old, originates from the cirque north of Plinth Peak and is thought to cover the vent of the Bridge River ash (Read, 1977). The flow once dammed the Lillooet River and now forms the Lillooet falls. Other features of the north flank area are the Pebble Creek hot springs and hydrogen sulfide gas emanating from an unknown source under the Affliction Creek glacier.

The heat source and parent reservoir locations for the Pebble Creek hot springs are unclear. There is no resistivity signature or obvious connection with the Lillooet Valley resistivity anomaly (as compared to the connection between the Meager Creek hot springs and the South Reservoir). It is probable, from geological and geophysical inference, that the hot water originates somewhere west of the springs on the south side of the valley.

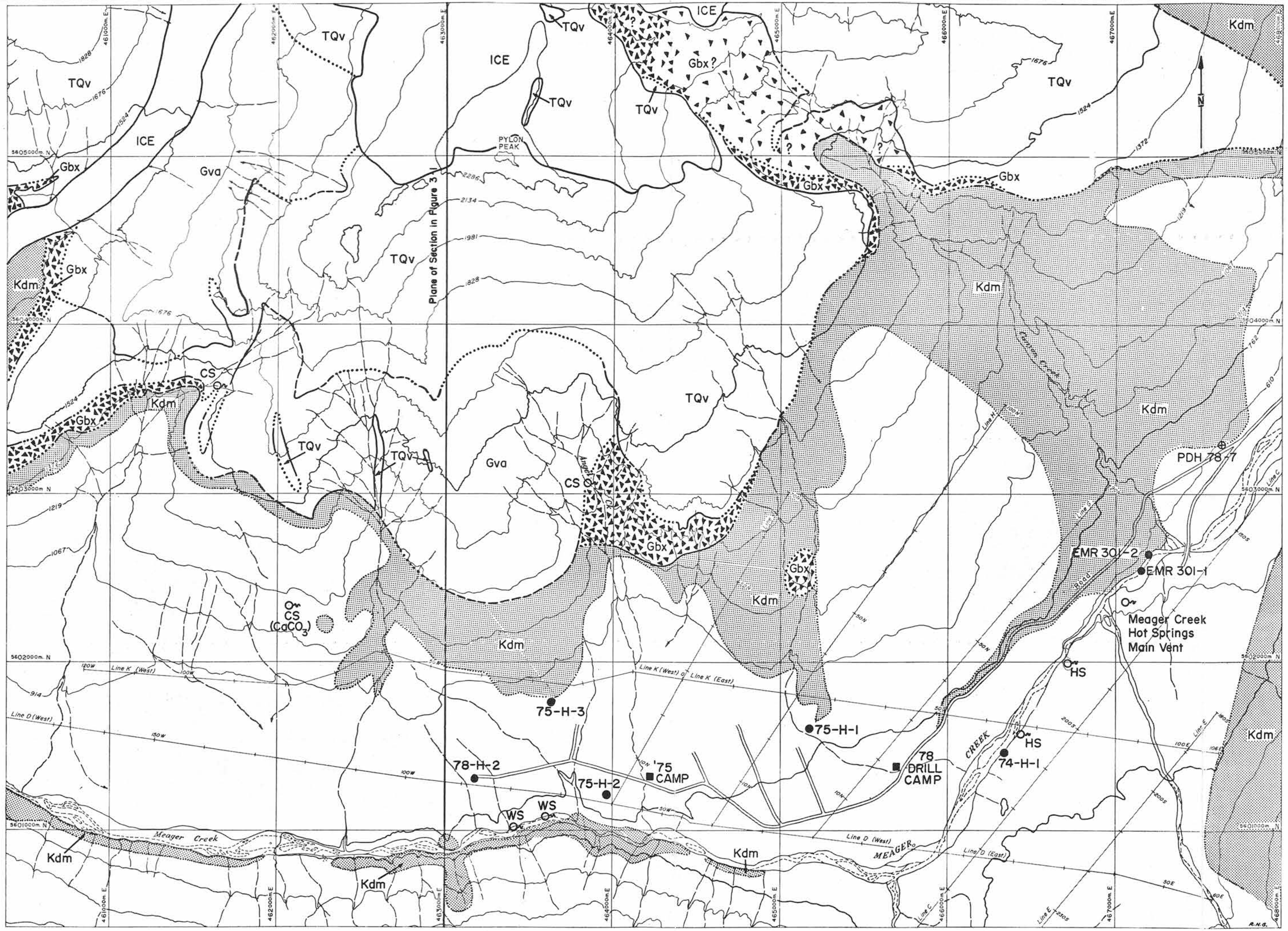


Figure 3·2

SUMMARY OF GEOLOGY
MEAGER MAP AREA

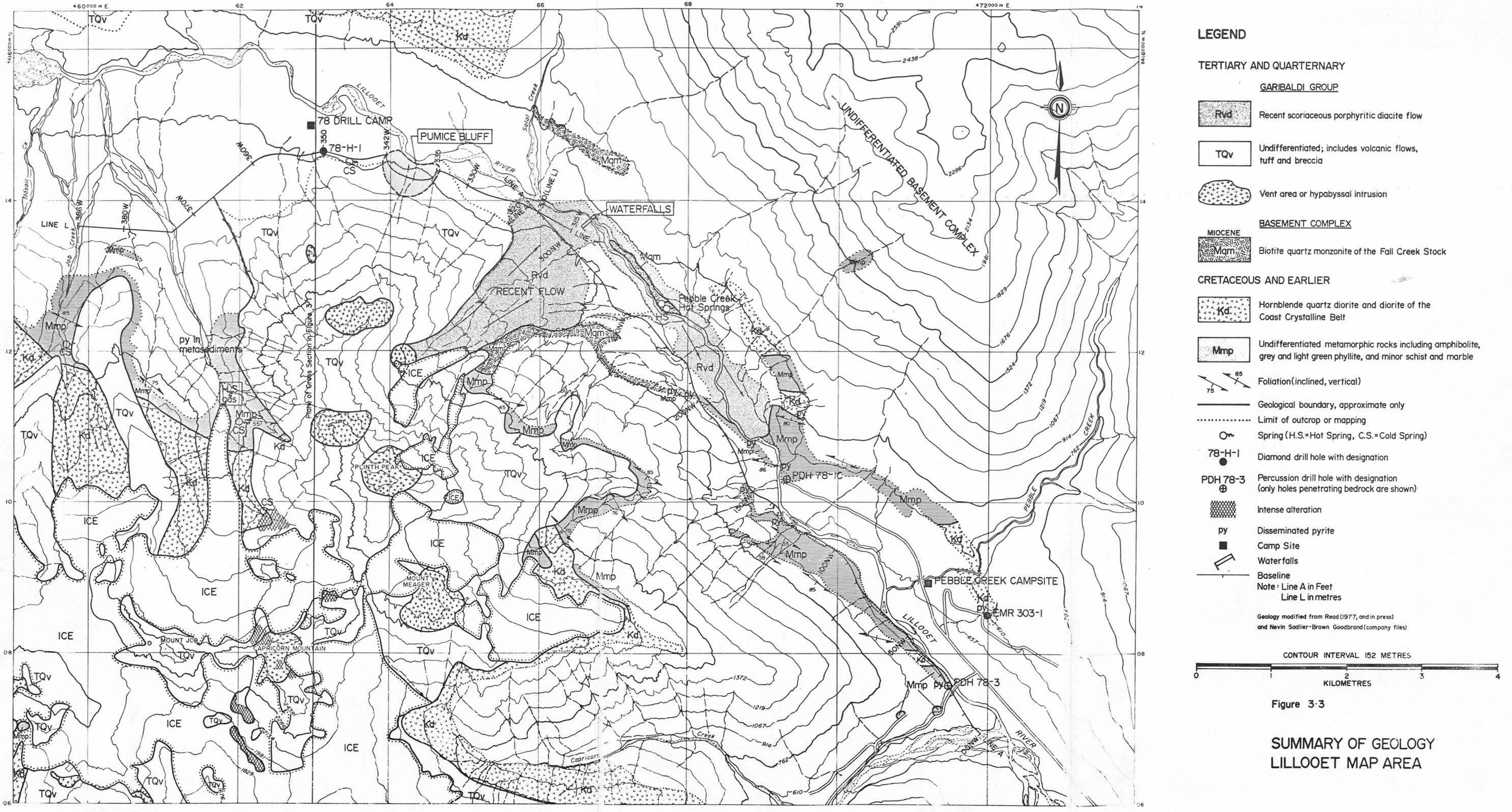


Figure 3·3

SUMMARY OF GEOLOGY
LILLOOET MAP AREA

4.0 RESISTIVITY

4.1 Introduction

4.1.1 Objectives

The 1978 resistivity program was designed to initiate or complete investigations in the South Reservoir area, in the Lower Lillooet River valley (Lillooet Valley resistivity anomaly), and on the north flank of Meager Mountain (Possible North Reservoir). These areas are shown on Figure 1.1 and the surveys are detailed in the following paragraphs.

Dipole-dipole array surveys undertaken in 1974 and 1975 defined a large resistivity anomaly in the Meager Creek valley on the south flank of the complex. The 1978 pole-pole survey work was designed to explore the higher elevations beyond the reach of dipole-dipole survey and to trace any extensions of the valley resistivity anomaly northward within the basement rocks and possibly continuing beneath the cap of volcanic rocks. The possibility of eastward or westward extensions of the resistivity anomaly on the slope was also investigated.

A dipole-dipole resistivity survey along the south-west side of the Lillooet Valley in 1974, and self-potential (SP) and resistivity sounding in 1976, led to the application of pole-pole array survey in 1977. The 1977 survey located anomalous low resistivities in the lower valley, downstream from Pebble Creek. The 1978 survey was designed to resolve previously ambiguous lower valley anomalies, test for lateral extensions, and extend coverage to the unsurveyed Lillooet Valley slopes northwest of Pebble Creek.

A single dipole-dipole survey line was planned as a northwest extension of the Line A dipole-dipole survey in the Lillooet Valley (Nevin Sadlier-Brown Goodbrand Ltd, 1975) to aid in siting research well 78-H-1. The drilling was expected to provide some geologic control for the interpretation of the dipole-dipole resistivity data.

4.1.2 Resistivity Measurement Theory

Measurements of the earth's electrical properties are routinely used to gain insight into the physical makeup of what lies below the surface. In geothermal exploration, the leading approach is "resistivity", an active survey method in which the electrical resistivity characteristics of a selected region are studied. Quantitative estimates of the resistivity value are derived for specific volumes of the subsurface.

Electrical conductivity in rocks (with the exception of metallic or carbonaceous rocks) is principally due to ionic conduction in water-filled, connected pore space. This pore space may be an inherent characteristic of the rock, as in a sandstone, or may derive from interconnected fractures in an otherwise non-porous rock such as the granite basement of the Meager Mountain area.

The resistivity anomaly permitted by the increased fluid communication within a porous or permeable zone may be enhanced in a thermal environment by two factors

a) elevated fluid temperatures
b) dissolved solids, which are characteristically high in geothermal waters.

In the predominantly water-saturated Meager Mountain environment, variation of observed resistivity within a single non-metallic non-carbonaceous rock unit (such as the granitic basement) is interpreted as a function of the degree of fracturing of the rock, with possible contribution from elevated fluid temperatures and to a lesser extent, elevated fluid salinity.

A resistivity anomaly in the Meager environment can be defined in two ways:

a) a decrease in resistivity within a single rock unit, where a more resistive background can be identified and the anomaly expressed as a fraction of the apparent local background value for that rock type.

b) in the absence of local background values, an observed resistivity which is known to be low in comparison with typical values for the rock type in other localities.

Under these criteria, a low resistivity value measured in certain rock units is not necessarily an anomalous condition. For example, the volcanic rocks above the South Reservoir are known to be highly altered, pyritic, very porous and water-saturated. A low resistivity value is readily explained, and its cause attributable to the nature of the rock unit itself. The occurrence of a low resistivity area (the South Reservoir) within a rock type (granodiorite) which is not inherently porous, heavily mineralized or substantially altered, and whose background resistivity has been measured in large areas surrounding the low resistivity area, does qualify as anomalous. The conventional explanation for such an anomaly describes a large water-saturated zone of increased fracture density, fissuring, or both.

4.2 Pole-Pole Array Theory

4.2.1 Geometry and Computations

The pole-pole array and its performance and previous application at Meager Creek are described by Shore (1978) and Nevin Sadlier-Brown Goodbrand Ltd. (1978). The pole-pole system used in 1977 was modified in the 1978 surveys. Instead of random electrode positions, a grid was approximated for line and station positions to ensure a regular distribution of data.

With reference to Figure 4.1 (Meager Map area) and Figure 4.6 (Lillooet Map area) showing the locations of current and potential lines, the geometry and operation of the survey are described as follows: two sub-parallel lines are installed, one with an array of current electrodes at controlled intervals, and one with similarly arrayed potential electrodes. These arrays are the active electrodes. Reference or "infinite" electrodes, one for current and one for potential, are installed at positions greater than 5 km from the active electrodes. To obtain each apparent resistivity determination, the operator transmits a current between the "current infinite" and a selected current electrode on the active array and measures the potential between the "potential infinite" and a selected potential electrode on the active array. The procedure is repeated in sequence for every current-potential pair in the active array, producing a corridor of data between the two electrode lines.

The formula for calculation of apparent resistivity for the pole-pole array is:

$$R(A) = 2\pi aVp/Ig$$

where R(A) = apparent resistivity in ohm-metres

a = distance in metres between the active current and potential electrodes

Vp = measured primary voltage in volts at potential electrode

Ig = current in amperes passed through current electrode

X, Y and Z co-ordinates for the measurement electrodes are used in the calculation of an approximation of the ground surface slope in the vicinity of each pole-pole measurement, permitting estimation of the location of the sampled volume and the XYZ co-ordinates of the data plotting point at depth.

Defining the vector distance between the two reporting electrodes as PC, the effective penetration

(Ze) is 0.75 PC (Edwards, 1977). The nominal plot point is located at distance Ze perpendicular to the calculated ground-surface plane, from the midpoint of line PC. The method used for approximating the local slope is described in Appendix B-3.

4.2.2 Presentation Drawings

Apparent resistivity data are standardized and presented on three types of conventional drawings: plan maps, pseudosections, and plots of log apparent resistivity vs. depth.

Plan maps (Figures 4.1 and 4.6) show the location of data corridors and summarize survey results. A data corridor is indicated by a group of lines, each plotted from the midpoint between a pair of measurement electrodes (midpoint of PC), to the corresponding plot point at depth. The length and orientation of these lines in plan view is a function of the tilt of the calculated slope plane, the penetration depth (Ze), and the relative position of the measurement electrodes. Lines which counter gross trends result from special instances, where reporting electrodes are closely spaced and local topography slopes obliquely to the data corridor.

Pseudosections (Figures 4.2, 4.4, and 4.7, and Appendix B-2) for each corridor are constructed from the calculated X, Y, Z co-ordinates of the data points. Triangles at the top of each pseudosection correspond with reference triangles on the plan maps. Pseudosections are a conventional interpretation aid in which raw apparent resistivity is presented in an idealized plot for further study and evaluation. An interpretation of conductive zones and resistivity contacts is included on the pseudosections.

Plots of log apparent resistivity vs. depth (Figures 4.3, 4.5 and 4.9, and Appendix B-2) provide comparison of trends in apparent resistivity with depth, at regular intervals across a data corridor, and on a corridor-to-corridor basis. Plots are constructed by dividing pseudosections into a series of one km wide vertical strips and replotting the data within each strip in graphical form. The scales of the graphs match those of the corresponding pseudosections to enable direct comparison of the two. The general form of the presentation is similar to standard vertical electrical sounding (VES) plots with similar advantages in visual analysis. The addition of a measurement direction symbol on the plots permits evaluation of apparent resistivity anisotropy, and an appreciation of sample direction distribution.

4.3 Dipole-Dipole Array Theory

Dipole-dipole array surveys are used at Meager Creek when terrain and penetration requirements permit. Dipole-dipole is a standard reconnaissance array, with good vertical resolution, good definition of lateral resistivity changes, and proven operating logistics. It is used in the Meager area along valley bottoms where long, straight survey lines can be laid out. Comparative performance characteristics of the pole-pole and dipole-dipole resistivity arrays have been reviewed previously by Shore (1978). A drawing of a dipole-dipole array is included in Figure 4.9. Current is passed into the ground through two current electrodes (current dipole) and the resultant electrical potential measured across two potential electrodes (potential dipole).

The formula for calculation of apparent resistivity is:

$$R(A) = \pi a(n)(n+1)(n+2)Vp/Ig$$

where R(A) = apparent resistivity in ohm metres

a = length in metres of each survey dipole

n = integer multiple of distance "a", defining separation distance between the two survey dipoles

Vp = measured primary voltage across potential dipole, in volts

Ig = current in amperes passed through current dipole

Apparent resistivities are presented in a standard pseudosection form (Figure 4.9).

4.4 Areas Surveyed (refer to Figure 1.1)

4.4.1 Pole-Pole Array Coverage

In the Meager Creek Valley, electrode lines installed on the south side of the complex extended from tree-line approximately down the fall line to the valley floor. Lines were placed through and straddling the South Reservoir (Figure 4.1). Seven lines provided six data corridors over an area of 4.5 square kilometres, to an effective probing depth of 0.5 to 2 kilometres.

A special-case "in-line" pole-pole survey line was operated on line 630, to provide shallower resolution over the South Reservoir.

In the Lillooet River Valley, electrode lines extending across the valley from tree-line on the south-west to tree-line on the northeast were installed from Pebble Creek, northwest almost to Salal Creek, providing five corridors of data (Figure 4.6), over an area of 11.5 square kilometres, to an effective probing depth of 1 to 2.5 kilometres. The survey area included the Lillooet Valley resistivity anomaly.

4.4.2 Dipole-Dipole Array Coverage

One dipole-dipole survey line (Line L, Figure 4.6) was operated in the north Lillooet Valley, over the proposed site of research well 78-H-1. It extends the coverage of Line A (surveyed in 1974) for a distance of 7.1 km to the northwest, along the break in slope, ending near Job Creek. This line probed to an effective depth of 450 metres.

4.5 Interpretation of Results

4.5.1 Pole-Pole Data Interpretation Procedure

Two characteristics of the multi-directional pole-pole array used at Meager Mountain in 1978 contribute to significantly improved interpretation over previously applied linear dipole-dipole arrays:

a) The use of two active measurement electrodes (versus four for dipole-dipole) permits the operation and subsequent analysis of results from groups of readings in which one electrode is stationary, and the second electrode is moved to sample varying volumes and effective depths. With a single variable in the data group, effects due to lateral resistivity variations can frequently be identified and distinguished from effects due to increased penetration. Effective mapping of vertical resistivity boundaries is often possible.

b) While holding the nominal sampled volume of earth constant by maintaining similar measurement electrode separation, the array can be rotated over the same nominal sampled earth and a group of data accumulated with array orientation as the single variable. In essence, a lateral resistivity change within the sampled volume will cause the data set to be anisotropic.

The high density of data yielded by the array configuration lends itself to the reading-by-reading stacking of information to build a structural model. The general interpretation procedure is described below in roughly sequential order:

a) starting at a selected point, each individual reading is examined and the position of its measurement electrodes is identified on a working pseudosection (a template assists in the recovery of electrode positions).

b) groups of readings having one common electrode are analyzed. Within each group, response variations due to lateral resistivity variation are identified, assessed and weighted as to magnitude and sharpness and correlation with other data.

c) groups of readings having similar electrode separations but different orientations are identified. Any apparent near-surface sources of data-group anisotropy (such as a single electrode of one reading lying within the conductive volcanics) are assessed and readings flagged.

d) consideration is given to topographic effects.

e) available geological information is integrated, particularly the extent and known limits of any units of extreme resistivity characteristics.

f) previous geophysical data is considered.

g) lateral resistivity boundaries are identified principally through the weighted values accumulated in steps b) and c).

h) vertical resistivity distribution can be interpreted after modification of values through steps b) and c).

The identified boundaries and low resistivity zones are presented on pseudosection with the measured apparent resistivity data (Figures 4.2, 4.4, 4.7 and Appendix B-2). Possible interpreted models are described in the following sections.

4.5.2 South Reservoir, Meager Map Area; Pole-Pole Survey

The east and west limits of the South Reservoir resistivity anomaly were identified in the 1975 dipole-dipole resistivity survey, and the north and south boundaries remained open. The 1978 pole-pole survey confirms northerly up-slope continuation of the anomaly in the quartz diorite basement rocks, up to the lower limit of volcanic rocks (Figure 4.1). At this point, the highly conductive volcanic rocks covering the basement complex effectively mask deeper survey response. It is not possible to determine from the resistivity data whether the anomalously conductive quartz diorite continues northward under the volcanics.

The volcanics covering the north section of the map area (Gva, Figure 3.2) are highly altered acid tuff, breccia and flows. With the exception of the breccia above Angel Creek, they are characterized by low resistivities (100-150 ohm-metres) due to porous, water-saturated, weathered rocks with substantial components of clays and pyrite. The lower limit of the volcanics on the south-facing slope of the complex has been mapped (Figures 3.2 and 4.1), and is identified on each of the data corridor pseudosections (Figures 4.2, 4.4 and Appendix B-2).

A single reference boundary enclosing "low resistivity" zones is marked on each pseudosection. Where it is nearly parallel to the surface, this boundary is generally consistent with a 350 ohm-metre contour interval in the apparent resistivity data. The enclosed low resistivity areas contain interpreted resistivites in the range of 70 to 200 ohm-metres. Any low resistivity zone on the "basement" side of the mapped contact represents anomalous resistivity in quartz diorite basement rocks. The low resistivity zone north of the contact is an area in which known conductive volcanics (as measured in shallow reading on corridor 630, Figure 4.4) overlie basement rocks to an unknown depth and may mask continued anomalous resistivities in the basement rocks.

In comparing corridors 605, 615, 625, 635, 645 and 655, the portions of data at depths shallower than one km (dotted line on pseudosections) and bounded to the north by the indicated limit of volcanics, shows the measurement of low resistivity in the South Reservoir zone on Corridor 625, and of higher background resistivities on all other corridors. This is in agreement with the dipole-dipole coverage of the area (Nevin Sadlier-Brown Goodbrand, 1975), and serves to confirm that there is no significant extension of the South Reservoir anomaly to the east or west, below the limit of volcanics.

The shallow-resolution Corridor 630 (Figure 4.4 and 4.5) through the South Reservoir confirms in detail the northward extension of the South Reservoir anomaly at least to the limit of volcanics, 1 km further north of the area previously covered in the 1975 dipole-dipole survey. The data on Corridors 625 and 630 (Figures 4.2, 4.3, 4.4 and 4.5) suggest a resistive cutoff along the south side of the survey area, leaving the anomaly effectively closed on three sides and open only on the north side.

The northern volcanic flows and tuffs are consistently conductive but the breccia at Angel Creek indicates a high resistance, of a magnitude similar to the non-reservoir quartz diorite. Shallow survey resolution in this area is poor; therefore, a small, highly conductive conduit or other structure could be associated with the breccia and not be detected in the large volumetric sample measured by the array. However, the data indicate that the breccia exposure mapped (refer to Figure 3.2) is not likely to represent the position of a low resistivity structure of major physical dimensions.

Background resistivities in the basement quartz diorite are about 350 to 500 ohm-metres. Increased background resistivity of 500 to 700 ohm-metres (Data Corridor 655, Appendix B-2) indicates less fracturing in the area of Canyon Creek, and confirms similar findings of the 1975 dipole-dipole survey.

Pole-dipole array measurements were obtained on in-line corridor 630 concurrent with pole-pole measurement operations for use as a calibration and control for the pole-pole technique. Preliminary evaluation of results indicates good correlation between the two array types in apparent resistivity values.

4.5.3 Lillooet Valley Resistivity Anomaly, Lillooet Map Area; Pole-Pole Survey

The large (9sq. km) resistivity anomaly delineated by the 1978 pole-pole survey (Lillooet Valley resistivity anomaly, Figure 4.6) is a west-northwesterly extension of a low resistivity zone outlined in the 1977 survey in the Lillooet Valley near Pebble Creek. The anomaly is up to 2 km wide, and extends from a low valley position near Pebble Creek obliquely up the southwest valley slope to a point below Plinth Peak. At this point, it may continue beyond the limits of the present survey coverage.

The anomaly appears to be associated with metamorphic rocks mapped in the area (refer to Figure 3.5). Part of the anomaly lies in and beneath the valley floor, where measured resistivities may be lowered by the effects of conductive alluvial deposits. It is probable however, that the anomalous response in this area is in large part due to the southeastward continuation of the conductive rock body detected on the higher slopes. A dotted line in Figure 4.6 divides the eastern part of the anomaly into two categories:

a) to the southwest, conductive conditions independent of influence from river alluvium.

b) to the northeast, conductive conditions possibly emphasized by the overlying conductive sediments.

The pseudosection view of the anomaly is given in Figures 4.7 and 4.8. The resistivity contacts A and B (Figure 4.6) are distinct, and separate the conductive zone from highly resistive rocks to the southwest and northeast. Background resistivity of 1000 to 2000 ohm-metres is 2 to 3 times that of the quartz diorite on the south side of the complex, which indicates that the bedrock is probably unfractured intrusive or resistive metamorphic rock.

Resistivity contact C (Figure 4.6) marks a northern limit for the main conductive unit as it extends upslope to the west. Some conductive material appears to extend northward beyond this contact toward Pebble Creek hotsprings, beneath a resistive cap layer.

The 1974 dipole-dipole survey identified a conductive zone on line A from 140 to 170 NW (Figure 4.6), under an unspecified thickness of resistive rock. This anomaly lies within the anomaly defined by the 1978 survey, and provides the only near-surface detail presently available.

The Lillooet Valley resistivity anomaly appears to be associated with the metamorphic rocks mapped in the area. Its strike is conformable to regional trends, and invites extrapolation of the anomaly beyond the limit of data toward the rusty, altered metamorphic rocks near Job and Mosaic Creeks. Sulphide mineralization has been observed at several localities within the anomalous area, including up to 10% disseminated pyrite in biotite-muscovite gneiss near the Lillooet River bridge. Minor pyrite also occurs in metamorphic rocks outside the anomalous zone. More detailed geological mapping is required to determine whether the anomaly is due to pyrite and graphite within the metamorphics, or due to dense fracturing or other conditions associated with a geothermal system.

4.5.4 Possible North Reservoir; Lillooet Map Area; Dipole-Dipole Survey

The dipole-dipole survey indicates a 1 km wide anomaly along Line L between 351W and 361W in the Possible North Reservoir area (Figure 4.6). The conductive zone is open to depth, with well-defined east and west boundaries and a resistive cap at surface (Figure 4.9). Additional survey lines are required to define the north and south anomaly boundaries.

The resistivity anomaly lies within the quartz monzonite basement. Rhyodacite flows cover the area to a drill-indicated depth of about 260 metres (refer to Figure 5.2), comparable to a thickness estimate of 250 metres for the resistive cap over the anomaly. Possible models include a cylindrical vent structure associated with the last major stage of volcanism or a tabular structure caused by faulting or shearing. Continued thermal activity (convective circulation) in zones of relatively high permeability may have effected a precipitate seal in the overlying rhyodacite as suggested by its high resistivity signature. Further resistivity work in this area is required to define the shape of the anomaly.

4.6 Resistivity Anisotropy

Indications of resistivity anisotropy in the data may result from two survey measurement modes:

a) measurements made within a known rock type wherein observed anisotropy is a characteristic of the fabric of that rock, and may be due to parallel fracture sets or fissures (Risk, 1975) which provide preferential current flow along their dominant orientation.

b) measurements made on a large scale reconnaissance survey, as at Meager Mountain, 1978, wherein observed anisotropy is not a rock fabric signature but is principally due to the effects of large scale structural features such as resistivity contacts between rock types or phases, and unevenly distributed near-surface resistivity variations such as conductive overburden or weathered volcanic layers.

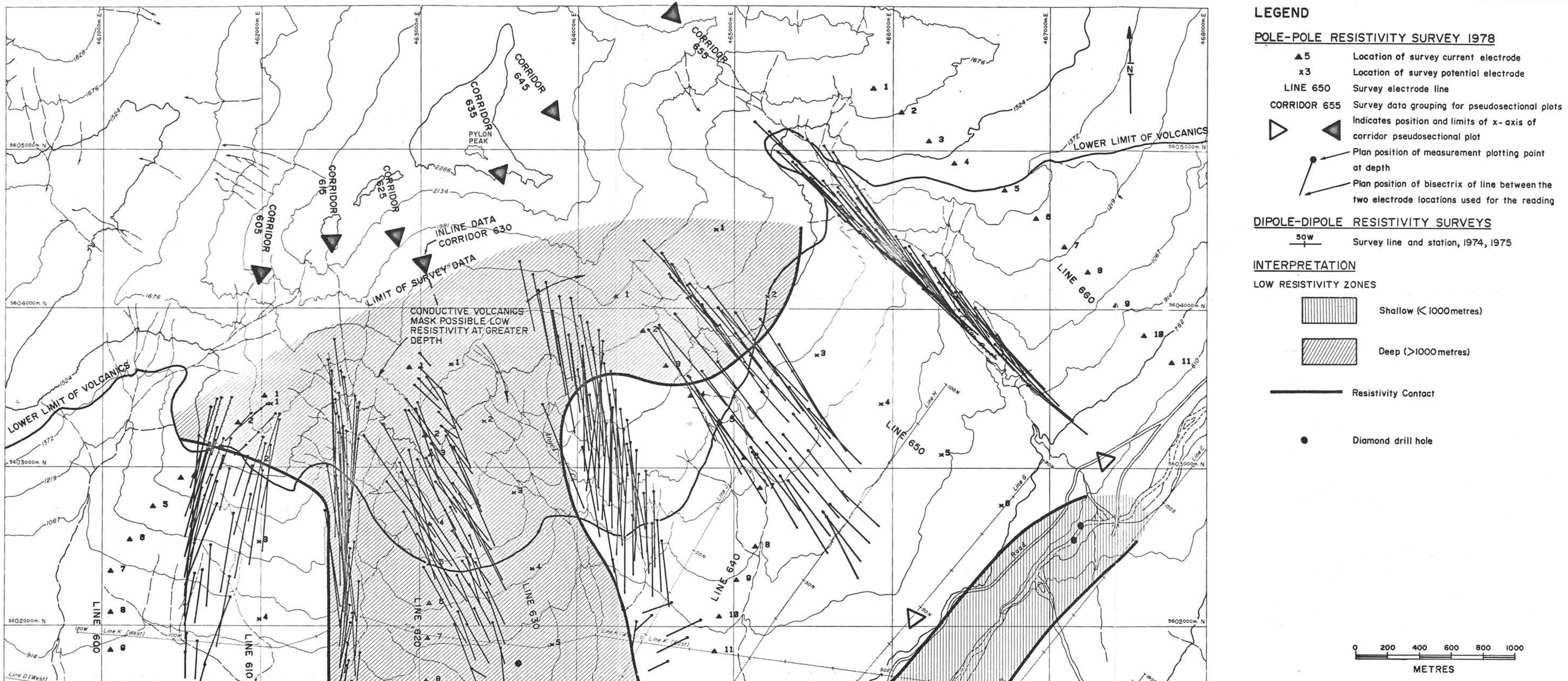
Observations of apparent resistivity anisotropy in the current survey data result from b (above) and are incorporated in the interpretation procedure outlined in section 4.5.1. Analysis of anisotropy as an indicator of rock fabric (a, above) requires data from a smaller scale, more detailed survey than was undertaken in 1978.

4.7 Quantitative Interpretation Techniques

An investigation was made into the availability of techniques for the interpretation of apparent resistivity data by data inversion, a method of fitting survey results to ideal calculated results for various hypothetical subsurface models. While standard techniques are available for the inversion of certain types of dipole-dipole array data involving layered earths, no off-the-shelf programming is presently available for the treatment of pole-pole data. Development and adaptation of inversion techniques for the existing survey data may be possible within about two years.

Dipole-dipole resistivity inversion was applied to the anomaly on Line L. Results were somewhat ambiguous, but the best computer interpretation tends to confirm the manual interpretation shown on Figure 4.9. Inversion results indicate ρ_1 = 1020 ohm-metres, ρ_2 = 192 ohm-metres and an interface depth of 220 metres, with probable plus-or-minus 20 percent error for all values.

An attempt was made to process the randomly spaced 1977 data into the quasiplanar corridor format used in 1978. The effort was abandoned because of high cost and the anticipation that results would not enhance previous subjective interpretation of the 1977 data. The 1977 and 1978 surveys overlapped (Figure 1.1) sufficiently, and data were consistent with one another, so as to obviate the need for further processing.



1975-78 Geophysical data by Deep Grid Analysis (1977) Ltd., Vancouver, B.C.
1974 Geophysical data by McPhar Geophysics Ltd., Vancouver, B.C.

Figure 4·1

GEOPHYSICAL DATA LOCATION AND SUMMARY RESULTS MEAGER MAP AREA

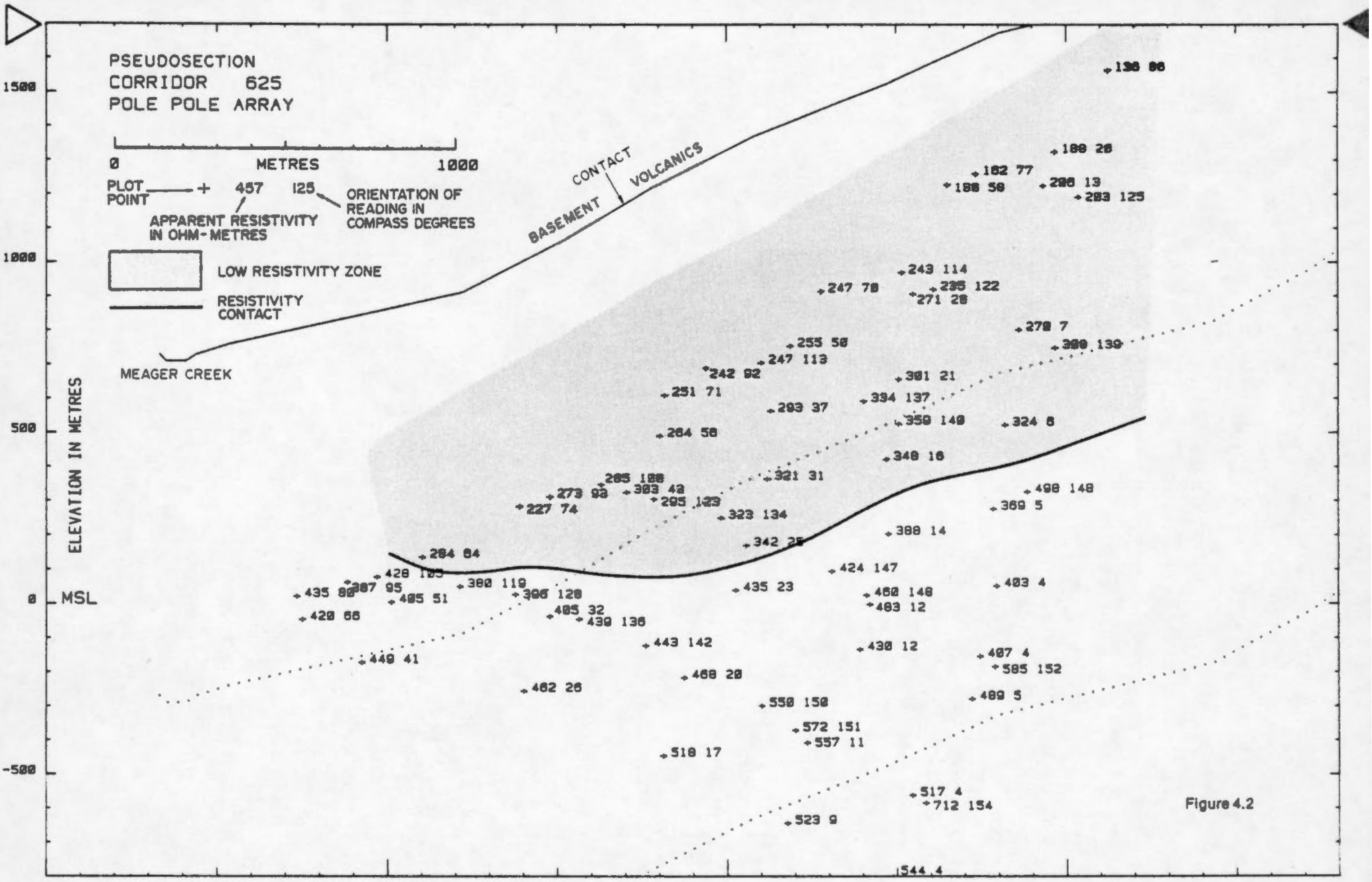


Figure 4.2

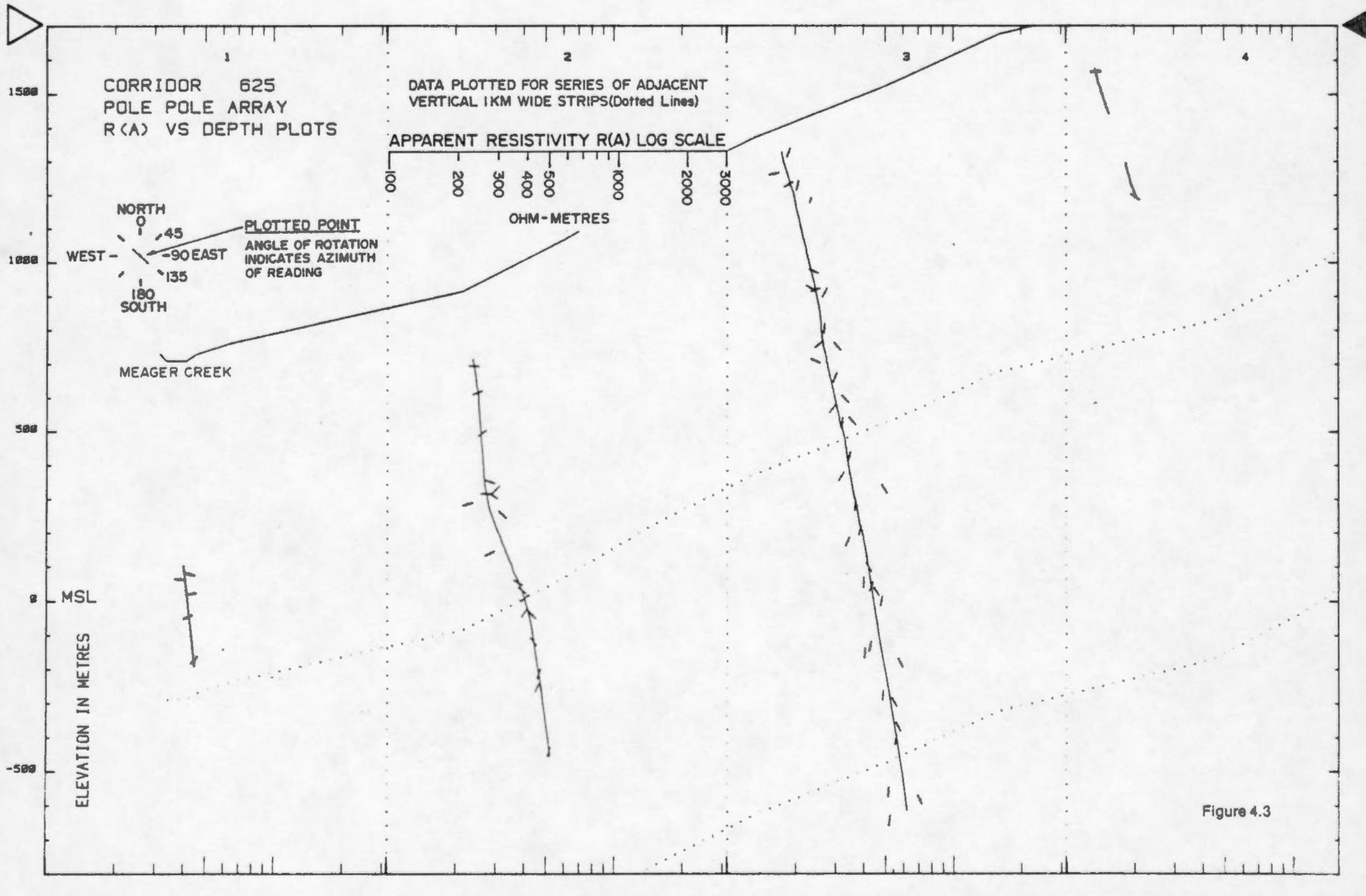


Figure 4.3

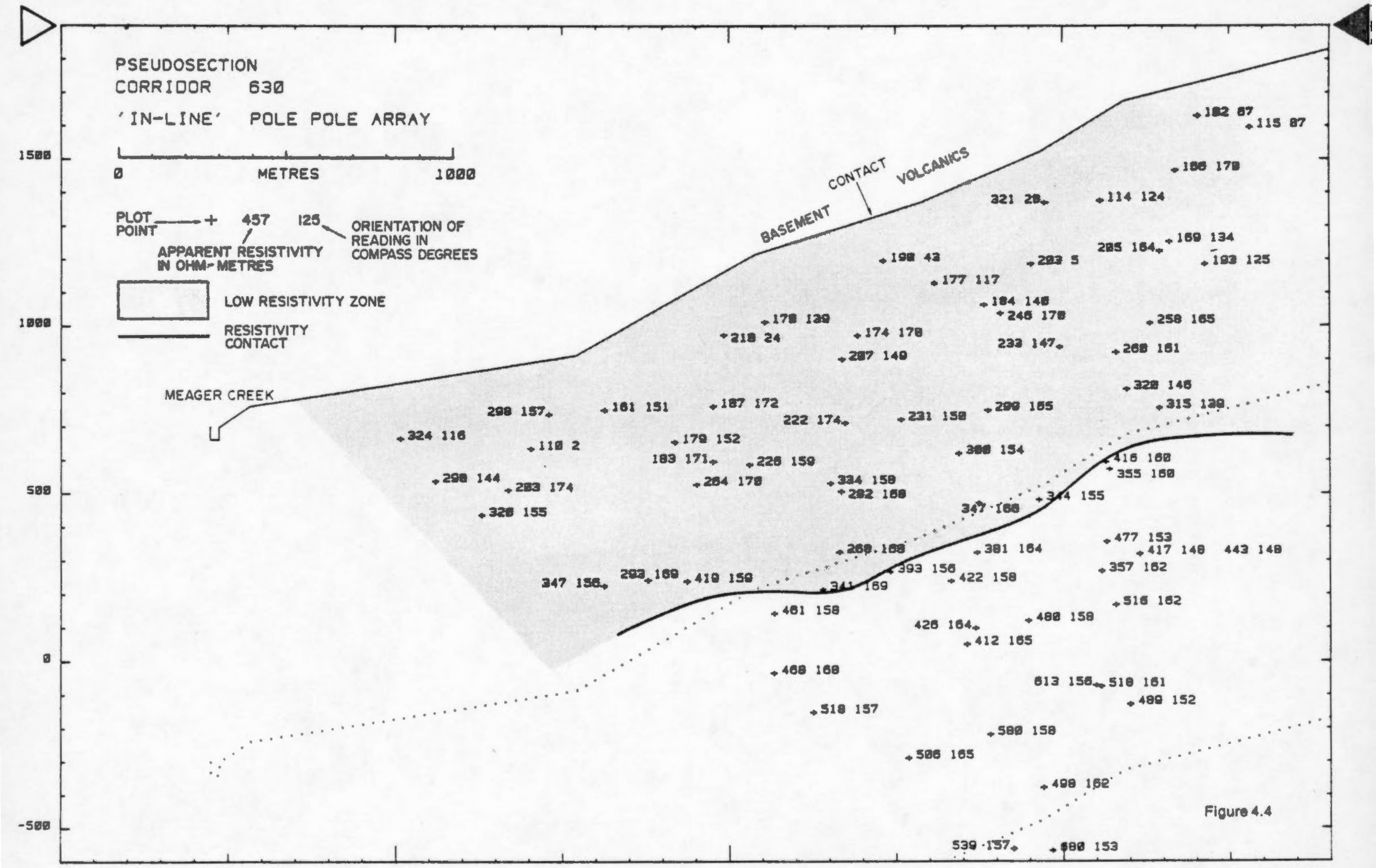


Figure 4.4

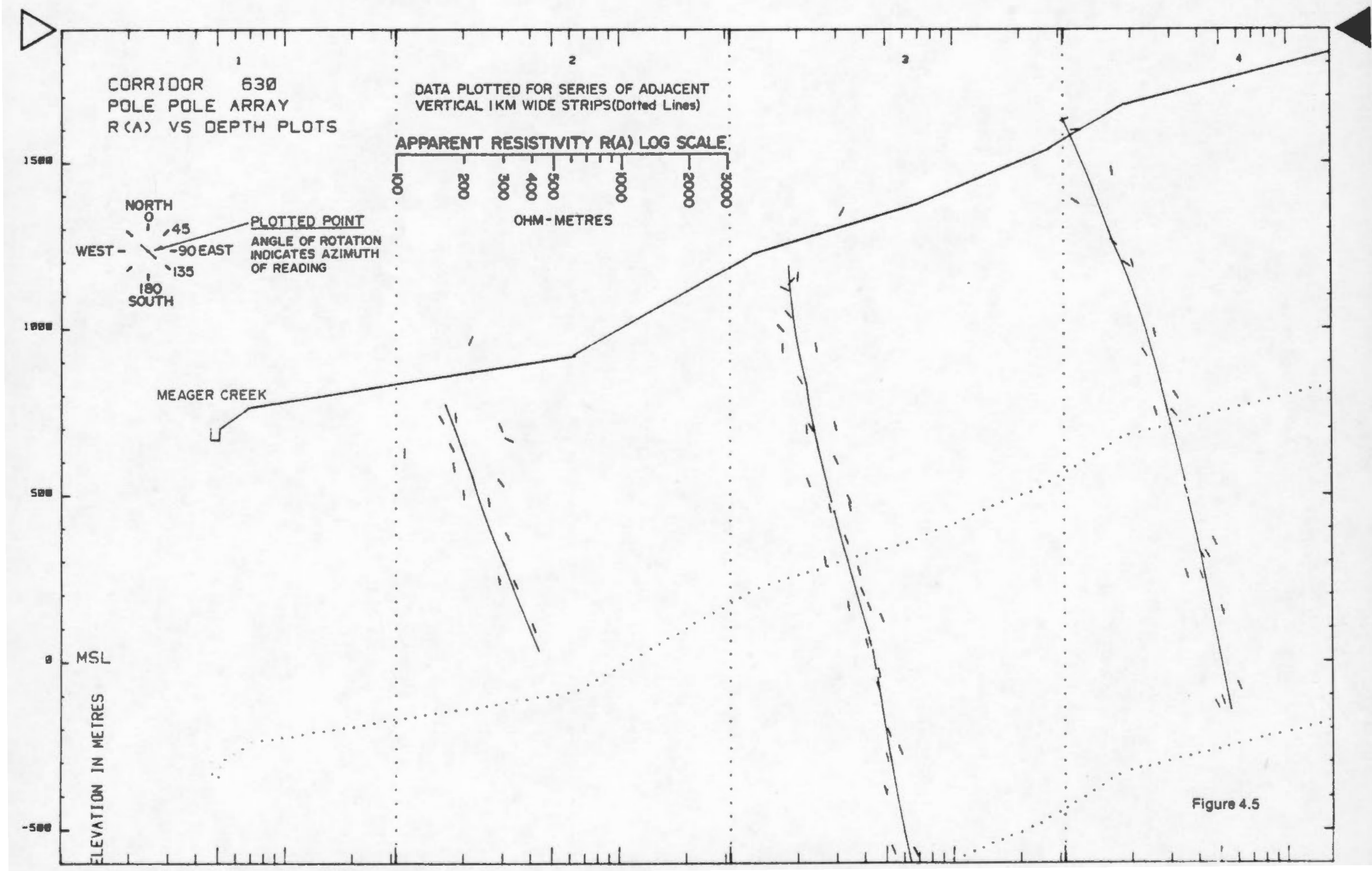
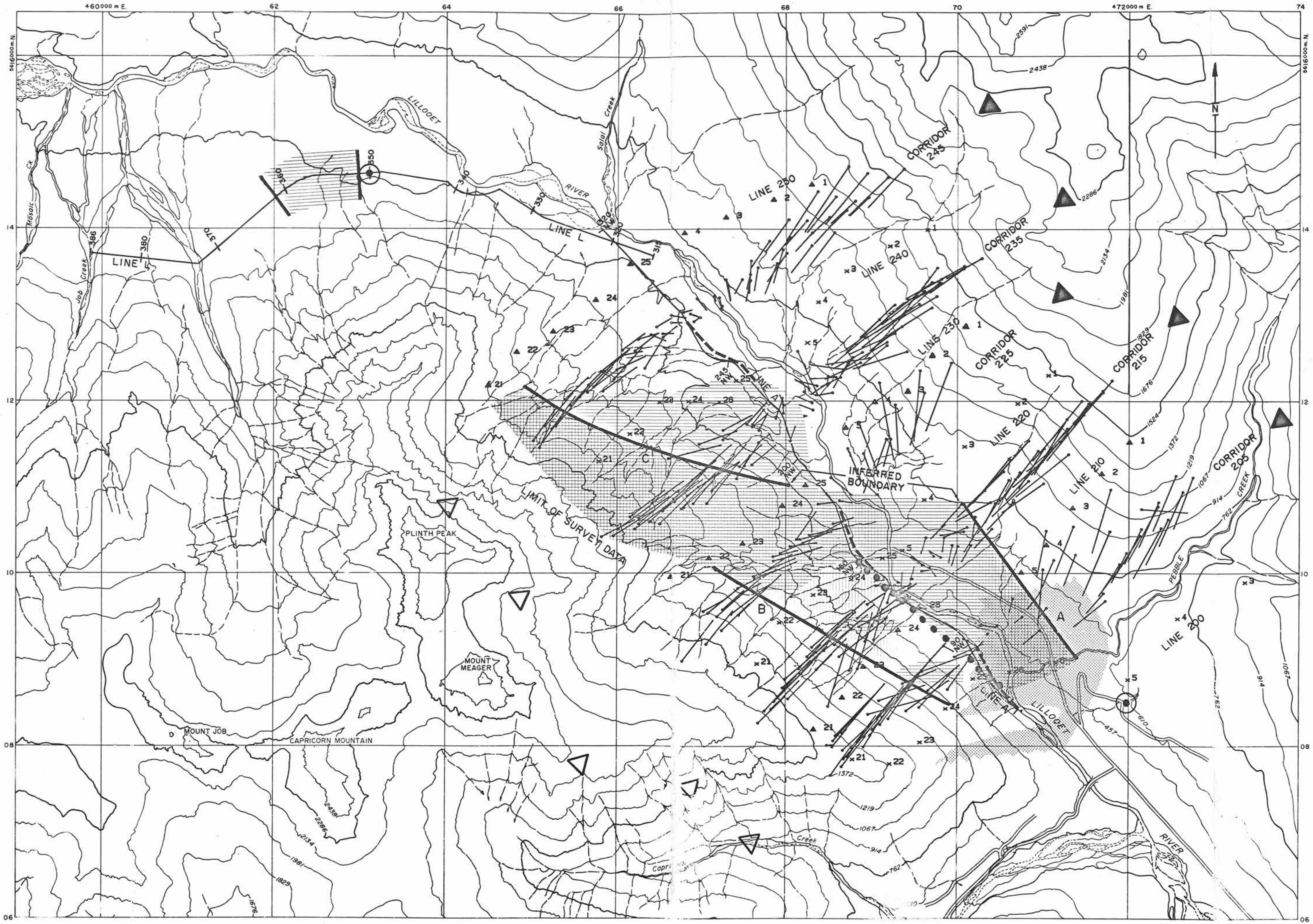


Figure 4.5



LEGEND

POLE-POLE RESISTIVITY SURVEY 1978

▲5	Location of survey current electrode
x 3	Location of survey potential electrode
LINE 240	Survey electrode line
CORRIDOR 245	Survey data grouping for pseudosectional plots
▷ ◀	Indicates position and limits of x-axis of corridor pseudosectional plot
	Plan position of measurement plotting point at depth
	Plan position of bisectrix of line between the two electrode locations used for the reading

DIPOLE-DIPOLE RESISTIVITY SURVEYS, 1974, 1978

350W	Survey line and station, 1978
100NW	Survey line and station, 1974

INTERPRETATION

LOW RESISTIVITY ZONES

	Shallow (<1000metres)
	Deep (>1000metres)
	Resistivity Contact
● ● ● ● ● ●	Southwest limit of Conductive Valley Sediments
	1974 Dipole-Dipole Resistivity anomaly
⊙	Diamond drill hole
	1977 Pole-Pole Resistivity anomaly (Deep)

0 400 800 1200 1600 2000

METRES

1977-78 Geophysical data by Deep Grid Analysis (1977) Ltd., Vancouver, B.C.
1974 Geophysical data by McPhar Geophysics Ltd., Vancouver, B.C.

Figure 4·6

GEOPHYSICAL DATA LOCATION AND SUMMARY RESULTS LILLOOET MAP AREA

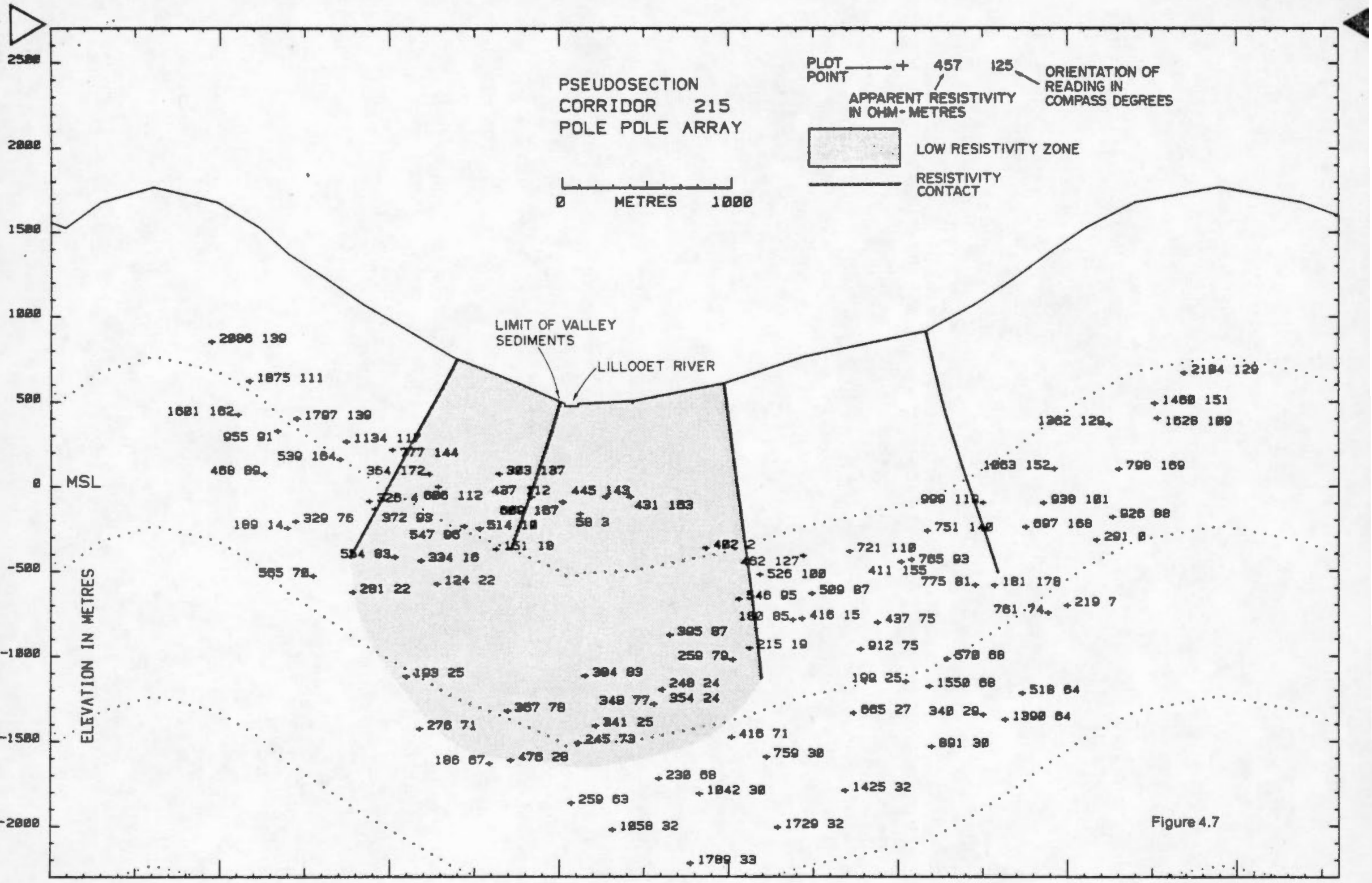


Figure 4.7

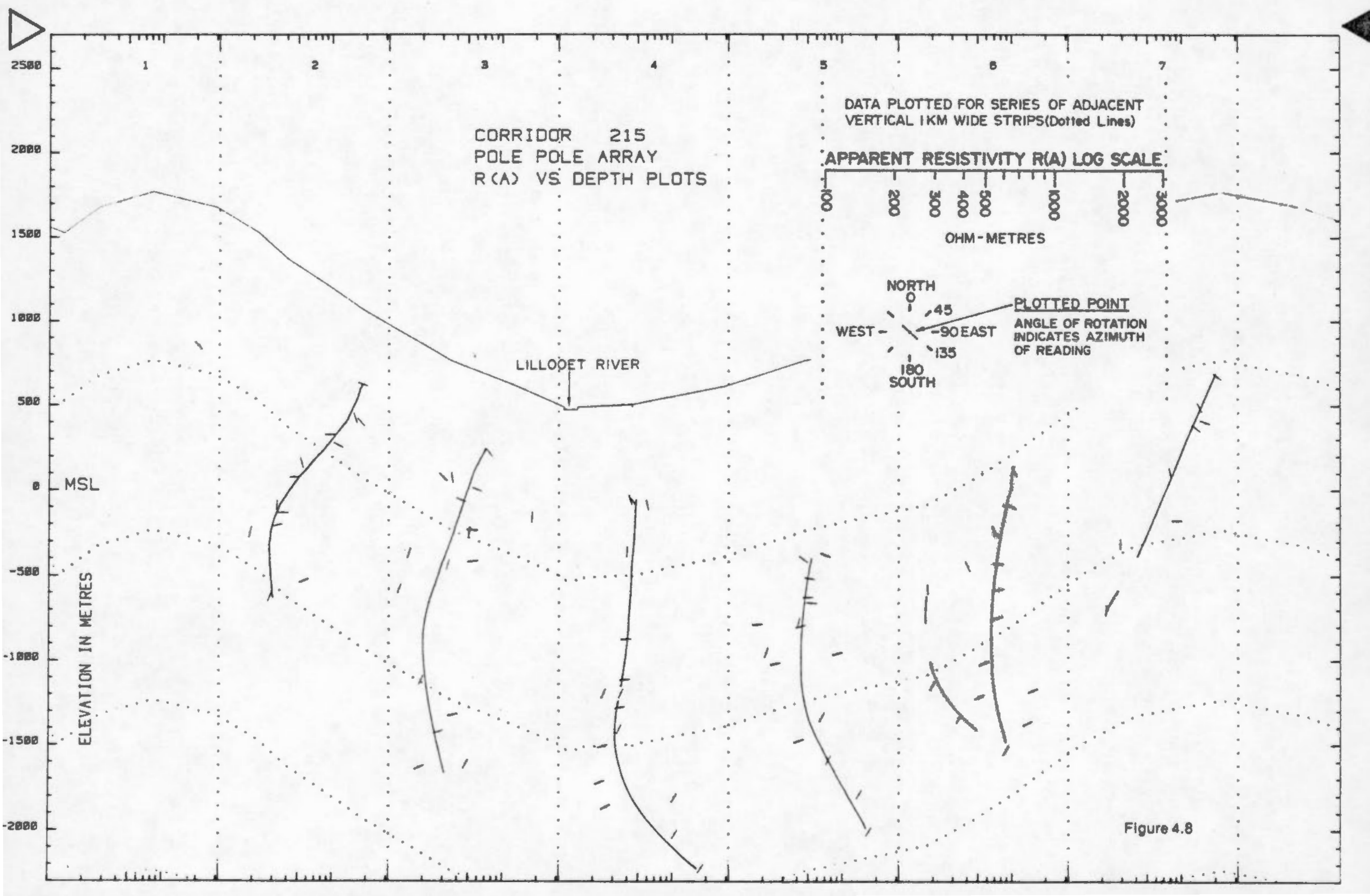


Figure 4.8

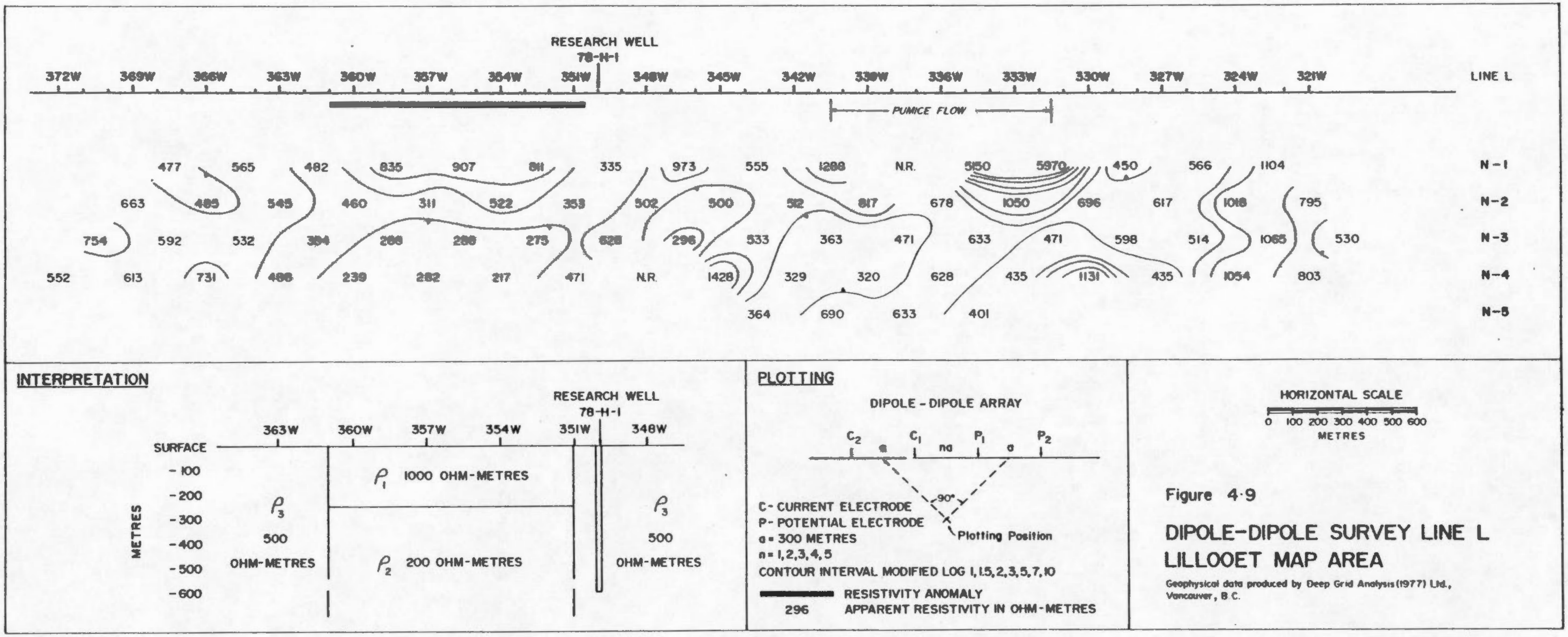


Figure 4·9

DIPOLE-DIPOLE SURVEY LINE L
LILLOOET MAP AREA

Geophysical data produced by Deep Grid Analysis (1977) Ltd., Vancouver, B.C.

5.0 DIAMOND DRILLING

5.1 Introduction

Two diamond drill holes were completed in 1978; research well 78-H-1 (602.6 m), on the south side of the Lillooet River valley north of Plinth Peak, and research well 78-H-2 (250.2 m), on the bench of Meager Creek valley west of 75-H-2 (Figure 5.1). Both 1978 holes were encouraging in that they encountered temperatures greater than 100°C. A temperature gradient of 210.6°C/km at the bottom of 78-H-1 confirms the geothermal potential of the Possible North Reservoir. Well 78-H-2 failed to reach bedrock but indicates very hot water flowing in deep overburden west of previous drilling at the South Reservoir. Results of the 1978 drilling are summarized with earlier research wells in Table 5.1.

Drilling contractor was Canadian Longyear Limited using a Longyear 44 diamond drill and a mud circulation system in anticipation of deep holes and difficult overburden conditions. Wells were started with HW casing and HQ rods and reduced to NQ at depth. Both wells were lined with 1¼ inch steel pipe and capped at surface to allow future access.

Temperatures were measured using thermistor, probe and Wheatstone bridge supplied by Energy, Mines and Resources. Where possible, temperatures were taken at the bottom of the hole between shifts. Twelve hours were allowed after the drilling shift to allow bottom hole temperatures to reach equilibrium (see Appendix C-3 for temperature rebound curve after stopped circulation). The physical limits of the cable and probe were exceeded in 78-H-1 at 573.3 metres depth where the temperature was slightly greater than 102°C.

5.2 Research Well 78-H-1

The location of research well 78-H-1 was chosen on geological concepts to test the thermal significance of relatively recent volcanic activity in the northern part of the complex. A single line of dipole-dipole resistivity was completed across the area prior to drilling, and final site selection was made with regard to a deep resistivity anomaly detected. The hole is immediately east of the anomaly (refer to Figure 4.9).

Three main lithologies occur in 78-H-1 (Figure 5.2):

a) unconsolidated alluvial sediments from 0 to 47 metres,

b) rhyodacite porphyry volcanics from 47 to 255 metres, the upper 105 metres of which may be boulders with interlayered sand lenses, and the remainder flows,

c) slightly variable, fractured biotite quartz monzonite from 262 to 603 metres. An 8-metre semiconsolidated alluvial gravel layer at the base of the volcanic flows defines a pre-volcanic erosional surface.

The unconsolidated sediments consist mainly of sand and gravel layers, with occasional 5-8 metre zones of up to 1 metre boulders, locally mixed with fine material suggesting glacial till. Underlying volcanics are interspersed with sand layers in the upper 105 metres followed by massive gray-matrix rhyodacite porphyry flows. Porphyry flows are locally flow-banded with variable matrix shade and phenocryst size. Plagioclase feldspar forms phenocrysts up to 1 cm in length; lesser biotite and hornblende occur as euhedral crystals to 5 mm in size, and clear quartz appears as scattered blebs. Volcanic core is often strongly magnetic and contains occasional clasts of dioritic and gneissic material. The volcanic section correlates with Phase III rhyodacites of Plinth Peak.

The prevolcanic unccnformity is represented by a semi-consolidated polymictic conglomerate layer, approximately half of which is recovered as core, containing pebbles of diorite, gneiss, quartz monzonite and quartz.

The basement rock is highly fractured and weathered with chloritic alteration pervasive from 262 to 268 metres, and biotite quartz monzonite from 268 metres onward. The intrusive section includes gradational changes to granodiorite and minor mafic dykes. Fractures are commonly filled with dark gray, cryptocrystalline layered silica, occasionally accompanied by pyrite and rare molybdenite. Unfractured zones are present up to 10 metres thick. Quartz monzonite in 78-H-1 correlates with that in the Lillooet Valley near the falls and at Fall Creek southwest of the falls, and is probably part of the Fall Creek Stock.

The temperature profile measured in well 78-H-1 is shown on Figure 5.2. All points are bottom-hole temperatures except the section between 60-215 metres (where use of heavy mud prior to casing off the incompetent volcanic section precluded lowering the probe into the hole). The temperature probe and measurement circuitry functioned well at temperatures below 102°C in the upper 560 metres of the hole; results are reliable and reproducible. The probe cable failed during the temperature measurement at 573.3 metres, rendering the 102.8°C result unreliable (and possibly on the low side). Temperature measurements were not possible in the bottom 29 metres of the well with the equipment on-site.

The temperature profile indicates a relatively near-surface heat source with greater than 100°C temperatures present at depths below 550 metres. Maximum reliable temperature recorded is 101.8°C at 556.6 metres. The thermal gradient at the bottom of the well is 210.6°C/km. A lesser gradient of approximately 125°C/km in the top section is due to increased permeability and heat conductivity of the volcanic rocks. Sand layers in the volcanics provide conduits for surface water and heat dissipation.

The temperature bulge and inversion between 225 and 450 metres indicates lateral heat input. Increased temperatures due to lateral heat are overprinted on the "background" temperature gradient. The temperature bulge represents either:

a) A tabular heat channelway or hot water aquifer with discreet boundaries (at about 300 and 380 metres depth). Heat is lost through conduction (and possibly minor convection) above and below the tabular heat source. The channelway may represent a fracture zone and is not necessarily horizontal. This model is compatible with the data and the concept of a fracture controlled geothermal reservoir.

b) Lateral heat flow through a relatively homogenous medium. The gradational boundaries of the heat flow would be influenced by hydrodynamic parameters and variations in the heat and hydraulic conductivity within the intrusive rocks.

Possible heat transfer mechanisms in both of the above models include convection over a deep heat source or hydraulic flow driven by hydrostatic pressure.

From the data available a convection cell distorted by fracture channelways is a promising working model. A fracture controlled heat channelway is favoured due to the linearity of segments of the temperature buldge and its symmetry when the background component of temperature is subtracted (compare with asymmetric profile in 78-H-2). The axis of symmetry indicates the centre of the heat input or fracture zone. The width of the conductive heat loss zones above and below the possible heat channelway is the same at about 100 metres. Temperatures within the zone of lateral heat input are elevated a constant 36°C (Figure 5.2).

5.3 Research Well 78-H-2

Research well 78-H-2 was designed to investigate the subsurface in the southwest area of the South Reservoir resistivity anomaly, extending drill hole coverage toward the western limit of low resistivity. Previous drilling has been restricted to the eastern half of the resistivity anomaly and outflow plume area. Research well 78-H-2 was completed to 250 metres in unconsolidated valley-fill sediments. Drilling was suspended before reaching bedrock due to budget considerations and high footage costs in overburden which was found to be deeper than anticipated.

Sediments consist of sand, gravel, clay and interlayered zones of large boulders up to 5 metres, suggesting landslide material and glacial outwash clays. Thin clay horizons are common, occasionally directly under boulders.

Temperatures in the upper 150 metre section were taken at 30 metre intervals 9 hours after last circulation with the hole at 208 metres. Temperatures in the remaining lower section were obtained following completion of the well. All measurements were taken inside drill rods. Bottom-hole temperatures as drilling progressed could not be obtained for several reasons: firstly, the use of heavy mud in 78-H-2 precluded lowering the probe in the hole; secondly, the tricone bit used in the overburden would have to be pulled with the rods, exposing the uncased well to the danger of caving; and thirdly, time was not available between drill shifts to allow the bottom-hole conditions to reach temperature equilibrium following ceased drill fluid circulation.

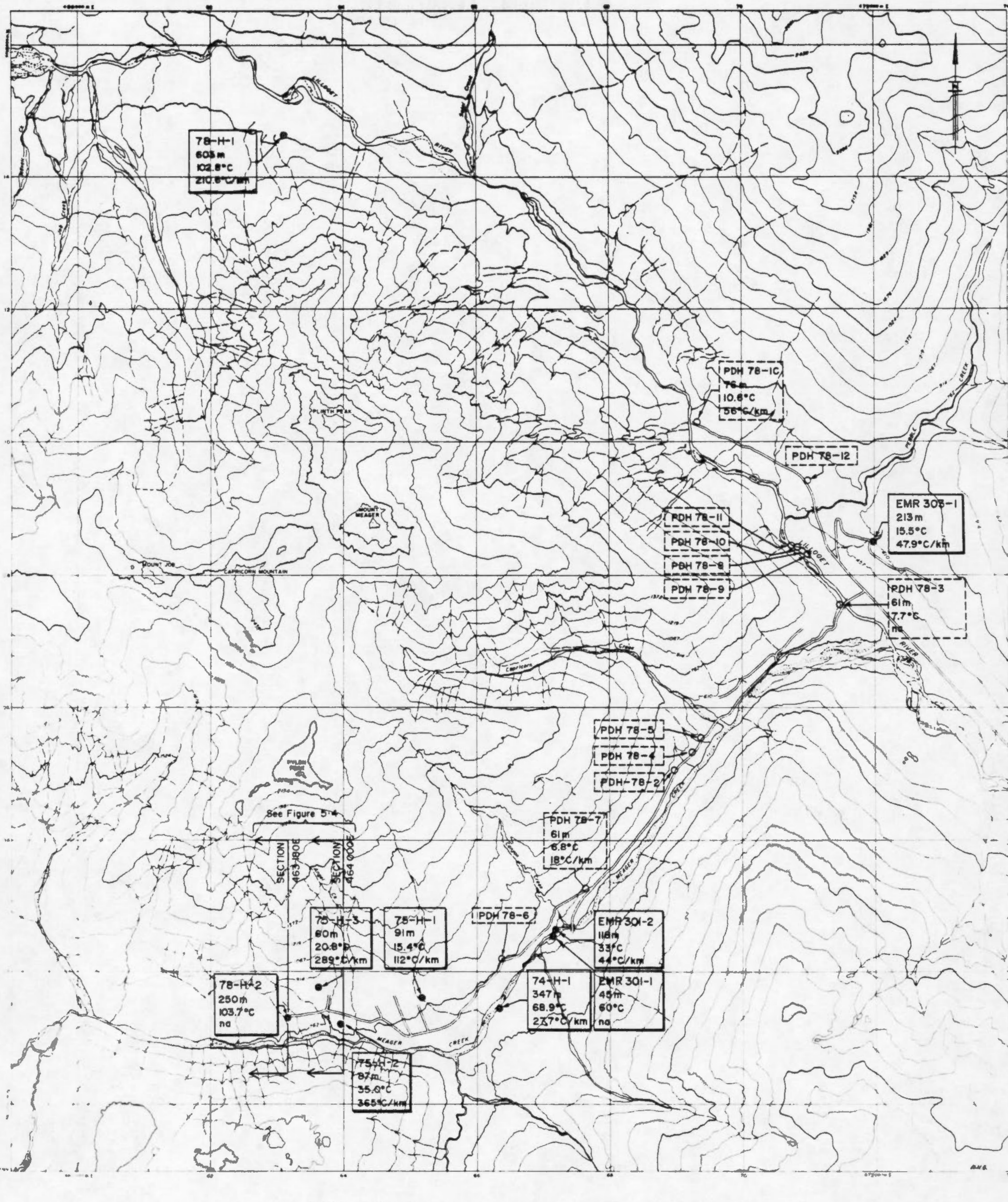
Post-drilling temperature measurements yield a gradient of approximately 480°C/km in the upper three-quarters of the hole with a temperature inversion near the bottom. Maximum temperature recorded is 103.7°C at 213 metres and bottom temperature is 95.1°C.

Despite the consistent lack of circulation return, standing water was encountered within 20 metres of surface whenever the probe was lowered. The results indicate very hot water flowing laterally in the over-burden at a point west of previous drilling. The hot water probably flows down the inferred hydrological gradient from the west or north.

5.4 Bedrock Topography - South Reservoir Area

Bedrock topography is an important consideration in spotting future exploration or production holes in the South Reservoir area. Bedrock in research well 78-H-2 is well below the present level of Meager Creek which, coupled with the lithology of sediments and the temperature inversion at the bottom of the hole, indicates a buried channel. Concepts of the location of the buried channel are shown in Figure 5.4, two north-south cross sections.

The elevation at the bottom of well 78-H-2 (572 metres a.s.l.) represents the maximum possible elevation of the buried channel at the point. One kilometre downstream, in research well 75-H-2, the buried channel is not apparent and is probably located north of the hole. In research well 74-H-1 (downstream from the cross sections), the bedrock intersection at 124 metres depth, or 511 metres a.s.l., probably reflects the buried channel. Clay and water-lain varved clay in the bottom part of 74-H-1 may represent a buried lake behind a bedrock high in the Meager Creek main springs area.



LEGEND

DIAMOND DRILLING

● Location of hole

78-H-2	Designation of hole (EMR indicates Energy Mines and Resources, Canada)
60m	Depth in metres
20.8°C	Maximum bottom hole temperature
289°C/km	Thermal gradient at bottom (from bottom hole temperatures)

na Not applicable

PERCUSSION DRILLING

○ Location of hole

PDH 78-1C	Designation of hole
76m	Depth in metres
10.6°C	Maximum post drilling temperature
56°C/km	Thermal gradient at bottom (from post drilling temperatures)

NOTE: *Depth and temperature information not plotted for holes less than 30m completed in overburden*

Figure 5·1

SUMMARY PLAN
DIAMOND and PERCUSSION DRILLING

TABLE 1: SUMMARY OF DIAMOND DRILLING

RESEARCH WELL	LOCATION	COORDINATES	DATE COLLARED (Drilled by)	COLLAR ELEVATION (m)	DEPTH (m)	DEPTH OF OVERBURDEN (m)	MAXIMUM TEMPERATURE (m)	BHT GRADIENT AT BOTTOM (°C/km)	COMMENT
301-1	Meager Creek hot springs	5,602,540N 467,160E	March 74 (EMR)	587	45	18	60	n.a.	- hole inclined at -70° - making water at 6 l/s - temperature inversion, -ve gradient at bottom
301-2	Meager Creek hot springs	5,602,640N 467,200E	March 74 (EMR)	583	118	0	33	44	- making water at 1.7 l/s
303-1	Lillooet valley	5,608,510N 471,970E	Sept 77 (EMR)	580	213	0	15.5	48	- making water at less than 1 l/s
74-H-1	South Reservoir Outflow Plume	5,601,440N 466,350E	Nov 74 (B.C. Hydro)	635	347	124	68.9	27.7	- making water at 3 l/s - temperature inversion in overburden section
75-H-1	South Reservoir	5,601,610N 465,200E	Sept 75 (B.C Hydro)	774	91	11	15.4	112	- making water at 0.3 l/s
75-H-2	South Reservoir	5,601,200N 464,015E	Sept 75 (B.C. Hydro)	770	87	65	35.0	365	
75-H-3	South Reservoir	5,601,770N 463,000E	Sept 75 (B.C. Hydro)	808	60	12	20.8	289	- inclined at -70°
78-H-1	North Lillooet Valley	5,614,630N 463,090E	Sept 78 (Joint Venture)	760	603	47	102.8	211	- temperature inversion between 387 and 450 m
78-H-2	South Reservoir	5,601,310N 463,160E	Oct 78 (Joint Venture)	822	>250	250	103.7	n.a.	- temperature inversion in bottom section

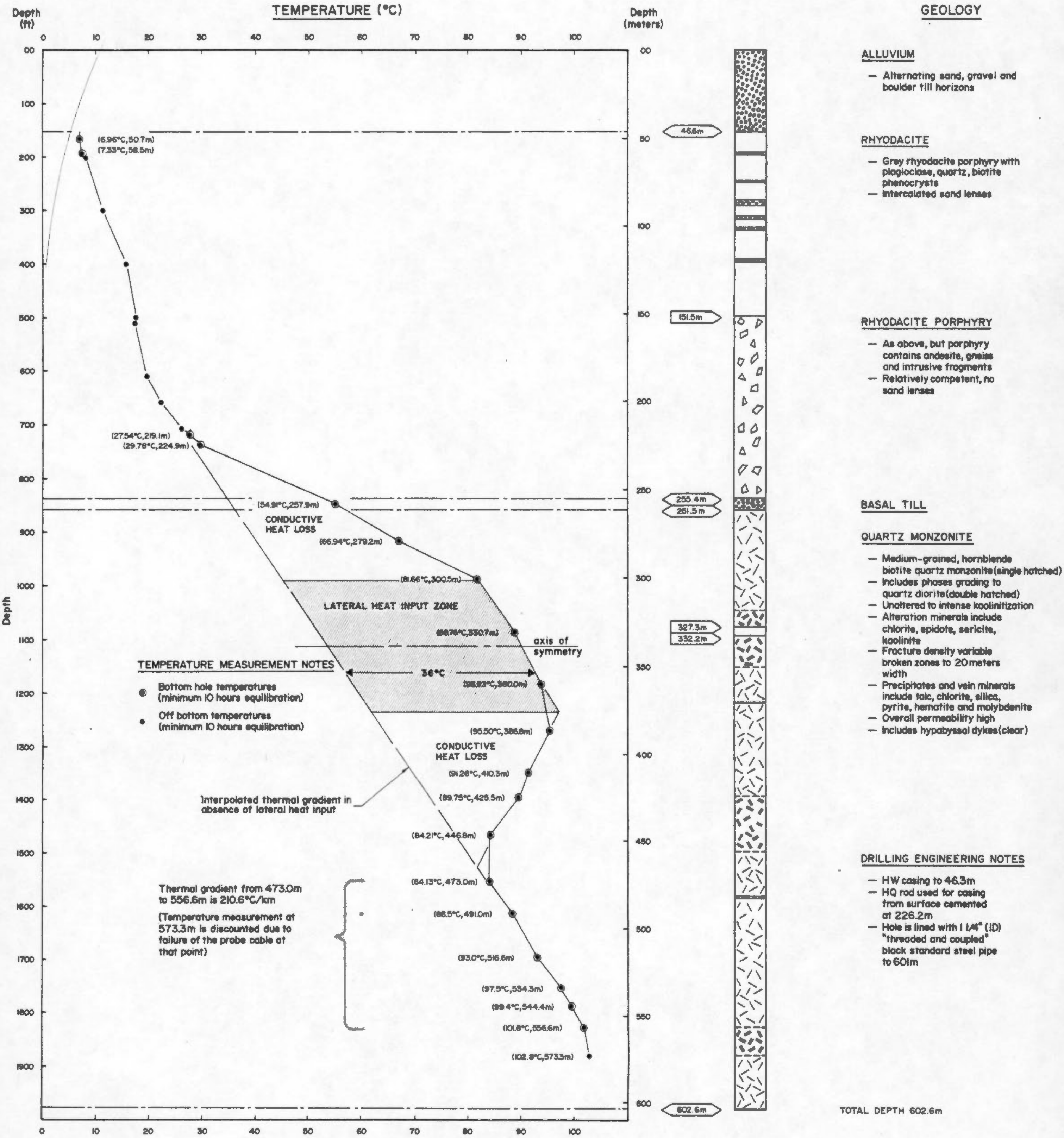


Figure 5·2

TEMPERATURE PROFILE AND GRAPHIC LOG
RESEARCH WELL 78-H-1

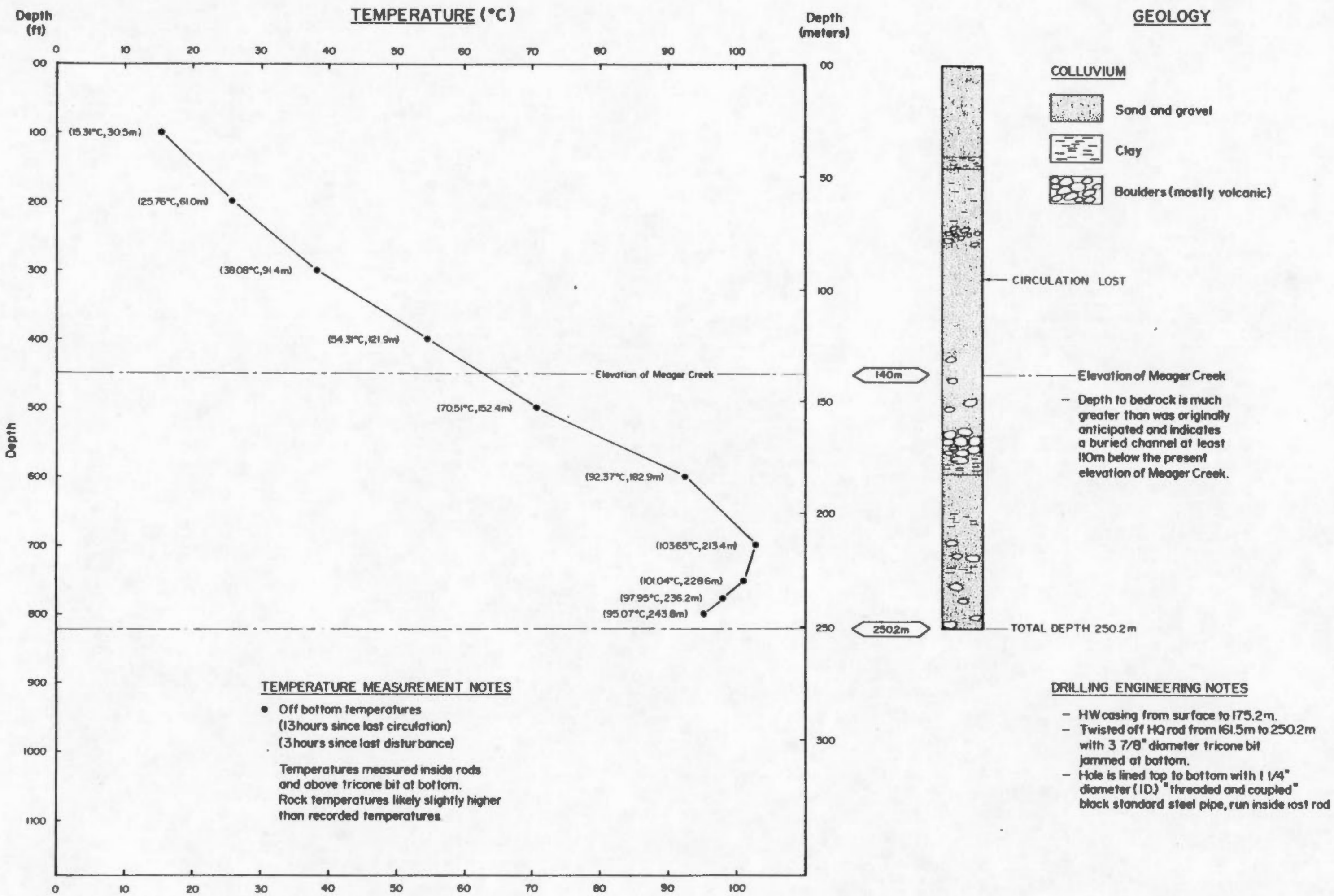


Figure 5·3

TEMPERATURE PROFILE AND GRAPHIC LOG
RESEARCH WELL 78-H-2

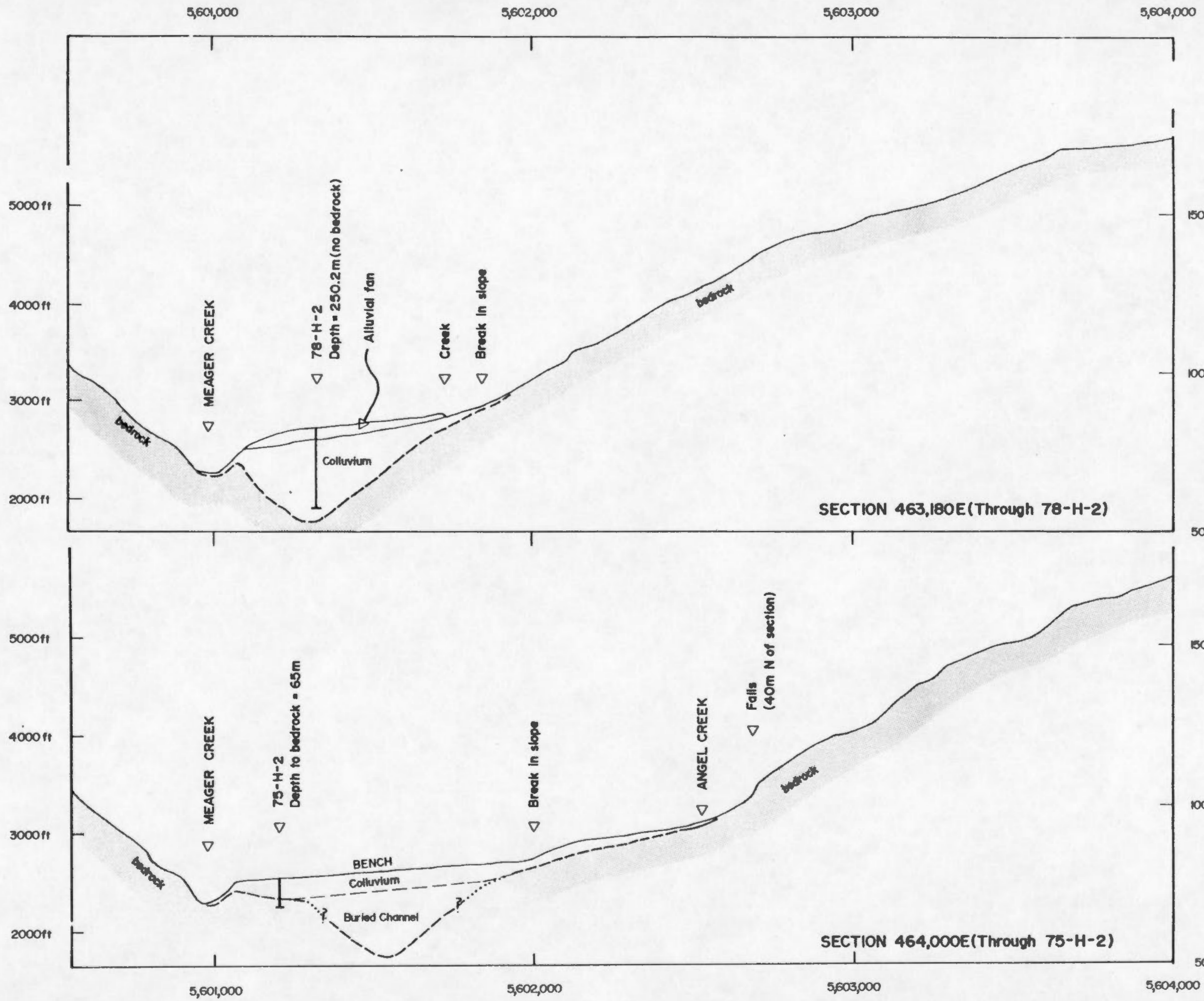


FIGURE 5·4

CROSS SECTIONS LOOKING WEST THROUGH RESEARCH WELL 78-H-2 (Top) AND 75-H-2 (Bottom)

SHOWING OVERBURDEN CONDITIONS AT SOUTH RESERVOIR MEAGER MAP AREA

For location of sections, see Figure 5·1

6.0 OTHER INDIRECT EXPLORATION METHODS

6.1 Percussion Drilling

(refer to Figure 5.1 for location map)

Percussion drilling was meant to test the thermal nature of the Lillooet Valley resistivity anomaly, and to confirm the eastern cut-off of the South Reservoir. The method was limited to areas with road access. It was used in the vicinity of previous self-potential anomalies, which possibly implied near-surface thermal water movement. Twelve holes were drilled and of these, three were completed in bedrock. Holes were lined with plastic pipe (2.2 cm I.D.) and post drilling temperatures obtained with thermistor probe and Wheatstone bridge equipment supplied by EMR. Drill cuttings were dried and bagged to determine lithologies of rock penetrated.

Experience indicates that post-drilling temperature gradients approximate corresponding bottom-hole temperature gradients where no water is flowing from or in the hole (Nevin Sadlier-Brown Goodbrand Ltd., 1975; Lewis, 1977; Lewis and Souther, 1978). Where water flows occur post-drilling temperatures measured in a well are biased towards the temperature of the water flow at its point of entry into the well; hence measured post-drilling temperature gradients may be lower than a representative value.

Temperature measurements in percussion holes are shown on Figure 6.1. The most meaningful temperature profiles are derived from the three holes penetrating bedrock. No water flows are discernible

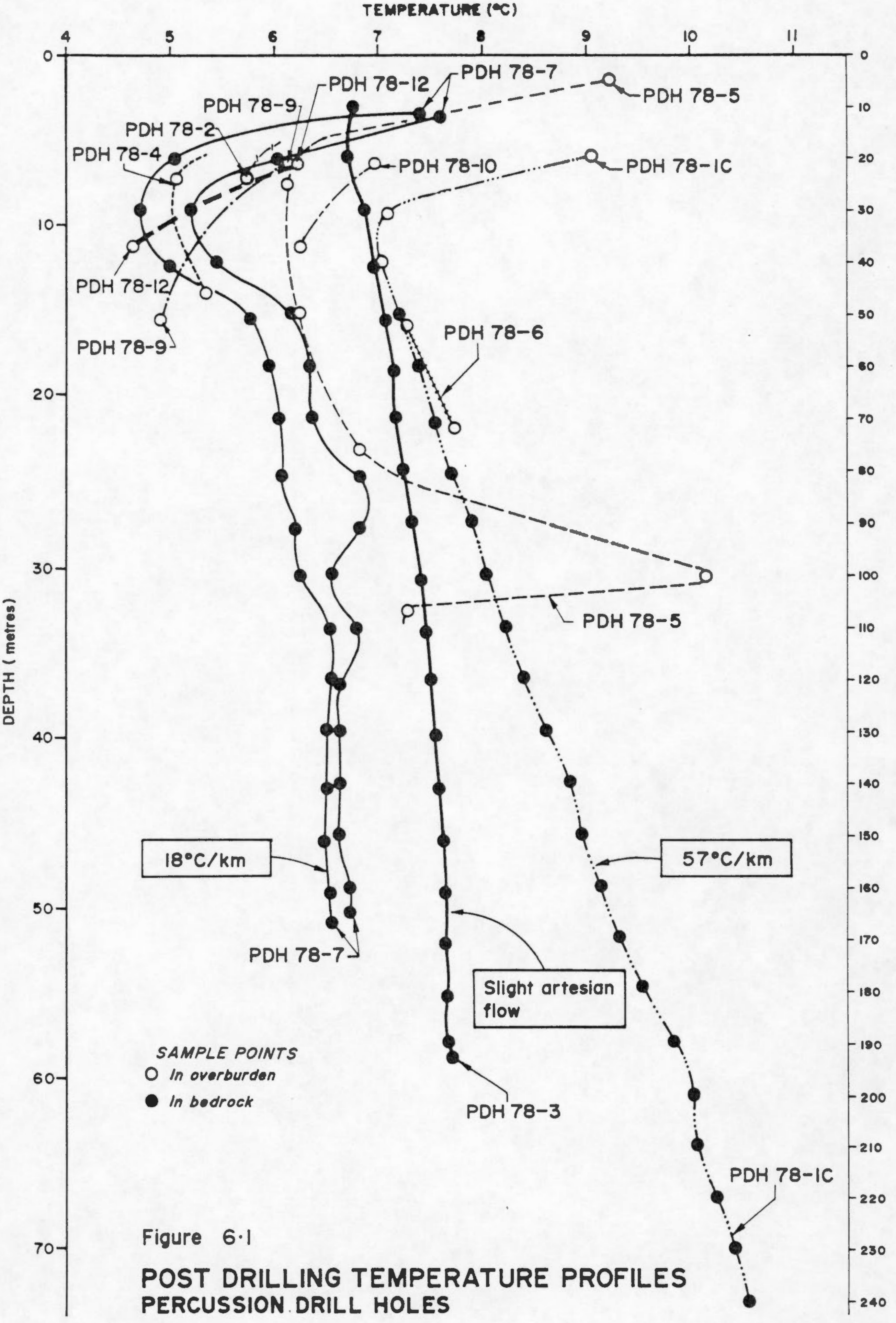


Figure 6·1

POST DRILLING TEMPERATURE PROFILES
PERCUSSION DRILL HOLES

in PDH 78-1C in the Lillooet River valley and the measured gradient of 57°C/km is representative of an abnormally high near-surface heat flow comparable with EMR diamond drilling results at sites 303-1 and 303-2 to the southeast in the Lillooet Valley (Lewis, 1977). None of these holes pinpoints a particular heat source but collectively they show the Lillooet Valley to be a region of elevated heat flow. At the Lillooet River bridge, a slight artesian water flow from near the bottom of PDH 78-3 has caused off-bottom temperatures to be elevated. The measured post-drilling temperature gradient (16°C/km) is, therefore, lower than the actual gradient. In PDH 78-7, the non-linearity of the temperature profile probably indicates water flows in the hole although no water comes to surface. Two sets of temperature measurements were obtained to confirm results in view of the unstable nature of the temperature profile. An averaged measured gradient of 18°C/km from 20 metres to bottom may be representative of the near surface gradient which in this area is affected by ground water flows. The low gradient at PDH 78-7 is consistent with the hypothesis that the South Reservoir outflow plume ends at the Meager Creek hot springs.

Temperature measurements in overburden are almost certainly affected by surface conditions and groundwater flows and therefore, are of limited use in determining geothermal potential. Two features of the temperature-depth graphs are notable however. Firstly, overburden temperatures in PDH 78-6, within the South Reservoir outflow plume, are slightly elevated. Secondly, the temperature spike in PDH 78-5 near Capricorn Creek may be caused by relatively warm water in a restricted aquifer. In both of the foregoing cases, no definite conclusions can be reached regarding the cause of elevated temperatures.

Negative slopes of temperature-depth plots in the top sections of all the holes are a surface effect caused by relatively warm summer groundwater. Some initial readings may be above the groundwater table.

6.2 Trace Element Survey

6.2.1 General

Measurement of mercury (Matlick and Buseck, 1976) and radon gas (Kruger, 1978) concentrations in soils has been applied to geothermal prospects with some success. Anomalously high concentrations may indicate deep geothermal features or outline the network of passageways by which the volatile elements rise to the surface.

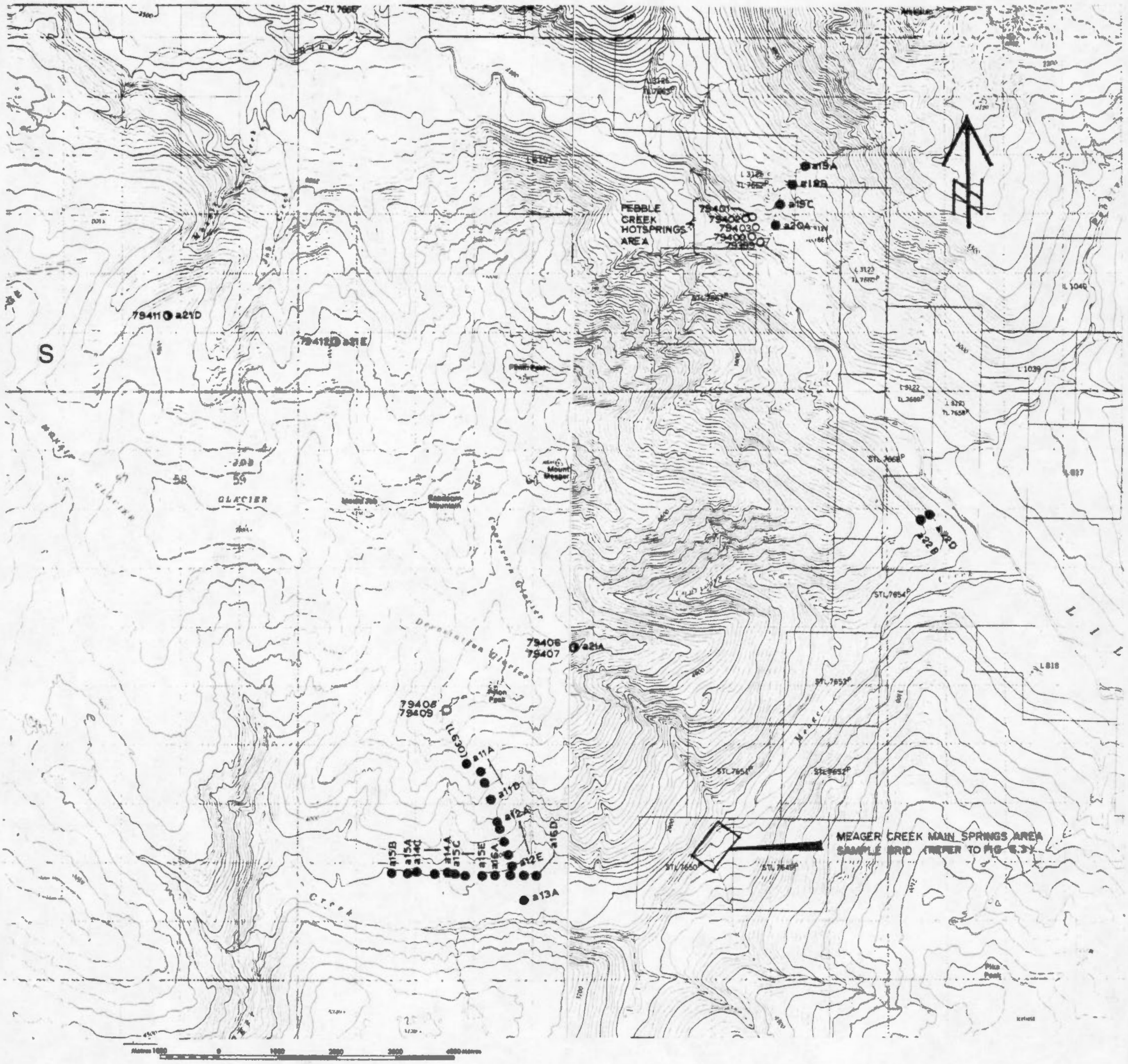
The tests at Meager Creek had several purposes: to see if either method could reproduce known or inferred information from other sources; to seek new data on concealed or subtle geothermal vents; and to determine whether or not either of the methods could be used in the future in such an area -- with highly variable microclimates (northern alpine to coastal rain forest), ground cover (dense vegetation to glacier ice), soil conditions (fine organic to boulder talus) and relief (350 m to 2650 m elevation).

Radon gas and mercury soil surveys both detected anomalous results. The mercury survey indicated that the project area as a whole contains elevated soil mercury and that the presence of organic soil is a prerequisite for the concentration of anomalous amounts of mercury in soil. Results of the radon survey had some correlation with geothermal waters. Both radon and mercury could be used as regional reconnaissance survey tools although further orientation work would be required to verify preliminary conclusions and establish more definite exploration guidelines.

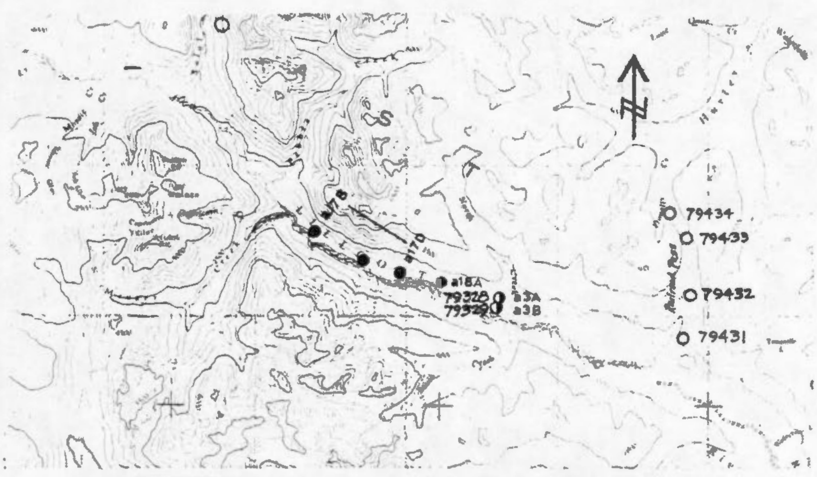
6.2.2 Mercury Survey

One hundred and eleven soil samples were collected for mercury analysis from the Meager Creek main springs area, the bench area and mountain slopes of the South Reservoir, the Lillooet River valley, the Pebble Creek springs area, and Railroad Pass, 30 km east of the geothermal area (Figure 6.2). Samples were dried for 2-3 hours under an infra-red lamp (soil temperature kept below 40°C), sieved to minus 80 mesh, and accepted or rejected on the basis of fines content and composition (silt or organic material). Fifty-one samples were analyzed with suitable results using a Jerome Instrument Corporation "Gold Foil Mercury Detector".

Frequency histograms of all data show the results to be log-normally distributed, with no apparent populations of anomalous values. However, partitioning data into domains by collection locality reveals that most of the low values are from areas of poor soil development (Meager Creek main springs area), or from the Lillooet Valley away from the geothermal area. All other domains show anomalous content to as high as 298 ppb (parts per billion). Background is established by samples away from the geothermal



MEAGER CREEK GEOTHERMAL AREA



LILLOOET VALLEY RECONNAISSANCE AREA

KEY

79412 — Radon Cup Serial Number

◑ — Sample Location

a21E — Mercury Soil Sample Number

SOLID CIRCLE - MERCURY SOIL SAMPLE LOCATION.
OPEN CIRCLE - RADON CUP PLACEMENT LOCATION.

Figure 6·2

MERCURY SOIL AND RADON CUP LOCATION MAP

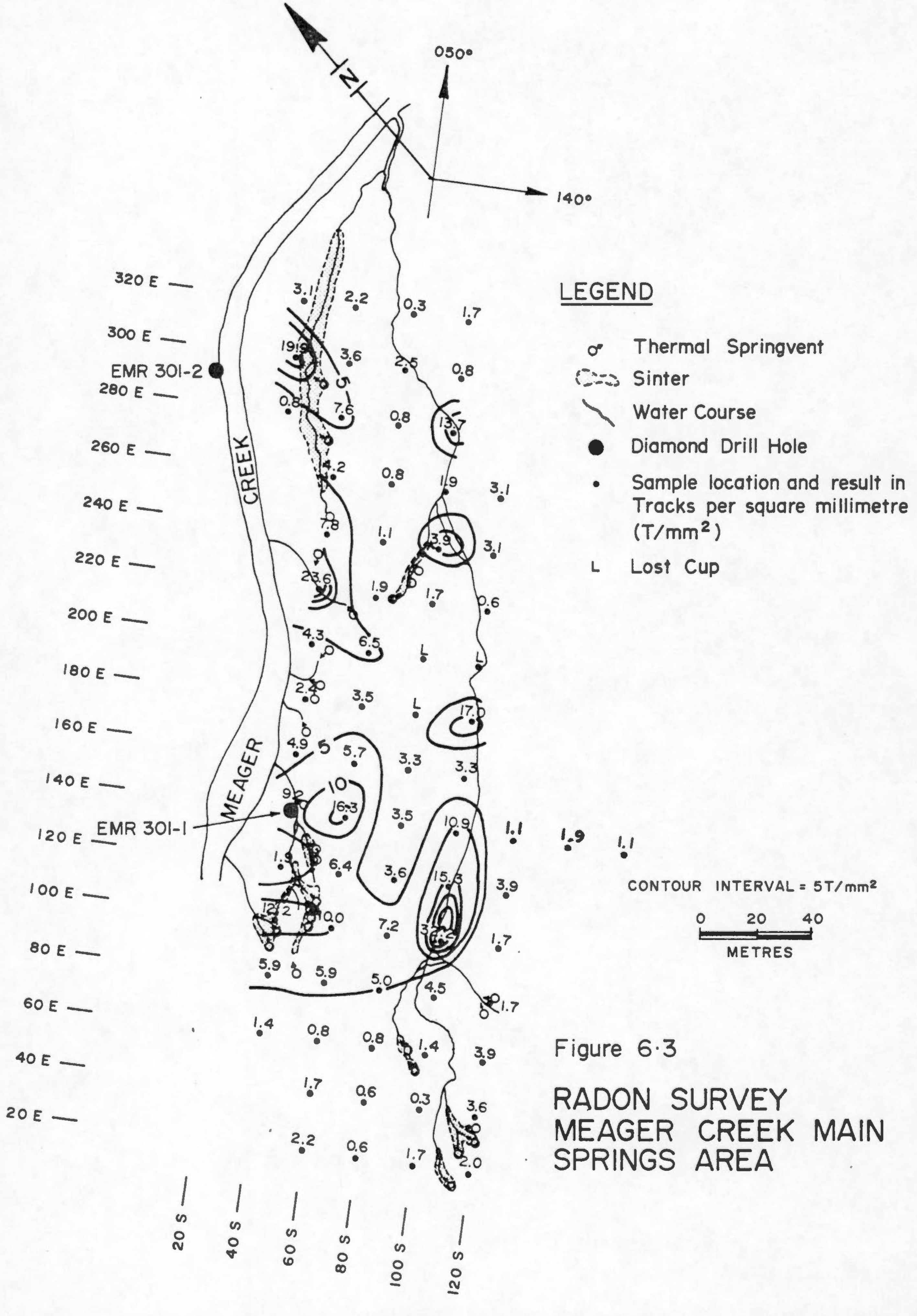


Figure 6·3

RADON SURVEY
MEAGER CREEK MAIN
SPRINGS AREA

area, at approximately 32 ppb.

The Meager Creek main springs area, with a major surface expression of underlying geothermal activity, is barren of both soil and soil mercury. The springs vent on a bench of boulders, gravel, sand and silt, flooded occasionally by Meager Creek. Excluding the main springs area, 49 percent of the samples analyzed are above the postulated background of 32 ppb, and 27 percent have a peak-to-background ratio greater than 2:1. The highest ratio is 9-to-1. Anomalous mercury concentration occurs only in organic-rich soils. Thus, the geothermal system may be generating mercury, but the highly variable soil development does not permit its accumulation in a detectable, systematic pattern reflective of the source.

6.2.3 Radon Survey

Radon is a radioactive gaseous element (the important isotope is 222 Rn with a half life of 3.8 days) occuring as a result of the natural decay of radium. Radium in turn is produced by the in-series decay of parent uranium and thorium. In geothermal applications, the extent of radon emanations has been tied to the spacial distribution of radium in the formation matrix, rock porosity, and geothermal fluids present in pore spaces (Kruger, 1978).

For the Meager Creek survey, "Track Etch radon-detector cups", marketed by Terradex Corporation, were used to detect radon. The cups resemble plastic drinking glasses with a film strip sensitive to alpha particle radiation from radon gas in the base. Detector cups are buried inverted in the ground for a measured exposure period. Thoron filters are applied to eliminate detection of radiation from thoron due to thorium.

A total of 117 Track-Etch radon-detector cups were installed concurrent with mercury soil sampling. Of these, 91 were recovered and analyzed for radon. Cups with thoron filters were placed in a regular grid over the Meager Creek main springs area (Figure 6.3), and in random locations or lines in remaining areas (Figure 6.2), buried to a depth of 30-40 cm. The results and accompanying report from Terradex Corporation are included in Appendix G. Data are expressed in tracks per square millimetre of detector area normalized to the equivalent of a 30 day exposure, and for several variables arising from the analytical technique. Terradex reports a background mean of 2.6T/sq mm, standard deviation of 1.6T/sq mm, and range of 0.3 to 32.2T/sq mm. Readings are log-normally distributed and breaking the data into several domains on the basis of collection locality shows all areas to present the same distribution.

A contour map of radon data from the Meager Creek main springs area (Figure 6.3) shows anomalous areas, with no distinct pattern attributable to inferred subsurface structures. However, there is high coincidence of elevated radon results with spring vents and hot watercourses. Also evident is a concentration of radon at the break in slope below the springs in the south corner of the grid. The above results show an association of radon gas with geothermal waters. Two detectors, placed within hot spring vents as an experiment, yielded extremely high values; 110T/sq mm (079324) in the Meager Creek main springs area, and 193T/sq mm (079399) at the Pebble

Creek hot springs. These values confirm that the geothermal waters carry significant radon.

No high values were obtained from Lillooet Valley or Railroad Pass away from the geothermal area, suggesting that radon is detectable in erratic anomalous quantities only over the Meager geothermal area.

At two localities, detectors were installed both with and without thoron filters. These showed a higher (1 to 3½ times) contribution of "tracks" on detector film from thoron than from radon. This is expected from thorium concentrations of the basement Coast Intrusion rocks of the area. Thus thoron must be considered as a natural contaminant to future radon surveys in the Meager Creek area.

Respectfully submitted

NEVIN SADLIER-BROWN GOODBRAND LTD.

Brian D. Fairbank, P.Eng.

G. A. Shore

L. J. Werner

Andrew E. Nevin, P.Eng.

T. L. Sadlier-Brown

APPENDICES - A to F

APPENDIX A - REFERENCES

Edwards, L.S., 1977, A modified pseudosection for resistivity and I.P: Geophysics, V. 42, pp. 1020-1036.

Hammerstrom, L.T., and Brown, T.H., 1977, The geochemistry of thermal waters from the Mount Meager hot springs area, B.C.: Geol. Surv. of Canada, Open File Report, 34 pp.

Kruger, Paul, 1978, Radon in geothermal Reservoir Engineering: Transactions, Geothermal Resources Council, Annual Meeting. 25-27 July, 1978, Vol. 2, Sec. 2, pp 383-385.

Lewis, John F., 1977, Preliminary field report of drilling near Mt. Meager and Mt. Cayley volcanic centres: EMR, Earth Physics Branch, Open File Report 1977. 12 pp.

Lewis, T.J., and Souther, J.G., 1978, Meager Mt., B.C. - possible geothermal energy resource: EMR, Earth Physics Branch, Geothermal Series No. 9, Ottawa, 17 pp.

McNitt, J.R., 1976, Summary of united nations geothermal exploration experience, 1965 to 1975: Proceedings of the Second United Nations Symposium on the Development and Utilization of Geothermal Resources, San Francisco, May 1975, pp. 1127-1134.

Matlick, J.D., and Buseck, P.R., 1976, Exploration for geothermal Areas using mercury: A new geochemical technique: Proceedings of the Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, May 1975, pp. 785-792.

Meidav, T. and Tonani, F., 1976, A critique of geothermal exploration techniques: Proceedings of the Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, May 1975, pp. 1143-1154.

Nevin, Andrew E., and Stauder, J., 1976, Canada, - early stages of geothermal investigation in British Columbia: Proceedings of the Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco , May 1975, pp. 1161-1165.

APPENDIX A - REFERENCES (Cont'd)

Nevin, Andrew E., Crandall, J.T., Souther, J.G., and Stauder, J., 1978, Meager Creek geothermal system, British Columbia, Part I: Exploration and research program: Transactions, Geothermal Resources Council, Annual Meeting, 25-27 July, 1978, Vol. 2.

Nevin Sadlier-Brown Goodbrand Ltd., 1974, Report on investigation of geothermal resources in southwestern British Columbia: (unpublished) to B.C. Hydro and Power Authority, 24 pp.

Nevin Sadlier-Brown Goodbrand Ltd., 1975, Report on detailed geothermal investigation at Meager Creek: (unpublished) to B.C. Hydro and Power Authority, 18 pp.

Nevin Sadlier-Brown Goodbrand Ltd., 1977, Report on 1976 geothermal investigation at Meager Creek, north and northeast flanks of the volcanic complex (unpublished) to B.C. Hydro and Power Authority, 10 pp.

Nevin Sadlier-Brown Goodbrand Ltd., 1978, Progress report for 1977 Meager Creek geothermal project, investigations for 1977-1978: (unpublished) to B.C. Hydro and Power Authority, 15 pp.

Palmason, G., 1976, Geophysical methods in geothermal exploration: Procedings of the Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, May 1975, pp 1175-1184.

Patton, F.D., 1976, The Devastation glacier slide, Pemberton, B.C.: in "Geomorphology of the Canadian Cordillera and its Bearing on Mineral Deposits": Geol. Assoc. Can., Cord, Sect., Programme and Abstracts, pp 26-27.

Read, P.B., 1977, Meager Creek volcanic complex, southwestern British Columbia: in Report of Activities, Part A G.S.C. Paper 77-1A, pp 277-281.

Read, P.B., 1979, Geology, Meager Creek geothermal area, British Columbia: G.S.C. open file 603, map, legend and descriptive notes.

APPENDIX A - REFERENCES (Cont'd)

Shore, G., 1975, Report on deep resistivity surveys and supplementary geophysics at Meager Creek selected area, Pemberton, B.C.: (unpublished) to Nevin Sadlier-Brown Goodbrand Ltd., 15 pp.

Shore, G., 1978, Meager Creek geothermal system, British Columbia, Part III: resistivity methods and results: Geothermal Resources Council, Transactions, Vol. 2, July 1978, pp 593-596.

Souther, J.G., 1976, Geothermal potential of western Canada: Proceedings of the Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, May 1975, pp 259-267.

Woodsworth, G.J., 1977, Geology, Pemberton (92J) Map Area: G.S.C. open file 482, map and legend.

APPENDIX B-1

DATA PRINT OUTS

The print outs contain apparent resistivity (R(A)) data for each corridor, listed in ascending order of magnitude to facilitate cross-reference from the pseudosection plots. Each R(A) value is listed with the plot location co-ordinates, measurement direction, and electrode numbers, providing all of the information used for the construction of the pseudo-sections and R(A) vs. depth plots.

The corridor number is the principal identification for the body of data. The P Line number and C Line number are numbers assigned to the potential electrode line and the current electrode line, respectively. These lines are plotted in Figure 4.1 (Meager Map Area) and Figure 4.6 (Lillooet Map Area).

The columns of data provided are:

- R(A): Apparent resistivity in ohm-metres.
- Dir: Direction of reading; compass orientation of a line between the potential and current electrodes. North = 0.
- C#: Number assigned to the current electrode responsible for the reading.
- P#: Number assigned to the potential electrode responsible for the reading.
- Ze: Effective depth of penetration or search, after Edwards (1977), in metres.
- Xd: X coordinate (northing) of plot point at depth Ze below the estimated surface plane (Universal Transverse Mercator Grid)
- Yd: Y coordinate (easting) of plot point; as above.
- Zd: Z coordinate of the plot point; metres of elevation above (below) mean sea level.
- Vhor: Relative horizontal distance in metres of the plot point Xd, Yd, Zd along the data corridor (This value is used with Zd to plot pseudo - sections).

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 605 P LINE 600 C LINE 610
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
220	59	2	1	202	462038	5603400	1500	2512
232	37	8	1	1384	461689	5603380	120	2458
262	49	4	1	595	461936	5603340	1040	2442
270	52	3	1	404	462001	5603370	1262	2478
272	48	5	1	813	461817	5603440	797	2526
285	53	9	3	908	461587	5602520	236	1589
288	32	9	1	1527	461728	5603250	-57	2326
288	37	9	2	1252	461696	5602950	114	2023
289	58	6	2	786	461715	5603170	693	2242
295	27	24	1	1762	461767	5603070	-329	2150
295	101	3	2	252	461907	5603140	1316	2238
299	52	7	2	974	461684	5603150	464	2227
306	43	7	1	1220	461726	5603430	314	2510
308	45	6	1	1022	461753	5603440	554	2522
308	108	5	3	525	461727	5602910	320	1988
309	30	24	2	1478	461727	5602770	-148	1845
313	32	25	2	1402	461632	5602870	-51	1945
314	3	1	2	321	462092	5603340	1361	2466
317	44	25	3	1033	461549	5602420	94	1489
323	63	8	3	811	461590	5602670	372	1742
328	44	8	2	1120	461666	5603090	282	2159
329	28	25	1	1684	461614	5603200	-222	2266
331	66	5	2	593	461768	5603180	926	2262
331	169	2	3	633	462015	5603190	874	2306
345	1	1	3	773	462116	5603340	807	2471
345	41	24	3	1100	461589	5602330	7	1396
347	78	7	3	732	461607	5602780	499	1854
348	90	6	3	611	461651	5602820	669	1897
383	77	4	2	397	461814	5603180	1166	2259
391	149	2	2	209	461986	5603220	1408	2325
398	151	3	3	528	461919	5603070	923	2169
398	173	2	4	1050	462028	5603150	370	2264
401	131	7	5	959	461528	5602130	-9	1198
410	110	9	5	753	461531	5601830	131	898
410	168	3	5	1336	461937	5602830	-53	1938
413	129	4	3	493	461805	5602990	926	2075
419	121	8	5	834	461540	5601950	63	1017
435	95	25	5	709	461503	5601610	146	684
438	141	7	6	1309	461606	5601900	-387	973
443	88	24	5	705	461505	5601550	143	626
450	1	1	4	1194	462117	5603300	301	2434
464	163	3	4	923	461947	5603010	436	2113
470	151	5	5	1124	461689	5602510	1	1588
473	162	4	6	1616	462142	5602550	-363	1720
481	168	3	6	1722	462405	5602670	-381	1933
482	142	6	5	1029	461637	5602350	22	1427
489	160	4	5	1229	461831	5602710	8	1798
496	128	9	6	1031	461544	5601500	-136	572
500	175	2	5	1469	462012	5602980	-121	2099
505	155	5	6	1508	461807	5602310	-411	1401
507	135	8	6	1154	461654	5601750	-277	824
516	148	6	6	1400	461811	5602180	-362	1272
518	180	1	5	1613	462062	5603140	-189	2266
541	119	25	6	923	461556	5601370	-94	438
542	173	2	6	1850	462625	5602790	-415	2138
553	114	24	6	881	461561	5601300	-60	375
582	177	1	6	1996	463342	5602810	-158	2584

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 615 P LINE 620 C LINE 610
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
245	75	1	1	676	462457	5603810	1163	2854
263	81	2	2	785	462465	5603430	865	2474
270	88	3	2	806	462486	5603470	873	2520
281	156	10	1	1917	462415	5603010	-501	2063
282	57	1	2	844	462418	5603680	925	2731
283	101	2	1	752	462498	5603610	979	2651
288	97	5	3	810	462543	5602830	507	1877
304	67	7	5	855	462544	5601890	54	939
311	92	11	6	656	462540	5601140	123	184
318	96	7	4	800	462534	5602270	218	1320
338	107	3	1	809	462520	5603570	902	2611
339	58	6	5	952	462586	5602080	45	1130
340	74	10	6	676	462559	5601210	126	250
342	71	5	4	861	462549	5602630	336	1675
345	91	9	5	750	462534	5601570	104	612
350	129	10	4	985	462546	5601880	-56	923
352	110	8	4	842	462557	5602130	142	1172
355	129	8	3	1061	462537	5602510	97	1556
356	40	1	3	1160	462441	5603610	493	2660
356	84	4	3	809	462542	5603020	612	2062
362	60	4	4	960	462554	5602800	321	1850
365	110	4	2	872	462509	5603250	698	2300
365	119	9	4	873	462560	5602020	95	1069
373	105	10	5	775	462517	5601460	53	507
382	57	2	3	961	462487	5603320	574	2371
384	119	11	5	859	462501	5601360	-67	410
388	42	4	5	1235	462586	5602530	-58	1573
390	63	3	3	931	462515	5603260	582	2304
396	137	11	4	1136	462551	5601780	-242	827
403	136	9	3	1134	462553	5602430	12	1475
404	142	10	3	1286	462525	5602300	-183	1342
409	141	6	1	1303	462616	5603410	278	2453
410	121	5	2	979	462506	5603190	537	2231
415	110	6	3	863	462550	5602730	399	1771
423	30	1	4	1516	462439	5603540	46	2589
424	84	6	4	810	462559	5602490	330	1539
428	146	7	1	1462	462602	5603380	71	2421
430	53	8	6	857	462584	5601460	-11	506
430	147	11	3	1467	462544	5602210	-394	1259
442	130	6	2	1111	462513	5603120	358	2163
455	119	7	3	944	462534	5602660	262	1709
469	31	2	5	1601	462500	5603000	-253	2048
472	41	2	4	1254	462483	5603220	181	2268
475	60	9	6	757	462568	5601360	77	404
476	46	3	4	1196	462514	5603140	211	2185
479	38	6	6	1144	462622	5601830	-181	878
496	81	8	5	790	462541	5601750	91	796
502	44	7	6	1000	462569	5601650	-119	692
517	22	2	6	1901	462495	5602770	-594	1815
522	33	5	6	1311	462572	5602080	-263	1121
523	136	7	2	1249	462496	5603080	172	2126
525	135	5	1	1140	462588	5603450	479	2499
529	23	1	5	1895	462468	5603340	-413	2389
546	154	11	2	1862	462416	5602650	-578	1706
557	16	1	6	2218	462456	5603120	-774	2168
562	159	11	1	2118	462471	5602950	-729	1999
563	29	4	6	1494	462615	5602280	-358	1328
581	150	8	1	1633	462534	5603230	-155	2276
582	154	9	1	1737	462611	5603180	-260	2229
588	49	5	5	1090	462558	5602330	8	1373
588	143	8	2	1404	462466	5602940	-31	1987
596	147	9	2	1497	462483	5602870	-138	1916
608	33	3	5	1528	462525	5602910	-211	1958
629	151	10	2	1668	462400	5602730	-353	1782
685	24	3	6	1818	462519	5602680	-541	1722

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 625 P LINE 620 C LINE 630
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
136	86	1	1	214	462998	5603720	1567	2924
162	77	2	2	303	463119	5603350	1263	2535
188	20	2	1	368	462991	5603560	1327	2767
188	58	3	2	304	463137	5603260	1231	2451
203	125	1	2	505	462996	5603630	1194	2837
206	13	3	1	457	462965	5603520	1228	2733
227	74	8	5	627	463301	5602010	284	1190
235	122	2	3	563	463165	5603230	923	2410
242	92	5	4	499	463318	5602570	692	1740
243	114	3	3	484	463196	5603140	973	2317
247	70	4	3	435	463212	5602900	918	2080
247	113	4	4	567	463289	5602730	708	1903
251	71	6	4	518	463323	5602450	613	1619
255	50	5	3	526	463219	5602810	757	1989
264	56	7	4	607	463300	5602430	493	1604
270	7	4	1	808	462913	5603430	804	2663
271	28	4	2	558	463072	5603150	910	2352
273	93	7	5	604	463349	5602110	313	1280
284	64	9	5	701	463331	5601730	137	904
285	108	6	5	655	463316	5602260	349	1431
293	37	6	3	673	463195	5602750	566	1931
295	123	5	5	765	463271	5602410	307	1586
301	21	5	2	748	463072	5603110	659	2309
303	43	8	4	749	463238	5602320	326	1506
308	139	1	3	878	463042	5603570	751	2770
321	31	7	3	834	463161	5602730	366	1921
323	134	4	5	918	463207	5602600	252	1784
324	6	5	1	1019	462985	5603410	525	2622
334	137	3	4	797	463243	5603030	595	2206
342	25	8	3	1020	463070	5602640	172	1858
348	16	6	2	944	463042	5603060	424	2272
359	140	2	4	894	463218	5603130	529	2308
369	5	6	1	1225	462975	5603370	278	2587
380	119	7	6	841	463515	5601860	51	1015
387	95	9	6	770	463454	5601530	64	684
388	14	7	2	1129	462986	5603050	205	2278
396	128	6	6	946	463464	5602020	28	1179
403	4	7	1	1418	462908	5603360	53	2596
405	32	10	4	1038	463245	5602090	-36	1280
405	51	10	5	806	463331	5601630	6	813
407	4	8	1	1620	462764	5603270	-153	2547
420	66	11	6	836	463448	5601390	-45	551
424	147	3	5	1206	463101	5602910	96	2111
428	105	8	6	766	463473	5601620	79	771
430	12	9	2	1467	462791	5602910	-133	2193
435	23	9	3	1155	462985	5602580	41	1827
435	80	10	6	779	463472	5601380	23	535
439	136	5	6	1091	463427	5602210	-44	1366
443	142	4	6	1260	463356	5602400	-122	1562
449	41	11	5	947	463335	5601540	-171	726
460	148	2	5	1307	463066	5603010	26	2213
462	26	11	4	1225	463223	5602010	-255	1203
468	20	10	3	1343	463071	5602450	-216	1675
483	12	8	2	1330	462882	5602970	-1	2222
489	5	9	1	1754	462646	5603200	-278	2523
498	148	1	4	1240	463134	5603500	328	2687
517	4	10	1	1951	462931	5603110	-561	2347
518	17	11	3	1546	463026	5602370	-445	1613
523	9	11	2	1874	462899	5602720	-644	1978
544	4	11	1	2165	462874	5603030	-801	2289
550	150	3	6	1564	463288	5602730	-298	1903
557	11	10	2	1662	462947	5602790	-407	2037
572	151	2	6	1666	463253	5602830	-370	2002
585	152	1	5	1663	462930	5603360	-183	2591
712	154	1	6	2024	463168	5603200	-584	2386

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 630 P LINE 630 C LINE 630
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
102	67	2	1	89	463130	5603660	1630	2706
110	2	11	5	168	463770	5601770	635	707
114	124	3	2	175	463264	5603400	1377	2414
115	87	1	1	221	463004	5603780	1596	2863
161	151	9	5	154	463689	5601970	751	927
166	170	3	1	207	463155	5603600	1467	2639
169	134	2	2	378	463141	5603580	1254	2622
170	139	7	4	135	463607	5602460	1014	1408
174	178	7	3	273	463497	5602710	973	1687
177	117	5	3	204	463416	5602930	1130	1918
179	152	8	5	357	463523	5602130	655	1138
183	171	10	4	416	463642	5602300	596	1253
184	140	4	3	344	463302	5603050	1066	2066
187	172	9	4	288	463618	5602300	762	1253
190	43	6	3	119	463480	5602790	1198	1764
193	125	1	2	513	462992	5603630	1186	2729
203	5	5	2	263	463308	5603200	1188	2206
203	174	12	5	320	463699	5601650	511	639
205	164	4	1	423	463087	5603530	1226	2593
207	149	6	4	367	463422	5602630	903	1640
218	24	8	4	111	463648	5602340	975	1285
222	174	8	3	482	463505	5602680	712	1649
226	159	7	5	563	463339	5602280	588	1362
231	150	5	4	551	463407	5602820	723	1817
233	147	3	3	558	463170	5603240	939	2293
246	170	6	2	435	463218	5603060	1040	2115
258	165	5	1	594	463136	5603510	1009	2564
260	161	6	1	776	462860	5603270	922	2461
264	170	11	4	584	463372	5602110	528	1203
268	168	10	3	802	463463	5602640	326	1632
282	168	9	3	674	463395	5602620	507	1636
293	169	12	4	730	463721	5602120	242	1057
298	144	11	6	247	463923	5601520	538	420
298	157	9	6	527	463405	5601530	737	761
299	165	7	2	661	463212	5603020	751	2077
300	154	4	4	716	463334	5602980	621	1990
315	139	1	3	884	462879	5603430	756	2591
320	146	2	3	765	463016	5603390	813	2493
320	155	10	6	413	463718	5601570	436	559
321	28	4	2	111	463334	5603250	1371	2248
324	116	12	6	117	463952	5601420	665	315
334	158	6	5	798	463080	5602400	532	1605
341	169	11	3	971	463229	5602470	215	1581
344	155	3	4	935	463391	5603250	482	2230
347	156	8	6	722	463820	5602020	225	925
347	166	8	2	872	463263	5603010	473	2050
355	160	7	1	1009	462947	5603300	574	2441
357	162	8	1	1218	463183	5603380	268	2417
381	164	9	2	1070	463004	5602880	325	2044
393	156	5	5	978	463121	5602640	267	1784
412	165	11	2	1366	462821	5602710	51	2013
416	160	9	1	1419	462257	5602760	595	2430
417	148	1	4	1246	462973	5603410	319	2531
419	159	7	6	928	463259	5601990	239	1174
422	158	4	5	1146	462891	5602710	240	1966
426	164	10	2	1197	463149	5602950	99	2039
443	148	1	4	1246	462973	5603410	319	2531
461	158	6	6	1159	463050	5602150	143	1435
468	168	12	3	1118	463587	5602480	-35	1434
477	153	2	4	1139	463213	5603400	356	2432
480	158	3	5	1365	462724	5602870	121	2197
489	152	1	5	1669	462617	5603170	-129	2502
498	162	12	1	1858	463946	5603360	-378	2241
506	165	12	2	1512	463418	5602840	-289	1837
516	162	11	1	1713	462188	5602730	168	2459
518	157	5	6	1346	463219	5602430	-152	1552
518	161	10	1	1546	462874	5603230	-75	2415
539	157	2	6	1933	463321	5603140	-561	2151
580	158	3	6	1732	464259	5603190	-218	2082
613	156	2	5	1568	462704	5603110	-71	2399
680	153	1	6	2030	462848	5603040	-567	2267
680	153	1	6	2030	462848	5603040	-567	2267

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 635 P LINE 640 C LINE 630
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
287	67	1	1	857	463631	5604300	1035	3103
306	50	3	3	975	464031	5603640	526	2370
313	82	4	2	997	464028	5603770	569	2500
342	46	1	2	907	463750	5604120	862	2904
343	80	2	1	936	463714	5604220	886	3006
345	60	2	2	891	463840	5603990	793	2755
345	73	3	2	915	463942	5603840	687	2586
368	114	11	4	977	464230	5602420	34	1133
369	93	9	4	980	464363	5602700	165	1393
379	52	10	6	848	464588	5601780	35	470
380	27	1	3	1136	463837	5603970	533	2731
389	104	10	4	929	464314	5602560	166	1258
390	90	3	1	1036	463797	5604170	746	2936
391	80	10	5	823	464486	5602070	69	753
391	101	5	1	1336	463956	5604070	357	2809
394	70	5	3	1047	464207	5603460	354	2166
395	88	7	3	1178	464329	5603300	138	1990
398	61	11	6	732	464473	5601630	71	318
402	89	5	2	1130	464097	5603760	400	2473
403	97	4	1	1168	463883	5604080	560	2831
404	84	8	4	1073	464380	5602880	112	1569
412	38	2	3	1037	463955	5603780	527	2521
429	25	2	4	1322	464000	5603620	166	2360
441	91	11	5	780	464388	5602030	48	725
448	17	1	4	1460	463875	5603830	134	2585
448	102	8	3	1189	464351	5603160	87	1844
450	97	6	2	1265	464172	5603660	212	2365
450	110	9	3	1151	464329	5603020	99	1708
455	120	10	3	1165	464283	5602900	40	1599
456	33	3	4	1210	464076	5603460	209	2186
458	62	6	4	1151	464337	5603110	108	1803
461	52	5	4	1159	464260	5603240	152	1935
466	81	6	3	1114	464286	5603370	240	2062

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
472	107	6	1	1505	464015	5603960	124	2690
474	127	11	3	1259	464168	5602760	-141	1486
484	42	4	4	1156	464167	5603350	220	2057
484	70	7	4	1157	464328	5603150	122	1843
485	64	8	5	1103	464488	5602650	-62	1337
487	114	8	2	1454	464247	5603490	-48	2189
487	121	9	2	1454	464230	5603380	-67	2076
489	103	7	2	1373	464215	5603610	69	2308
504	129	10	2	1504	464188	5603280	-159	1983
506	45	8	6	1209	464794	5602040	-253	781
512	61	4	3	979	464109	5603570	493	2285
513	111	7	1	1635	464059	5603920	-39	2642
518	22	3	5	1546	464217	5603370	-240	2076
519	47	9	6	1034	464711	5601930	-95	642
529	37	5	5	1403	464390	5603110	-213	1798
535	70	9	5	958	464612	5602150	-16	841
543	134	11	2	1621	464031	5603130	-366	1871
556	46	6	5	1329	464449	5602980	-190	1661
562	53	7	5	1278	464499	5602850	-191	1537
565	16	2	5	1688	464153	5603550	-309	2260
573	37	7	6	1441	464549	5602540	-393	1222
577	18	4	6	1724	464404	5602960	-501	1647
578	13	3	6	1841	464245	5603120	-562	1824
605	120	8	1	1753	464136	5603870	-168	2576
608	29	4	5	1453	464309	5603240	-195	1928
608	32	6	6	1529	464522	5602670	-430	1349
615	132	10	1	1838	464165	5603720	-278	2430
667	126	9	1	1771	464163	5603800	-185	2501
688	25	5	6	1644	464435	5602840	-483	1524
724	10	1	5	1853	464030	5603770	-364	2496
733	9	2	6	2001	464216	5603300	-652	2004
791	4	1	6	2178	464042	5603520	-721	2255
1234	137	11	1	1964	463778	5603400	-568	2203

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 645 P LINE 640 C LINE 650
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vnor
249	35	2	1	595	464549	5604350	1167	2674
272	74	2	2	618	464709	5604150	1051	2421
273	21	5	2	653	464915	5603900	885	2103
277	37	4	2	603	464834	5603960	984	2197
281	71	4	3	640	464961	5603780	830	1975
294	55	3	2	585	464802	5604030	1022	2270
311	8	4	1	826	464595	5604220	873	2540
321	56	1	1	575	464435	5604430	1263	2803
324	20	3	1	705	464613	5604280	1008	2581
324	85	3	3	737	464879	5603900	774	2124
327	55	5	3	559	465073	5603670	851	1930
328	83	5	4	783	465241	5603550	537	1648
339	100	3	4	1075	465015	5603850	367	2016
341	2	7	2	958	464981	5603770	502	1957
360	178	5	1	955	464655	5604180	701	2474
364	97	2	3	869	464774	5604050	709	2307
364	112	1	4	1449	464725	5604160	156	2421
365	2	8	2	1245	464901	5603670	182	1913
379	54	7	4	697	465381	5603340	530	1392
391	92	4	4	933	465108	5603710	463	1349
398	0	1	2	750	464561	5604300	1013	2626
414	170	7	1	1319	464709	5604070	263	2349
416	106	1	3	1064	464604	5604200	606	2516
416	112	3	6	1807	465291	5603780	-482	1342
422	108	3	5	1441	465129	5603810	-68	1933
424	23	7	3	698	465181	5603480	616	1604
427	17	8	3	973	465099	5603380	308	1557
435	172	8	1	1599	464632	5603970	-51	2307
464	79	7	5	886	465524	5603250	264	1265
467	107	2	4	1239	464903	5604010	273	2210

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
471	41	8	4	899	465317	5603210	288	1309
472	6	9	2	1408	464801	5603610	14	1917
482	68	10	6	1438	465568	5602720	-491	756
493	63	8	5	982	465475	5603110	127	1146
500	80	8	6	1194	465687	5602850	-198	832
508	98	5	5	1104	465356	5603510	148	1567
509	103	4	5	1280	465225	5603670	46	1761
513	116	1	5	1838	464839	5604140	-299	2350
525	9	11	2	1792	464725	5603570	-449	1932
536	176	9	1	1747	464532	5603900	-203	2311
538	8	10	2	1605	464713	5603580	-207	1943
539	179	10	1	1932	464465	5603870	-417	2327
548	109	4	6	1637	465374	5603610	-367	1648
565	49	11	5	1420	465298	5602950	-409	1033
572	39	9	4	1079	465213	5603160	106	1311
579	19	9	3	1152	464995	5603320	126	1568
605	63	11	6	1521	465589	5602690	-634	717
608	106	5	6	1451	465479	5603370	-269	1395
610	112	2	5	1619	465015	5603980	-176	2131
618	118	1	6	2215	464927	5603990	-743	2177
621	0	11	1	2119	464528	5603880	-666	2294
630	33	11	4	1432	465121	5603100	-330	1313
633	58	9	5	1134	465361	5603060	-19	1155
642	19	11	3	1534	464903	5603270	-337	1589
643	20	10	3	1355	464900	5603290	-100	1602
659	74	9	6	1311	465612	5602770	-326	786
676	37	10	4	1274	465112	5603130	-103	1347
689	53	10	5	1299	465349	5602920	-260	1040
709	116	2	6	1992	465171	5603940	-599	2032
834	116	2	6	1992	465171	5603940	-599	2032

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 655 P LINE 660 C LINE 650
MEAGER CREEK MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
345	67	3	1	1100	465291	5605040	640	2988
362	73	6	2	1332	465778	5604700	217	2399
371	35	2	2	1071	465376	5604930	628	2847
372	74	4	1	1186	465353	5604990	523	2911
418	48	1	1	998	465137	5605180	819	3195
418	57	2	1	1035	465229	5605120	753	3088
420	45	3	2	1055	465472	5604820	583	2702
430	54	4	2	1082	465501	5604820	555	2685
439	65	5	2	1233	465660	5604770	350	2535
442	82	5	1	1407	465468	5605070	294	2882
463	18	2	3	1235	465487	5604830	367	2700
463	26	1	2	1106	465285	5604990	619	2958
468	35	4	3	1119	465679	5604650	390	2437
476	91	9	2	1706	465915	5604530	-291	2184
484	80	7	2	1445	465836	5604640	60	2315
507	27	3	3	1153	465597	5604710	387	2541
510	58	6	3	1219	466021	5604460	182	2060
519	48	5	3	1180	465891	5504550	256	2215
519	88	6	1	1550	465574	5605030	128	2782
522	92	7	1	1701	465631	5604990	-65	2711
535	16	4	4	1218	465392	5604500	190	2177
545	95	10	2	1889	465895	5604430	-555	2128
575	173	2	5	1717	465775	5604640	-279	2359
600	3	2	4	1433	465677	5604720	79	2486
600	10	3	4	1302	465794	5604580	145	2309
608	85	8	2	1557	465869	5604590	-93	2262
612	86	10	3	1608	466162	5604180	-423	1766
616	96	8	1	1839	465661	5604940	-248	2654
634	2	4	5	1442	466008	5604400	-112	2030
640	103	10	1	2218	465637	5604670	-776	2481
641	49	9	5	1093	466662	5603840	-52	1167
642	66	7	3	1277	466080	5604390	79	1967
645	67	9	4	1215	466396	5604110	-32	1545
652	180	5	6	1556	466290	5604170	-333	1665
663	11	1	3	1320	465398	5604910	306	2818
663	99	11	2	2058	465914	5604380	-771	2080
668	30	5	4	1182	466105	5604400	160	1955
671	75	10	4	1322	466418	5604000	-228	1458
678	29	9	6	1103	466738	5603720	-91	1027
678	165	2	6	2024	465796	5604490	-625	2245
682	57	8	4	1163	466320	5604190	76	1661
692	80	9	3	1458	466166	5604280	-190	1828
697	13	5	5	1332	466226	5604300	-63	1805
700	39	6	4	1152	466192	5604340	179	1858
702	49	7	4	1142	466268	5604260	142	1744
716	6	6	6	1425	466409	5604080	-222	1519
716	73	8	3	1350	466111	5604350	-31	1920
718	172	4	6	1715	466053	5604270	-427	1903
718	177	3	5	1558	465900	5604500	-186	2173
729	162	1	6	2178	465670	5604590	-745	2402
736	91	11	3	1757	466190	5604130	-621	1711
737	68	11	5	1204	466700	5603720	-274	1059
744	82	11	4	1445	466458	5603960	-399	1395
752	40	10	6	1058	466873	5603520	-179	793
754	21	6	5	1241	466325	5604230	13	1682
756	50	11	6	1067	466856	5603520	-191	809
760	13	7	6	1296	466534	5603960	-156	1342
774	168	3	6	1849	465932	5604360	-518	2054
778	30	7	5	1161	466432	5604110	34	1525
781	178	1	4	1554	465567	5604810	-11	2630
802	59	10	5	1129	466649	5603780	-149	1136
805	20	8	6	1202	466621	5603850	-120	1203
812	38	8	5	1119	466523	5604010	13	1385
856	169	1	5	1859	465661	5604740	-388	2510

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 205 P LINE 210 C LINE 200
LILLOOET RIVER MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
132	21	3	26	1582	471122	5610150	-841	3709
170	74	21	6	2331	468970	5608350	-1218	911
196	143	25	25	782	469690	5608980	-243	1964
214	165	25	24	961	469438	5608660	-210	1459
217	81	22	25	1245	469026	5608180	-232	836
219	80	22	6	1961	469413	5608390	-1054	1272
219	81	22	26	1572	469099	5608510	-664	1121
225	136	3	4	1344	472144	5610510	-428	4729
228	32	2	25	2178	471035	5610490	-1232	3887
239	72	21	25	1632	468672	5607930	-413	400
242	109	25	5	1930	470955	5609330	-1377	3074
251	6	3	6	1412	471376	5610210	-657	3940
252	179	25	23	1291	469207	5608300	-333	1054
253	28	4	25	1343	470643	5609700	-697	3051
255	87	24	4	2437	470995	5610040	-1683	3539
259	28	5	24	1378	470147	5609040	-667	2250
259	32	4	23	2068	469969	5609020	-1090	2096
266	92	23	26	1324	469372	5608710	-567	1453
269	96	23	25	1003	469217	5608440	-129	1152
272	23	25	21	1627	468666	5608130	-495	556
276	123	24	25	776	469496	5608760	-107	1573
277	113	3	3	1657	472628	5610940	-553	5375
281	10	25	22	1551	468926	5608090	-448	701
281	31	4	24	1681	470270	5609390	-883	2567
283	125	25	26	966	470073	5609230	-521	2317
293	92	5	3	1998	472372	5610520	-1130	4917
296	16	4	26	1178	470963	5609770	-563	3344
299	24	5	25	1020	470462	5609390	-479	2714
300	35	4	22	2393	469594	5608850	-1273	1707
301	88	23	6	1713	469665	5608630	-952	1619
304	110	24	26	1039	469844	5609150	-508	2095
334	24	2	26	1998	471351	5610540	-1082	4145
352	101	24	6	1403	470120	5609210	-869	2334
354	34	5	22	2114	469562	5608430	-1065	1416
361	169	24	23	1079	469112	5608230	-46	934
367	19	24	21	1350	468586	5608100	-155	486
368	6	5	26	879	470754	5609490	-379	3007
373	30	5	23	1782	469887	5608640	-874	1805
385	112	25	6	1284	470352	5609290	-832	2562
403	85	25	3	2890	471774	5610480	-2067	4420
409	3	24	22	1302	468845	5608030	-132	603
420	106	5	4	1433	471888	5610100	-726	4280
429	149	24	24	819	469322	5608540	22	1294
434	162	3	5	1595	471904	5610080	-754	4283
455	18	1	6	2174	471786	5610970	-1067	4756
481	158	5	6	850	471036	5609590	-337	3289
554	135	5	5	1324	471722	5609670	-653	3905
619	152	2	4	1477	472344	5610820	-393	5078
664	148	4	5	1379	471700	5609760	-665	3933
674	100	4	3	1790	472455	5610620	-842	5044
689	119	4	4	1316	471970	5610230	-527	4420
770	127	2	3	1599	472748	5611110	-375	5574
795	180	1	5	2171	472339	5610770	-997	5038
822	172	2	5	1869	472128	5610430	-860	4663
851	164	1	4	1694	472547	5611130	-444	5427
865	80	21	24	1271	468693	5607830	57	353
1034	140	1	3	1647	472145	5610740	-336	4870
1049	96	22	24	939	468990	5608100	189	757
1255	117	23	24	805	469135	5603320	201	1010
1513	6	23	21	894	463558	5608040	405	422
1686	96	21	23	976	468658	5607740	463	297
1688	164	23	22	932	468776	5607960	352	502
1907	143	23	23	837	468997	5608110	326	771
2241	119	22	23	783	468917	5607970	471	627
2559	113	21	22	740	468529	5607640	813	160
2774	126	21	21	434	468484	5607990	1038	346
3174	144	22	22	726	468726	5607850	647	401
3244	170	22	21	580	468548	5607970	791	353

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 215 P LINE 210 C LINE 220
LILLOOET RIVER MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
58	3	24	5	704	469313	5609680	-161	2326
124	22	22	5	1490	468848	5608880	-575	1482
151	18	23	5	1132	469041	5609220	-371	1829
180	85	4	25	1438	470248	5610520	-787	3582
181	178	5	2	1547	471011	5611450	-582	4774
186	67	4	21	2787	468865	5609370	-1632	1788
189	14	21	24	1504	468024	5608530	-244	599
193	25	21	4	2314	468453	5609090	-1117	1299
199	25	25	2	2045	470535	5611180	-1148	4247
215	19	24	3	1713	469851	5610560	-952	3325
219	7	5	1	1873	471276	5611790	-701	5203
230	68	3	22	2750	469473	5610180	-1720	2788
245	73	4	22	2442	469233	5609750	-1508	2312
248	24	23	3	2114	469595	5610090	-1196	2809
259	63	3	21	3099	469066	5609850	-1863	2271
259	79	4	24	1723	469941	5610320	-1019	3224
276	71	5	21	2536	468631	5609020	-1426	1378
281	22	21	25	1789	468499	5608440	-624	982
291	0	4	1	1582	471472	5611840	-315	5376
303	137	24	24	602	468847	5609470	76	1845
326	4	22	24	1112	468362	5608870	-86	1080
329	76	24	21	1429	467960	5608660	-206	647
334	16	22	25	1370	468752	5608860	-439	1387
340	29	25	1	2441	470827	5611540	-1342	4705
341	25	22	3	2448	469357	5609770	-1408	2417
348	77	4	23	2080	469592	5610020	-1281	2760
354	24	23	3	2114	469595	5610090	-1196	2809
364	172	23	24	805	468578	5609160	74	1433
367	78	5	22	2194	468970	5609420	-1321	1896
372	93	24	22	1110	468250	5609020	-133	1112
384	83	5	23	1835	469315	5609720	-1115	2354
395	87	5	24	1476	469681	5610060	-876	2855
402	2	25	4	960	469641	5610410	-364	3068
411	155	5	3	1229	470597	5611080	-446	4221
416	15	25	3	1492	470052	5610800	-780	3635
416	71	3	23	2385	469848	5610410	-1477	3218
431	163	25	5	515	469481	5609930	-59	2621
437	75	3	5	1567	470649	5610820	-802	4081
437	112	25	24	652	468964	5609630	-60	2037
445	143	25	25	531	469320	5609890	-60	2477
462	127	5	4	1060	470209	5610650	-410	3644
468	89	21	23	1277	467861	5608500	76	460
476	28	21	3	2842	469022	5609380	-1612	1914
509	87	4	5	1267	470400	5610510	-632	3694
514	10	23	25	1022	468937	5609200	-247	1731
518	64	1	5	2321	471295	5611380	-1216	4936
526	100	5	5	1047	470156	5610320	-520	3386
539	164	22	23	965	468171	5608820	160	908
546	95	5	25	1207	470005	5610310	-664	3263
547	96	25	23	979	468619	5609400	-234	1640
554	83	25	22	1324	468308	5609130	-418	1231
565	70	25	21	1686	467990	5608760	-529	749
570	68	2	5	1944	471003	5611040	-1015	4492
606	112	24	23	827	468532	5609280	0	1487
609	167	24	25	647	469200	5609650	-90	2221
665	27	24	2	2271	470316	5610960	-1334	3938
697	168	4	2	1300	471191	5611530	-239	4958
721	110	4	4	1133	470438	5610810	-384	3916
751	140	4	3	1120	470727	5611170	-260	4375
759	30	23	2	2665	470074	5610480	-1591	3424
761	74	1	4	1946	471287	5611620	-746	5089
765	93	3	4	1305	470675	5611090	-432	4281
775	81	2	4	1608	470989	5611300	-582	4659
777	144	23	23	772	468360	5609070	216	1216
798	169	3	1	1243	471529	5611970	104	5506
891	30	24	1	2660	470601	5611330	-1530	4398
912	75	3	25	1742	470484	5610850	-960	3980
926	88	1	3	1508	471449	5612000	-179	5469
938	101	2	3	1245	471192	5611670	-95	5061
955	91	23	21	1018	467910	5608560	327	538
999	119	3	3	1084	470941	5611420	-94	4705
1042	30	22	2	2987	469810	5610180	-1809	3028
1058	32	21	2	3369	469440	5609820	-2021	2514
1063	152	3	2	1043	471280	5611680	106	5124
1134	117	23	22	846	468153	5608880	265	944
1362	129	2	2	956	471509	5611900	367	5447
1390	64	1	25	2489	471100	5611440	-1372	4834
1425	32	23	1	3038	470387	5610820	-1790	3887
1460	151	2	1	996	471695	5612100	490	5717
1550	68	2	25	2115	470829	5611070	-1177	4385
1601	162	21	22	1033	467747	5608390	424	305
1628	109	1	2	1060	471694	5612120	402	5733
1729	32	22	1	3348	470113	5610530	-2008	3489
1789	33	21	1	3715	469730	5610190	-2222	2974
1797	139	22	22	864	467977	5608650	400	652
1875	111	22	21	839	467827	5608410	621	372
2086	139	21	21	766	467672	5608250	853	150
2104	129	1	1	918	471801	5612240	670	5891

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 225 P LINE 230 C LINE 220
LILLOOET RIVER MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
114	69	25	2	2019	469623	5612100	-996	4037
129	92	23	5	1488	467950	5610160	-632	1489
170	15	25	21	1722	467442	5609510	-516	698
174	9	24	21	1459	467357	5609520	-167	627
187	90	22	25	1610	467625	5609960	-705	1112
194	160	24	23	828	467848	5610190	102	1435
200	72	24	3	1678	468918	5611390	-763	3039
201	1	24	22	1031	467616	5609960	27	1110
218	175	25	23	972	467931	5610230	-135	1519
230	96	23	25	1322	467851	5610140	-449	1401
248	10	25	22	1262	467692	5609980	-295	1174
268	110	24	5	1179	468279	5610440	-436	1918
273	87	24	4	1258	468633	5610840	-450	2448
275	125	23	23	790	467627	5609940	236	1100
278	66	23	3	2126	468531	5611110	-1117	2571
279	108	23	24	1067	467734	5609960	-115	1195
286	153	25	24	920	468203	5610350	-209	1803
296	123	25	5	1042	468558	5610570	-448	2216
303	136	24	24	912	468046	5610310	-36	1659
330	76	25	3	1439	469236	5611560	-623	3387
334	173	23	21	1094	467245	5609330	275	442
341	117	24	25	1047	468162	5610390	-279	1798
342	66	24	2	2252	469288	5611960	-1135	3712
353	90	21	24	1688	467138	5609490	-556	472
377	133	25	25	946	468345	5610420	-289	1960
388	109	22	23	1001	467434	5609820	44	881
391	154	23	22	753	467481	5609760	370	875
394	112	21	22	1061	467029	5609550	195	423
419	96	25	4	1050	468953	5611020	-360	2812
421	134	21	21	1083	466777	5609970	502	223
427	66	22	3	2451	468380	5610800	-1429	2243
463	97	21	23	1328	467083	5609530	-133	433
485	155	22	21	1042	467061	5609170	383	232
496	66	21	3	2845	468124	5610390	-1707	1769
618	132	22	22	839	467256	5609570	352	574
681	65	25	1	2406	469930	5612450	-1177	4505
853	63	23	2	2699	468859	5611760	-1489	3280
969	63	24	1	2627	469573	5612360	-1305	4196
995	63	22	2	3020	468731	5611450	-1332	2960
1539	61	23	1	3067	469105	5612220	-1644	3793
1721	61	22	1	3383	469186	5611560	-2053	3349
1836	62	21	1	3757	469077	5610910	-2333	2835

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 235 P LINE 230 C LINE 240
LILLOOET RIVER MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
129	72	2	21	129	467609	5611740	-1820	2370
239	103	24	21	239	466398	5610610	-445	738
252	106	25	22	252	466737	5610960	-656	1205
253	10	24	4	253	468324	5611910	-930	3054
259	18	23	5	259	467605	5611270	-948	2109
269	11	25	3	269	468889	5612460	-1017	3931
270	82	5	21	270	466610	5611340	-1249	1372
288	170	23	26	288	467075	5610820	-330	1440
312	147	21	21	312	465821	5610430	255	174
313	81	3	22	313	467684	5611670	-1444	2394
314	114	24	22	314	466697	5610940	-401	1106
326	72	1	22	326	468368	5612190	-1834	3253
326	82	4	22	326	467262	5611560	-1303	1987
330	88	5	22	330	466982	5611510	-1085	1749
336	22	5	1	336	469796	5613390	-805	5113
341	25	25	1	341	469395	5613010	-1372	4555
344	19	25	2	344	469198	5612700	-1236	4222
347	75	2	22	347	467972	5611970	-1624	2802
352	76	1	23	352	468674	5612380	-1589	3607
359	80	2	23	359	468272	5612160	-1392	3158
367	177	23	25	367	457133	5610970	-518	1552
369	97	5	23	369	467253	5611670	-911	2061
385	3	22	26	385	466300	5610770	-417	1165
394	18	21	25	394	466543	5610730	-787	918
400	163	21	22	400	465014	5610520	3	367
406	26	23	2	406	468557	5612110	-1739	3361
414	119	23	21	414	466211	5610520	-150	523
418	146	22	22	413	465255	5610650	-85	634
427	133	23	22	427	466556	5610760	-240	945
431	162	22	23	431	466418	5610820	-318	866
435	15	21	26	435	465510	5610580	-555	826
441	133	25	26	441	467459	5611250	-310	1972
456	119	25	23	456	466908	5611100	-556	1425
460	87	3	23	460	467973	5611870	-1238	2744
460	146	25	25	460	467684	5611530	-423	2312
461	130	22	21	461	465958	5610440	86	274
463	16	4	1	463	469770	5613560	-468	5200
474	129	24	23	474	466817	5610950	-360	1271
492	4	25	4	492	468491	5612210	-837	3363
495	114	2	4	495	469429	5613200	0	4704
504	149	23	23	504	466573	5610870	-359	1107
506	29	2	24	505	468595	5612290	-1247	3493
508	31	21	5	508	466970	5611010	-1357	1433
515	108	3	24	515	468310	5611990	-1093	3098
519	8	22	25	519	466838	5610910	-630	1266
522	92	1	24	522	468990	5612510	-1448	3943
522	176	21	23	522	466154	5610660	-327	568
524	89	4	23	524	467543	5611740	-1098	2319
557	167	5	4	557	468943	5612750	-335	4043
558	134	3	4	558	469342	5612990	-56	4507
575	99	1	4	575	469710	5613390	-100	5044
595	76	1	25	585	469286	5612800	-1031	4349
585	124	5	24	585	467605	5611710	-767	2350
594	134	2	3	594	469529	5613240	112	4808
600	148	24	26	600	467425	5611110	-237	1877
611	4	21	24	611	466255	5610580	-448	598
619	27	24	1	619	469428	5612590	-1481	4350
623	175	22	24	623	466544	5610730	-365	923
624	152	3	3	624	469471	5613090	-79	4670
632	13	5	2	632	469563	5613140	-672	4775
634	166	23	24	634	466777	5610760	-322	1140
639	0	5	3	639	469195	5612960	-495	4374
639	149	4	4	639	469105	5612960	-111	4305
642	93	3	25	642	468649	5612290	-707	3538
645	114	4	24	645	467882	5611810	-953	2634
654	167	4	3	654	469280	5613130	-233	4544
562	5	4	2	662	469625	5613290	-351	4913
652	156	5	5	662	468501	5612300	-181	3420
667	114	1	3	667	469818	5613430	149	5156
671	82	2	25	671	468908	5612580	-835	3914
687	145	25	24	687	467275	5611210	-500	1796
692	159	24	25	692	467517	5611260	-365	2030
730	130	4	5	730	468797	5612520	-67	3788
759	173	3	2	759	469764	5613230	-90	4989
762	114	3	5	762	469195	5612660	-61	4194
763	9	24	5	763	468056	5611550	-643	2643
808	83	1	5	809	469707	5613100	-306	4867
810	94	2	5	810	469366	5612880	-128	4465
837	1	25	5	887	468224	5611940	-556	2933
934	153	24	24	934	466917	5610820	-167	1292
937	99	4	25	937	468217	5612120	-594	3037
1072	159	2	2	1072	469815	5613380	258	5124
1075	30	23	1	1075	468738	5612460	-1834	3706
1209	177	2	1	1209	470075	5613550	314	5434
1217	136	1	2	1217	470080	5613530	494	5453
1229	33	22	1	1229	468138	5612590	-2089	3330
1755	158	1	1	1755	470281	5613670	693	5670

POLE-POLE RESISTIVITY DATA: 1978
CORRIDOR 245 P LINE 250 C LINE 240
LILLOOET RIVER MAP AREA

R(a)	Dir	C#	P#	Ze	Xd	Yd	Zd	Vhor
133	127	21	21	133	465097	5611460	337	341
184	131	3	4	184	469050	5613910	-179	4144
249	109	21	22	249	465138	5611530	113	398
249	109	21	22	249	465138	5611530	118	398
370	89	4	1	370	468744	5614740	-859	5201
406	112	23	26	406	465835	5612120	-684	1297
411	15	4	22	411	466207	5612590	-855	1990
413	94	21	23	413	465288	5611710	-200	617
429	116	23	24	429	465661	5612110	-396	1153
463	93	3	1	463	468968	5614660	-470	5329
470	122	23	23	470	465564	5612190	-89	1203
512	125	22	22	512	465162	5611710	41	513
513	136	24	24	513	466060	5612540	-393	1735
515	160	23	21	515	465239	5611680	75	557
530	36	1	22	530	467252	5613110	-1556	3024
570	93	4	2	570	468381	5614450	-713	4738
582	24	3	22	582	466545	5612750	-1059	2242
585	142	23	22	585	465457	5611950	23	890
588	35	1	23	588	467486	5613420	-1263	3393
591	147	24	23	591	465813	5612350	-57	1422
600	109	22	23	600	465393	5612020	-222	893
611	20	4	21	611	465963	5612260	-1043	1481
614	27	3	21	614	466326	5612390	-1277	1853
670	8	4	23	670	466465	5612870	-617	2258
671	20	3	23	671	466798	5613040	-800	2619
674	31	2	22	674	466918	5612930	-1343	2648
674	143	22	21	674	465023	5611540	185	300
677	167	25	23	677	466060	5612600	-336	1777
681	165	24	22	681	465514	5612150	-131	1140
682	8	25	21	682	465563	5612050	-633	1034
705	116	4	4	705	467806	5613370	-456	3926
732	99	3	2	732	468597	5614390	-336	4866
741	157	1	3	741	468722	5614230	337	4870
745	131	4	5	745	467582	5613480	-745	3509
747	103	4	3	747	468035	5614120	-499	4263
755	133	2	3	755	468519	5614150	182	4662
759	168	4	26	759	466877	5613020	-772	2671
760	100	2	1	760	469205	5614610	-19	5483
762	127	1	2	762	468984	5614380	395	5174
782	178	4	24	782	465550	5613010	-707	2487
783	111	2	2	783	468824	5614340	79	5022
799	179	25	22	789	465814	5612350	-496	1423
818	113	3	3	818	468252	5614110	-153	4426
820	146	25	26	820	466541	5612790	-715	2263
827	156	25	24	827	466250	5612730	-537	1998
828	175	1	4	829	468577	5614100	22	4680
844	111	1	1	844	469389	5614710	419	5696
852	155	2	4	852	468314	5613970	-7	4337
891	104	23	25	891	465995	5612370	-815	1574
903	146	3	5	903	468011	5613730	-512	4001
904	2	3	26	904	467220	5613210	-833	3059
911	29	2	23	911	467164	5613230	-1056	3022
928	29	1	24	928	467596	5613640	-1223	3620
947	21	1	25	947	467968	5613770	-919	3991
1011	11	3	24	1011	466960	5613200	-832	2847
1024	23	2	24	1024	467299	5613420	-1042	3249
1033	15	2	26	1033	467584	5613410	-986	3470
1044	165	2	5	1044	468309	5613820	-433	4298
1059	23	1	26	1059	467897	5613610	-1137	3841
1059	180	1	5	1059	468580	5613970	-449	4606
1829	11	2	25	1829	467672	5613560	-731	3627
2167	176	3	25	2167	467324	5613350	-660	3226
3035	119	24	25	3035	466331	5612740	-654	2107
3807	135	25	25	3807	465647	5612920	-675	2428

APPENDIX B-2

PSEUDOSECTION DATA PLOTS AND R(A) Vs. DEPTH PLOTS

The apparent resistivity R(A) data are plotted on topographic sections located through each data corridor. The position of each pseudosection and accompanying R(A) vs. Depth Plot is shown on plan maps of Figures 4.1 and 4.6 by two triangles

▷ ◀

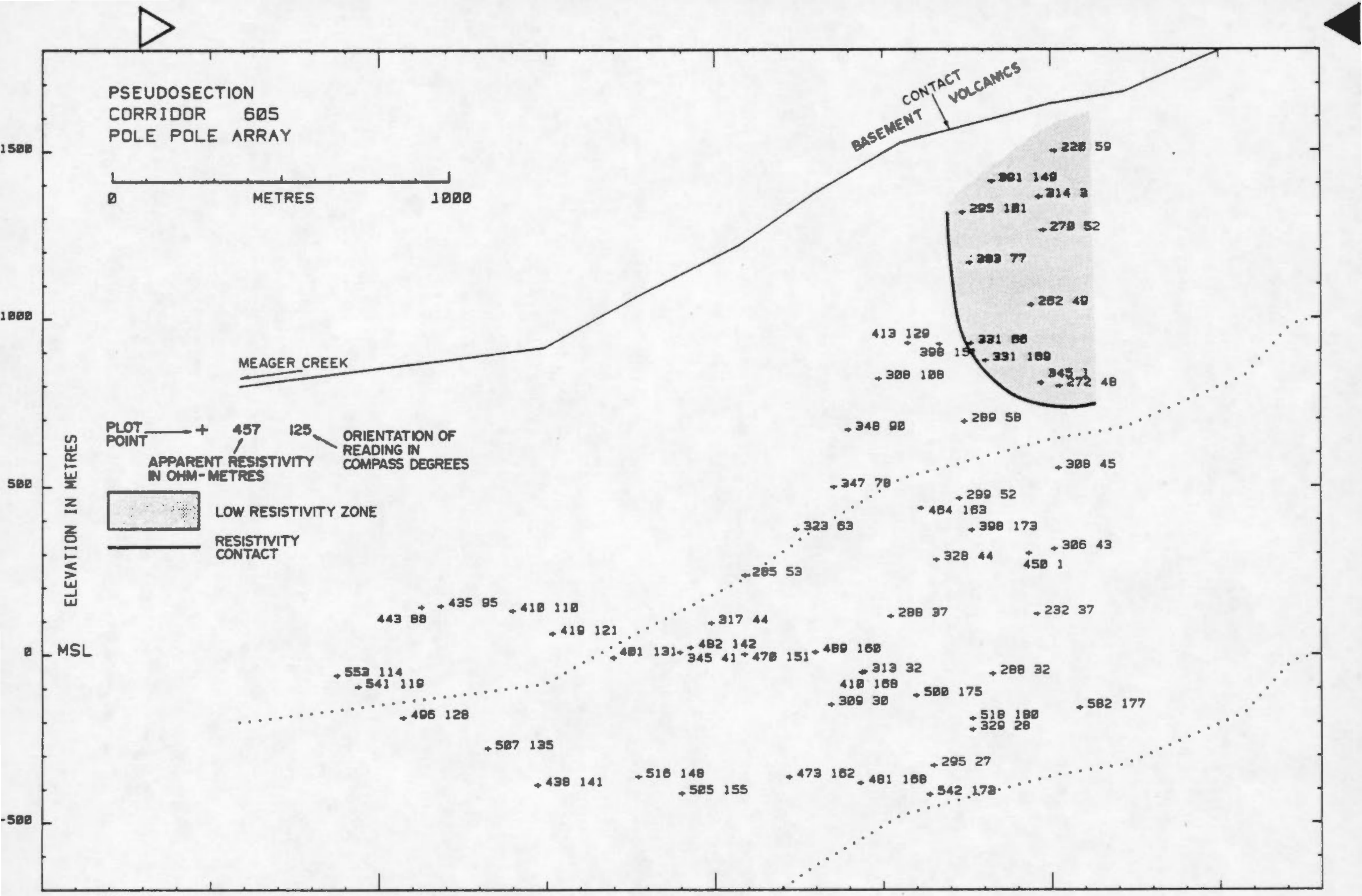
marking the horizontal limits of the section. Triangles on the plan maps correspond with those at the top of the section plots.

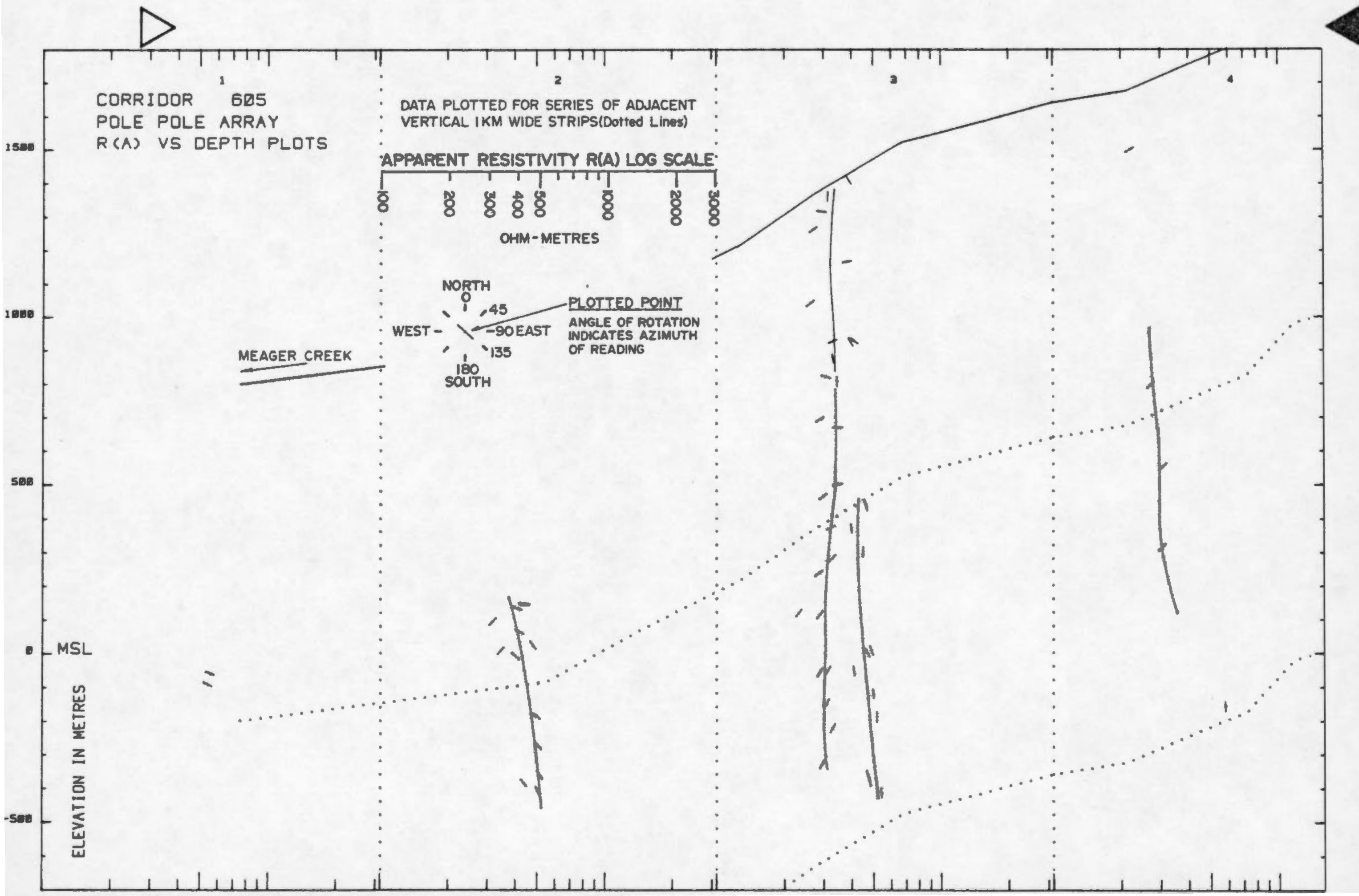
The pseudosection plots are not true sections of resistivity values - they are a conventional means of graphically presenting data for purposes of analysis and interpretation. The vertical coordinate is plotted according to a method described by Edwards (1977).

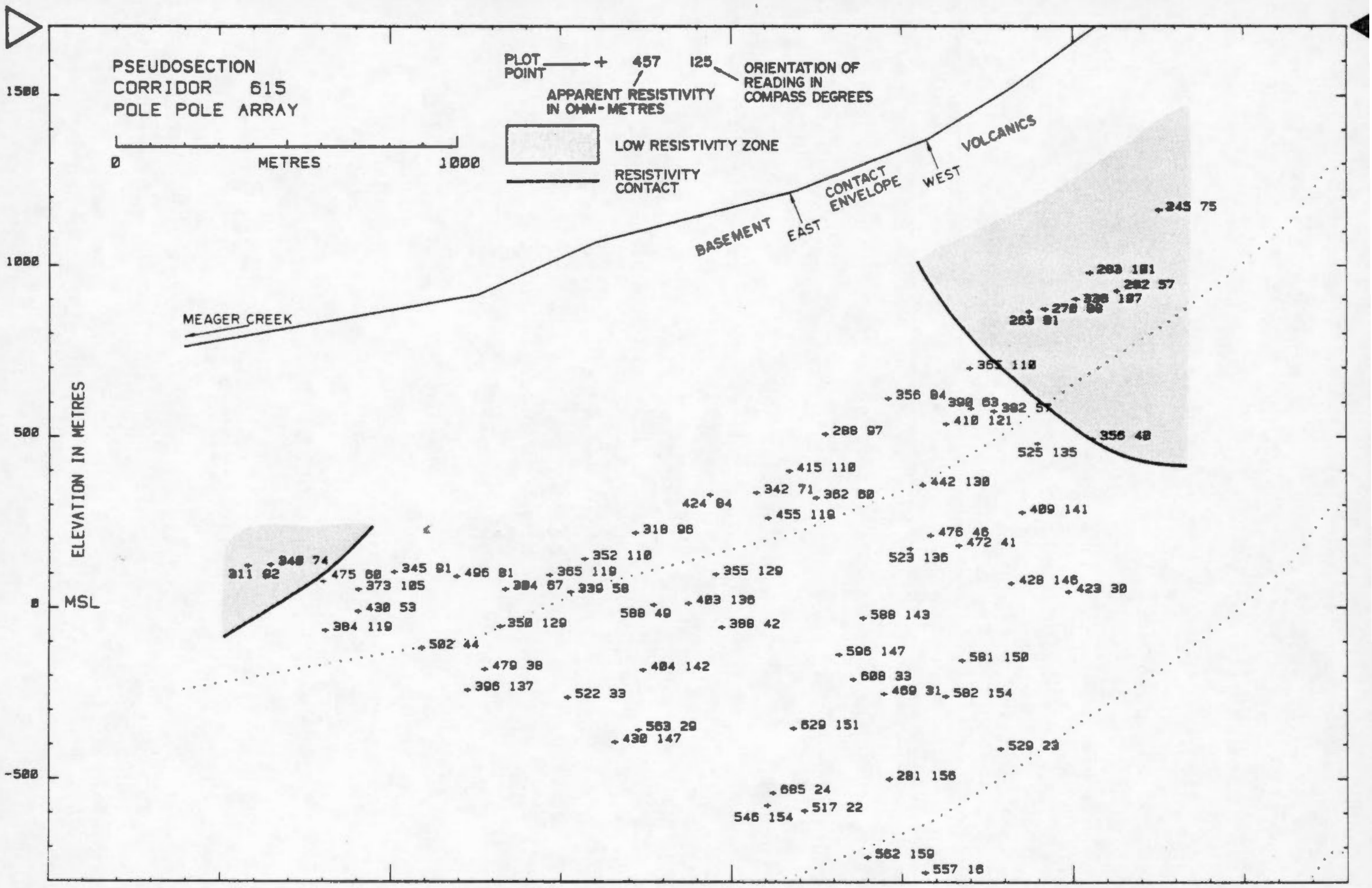
R(A) vs. Depth plots are constructed to facilitate observation of trends of apparent resistivity with depth over the width of the pseudosection and to improve resolution of anisotropic conditions if any. These also follow standard geophysical convention. Two steps are taken in the construction:

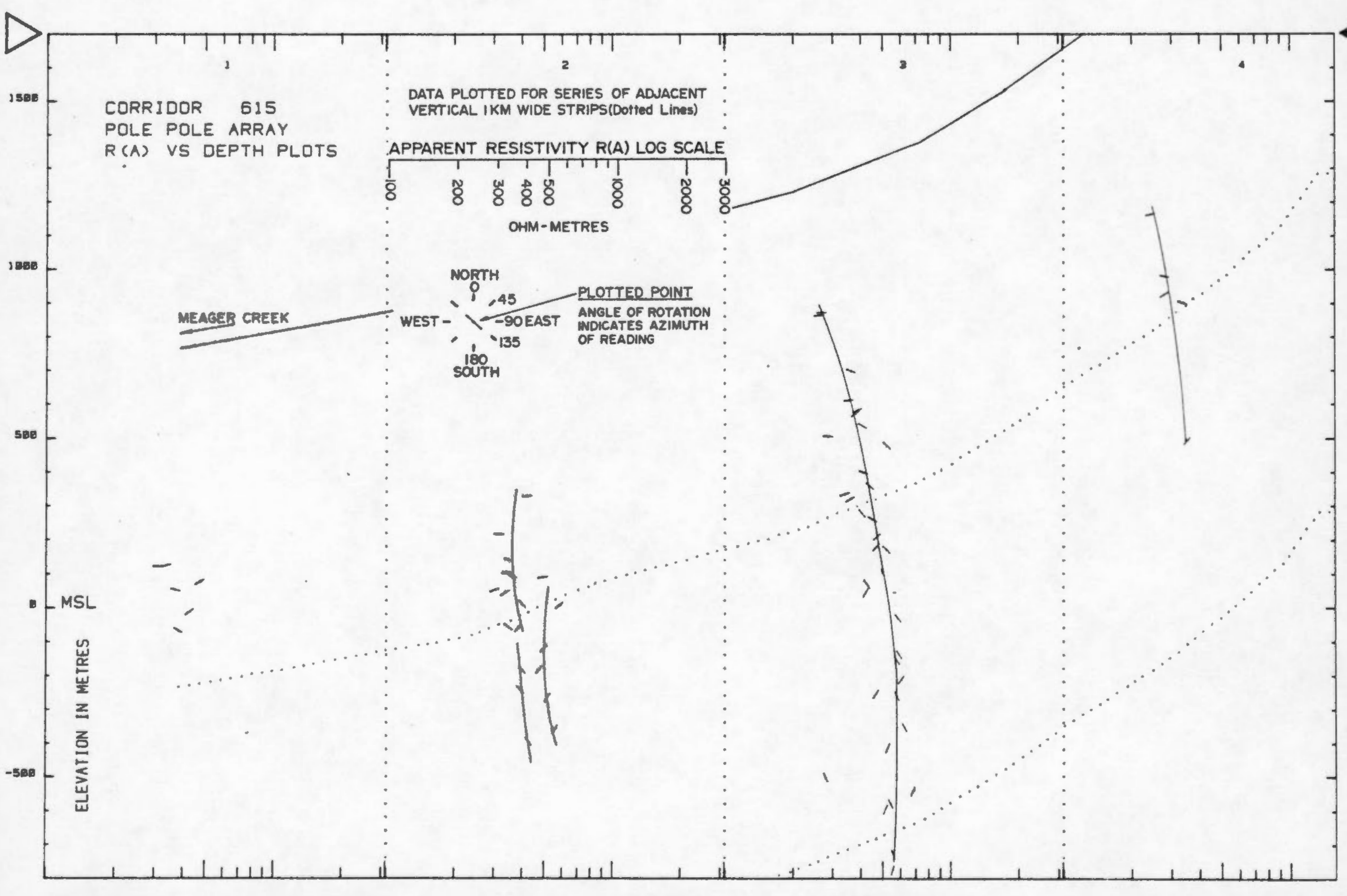
a) The pseudosection is divided into 1 km wide slices, defined by the vertical dotted lines on the plots. Data located within each slice are grouped and designated as representative of conditions within the area represented by the slice.

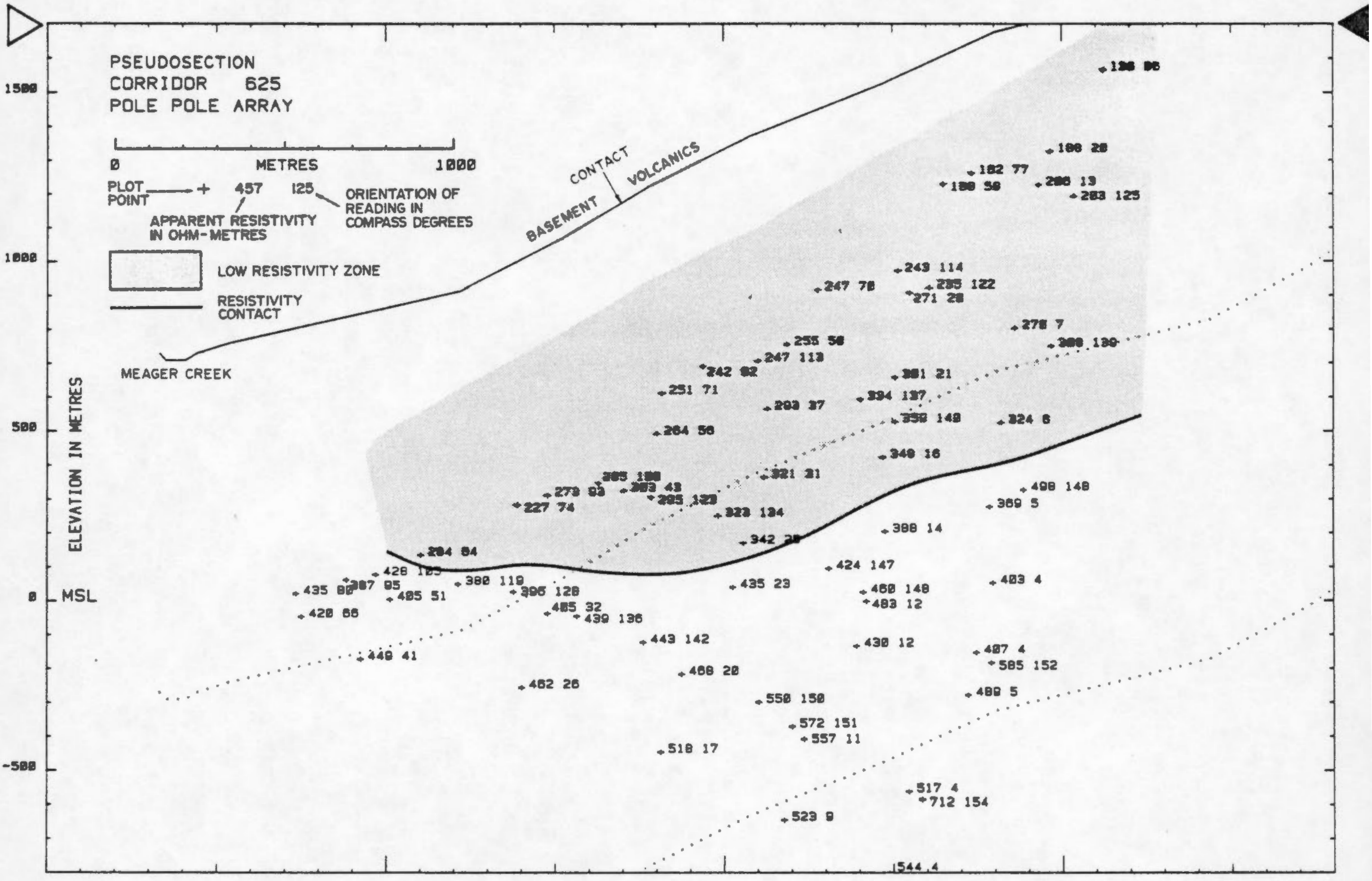
b) The areas defined for each slice are reformatted as individual graphs plotting the log of apparent resistivity on the X axis and the elevation of the plotting point (Zd) on the Y axis. The orientation of each resistivity reading is indicated by the angle of rotation (from the perpendicular) of the plot symbol. North is 0°, East is 90°, as indicated on the legend.


PSEUDOSECTION
CORRIDOR 605
POLE POLE ARRAY
0 METRES 1000
1500
1000
500
0 MSL
-500
ELEVATION IN METRES
CONTACT
BASEMENT
VOLCANICS
MEAGER CREEK
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
228 59
301 149
314 3
295 181
279 52
283 77
282 49
413 129
398 15
331 88
331 189
308 108
345 1
272 48
289 58
348 98
308 45
347 78
299 52
404 183
323 63
398 173
328 44
306 43
450 1
285 53
435 95
410 110
443 88
317 44
288 37
232 37
419 121
492 142
481 131
345 41
478 151
489 168
553 114
541 119
313 32
288 32
410 168
500 175
309 30
518 180
329 28
582 177
496 128
587 135
295 27
516 148
473 162
438 141
481 168
505 155
542 173

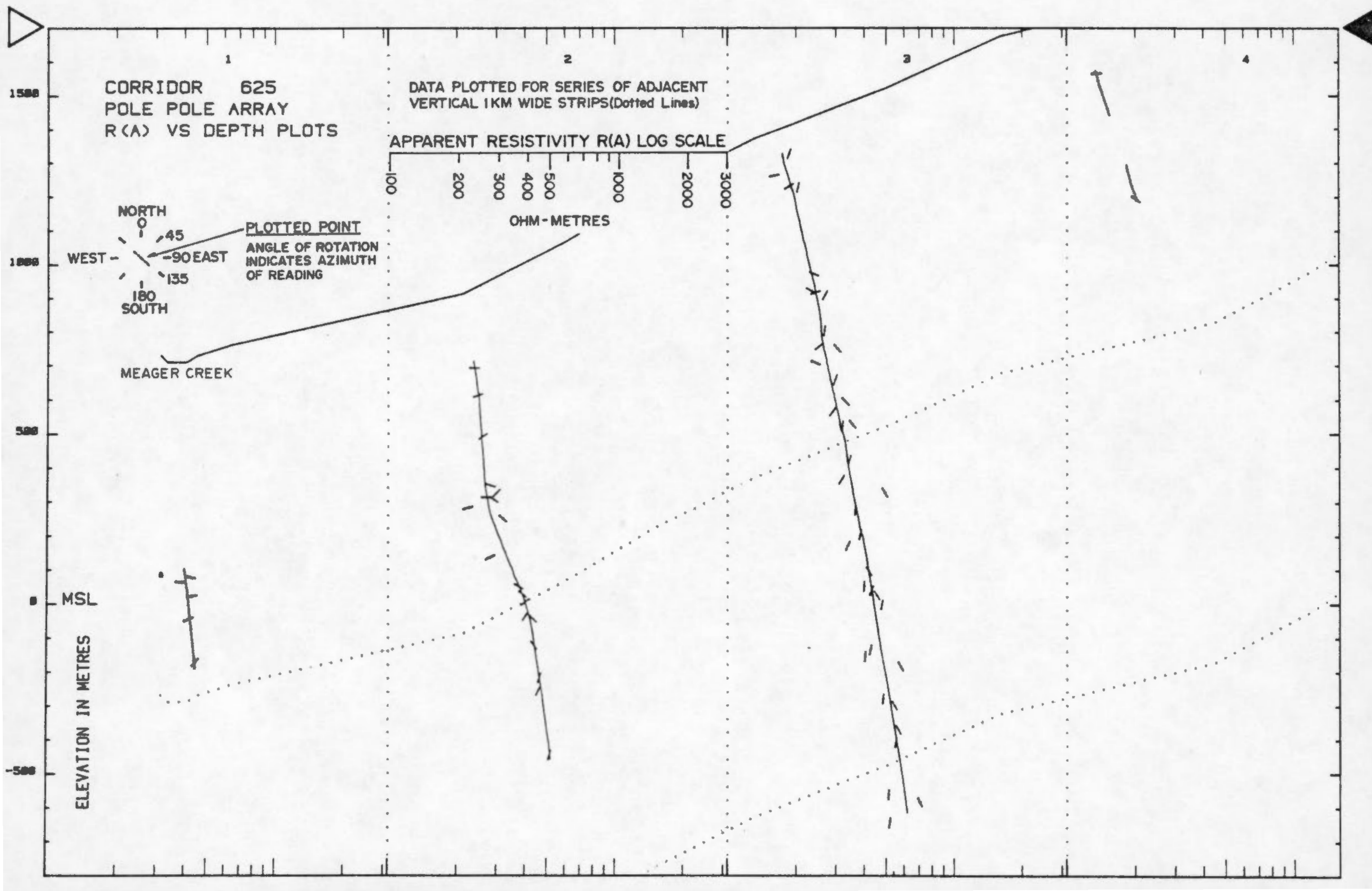

CORRIDOR 605
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
1
2
3
4
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
1500
1000
500
0 MSL
-500
ELEVATION IN METRES


PSEUDOSECTION
CORRIDOR 615
POLE POLE ARRAY
0 METRES 1000
PLOT POINT + 457 125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
BASEMENT
EAST
CONTACT ENVELOPE
WEST
VOLCANICS
MEAGER CREEK
ELEVATION IN METRES
1500
1000
500
0 MSL
-500

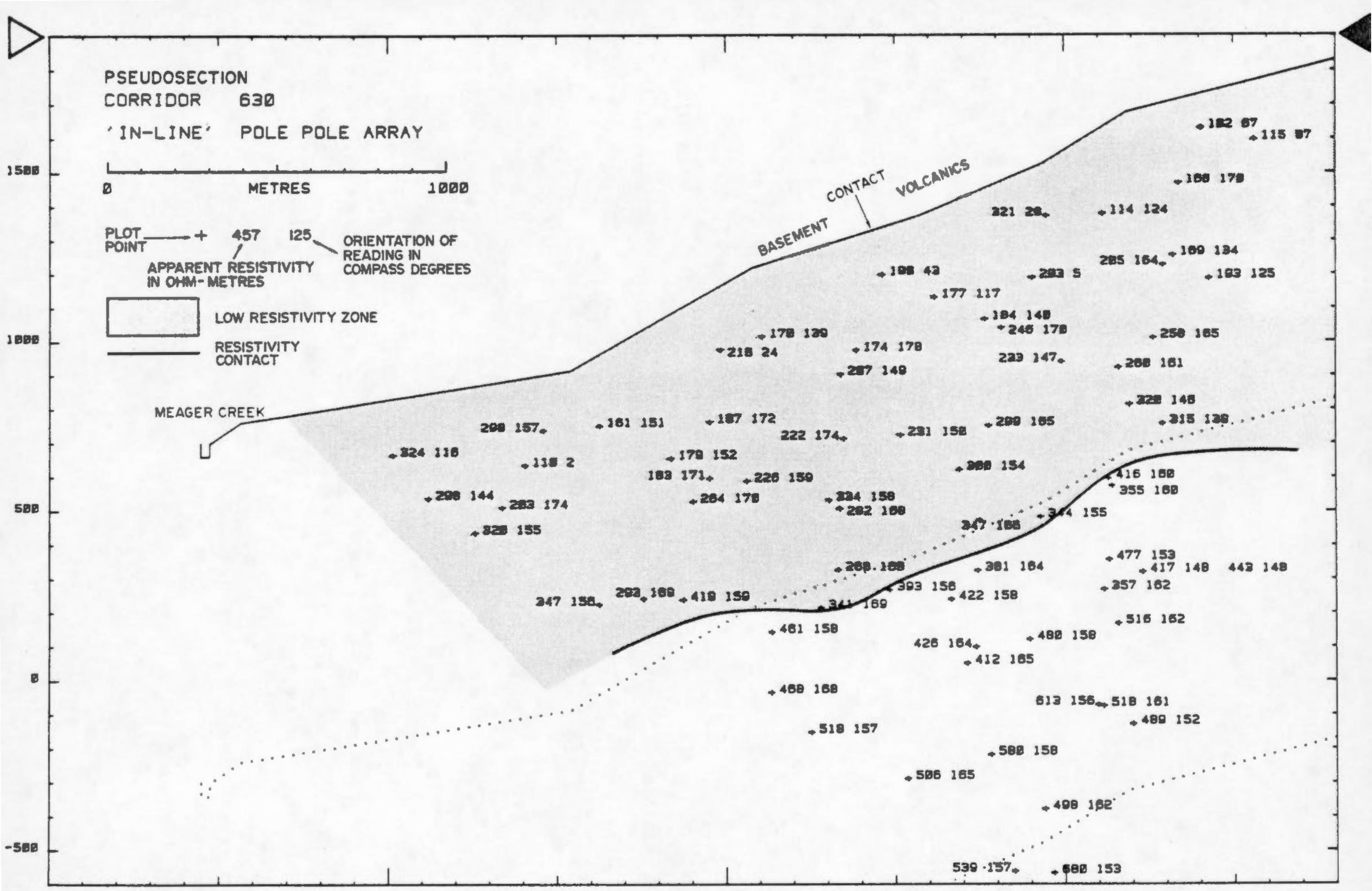

CORRIDOR 615
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100 200 300 400 500 1000 2000 3000
OHM-METRES
NORTH 0
45
WEST -
-90 EAST
135
180 SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
1 2 3 4
ELEVATION IN METRES
1500
1000
500
0 MSL
-500



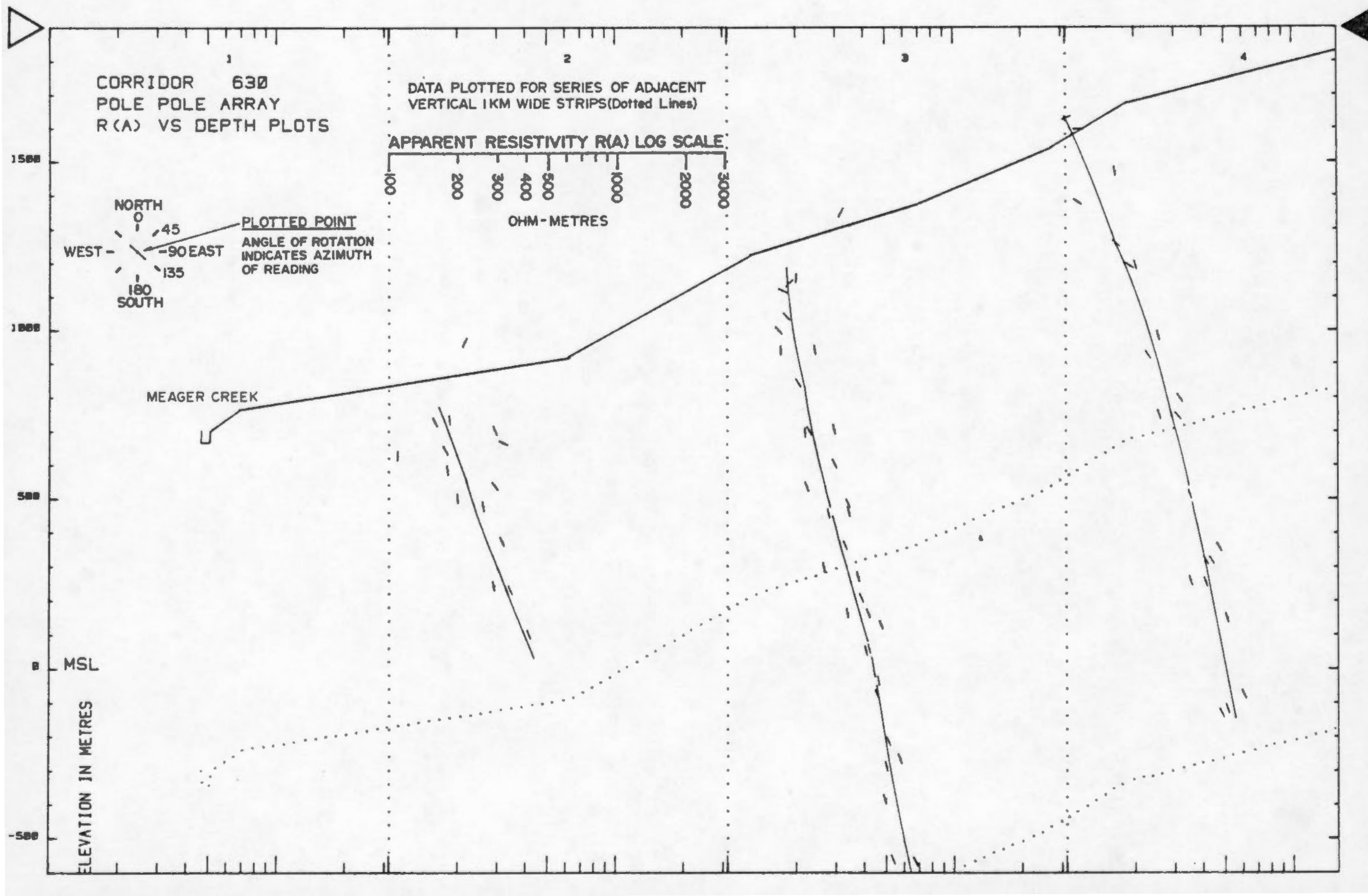
PSEUDOSECTION
CORRIDOR 625
POLE POLE ARRAY
0 METRES 1000
PLOT POINT
457
125
ORIENTATION OF READING IN COMPASS DEGREES
APPARENT RESISTIVITY IN OHM-METRES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
MEAGER CREEK
CONTACT
BASEMENT
VOLCANICS
ELEVATION IN METRES
1500
1000
500
0 MSL
-500
544.4



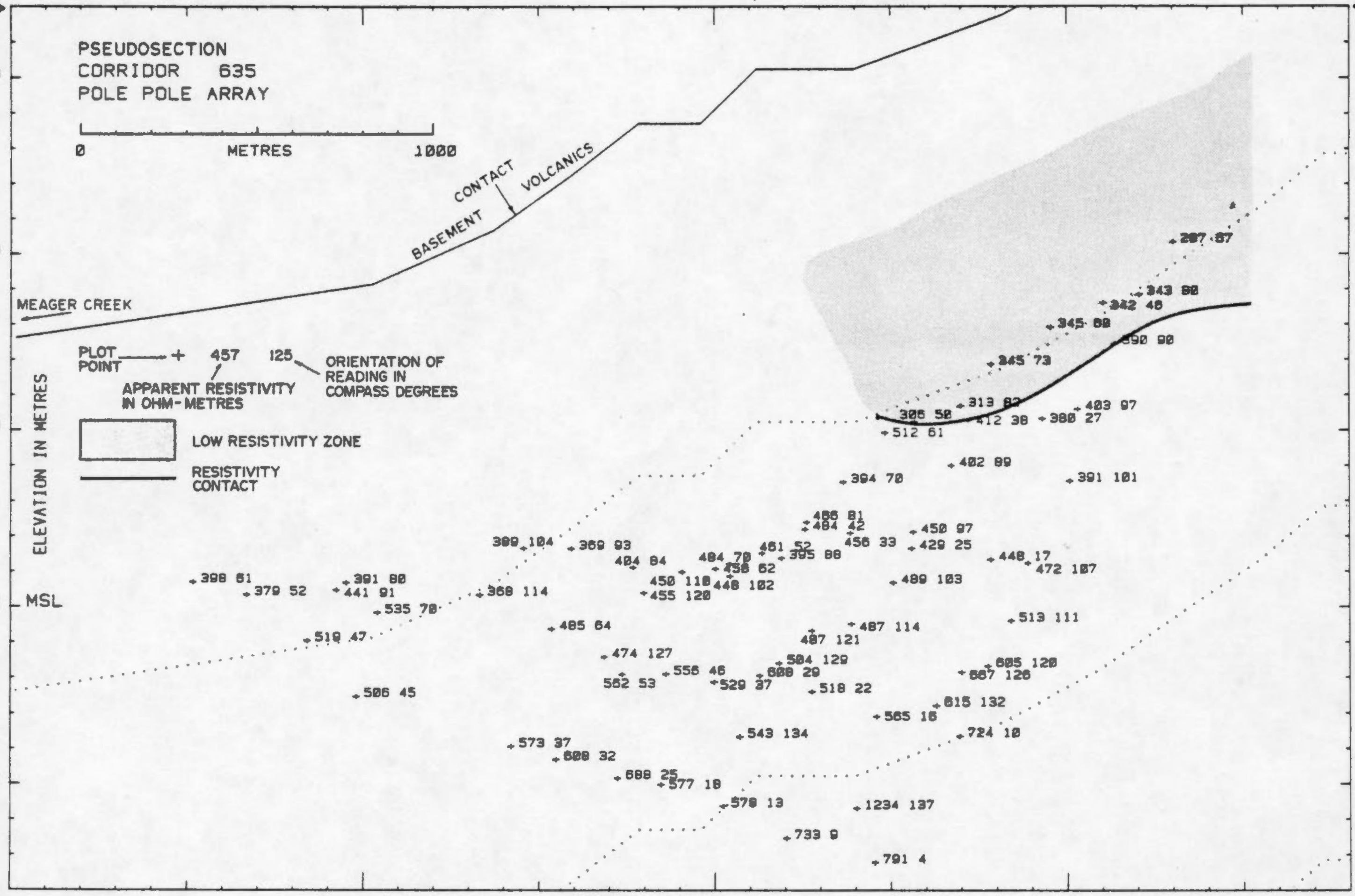
CORRIDOR 625
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
-90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
ELEVATION IN METRES
1500
1000
500
0 MSL
-500
1
2
3
4

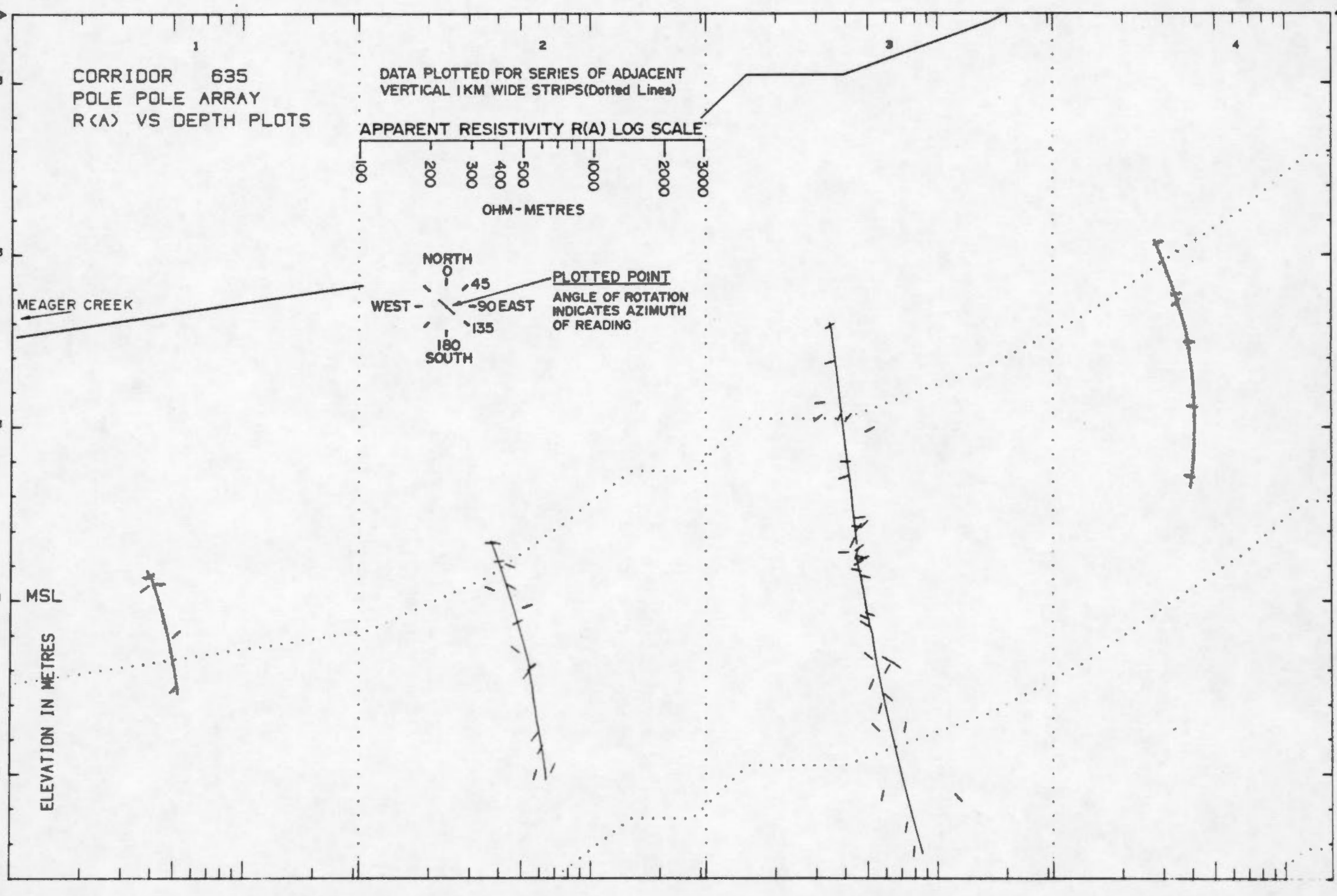


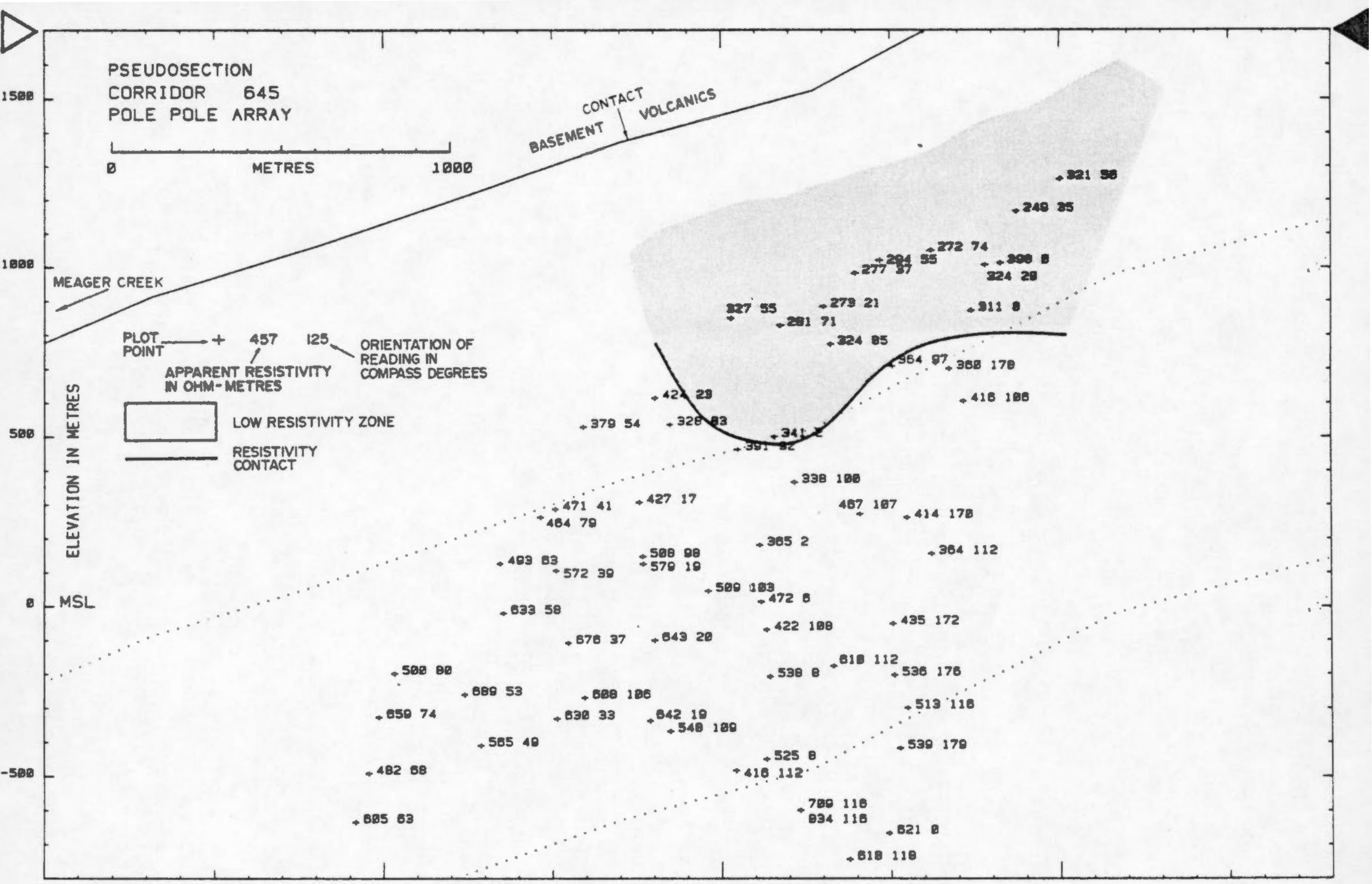
PSEUDOSECTION
CORRIDOR 630
'IN-LINE' POLE POLE ARRAY
0 METRES 1000
PLOT POINT
457 125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
MEAGER CREEK
BASEMENT
CONTACT
VOLCANICS
1500
1000
500
0
-500

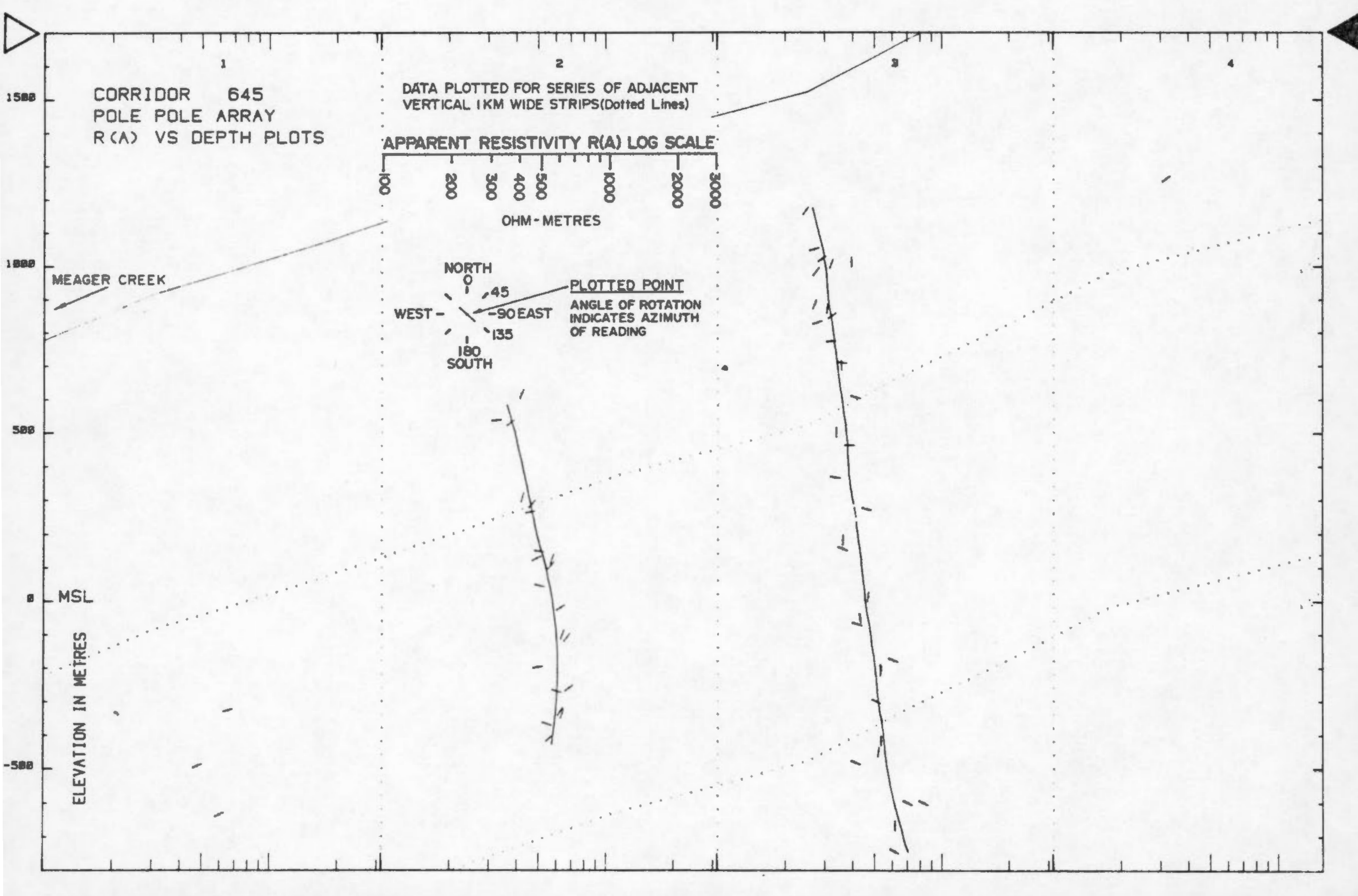


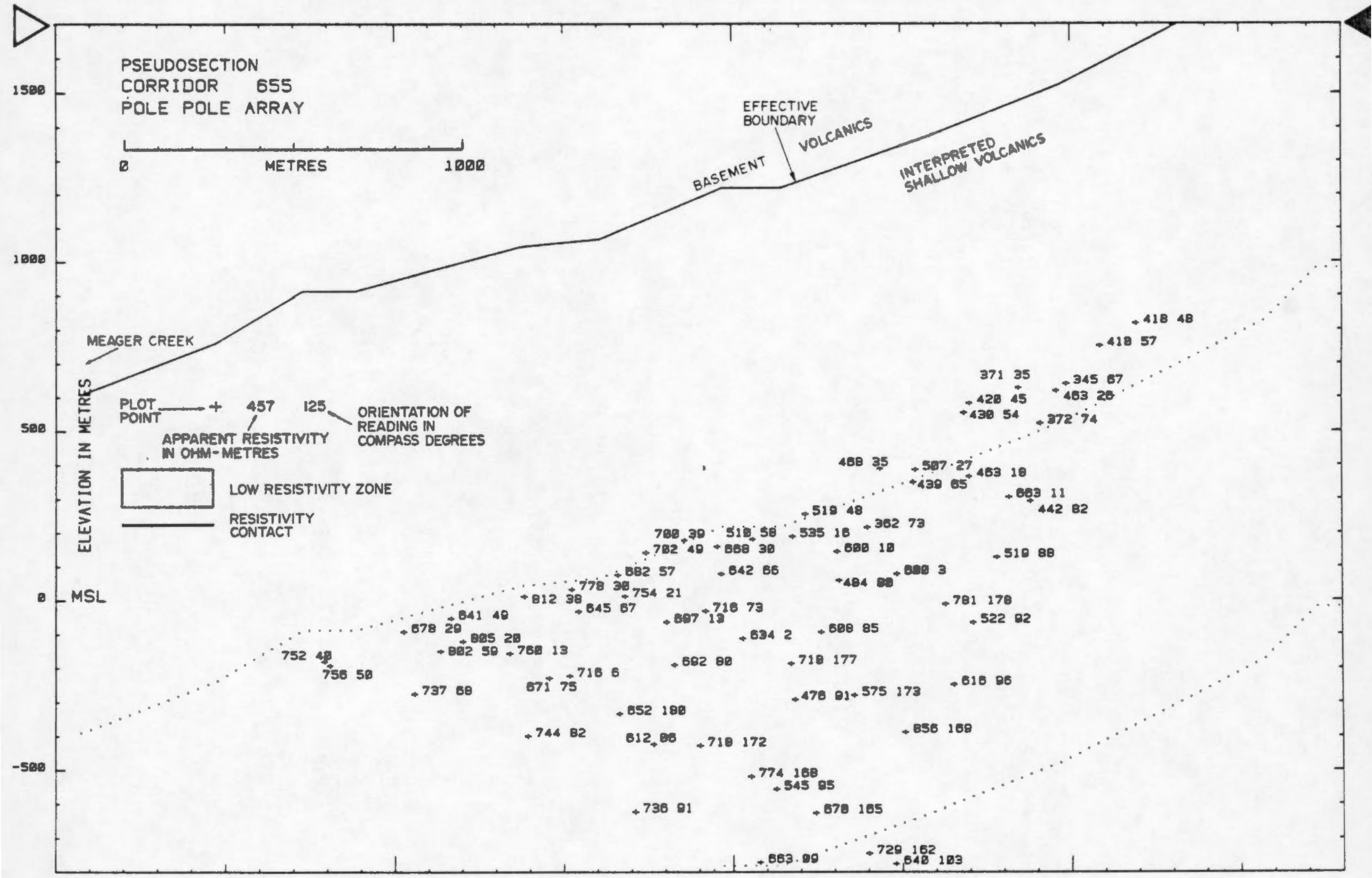
CORRIDOR 630
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS(Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100 200 300 400 500 1000 2000 3000
OHM-METRES
NORTH 0 45
WEST
90 EAST
135
180 SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
MSL
ELEVATION IN METRES
1 2 3 4
1500
1000
500
0
-500

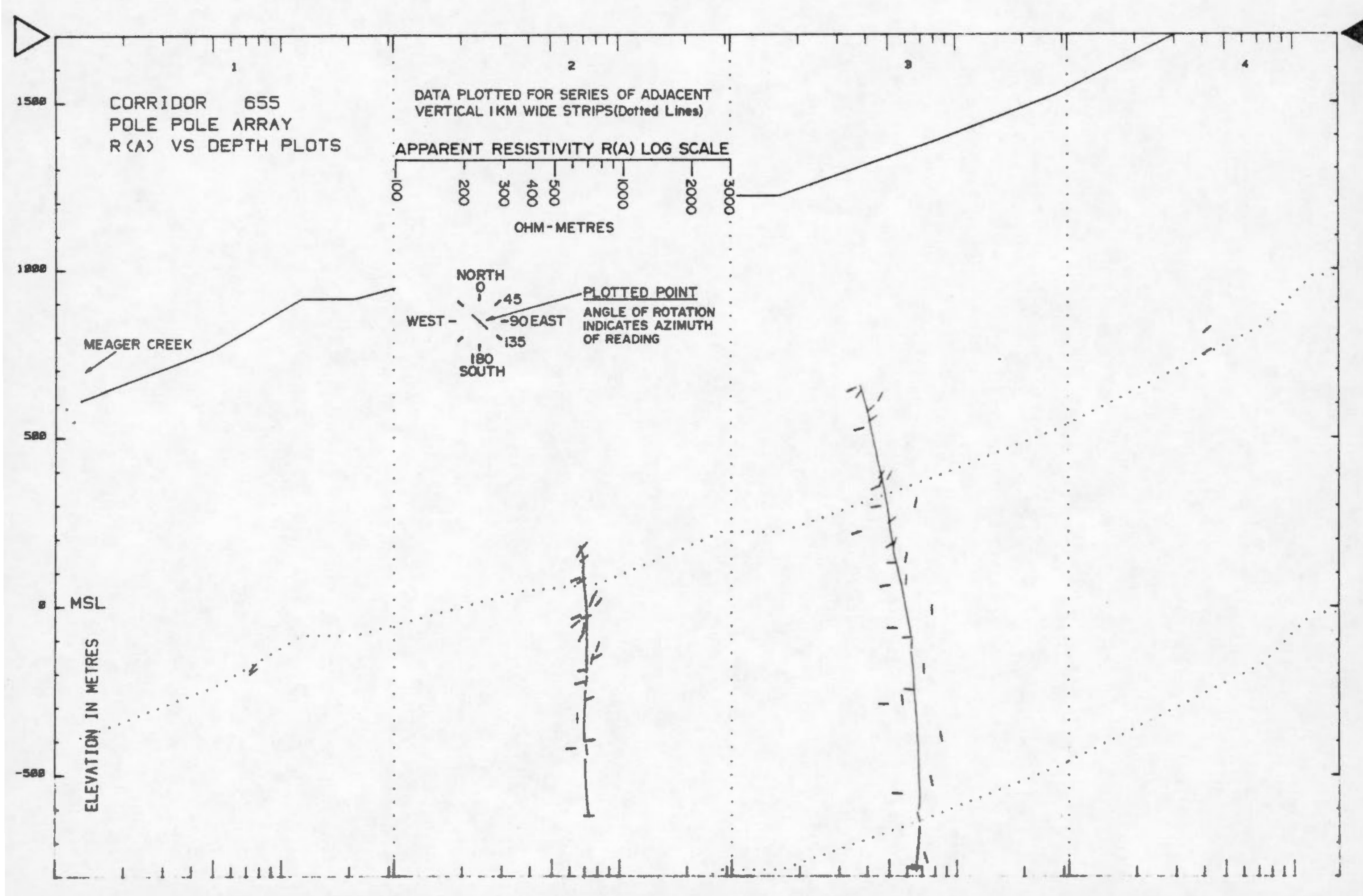

PSEUDOSECTION
CORRIDOR 635
POLE POLE ARRAY
0
METRES
1000
CONTACT
BASEMENT
VOLCANICS
MEAGER CREEK
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
ELEVATION IN METRES
1500
1000
500
0
MSL
-500

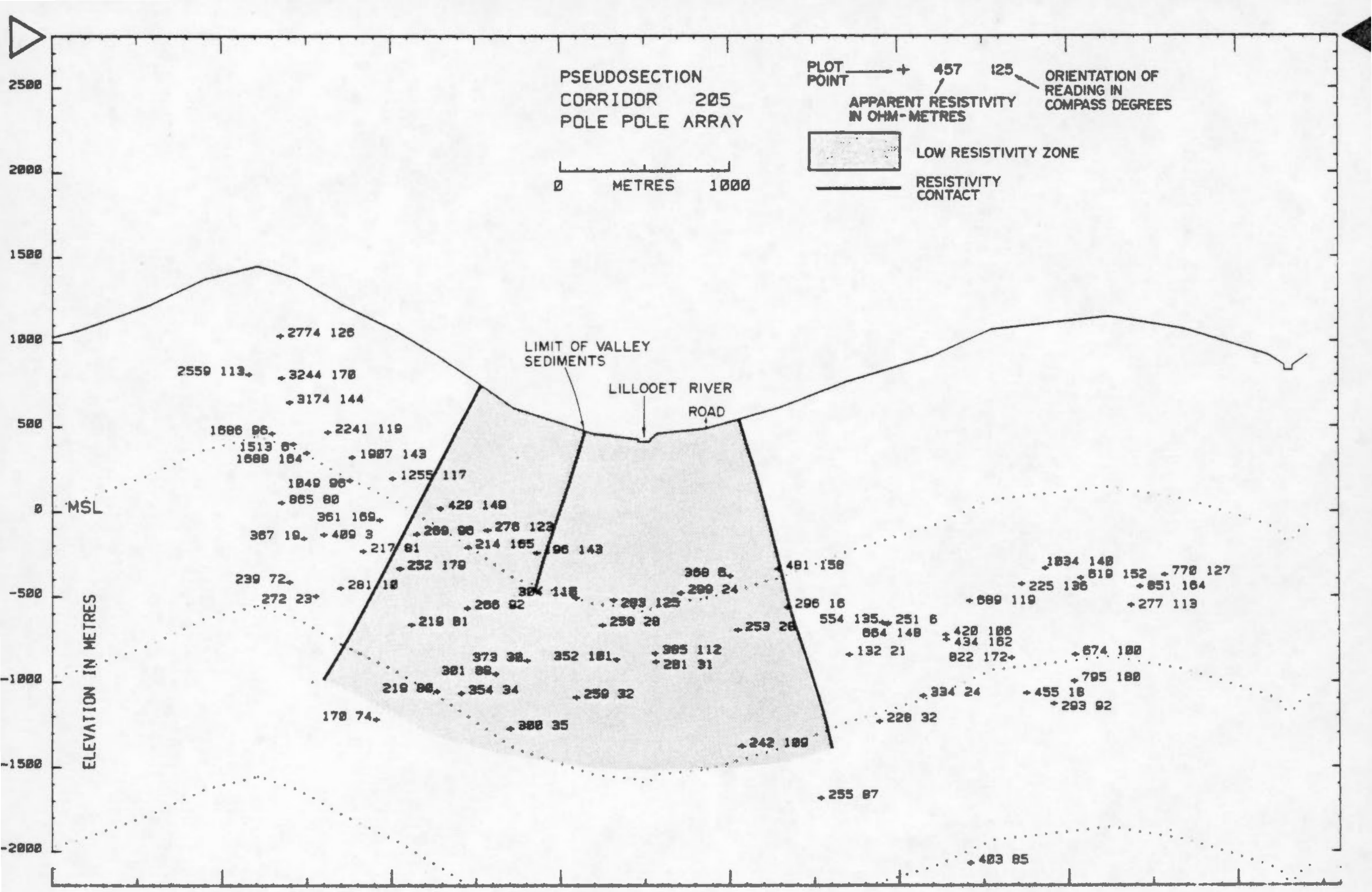

1
2
3
4
CORRIDOR 635
POLE POLE ARRAY
R (A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS(Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
ELEVATION IN METRES
1500
1000
500
0
MSL
-500

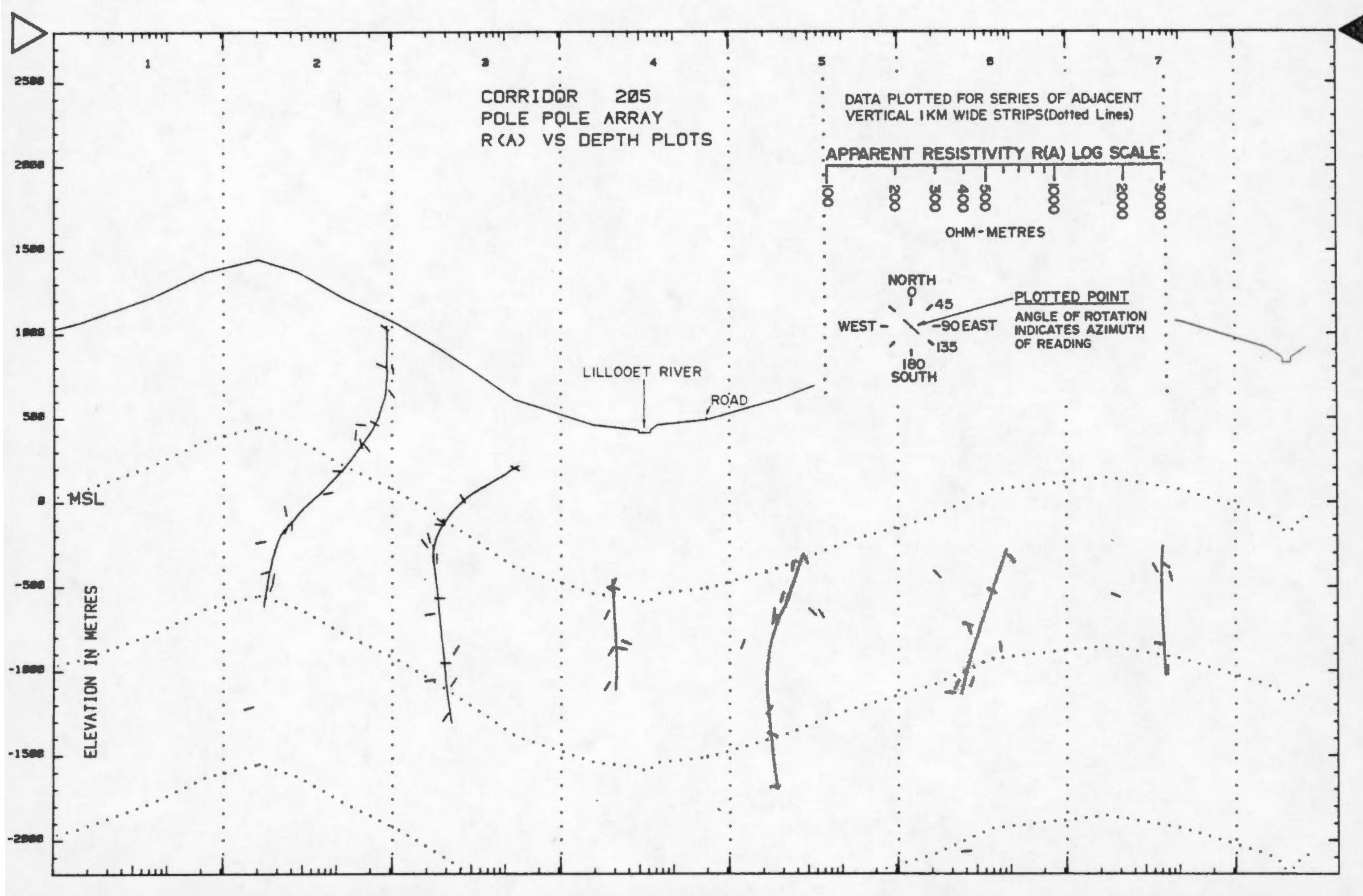

PSEUDOSECTION
CORRIDOR 645
POLE POLE ARRAY
0
METRES
1000
CONTACT
BASEMENT
VOLCANICS
MEAGER CREEK
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
ELEVATION IN METRES
1500
1000
500
0 MSL
-500
321 58
249 35
272 74
284 55
277 37
308 8
324 28
327 55
279 21
281 71
311 8
324 85
364 97
368 178
416 108
424 23
379 54
328 83
341 2
391 82
338 108
471 41
427 17
464 79
467 107
414 178
365 2
493 83
588 98
579 19
572 39
364 112
509 183
472 6
633 58
422 108
435 172
676 37
643 28
500 80
618 112
538 8
536 176
889 53
688 186
659 74
630 33
642 19
548 109
513 118
565 49
525 8
539 179
482 68
416 112
709 118
834 118
605 63
621 8
618 118

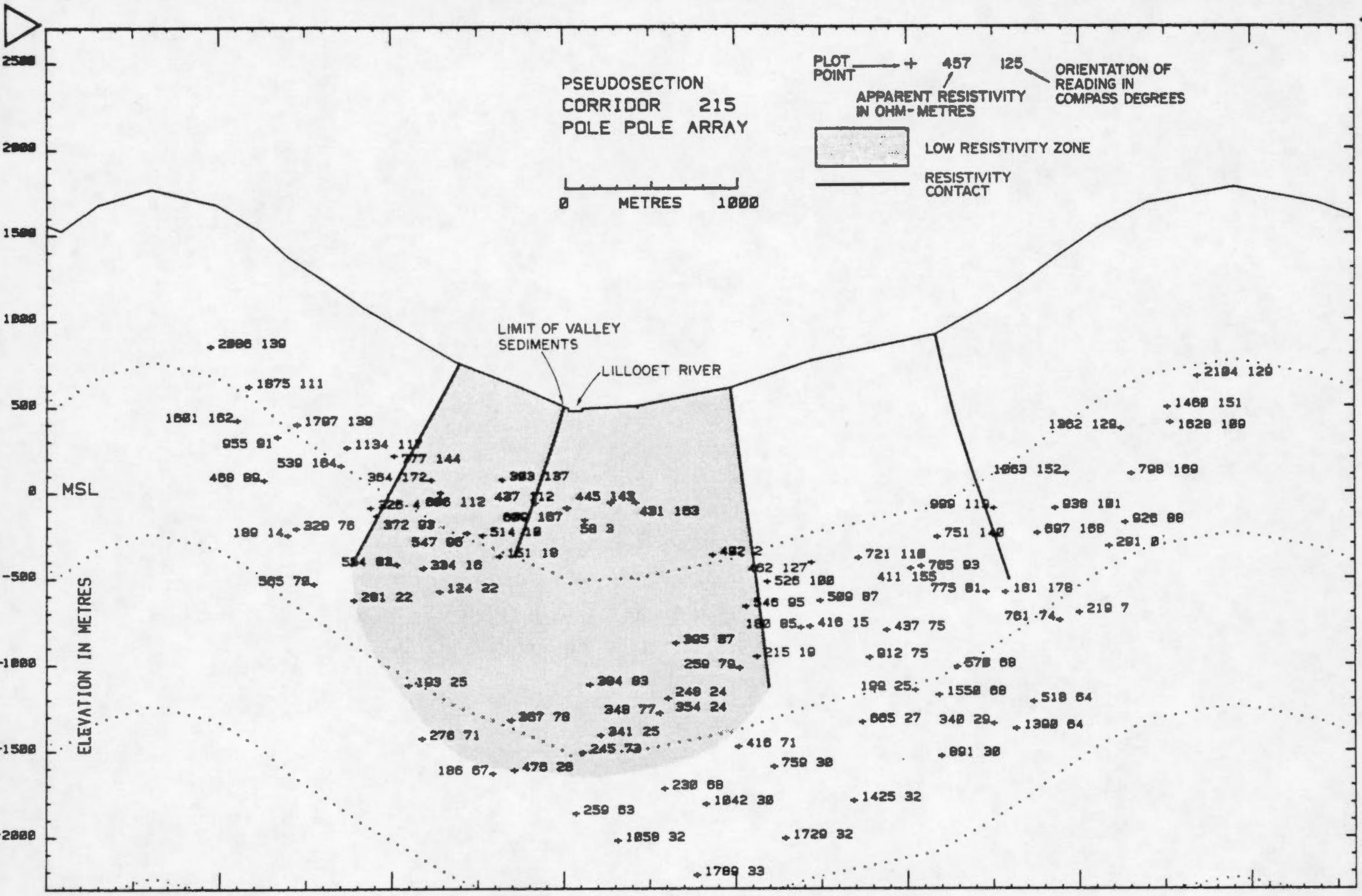

1
2
3
4
CORRIDOR 645
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS(Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
ELEVATION IN METRES
1500
1000
500
0 MSL
-500

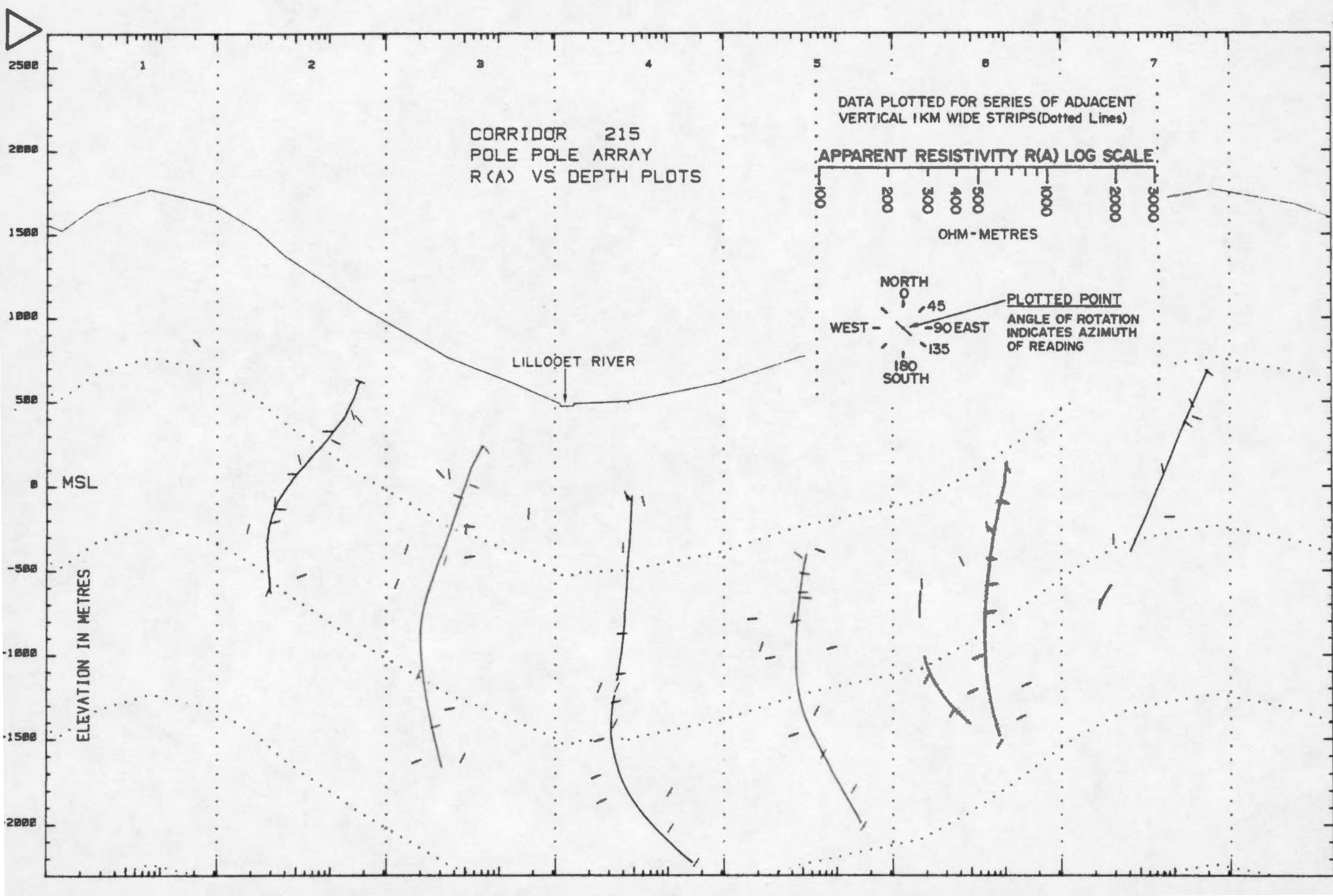

PSEUDOSECTION
CORRIDOR 655
POLE POLE ARRAY
0 METRES 1000
EFFECTIVE BOUNDARY
BASEMENT
VOLCANICS
INTERPRETED SHALLOW VOLCANICS
MEAGER CREEK
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
ELEVATION IN METRES
1500
1000
500
0 MSL
-500
418 48
418 57
371 35
345 67
420 45
463 28
430 54
372 74
488 35
507 27
463 18
439 65
883 11
442 82
519 48
362 73
708 39
518 58
535 18
702 49
868 30
600 18
519 88
882 57
842 66
484 88
680 3
778 38
754 21
812 38
645 67
716 73
781 178
641 49
887 13
522 92
678 29
634 2
608 85
885 28
882 59
768 13
752 40
756 58
692 80
718 177
718 6
671 75
616 96
737 68
478 91
575 173
652 180
744 82
856 169
612 86
718 172
774 168
545 95
736 91
678 165
729 162
863 99
640 103

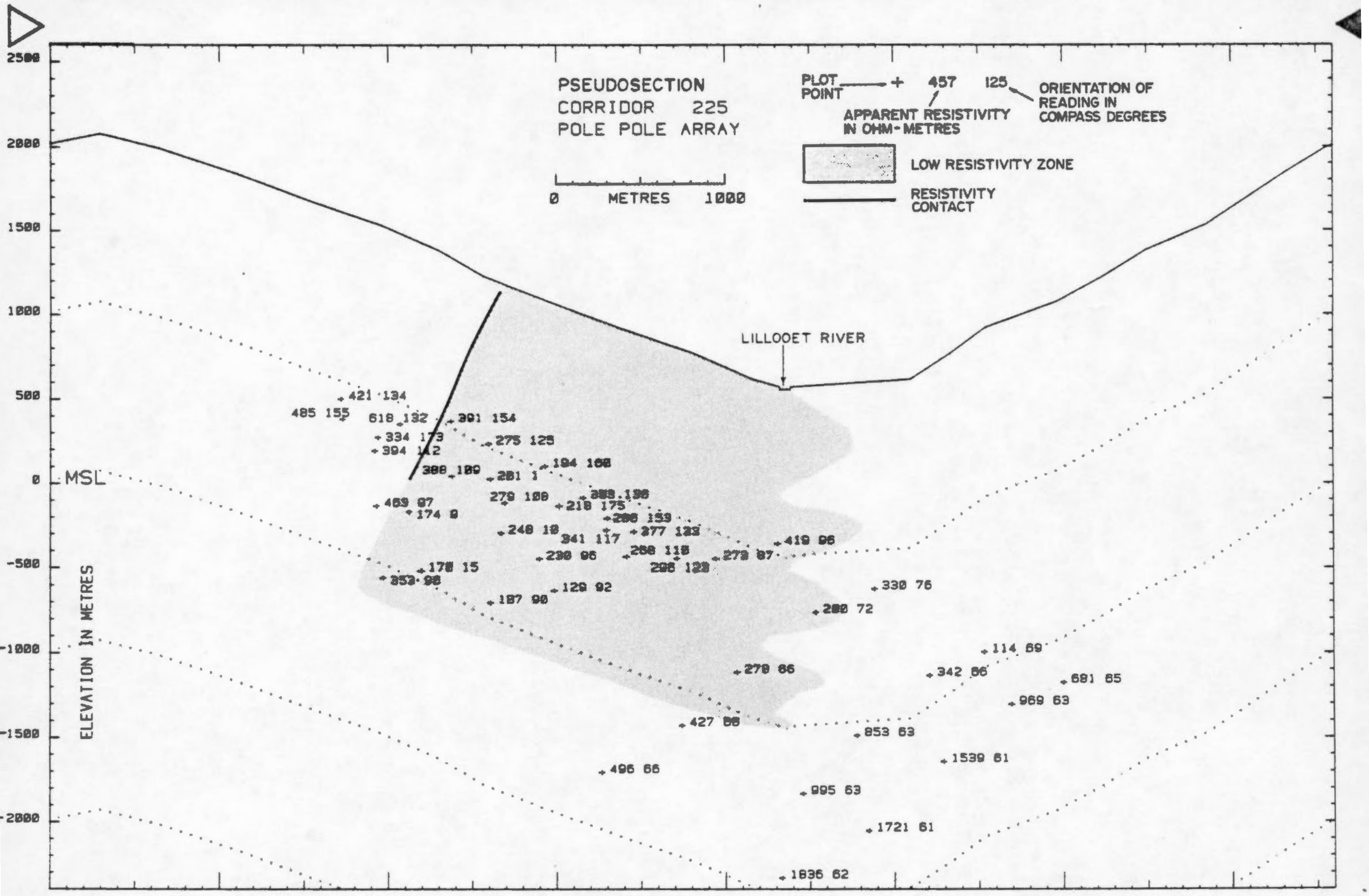

1
2
3
4
CORRIDOR 655
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
MEAGER CREEK
1500
1000
500
0 MSL
-500
ELEVATION IN METRES

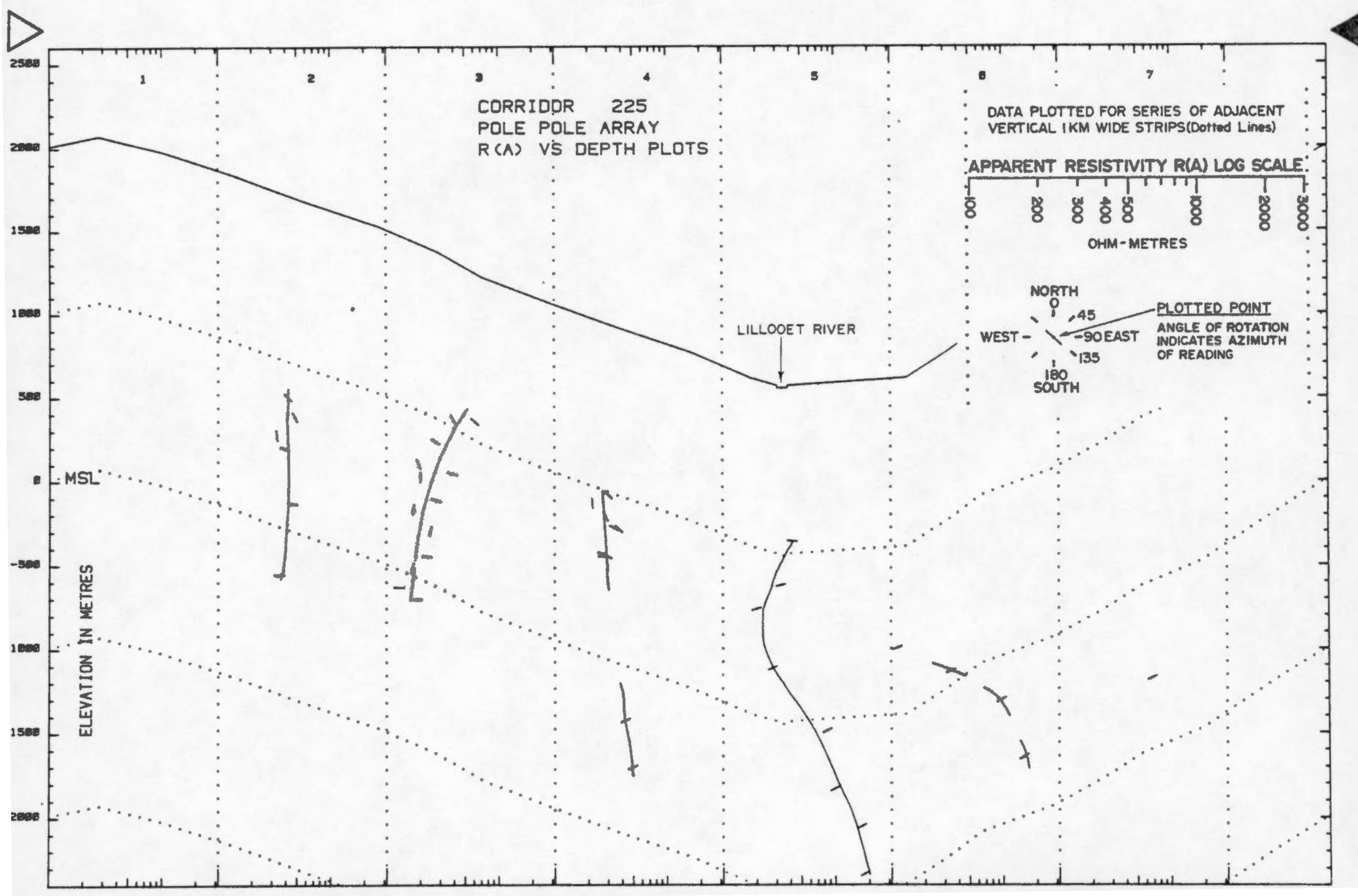

PSEUDOSECTION
CORRIDOR 205
POLE POLE ARRAY
0 METRES 1000
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
LIMIT OF VALLEY SEDIMENTS
LILLOOET RIVER
ROAD
MSL
ELEVATION IN METRES

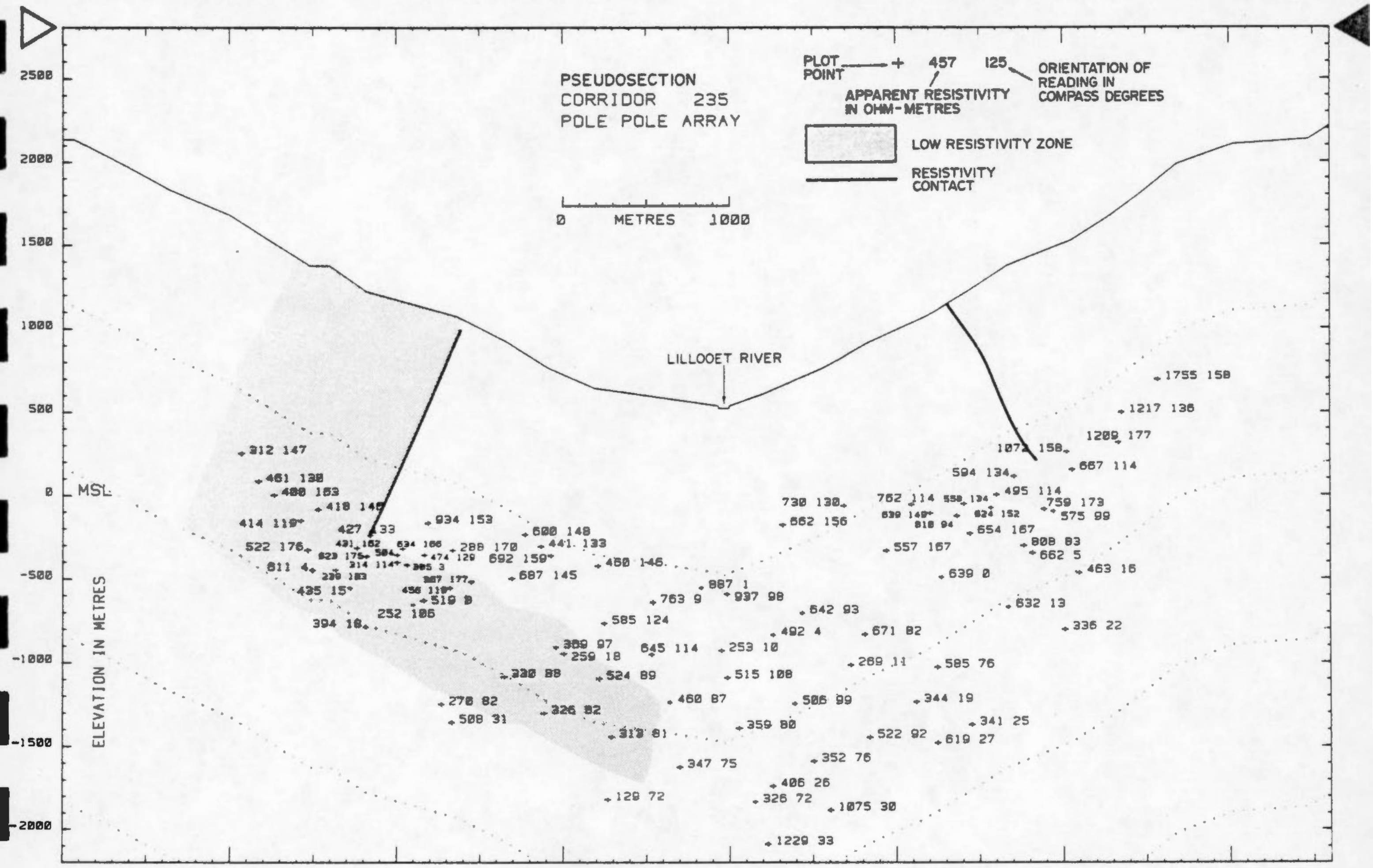

CORRIDOR 205
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
LILLOOET RIVER
ROAD
MSL
ELEVATION IN METRES

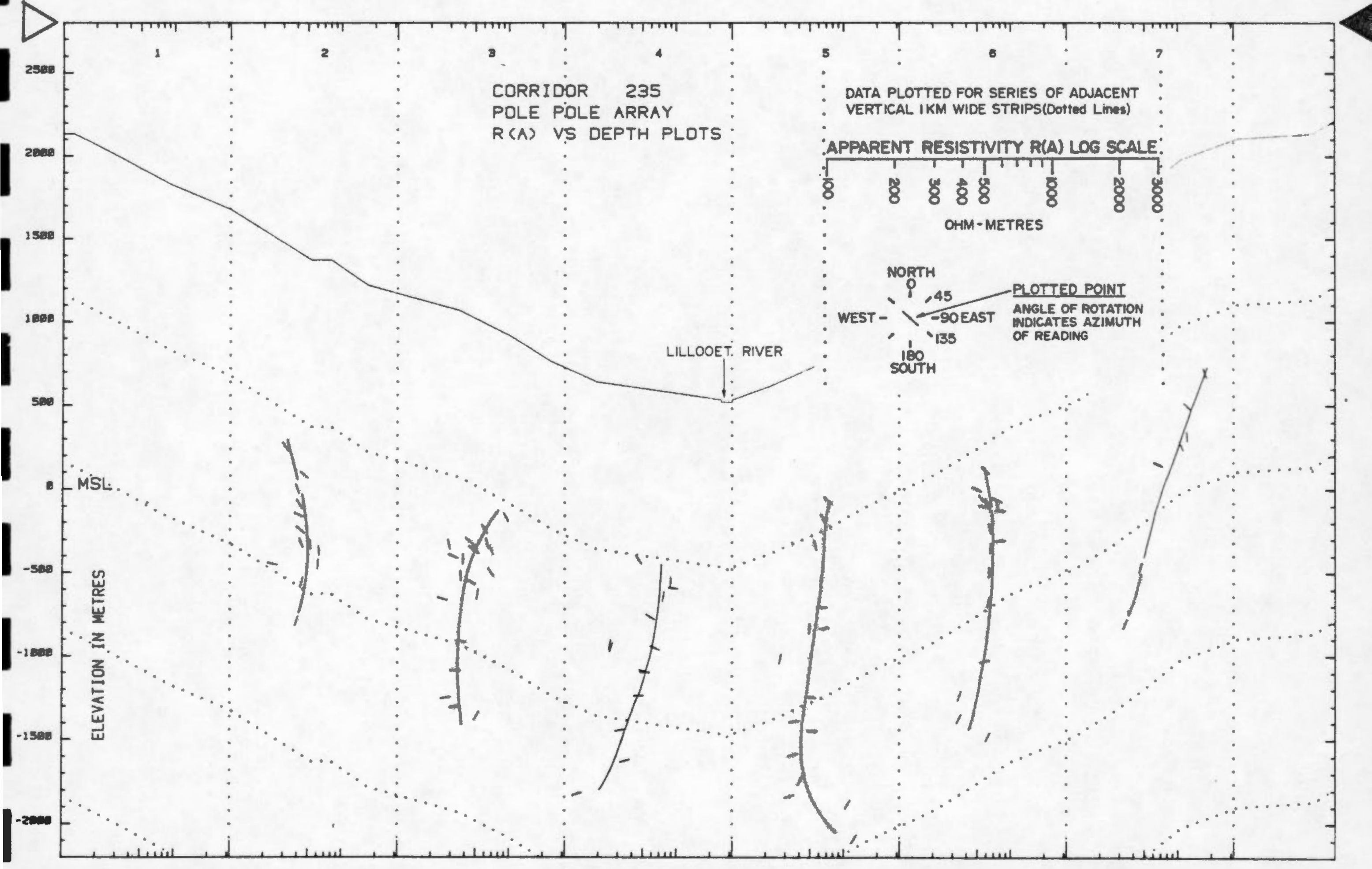

PSEUDOSECTION
CORRIDOR 215
POLE POLE ARRAY
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
0 METRES 1000
LIMIT OF VALLEY SEDIMENTS
LILLOOET RIVER
MSL
ELEVATION IN METRES

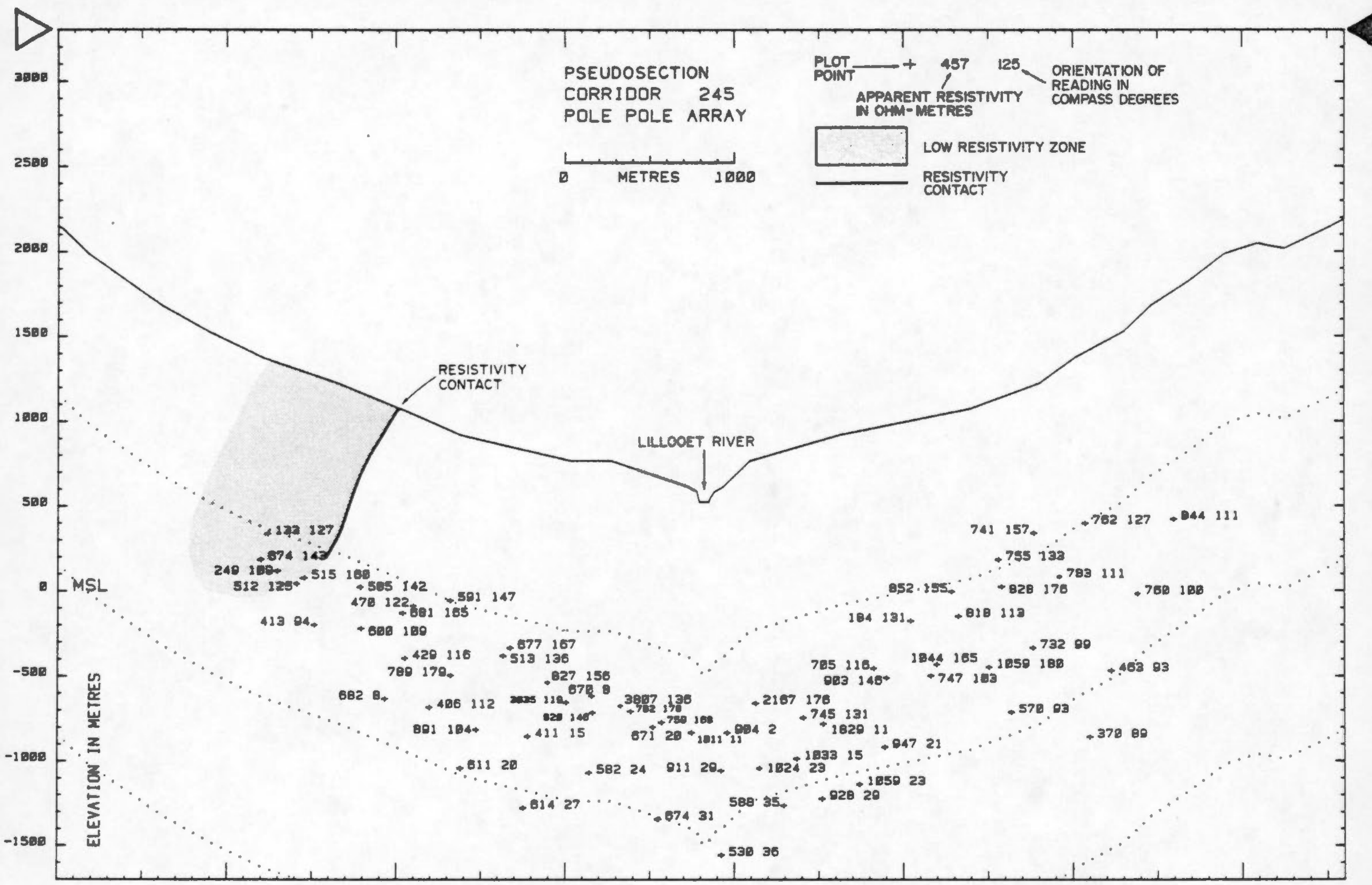

CORRIDOR 215
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100 200 300 400 500 1000 2000 3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
LILLOOET RIVER
MSL
ELEVATION IN METRES

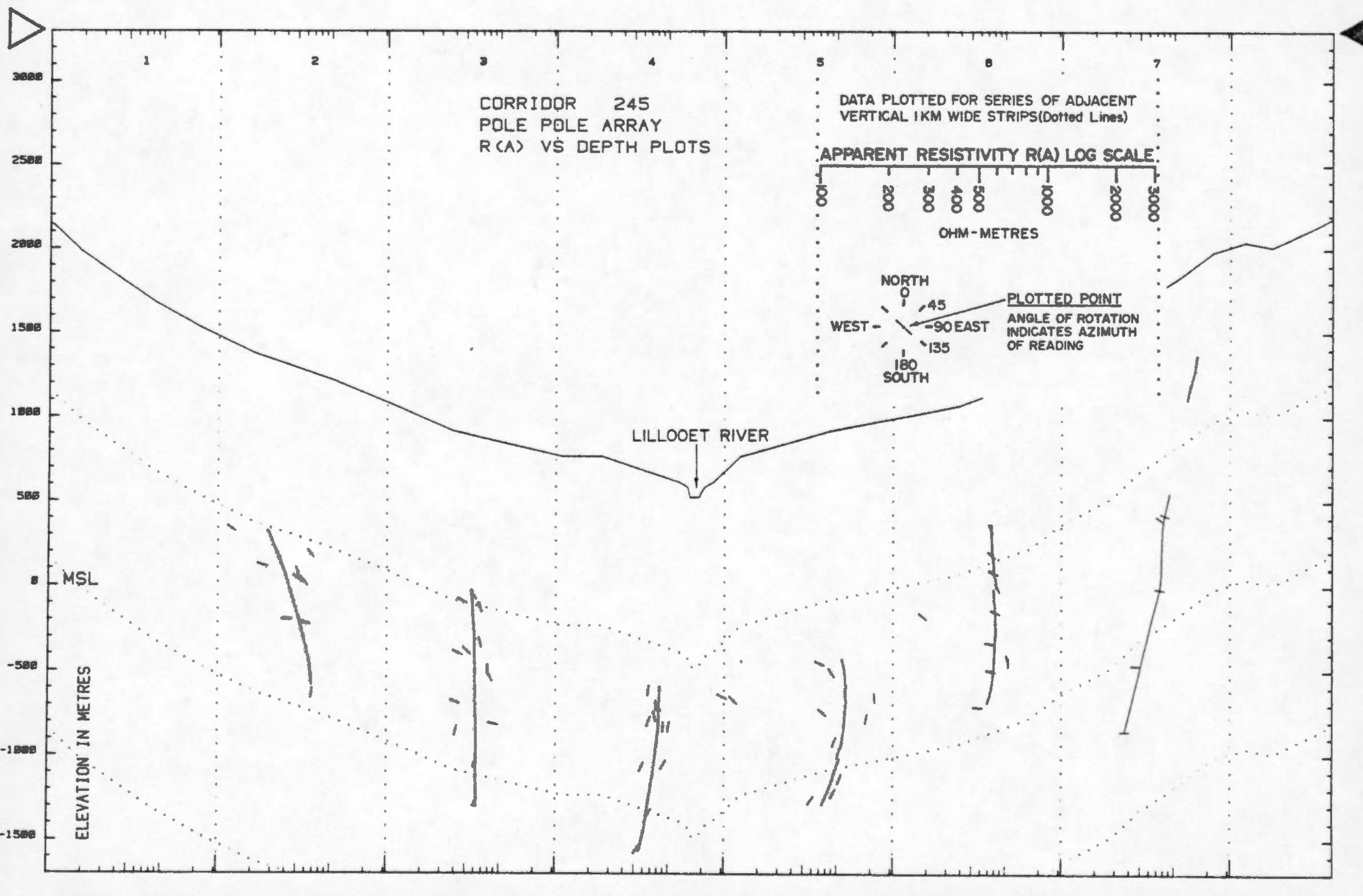

PSEUDOSECTION
CORRIDOR 225
POLE POLE ARRAY
0 METRES 1000
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
LILLOOET RIVER
MSL
ELEVATION IN METRES


CORRIDOR 225
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
OHM-METRES
NORTH
WEST
EAST
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
LILLOOET RIVER
MSL
ELEVATION IN METRES


PSEUDOSECTION
CORRIDOR 235
POLE POLE ARRAY
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
0 METRES 1000
LILLOOET RIVER
MSL
ELEVATION IN METRES
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000


CORRIDOR 235
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS (Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100 200 300 400 500 1000 2000 3000
OHM-METRES
NORTH 0
45
WEST
-90 EAST
135
180 SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
LILLOOET RIVER
MSL
ELEVATION IN METRES
1 2 3 4 5 6 7


PSEUDOSECTION
CORRIDOR 245
POLE POLE ARRAY
0 METRES 1000
PLOT POINT
457
125
APPARENT RESISTIVITY IN OHM-METRES
ORIENTATION OF READING IN COMPASS DEGREES
LOW RESISTIVITY ZONE
RESISTIVITY CONTACT
RESISTIVITY CONTACT
LILLOOET RIVER
MSL
ELEVATION IN METRES


CORRIDOR 245
POLE POLE ARRAY
R(A) VS DEPTH PLOTS
DATA PLOTTED FOR SERIES OF ADJACENT VERTICAL 1KM WIDE STRIPS(Dotted Lines)
APPARENT RESISTIVITY R(A) LOG SCALE
100
200
300
400
500
1000
2000
3000
OHM-METRES
NORTH
0
45
WEST
90 EAST
135
180
SOUTH
PLOTTED POINT
ANGLE OF ROTATION INDICATES AZIMUTH OF READING
LILLOOET RIVER
MSL
ELEVATION IN METRES

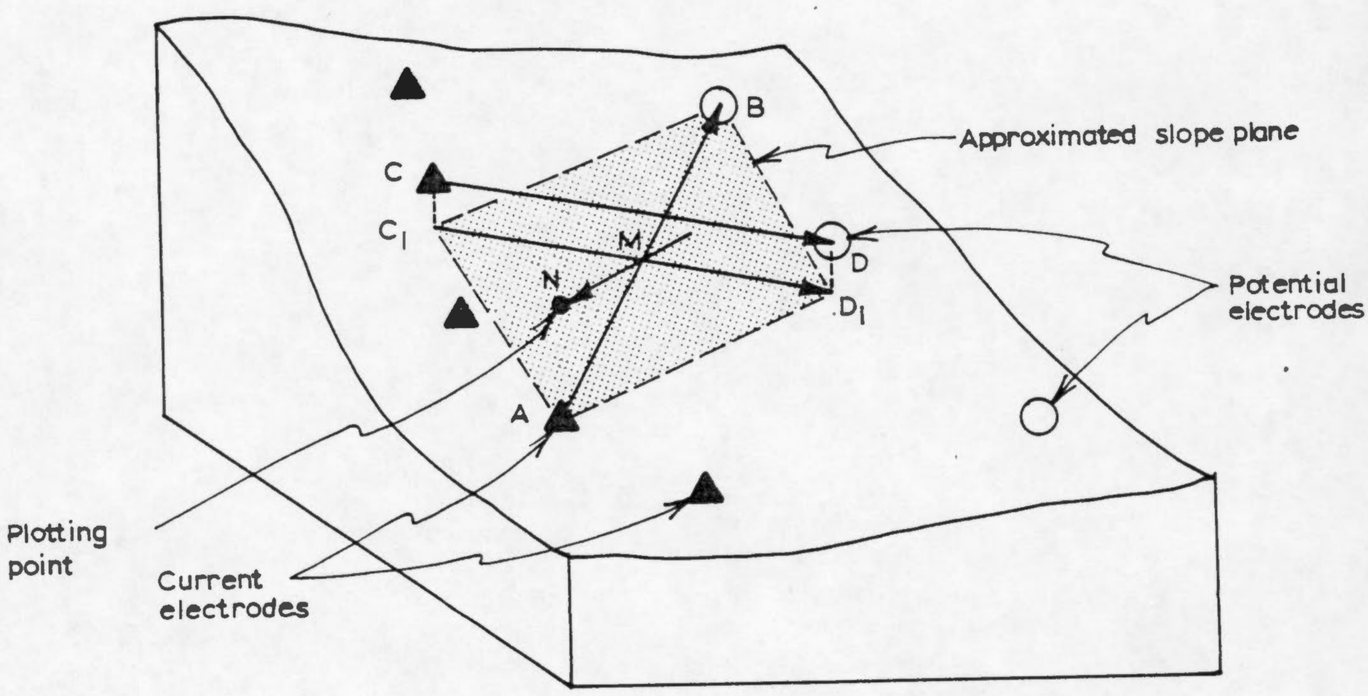
APPENDIX B-3

PLOTTING PROGRAM

The survey grid installed at Meager Creek is irregular in all three dimensions, due to the variable topography. Calculation of a nominal, conventional plotting point for each measurement required a computer program to estimate the local slope characteristics for each reading, and to compute the position of the plot point relative to the slope.

All electrode coordinates (X, Y, Z) and measurement data are stored on magnetic tape. In the example pictured below, current electrode "A" and potential electrode "B" are measurement electrodes. Positions "C" and "D", on the operative lines, are inactive electrode stations providing topographic reference points opposite each of the measurement electrodes. The effective ground slope for the measurement is approximated by the plane defined by vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$. The plot point is perpendicular to this plane from the midpoint between the measurement electrodes at penetration depth Ze.

The computer uses the stored coordinates of A,B,C and D to perform the following calculation steps:



B-3(ii)

1) compute distance AB
2) compute coordinates of bisectrix of AB (point "M")
3) identify vector $\overrightarrow{CD}$
4) compute the cross product of $\overrightarrow{CD}$ and $\overrightarrow{AB}$ ($\overrightarrow{CD} \times \overrightarrow{AB}$), a vector perpendicular to the estimated effective surface plane.
5) identify directed line segment MN parallel to $\overrightarrow{CD} \times \overrightarrow{AB}$ and length equal to Ze = 0.75(AB) into the earth.
6) compute and record the coordinates of plot point "N" (Xd, Yd, Zd).

APPENDIX B-4

RESISTIVITY SURVEY EQUIPMENT

SURVEY EQUIPMENT

All field potential measurements were taken in analog form on a Hewlett Packard chart recorder model 7155B, using self-potential offset circuitry at the input terminals. The full waveform was recorded.

Transmitter equipment for the pole-pole survey consisted of a Phoenix Geophysics IPT-1 transmitter and 3 kilowatt generator, and a Huntec Mark III LOPO transmitter.

Dipole-dipole survey used the Phoenix transmitter exclusively.

Operating frequency for the two transmitters was 0.25 Hertz, reversing square wave.

DATA PROCESSING EQUIPMENT

All data was entered by keyboard into a Hewlett Packard (HP) 9825A computer, and stored on magnetic tape cassettes in ASC11 form. Processing and graphics peripherals used were:

HP 9885 flexible disk system
HP 9827A four colour X-Y plotter
HP 9871A printing/plotting impact printer

APPENDIX C-1

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET.

Hole No. 78-H-1

Sheet 1 of 7

Project Location MEAGER CREEK (LILLOOET) Co-ordinates 5 614 630N 463 090 E Collar elevation 760 m

Date Started 78-9-10 Date Completed 78-10-21 Total Depth 602.6 m Type/Size of Bits HQ/NQ IMPREGNATED & SET

Drilling Contractor CANADIAN LONGYEAR Geologic Log By L.J WERNER Geophysical Log By L.J WERNER

General Summary Comments

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
0	11	11	-- Competent	Fine to coarse sand, fairly competent, does not slump in between shifts or runs.			
11	18	7	Competent	Coarse sand, gravel, some boulders; all mixed, could be till.			
18	24	6	Loose, lost circulation, sealed	Large boulders up to 1 m; mixed with gravel, possible boulder till. Some boulders very hard, probably granite (mud white).			
24	33	9	Loose, lost circulation @ 30 m, possibly making water	Coarse to fine gravel, minor interspersed hard boulders up to 1 m, making water (no artesian head) at 30 m.			
33	34	1	--	Sand			
34	37	3	--	Small boulders mixed with gravel.			
37	38	1	--	Sand			
38	39	1	--	Medium to fine gravel.			

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.)

Hole No. 78-H-1

Sheet 2 of 7

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
39	40	1	Hard drilling	Boulder layer.			
40	42	2	--	Medium to fine gravel.			
42	45	3	--	Boulders & heavy sand, changing to very hard boulders with breaks at heavy sand.			
45	46	1	--	Solid rock. Began coring @ 46m			
46	56	10	79%, good to 55 m; poor 55 - 56 m (20%) 49 - 50 m (20%)	Dacite-rhyodacite porphyry, 5 mm. phenocrysts & quartz blebs, fine-grained semi-translucent dark grey matrix. No vesicles. Feldspar phenocrysts euhedral, clear to white. Occasional euhedral biotite books 2-3 mm; pseudo hexagonal. Rare if any hornblende. 15% white (K spar) euhedral 5-10% quartz clear, glassy 2% biotite, 1-3mm books Balance - matrix, fine grained.	51 m	6.964	11 hrs. Solid bottom, bottom of hole, 20' below drill string.
56	64	8	Very poor recovery-all looks like pieces of rocks & cobbles	Dacite-rhyodacite porphyry, highly fractured, probably breccia. Interspersed flowing sand layers or sand-filled fractures, sand mostly quartz.	59 m	7.333	11 hrs. Soft bottom, 5 m from bottom at hole, 6m below drill string.

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.)

Hole No. 78-H-1

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
64	74	10	10% recovery, lost circulation, changed to tricone at 74 m	Chunks of dacite porphyry, one rock of vesicular dacite andesite, 5mm vesicles. Sand flows in to seal rods between runs, have to pull back 12 m			
74	103	29	Triconed	Incompetent volcanics mixed with layers or filled fractures of sand. Possibly agglomerate, breccia.			
103	108	5	Triconed	Slow indistinct transition to harder material. More biotite, hornblende & magnotite in cuttings. Change to coring bit at 108 m			
108	120	12	76%	Homogeneous rhyodacite porphyry, crumbly zones. Open fracture at 120 m; possible flow boundary.			
120	134	14	Open cavity, lost circulation at 120 m. Minor caving	Homogeneous rhyodacite porphyry, biotite to 5 mm phenocrysts. Some flow banding, generally light grey. Occasional greenish mineral along fractures. Rock fairly incompetent, crumbly to 30 cm fracture spacing.			

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.)

Hole No. 78-H-1

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
134	149	15	92% minor caving, several periods of lost circulation, regained with quick seal. Generally blocky	Rhyodacite porphyry, flow boundary 134 m, light grey to dark grey matrix. Several shear zones, generally highly fractured, spacing 2-10 cm. Feldspar phenocrysts 6-10 mm. Clay fills open fractures.			
149	187	38	100% after 151 m. More competent rock, still occasionally blocky	Rhyodacite porphyry, less crumbly & more massive, with appearance of included clasts of diorite and pumice. Minor open cavities to 1 cm, some with zeolite (chabazite) nodules. Both hornblende & biotite present.			
187	226	39	100% fairly competent, no caving, continual 40-60% circulation loss. HQ coring stopped, HQ string cemented at 226 m.	Rhyodacite porphyry, reasonably massive with some minor matrix shade changes indicating flow boundaries. Occasionally very jumbled appearance indicating mixing between flows and agglomerate horizons.	225	29.8	12 hrs. since circulation. (hole cleaned & flushed after cementing casing)

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.) Hole No. 78-H-1

Sheet 5 of 7

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
226	225	29	100% little caving, fairly competent even when highly fractured, probably due to drilling mud. 40-60% circ, loss.	Rhyodacite porphyry, flow banded, very rusty fractures toward bottom. Variable fracturing, spacing 10-40 cm. Pumice or vesicular fragments increasing.			
255	262	7	50% Remarkably competent for semi-lithified material.	Semi-lithified polymict conglomerate, some sandy layers contributing to lost core. Cemented & triconed.	258	54.9	12 hrs.
262	271	9	95% (100% after 269).	Greenish, altered intrusive probably epidotized quartz monzonite, Pyrite along fractures. Highly fractured to 269 m, then competent.			
271	294	23	100% competent. Core in 5' lengths in places.	Massive quartz monzonite, occasionally altered (kaolinized) in fractures, partially epidotized. Pyrite occurs disseminated and in fractures.	279	66.9	12 hrs.
294	327	33	100% competent, no caving, some loss at circulation.	Quartz monzonite, more fractured to crumbly in places. Feldspars mostly kaolinized, mafics chloritized. Silica cemented in fractures.	301	86.7	12 hrs.

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.) Hole No.

Sheet 6 of 7

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	T°C	Comments, hole bottom, elapsed hours since circulation.
327	332	5	100%	Massive fine-grained, green matrix, feldspar porphyry dyke, chill margins on both contacts. Fracture spacing 10-50 cm to crumbly.	331	88.8	12 hrs.
332	370	38	100% competent	Altered quartz monzonite, kaolinized feldspar, considerable pyrite. Fracturing highly variable, most fractures contain precipitated silica, veins to 4 cm thick.	360	93.9	12 hrs.
370	370.3	.3	100%. Competent.	Fine-grained mafic dyke, green matrix.			
370	431	61	100% competent, some caving	Altered quartz monzonite, kaolinized feldspars, considerable pyrite. Fracturing highly variable, spacing 50 cm to crumbly in 1 cm chunks. Silica veins, common, considerable pyrite disseminated in veins and cavities. Some epidote.	387 410 426	95.5 91.3 89.8	12 hrs. 12 hrs. 12 hrs.
431	450	19	100%	Relatively unaltered quartz monzonite to granodiorite, rare silica veins. Fracture spacing 40-80 cm, with occasional crumbly zones.	447	84.2	12 hrs.

NEVIN SADLIER-BROWN GOODBRAND LTD. - GEOTHERMAL TEST HOLE LOG SHEET (Cont.)

Hole No. 78-

Sheet

Projec Lc
Date S
Drilli
Genera Su

DRILLING LOG				GEOLOGICAL LOG	GEOPHYSICAL LOG		
Depth (m) From	To	Metres	% sample recovery, general hole conditions	Rock type, description, alteration, precipitated minerals, fracture density.	Depth	$T^{o}C$	Comments, hole botto hours since circulat
450	461	11	80%. 2 runs lost due to core tube not locking	Altered quartz monzonite, kaolinized feldspar. Fracture spacing 3-30 cm. Still few silica veins, rare pyrite.			
461	481	20	100% competent.	Altered quartz monzonite, kaolinized feldspars, increase in silica veins and pyrite. Fracture spacing 20-120 cm, highly variable.	473	84.1	12 hrs. Possible re problems with probe
481	483	2	100% competent.	Fine-grained green mafic dyke, cut by silica veins.			
483	556	73	100% competent, increasing lost circulation to no return.	Altered quartz monzonite, kaolinized feldspars, extensive silica/pyrite veins. Fracturing extremely variable, 1 to 50 cm.	491 517 534 544	88.5 93.0 97.5 99,4	12 hrs. 12 hrs, soft bottom 12 hrs. rebuilt prob 12 hrs.
556	572	16	85% caving, loss of head pressure	Coarse-grained porphyritic granodiorite-quartz diorite massive to 561 m, then into highly sheared material. All distinctly free of silica veins.	577	101.8	12 hrs.
572	603	31	90% lost core due to some open cavities & extremely crumbly material. Minor periods of circulation return. Some caving problems near bottom.	Altered quartz monzonite, kaolinized feldspars, some sericite-talc alteration along fractures. Layered silica and drusy quartz veins. Fault/shear zone to 585m, then to more massive with fractures variable, spacing 1-60 cm.	573	102.8	12 hrs. Probe cabl by heat, pressure, t blems.

De th
From
0
47.
71.
76.
121.

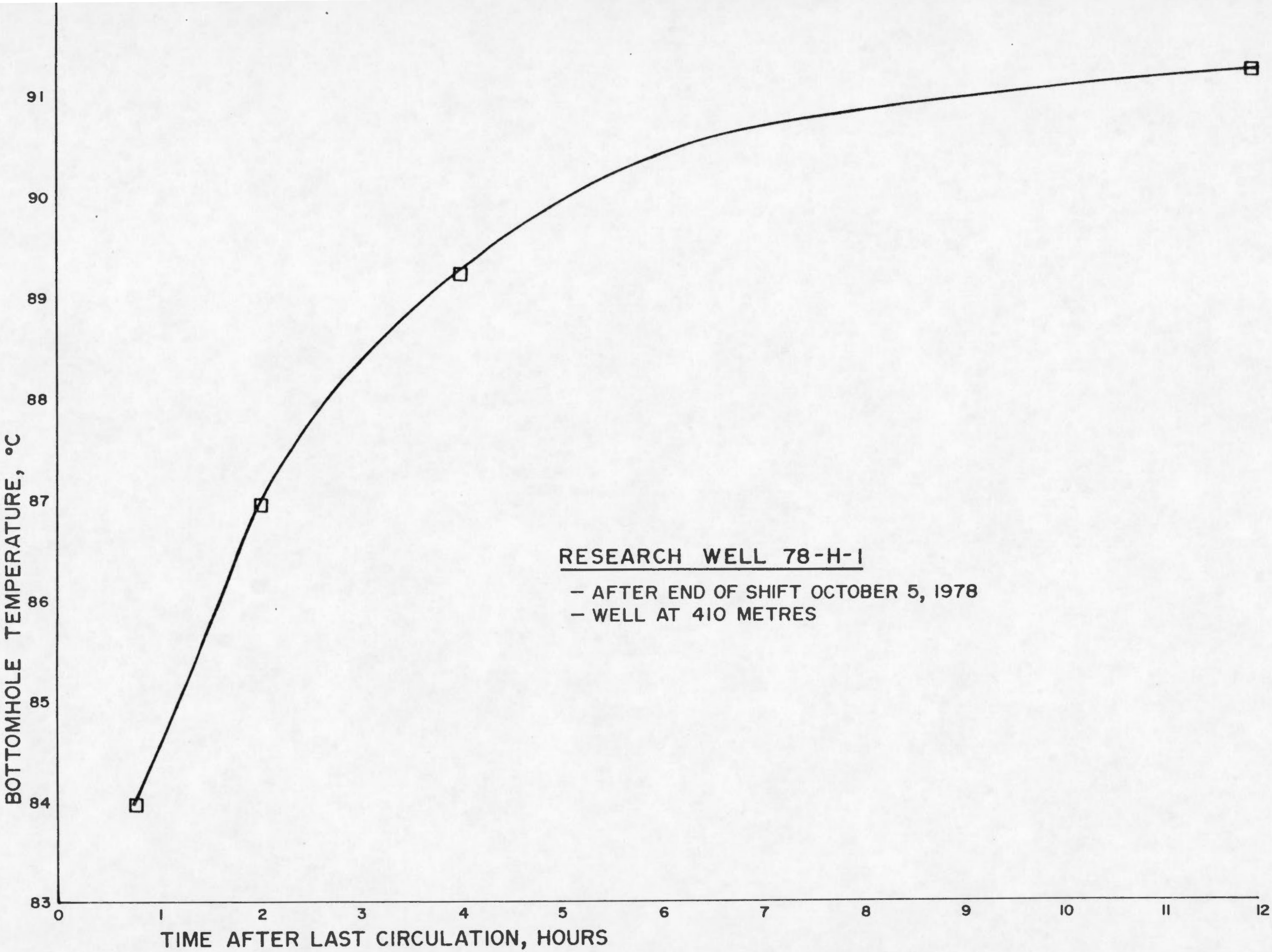
De th
Fro
176
182

APPENDIX C-3

GRAPH OF TEMPERATURE REBOUND AFTER STOPPED CIRCULATION

Temperature measurements in research wells are taken at the bottom of the hole after each drill shift as drilling progresses. Undisturbed temperatures (pre-drilling) at depth are affected by drilling operations including (1) heat input from friction (2) heat dissipation by relatively cold circulation fluid in the hole (3) heat dissipation by conduction through drill bits and drill rods. To cover the above effects, standard practice is to lift the rods and drill bit 6 - 10 metres off bottom and cease drilling operations for 12 hours before making the temperature determination. This allows the "bottom-hole temperature" to equilibrate with the natural ambient temperature.

The graph on the following page is a specific case documenting the temperature rebound after ceasing drill operations. It shows that at least 10 hours are required to reach representative equilibrium temperatures following stopped circulation. The curve and rebound time is dependent on a number of parameters including (1) "true" bottom-hole temperature (2) temperature of circulating drill fluid (3) temperature, rate and location of natural water flows into the hole (4) structure and heat conductivity of the surrounding rock.



APPENDIX C-3 GRAPH OF TEMPERATURE REBOUND AFTER STOPPED CIRCULATION

APPENDIX D-1: SUMMARY OF PERCUSSION DRILLING

HOLE NO.	(m) NORTHING	(m) EASTING	(m) DEPTH OF PENETRATION	(m) DEPTH OF OVERBURDEN	(m) DEPTH OF PVC PIPE	(°C/m) MAX. TEMP. (DEPTH)	(°C/km) TEMP. GRADIENT	ROCK TYPE/OVERBURDEN
PDH 78-1C	5610290	469320	76.2	15.2	75.6	10.56/73.1	56.9°C/km	-light green banded metasediments
PDH 78-2	5605010	468990	22.9	-	15.2	5.71/7.3	-	-colluvium with large blocky slide boulders
PDH 78-3	5607570	471510	61.0	0.0	60.4	7.71/58.8	-	-biotite muscovite schist and gneiss disseminated pyrite up to 10 percent
PDH 78-4	5605320	469260	39.6	-	25.9	5.34/14.0	-	-colluvium
PDH 78-5	5605530	469360	51.8	-	42.7	10.16/30.5	-	-soft, clay rich, volcanic derived colluvium
PDH 78-6	5602160	466390	30.5	-	?	7.73/21.9	-	-overburden, adjacent to road cut exposure of foliated quartz diorite
PDH 78-7	5603290	467650	61.0	0.0	61.0	6.81/27.7	18.7°C/km	-hornblende quartz diorite (82 my)
PDH 78-8	5608410	470920	18.3	-	-	-	-	-river gravel, sandy with round boulders
PDH 78-9	5608320	471000	30.5	-	24.4	4.91/15.5	-	-river gravel
PDH 78-10	5608420	470860	24.4	-	24.4	6.27/11.3	-	-river gravel
PDH 78-11	5608440	470880	18.3	-	12.2	-	-	-river gravel
PDH 78-12	5609430	470980	24.4	-	22.9	4.63/11.3	-	-colluvium, alluvium

NOTES: Drill Contractor: Josco Mining Co. Ltd.
Hole diameter : 5 cm.
PVC Lining : I.D. = 2.2 cm, O.D. = 2.5 cm

JEROME INSTRUMENT CORPORATION

DESCRIPTION AND OPERATING INSTRUCTIONS

FOR

MODEL 301 GOLD FILM MERCURY DETECTOR

P.O. BOX 988 JEROME, ARIZONA 86331 (602) 634-5908

INTRODUCTION

The following method is for the determination of total mercury in soils and rocks in the 1 - 5000 ppb range using the Model 301 Gold Film Mercury Detector. The precision of this method is ± 5% of the amount present at the 95% confidence limit in soils and rocks at 100 ppb. The method is based on the resistivity change in a thin gold film upon the adsorption of elemental mercury.

Principal of Operation:

The following is an overview of the instruments operation. Please read the section on procedures before attempting to operate the instrument.

When a sample is heated in the combustion assembly (see Fig. 1) gaseous combustion products including mercury from the sample enter the air stream and pass over a gold-plated collector coil contained within the plug-in module on the panel face. The mercury is adsorbed on the gold collector and the remaining combustion products pass into the atmosphere at point (6) in Fig. 1. A timed cycle is then activated during which the gold collector coil is heated for 9-10 seconds to volatilize the mercury back into the air stream. The sample mercury and any H_2S that may be present pass into the mallcosorb where H_2S is selectively adsorbed. The air stream is then split and mercury is removed from the reference stream by palladium black on pyrex wool (Filter A) before passing over the reference gold film. The other stream passes over an equal quantity of clean pyrex wool (Filter B) and over the sensor gold film; the mercury in the air stream causing the resistance of the sensor film to increase. The reference and sensor films are two legs of a wheatstone bridge. The resistance bias between them is measured and displayed on a digital galvanometer. Any mercury not adsorbed by the film or mercury released by the films when they are heated and cleaned is exhausted through Filter C, which contains activated charcoal to adsorb the mercury and prevent contamination of the work area.

An auto-zero circuit continually compensates for any drift in the resistance of the films. When mercury adsorbs on the sensor film the rate of change in resistance of the sensor film over-rides the auto-zero and a readout is obtained on the digital meter. The peak reading will be displayed for a few seconds, then the auto-zero circuit will begin automatically re-zeroing the bridge.

A timer circuit controls the heating of the gold collector coil and the gold films. The timer cycle is approximately 10 seconds for the collector and 10 minutes for the films. The small lights will turn on when either of these cycles are activated. The films need to be heated after 100 - 150 samples have been analyzed, the exact number dependent on the quantity of mercury present in the samples.

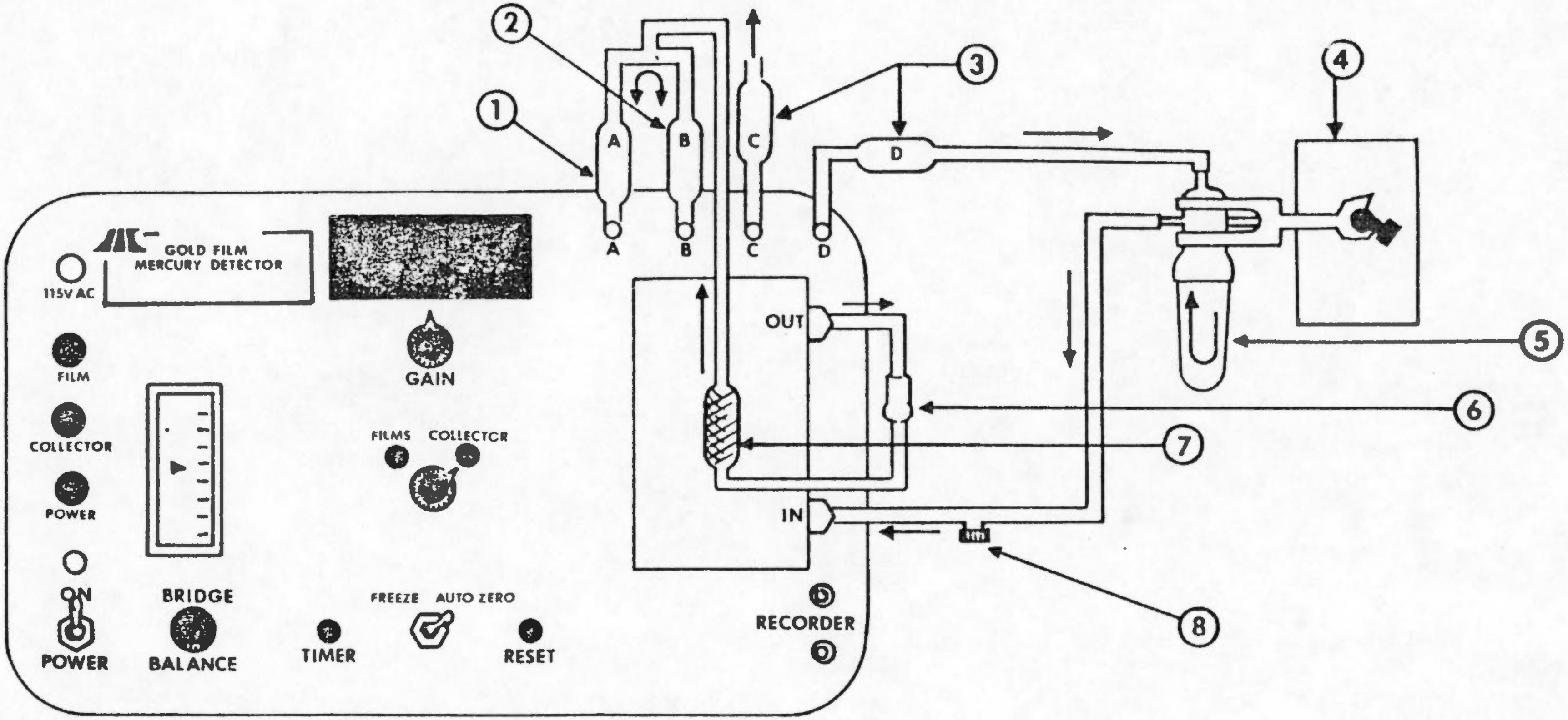


FIGURE 1: Flow system and tubing schematic of the Model 301 Gold Film Mercury Detector.

1. Palladium black on pyrex wool
2. Pyrex wool
3. Charcoal filters
4. Ring stand and clamp
5. Combustion assembly
6. Quick disconnect
7. Mallcosorb
8. Standard septum

Procedure:

Referring to Fig. 1, the tubing, filters and combustion assembly are connected as shown. The six yellow valves marked A, B, C, D and IN and OUT on the panel face are sealed to air flow unless the steel inserts on the end of the tubing are pushed in and firmly seated. (To remove these inserts press in on the spring clip and pull up on the inserts.) Once all of the tubing and filters are connected as shown in Fig. 1, the instrument is ready to turn on. DO NOT TURN THE INSTRUMENT ON UNTIL ALL TUBING IS CONNECTED. THE INTERNAL AIR PUMP MAY BE DAMAGED AS THE FLOW SYSTEM IS SEALED UNLESS THE STEEL INSERTS ARE PLUGGED INTO THE VALVES.

Turn the power switch on and allow the instrument to warm up for 5 - 10 minutes. This allows the gold films to stabilize in the air flow.

> Note: If the meter registers all zeros, turn the power switch off and on until a number appears on the meter.

With power to the system the internal air pump will always be running. After the warm up period the instrument is ready to be balanced. Check the following: the switch marked "films" and "collector" should be turned to "collector"; the gain adjust should be in the first or second position and the pump speed at the first or second setting for routine soil or rock analysis. Turn the bridge balance pot either clockwise or counterclockwise until the needle on the small meter above the bridge balance pot is roughly centered. Now push and release the reset button. The digital panel meter should now indicate a stable reading between ± .002 to .010. The auto-zero circuit will continually compensate for any small drift and maintain this zero or near zero reading.

> Note: The meter will never read exactly zero, but will show some slight offset around the zero point which will vary slightly with the gain adjustment.

The instrument is now ready to be calibrated using the syringe, calibration vessel and chart. (See Appendix I for details on the calibration vessel and syringe technique.)

> Note: Be sure that a combustion bulb is inserted. If the bulb is not in place the air flow through the instrument will change and the standard values obtained will be incorrect.

Before injecting a standard into the septum (#8, Fig. 1) check to insure there is no residual mercury contamination on the gold collector coil, mounted within the plug-in module on the panel face. To do this push the timer button down and release. This activates a timed heating cycle which will automatically heat the collector coil for 10 seconds and volatilize any residual mercury. If a reading is noticed on the digital panel meter (greater than 5 - 7 digits) repeat the above procedure after re-zeroing the instrument by pushing the reset button. TO PREVENT OVERHEATING OF THE COLLECTOR COIL, ALLOW A TWO MINUTE COOLING PERIOD BEFORE ACTIVATING THIS CYCLE A SECOND TIME.

Once it has been determined that the collector coil is free of mercury a standard can be injected and the instrument calibrated. Using the syringe, ½ to 1 cm3 of mercury saturated air is withdrawn from the calibration vessel and injected into the standard septum. (See Appendix I for additional details on this procedure.) After the standard has been injected, press the timer button. After approximately 9 - 10 seconds the highest reading on the panel meter is recorded (minus the offset around the zero point). This procedure should be practiced until it can be done with reproducible results.

The mercury value may now be calculated by dividing the number of nanograms in the standard by the peak reading minus the offset on the meter. Example: If 10 nanograms of mercury were injected and a reading of 200 was recorded the value per digit would be .05 nanograms. This value may be increased or decreased by adjusting the gain under the digital panel meter. For most routine soil and rock analysis the first gain position is adequate. Turning this knob clockwise increases the gain. If you re-adjust the gain a new mercury standard will have to be injected as the number of nanograms/digit will change.

Sample Analysis:

Using the calibrated scoops measure a level cup of -80 mesh soil and place in a combustion bulb. As most soils run between 25 - 100 ppb the .1 gm scoop is adequate. Use the .25 gm scoop if greater precision is desired as a larger sample size will increase reproducibility. In very high mercury samples the .01 scoop should be used. Reproducibility can be improved by weighing the samples on an analytical balance.

Place the combustion bulb back into the holder and disconnect the quick connect. (#6, Fig. 1) By disconnecting the quick connect the gaseous combustion products from the soils are vented to the atmosphere. Heat the soil for 1 minute using a low flame on a propane torch. The bulb and soil should glow a dull red after the 1 minute heating period.

> Note: The combustion assembly glassware is often contaminated with mercury if it has not been heated for some time. To insure the glassware is not contaminated, heat the combustion bulbs with the torch before using.

After the 1 minute heating period remove the bulb containing the combusted soil and replace with a bulb containing the next sample or a clean bulb. Wait 1 minute before reconnecting the quick connect. This above procedure helps insure that residual organics from the soil combustion will not interfere with analysis. If Filters A and B are packed correctly, i.e. equal densities, the air stream will split exactly in half before entering the sample chamber containing the gold films. Any residual organic "smoke" will pass over the sensor and reference film in equal concentration and balance out any possible interferences. This is extremely important to insure reproducible results.

After the quick connect has been reconnected check to see that the instrument is zeroed and then press the timer switch. Record the peak value minus the offset and press the reset button. Periodically check to see that the bridge balance meter is not off scale. If this meter is off scale the auto-zero will not function properly, and the digital meter will not zero.

To calculate the mercury value of the soil in ppb:

$$\frac{\text{ng Hg in standard}}{\text{Standard reading}} \quad X \quad \frac{\text{Sample reading}}{\text{Sample weight}} = \text{ppb Hg}$$

Example:

$$\frac{10}{200} \quad X \quad \frac{158}{.1} = 79 \text{ ppb}$$

Note: If a high reading (greater than 300 ppb) is obtained, check that the collector coil is free of any residual mercury. If a reading is obtained add this to the value obtained from the first heating cycle. Sometimes a sample high in mercury will cause the instrument to go off scale, i.e., $\pm$ 1.999. If this happens reduce the sample size and repeat the analysis. If an extremely high sample is run, i.e., 1 ppm, it may be necessary to allow a few minutes for the instrument to stabilize.

Standards should be run after every five to seven samples. The films will gradually lose their sensitivity and the standard value will correspondingly decrease. A typical group of analyses is shown in Table I illustrating this decrease in sensitivity.

TABLE I

Typical Analysis Showing Decrease in Standard Values

Sample #	Sample Size	Meter Readout	Standard Value	ppb Hg
Standard 22°C	1cm3 = 16 ng Hg	167	.096	
JR-8	.1 gm	62	.096	60
JR-9	.1 gm	313	.096	300
JR-10	.1 gm	371	.096	356
JR-11	.1 gm	422	.096	405
Standard 22°C	1cm3 = 16 ng Hg	159	.101	
JR-12	.1 gm	59	.101	59
JR-13	.1 gm	181	.101	181
JR-14	.1 gm	62	.101	62
JR-15	.1 gm	667	.101	667
Standard 22°C	1cm3 = 16 ng Hg	148	.108	

After approximately 2000 nanograms have collected on the films the filters marked A and B should be switched. There are two gold films in the sensing unit and when one becomes saturated with mercury the second film may be used. Move filter A to B and B to A and calibrate the instrument as previously explained.

When both films become saturated the films should be heated to volatilize the accumulated mercury. Turn the switch marked "collector" and "films" to "films" and press the timer button. The films will heat automatically for 10 minutes, volatilizing the accumulated mercury and restoring sensitivity. IT IS IMPORTANT TO KEEP THE FLOW SYSTEM INTACT DURING THIS HEATING CYCLE. This allows the mercury volatilizing from the fims to exhaust from the system and prevents the films from overheating. After this heating cycle is complete it will take another 20 minutes until the instrument is ready to operate once again. This period of time is necessary to allow the films and film chamber to cool after the heating cycle.

OPERATIONAL OUTLINE

1. Connect tubing, filters and the combustion assembly as shown in Figure 1.
2. Check that the collector coil is free of any residual mercury.
3. Calibrate using saturated vapor.
4. Place sample to be combusted in the combustion assembly.
5. DISCONNECT quick connect.
6. Combust sample for one minute.
7. Replace combustion bulb with clean bulb containing the next sample.
8. Reconnect quick disconnect, wait 10 seconds.
9. Activate collector cycle and record highest reading.
10. Calculate result in ppb as outlined in manual.

APPENDIX I

The mercury concentration in the samples is determined from the ratio of the instrument readings of the sample and a standard; this standard usually being a measured quantity of mercury saturated air. A drop or two of clean mercury is placed in a closed container with a septum or small hole for withdrawing the standard (Fig. 2). The container should not be so tight that the interior cannot reach equilibrium with atmospheric pressure. It should be insulated to minimize temperature change, which is monitored with a thermometer, as the mercury content of the air only slowly reaches equilibrium. The standard is withdrawn in a 2.5 cm3 calibrated gas-tight syringe, care being taken that the needle does not come in contact with metallic mercury. Syringing the standard takes some practice. When withdrawing the standard the plunger is brought back slowly past the calibration mark, then back to it. The needle is allowed to remain in the container for a few seconds until the pressure in the syringe equals the pressure in the container. The needle is inserted into the standard septum (which should be replaced periodically) and the mercury vapor injected slowly into the system. This procedure should be practiced until it can be done with reproducible results. ($\pm$ 5%). Table II lists the weight of mercury contained in a cm3 of saturated air at various temperatures.

TABLE II

Temperature/concentration Values of Mercury

Temp. Degrees C	Nanograms/cm3	Temp. Degrees C	Nanograms/cm3
10	5.5	21	14.5
11	6.0	22	15.8
12	6.5	23	17.2
13	7.2	24	18.8
14	7.8	25	20.5
15	8.5	26	22.3
16	9.3	27	24.5
17	10.2	28	26.7
18	11.1	29	29.2
19	12.1		
20	13.2		

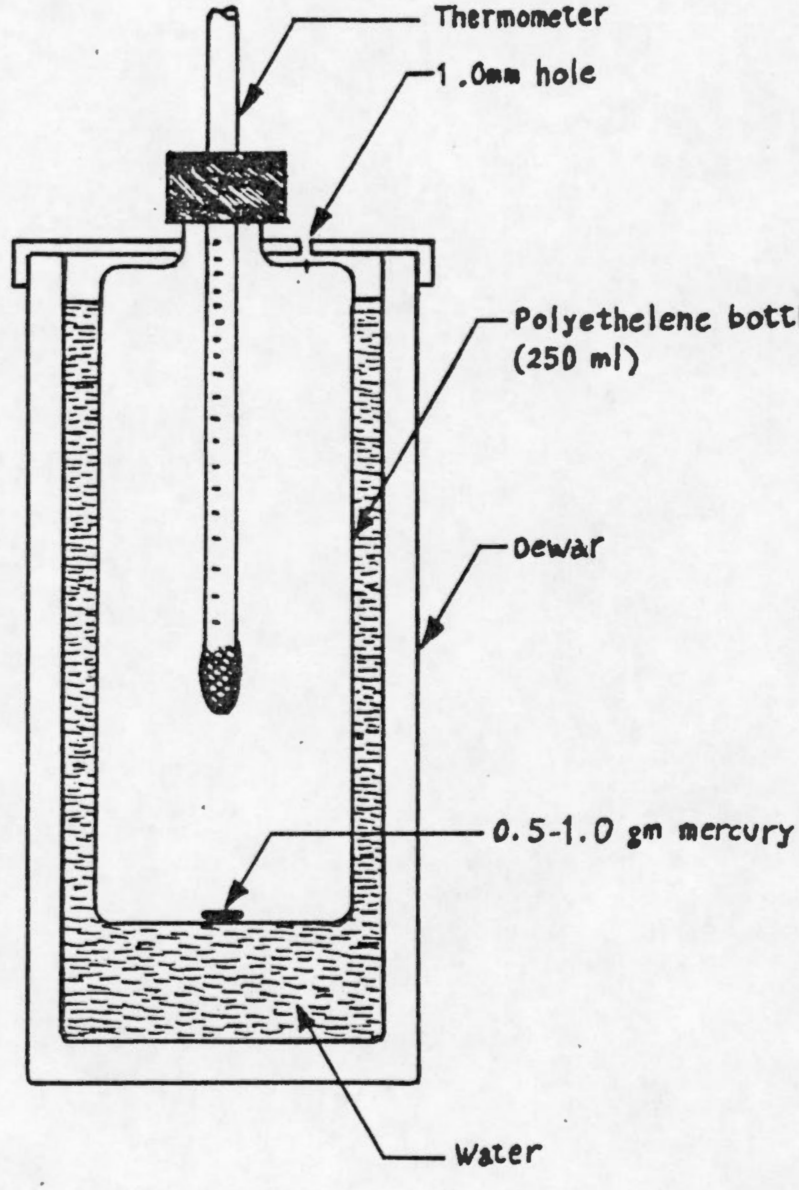


FIGURE 2: Mercury Standard Set-up.

APPENDIX II

TROUBLE SHOOTING

1. DECREASE IN FILM SENSITIVITY

(A) $PdCl_2$ filter is saturated with mercury. This condition may be checked by placing the septum assembly before the $PdCl_2$ filter and injecting a mercury standard. If a signal is seen on the digital readout, the filter is allowing mercury to pass and should be cleaned. This is done by unpacking the pyrex wool saturated with $PdCl_2$ and heating to 400°C for 1 - 2 hours. This will volatilize the accumulated mercury and restore the filters efficiency. When repacking the filter, it is important that both the $PdCl_2$ filter and the pyrex wool filter offer equal impedance to air flow. This can be checked by using a flow meter in each side of the line, i.e. before Filter A and Filter B, Figure 1. The filter packing can then be adjusted until both filters are flow balanced. Alternatively a replacement set of filters may be purchased.

(B) Leak in the flow system:

Check tubing connectors and filters for leaks. Also make sure that the mallcosorb is not packed too tightly or saturated with moisture.

2. COLLECTOR WILL NOT BLANK

(A) If a persistent signal is noticed of approximated 20 - 30 digits even after 3 - 4 consecutive blank cycles on the collector, replace the mallcosorb. The mallcosorb should be replaced periodically, generally after 200 - 300 samples.

(B) System contaminated with mercury due to excessively high mercury sample, i.e. > 20 ppm. Discard tubing and standard septum before the intake into the collector box. Heat the top of the combustion assemble to remove any residual mercury.

(C) When operating the instrument in a laboratory where high mercury levels are present in the atmosphere, Filter D should be replaced periodically, otherwise mercury from the atmosphere will contaminate the collector coil.

GENERAL MAINTENANCE

The combustion bulbs should be cleaned after each analysis. Discard the combusted sample and clean the inside of the bulb of any excess soil particles using a stiff bristle brush. (Nipple brushes, available at any drug store are ideal for this purpose). The combustion top should be cleaned periodically and the tubing replaced from the outlet of the combustion assembly to the intake of the collector coil, normally after every 200 - 300 samples.

The mallcosorb needs replacement generally after 200 - 300 samples. To check the condition of the mallcosorb run 2 heating cycles (allowing for the 2 minute cooling period) on the collector coil. If a persistent signal of approximately 15 - 25 digits is noticed, replacing the mallcosorb will normally correct this high blank level.

EQUIPMENT LIST

(1) Gold film mercury detector
(2) Activated charcoal filter (Filters C and D)
(3) Pyrex wool filter (Filter A or B)
(4) Palladium black on pyrex wool filter (Filter A or B)
(5) Mallcosorb filter (Filter E)
(6) Tygon tubing
(7) Combustion assembly (1 top and 5 bulbs)
(8) Propane torch
(9) Sample scoops (1 gm, .25 gm, .1 gm and .01 gm)
(10) 2½ cc syringe
(11) Standard septum
(12) 0-100°C thermometer
(13) Accessory carrying case
(14) Ring stand
(15) 3-prong clamp

APPENDIX E-2

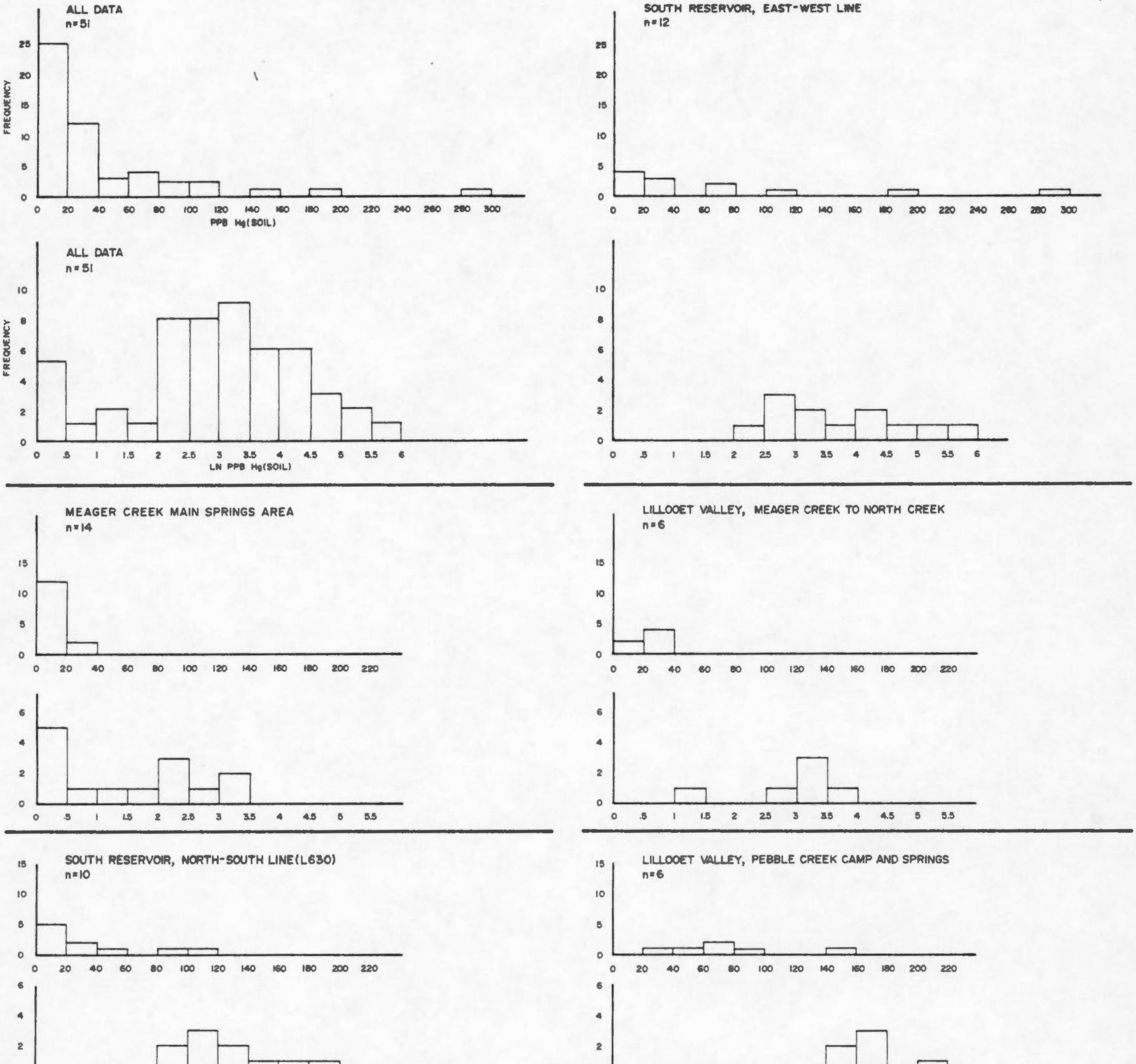
MERCURY SURVEY - TABLE OF RESULTS

SAMPLE	PPB Hg	LN PPB Hg	REMARKS	PEAK TO BACKGROUN RATIO
MAIN SPRINGS AREA:	N = 14			
80E 100S	0	0.01	Brown forest soil, dry birch	0
80E 120S	9.5	2.25	Grey sandy silt, near swamp	.3
100E 100S	0	0.01	Black muck, cold seepage	0
120E 120S	6.3	1.84	Dry sandy clay	.2
140E 60S	0	0.01	Sand under moss	0
140E 80S	9.3	2.23	Dry coarse sand	.3
140E 120S	21.6	3.07	Brown forest soil	.7
140E 140S	15.4	2.73	Brown forest soil	.5
140E 160S	24.7	3.21	Coarse brown sand, rock fragments	.8
180E 100S	2.0	0.69	Black muck, warm seepage	.1
200E 40S	3.2	1.16	Dry, grey sand	.1
200E 100S	0	0.01	Dry, grey silt	0
220E 100S	9.5	2.25	Dry, grey sand	.3
240E 100S	0	0.01	Dry, grey sand	0
SOUTH RESERVOIR, RESISTIVITY L630C		(NORTH-SOUTH)		
a11A	7.7	2.04	Brown soil under moss & grass	.2
a11B	7.7	2.04	Black soil, organic	.2
a11C	21.3	3.06	Brown soil in zone of slow creep	.7
a11D	13.5	2.60	Light brown soil, avalanche slope	.4
a12A	32.9	3.49	Black soil, small bog	1.0
a12B	15.5	2.74	Scarce soil under moss, base of tree	.5
a12C	54.2	3.99	Scarce soil under moss, base of tree	1.7
a12D	116.0	4.75	Brown thin soil	3.6
a12E	19.3	2.96	Scarce soil base of tree	.6
a13A	85.1	4.44	Brown forest soil	2.7
SOUTH RESERVOIR, RESISTIVITY		(EAST-WEST)		
a14A	35.6	3.57	Thin grey soil over boulders	1.1
a14B	13.0	2.56	Brown soil over cobbles	.4
a14C	116.6	4.76	Brown forest soil near travertine deposit	3.6
a15A	9.7	2.27	Thin soil over decaying wood	.3
a15B	13.0	2.56	Silt or ash under moss	.4
a15C	61.6	4.12	Thin brown soil over decaying wood	1.9
a15D	19.4	2.97	Thin brown soil over decaying wood	.6
a15E	22.7	3.12	Thin brown soil	.7
a16A	184.7	5.22	Black organic soil	5.8
a16B	32.4	3.48	Thin brown soil	1.0
a16C	77.8	4.35	Fine silty soil	2.4
a16D	298.1	5.70	Brown organic soil	9.3

APPENDIX E-2 (Cont'd)

MERCURY SURVEY - TABLE OF RESULTS

SAMPLE	PPB Hg	LN PPB Hg	REMARKS	PEAK TO BACKGROUND RATIO
LILLOOET VALLEY, MEAGER CREEK TO NORTH CREEK: N = 6				
a17B	31.8	3.46	Thick brown organic soil over river gravel	1.0
a17C	33.8	3.52	Thin brown organic soil over talus	1.1
a17D	31.8	3.46	Grey silt over till	1.0
a18A	29.9	3.40	Dark grey silt with organic material	.9
a3A	12.3	2.51	Grey sandy soil	.4
a3B	3.1	1.13	Flood silt under decaying wood	.1
LILLOOET VALLEY, ABOVE PEBBLE CREEK SPRINGS: N = 4				
a19A	81.6	4.40	Organic soil over ash	2.6
a19B	159.2	5.07	Organic soil over ash	5.0
a19C	33.8	3.52	Grey soil with organic material	1.1
a20D	53.7	3.98	Thin grey soil with organic material over boulders	1.7
LILLOOET VALLEY, ABOVE PEBBLE CREEK CAMP: N = 2				
a22B	69.0	4.23	Organic soil	2.2
a22C	75.0	4.32	Organic soil, mixed decaying wood	2.3
MEAGER MASSIF, ABOVE 5600 FEET: N = 3				
a21A	15.0	2.71	Fine brown soil	.5
a21D	12.0	2.48	Brown soil in swampy meadow	.4
a21E	45.0	3.81	Coarse brown soil	1.4



For each area, Histograms of PPB Hg and LN PPB Hg(in soil) are plotted

APPENDIX E-4

MERCURY SURVEY
FREQUENCY HISTOGRAMS OF DATA

APPENDIX F-1

TRACK ETCH® SERVICE PROGRAM

FOR

MEAGER GEOTHERMAL AREA

Terradex Corporation
1900 Olympic Boulevard
Walnut Creek, California 94596
Phone: (415) 938-2545 Telex: 33-7793

December 14, 1978

Mr. L. J. Werner
Nevin, Sadlier-Brown Goodbrand Ltd.
Suite 504
134 Abbott St.
Vancouver, B. C.
Canada

Dear Mr. Werner,

I am enclosing two sets of final tabulated data from your recent Track Etch survey of the Meager Geothermal Area. The Track Etch readings are reported in units of tracks per square millimeter (T/sq.mm) and they are normalized to equivalent 30 day exposures. The data have been tabulated in two different ways for easy use; firstly by ascending Track Etch readings and seconly, by ascending serial numbers. The readings ranged from 0.3 to 193.5 T/sq.mm and the mean of the background distribution for the area was 2.6 T/sq.mm. The standard deviation of the background mean was 1.6 T/sq.mm or 61.0%. All statistics on the program are also included on the attached statistics sheet.

The background mean and its standard deviation are related to shallow mineralization of uranium in the survey area. For this survey the background mean is substantially lower than the Canadian average of 11 T/sq.mm.

High ranking points may be expressed in terms of "Z", the number of standard deviations above background. Rudimentary statistics imply that values with Z greater than three have a very low probability of belonging to the background distribution and hence are anomalous. The range of "Z" for the high ranking points in your survey are shown below together with the more conventional ratio to background.

Range of Z	# of Points	Range of T/sq.mm	Range of Ratio to Background
2 - 3	5	5.9 - 7.2	2.2 - 2.7
3 - 4	2	7.6 - 7.8	2.9 - 2.9
4 - 5	3	9.2 - 10.5	3.5 - 4.0
over 5	11	12.0 -193.5	4.5 - 73.2

It is highly improbable that points with Z greater than 3 are part of the background distribution; hence they are almost certainly anomalous. In this survey 16 points have a Z greater than 3, or 17.6% of the total. This, in our experience, is a fairly high percentage of anomalous values but of course it may be due to the sampling pattern you used on this survey.

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

TRACK ETCH SURVEY RESULTS AND STATISTICS

VALUES GIVEN IN T/SQ. MM. NORMALIZED TO 30 DAY EXPOSURE

NO. USEFUL PTS. : 91

HIGH (T/SQ. MM.): 193.5

LOW (T/SQ. MM.): 0.3

BACKGROUND MEAN (T/SQ. MM.): 2.6

STD. DEVIATION OF BKG. MEAN (T/SQ. MM.): 1.6

RELATIVE STD. DEVIATION (PERCENT): 61.0

HIGH RANKING POINTS

RANGE OF Z	NO. OF PTS.	RANGE OF T	RANGE OF RATIO TO BACKGROUND
2 - 3	5	5.9 - 7.2	2.2 - 2.7
3 - 4	2	7.6 - 7.8	2.9 - 2.9
4 - 5	3	9.2 - 10.5	3.5 - 4.0
OVER 5	11	12.0 - 193.5	4.5 - 73.2

NO. OF PTS. ABOVE Z = 3: 16

PERCENT OF TOTAL PTS. : 17.6

(Z IS THE NUMBER OF STD. DEVIATIONS ABOVE BKG. MEAN)

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

DETECTOR READING (T/SQ. MM.)	CUP SERIAL NUMBER	FIELD NOTES AND DATA		
	79342.	LOST	GREY SOIL	
	79341.	LOST	SAND	
	79404.		DUG OUT	NR
	79337.	LOST		
	79410.	LOST	6200 NOT FOUND	
0.3	79365.		FHUMUS SAND	
0.3	79389.		FSAND	
0.6	79346.		F	
0.6	79388.		FBOULDER PILE	
0.6	79392.		FBOULDER PILE	
0.8	79434.		4300	
0.8	79352.		F	
0.8	79362.		FSAND SILT	
0.8	79383.		FSAND ROCKS	
0.8	79384.		FSAND GRASS	
0.8	79355.		FSAND&BOULDERS	
0.8	79357.		FBOULDERS GRAVEL	
1.1	79325.	CRACK	140E120S IN FOREST	
1.1	79327.		140E160S IN FOREST	
1.1	79328.		CHECK STA 1FOREST	
1.1	79348.		F	
1.1	79406.		CAPRICORN GLACIER 6080	
1.4	79382.		FSILT	
1.4	79385.		FSAND	
1.6	79433.		4550	
1.7	79345.		F	
1.7	79402.		DISTURBED	
1.7	79440.			
1.7	79435.			
1.7	79376.		FBROWN SOIL	
1.7	79439.			
1.7	79387.		FSAND ROCKS	
1.7	79381.		FBROWN SOIL	
1.7	79393.		FBOULDER PILE	
1.7	79366.		FBOULDERS	
1.9	79326.		140E140S IN FOREST	
1.9	79344.		F	
1.9	79367.		FIN WATER	
1.9	79353.		F	
2.0	79394.		FBLACK MUCK	
2.0	79431.		2950	
2.2	79391.		FBOULDERS SILT	
2.2	79364.		FBOULDERS GRAVEL	
2.3	79412.		6130 PBR CAMP	
2.3	79409.		PYLON PEAK 5640	
2.4	79335.		SAND SINTER	
2.5	79361.		FFINE SAND	
2.8	79401.			
3.0	79329.		CHECK STA 2SANDFLAT	
3.1	79354.		F	

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

DETECTOR READING (T/SQ. MM.)	CUP SERIAL NUMBER	FIELD NOTES AND DATA
3.1	79350.	F
3.1	79363.	FSAND BOULDERS
3.3	79334.	HOT MUCK
3.3	79333.	
3.3	79436.	
3.5	79323.	140E80S CREEK SAND
3.5	79336.	ROCKY
3.6	79369.	FSAND
3.6	79390.	FBLACK MUCK
3.6	79360.	FBOULDERS GRAVEL
3.7	79432.	3600
3.9	79371.	FSAND CLAY
3.9	79400.	BTWN VENTS
3.9	79386.	FMVD
4.0	79411.	5760
4.2	79351.	CRACK F
4.3	79339.	CRACK SAND
4.4	79438.	
4.5	79380.	FBROWN SOIL
4.9	79331.	WATER SAND, IN WATER
5.0	79403.	
5.0	79379.	FSAND
5.1	79407.	NO FILTER
5.1	79408.	NO FILTER PYLON PEAK
5.7	79332.	GRAVEL
5.9	79378.	FSAND ROCKS
5.9	79377.	FIN WATER SINTER
6.4	79368.	FBOULDERS SAND
6.5	79340.	SAND&ROCKS
7.2	79374.	FSAND
7.6	79356.	FSAND, IN WATER
7.8	79347.	F
9.2	79321.	140E40SINSPRING WATER
10.0	79373.	FSAND ROCKS
10.5	79437.	
12.0	79338.	MUCK
12.2	79372.	FGRAVEL ROCKS
13.7	79358.	F4 M. SOUTH
13.9	79349.	F
15.3	79370.	FWET SAND CLAY
16.3	79322.	140E60S CREEK SAND
19.9	79359.	FSILTY IN REEDS
23.6	79343.	F
32.2	79375.	FBLACK MUCK, IN WATER
110.9	79324.	140E100S HOT CREEK FORK
193.5	79399.	ON RIVER

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

CUP SERIAL NUMBER	DETECTOR READING (T/SQ. MM.)		FIELD NOTES AND DATA
79321.	9. 2		140E40SINSPRING WATER
79322.	16. 3		140E60S CREEK SAND
79323.	3. 5		140E80S CREEK SAND
79324.	110. 9		140E100S HOT CREEK FORK
79325.	1. 1	CRACK	140E120S IN FOREST
79326.	1. 9		140E140S IN FOREST
79327.	1. 1		140E160S IN FOREST
79328.	1. 1		CHECK STA 1FOREST
79329.	3. 0		CHECK STA 2SANDFLAT
79331.	4. 9	WATER	SAND, IN WATER
79332.	5. 7		GRAVEL
79333.	3. 3		
79334.	3. 3		HOT MUCK
79335.	2. 4		SAND SINTER
79336.	3. 5		ROCKY
79337.		LOST	
79338.	12. 0		MUCK
79339.	4. 3	CRACK	SAND
79340.	6. 5		SAND&ROCKS
79341.		LOST	SAND
79342.		LOST	GREY SOIL
79343.	23. 6		F
79344.	1. 9		F
79345.	1. 7		F
79346.	0. 6		F
79347.	7. 8		F
79348.	1. 1		F
79349.	13. 9		F
79350.	3. 1		F
79351.	4. 2	CRACK	F
79352.	0. 8		F
79353.	1. 9		F
79354.	3. 1		F
79355.	0. 8		FSAND&BOULDERS
79356.	7. 6		FSAND, IN WATER
79357.	0. 8		FBOULDERS GRAVEL
79358.	13. 7		F4 M. SOUTH
79359.	19. 9		FSILTY IN REEDS
79360.	3. 6		FBOULDERS GRAVEL
79361.	2. 5		FFINE SAND
79362.	0. 8		FSAND SILT
79363.	3. 1		FSAND BOULDERS
79364.	2. 2		FBOULDERS GRAVEL
79365.	0. 3		FHUMUS SAND
79366.	1. 7		FBOULDERS
79367.	1. 9		FIN WATER
79368.	6. 4		FBOULDERS SAND
79369.	3. 6		FSAND
79370.	15. 3		FWET SAND CLAY
79371.	3. 9		FSAND CLAY

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

CUP SERIAL NUMBER	DETECTOR READING (T/SQ. MM.)	FIELD NOTES AND DATA
79372.	12.2	FGRAVEL ROCKS
79373.	10.0	FSAND ROCKS
79374.	7.2	FSAND
79375.	32.2	FBLACK MUCK, IN WATER
79376.	1.7	FBROWN SOIL
79377.	5.9	FIN WATER SINTER
79378.	5.9	FSAND ROCKS
79379.	5.0	FSAND
79380.	4.5	FBROWN SOIL
79381.	1.7	FBROWN SOIL
79382.	1.4	FSILT
79383.	0.8	FSAND ROCKS
79384.	0.8	FSAND GRASS
79385.	1.4	FSAND
79386.	3.9	FMVD
79387.	1.7	FSAND ROCKS
79388.	0.6	FBOULDER PILE
79389.	0.3	FSAND
79390.	3.6	FBLACK MUCK
79391.	2.2	FBOULDERS SILT
79392.	0.6	FBOULDER PILE
79393.	1.7	FBOULDER PILE
79394.	2.0	FBLACK MUCK
79399.	193.5	ON RIVER
79400.	3.9	BTWN VENTS
79401.	2.8	
79402.	1.7	DISTURBED
79403.	5.0	
79404.		DUG OUT NR
79406.	1.1	CAPRICORN GLACIER 6080
79407.	5.1	NO FILTER
79408.	5.1	NO FILTER PYLON PEAK
79409.	2.3	PYLON PEAK 5640
79410.		LOST 6200 NOT FOUND
79411.	4.0	5760
79412.	2.3	6130 FBR CAMP
79431.	2.0	2950
79432.	3.7	3600
79433.	1.6	4550
79434.	0.8	4300
79435.	1.7	
79436.	3.3	
79437.	10.5	
79438.	4.4	
79439.	1.7	
79440.	1.7	

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

TRACK ETCH SURVEY RESULTS AND STATISTICS

VALUES GIVEN IN T/SQ. MM. NORMALIZED TO 30 DAY EXPOSURE

NO. USEFUL PTS. : 91

HIGH (T/SQ. MM.): 193.5

LOW (T/SQ. MM.): 0.3

BACKGROUND MEAN (T/SQ. MM.): 2.6

STD. DEVIATION OF BKG. MEAN (T/SQ. MM.): 1.6

RELATIVE STD. DEVIATION (PERCENT): 61.0

HIGH RANKING POINTS

RANGE OF Z	NO. OF PTS.	RANGE OF T	RANGE OF RATIO TO BACKGROUND
2 - 3	5	5.9 - 7.2	2.2 - 2.7
3 - 4	2	7.6 - 7.8	2.9 - 2.9
4 - 5	3	9.2 - 10.5	3.5 - 4.0
OVER 5	11	12.0 - 193.5	4.5 - 73.2

NO. OF PTS. ABOVE Z = 3: 16

PERCENT OF TOTAL PTS. : 17.6

(Z IS THE NUMBER OF STD. DEVIATIONS ABOVE BKG. MEAN)

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

CUP SERIAL NUMBER	DETECTOR READING (T/SQ. MM.)		FIELD NOTES AND DATA
79321.	9.2		140E40SINSPRING WATER
79322.	16.3		140E60S CREEK SAND
79323.	3.5		140E80S CREEK SAND
79324.	110.9		140E100S HOT CREEK FORK
79325.	1.1	CRACK	140E120S IN FOREST
79326.	1.9		140E140S IN FOREST
79327.	1.1		140E160S IN FOREST
79328.	1.1		CHECK STA 1FOREST
79329.	3.0		CHECK STA 2SANDFLAT
79331.	4.9	WATER	SAND, IN WATER
79332.	5.7		GRAVEL
79333.	3.3		
79334.	3.3		HOT MUCK
79335.	2.4		SAND SINTER
79336.	3.5		ROCKY
79337.		LOST	
79338.	12.0		MUCK
79339.	4.3	CRACK	SAND
79340.	6.5		SAND&ROCKS
79341.		LOST	SAND
79342.		LOST	GREY SOIL
79343.	23.6		F
79344.	1.9		F
79345.	1.7		F
79346.	0.6		F
79347.	7.8		F
79348.	1.1		F
79349.	13.9		F
79350.	3.1		F
79351.	4.2	CRACK	F
79352.	0.8		F
79353.	1.9		F
79354.	3.1		F
79355.	0.8		FSAND&BOULDERS
79356.	7.6		FSAND, IN WATER
79357.	0.8		FBOULDERS GRAVEL
79358.	13.7		F4 M. SOUTH
79359.	19.9		FSILTY IN REEDS
79360.	3.6		FBOULDERS GRAVEL
79361.	2.5		FFINE SAND
79362.	0.8		FSAND SILT
79363.	3.1		FSAND BOULDERS
79364.	2.2		FBOULDERS GRAVEL
79365.	0.3		FHUMUS SAND
79366.	1.7		FBOULDERS
79367.	1.9		FIN WATER
79368.	6.4		FBOULDERS SAND
79369.	3.6		FSAND
79370.	15.3		FWET SAND CLAY
79371.	3.9		FSAND CLAY

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

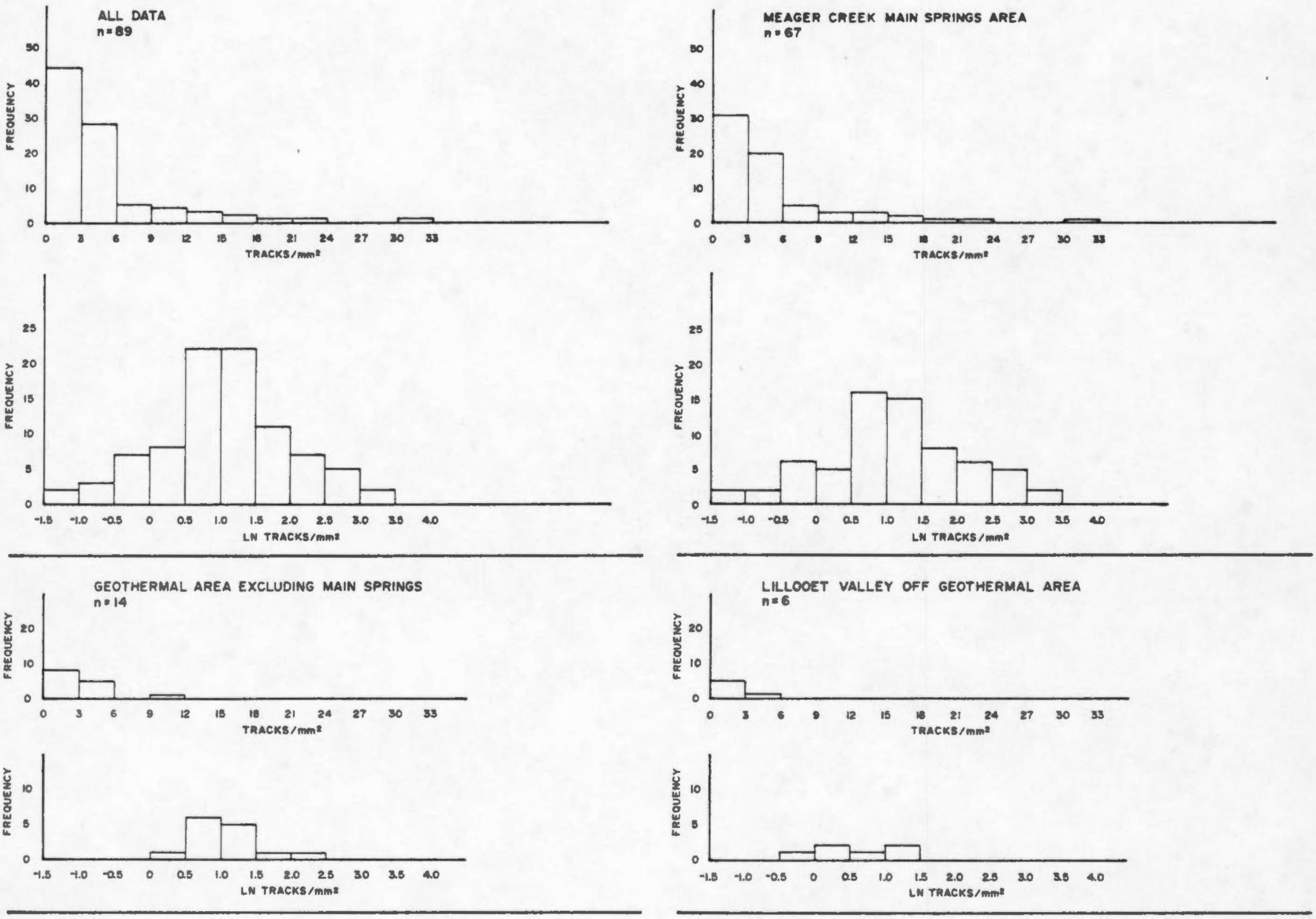
CUP SERIAL NUMBER	DETECTOR READING (T/SQ. MM.)	FIELD NOTES AND DATA
79372.	12.2	FGRAVEL ROCKS
79373.	10.0	FSAND ROCKS
79374.	7.2	FSAND
79375.	32.2	FBLACK MUCK, IN WATER
79376.	1.7	FBROWN SOIL
79377.	5.9	FIN WATER SINTER
79378.	5.9	FSAND ROCKS
79379.	5.0	FSAND
79380.	4.5	FBROWN SOIL
79381.	1.7	FBROWN SOIL
79382.	1.4	FSILT
79383.	0.8	FSAND ROCKS
79384.	0.8	FSAND GRASS
79385.	1.4	FSAND
79386.	3.9	FMVD
79387.	1.7	FSAND ROCKS
79388.	0.6	FBOULDER PILE
79389.	0.3	FSAND
79390.	3.6	FBLACK MUCK
79391.	2.2	FBOULDERS SILT
79392.	0.6	FBOULDER PILE
79393.	1.7	FBOULDER PILE
79394.	2.0	FBLACK MUCK
79399.	193.5	ON RIVER
79400.	3.9	BTWN VENTS
79401.	2.8	
79402.	1.7	DISTURBED
79403.	5.0	
79404.		DUG OUT NR
79406.	1.1	CAPRICORN GLACIER 6080
79407.	5.1	NO FILTER
79408.	5.1	NO FILTER PYLON PEAK
79409.	2.3	PYLON PEAK 5640
79410.		LOST 6200 NOT FOUND
79411.	4.0	5760
79412.	2.3	6130 PBR CAMP
79431.	2.0	2950
79432.	3.7	3600
79433.	1.6	4550
79434.	0.8	4300
79435.	1.7	
79436.	3.3	
79437.	10.5	
79438.	4.4	
79439.	1.7	
79440.	1.7	

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

DETECTOR READING (T/SQ. MM.)	CUP SERIAL NUMBER	FIELD NOTES AND DATA
	79342.	LOST GREY SOIL
	79341.	LOST SAND
	79404.	DUG OUT NR
	79337.	LOST
	79410.	LOST 6200 NOT FOUND
0.3	79365.	FHUMUS SAND
0.3	79389.	FSAND
0.6	79346.	F
0.6	79388.	FBOULDER PILE
0.6	79392.	FBOULDER PILE
0.8	79434.	4300
0.8	79352.	F
0.8	79362.	FSAND SILT
0.8	79383.	FSAND ROCKS
0.8	79384.	FSAND GRASS
0.8	79355.	FSAND&BOULDERS
0.8	79357.	FBOULDERS GRAVEL
1.1	79325.	CRACK 140E120S IN FOREST
1.1	79327.	140E160S IN FOREST
1.1	79328.	CHECK STA 1FOREST
1.1	79348.	F
1.1	79406.	CAPRICORN GLACIER 6080
1.4	79382.	FSILT
1.4	79385.	FSAND
1.6	79433.	4550
1.7	79345.	F
1.7	79402.	DISTURBED
1.7	79440.	
1.7	79435.	
1.7	79376.	FBROWN SOIL
1.7	79439.	
1.7	79387.	FSAND ROCKS
1.7	79381.	FBROWN SOIL
1.7	79393.	FBOULDER PILE
1.7	79366.	FBOULDERS
1.9	79326.	140E140S IN FOREST
1.9	79344.	F
1.9	79367.	FIN WATER
1.9	79353.	F
2.0	79394.	FBLACK MUCK
2.0	79431.	2950
2.2	79391.	FBOULDERS SILT
2.2	79364.	FBOULDERS GRAVEL
2.3	79412.	6130 PBR CAMP
2.3	79409.	PYLON PEAK 5640
2.4	79335.	SAND SINTER
2.5	79361.	FFINE SAND
2.8	79401.	
3.0	79329.	CHECK STA 2SANDFLAT
3.1	79354.	F

NEVIN, SADLIER, BROWN GOODBRAND 12-13-78

DETECTOR READING (T/SQ. MM.)	CUP SERIAL NUMBER	FIELD NOTES AND DATA
3.1	79350.	F
3.1	79363.	FSAND BOULDERS
3.3	79334.	HOT MUCK
3.3	79333.	
3.3	79436.	
3.5	79323.	140E80S CREEK SAND
3.5	79336.	ROCKY
3.6	79369.	FSAND
3.6	79390.	FBLACK MUCK
3.6	79360.	FBOULDERS GRAVEL
3.7	79432.	3600
3.9	79371.	FSAND CLAY
3.9	79400.	BTWN VENTS
3.9	79386.	FMVD
4.0	79411.	5760
4.2	79351.	CRACK F
4.3	79339.	CRACK SAND
4.4	79438.	
4.5	79380.	FBROWN SOIL
4.9	79331.	WATER SAND, IN WATER
5.0	79403.	
5.0	79379.	FSAND
5.1	79407.	NO FILTER
5.1	79408.	NO FILTER PYLON PEAK
5.7	79332.	GRAVEL
5.9	79378.	FSAND ROCKS
5.9	79377.	FIN WATER SINTER
6.4	79368.	FBOULDERS SAND
6.5	79340.	SAND&ROCKS
7.2	79374.	FSAND
7.6	79356.	FSAND, IN WATER
7.8	79347.	F
9.2	79321.	140E40SINSPRING WATER
10.0	79373.	FSAND ROCKS
10.5	79437.	
12.0	79338.	MUCK
12.2	79372.	FGRAVEL ROCKS
13.7	79358.	F4' M. SOUTH
13.9	79349.	F
15.3	79370.	FWET SAND CLAY
16.3	79322.	140E60S CREEK SAND
19.9	79359.	FSILTY IN REEDS
23.6	79343.	F
32.2	79375.	FBLACK MUCK, IN WATER
110.9	79324.	140E100S HOT CREEK FORK
193.5	79399.	ON RIVER



APPENDIX F-2

RADON SURVEY
FREQUENCY HISTOGRAMS OF DATA