STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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Portland, Oregon 97201

OPEN-FILE REPORT O-80-9

PRELIMINARY GEOLOGY AND GEOTHERMAL RESOURCE POTENTIAL OF THE LAKEVIEW AREA, OREGON

by

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Study completed under U. S. Department of Energy
Cooperative Agreement No. DE-FC07-79ET27220

1980

DISCLAIMER

This report has not been edited for complete conformity with Oregon Department of Geology and Mineral Industries standards. Data in this document are preliminary and are subject to change upon further verification.

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INTRODUCTION

The Lakeview Area is located at the extreme eastern edge of the Goose Lake Valley, on the shores of Goose Lake, in southernmost Central Oregon. The City of Lakeview, in the center of the project area, is 112 km (70 mi) east of Klamath Falls, Oregon, and 24 km (15 mi) north of the California-Oregon border. This study, performed under U.S. Department of Energy (USDOE) Contract No. DE FC07-79ET 27220, was undertaken to estimate the geothermal potential of the area by using various methods, including compilation of existing data, lineament analysis, well and spring geochemistry, and accrual of geothermal gradient data by logging of existing water wells and by drilling of 152m (500 ft) geothermal-gradient holes.

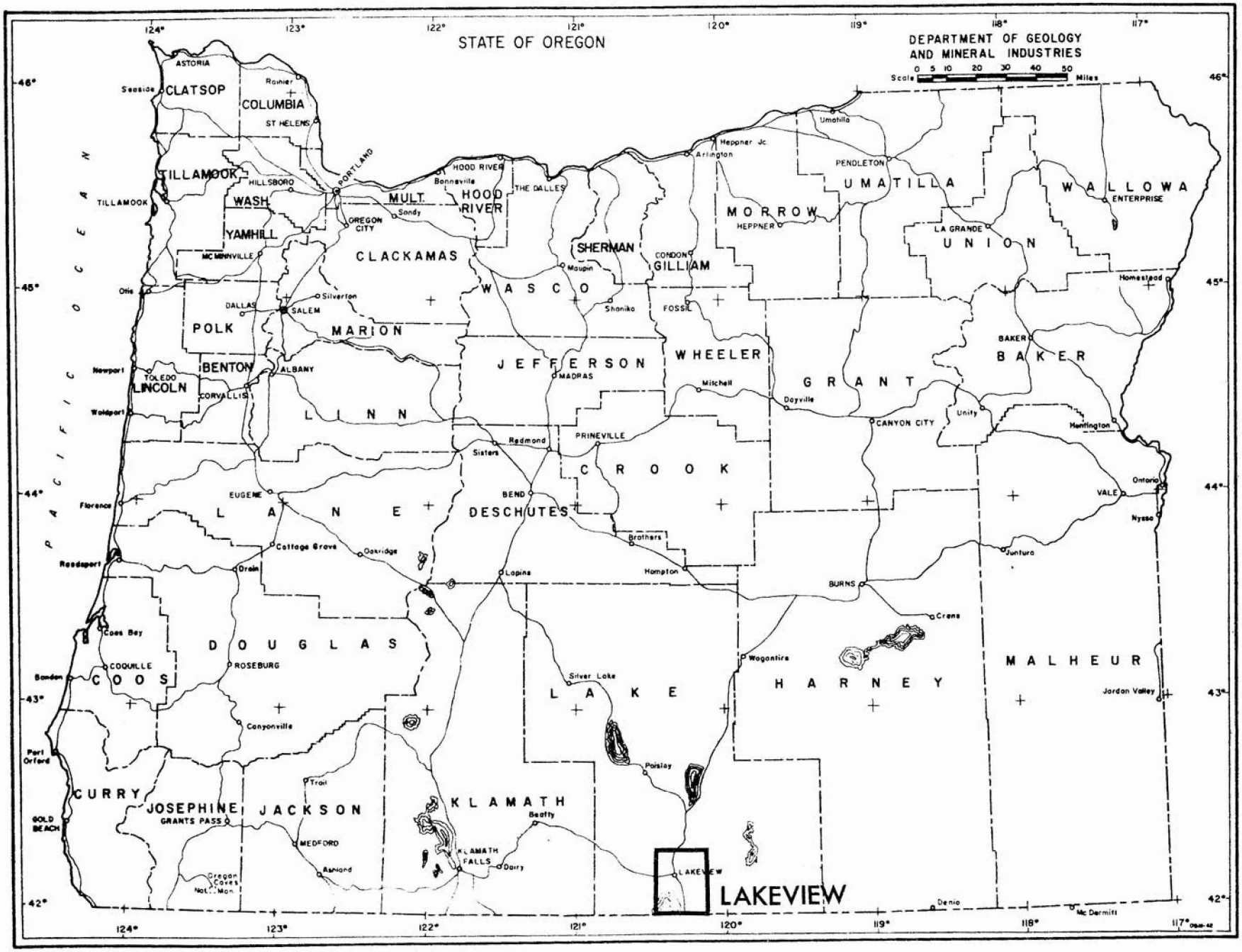


Figure 1: Map showing location of study area.

GEOLOGY

The Lakeview area is situated in the northern part of the Basin and Range Province, with typical horst and graben structures. An area of anomalously high temperature is centered on a fault zone along the eastern edge of northern Goose Lake Valley, a large graben adjacent to the Warner Mountain horst block (Plate I).

The oldest rocks exposed are in the Warner Mountains, at the base of the range east of Lakeview, in a thick section of mainly andesite and basalt flows, pyroclastic rocks and related sedimentary rocks of Oligocene (?) age (Walker, 1963). Well logs indicate that volcanic rocks as old as Cretaceous may lie below the Oligocene section, whereas the youngest lava flows, high in the section, are Pliocene to Pleistocene (Walker, 1963). Well logs and exposures in the Warner Mountains indicate that the volcanic pile is at least 3,000 m (10,000 ft) thick.

Detailed stratigraphy was not attempted for this study (Plate I), however, traverses of canyons along the Warner Mountain front allow some general observations. The lowermost rocks exposed in the fault escarpment east of Lakeview are mainly pyroclastic rocks of andesitic composition. They include dark gray, greenish to reddish brown layered tuff breccias, sandstones, and siltstones, and minor conglomerate layers (unit *TmsT*). Thick, massive, mud flow breccia lenses are also present, especially north of Lakeview, and minor andesite and basalt flows are also present in the section. Lighter-colored ash-flow tuffs of dacite and rhyolite composition are also conspicuous in the section and, in some places, are as much as 200 feet thick. These ash flows could serve as structural marker beds. Narrow N-S striking basaltic dikes commonly cut the section and are probably the feeders for basalt flows that occur higher in the section and east of the area studied. Thicknesses of individual rock units

Table 1. Radiometric (K/Ar) ages of selected rocks of the Lakeview area.

Sample no.*	Location	Rock type	Age**	Stratigraphic unit
Bullard-1	39S/20E/ 14Bbb	Basalt	$^{w}24.6\pm0.8$ my	Tmst
Bullard-2	39S/20E/ 15Acc	Basalt	$^{p}27.2\pm0.9$ my	Tmst
Humble Oil Leavitt No. 1	$42^{o}08'N$ $120^{o}20'W$	Andesite	83.4 ± 2 my 79.8 ± 4 my	Basement

* References: Bullard - samples taken for this report, unpublished analyses by University of Utah Research Institute, Stan Evans and Duncan Foley, analysts; Humble - petroleum exploration hole core at 9576 ft.

**w - whole rock age; p - plagioclase age

vary greatly along the range front, and it is apparent that relief was considerable, because most of the volcanic rocks are in steep depositional contact with one another. Overlying unit *Tmst*, in conformable to unconformable contact high in the section, is a unit of Miocene (?) tuffs of dacitic to rhyolitic composition (unit *Tmt*) of chiefly volcanic origin (Walker, 1963). Epiclastic rocks are a minor constituent, compared to unit *Tmst*.

Overlying and intruding these rocks are basalt flows (unit *Tmpb*), andesite flows (unit *Tva*), young basaltic, andesitic, and gabbroic plugs, necks, and dikes (unit *QTi*), a number of rhyolitic to rhydacitic domes and flows (unit *QTr*), and a small incised cinder cone of basaltic composition found in the northeast corner of the study area (unit *QTmv*). Occupying benches above the city of Lakeview are a number of patches of unconsolidated to semi-consolidated sands and gravels which are interpreted to represent an ancestral bed of Goose Lake subsequently uplifted during formation of the Warner Mountains.

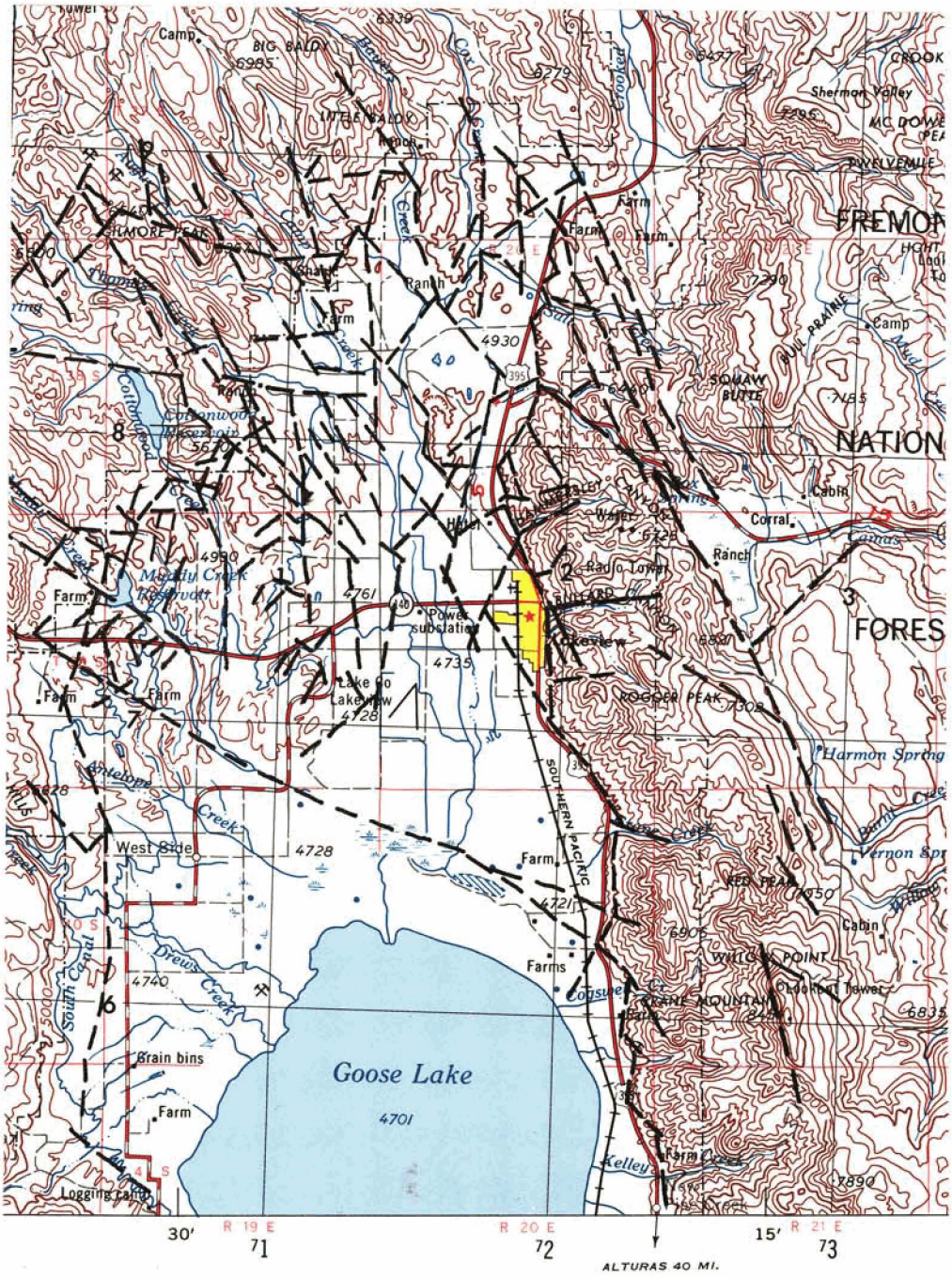
In the Goose Lake basin, west of the frontal fault, only unconsolidated Pleistocene to Holocene lacustrine and fluvial sedimentary rocks of wide variety both in texture and composition, are exposed. Gravity studies and drill logs indicate that these sediments are as much as 5,000 feet thick in the center of the basin (Plate I cross-sections). Relatively thick wedges of colluvium and fan deposits overlie the lake- and stream-deposited sediments on the edges of the basin.

The terminus of a large, conspicuous delta-like deposit of sand and gravel is located about three miles north of Lakeview. This deposit extends north and west for several miles, and road cuts show cross-bedding, channeling, foreset and topset beds typical of this kind of deposit. There is significant tilting of layered rocks, and minor faulting has slightly offset some of the layers, indicating Pleistocene fault activity.

Structural geology

The dominant structure of the area is the north-south trending Basin and Range frontal fault that separates the Goose Lake Valley from the uplifted Warner Mountains to the east. A less apparent structural grain trends N. 30° W. to N. 60° W. and most often occurs as narrow discontinuous fractures or faults filled by basaltic dikes. From a study of the area, Peterson and McIntyre, 1970, suggested the earliest movement along the range faults appears to have been early in the Pliocene, at which time the present major topographic basins and intervening fault-block uplifts were formed. Most of the range elevation appears to have been achieved prior to the onset of glaciation, which has affected the higher portions of the Warner Mountains. Several stages of displacement (uplift) are indicated in the northern Warner Mountains by well-developed terraces and faceted spurs. The layered rocks of the Warner Mountain fault block generally show a tilt to the east, and in the Lakeview area, dips of 15° to 20° E. are common. Late Tertiary folding, resulting in long sinuous anticlinal and synclinal structures, has been proposed (Walker et al., 1967; Peterson and McIntyre, 1970). One of these discontinuous anticlinal structures is postulated to strike NW-SE through the Goose Lake Basin and the Warner Mountains. Donath (1962), Larson (1965) and Pease (1969) also discuss the general structural patterns in south-central Oregon. A lineament map prepared for this report indicates similar trends (Figure 2).

In the immediate Lakeview geothermal area, the range front fault appears to be a nearly vertical to west-dipping, relatively narrow fractured zone. It is exposed at several places within and just north and south of the city. Zones as wide as 50 feet are brecciated and contain clay alteration, as well as bleached and iron-stained rocks. Calcite, gypsum, and other white alkaline precipitates are common alteration minerals found in fractures and disseminations of the rocks. Some of the areas of greatest rock alteration are shown



taken from LANDSAT infrared 1:500,000 imagery and
NASA U-2 1:125,000 imagery

Scale 1:250,000

Figure 2: **Photo-lineament map of the Lakeview area, Oregon**

KLAMATH FALLS; OREGON; CALIFORNIA
1955
REVISED 1970

on the geologic map as a stippled area (Plate I). Steeply dipping slicken sided fault planes are present in the N-S trending frontal fault and also at slight angles to it. These are well exposed near the mouth of Eadman Canyon, in quarries opened for removal of road rock. A conpicuous N. 40^{o} W-trending fracture, one to two feet wide, in the SE quarter of sec. 28, T. 38 S., R. 20 E., has been filled with crystalline calcite, probably from hot spring activity in the past. Also in the section 28 along U.S. Highway 395, sandstone beds (Goose Lake beds of Pleistocene age) have been cemented by hot spring activity.

The only visible silica deposits are north of the area studied, in sec. 12, T. 38 S., R. 20 E., along Salt Creek. Here, hot spring deposits (unit *Qss* on the geologic map) consist of beds up to ten feet thick of opal and chalcedony, with some cinnabar. This deposit covers an area of about 1/3 square mile (Schaffer, 1956; Peterson, 1971).

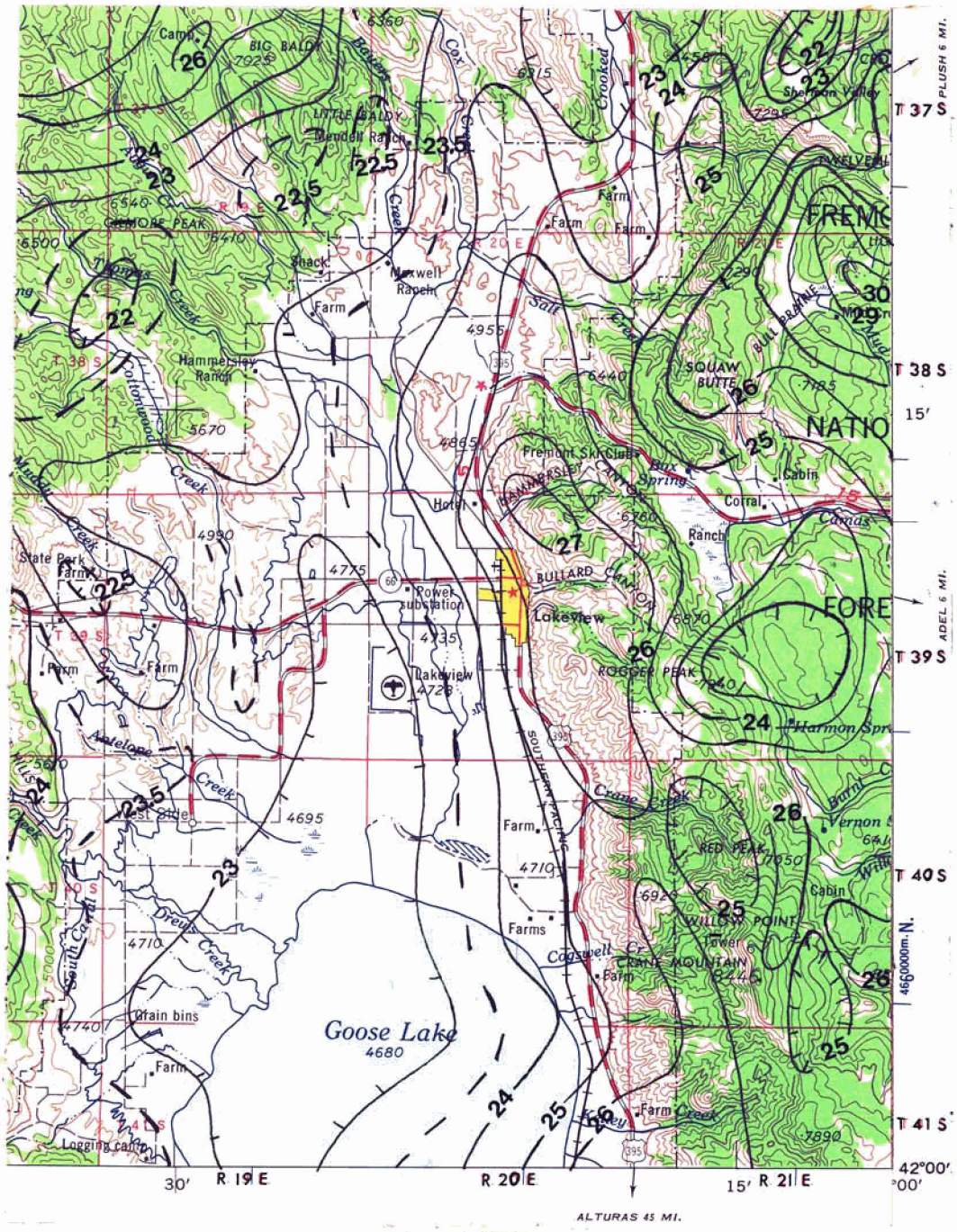
GEOPHYSICS

Two geophysical studies were available for inclusion and evaluation in this study. They are (1) a regional total field aeromagnetic study performed by the U.S.G.S. in 1972 (Figure 3), and (2) a complete Bouguer anomaly gravity map (Plate II) compiled and reduced by the Oregon State University Geophysics Group for this study.

Owing to the high elevation (9,000 ft) of the flight lines, and regional nature of the study, the aeromagnetic survey is difficult to interpret on a site-specific basis. The only characteristics of consequence are a magnetic maximum centered over the relatively susceptible rocks comprising the Warner Range, and a broad magnetic minimum centered on the deeply filled, relatively nonsusceptible Goose Lake graben.

The complete Bouguer gravity map yields similar interpretations as the aeromagnetic map. However, the gravity map reveals the steep nature of the Lakeview frontal fault, and the shape of the gravity low centered over the Goose Lake graben is such that it appears that the floor of the valley is dipping toward the east. The bedrock may reappear to the west of the lake without extensive block faulting and uplift. Interpretation of the relatively flat gravity gradients to the north of Lakeview is difficult, owing to lower density of gravity stations.

Refinement of these geophysical data, together with other studies, is needed before detailed structural analysis can be made on the basis of geophysics.



Scale 1:250,000

5 0 5 Statute Miles

5 0 5 Kilometers

CONTOUR INTERVAL 200 FEET

Figure 3.

KLAMATH FALLS, OREGON; CALIFORNIA

1955

LIMITED REVISION 1962

TOTAL FIELD AEROMAGNETIC ANOMALY MAP

—27— 100 Gamma contour

-24.5- - - 50 Gamma contour

TOTAL READING = NUMBER x 100

WATER CHEMISTRY

During the period of this study, twenty thermal springs and wells were sampled and their waters analyzed. Together with existing published analyses (DOGAMI and USGS, 1979; etc.), a total of twenty-seven analyses are available for evaluation (Table 2). These analyses were used to calculate minimum reservoir temperatures (Table 3), using standard equations for geothermometry. The methods used in these analyses, together with references, are included as Appendix A. Our reconnaissance of the area indicates a considerable number of thermal wells and springs are present; however, many of these wells and springs were either unlocatable, not flowing at the time of the study, or not sampled, owing to time constraints.

Sample temperature during field collection ranged from near boiling for the major hot springs (Barry Ranch, Hunter, etc.) down to 16^{o} for the Lakeview City wells. The natural thermal waters of the study area can best be described as relatively alkaline mixed-ion bicarbonate waters, typical of Basin-Range deep circulation, fluid-dominated systems.

Preliminary calculations for this report (Table 3) indicate minimum reservoir temperatures in the low to moderate range of 100^{o}-150^{o} C. These temperatures are, again, typical of Basin and Range geothermal systems. Due to the relatively high amount of mafics exposed in the geologic section and in the metamorphic basement, a large amount of the silica found in the water analyses may be contributed by chalcedony.

Detailed systematic sampling of all thermal and low-temperature springs and wells, including gas and isotopic analyses, is needed before a realistic thermal model can be attempted. As of yet, only the more obvious high-temperature anomalies have been sampled and analyzed.

Table 2. Spring and well chemistry of the Lakeview area. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	Barry Ranch Hot Spring	Barry Ranch Hot Spring	Barry Ranch Hot Spring	Antone Spring	Ingledew Well
Location	39S/30E/ 27Db	39S/20E/ 27Db	39S/20E/ 27Db	38S/20E/ 6Aa	39S/20E/ 4Aab
Date sampled	5/48	/72	7/79	7/79	9/79
Temp. (^{o} C)	85	88	92.5	22.5	23
pH	7.3	7.76	7.7	8.2	7.7
Conductance µmhos/cm	1320	1370	1382	16.9	345
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	nt	nt	167_c	86_c	138_c
Hardness as mg/l $CaCO_3$	nt	nt	nt	nt	nt
Total dissolved solids	905	nt	965	130	403
SiO_2	140	130	77	45.8	34.4
Na	268	280	268	12.2	22
K	8.8	9	9.6	4.3	0.9
Ca	8.5	8.8	8.8	12	40
Mg	1.4	0.1	0.08	7.7	8.3
Cl	146	170	158	0.6	48
As	nt	0.07	0.101	<0.005	0.013
B	9.9	11	nt	nt	0.36
Li	nt	0.15	0.18	<0.05	0.01
F	6.9	5.4	5.6	<0.1	0.3
Fe (total)	0.02	<0.02	0.15	0.06	6.2
Al	nt	0.014	0.34	<0.1	13
HCO_3	208	232	nt	nt	nt
PO_4	nt	0.18	0.031	0.0036	0.033
SO_4	223	240	223.8	2	12.2
NO_3	0.3	nt	nt	nt	0.74
NH_3	nt	1.8	nt	nt	nt

Table 2. Spring and well chemistry of the Lakeview area--Continued. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	Fisher Hot Spring	Chambers Ranch Irrigation Well	Colvert Spring	Don Lindsey Well	E. McDonald Hot Well
Location	38S/25E/ 10Bbb	38S/20E/22Ca	37S/20E/ 16Caa	38S/20E/ 33Ab	38S/20E/ 33Cdd
Date sampled	/72	7/79	8/79	7/79	9/79
Temp. (^{o} C)	68	28.5	16	48	94
pH	7.93	8.3	7.4	7.8	8.2
Conductance µmhos/cm	513	663	110	788	1137
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	nt	338_c	44_c	72_c	60_c
Hardness as mg/l $CaCO_3$	nt	nt	nt	nt	nt
Total dissolved solids	nt	432	nt	556	803
SiO_2	77	54	58	60	123
Na	92	153	10	140	195
K	7.9	1.5	2.8	2.4	8.7
Ca	8.4	7.2	9.8	21.9	12.7
Mg	1	1.67	2.57	0.62	0.06
Cl	56	2.6	1.3	50	118
As	0.1	0.026	<0.005	0.047	0.19
B	2.2	0.007	nt	nt	7.13
Li	0.04	<0.05	<0.01	0.05	0.14
F	3.5	0.5	<0.1	2.2	4.3
Fe (total)	<0.02	<0.05	0.21	0.62	<0.05
Al	0.011	<0.1	0.47	<0.1	0.07
HCO_3	105	nt	nt	nt	nt
PO_4	0.18	0.039	0.111	0.004	0.022
SO_4	59	14.1	1.4	215.3	168.6
NO_3	nt	nt	nt	nt	nt
NH_3	0.18	nt	nt	nt	nt

Table 2. Spring and well chemistry of the Lakeview area--Continued. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	E. McDonald Hot Spring	Hunter's Well	Lakeview City Well #3	Lakeview City Well #4	Lakeview City Well #5
Location	38S/20E/ 33Dc	39S/20E/ 33Dc	39S/20E/ 16Ab	39S/20E/ 16Aa	39S/20E/ 15Ba
Date sampled	7/79	8/79	7/79	7/79	7/79
Temp. (^{o} C)	77.5	95	16.5	19.5	37.5
pH	8.6	8.7	8	7.8	8.5
Conductance µmhos/cm	1152	1120	286	358	448
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	50_c	60_c	114_c	144_c	80_c
Hardness as mg/l $CaCO_3$	nt	nt	nt	nt	nt
Total dissolved solids	841	852	236	273	298
SiO_2	66	168	nt	77.5	32.1
Na	207	192	56	68	80
K	9.4	9.1	2.6	2.5	0.6
Ca	14.2	12.8	nt	5.8	8.5
Mg	0.07	0.12	0.83	1.9	0.38
Cl	118	123	10.5	18.8	30.3
As	0.133	0.116	0.005	0.005	0.012
B	8	nt	1.5	1.7	4.1
Li	0.13	0.13	0.05	0.05	0.05
F	4.7	4.3	1.4	1.1	1.7
Fe (total)	0.07	0.09	0.11	0.13	0.05
Al	0.29	nt	0.1	0.1	0.1
HCO_3	nt	nt	nt	nt	nt
PO_4	0.062	0.015	0.437	0.46	0.004
SO_4	337.6	186.8	4.9	3	77.3
NO_3	nt	nt	nt	nt	nt
NH_3	nt	nt	nt	nt	nt

Table 2. Spring and well chemistry of the Lakeview area--Continued. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	Lakeview City Well #7	Leithead Hot Spring	Leithead Hot Spring	Hunter's Hot Spring	Hunter's Hot Spring
Location	39S/20E/ 16Bb	39S/20E/ 27Ab	39S/20E/ 27Ab	39S/20E/ 4Ba	39S/20E/ 4Ba
Date sampled	7/79	6/48	7/79	10/56	10/57
Temp. (^{o} C)	16	69.4	70	98	86
pH	7.9	7.7	8.1	8.3	8.4
Conductance µmhos/cm	280	813	819	1110	1140
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	92_c	nt	63_c	nt	nt
Hardness as mg/l $CaCO_3$	nt	nt	nt	nt	nt
Total dissolved solids	216	531	552	nt	821
SiO_2	69	66	74.2	146	140
Na	54	152	139	209	208
K	2.2	2.2	2.6	9.5	10
Ca	2.4	15	14.3	12	8
Mg	0.57	0.4	0.1	nt	2.4
Cl	15.5	99	56	116	120
As	0.006	nt	<0.005	nt	nt
B	nt	7	nt	7.2	7.1
Li	0.05	nt	<0.05	0.2	nt
F	1.2	3.1	3.4	nt	4.5
Fe (total)	0.14	0.06	<0.05	nt	0.01
Al	0.1	nt	<0.1	nt	nt
HCO_3	nt	8.4	nt	62	64
PO_4	0.6	nt	0.004	nt	nt
SO_4	9.8	152	156.7	265	258
NO_3	nt	0.2	nt	7.2	0.3
NH_3	nt	nt	nt	nt	nt

Table 2. Spring and well chemistry of the Lakeview area--Continued. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	Hunter's Hot Springs	Hunter's Hot Springs	Hunter's Hot Springs	Hunter's Hot Springs
Location	39S/20E/4Ba	39S/20E/4Ba	39S/20E/4Ba	39S/20E/4Ba
Date sampled	/72	7/79	7/79	7/79
Temp. (^{o} C)	96	94	88	95
pH	7.77	8.6	8.8	7.9
Conductance µmhos/cm	1120	1114	1114	1101
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	nt	51_c	52_c	60_c
Hardness as mg/l $CaCO_3$	nt	nt	nt	nt
Total dissolved solids	nt	807	424	805
SiO_2	140	60	53.5	66
Na	210	206	201	197
K	8.5	9.8	9.5	9.8
Ca	13	11.7	12.8	14.4
Mg	<0.1	0.03	0.05	0.07
Cl	120	115	118	115
As	0.06	0.151	0.161	0.162
B	6.9	0.0075	0.0075	0.007
Li	0.15	0.13	0.13	0.12
F	4.4	4.9	4.3	4.8
Fe (total)	<0.02	<0.05	<0.005	<0.05
Al	0.034	0.1	<0.1	0.11
HCO_3	79	nt	nt	nt
PO_4	0.25	0.043	0.033	0.044
SO_4	260	288.8	290.9	306.5
NO_3	nt	nt	106	103
NH_3	0.31	nt	nt	nt

Table 2. Spring and well chemistry of the Lakeview area--Continued. All measurements are in mg/l, except for pH or as indicated. nt = not tested; tr = trace.

	Ledford Well	Robbie Well	Rockford Ranch Well
Location	41S/21E/ 18Bbb	39S/20E/ 4Baa	40S/20E/10c
Date sampled	8/79	8/79	7/79
Temp. (^{o} C)	21	30	77
pH	8.9	8.1	8.3
Conductance µmhos/cm	292	932	1152
Alkalinity X_h as mg/l HCO_3 X_c as mg/l $CaCO_3$	50_c	66_c	326_c
Hardness as mg/l $CaCO_3$	nt	nt	nt
Total dissolved solids	213	705	813
SiO_2	18.2	126	74
Na	65.9	163	238
K	0.8	5.9	9.6
Ca	1.6	18.1	4.2
Mg	0.26	0.49	0.15
Cl	1.1	98.5	112
As	0.005	0.072	<0.005
B	nt	nt	nt
Li	0.02	0.1	0.22
F	0.1	3.7	3.7
Fe (total)	0.12	<0.05	<0.05
Al	0.06	0.1	<0.1
HCO_3	nt	nt	nt
PO_4	18.2	0.015	0.021
SO_4	6.6	227	74.6
NO_3	nt	nt	nt
NH_3	nt	nt	nt

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area.

	Barry Ranch Hot Spring '48	Barry Ranch Hot Spring '72	Barry Ranch Hot Spring '79	Antone Spring '79	Ingledew Well '79
Flow rate liters/min.	189	200	38	nc	nc
Measured temperature ^{o}C	85	88	92.5	22.5	23
Na:K ^{o}C	107	106	112	289	119
Na:K:Ca 1/3 β ^{o}C	140	139	144	207	104
Na:K:Ca 4/3 β ^{o}C	130	131	133	60	7
Na:K:Ca Mg corrected ^{o}C	102	nc	nc	37	80
SiO_2 conductive ^{o}C	157	152	123	98	85
SiO_2 adiabatic ^{o}C	149	145	121	99	88
SiO_2 chalcedony ^{o}C	132	127	95	67	54
SiO_2 opal ^{o}C	35	31	4	-17	-28

*Methodology for calculations presented in Appendix A. nc = not calculated.

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area--Continued.

	Fisher Hot Spring '72	Chambers Ranch Irrigation Well '79	Colvert Spring '79	Don Lindsey Well	E. McDonald Hot Well '79
Flow rate liters/min.	70	nc	nc	nc	nc
Measured temperature ^{o}C	68	28.5	16	48	94
Na:K ^{o}C	165	54	264	77	124
Na:K:Ca 1/3 β ^{o}C	169	86	192	209	146
Na:K:Ca 4/3 β ^{o}C	111	64	50	158	114
Na:K:Ca Mg corrected ^{o}C	125	nc	68	nc	nc
SiO_2 conductive ^{o}C	123	105	109	110	149
SiO_2 adiabatic ^{o}C	121	106	109	110	143
SiO_2 chalcedony ^{o}C	95	76	79	81	124
SiO_2 opal ^{o}C	4	-11	-8	-6	28

*Methodology for calculations presented in Appendix A. nc = not calculated.

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area--Continued.

	E. McDonald Hot Spring '79	Hunter's Well	Lakeview City Well #3 '79	Lakeview City Well #4 '79	Lakeview City Well #5 '79
Flow rate liters/min.	38	nc	pumped	nc	nc
Measured temperature ^{o}C	77.5	95	16.5	19.5	37.5
Na:K ^{o}C	125	127	126	113	44
Na:K:Ca 1/3 β ^{o}C	147	149	nc	128	70
Na:K:Ca 4/3 β ^{o}C	115	116	nc	76	30
Na:K:Ca Mg corrected ^{o}C	nc	nc	nc	50	nc
SiO_2 conductive ^{o}C	115	168	nc	123	82
SiO_2 adiabatic ^{o}C	114	159	nc	121	85
SiO_2 chalcedony ^{o}C	86	145	nc	95	51
SiO_2 opal ^{o}C	-2	45	nc	5	-31

*Methodology for calculations presented in Appendix A. nc = not calculated.

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area--Continued.

	Lakeview City Well #7 '79	Leithead Hot Spring '48	Leithead Hot Spring '79	Hunter's Hot Spring '56	Hunter's Hot Spring '57
Flow rate liters/min.	nc	186	186	19	19
Measured temperature ^{o}C	16	69.	70	98	86
Na:K ^{o}C	119	69	80	125	128
Na:K:Ca 1/3 β ^{o}C	135	96	104	148	154
Na:K:Ca 4/3 β ^{o}C	89	61	66	120	134
Na:K:Ca Mg corrected ^{o}C	85	nc	nc	nc	75
SiO_2 conductive ^{o}C	117	115	121	159	157
SiO_2 adiabatic ^{o}C	116	114	119	151	149
SiO_2 chalcedony ^{o}C	89	86	93	135	132
SiO_2 opal ^{o}C	0	-2	3	37	35

*Methodology for calculations presented in Appendix A. nc = not calculated.

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area--Continued.

	Hunter's Hot Spring '72	Hunter's Hot Spring '79	Hunter's Hot Spring '79	Hunter's Hot Spring '79	Ledford Well '79
Flow rate liters/min.	2300	nc	nc	nc	nc
Measured temperature ^{o}C	96	94	88	95	21
Na:K ^{o}C	119	128	127	130	62
Na:K:Ca 1/3 β ^{o}C	143	151	149	150	93
Na:K:Ca 4/3 β ^{o}C	114	122	118	116	67
Na:K:Ca Mg corrected ^{o}C	nc	nc	nc	nc	nc
SiO_2 conductive ^{o}C	157	110	105	115	60
SiO_2 adiabatic ^{o}C	149	110	105	114	66
SiO_2 chalcedony ^{o}C	132	81	75	86	28
SiO_2 opal ^{o}C	35	-6	-11	-2	-49

*Methodology for calculations presented in Appendix A. nc = not calculated.

Table 3. Geothermetric calculations* of minimum reservoir temperatures for selected thermal waters of the Lakeview area--Continued.

	Robbie Well '79	Rockford Ranch Well (Old Deter) '79
Flow rate liters/min.	nc	757
Measured temperature ^{o}C	80	77
Na:K ^{o}C	113	118
Na:K:Ca 1/3 β ^{o}C	131	153
Na:K:Ca 4/3 β ^{o}C	89	154
Na:K:Ca Mg corrected ^{o}C	nc	nc
SiO_2 conductive ^{o}C	150	121
SiO_2 adiabatic ^{o}C	144	119
SiO_2 chalcedony ^{o}C	125	93
SiO_2 opal ^{o}C	29	3

*Methodology for calculations presented in Appendix A. nc = not calculated.

LAKEVIEW AREA GEOTHERMAL GRADIENT AND HEAT FLOW DATA*

The temperature gradient and heat-flow results for the Lakeview area in south central Oregon are shown in Table 4. Included in the table are the township/range-section and latitude and longitude location of each hole. In addition, the hole name, date of logging used, and collar elevation, are included for each hole. The bottom hole temperature, maximum depth, corrected temperature gradient, and (where available) corrected heat-flow are shown in blue on Plate I. These values are also listed in the table, as are the depth interval and average thermal conductivity used for calculation of the gradient and heat flow. The table values are given in SI units. To transform units, 1×10^{-6} cal/cm^2 sec (HFU) = 41.84 mWm^{-2}, 1×10^{-3} cal/cm sec^{o}C (TCU) = 0.4184 Wm^{-1}K^{-1}. Also 1^{o}C/km - 1 mKm^{-1} = 18.2^{o}F/100 ft. The temperature-depth measurements themselves for each hole have been open-filed at the DOGAMI office in Portland, and are included in Appendix B. Corrected gradient and corrected heat-flow are values for which the topographic effects have been removed. These are significant for some of the sites studied.

The holes are ranked in terms of the quality of the gradient or heat flow information, from high quality (A) to good quality (B), to marginal quality (C), to data with some problems (D), to data for which no useful temperature gradient or heat flow can be estimated (X). Holes indicated by a G are those which are in geothermal systems.

The holes available are a combination of wells drilled for water, either potable or for space heating, and holes drilled by DOGAMI for exploration of the resource potential. For holes which have been drilled for geothermal exploration, we have cuttings and have made thermal conductivity measurements

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*Written by Dr. David D. Blackwell, Southern Methodist University, Dallas, Texas

Table 4. Geothermal-gradient data, Lakeview area, Oregon.

Twn/Rng-Section	N Lat. Deg.Min.	W Long Deg.Min.	Hole # Date	Collar Elev.	Bottom Temp. (°C)	Depth Interval (m)	Avg. TC $Wm^{-1}K^{-1}$	# TC	Uncorr. Gradient °C/km	Corr. Gradient °C/km	Corr. HF mWm^{-1}	Q HF
38S/20E-21DAC	42-15.36	120-21.47	G PLATO 7/31/79	1499	12.39	22.5 40.0			37.9 2.0			D
38S/20E-22CBC	42-15.16	120-20.95	CL SMITH 7/31/79	1536	14.80	17.5 30.0	2.20	1	86.6 3.3	72.9	161	G
						17.5 56.5	2.20	1	81.6 6.0	68.7	151	G
38S/20E-28CAA	42-14.59	120-21.98	SELBY 8/29/79	1490	15.99	16.0 40.0						X
38S/20E-33ABB1	42-14.18	120-21.79	D LNDSAY 7/30/79	1499	100.50	.0 247.0	(2.22)		<358.0	<358.0	< 796	G
						35.0 110.0	(2.22)		551.5 .1	551.5	1222	G
38S/20E-33ABB2	42-14.12	120-21.80	STKSBRRY 7/30/79	1492	44.48	15.0 56.5	(2.22)		379.4 26.1	379.4	842	G
38S/20E-33DBC	42-13.58	120-21.91	STRBY-WW 7/31/79	1470	27.89	17.5 32.5	(1.26)		422.3 2.7	422.3	531	G
38S/20E-33DCD	42-13.39	120-21.65	LEACH 2 8/23/79	1470	112.69	.0 120.0	(1.42)		839.0	839.0	1180	G
38S/20E-33DDC	42-13.38	120-21.53	LEACH 1 8/23/79	1487	103.04	.0 130.0	1.42	1	698.0	698.0	992	G
38S/20E-33CDD	42-13.34	120-21.95	EMCDONLD 8/24/79	1455	98.97	.0 21.0	(1.26)		3755.0	3755.0	4715	G
39S/20E-4AAB	42-13.32	120-21.61	INGLDEW 11/ 9/79	1470	30.44	.0 31.0	(1.51)		594.8	594.8	895	G
39S/20E-3ABA	42-13.30	120-20.53	HMSLCAN3 1/23/80	1567	34.40	20.0 82.5	1.49	9	302.2 11.4	208.4	309	G
39S/20E-4AAA	42-13.29	120-21.48	MUNSELL 11/ 9/79	1484	102.85	.0 47.5	(1.51)		1912.0	1912.0	2883	G

Table 4. Geothermal-gradient data, Lakeview area, Oregon--Continued.

Twn/Rng-Section	N Lat. Deg.Min.	W Long Deg.Min.	Hole # Date	Collar Elev.	Bottom Temp. (°C)	Depth Interval (m)	Avg. TC $Wm^{-1}K^{-1}$	# TC	Uncorr. Gradient °C/km	Corr. Gradient °C/km	Corr. HF mWm^{-1}	Q HF
39S/20E-3BDB	42-13.08	120-20.96	HMSLCAN1 1/23/80	1507	94.42	.0 40.0	1.54		2150.0	2150.0	3310	G
						.0 89.0	1.54		<926.0	<926.0	<1426	G
39S/20E-3BCB	42-12.92	120-21.16	HMSLCAN2 1/23/80	1457	37.79	17.5 90.0	1.48	11	280.1 16.6	193.0	286	G
39S/20E-4DAC	42-12.82	120-21.45	SNIDR-WW 7/31/79	1458	32.29	70.0 125.0			192.1 3.5			G
						15.0 145.0	(1.26)		166.2 8.6	151.1	190	G
39S/20E-4DCA	42-12.65	120-21.70	PR PN CO 1/22/80	1453	26.37	12.5 37.5	1.24	11	132.9 1.5			G
						12.5 125.0	1.24	11	138.1 13.0	128.5	160	G
39S/20E-9DAA	42-11.97	120-21.28	FRMT-WW1 8/ 1/79	1444	24.27	.0 145.0	(1.26)		(84.6)	78.3	98	D
39S/20E-15BAA	42-11.52	120-20.72	LKVWTNLT 1/23/80	1453	20.90	42.5 90.0	1.37	9	106.3 4.7	90.9	125	B
39S/20E-14BBB	42-11.48	120-20.08	BULLCAN1 1/23/80	1503	15.98	15.0 48.0	2.33	7	111.0 3.4	77.6	180	B
39S/20E-15AAC	42-11.44	120-20.50	BULLCAN2 1/23/80	1486	21.77	12.5 87.5	1.60	10	125.4 1.1	87.7	141	B
39S/20E-15ABD	42-11.40	120-20.25	LKVWSWMP 11/15/79	1468	62.22	385.0 548.5			93.5 4.3			B
						30.0 548.5			81.7 4.0			B
						75.0 200.0	(1.59)		111.5 6.8	94.5	150	B

Table 4. Geothermal-gradient data, Lakeview area, Oregon--Continued.

Twn/Rng-Section	N Lat. Deg.Min.	W Long Deg.Min.	Hole # Date	Collar Elev.	Bottom Temp. (°C)	Depth Interval (m)	Avg. TC $Wm^{-1}K^{-1}$	# TC	Uncorr. Gradient °C/km	Corr. Gradient °C/km	Corr. HF mWm^{-1}	Q HF
39S/20E-15CCB	42-10.84	120-21.28	MTCHTT 1 7/30/79	1443	27.02	60.0 167.5	(1.26)		106.3 3.1	99.3	125	B
39S/20E-17AB	42-11.58	120-22.96	UTLEY-1 11/14/73	1459	115.83	.0 1652.0	(1.26)		61.0	61.0	77	C
39S/20E-22ABA	42-10.70	120-20.50	MTCHTT 2 7/30/79	1475	20.31	20.0 66.5	1.94	1	111.5 14.9	97.7	190	C
39S/20E-22ACB	42-10.38	120-20.65	JACKSON 8/24/79	1450	24.02	20.0 65.0	(1.26)		99.9 4.3	87.9	110	C
39S/21E-29AD	42- 9.58	120-15.38	RPK-1 7/22/73	2865	5.49	10.0 35.0						X
39S/20E-27DBB	42- 9.36	120-20.61	BARRY 1/23/80	1566	75.70	32.5 70.0	1.72	8	430.8 .1	430.8	742	G
41S/20E-1CAD	42- 2.28	120-18.55	ROCKFRD1 6/ 9/80	1451	69.90	25.0 65.0	(1.26)		405.1 .1	405.1	51	G
						.0 415.0	(1.26)		<139.5	<139.3	< 175	G
41S/20E-1CCD	42- 2.14	120-18.29	ROCKFRD2 6/ 9/80	1440	66.66	.0 120.0	(1.26)		<455.5	<455.5	< 572	G
41S/20E-13AAA	42- 1.09	120-17.91	SWINGLE 8/23/79	1469	14.73	5.0 28.0	(1.26)		83.9 14.9	72.2	91	C
41S/21E-18CBC	42- .56	120-17.78	GILMORE 8/23/79	1467	15.98	10.0 73.0	(1.26)		83.2 8.4	77.0	97	C

on the cuttings. At least three areas of high temperature at shallow depth are known in the Lakeview area. These are the Leach Hot Well area in the northern part of the study area, the Barry Ranch Warm Spring in the central part of the area, and the Rockford Ranch area in the southern part of the study region. Highest temperatures actually measured in the three regions are 112°C in hole 33Dcd, one of the Leach holes, 75.7°C in hole 27Ddb at the Barry Ranch, and 71.2°C in hole 1Ccb on the Rockford Ranch. All of the areas of high heat flow are associated with the boundary between the Warner Range and the Lakeview Valley. Drilling at the Leach area has demonstrated that the actual upflow of geothermal fluid is within the range block and is, thus, circulation in the upthrown block of the basin-and-range, normal-fault pair. In the Leach area, heat flow is three times normal for a distance of at least 1½ km into the range, indicating a rather large anomaly. One hole, 3Bdb, had a shallow flow of 99.1°C water at 45 m; however, the hole indicates that the background gradient and heat flow are nearly the same as holes 3Bcb and 3Aba, i.e., approximately 200°C/km and 300 mWm^{-2}. The areas of high temperature are localized, perhaps, by the intersection of some kind of feature in the range block. In the town of Lakeview itself, several holes and the deep swimming pool well (15Abd) indicate somewhat lower geothermal-gradient and heat-flow values, although the heat-flow values are still approximately 50% higher than the regional background. These higher heat-flow values may be caused by refraction of heat from the low conductivity basin into the range block, or they may indicate that this site is on the edge of the anomalies at either the Barry Ranch or in the Leach Hot Well area.

Based on the data available, it seems that the heat requirements of the town of Lakeview could be satisfied with water from geothermal systems within a distance of five miles of the town. Subsequent to the studies described here, Northwest Geothermal Corporation has drilled several holes in an attempt

to develop a low-temperature geothermal resource for use in the town. Results of these drill holes are proprietary at this time.

CONCLUSIONS AND RECOMMENDATIONS

The geothermal system at Lakeview has been used for heating, greenhouses, therapeutics, and recreation since before the turn of the century. The resource for direct utilization appears to be of large enough volume and high enough temperature to warrant exploration by Northwest Geothermal Corporation for a local heating district. Active exploration and drilling is, at the writing of this report, ongoing. Understanding of the actual geothermal system is, however, at a low level of confidence. The following are recommendations designed to bring that understanding up to a level commensurate with the next stages of intermediate-level drilling and final production:

1. Detailed (scale 1:24,000) geologic mapping of the Warner Mountain Range fault block and areas to the north and west of Lakeview--to identify and evaluate active thermal structures, identify areas of recent hydrothermal alteration, and define the absolute age of rock units and related structures.
2. Detailed sampling and analysis of hot and cold springs and wells, including isotope and gas analyses--to determine fluid flow directions, provenance, and precise reservoir conditions, and possibly to identify heretofore unknown thermal areas.
3. Closely spaced complete Bouguer and residual gravity anomaly studies across the Goose Lake Basin and Warner Mountain Range--to delineate possible active thermal structures or intrusives below surface units.
4. Several resistivity traverses (either dipole-dipole, roving dipole, or telluric) normal to mapped structures and tied in to known thermal aquifers--to further define the thermal regime.
5. A micro-earthquake/contemporary seismic study of the entire Lakeview area, making use of a high-gain seismometer array--to define the seismicity of the area in relation to geothermal systems.

6. A program of twenty to thirty 500-ft gradient/stratigraphy holes, followed by a program of five to ten 2,000-ft holes--to model heat flow and directly test geothermal aquifers.

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APPENDIX A

Formulas used in calculations

Na:K (revised): $$t\ ^{o}C = \frac{1217}{\log (Na/K) + 1.483} - 273.15$$ (Fournier, 1979)

Na:K:Ca: $$t\ ^{o}C = \frac{1647}{2.24 + F\ (T)} - 273.15$$ (Fournier and Truesdell, 1973),

where $F\ (T) = \log (Na/K) + [\ \beta \log (\sqrt{Ca}/Na)\ ]$,

β = 1/3 if t> 100°C, and 4/3 if t <100°C,

$t^{o}C$ = calculated reservoir temperature,

and concentrations are expressed in molality.

Magnesium correction ratio:

$$R = \frac{(\text{milliequivalents Mg})}{(\text{milliequivalents Mg}) + (\text{milliequivalents Ca}) + (\text{milliequivalents K})} \times 100$$

If R <5 or >50, no calculation was made. For R between 5-50,

$$\Delta t_{Mg} = 10.66 - (4.7415)\ (R) + [(325.87)\ (\log R)^2] - [(1.032 \times 10^5)\ (\log R)^2/T] - [(1.968 \times 10^7)\ (\log R)^2/T^2] + [(1.605 \times 10^7)\ (\log R)^3/T^2],$$

where R = magnesium correction ratio expressed in equivalents,

Δt_{Mg} = the temperature correction that is subtracted from the Na:K:Ca 1/3 β calculated temperature,

T = Na:K:Ca 1/3 β calculated temperature in °K.

Or Δt_{Mg} can be obtained by using the graph compiled by Fournier and Potter (1979).

SiO_2 temperature calculations (Fournier and Rowe, 1966):

SiO_2 (conductive), $$t^{o}C = \frac{1309}{5.19 + \log (SiO_2)} - 273.15$$

SiO_2 (adiabatic), $$t^{o}C = \frac{1522}{5.75 + \log (SiO_2)} - 273.15$$

SiO_2 (chalcedony), $$t^{o}C = \frac{1032}{4.69 + \log (SiO_2)} - 273.15$$

SiO_2 (opal), $$t^{o}C = \frac{731}{4.52 + \log (SiO_2)} - 273.15,$$

where SiO_2 is expressed in mg/l.

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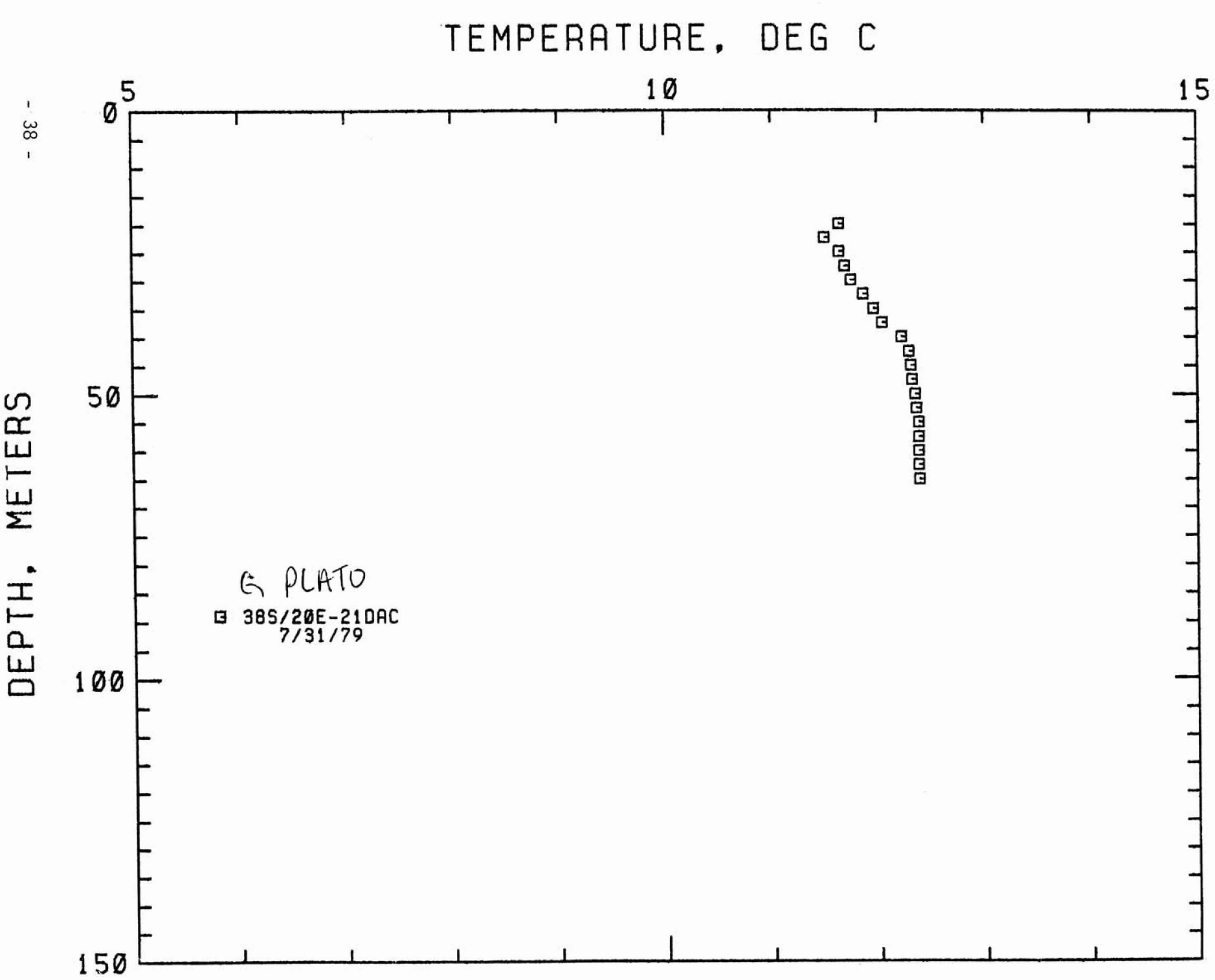
APPENDIX B

GEOTHERMAL GRADIENT DATA

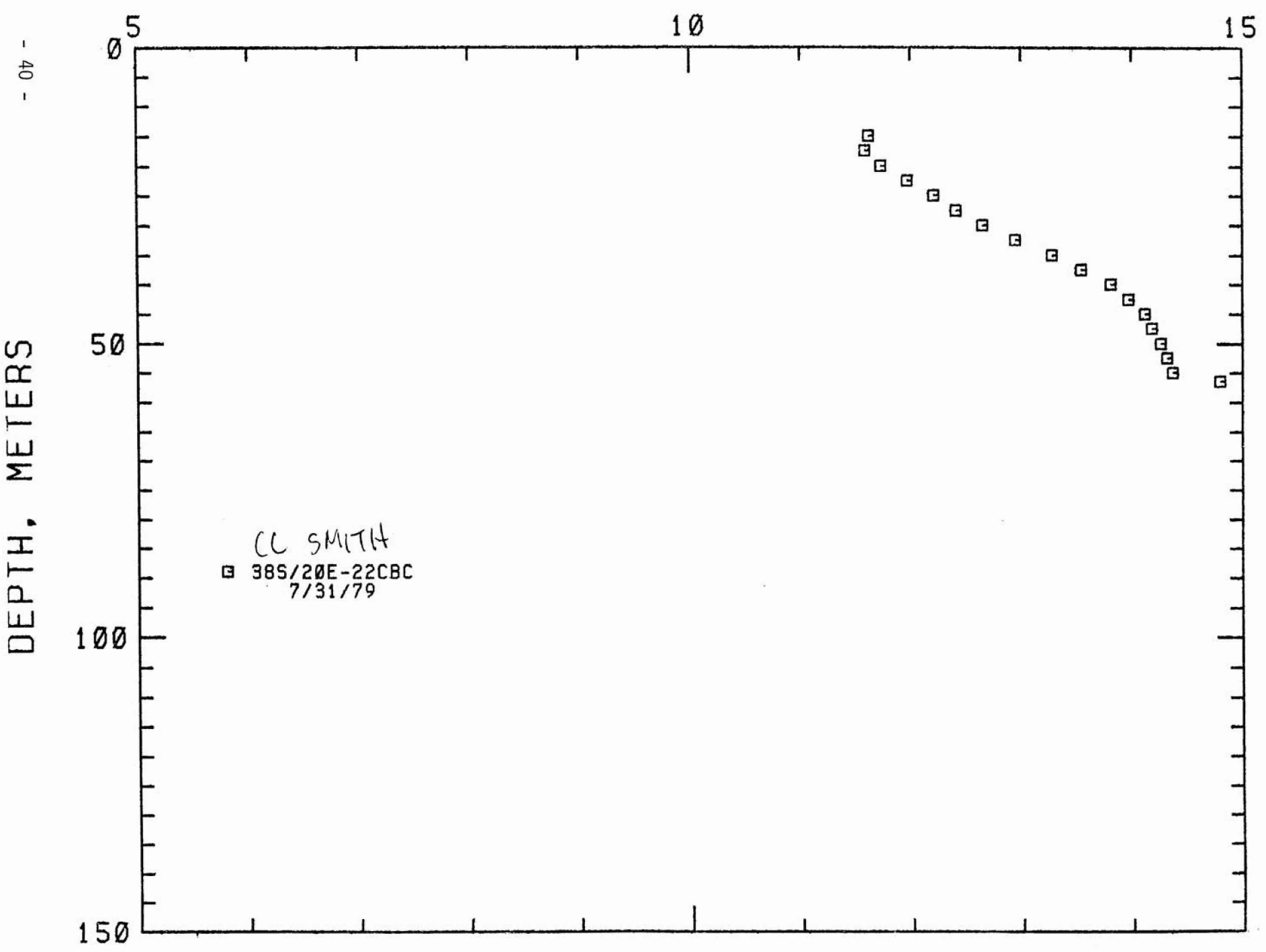
LOCATION: KLAMATH FALLS AMS,OREGON
38S/20E-21DAC
HOLE NAME: G PLATO
DATE MEASURED: 7/31/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
20.0	65.6	11.640	52.95	0.0	0.0
22.5	73.8	11.500	52.70	-56.0	-3.1
25.0	82.0	11.640	52.95	56.0	3.1
27.5	90.2	11.690	53.04	20.0	1.1
30.0	98.4	11.750	53.15	24.0	1.3
32.5	106.6	11.860	53.35	44.0	2.4
35.0	114.8	11.960	53.53	40.0	2.2
37.5	123.0	12.040	53.67	32.0	1.8
40.0	131.2	12.220	54.00	72.0	4.0
42.5	139.4	12.290	54.12	28.0	1.5
45.0	147.6	12.310	54.16	8.0	0.4
47.5	155.8	12.320	54.18	4.0	0.2
50.0	164.0	12.350	54.23	12.0	0.7
52.5	172.2	12.360	54.25	4.0	0.2
55.0	180.4	12.380	54.28	8.0	0.4
57.5	188.6	12.380	54.28	0.0	0.0
60.0	196.8	12.380	54.28	0.0	0.0
62.5	205.0	12.380	54.28	0.0	0.0
65.0	213.2	12.390	54.30	4.0	0.2


TEMPERATURE, DEG C
5
10
15
0
50
100
150
DEPTH, METERS
PLATO
38S/20E-21DAC
7/31/79

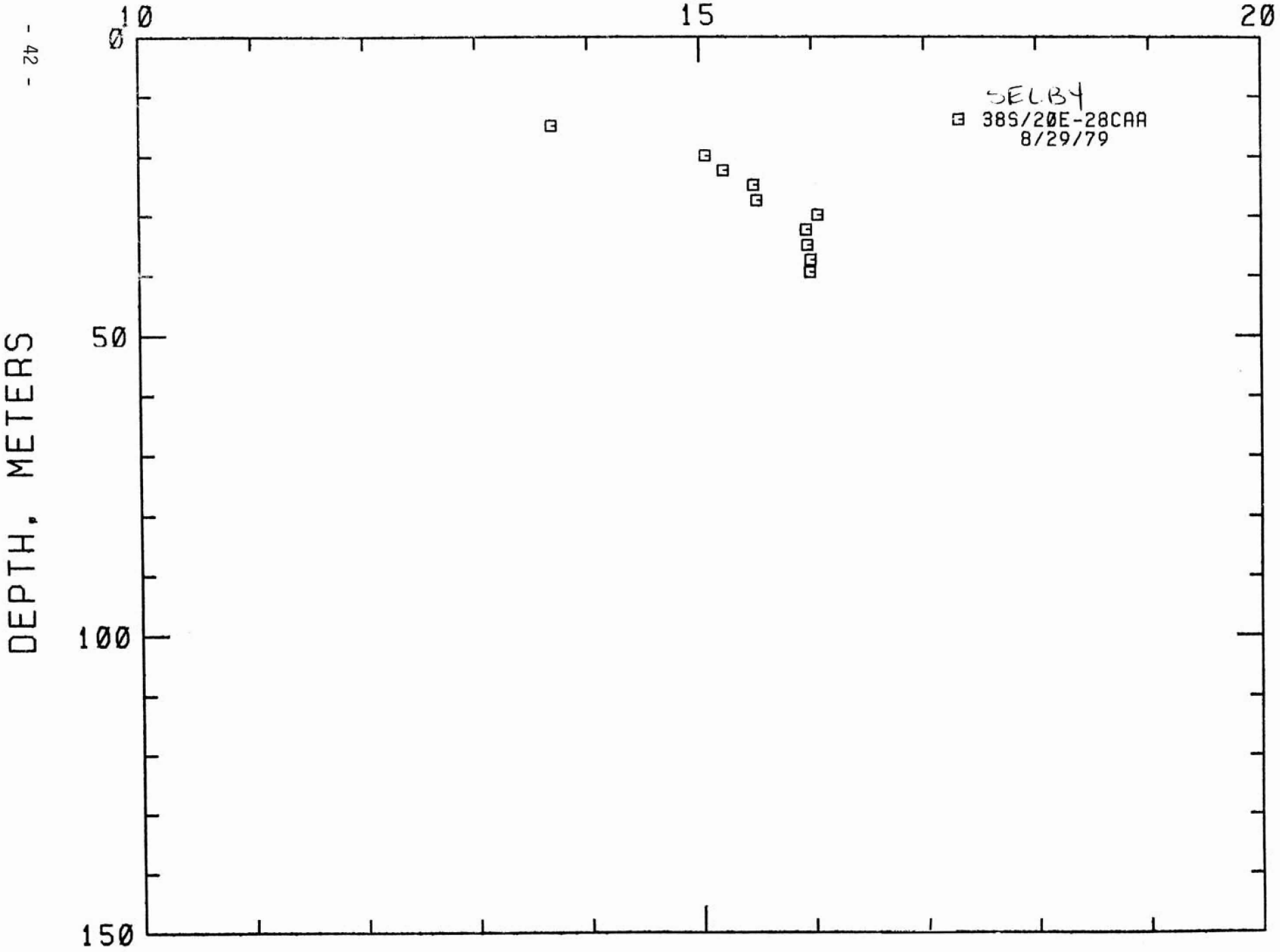
LOCATION: KLAMATH FALLS AMS, OREGON
38S/20E-22CBC
HOLE NAME: CL SMITH
DATE MEASURED: 7/31/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	11.620	52.92	0.0	0.0
17.5	57.4	11.590	52.86	-12.0	-0.7
20.0	65.6	11.730	53.11	56.0	3.1
22.5	73.8	11.970	53.55	96.0	5.3
25.0	82.0	12.210	53.98	96.0	5.3
27.5	90.2	12.410	54.34	80.0	4.4
30.0	98.4	12.650	54.77	96.0	5.3
32.5	106.6	12.950	55.31	120.0	6.6
35.0	114.8	13.280	55.90	132.0	7.2
37.5	123.0	13.540	56.37	104.0	5.7
40.0	131.2	13.810	56.86	108.0	5.9
42.5	139.4	13.970	57.15	64.0	3.5
45.0	147.6	14.120	57.42	60.0	3.3
47.5	155.8	14.180	57.52	24.0	1.3
50.0	164.0	14.260	57.67	32.0	1.8
52.5	172.2	14.320	57.78	24.0	1.3
55.0	180.4	14.370	57.87	20.0	1.1
56.5	185.3	14.800	58.64	286.7	15.7


TEMPERATURE, DEG C
5
10
15
0
50
100
150
DEPTH, METERS
CC SMITH
38S/20E-22CBC
7/31/79

LOCATION: KLAMATH FALLS AMS, ORE
38S/20E-28CAA
HOLE NAME: SELBY
DATE MEASURED: 8/29/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	13.680	56.62	0.0	0.0
20.0	65.6	15.050	59.09	274.0	15.0
22.5	73.8	15.210	59.38	64.0	3.5
25.0	82.0	15.480	59.86	108.0	5.9
27.5	90.2	15.510	59.92	12.0	0.7
30.0	98.4	16.050	60.89	216.0	11.9
32.5	106.6	15.950	60.71	-40.0	-2.2
35.0	114.8	15.960	60.73	4.0	0.2
37.5	123.0	15.990	60.78	12.0	0.7
39.5	129.6	15.980	60.76	-5.0	-0.3

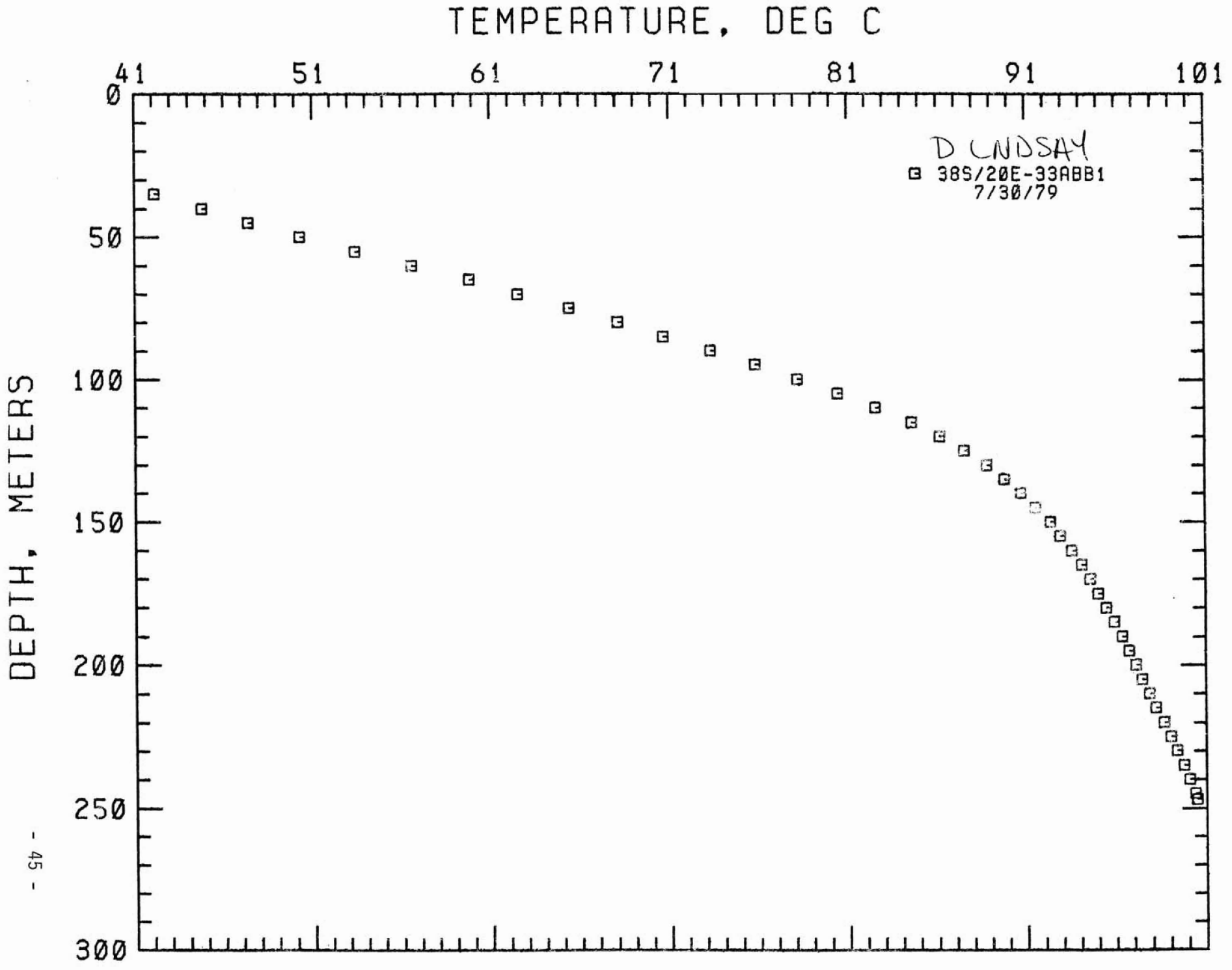

TEMPERATURE, DEG C
10
15
20
0
50
100
150
DEPTH, METERS
SELBY
38S/20E-28CAA
8/29/79

LOCATION: KLAMATH FALLS AMS, OREGON
38S/20E-33ABB1
HOLE NAME: D LNDSAY
DATE MEASURED: 7/30/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
35.0	114.8	42.140	107.85	0.0	0.0
40.0	131.2	44.800	112.64	532.0	29.2
45.0	147.6	47.410	117.34	522.0	28.6
50.0	164.0	50.320	122.58	582.0	31.9
55.0	180.4	53.410	128.14	618.0	33.9
60.0	196.8	56.610	133.90	640.0	35.1
65.0	213.2	59.810	139.66	640.0	35.1
70.0	229.6	62.520	144.54	542.0	29.7
75.0	246.0	65.420	149.76	580.0	31.8
80.0	262.4	68.110	154.60	538.0	29.5
85.0	278.8	70.670	159.21	512.0	28.1
90.0	295.2	73.300	163.94	526.0	28.9
95.0	311.6	75.810	168.46	502.0	27.5
100.0	328.0	78.180	172.72	474.0	26.0
105.0	344.4	80.440	176.79	452.0	24.8
110.0	360.8	82.570	180.63	426.0	23.4
115.0	377.2	84.580	184.24	402.0	22.1
120.0	393.6	86.140	187.05	312.0	17.1
125.0	410.0	87.530	189.55	278.0	15.3
130.0	426.4	88.810	191.86	256.0	14.0
135.0	442.8	89.780	193.60	194.0	10.6
140.0	459.2	90.700	195.26	184.0	10.1
145.0	475.6	91.520	196.74	164.0	9.0
150.0	492.0	92.360	198.25	168.0	9.2
155.0	508.4	92.910	199.24	110.0	6.0
160.0	524.8	93.570	200.43	132.0	7.2
165.0	541.2	94.100	201.38	106.0	5.8
170.0	557.6	94.580	202.24	96.0	5.3
175.0	574.0	95.020	203.04	88.0	4.8
180.0	590.4	95.480	203.86	92.0	5.0
185.0	606.8	95.910	204.64	86.0	4.7
190.0	623.2	96.360	205.45	90.0	4.9
195.0	639.6	96.740	206.13	76.0	4.2
200.0	656.0	97.120	206.82	76.0	4.2
205.0	672.4	97.480	207.46	72.0	4.0
210.0	688.8	97.880	208.18	80.0	4.4
215.0	705.2	98.230	208.81	70.0	3.8
220.0	721.6	98.660	209.59	86.0	4.7
225.0	738.0	99.040	210.27	76.0	4.2
230.0	754.4	99.380	210.88	68.0	3.7
235.0	770.8	99.760	211.57	76.0	4.2

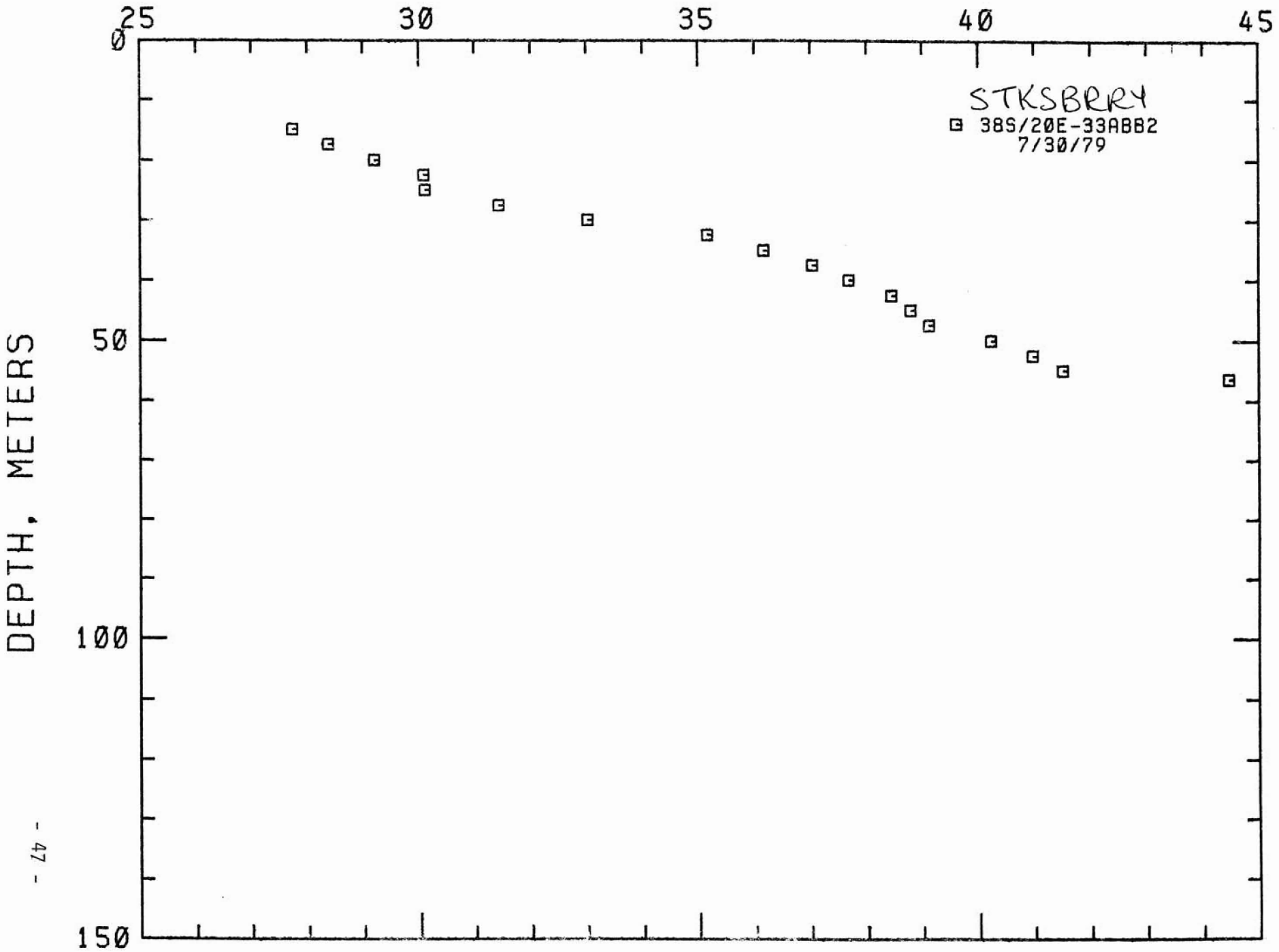
38S/20E-33ABB1
HOLE NAME: D LNDSAY
DATE MEASURED: 7/30/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
240.0	787.2	100.090	212.16	66.0	3.6
245.0	803.6	100.370	212.67	56.0	3.1
247.0	810.2	100.500	212.90	65.0	3.6


TEMPERATURE, DEG C
41
51
61
71
81
91
101
0
50
100
150
200
250
300
DEPTH, METERS
D LINDSAY
38S/20E-33ABB1
7/30/79

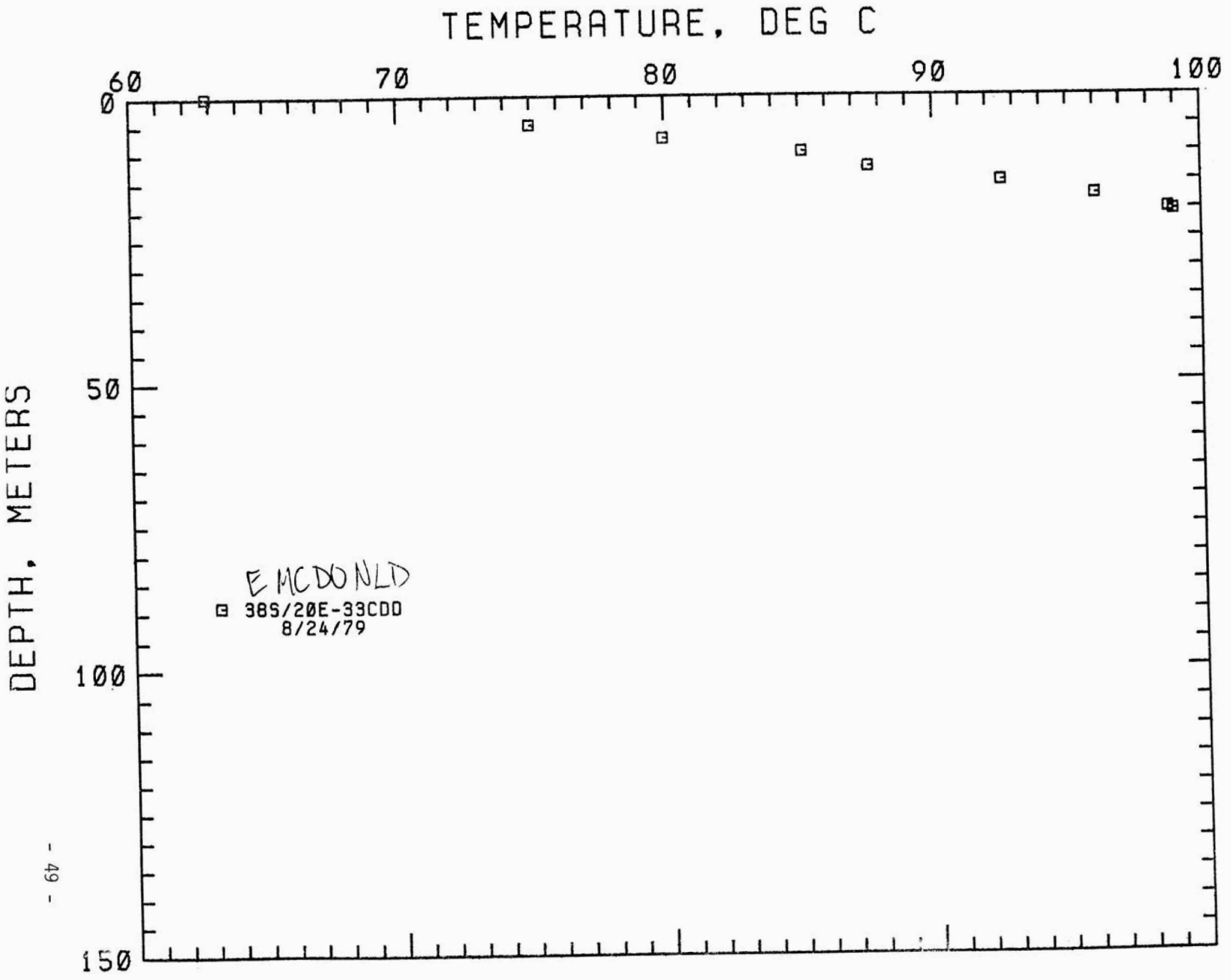
LOCATION: KLAMATH FALLS AMS, OREGON
38S/20E-33ABB2
HOLE NAME: STKSBRRY
DATE MEASURED: 7/30/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	27.750	81.95	0.0	0.0
17.5	57.4	28.390	83.10	256.0	14.0
20.0	65.6	29.220	84.60	332.0	18.2
22.5	73.8	30.100	86.18	352.0	19.3
25.0	82.0	30.120	86.22	8.0	0.4
27.5	90.2	31.440	88.59	528.0	29.0
30.0	98.4	33.030	91.45	636.0	34.9
32.5	106.6	35.170	95.31	856.0	47.0
35.0	114.8	36.170	97.11	400.0	22.0
37.5	123.0	37.030	98.65	344.0	18.9
40.0	131.2	37.690	99.84	264.0	14.5
42.5	139.4	38.450	101.21	304.0	16.7
45.0	147.6	38.790	101.82	136.0	7.5
47.5	155.8	39.130	102.43	136.0	7.5
50.0	164.0	40.230	104.41	440.0	24.1
52.5	172.2	40.980	105.76	300.0	16.5
55.0	180.4	41.510	106.72	212.0	11.6
56.5	185.3	44.480	112.06	1980.0	108.7


TEMPERATURE, DEG C
25
30
35
40
45
0
50
100
150
DEPTH, METERS
STKSBRY4
38S/20E-33ABB2
7/30/79

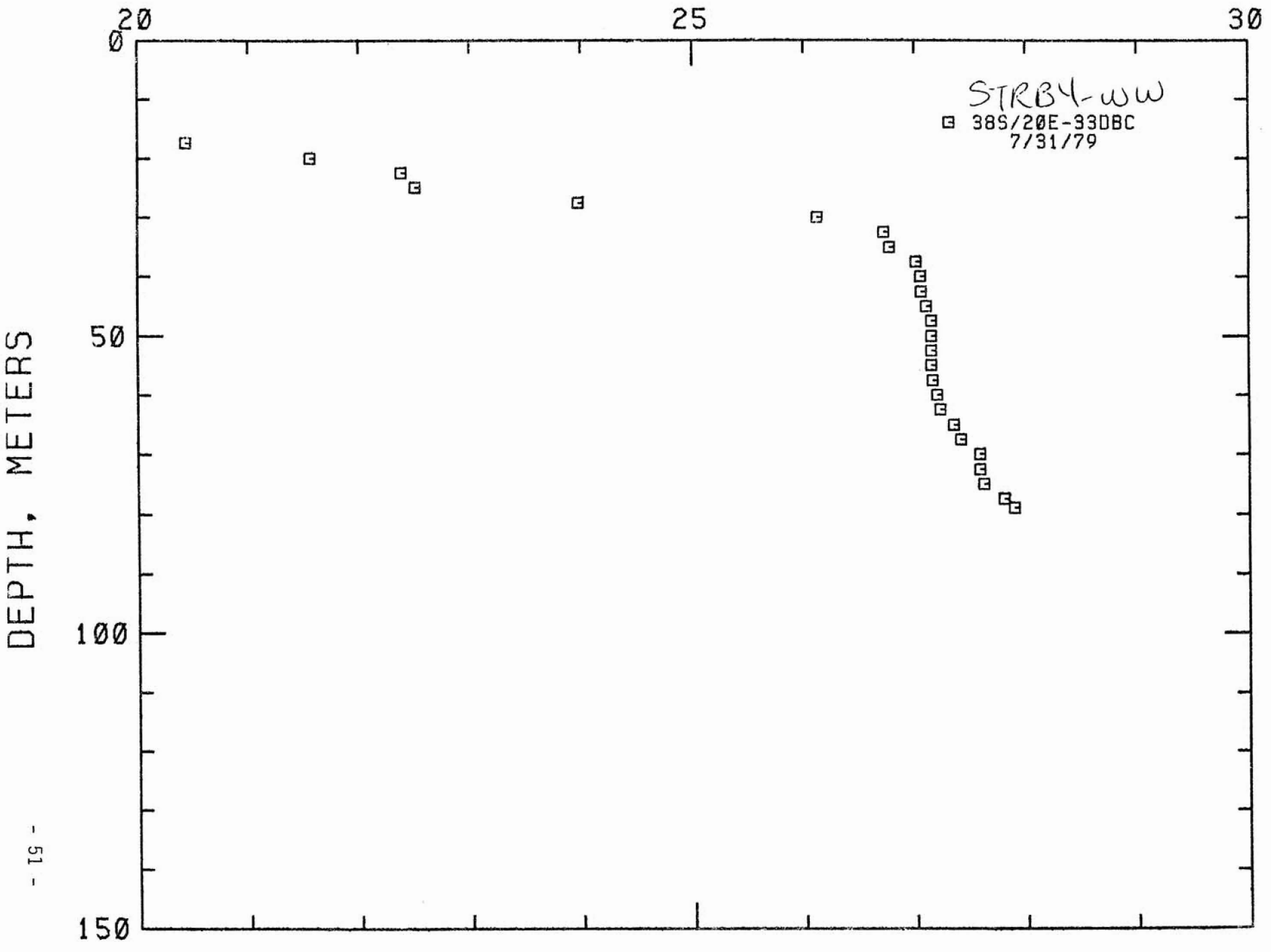
LOCATION: KLAMATH FALLS AMS, ORE
38S/20E-33CDD
HOLE NAME: EMCDONLD
DATE MEASURED: 8/24/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
0.0	0.0	62.880	145.18	0.0	0.0
5.0	16.4	74.990	166.98	2422.0	132.9
7.5	24.6	79.970	175.95	1992.0	109.3
10.0	32.8	85.150	185.27	2072.0	113.7
12.5	41.0	87.620	189.72	988.0	54.2
15.0	49.2	92.560	198.61	1976.0	108.4
17.5	57.4	96.070	204.93	1404.0	77.0
20.0	65.6	98.780	209.80	1084.0	59.5
20.5	67.2	98.970	210.15	380.0	20.9


TEMPERATURE, DEG C
60
70
80
90
100
0
50
100
150
DEPTH, METERS
E MCDONLD
38S/20E-33CDD
8/24/79

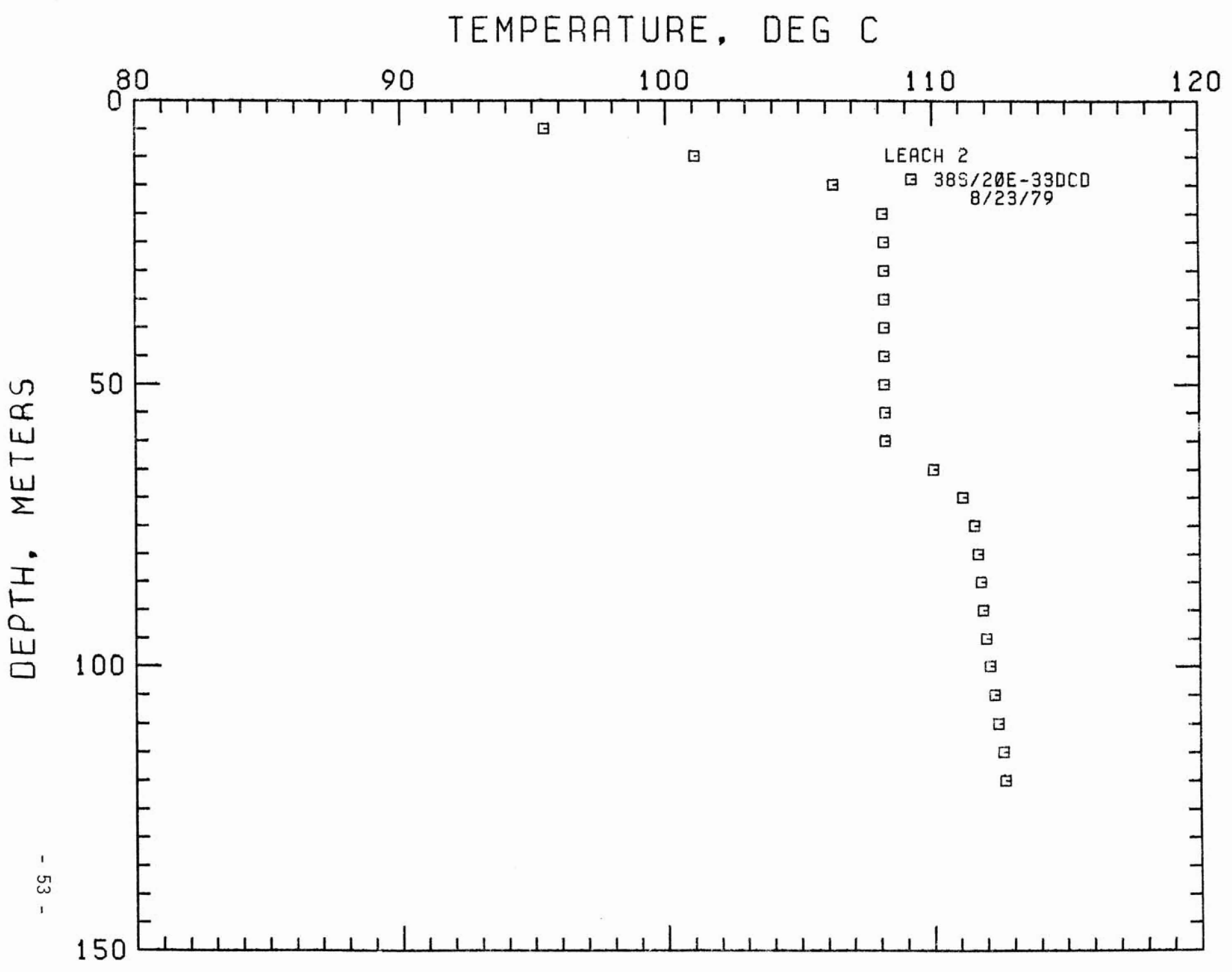
LOCATION: KLAMATH FALLS AMS,OREGON
38S/20E-33DBC
HOLE NAME: STRBY-WW
DATE MEASURED: 7/31/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
17.5	57.4	20.440	68.79	0.0	0.0
20.0	65.6	21.560	70.81	448.0	24.6
22.5	73.8	22.380	72.28	328.0	18.0
25.0	82.0	22.510	72.52	52.0	2.9
27.5	90.2	23.980	75.16	588.0	32.3
30.0	98.4	26.120	79.02	856.0	47.0
32.5	106.6	26.720	80.10	240.0	13.2
35.0	114.8	26.770	80.19	20.0	1.1
37.5	123.0	27.010	80.62	96.0	5.3
40.0	131.2	27.050	80.69	16.0	0.9
42.5	139.4	27.060	80.71	4.0	0.2
45.0	147.6	27.100	80.78	16.0	0.9
47.5	155.8	27.150	80.87	20.0	1.1
50.0	164.0	27.150	80.87	0.0	0.0
52.5	172.2	27.150	80.87	0.0	0.0
55.0	180.4	27.150	80.87	0.0	0.0
57.5	188.6	27.160	80.89	4.0	0.2
60.0	196.8	27.200	80.96	16.0	0.9
62.5	205.0	27.230	81.01	12.0	0.7
65.0	213.2	27.350	81.23	48.0	2.6
67.5	221.4	27.410	81.34	24.0	1.3
70.0	229.6	27.580	81.64	68.0	3.7
72.5	237.8	27.580	81.64	0.0	0.0
75.0	246.0	27.620	81.72	16.0	0.9
77.5	254.2	27.800	82.04	72.0	4.0
79.0	259.1	27.890	82.20	60.0	3.3


TEMPERATURE, DEG C
20
25
30
0
50
100
150
DEPTH, METERS
STRB4-WW
38S/20E-33DBC
7/31/79

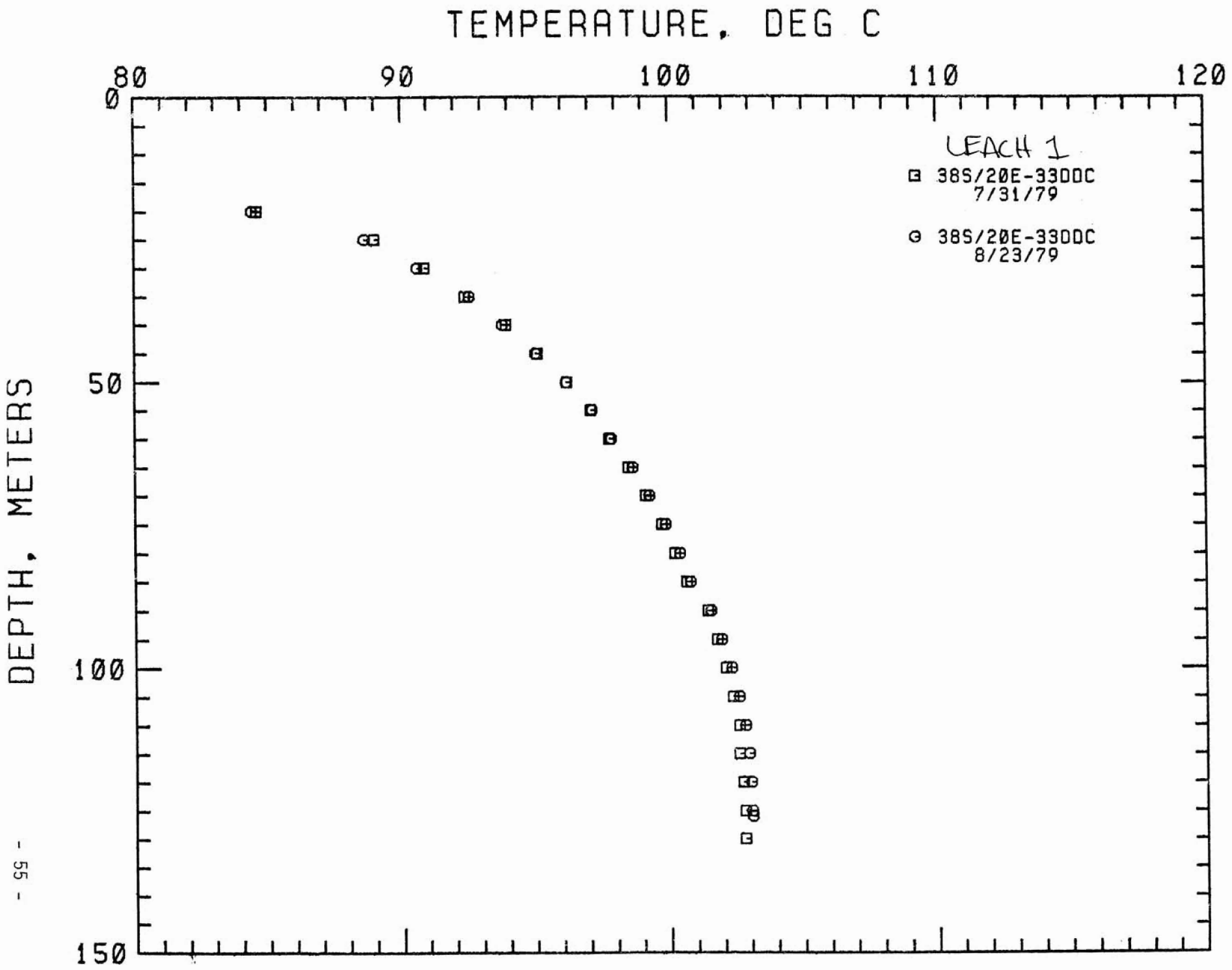
LOCATION: KLAMATH FALLS AMS, ORE
38S/20E-33DCD
HOLE NAME: LEACH 2
DATE MEASURED: 8/23/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	95.460	203.83	0.0	0.0
10.0	32.8	101.100	213.98	1128.0	61.9
15.0	49.2	106.300	223.34	1040.0	57.1
20.0	65.6	108.170	226.71	374.0	20.5
25.0	82.0	108.200	226.76	6.0	0.3
30.0	98.4	108.200	226.76	0.0	0.0
35.0	114.8	108.210	226.78	2.0	0.1
40.0	131.2	108.210	226.78	0.0	0.0
45.0	147.6	108.210	226.78	0.0	0.0
50.0	164.0	108.210	226.78	0.0	0.0
55.0	180.4	108.230	226.81	4.0	0.2
60.0	196.8	108.220	226.80	-2.0	-0.1
65.0	213.2	110.030	230.05	362.0	19.9
70.0	229.6	111.130	232.03	220.0	12.1
75.0	246.0	111.560	232.81	86.0	4.7
80.0	262.4	111.700	233.06	28.0	1.5
85.0	278.8	111.820	233.28	24.0	1.3
90.0	295.2	111.890	233.40	14.0	0.8
95.0	311.6	112.000	233.60	22.0	1.2
100.0	328.0	112.140	233.85	28.0	1.5
105.0	344.4	112.300	234.14	32.0	1.8
110.0	360.8	112.430	234.37	26.0	1.4
115.0	377.2	112.620	234.72	38.0	2.1
120.0	393.6	112.690	234.84	14.0	0.8


TEMPERATURE, DEG C
80
90
100
110
120
0
50
100
150
DEPTH, METERS
LEACH 2
38S/20E-33DCD
8/23/79

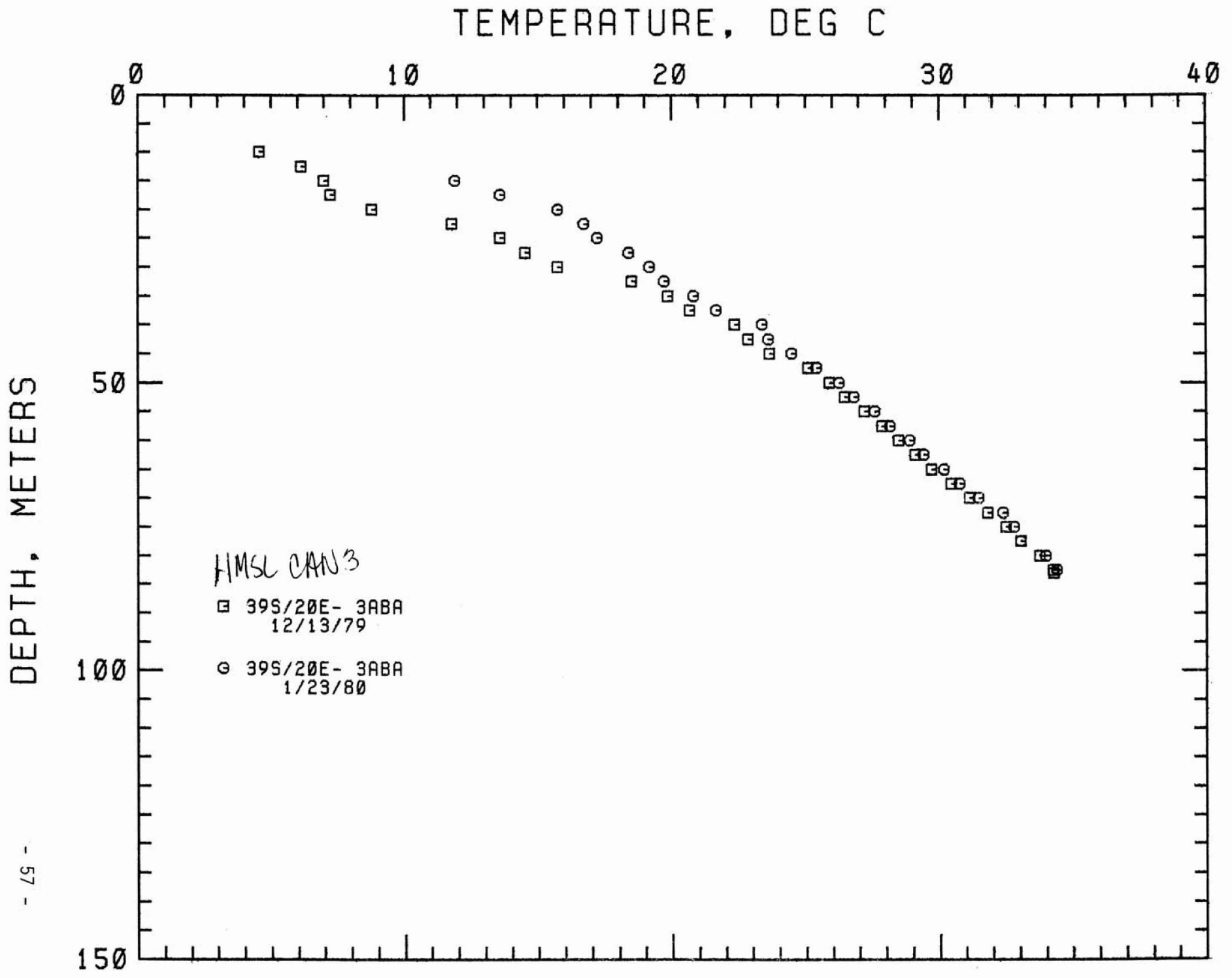
LOCATION: KLAMATH FALLS AMS, OREGON
38S/20E-33DDC
HOLE NAME: LEACH 1
DATE MEASURED: 8/23/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
20.0	65.6	84.440	183.99	0.0	0.0
25.0	82.0	88.640	191.55	840.0	46.1
30.0	98.4	90.630	195.13	398.0	21.8
35.0	114.8	92.560	198.61	386.0	21.2
40.0	131.2	93.800	200.84	248.0	13.6
45.0	147.6	95.050	203.09	250.0	13.7
50.0	164.0	96.190	205.14	228.0	12.5
55.0	180.4	97.140	206.85	190.0	10.4
60.0	196.8	97.860	208.15	144.0	7.9
65.0	213.2	98.640	209.55	156.0	8.6
70.0	229.6	99.270	210.69	126.0	6.9
75.0	246.0	99.860	211.75	118.0	6.5
80.0	262.4	100.390	212.70	106.0	5.8
85.0	278.8	100.770	213.39	76.0	4.2
90.0	295.2	101.540	214.77	154.0	8.5
95.0	311.6	101.920	215.46	76.0	4.2
100.0	328.0	102.290	216.12	74.0	4.1
105.0	344.4	102.560	216.61	54.0	3.0
110.0	360.8	102.790	217.02	46.0	2.5
115.0	377.2	102.920	217.26	26.0	1.4
120.0	393.6	102.990	217.38	14.0	0.8
125.0	410.0	103.020	217.44	6.0	0.3
126.0	413.3	103.040	217.47	20.0	1.1


TEMPERATURE, DEG C
80
90
100
110
120
0
50
100
150
DEPTH, METERS
LEACH 1
38S/20E-33DDC
7/31/79
38S/20E-33DDC
8/23/79

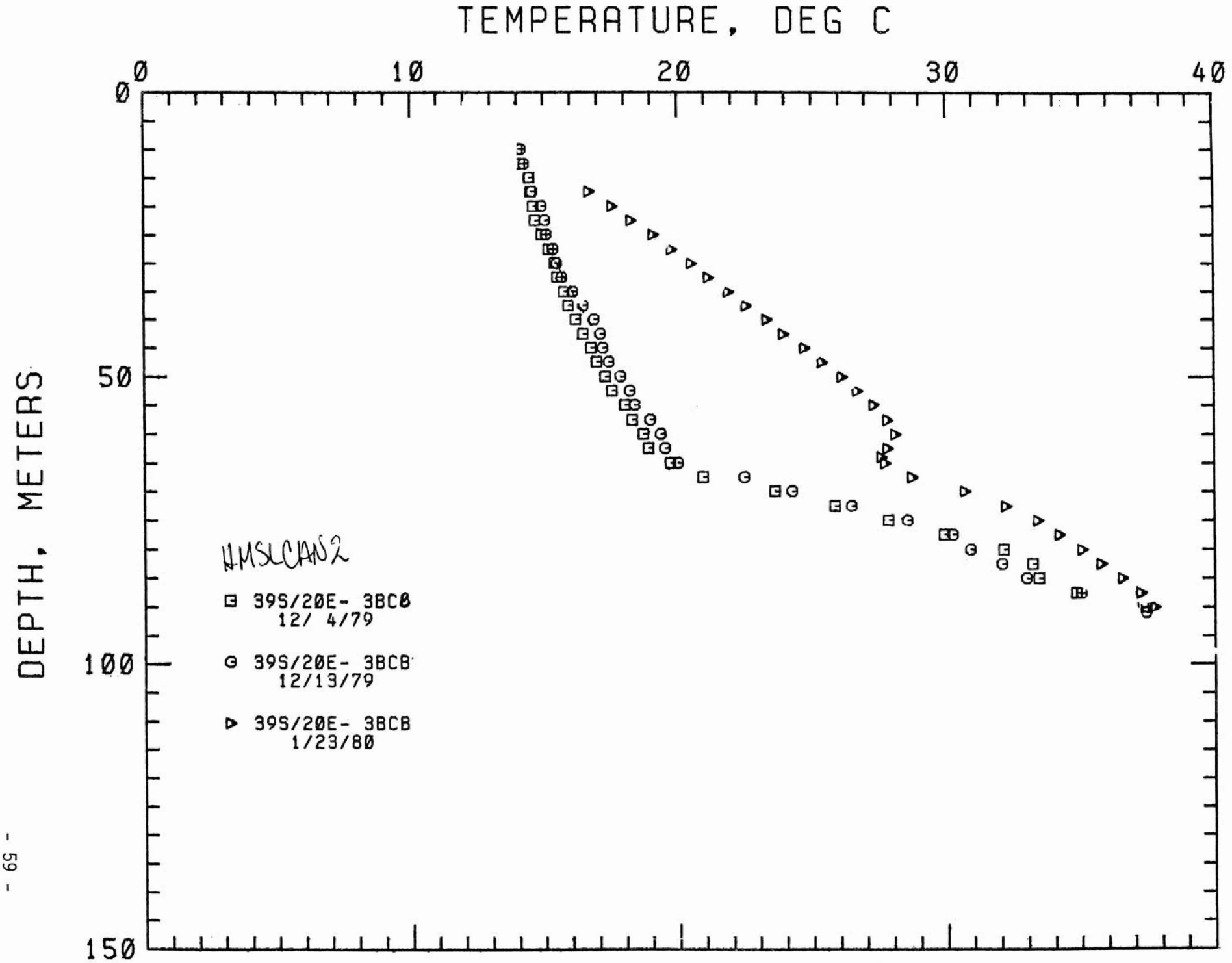
LOCATION: K FALLS AMS, OREGON
39S/20E- 3ABA
HOLE NAME: HMSLOAN3
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	11.900	53.42	0.0	0.0
17.5	57.4	13.600	56.48	680.0	37.3
20.0	65.6	15.740	60.33	856.0	47.0
22.5	73.8	16.720	62.10	392.0	21.5
25.0	82.0	17.230	63.01	204.0	11.2
27.5	90.2	18.390	65.10	464.0	25.5
30.0	98.4	19.180	66.52	316.0	17.3
32.5	106.6	19.720	67.50	216.0	11.9
35.0	114.8	20.830	69.49	444.0	24.4
37.5	123.0	21.680	71.02	340.0	18.7
40.0	131.2	23.380	74.08	680.0	37.3
42.5	139.4	23.620	74.52	96.0	5.3
45.0	147.6	24.470	76.05	340.0	18.7
47.5	155.8	25.420	77.76	380.0	20.9
50.0	164.0	26.260	79.27	336.0	18.4
52.5	172.2	26.810	80.26	220.0	12.1
55.0	180.4	27.590	81.66	312.0	17.1
57.5	188.6	28.170	82.71	232.0	12.7
60.0	196.8	28.890	84.00	288.0	15.8
62.5	205.0	29.410	84.94	208.0	11.4
65.0	213.2	30.180	86.32	308.0	16.9
67.5	221.4	30.760	87.37	232.0	12.7
70.0	229.6	31.480	88.66	288.0	15.8
72.5	237.8	32.380	90.28	360.0	19.8
75.0	246.0	32.810	91.06	172.0	9.4
77.5	254.2	33.040	91.47	92.0	5.0
80.0	262.4	33.990	93.18	380.0	20.9
82.5	270.6	34.400	93.92	164.0	9.0


TEMPERATURE, DEG C
0
10
20
30
40
DEPTH, METERS
0
50
100
150
HMSL CAN 3
39S/20E- 3ABA
12/13/79
39S/20E- 3ABA
1/23/80

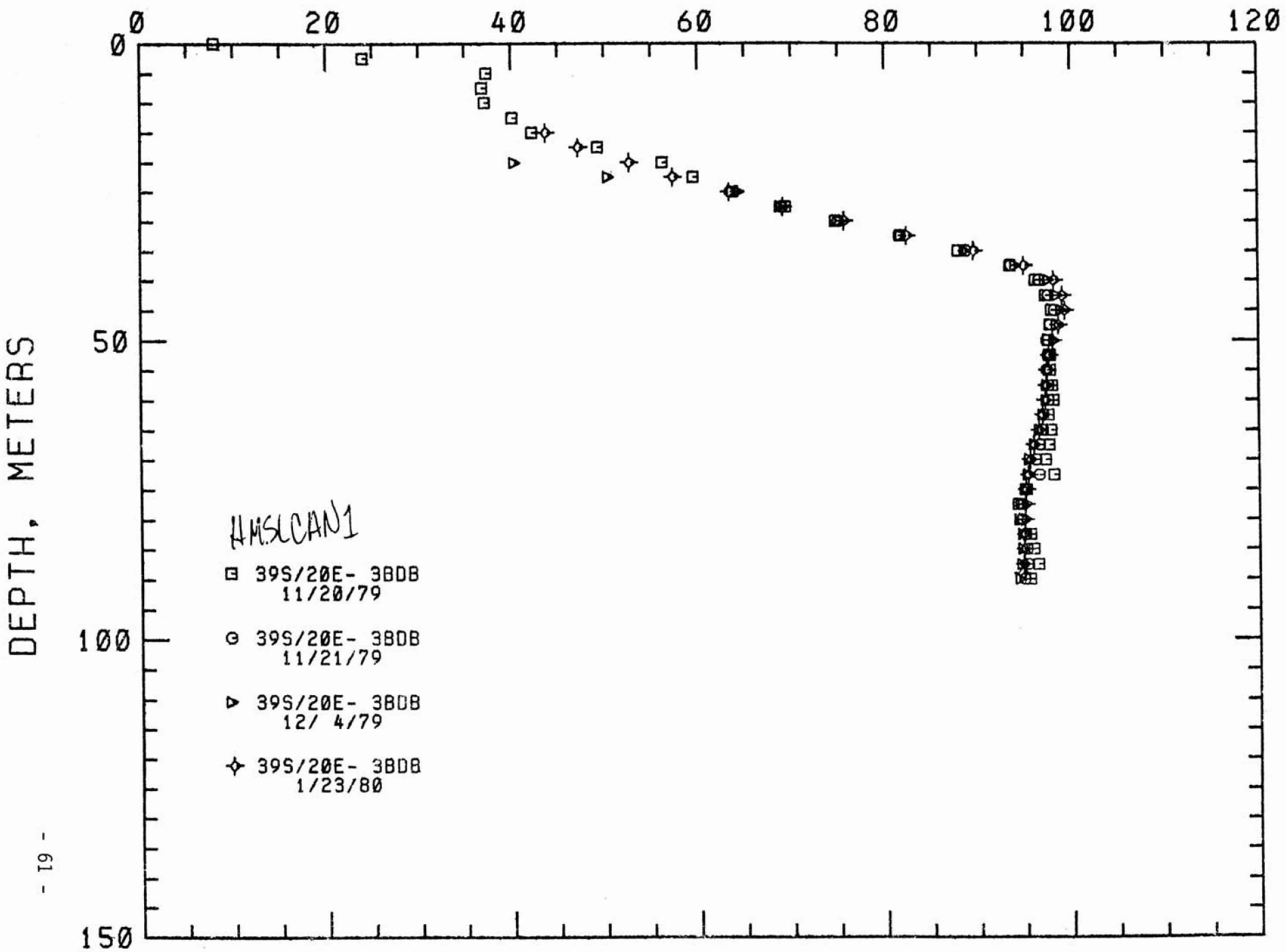
LOCATION: K FALLS AMS, OREGON
39S/20E- 3BCB
HOLE NAME: HMSLCAN2
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
17.5	57.4	16.740	62.13	0.0	0.0
20.0	65.6	17.610	63.70	348.0	19.1
22.5	73.8	18.310	64.96	280.0	15.4
25.0	82.0	19.130	66.43	328.0	18.0
27.5	90.2	19.810	67.66	272.0	14.9
30.0	98.4	20.550	68.99	296.0	16.2
32.5	106.6	21.190	70.14	256.0	14.0
35.0	114.8	21.930	71.47	296.0	16.2
37.5	123.0	22.590	72.66	264.0	14.5
40.0	131.2	23.370	74.07	312.0	17.1
42.5	139.4	23.970	75.15	240.0	13.2
45.0	147.6	24.750	76.55	312.0	17.1
47.5	155.8	25.410	77.74	264.0	14.5
50.0	164.0	26.150	79.07	296.0	16.2
52.5	172.2	26.730	80.11	232.0	12.7
55.0	180.4	27.340	81.21	244.0	13.4
57.5	188.6	27.850	82.13	204.0	11.2
60.0	196.8	28.130	82.63	112.0	6.1
62.5	205.0	27.850	82.13	-112.0	-6.1
64.0	209.9	27.600	81.68	-166.7	-9.1
65.0	213.2	27.750	81.95	150.0	8.2
67.5	221.4	28.760	83.77	404.0	22.2
70.0	229.6	30.730	87.31	788.0	43.2
72.5	237.8	32.240	90.03	604.0	33.1
75.0	246.0	33.430	92.17	476.0	26.1
77.5	254.2	34.230	93.61	320.0	17.6
80.0	262.4	35.090	95.16	344.0	18.9
82.5	270.6	35.790	96.42	280.0	15.4
85.0	278.8	36.590	97.86	320.0	17.6
87.5	287.0	37.290	99.12	280.0	15.4
90.0	295.2	37.780	100.00	196.0	10.8


TEMPERATURE, DEG C
0
10
20
30
40
DEPTH, METERS
0
50
100
150
HMSLCAN2
39S/20E- 3BC0
12/ 4/79
39S/20E- 3BCB
12/13/79
39S/20E- 3BCB
1/23/80

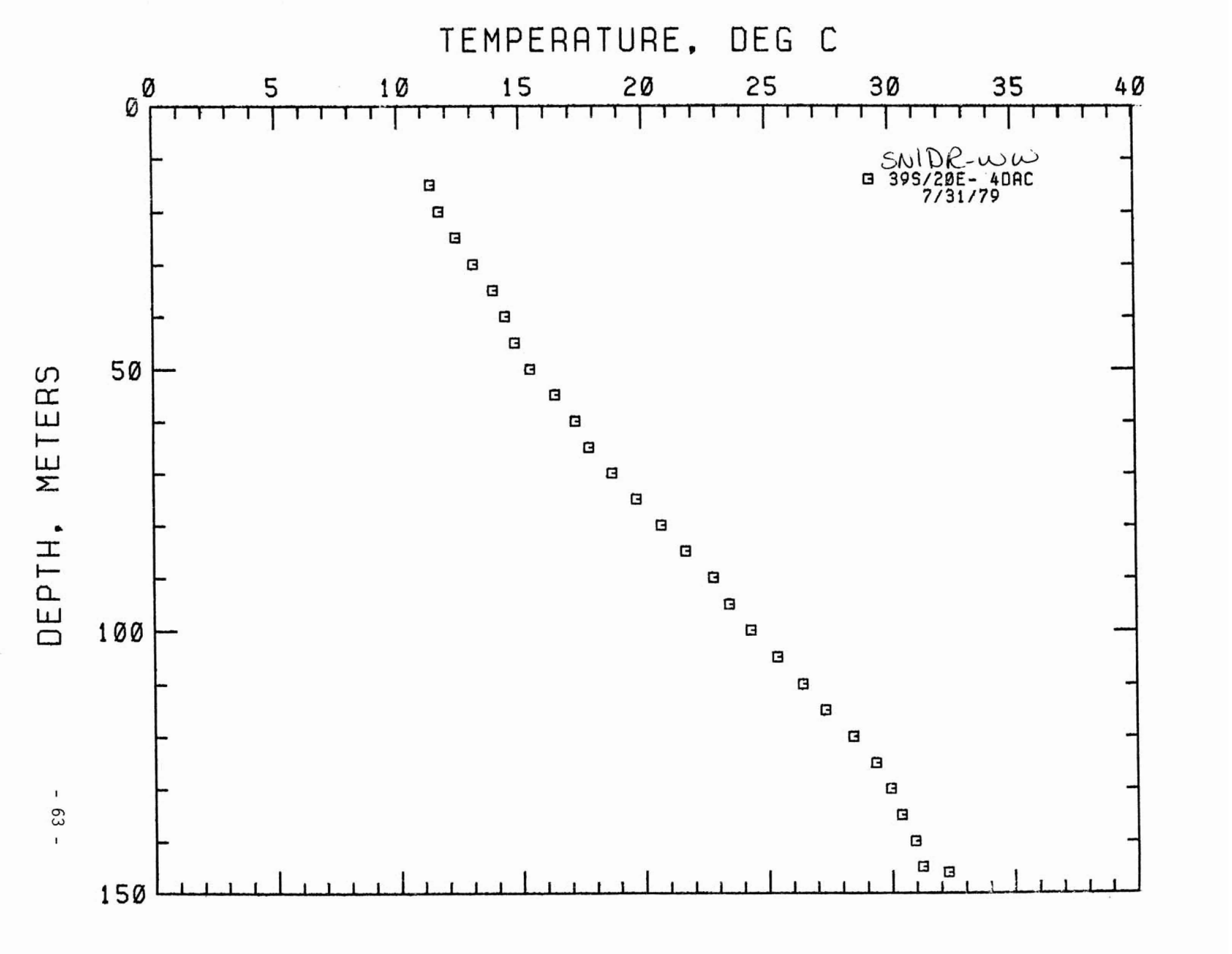
LOCATION: KLAMATH FALLS AMS, ORE
39S/20E- 3BDB
HOLE NAME: HMSLCAN1
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	43.510	110.32	0.0	0.0
17.5	57.4	47.060	116.71	1420.0	77.9
20.0	65.6	52.530	126.55	2188.0	120.1
22.5	73.8	57.200	134.96	1868.0	102.5
25.0	82.0	63.220	145.80	2408.0	132.1
27.5	90.2	69.000	156.20	2312.0	126.9
30.0	98.4	75.510	167.92	2604.0	142.9
32.5	106.6	82.210	179.98	2680.0	147.1
35.0	114.8	89.450	193.01	2896.0	158.9
37.5	123.0	94.780	202.60	2132.0	117.0
40.0	131.2	97.990	208.38	1284.0	70.5
42.5	139.4	98.910	210.04	368.0	20.2
45.0	147.6	99.120	210.42	84.0	4.6
47.5	155.8	98.450	209.21	-268.0	-14.7
50.0	164.0	97.830	208.09	-248.0	-13.6
52.5	172.2	97.430	207.37	-160.0	-8.8
55.0	180.4	97.240	207.03	-76.0	-4.2
57.5	188.6	97.190	206.94	-20.0	-1.1
60.0	196.8	97.040	206.67	-60.0	-3.3
62.5	205.0	96.750	206.15	-116.0	-6.4
65.0	213.2	96.310	205.36	-176.0	-9.7
67.5	221.4	95.790	204.42	-208.0	-11.4
70.0	229.6	95.370	203.67	-168.0	-9.2
72.5	237.8	95.190	203.34	-72.0	-4.0
75.0	246.0	94.910	202.84	-112.0	-6.1
77.5	254.2	94.820	202.68	-36.0	-2.0
80.0	262.4	94.780	202.60	-16.0	-0.9
82.5	270.6	94.780	202.60	0.0	0.0
85.0	278.8	94.730	202.51	-20.0	-1.1
87.5	287.0	94.600	202.28	-52.0	-2.9
89.0	291.9	94.420	201.96	-120.0	-6.6


TEMPERATURE, DEG C
0
20
40
60
80
100
120
DEPTH, METERS
0
50
100
150
H.M.S.CAN1
39S/20E- 3BDB
11/20/79
39S/20E- 3BDB
11/21/79
39S/20E- 3BDB
12/ 4/79
39S/20E- 3BDB
1/23/80

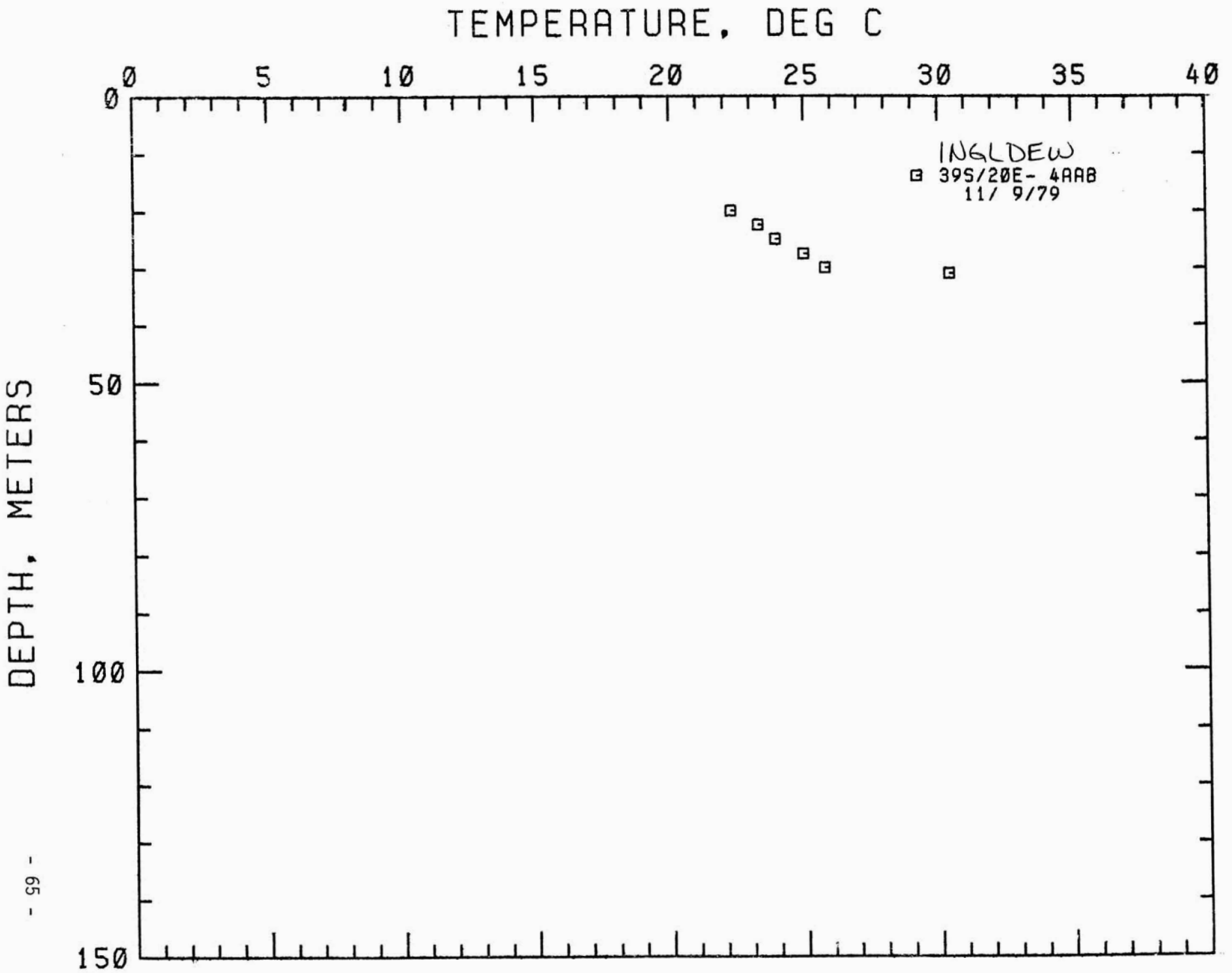
LOCATION: KLAMATH FALLS AMS,OREGON
39S/20E- 4DAC
HOLE NAME: SNIDR-WW
DATE MEASURED: 7/31/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	11.380	52.48	0.0	0.0
20.0	65.6	11.730	53.11	70.0	3.8
25.0	82.0	12.400	54.32	134.0	7.4
30.0	98.4	13.110	55.60	142.0	7.8
35.0	114.8	13.930	57.07	164.0	9.0
40.0	131.2	14.410	57.94	96.0	5.3
45.0	147.6	14.790	58.62	76.0	4.2
50.0	164.0	15.400	59.72	122.0	6.7
55.0	180.4	16.400	61.52	200.0	11.0
60.0	196.8	17.230	63.01	166.0	9.1
65.0	213.2	17.780	64.00	110.0	6.0
70.0	229.6	18.710	65.68	186.0	10.2
75.0	246.0	19.710	67.48	200.0	11.0
80.0	262.4	20.710	69.28	200.0	11.0
85.0	278.8	21.690	71.04	196.0	10.8
90.0	295.2	22.810	73.06	224.0	12.3
95.0	311.6	23.450	74.21	128.0	7.0
100.0	328.0	24.320	75.78	174.0	9.5
105.0	344.4	25.400	77.72	216.0	11.9
110.0	360.8	26.420	79.56	204.0	11.2
115.0	377.2	27.340	81.21	184.0	10.1
120.0	393.6	28.460	83.23	224.0	12.3
125.0	410.0	29.370	84.87	182.0	10.0
130.0	426.4	29.970	85.95	120.0	6.6
135.0	442.8	30.390	86.70	84.0	4.6
140.0	459.2	30.940	87.69	110.0	6.0
145.0	475.6	31.240	88.23	60.0	3.3
146.0	478.9	32.290	90.12	1050.0	57.6


TEMPERATURE, DEG C
0
5
10
15
20
25
30
35
40
DEPTH, METERS
0
50
100
150
SNIDR-WW
39S/20E- 4DAC
7/31/79

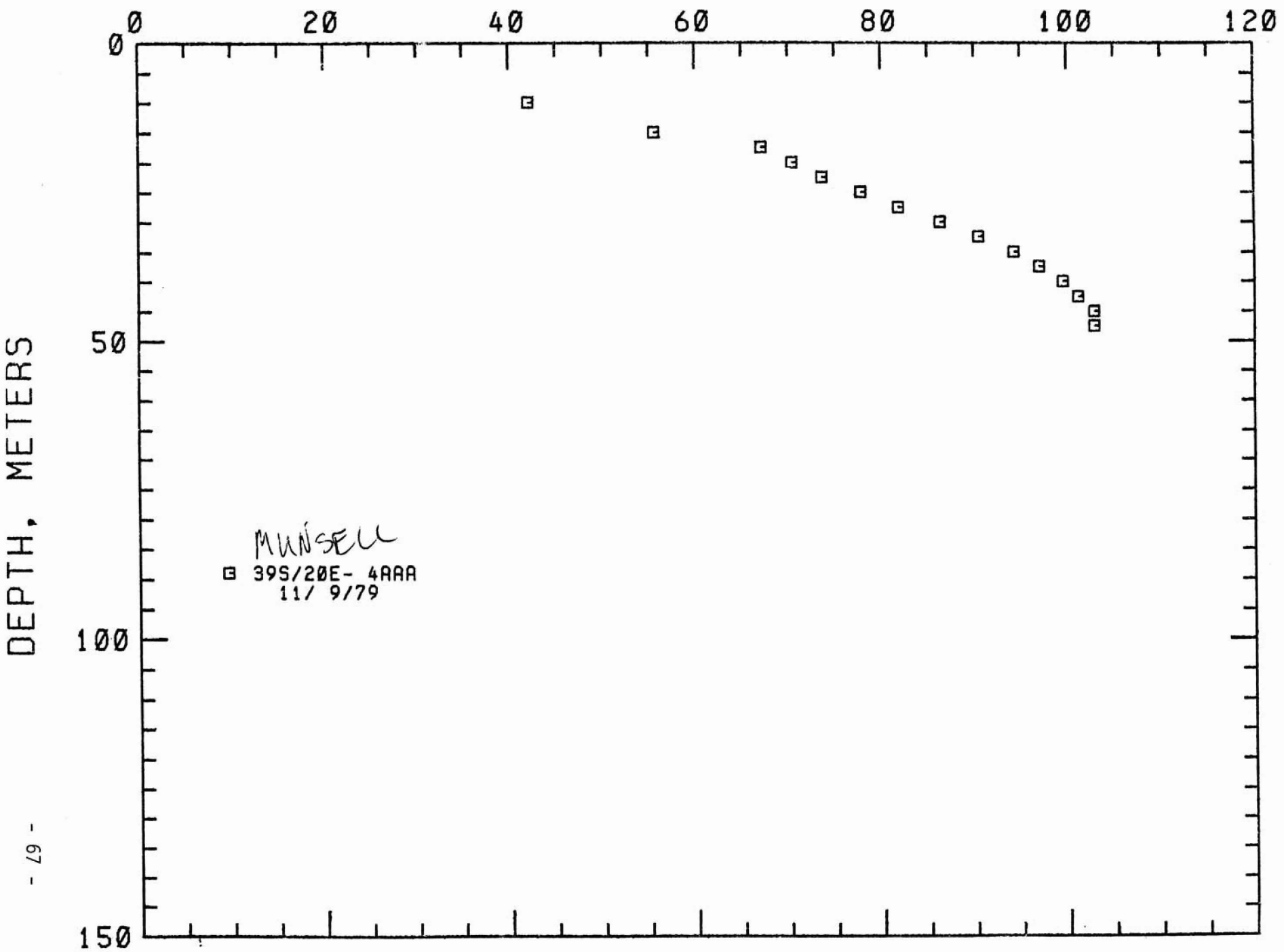
LOCATION: KLAMATH FALLS AMS, ORE
39S/20E- 4AAB
HOLE NAME: INGLDEW
DATE MEASURED: 11/ 9/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
20.0	65.6	22.300	72.14	0.0	0.0
22.5	73.8	23.310	73.96	404.0	22.2
25.0	82.0	23.960	75.13	260.0	14.3
27.5	90.2	25.010	77.02	420.0	23.0
30.0	98.4	25.810	78.46	320.0	17.6
31.0	101.7	30.440	86.79	4630.0	254.1


TEMPERATURE, DEG C
0
5
10
15
20
25
30
35
40
DEPTH, METERS
0
50
100
150
INGLDEW
39S/20E- 4AAB
11/ 9/79

LOCATION: KLAMATH FALLS AMS, ORE
39S/20E- 4AAA
HOLE NAME: MUNSELL
DATE MEASURED: 11/ 9/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
10.0	32.8	42.110	107.80	0.0	0.0
15.0	49.2	55.600	132.08	2698.0	148.1
17.5	57.4	67.130	152.83	4612.0	253.1
20.0	65.6	70.440	158.79	1324.0	72.7
22.5	73.8	73.620	164.52	1272.0	69.8
25.0	82.0	77.840	172.11	1688.0	92.6
27.5	90.2	81.900	179.42	1624.0	89.1
30.0	98.4	86.360	187.45	1784.0	97.9
32.5	106.6	90.430	194.77	1628.0	89.3
35.0	114.8	94.200	201.56	1508.0	82.8
37.5	123.0	96.940	206.49	1096.0	60.1
40.0	131.2	99.500	211.10	1024.0	56.2
42.5	139.4	101.160	214.09	664.0	36.4
45.0	147.6	102.850	217.13	676.0	37.1
47.5	155.8	102.850	217.13	0.0	0.0

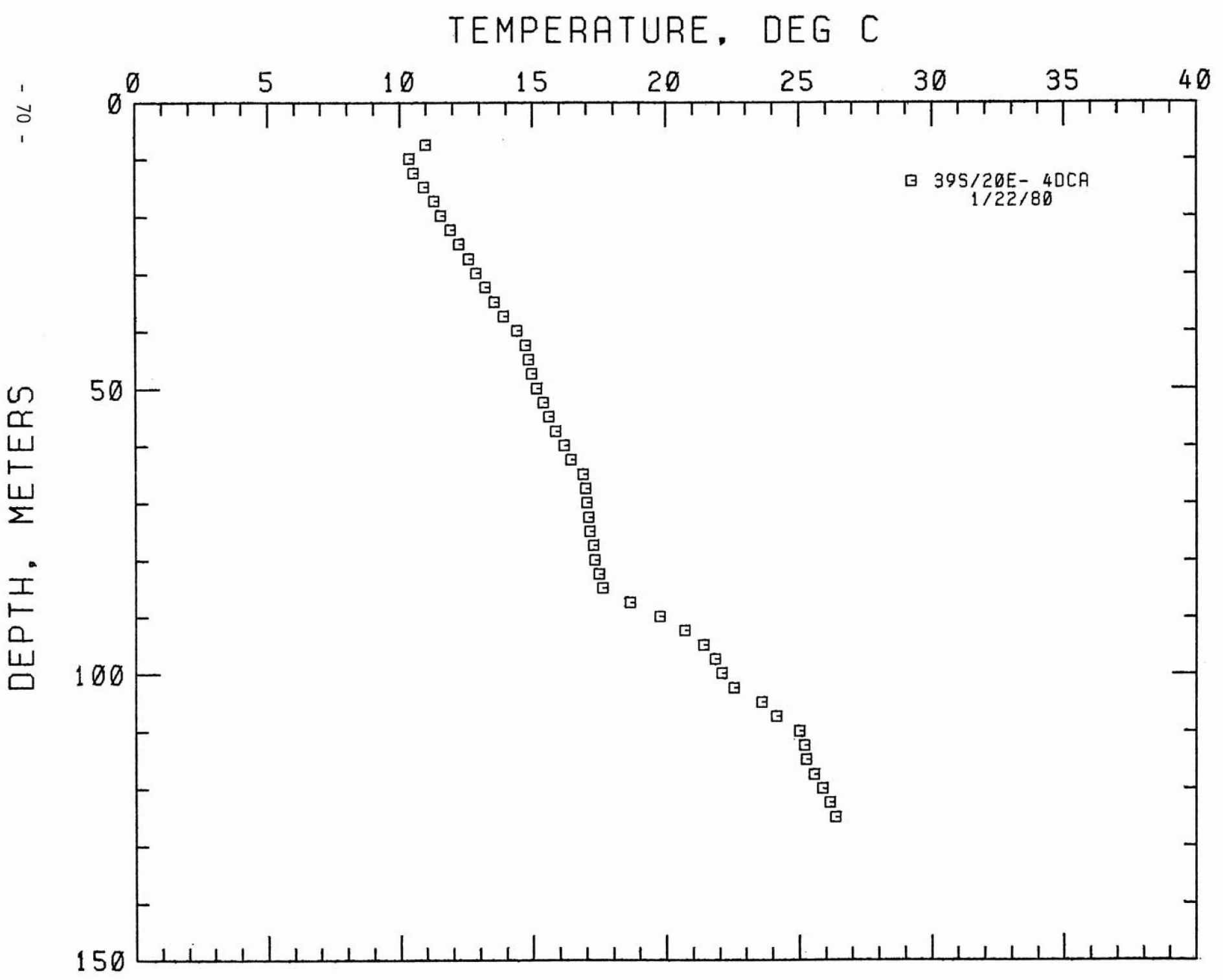

TEMPERATURE, DEG C
0
20
40
60
80
100
120
DEPTH, METERS
0
50
100
150
MUNSELL
39S/20E- 4AAA
11/ 9/79

LOCATION: K FALLS AMS, OREGON
39S/20E- 4DCA
HOLE NAME: PR PN CO
DATE MEASURED: 1/22/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
7.5	24.6	11.000	51.80	0.0	0.0
10.0	32.8	10.370	50.67	-252.0	-13.8
12.5	41.0	10.540	50.97	68.0	3.7
15.0	49.2	10.920	51.66	152.0	8.3
17.5	57.4	11.310	52.36	156.0	8.6
20.0	65.6	11.560	52.81	100.0	5.5
22.5	73.8	11.920	53.46	144.0	7.9
25.0	82.0	12.250	54.05	132.0	7.2
27.5	90.2	12.610	54.70	144.0	7.9
30.0	98.4	12.880	55.18	108.0	5.9
32.5	106.6	13.230	55.81	140.0	7.7
35.0	114.8	13.570	56.43	136.0	7.5
37.5	123.0	13.910	57.04	136.0	7.5
40.0	131.2	14.420	57.96	204.0	11.2
42.5	139.4	14.750	58.55	132.0	7.2
45.0	147.6	14.850	58.73	40.0	2.2
47.5	155.8	14.970	58.95	48.0	2.6
50.0	164.0	15.160	59.29	76.0	4.2
52.5	172.2	15.400	59.72	96.0	5.3
55.0	180.4	15.610	60.10	84.0	4.6
57.5	188.6	15.860	60.55	100.0	5.5
60.0	196.8	16.180	61.12	128.0	7.0
62.5	205.0	16.440	61.59	104.0	5.7
65.0	213.2	16.890	62.40	180.0	9.9
67.5	221.4	16.990	62.58	40.0	2.2
70.0	229.6	17.030	62.65	16.0	0.9
72.5	237.8	17.100	62.78	28.0	1.5
75.0	246.0	17.140	62.85	16.0	0.9
77.5	254.2	17.290	63.12	60.0	3.3
80.0	262.4	17.320	63.18	12.0	0.7
82.5	270.6	17.490	63.48	68.0	3.7
85.0	278.8	17.630	63.73	56.0	3.1
87.5	287.0	18.640	65.55	404.0	22.2
90.0	295.2	19.780	67.60	456.0	25.0
92.5	303.4	20.700	69.26	368.0	20.2
95.0	311.6	21.410	70.54	284.0	15.6
97.5	319.8	21.850	71.33	176.0	9.7
100.0	328.0	22.110	71.80	104.0	5.7
102.5	336.2	22.560	72.61	180.0	9.9
105.0	344.4	23.610	74.50	420.0	23.0
107.5	352.6	24.160	75.49	220.0	12.1

LOCATION: K FALLS AMS, OREGON PAGE 2
39S/20E- 4DCA
HOLE NAME: PR PN CO
DATE MEASURED: 1/22/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
110.0	360.8	25.020	77.04	344.0	18.9
112.5	369.0	25.210	77.38	76.0	4.2
115.0	377.2	25.270	77.49	24.0	1.3
117.5	385.4	25.570	78.03	120.0	6.6
120.0	393.6	25.890	78.60	128.0	7.0
122.5	401.8	26.160	79.09	108.0	5.9
125.0	410.0	26.370	79.47	84.0	4.6


TEMPERATURE, DEG C
0
5
10
15
20
25
30
35
40
DEPTH, METERS
0
50
100
150
39S/20E- 4DCA
1/22/80

LOCATION: KLAMATH FALLS AMS, ORE
39S/20E- 4DCA
HOLE NAME: PR PN CO
DATE MEASURED: 4/18/80

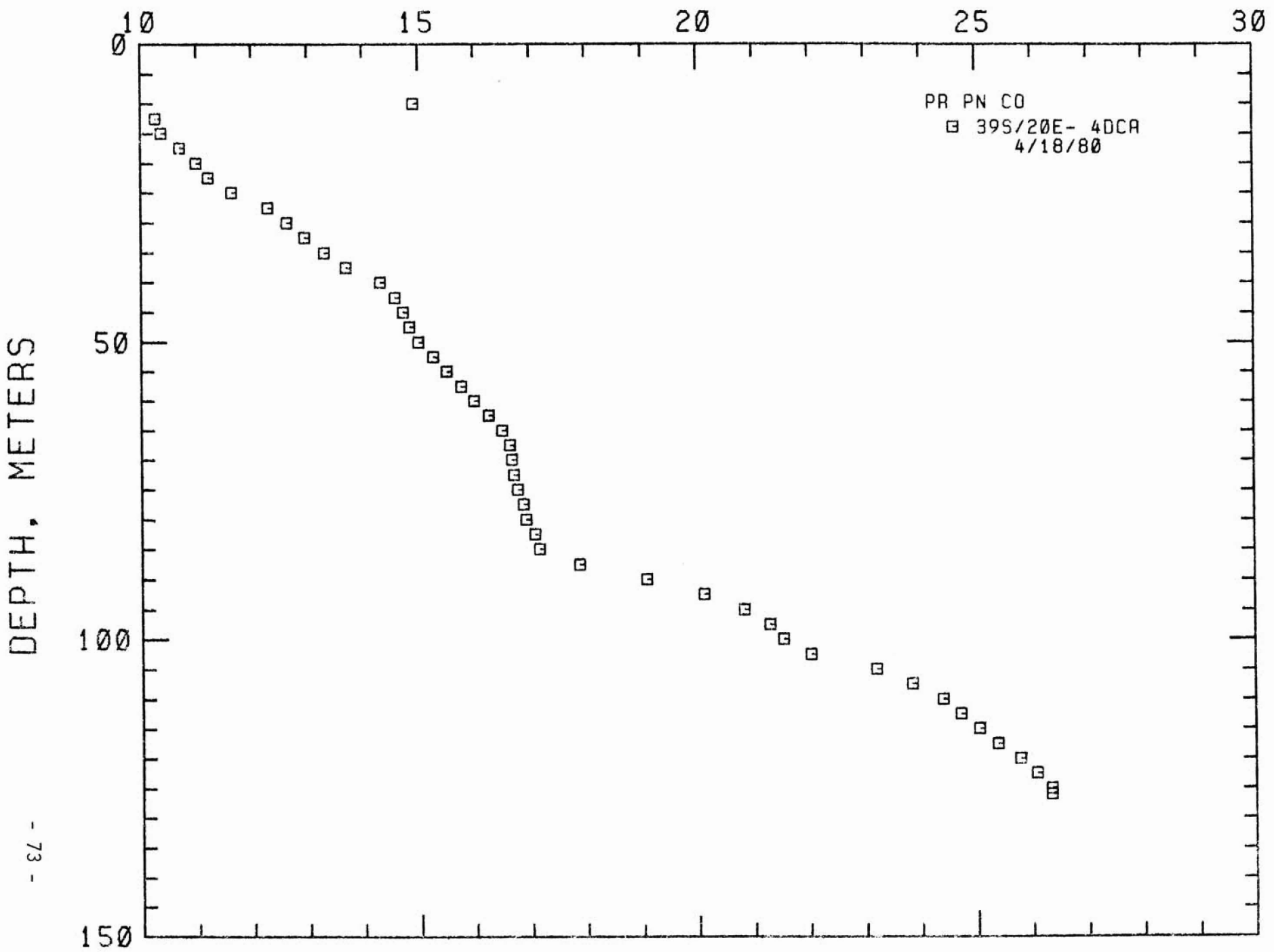
DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
10.0	32.8	14.920	58.86	0.0	0.0
12.5	41.0	10.270	50.49	-1860.0	-102.1
15.0	49.2	10.380	50.68	44.0	2.4
17.5	57.4	10.710	51.28	132.0	7.2
20.0	65.6	11.010	51.82	120.0	6.6
22.5	73.8	11.220	52.20	84.0	4.6
25.0	82.0	11.650	52.97	172.0	9.4
27.5	90.2	12.300	54.14	260.0	14.3
30.0	98.4	12.640	54.75	136.0	7.5
32.5	106.6	12.960	55.33	128.0	7.0
35.0	114.8	13.310	55.96	140.0	7.7
37.5	123.0	13.700	56.66	156.0	8.6
40.0	131.2	14.320	57.78	248.0	13.6
42.5	139.4	14.580	58.24	104.0	5.7
45.0	147.6	14.730	58.51	60.0	3.3
47.5	155.8	14.850	58.73	48.0	2.6
50.0	164.0	15.010	59.02	64.0	3.5
52.5	172.2	15.270	59.49	104.0	5.7
55.0	180.4	15.510	59.92	96.0	5.3
57.5	188.6	15.770	60.39	104.0	5.7
60.0	196.8	16.000	60.80	92.0	5.0
62.5	205.0	16.260	61.27	104.0	5.7
65.0	213.2	16.500	61.70	96.0	5.3
67.5	221.4	16.640	61.95	56.0	3.1
70.0	229.6	16.680	62.02	16.0	0.9
72.5	237.8	16.710	62.08	12.0	0.7
75.0	246.0	16.780	62.20	28.0	1.5
77.5	254.2	16.880	62.38	40.0	2.2
80.0	262.4	16.920	62.46	16.0	0.9
82.5	270.6	17.080	62.74	64.0	3.5
85.0	278.8	17.170	62.91	36.0	2.0
87.5	287.0	17.880	64.18	284.0	15.6
90.0	295.2	19.080	66.34	480.0	26.3
92.5	303.4	20.110	68.20	412.0	22.6
95.0	311.6	20.840	69.51	292.0	16.0
97.5	319.8	21.250	70.32	180.0	9.9
100.0	328.0	21.530	70.75	96.0	5.3
102.5	336.2	22.020	71.64	196.0	10.8
105.0	344.4	23.200	73.76	472.0	25.9
107.5	352.6	23.840	74.91	256.0	14.0
110.0	360.8	24.390	75.90	220.0	12.1

39S/20E- 4DCA

HOLE NAME: PR PN CO

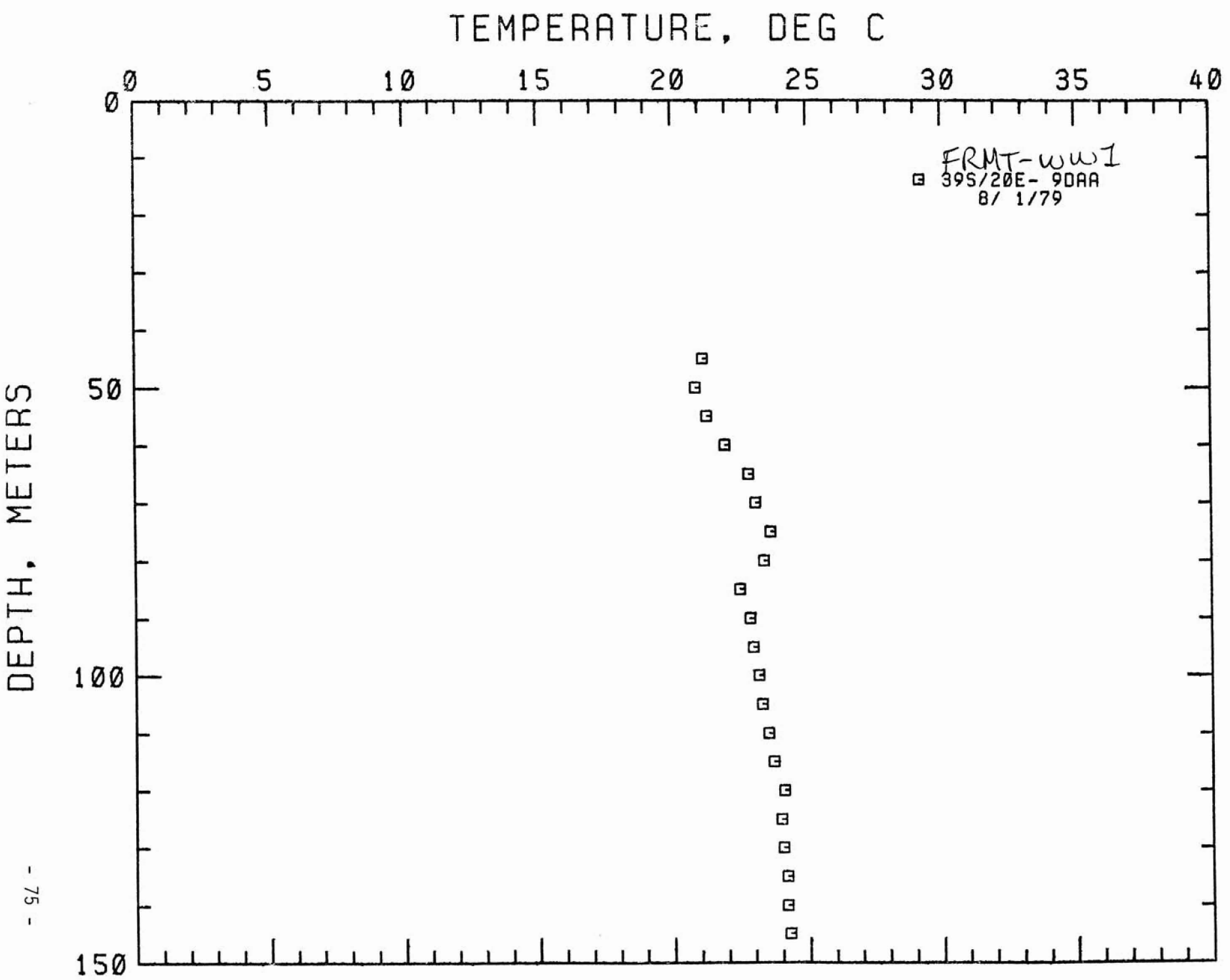
DATE MEASURED: 4/18/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
112.5	369.0	24.710	76.48	128.0	7.0
115.0	377.2	25.040	77.07	132.0	7.2
117.5	385.4	25.370	77.67	132.0	7.2
120.0	393.6	25.770	78.39	160.0	8.8
122.5	401.8	26.070	78.93	120.0	6.6
125.0	410.0	26.330	79.39	104.0	5.7
126.0	413.3	26.330	79.39	0.0	0.0


TEMPERATURE, DEG C
10
15
20
25
30
0
50
100
150
DEPTH, METERS
PR PN CO
39S/20E- 4DCA
4/18/80

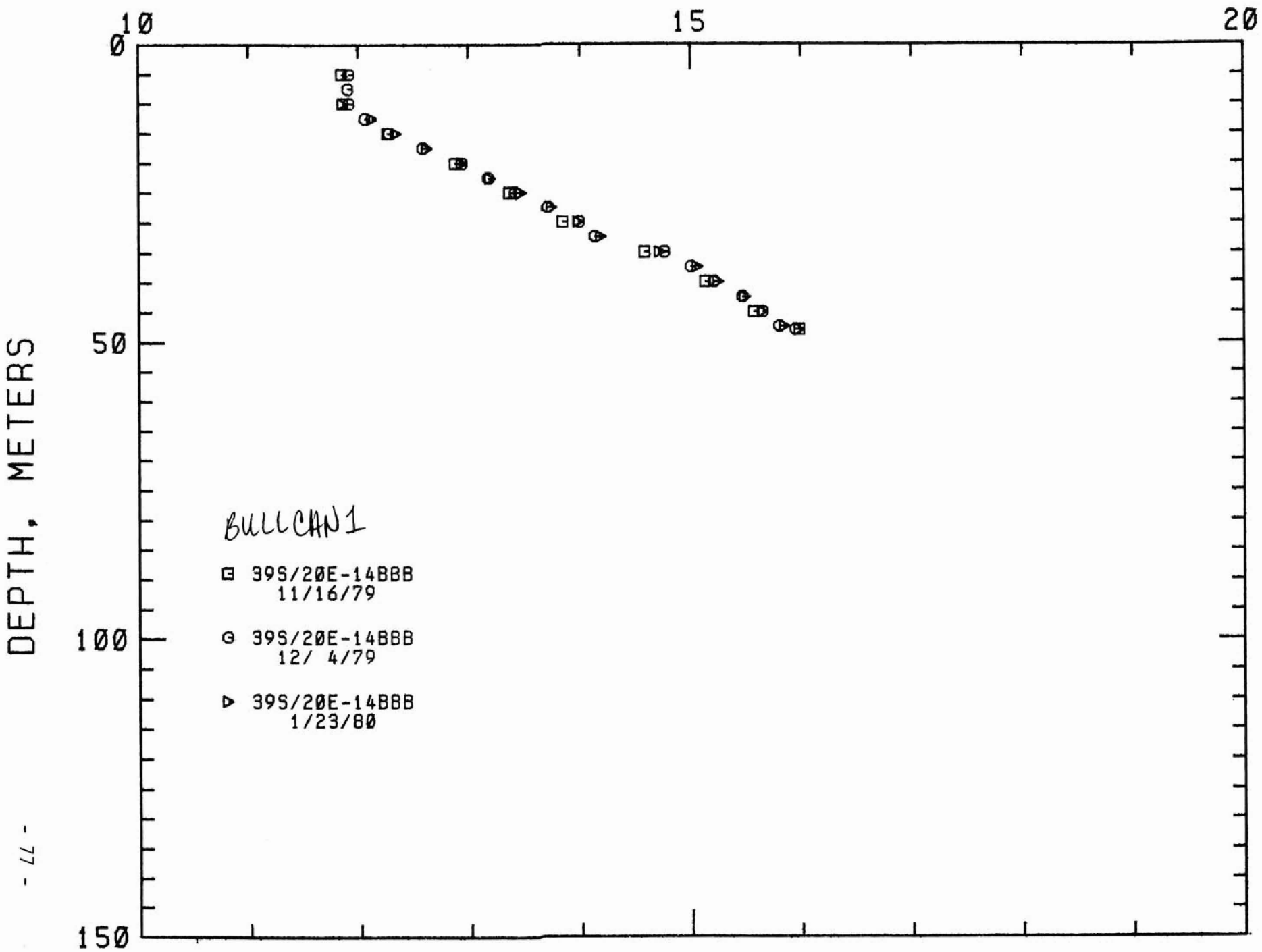
LOCATION: KLAMATH FALLS AMS,OREGON
39S/20E- 9DAA
HOLE NAME: FRMT-WW1
DATE MEASURED: 8/ 1/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
45.0	147.6	21.170	70.11	0.0	0.0
50.0	164.0	20.880	69.58	-58.0	-3.2
55.0	180.4	21.310	70.36	86.0	4.7
60.0	196.8	21.970	71.55	132.0	7.2
65.0	213.2	22.840	73.11	174.0	9.5
70.0	229.6	23.090	73.56	50.0	2.7
75.0	246.0	23.640	74.55	110.0	6.0
80.0	262.4	23.390	74.10	-50.0	-2.7
85.0	278.8	22.500	72.50	-178.0	-9.8
90.0	295.2	22.850	73.13	70.0	3.8
95.0	311.6	22.970	73.35	24.0	1.3
100.0	328.0	23.170	73.71	40.0	2.2
105.0	344.4	23.300	73.94	26.0	1.4
110.0	360.8	23.520	74.34	44.0	2.4
115.0	377.2	23.700	74.66	36.0	2.0
120.0	393.6	24.080	75.34	76.0	4.2
125.0	410.0	23.980	75.16	-20.0	-1.1
130.0	426.4	24.040	75.27	12.0	0.7
135.0	442.8	24.190	75.54	30.0	1.6
140.0	459.2	24.180	75.52	-2.0	-0.1
145.0	475.6	24.270	75.69	18.0	1.0


TEMPERATURE, DEG C
0
5
10
15
20
25
30
35
40
DEPTH, METERS
0
50
100
150
FRMT-WW1
39S/20E- 9DAA
8/ 1/79

LOCATION: KLAMATH FALLS AMS, ORE
39S/20E-14BBB
HOLE NAME: BULLCAN1
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
10.0	32.8	11.860	53.35	0.0	0.0
12.5	41.0	12.130	53.83	108.0	5.9
15.0	49.2	12.350	54.23	88.0	4.8
17.5	57.4	12.630	54.73	112.0	6.1
20.0	65.6	12.940	55.29	124.0	6.8
22.5	73.8	13.200	55.76	104.0	5.7
25.0	82.0	13.480	56.26	112.0	6.1
27.5	90.2	13.740	56.73	104.0	5.7
30.0	98.4	13.980	57.16	96.0	5.3
32.5	106.6	14.190	57.54	84.0	4.6
35.0	114.8	14.720	58.50	212.0	11.6
37.5	123.0	15.060	59.11	136.0	7.5
40.0	131.2	15.250	59.45	76.0	4.2
42.5	139.4	15.490	59.88	96.0	5.3
45.0	147.6	15.650	60.17	64.0	3.5
47.5	155.8	15.850	60.53	80.0	4.4
48.0	157.4	15.980	60.76	260.0	14.3


TEMPERATURE, DEG C
10
15
20
0
50
100
150
DEPTH, METERS
BULLCAN 1
39S/20E-14BBB
11/16/79
39S/20E-14BBB
12/ 4/79
39S/20E-14BBB
1/23/80

LOCATION: KLAMATH FALLS AMS, ORE
39S/20E-15ABD
HOLE NAME: LKUWSWMP
DATE MEASURED: 11/15/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
30.0	98.4	16.230	61.21	0.0	0.0
35.0	114.8	16.410	61.54	36.0	2.0
40.0	131.2	16.870	62.37	92.0	5.0
45.0	147.6	17.080	62.74	42.0	2.3
50.0	164.0	17.440	63.39	72.0	4.0
55.0	180.4	17.740	63.93	60.0	3.3
60.0	196.8	18.010	64.42	54.0	3.0
65.0	213.2	18.190	64.74	36.0	2.0
70.0	229.6	18.910	66.04	144.0	7.9
75.0	246.0	21.530	70.75	524.0	28.8
80.0	262.4	22.700	72.86	234.0	12.8
85.0	278.8	23.720	74.70	204.0	11.2
90.0	295.2	24.600	76.28	176.0	9.7
95.0	311.6	25.380	77.68	156.0	8.6
100.0	328.0	25.930	78.67	110.0	6.0
105.0	344.4	26.300	79.34	74.0	4.1
110.0	360.8	27.050	80.69	150.0	8.2
115.0	377.2	27.870	82.17	164.0	9.0
120.0	393.6	28.500	83.30	126.0	6.9
125.0	410.0	29.050	84.29	110.0	6.0
130.0	426.4	29.740	85.53	138.0	7.6
135.0	442.8	30.160	86.29	84.0	4.6
140.0	459.2	30.660	87.19	100.0	5.5
145.0	475.6	30.700	87.26	8.0	0.4
150.0	492.0	31.160	88.09	92.0	5.0
155.0	508.4	31.700	89.06	108.0	5.9
160.0	524.8	32.140	89.85	88.0	4.8
165.0	541.2	32.710	90.88	114.0	6.3
170.0	557.6	33.290	91.92	116.0	6.4
175.0	574.0	33.620	92.52	66.0	3.6
180.0	590.4	34.030	93.25	82.0	4.5
185.0	606.8	34.730	94.51	140.0	7.7
190.0	623.2	35.460	95.83	146.0	8.0
195.0	639.6	36.200	97.16	148.0	8.1
200.0	656.0	37.190	98.94	198.0	10.9
205.0	672.4	38.380	101.08	238.0	13.1
210.0	688.8	39.410	102.94	206.0	11.3
215.0	705.2	39.810	103.66	80.0	4.4
220.0	721.6	40.080	104.14	54.0	3.0
225.0	738.0	40.640	105.15	112.0	6.1
230.0	754.4	41.180	106.12	108.0	5.9

39S/20E-15ABD

HOLE NAME: LKVWSWMP

DATE MEASURED: 11/15/79

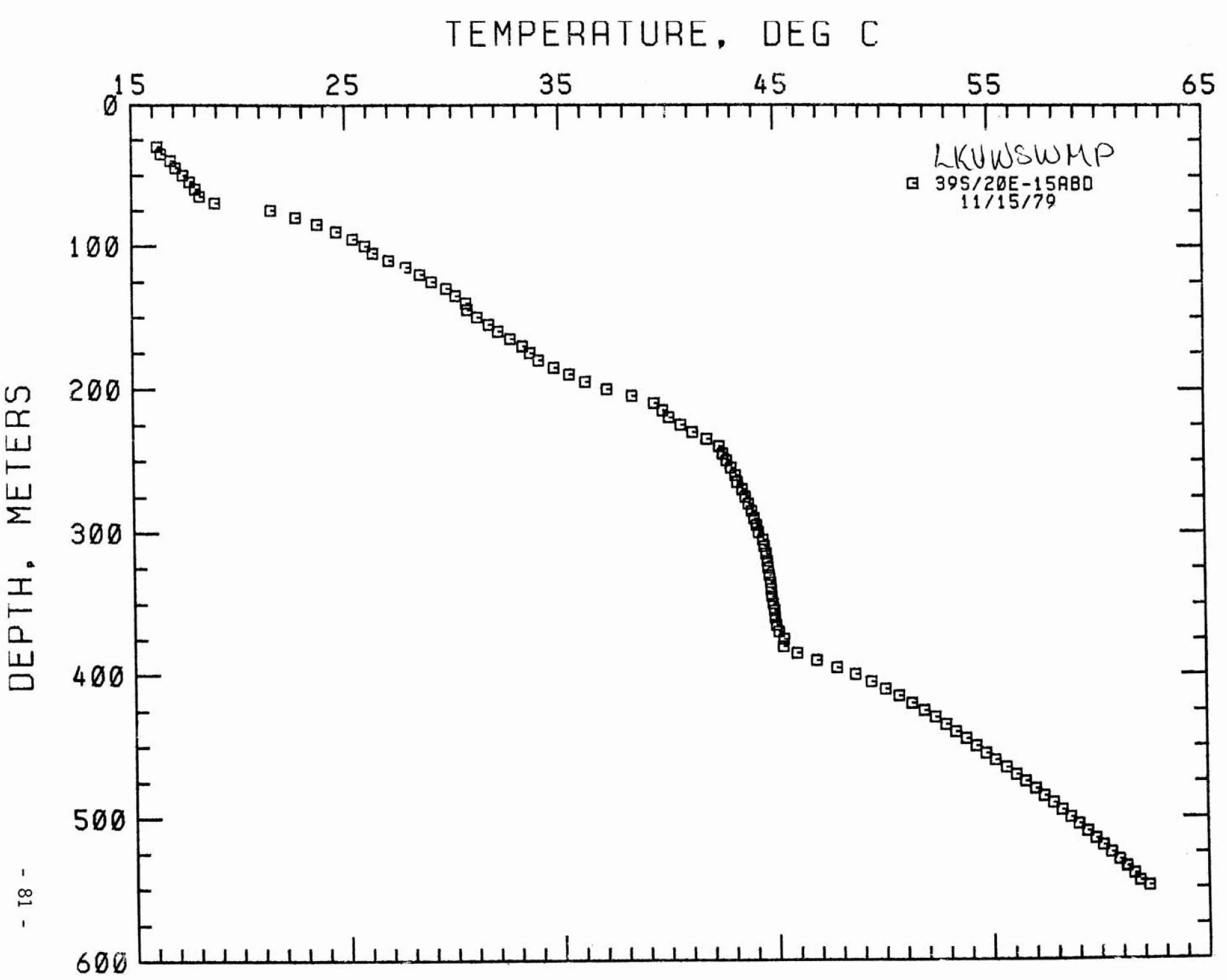
DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
235.0	770.8	41.820	107.28	128.0	7.0
240.0	787.2	42.410	108.34	118.0	6.5
245.0	803.6	42.560	108.61	30.0	1.6
250.0	820.0	42.730	108.91	34.0	1.9
255.0	836.4	42.940	109.29	42.0	2.3
260.0	852.8	43.130	109.63	38.0	2.1
265.0	869.2	43.240	109.83	22.0	1.2
270.0	885.6	43.470	110.25	46.0	2.5
275.0	902.0	43.590	110.46	24.0	1.3
280.0	918.4	43.750	110.75	32.0	1.8
285.0	934.8	43.880	110.98	26.0	1.4
290.0	951.2	43.990	111.18	22.0	1.2
295.0	967.6	44.110	111.40	24.0	1.3
300.0	984.0	44.210	111.58	20.0	1.1
305.0	1000.4	44.390	111.90	36.0	2.0
310.0	1016.8	44.460	112.03	14.0	0.8
315.0	1033.2	44.530	112.15	14.0	0.8
320.0	1049.6	44.610	112.30	16.0	0.9
325.0	1066.0	44.640	112.35	6.0	0.3
330.0	1082.4	44.690	112.44	10.0	0.5
335.0	1098.8	44.730	112.51	8.0	0.4
340.0	1115.2	44.780	112.60	10.0	0.5
345.0	1131.6	44.810	112.66	6.0	0.3
350.0	1148.0	44.850	112.73	8.0	0.4
355.0	1164.4	44.900	112.82	10.0	0.5
360.0	1180.8	44.930	112.87	6.0	0.3
365.0	1197.2	45.010	113.02	16.0	0.9
370.0	1213.6	45.110	113.20	20.0	1.1
375.0	1230.0	45.340	113.61	46.0	2.5
380.0	1246.4	45.320	113.58	-4.0	-0.2
385.0	1262.8	45.930	114.67	122.0	6.7
390.0	1279.2	46.870	116.37	188.0	10.3
395.0	1295.6	47.800	118.04	186.0	10.2
400.0	1312.0	48.660	119.59	172.0	9.4
405.0	1328.4	49.390	120.90	146.0	8.0
410.0	1344.8	50.060	122.11	134.0	7.4
415.0	1361.2	50.690	123.24	126.0	6.9
420.0	1377.6	51.280	124.30	118.0	6.5
425.0	1394.0	51.850	125.33	114.0	6.3
430.0	1410.4	52.360	126.25	102.0	5.6
435.0	1426.8	52.870	127.17	102.0	5.6

39S/20E-15ABD

HOLE NAME: LKVWSWMP

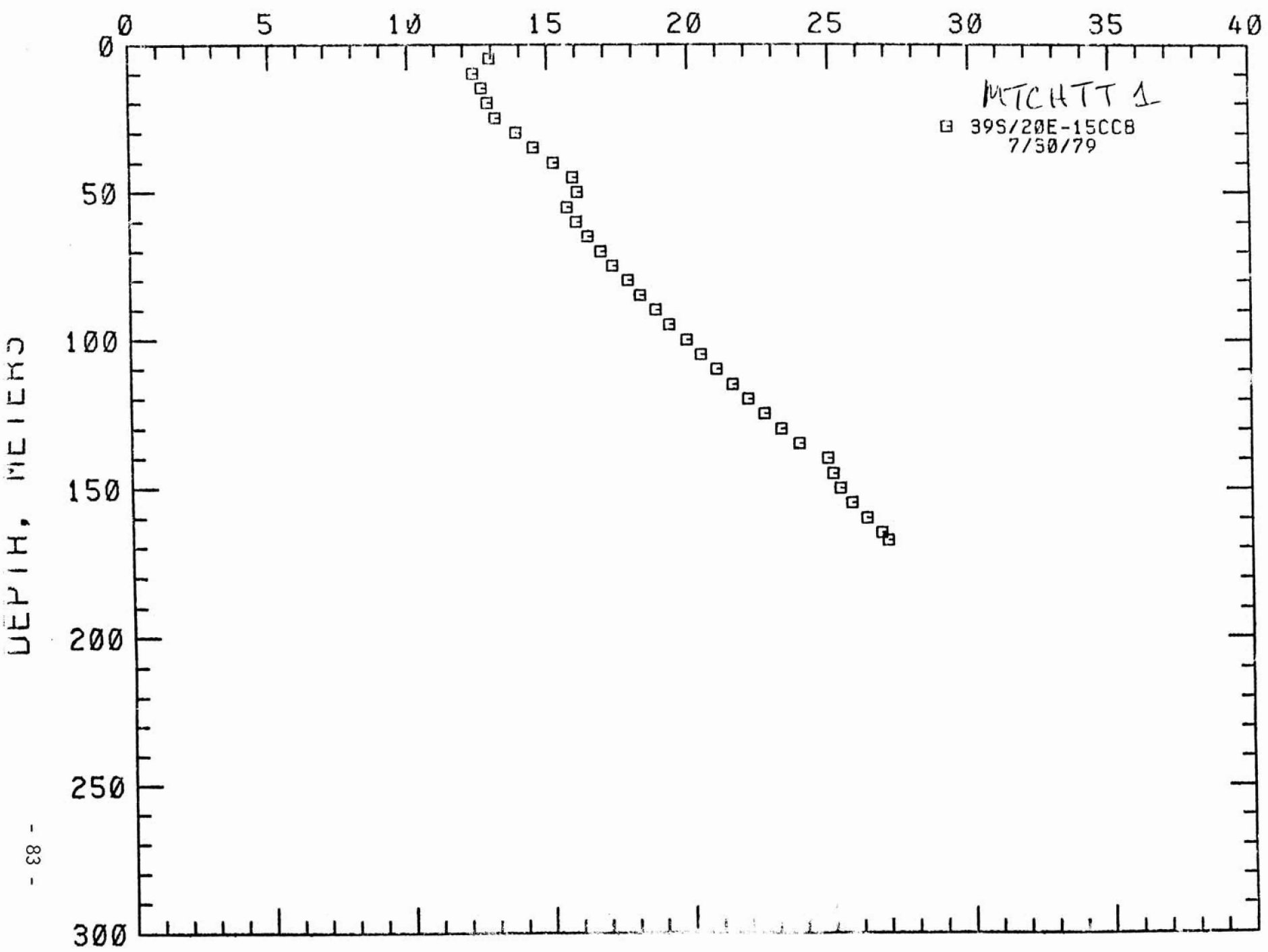
DATE MEASURED: 11/15/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
440.0	1443.2	53.310	127.96	88.0	4.8
445.0	1459.6	53.790	128.82	96.0	5.3
450.0	1476.0	54.250	129.65	92.0	5.0
455.0	1492.4	54.710	130.48	92.0	5.0
460.0	1508.8	55.150	131.27	88.0	4.8
465.0	1525.2	55.650	132.17	100.0	5.5
470.0	1541.6	56.100	132.98	90.0	4.9
475.0	1558.0	56.540	133.77	88.0	4.8
480.0	1574.4	56.990	134.58	90.0	4.9
485.0	1590.8	57.390	135.30	80.0	4.4
490.0	1607.2	57.830	136.09	88.0	4.8
495.0	1623.5	58.220	136.80	78.0	4.3
500.0	1640.0	58.620	137.52	80.0	4.4
505.0	1656.4	58.990	138.18	74.0	4.1
510.0	1672.8	59.390	138.90	80.0	4.4
515.0	1689.2	59.780	139.60	78.0	4.3
520.0	1705.6	60.110	140.20	66.0	3.6
525.0	1722.0	60.490	140.88	76.0	4.2
530.0	1738.4	60.850	141.53	72.0	4.0
535.0	1754.8	61.210	142.18	72.0	4.0
540.0	1771.2	61.540	142.77	66.0	3.6
545.0	1787.6	61.800	143.24	52.0	2.9
548.5	1799.1	62.220	144.00	120.0	6.6


TEMPERATURE, DEG C
15
25
35
45
55
65
0
100
200
300
400
500
600
DEPTH, METERS
LKUWSWMP
39S/20E-15ABD
11/15/79

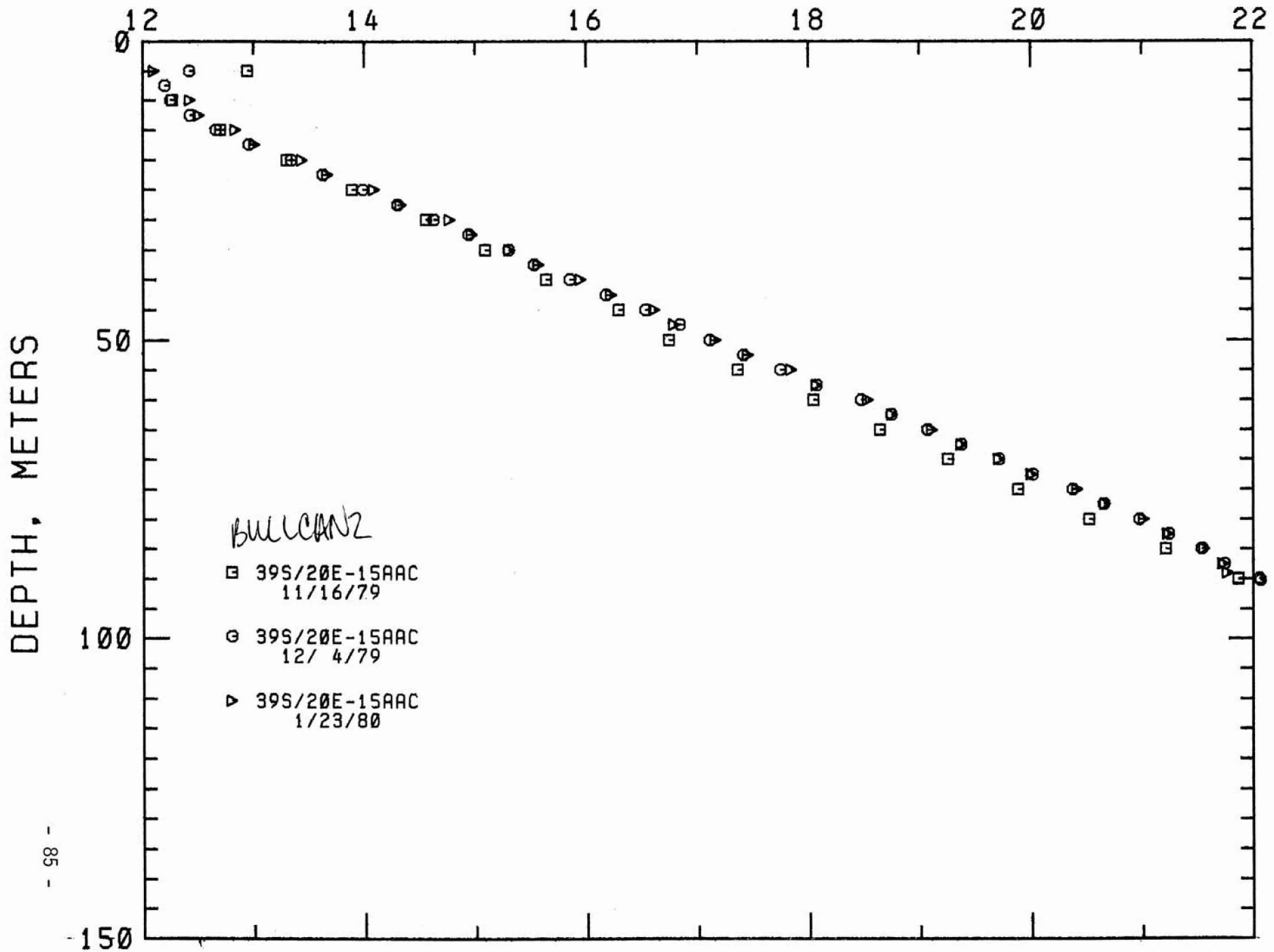
LOCATION: KLAMATH FALLS AMS, OREGON
39S/20E-15CCB
HOLE NAME: MTCHTT 1
DATE MEASURED: 7/30/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	12.960	55.33	0.0	0.0
10.0	32.8	12.370	54.27	-118.0	-6.5
15.0	49.2	12.660	54.79	58.0	3.2
20.0	65.6	12.860	55.15	40.0	2.2
25.0	82.0	13.140	55.65	56.0	3.1
30.0	98.4	13.970	56.97	146.0	8.0
35.0	114.8	14.480	58.06	122.0	6.7
40.0	131.2	15.190	59.34	142.0	7.8
45.0	147.6	15.880	60.58	138.0	7.6
50.0	164.0	16.040	60.87	32.0	1.8
55.0	180.4	15.680	60.22	-72.0	-4.0
60.0	196.8	16.010	60.82	66.0	3.6
65.0	213.2	16.420	61.56	82.0	4.5
70.0	229.6	16.870	62.37	90.0	4.9
75.0	246.0	17.270	63.09	80.0	4.4
80.0	262.4	17.830	64.09	112.0	6.1
85.0	278.8	18.270	64.89	88.0	4.8
90.0	295.2	18.820	65.88	110.0	6.0
95.0	311.6	19.300	66.74	96.0	5.3
100.0	328.0	19.900	67.82	120.0	6.6
105.0	344.4	20.400	68.72	100.0	5.5
110.0	360.8	20.960	69.73	112.0	6.1
115.0	377.2	21.520	70.74	112.0	6.1
120.0	393.6	22.070	71.73	110.0	6.0
125.0	410.0	22.660	72.79	118.0	6.5
130.0	426.4	23.250	73.85	118.0	6.5
135.0	442.8	23.890	75.00	128.0	7.0
140.0	459.2	24.890	76.80	200.0	11.0
145.0	475.6	25.070	77.13	36.0	2.0
150.0	492.0	25.320	77.58	50.0	2.7
155.0	508.4	25.730	78.31	82.0	4.5
160.0	524.8	26.260	79.27	106.0	5.8
165.0	541.2	26.790	80.22	106.0	5.8
167.5	549.4	27.020	80.64	92.0	5.0


TEMPERATURE, DEG C
0
5
10
15
20
25
30
35
40
DEPTH, METERS
0
50
100
150
200
250
300
MTCHTT 1
39S/20E-15CCB
7/30/79

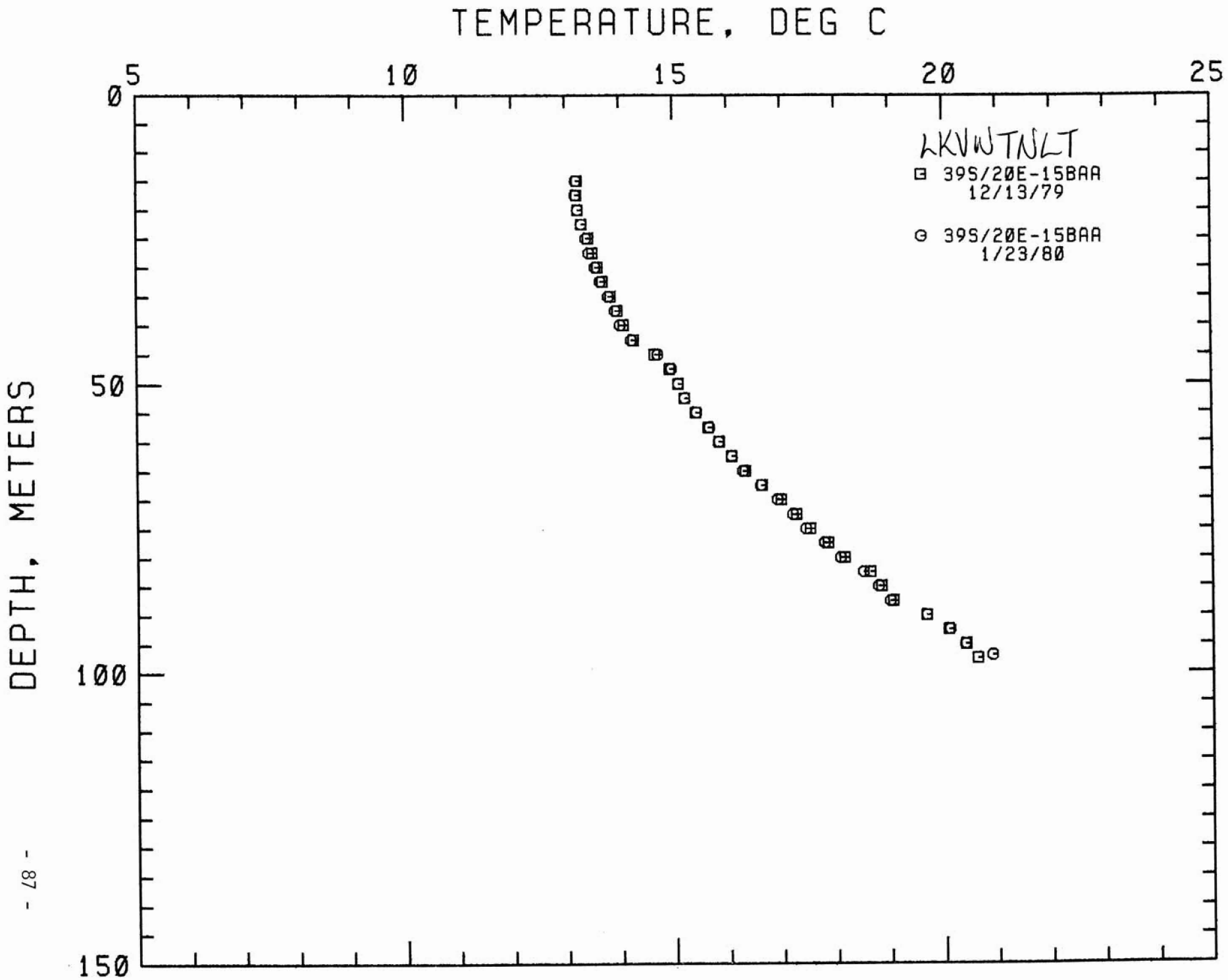
LOCATION: KLAMATH FALLS AMS, ORE
39S/20E-15AAC
HOLE NAME: BULLCAN2
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	12.100	53.78	0.0	0.0
10.0	32.8	12.430	54.37	66.0	3.6
12.5	41.0	12.510	54.52	32.0	1.8
15.0	49.2	12.840	55.11	132.0	7.2
17.5	57.4	13.010	55.42	68.0	3.7
20.0	65.6	13.440	56.19	172.0	9.4
22.5	73.8	13.670	56.61	92.0	5.0
25.0	82.0	14.090	57.36	168.0	9.2
27.5	90.2	14.330	57.79	96.0	5.3
30.0	98.4	14.770	58.59	176.0	9.7
32.5	106.6	14.970	58.95	80.0	4.4
35.0	114.8	15.310	59.56	136.0	7.5
37.5	123.0	15.570	60.03	104.0	5.7
40.0	131.2	15.950	60.71	152.0	8.3
42.5	139.4	16.220	61.20	108.0	5.9
45.0	147.6	16.610	61.90	156.0	8.6
47.5	155.8	16.790	62.22	72.0	4.0
50.0	164.0	17.160	62.89	148.0	8.1
52.5	172.2	17.450	63.41	116.0	6.4
55.0	180.4	17.840	64.11	156.0	8.6
57.5	188.6	18.070	64.53	92.0	5.0
60.0	196.8	18.530	65.35	184.0	10.1
62.5	205.0	18.750	65.75	88.0	4.8
65.0	213.2	19.110	66.40	144.0	7.9
67.5	221.4	19.370	66.87	104.0	5.7
70.0	229.6	19.710	67.48	136.0	7.5
72.5	237.8	20.000	68.00	116.0	6.4
75.0	246.0	20.410	68.74	164.0	9.0
77.5	254.2	20.660	69.19	100.0	5.5
80.0	262.4	21.010	69.82	140.0	7.7
82.5	270.6	21.230	70.21	88.0	4.8
85.0	278.8	21.560	70.81	132.0	7.2
87.5	287.0	21.730	71.11	68.0	3.7
89.0	291.9	21.770	71.19	26.7	1.5


TEMPERATURE, DEG C
12
14
16
18
20
22
0
50
100
150
DEPTH, METERS
BULLCAN2
39S/20E-15AAC
11/16/79
39S/20E-15AAC
12/ 4/79
39S/20E-15AAC
1/23/80

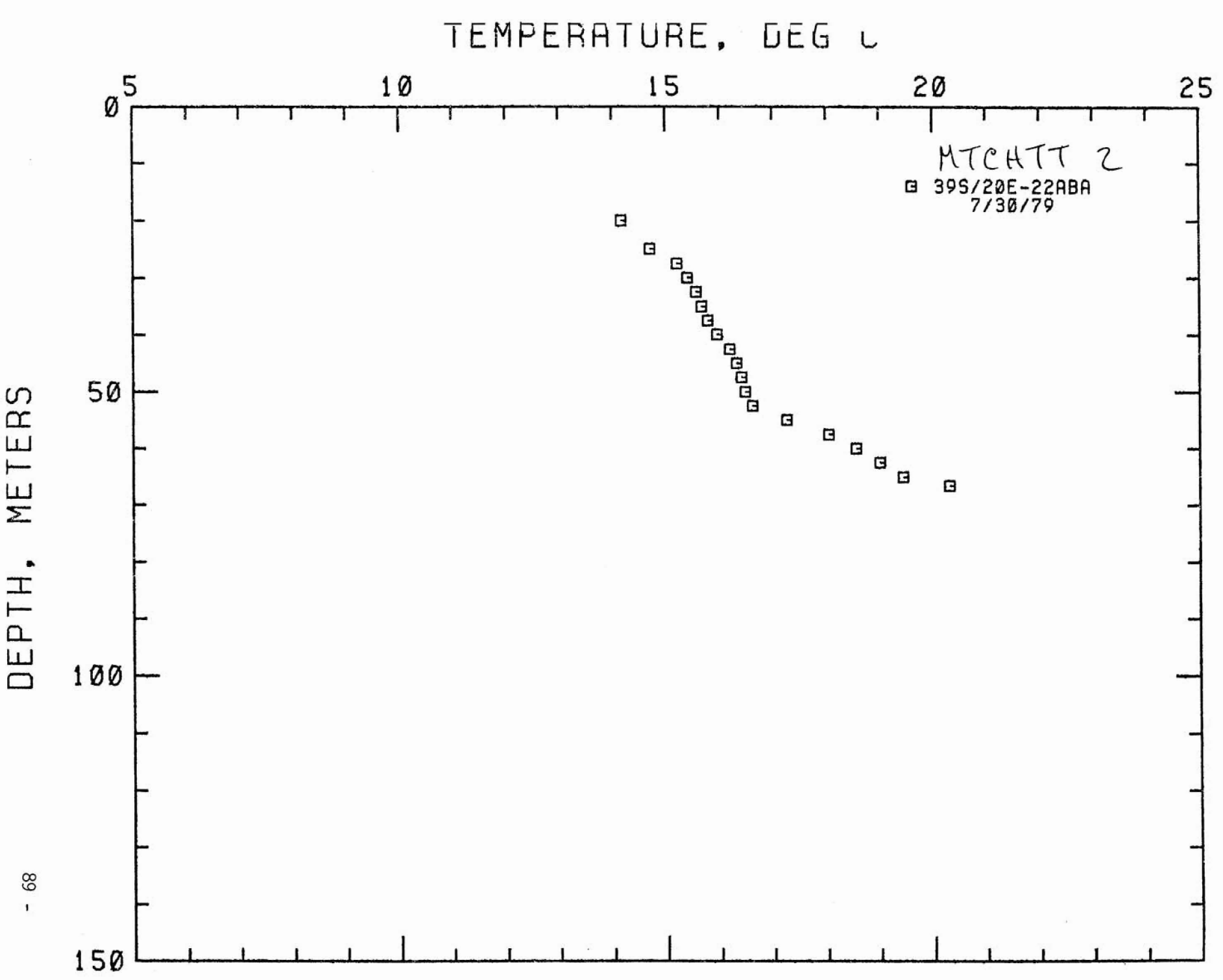
LOCATION: K FALLS AMS, OREGON
39S/20E-15BAA
HOLE NAME: LKVWTNLT
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
15.0	49.2	13.200	55.76	0.0	0.0
17.5	57.4	13.190	55.74	-4.0	-0.2
20.0	65.6	13.240	55.83	20.0	1.1
22.5	73.8	13.310	55.96	28.0	1.5
25.0	82.0	13.390	56.10	32.0	1.8
27.5	90.2	13.450	56.21	24.0	1.3
30.0	98.4	13.560	56.41	44.0	2.4
32.5	106.6	13.650	56.57	36.0	2.0
35.0	114.8	13.800	56.84	60.0	3.3
37.5	123.0	13.930	57.07	52.0	2.9
40.0	131.2	14.020	57.24	36.0	2.0
42.5	139.4	14.220	57.60	80.0	4.4
45.0	147.6	14.710	58.48	196.0	10.8
47.5	155.8	14.970	58.95	104.0	5.7
50.0	164.0	15.090	59.16	48.0	2.6
52.5	172.2	15.200	59.36	44.0	2.4
55.0	180.4	15.420	59.76	88.0	4.8
57.5	188.6	15.660	60.19	96.0	5.3
60.0	196.8	15.830	60.49	68.0	3.7
62.5	205.0	16.070	60.93	96.0	5.3
65.0	213.2	16.280	61.30	84.0	4.6
67.5	221.4	16.610	61.90	132.0	7.2
70.0	229.6	16.920	62.46	124.0	6.8
72.5	237.8	17.200	62.96	112.0	6.1
75.0	246.0	17.450	63.41	100.0	5.5
77.5	254.2	17.790	64.02	136.0	7.5
80.0	262.4	18.080	64.54	116.0	6.4
82.5	270.6	18.510	65.32	172.0	9.4
85.0	278.8	18.780	65.80	108.0	5.9
87.5	287.0	19.000	66.20	88.0	4.8
90.0	295.2	19.680	67.42	272.0	14.9
92.5	303.4	20.110	68.20	172.0	9.4
95.0	311.6	20.400	68.72	116.0	6.4
97.0	318.2	20.900	69.62	250.0	13.7


TEMPERATURE, DEG C
5
10
15
20
25
0
50
100
150
DEPTH, METERS
LKVWTNLT
39S/20E-15BAA
12/13/79
39S/20E-15BAA
1/23/80

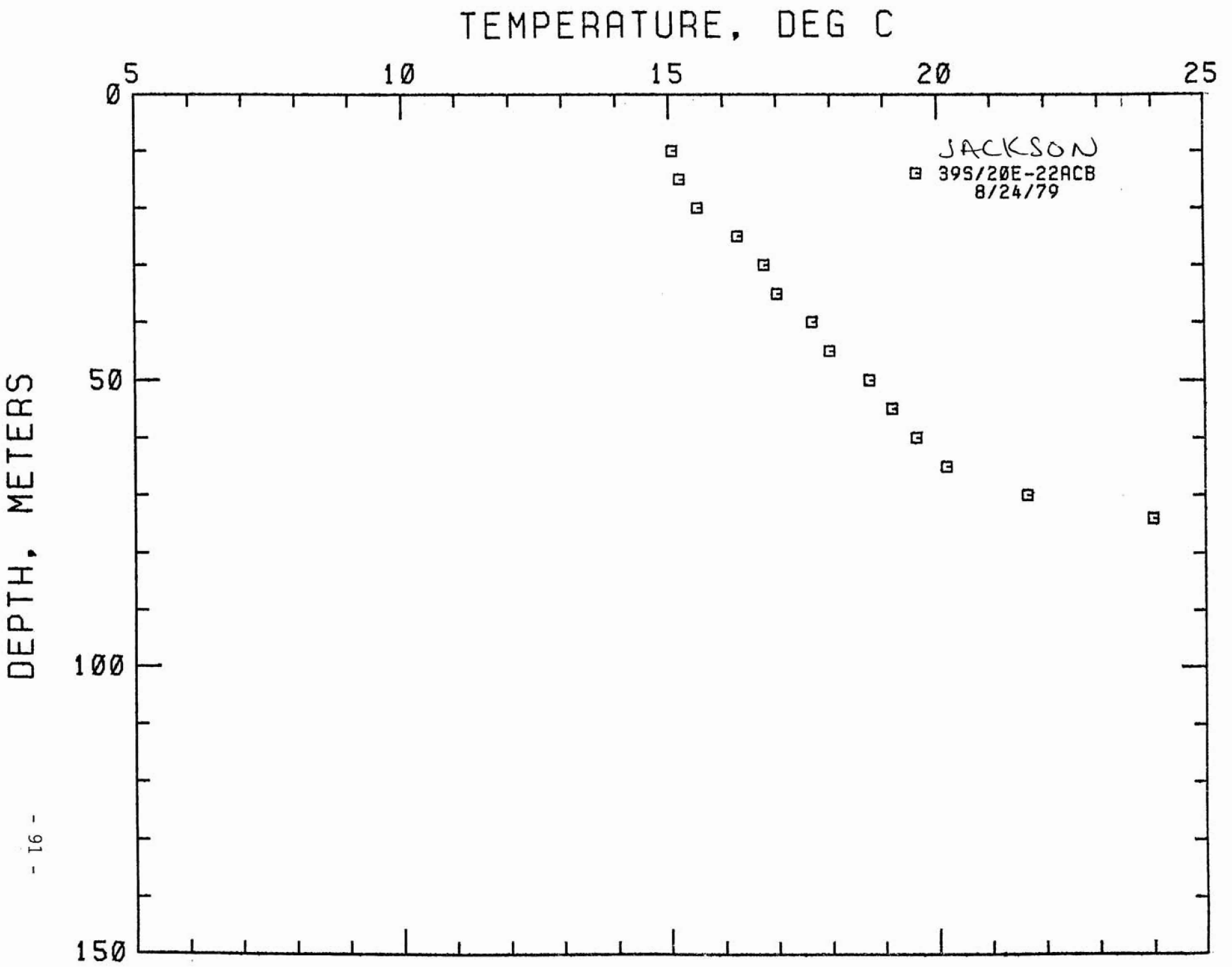
LOCATION: KLAMATH FALLS AMS,OREGON
39S/20E-22ABA
HOLE NAME: MTCHTT 2
DATE MEASURED: 7/30/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
20.0	65.6	14.180	57.52	0.0	0.0
25.0	82.0	14.710	58.48	106.0	5.8
27.5	90.2	15.220	59.40	204.0	11.2
30.0	98.4	15.410	59.74	76.0	4.2
32.5	106.6	15.570	60.03	64.0	3.5
35.0	114.8	15.670	60.21	40.0	2.2
37.5	123.0	15.790	60.42	48.0	2.6
40.0	131.2	15.960	60.73	68.0	3.7
42.5	139.4	16.200	61.16	96.0	5.3
45.0	147.6	16.330	61.39	52.0	2.9
47.5	155.8	16.420	61.56	36.0	2.0
50.0	164.0	16.490	61.68	28.0	1.5
52.5	172.2	16.620	61.92	52.0	2.9
55.0	180.4	17.260	63.07	256.0	14.0
57.5	188.6	18.050	64.49	316.0	17.3
60.0	196.8	18.570	65.43	208.0	11.4
62.5	205.0	19.010	66.22	176.0	9.7
65.0	213.2	19.450	67.01	176.0	9.7
66.5	218.1	20.310	68.56	573.3	31.5


TEMPERATURE, DEG C
0
5
10
15
20
25
50
100
150
DEPTH, METERS
MTCHTT 2
39S/20E-22ABA
7/30/79

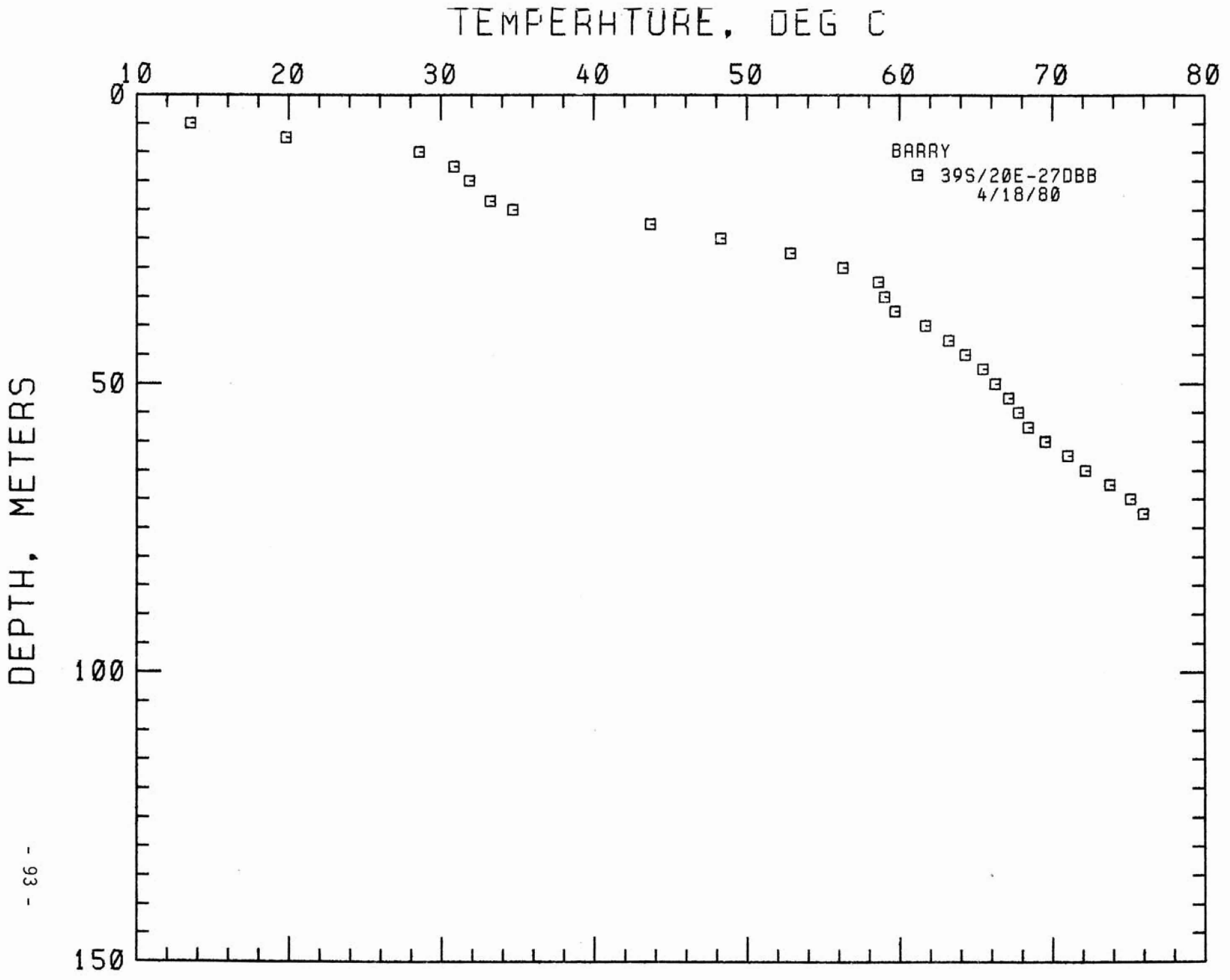
LOCATION: KLAMATH FALLS AMS, ORE
39S/20E-22ACB
HOLE NAME: JACKSON
DATE MEASURED: 8/24/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
10.0	32.8	15.070	59.13	0.0	0.0
15.0	49.2	15.200	59.36	26.0	1.4
20.0	65.6	15.540	59.97	68.0	3.7
25.0	82.0	16.280	61.30	148.0	8.1
30.0	98.4	16.770	62.19	98.0	5.4
35.0	114.8	17.010	62.62	48.0	2.6
40.0	131.2	17.660	63.79	130.0	7.1
45.0	147.6	17.990	64.38	66.0	3.6
50.0	164.0	18.740	65.73	150.0	8.2
55.0	180.4	19.160	66.49	84.0	4.6
60.0	196.8	19.600	67.28	88.0	4.8
65.0	213.2	20.170	68.31	114.0	6.3
70.0	229.6	21.670	71.01	300.0	16.5
74.0	242.7	24.020	75.24	587.5	32.2


TEMPERATURE, DEG C
5
10
15
20
25
0
50
100
150
DEPTH, METERS
JACKSON
39S/20E-22ACB
8/24/79

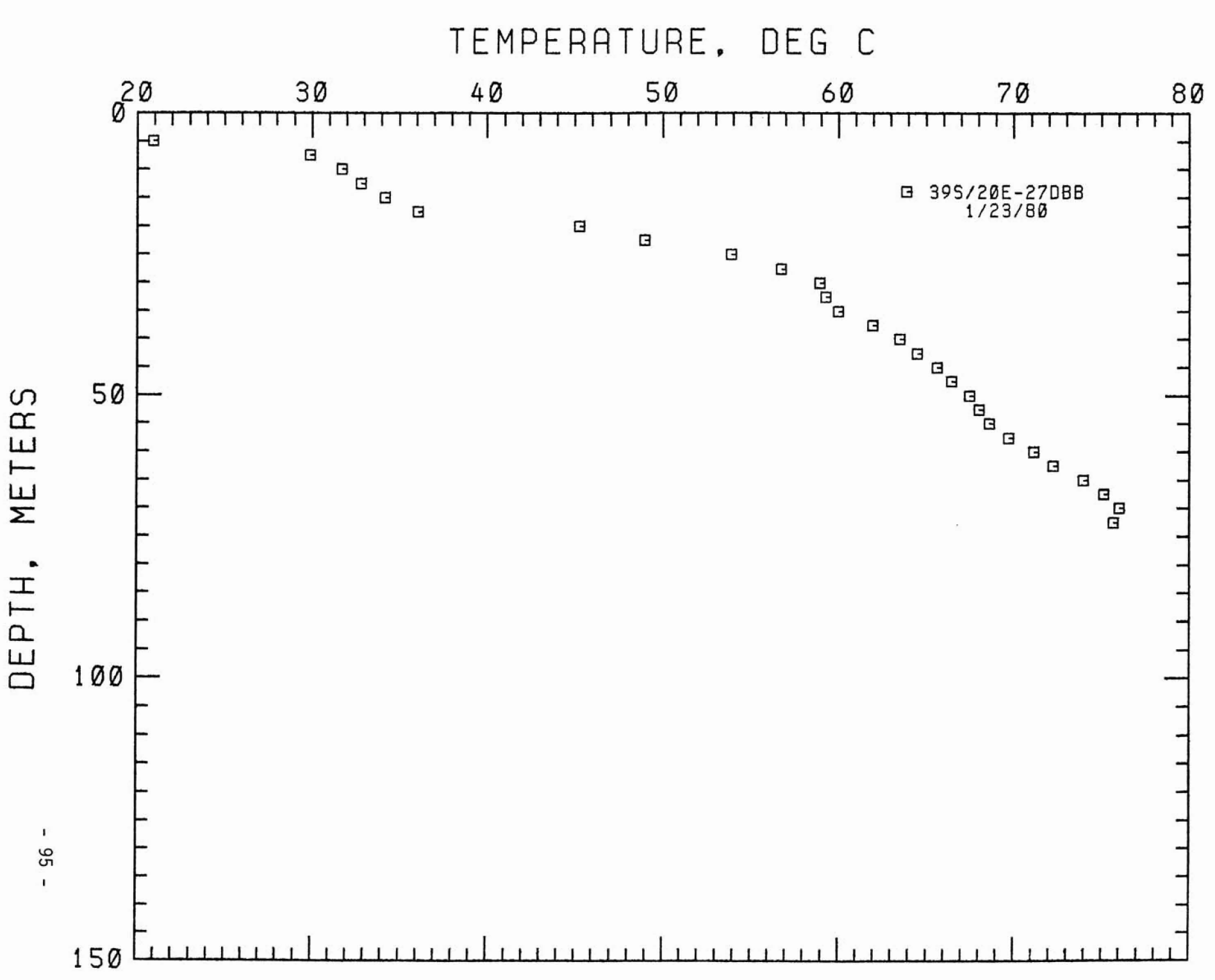
LOCATION: KLAMATH FALLS AMS, ORE
39S/20E-27DBB
HOLE NAME: BARRY
DATE MEASURED: 4/18/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	13.560	56.41	0.0	0.0
7.5	24.6	19.850	67.73	2516.0	138.1
10.0	32.8	28.610	83.50	3504.0	192.3
12.5	41.0	30.870	87.57	904.0	49.6
15.0	49.2	31.870	89.37	400.0	22.0
18.5	60.7	33.220	91.80	385.7	21.2
20.0	65.6	34.730	94.51	1006.7	55.2
22.5	73.8	43.720	110.70	3596.0	197.3
25.0	82.0	48.310	118.96	1836.0	100.8
27.5	90.2	52.880	127.18	1828.0	100.3
30.0	98.4	56.330	133.39	1380.0	75.7
32.5	106.6	58.640	137.55	924.0	50.7
35.0	114.8	59.020	138.24	152.0	8.3
37.5	123.0	59.720	139.50	280.0	15.4
40.0	131.2	61.730	143.11	804.0	44.1
42.5	139.4	63.220	145.80	596.0	32.7
45.0	147.6	64.310	147.76	436.0	23.9
47.5	155.8	65.460	149.83	460.0	25.2
50.0	164.0	66.270	151.29	324.0	17.8
52.5	172.2	67.150	152.87	352.0	19.3
55.0	180.4	67.810	154.06	264.0	14.5
57.5	188.6	68.440	155.19	252.0	13.8
60.0	196.8	69.550	157.19	444.0	24.4
62.5	205.0	71.030	159.85	592.0	32.5
65.0	213.2	72.210	161.98	472.0	25.9
67.5	221.4	73.790	164.82	632.0	34.7
70.0	229.6	75.140	167.25	540.0	29.6
72.5	237.8	76.000	168.80	344.0	18.9


TEMPERATURE, DEG C
10
20
30
40
50
60
70
80
0
50
100
150
DEPTH, METERS
BARRY
39S/20E-27DBB
4/18/80

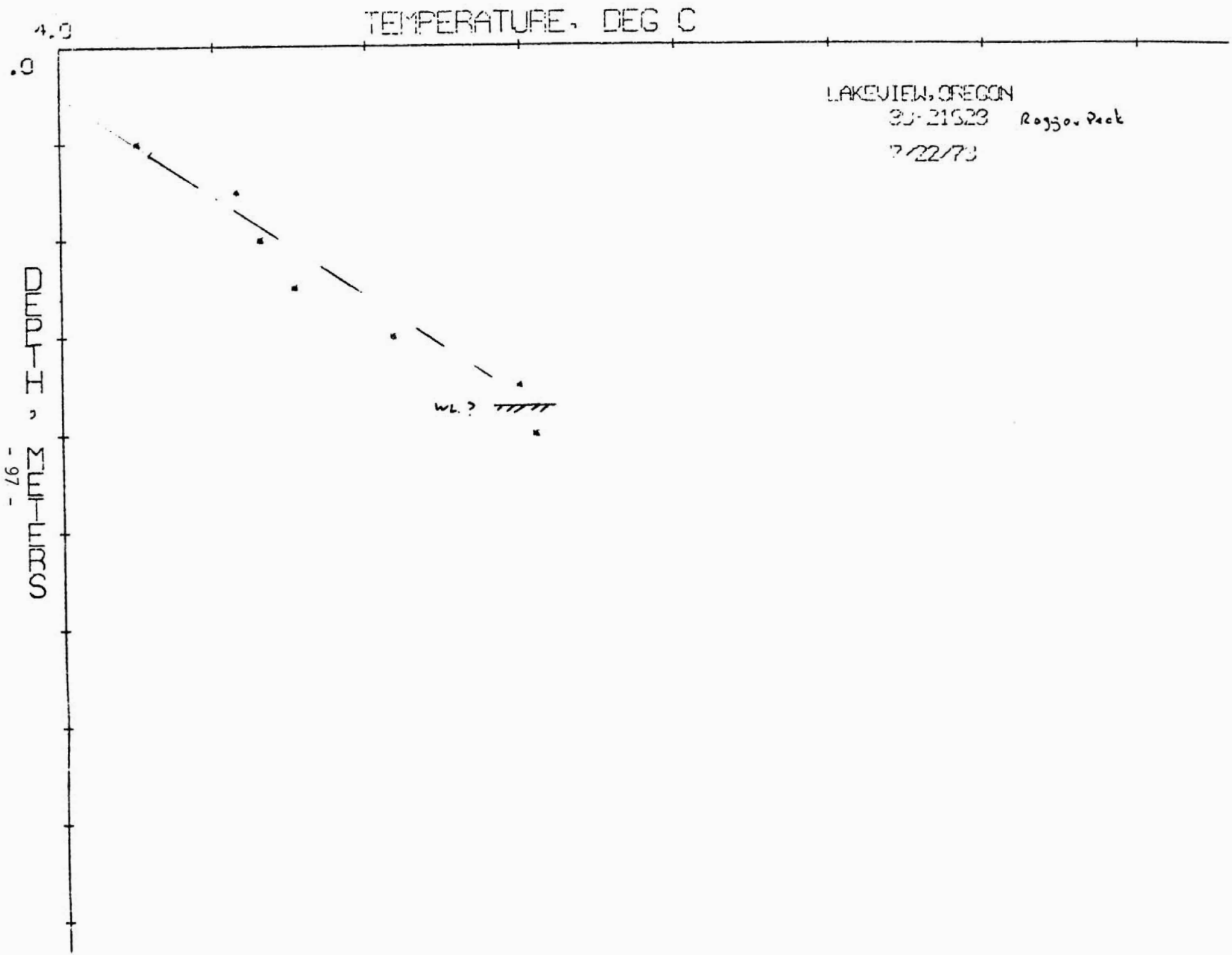
LOCATION: K FALLS AMS, OREGON
39S/20E-27DBB
HOLE NAME: BARRY
DATE MEASURED: 1/23/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	20.940	69.69	0.0	0.0
7.5	24.6	29.900	85.82	3584.0	196.7
10.0	32.8	31.710	89.08	724.0	39.7
12.5	41.0	32.810	91.06	440.0	24.1
15.0	49.2	34.210	93.58	560.0	30.7
17.5	57.4	36.090	96.96	752.0	41.3
20.0	65.6	45.270	113.49	3672.0	201.5
22.5	73.8	48.970	120.15	1480.0	81.2
25.0	82.0	53.920	129.06	1980.0	108.7
27.5	90.2	56.740	134.13	1128.0	61.9
30.0	98.4	58.940	138.09	880.0	48.3
32.5	106.6	59.290	138.72	140.0	7.7
35.0	114.8	60.010	140.02	288.0	15.8
37.5	123.0	61.960	143.53	780.0	42.8
40.0	131.2	63.500	146.30	616.0	33.8
42.5	139.4	64.510	148.12	404.0	22.2
45.0	147.6	65.630	150.13	448.0	24.6
47.5	155.8	66.440	151.59	324.0	17.8
50.0	164.0	67.500	153.50	424.0	23.3
52.5	172.2	68.020	154.44	208.0	11.4
55.0	180.4	68.620	155.52	240.0	13.2
57.5	188.6	69.710	157.48	436.0	23.9
60.0	196.8	71.150	160.07	576.0	31.6
62.5	205.0	72.260	162.07	444.0	24.4
65.0	213.2	73.950	165.11	676.0	37.1
67.5	221.4	75.140	167.25	476.0	26.1
70.0	229.6	76.020	168.84	352.0	19.3
72.5	237.8	75.690	168.24	-132.0	-7.2


TEMPERATURE, DEG C
20
30
40
50
60
70
80
0
50
100
150
DEPTH, METERS
39S/20E-27DBB
1/23/80

LOCATION: LAKEVIEW, OREGON
HOLE NUMBER: 39-21S29
DATE MEASURED: 7/22/73

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT FEET/DEG F
10.0	32.8	4.250	39.65	.0	.0
15.0	49.2	4.570	40.23	64.0	28.5
20.0	65.6	4.650	40.37	16.0	113.9
25.0	82.0	4.760	40.57	22.0	82.8
30.0	98.4	5.080	41.14	64.0	28.5
35.0	114.8	5.490	41.88	82.0	22.2
40.0	131.2	5.540	41.97	10.0	182.2


TEMPERATURE, DEG C
4.0
.0
DEPTH, METERS
- 97 -
WL ?
LAKEVIEW, OREGON
39-21S23 Roggon Rock
7/22/73

LOCATION: KLAMATH FALLS AMS, ORE
41S/20E- 1CAD
HOLE NAME: ROCKFRD1
DATE MEASURED: 6/ 9/80

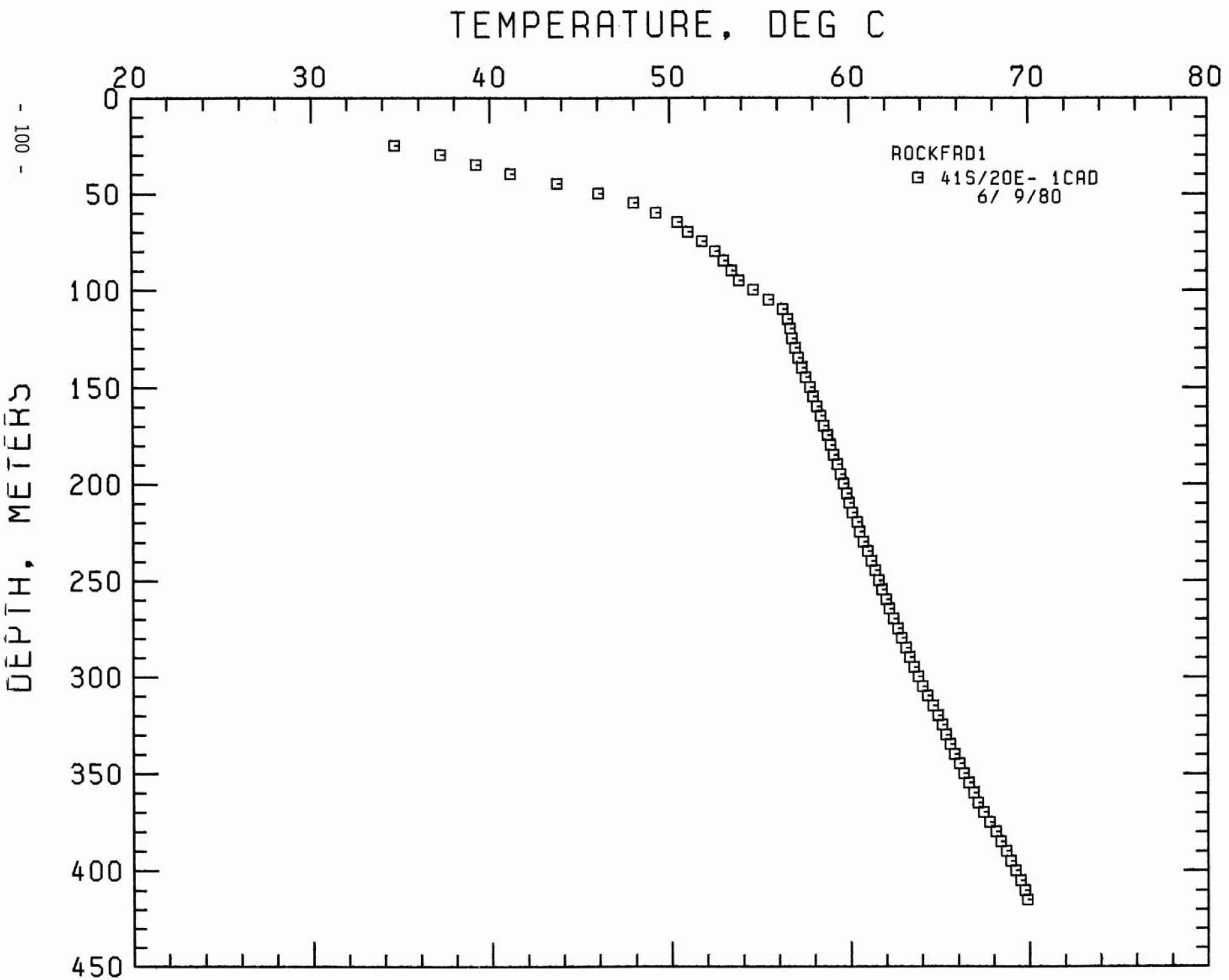
DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
25.0	82.0	34.690	94.44	0.0	0.0
30.0	98.4	37.230	99.01	508.0	27.9
35.0	114.8	39.240	102.63	402.0	22.1
40.0	131.2	41.170	106.11	386.0	21.2
45.0	147.6	43.750	110.75	516.0	28.3
50.0	164.0	46.070	114.93	464.0	25.5
55.0	180.4	48.010	118.42	388.0	21.3
60.0	196.8	49.260	120.67	250.0	13.7
65.0	213.2	50.440	122.79	236.0	13.0
70.0	229.6	51.040	123.87	120.0	6.6
75.0	246.0	51.800	125.24	152.0	8.3
80.0	262.4	52.540	126.57	148.0	8.1
85.0	278.8	53.030	127.45	98.0	5.4
90.0	295.2	53.470	128.25	88.0	4.8
95.0	311.6	53.890	129.00	84.0	4.6
100.0	328.0	54.670	130.41	156.0	8.6
105.0	344.4	55.520	131.94	170.0	9.3
110.0	360.8	56.320	133.38	160.0	8.8
115.0	377.2	56.580	133.84	52.0	2.9
120.0	393.6	56.720	134.10	28.0	1.5
125.0	410.0	56.830	134.29	22.0	1.2
130.0	426.4	57.000	134.60	34.0	1.9
135.0	442.8	57.160	134.89	32.0	1.8
140.0	459.2	57.380	135.28	44.0	2.4
145.0	475.6	57.580	135.64	40.0	2.2
150.0	492.0	57.800	136.04	44.0	2.4
155.0	508.4	58.000	136.40	40.0	2.2
160.0	524.8	58.200	136.76	40.0	2.2
165.0	541.2	58.390	137.10	38.0	2.1
170.0	557.6	58.580	137.44	38.0	2.1
175.0	574.0	58.780	137.80	40.0	2.2
180.0	590.4	58.940	138.09	32.0	1.8
185.0	606.8	59.110	138.40	34.0	1.9
190.0	623.2	59.330	138.79	44.0	2.4
195.0	639.6	59.510	139.12	36.0	2.0
200.0	656.0	59.670	139.41	32.0	1.8
205.0	672.4	59.840	139.71	34.0	1.9
210.0	688.8	59.990	139.98	30.0	1.6
215.0	705.2	60.160	140.29	34.0	1.9
220.0	721.6	60.410	140.74	50.0	2.7
225.0	738.0	60.560	141.01	30.0	1.6

41S/20E- 1CAD

HOLE NAME: ROCKFRD1

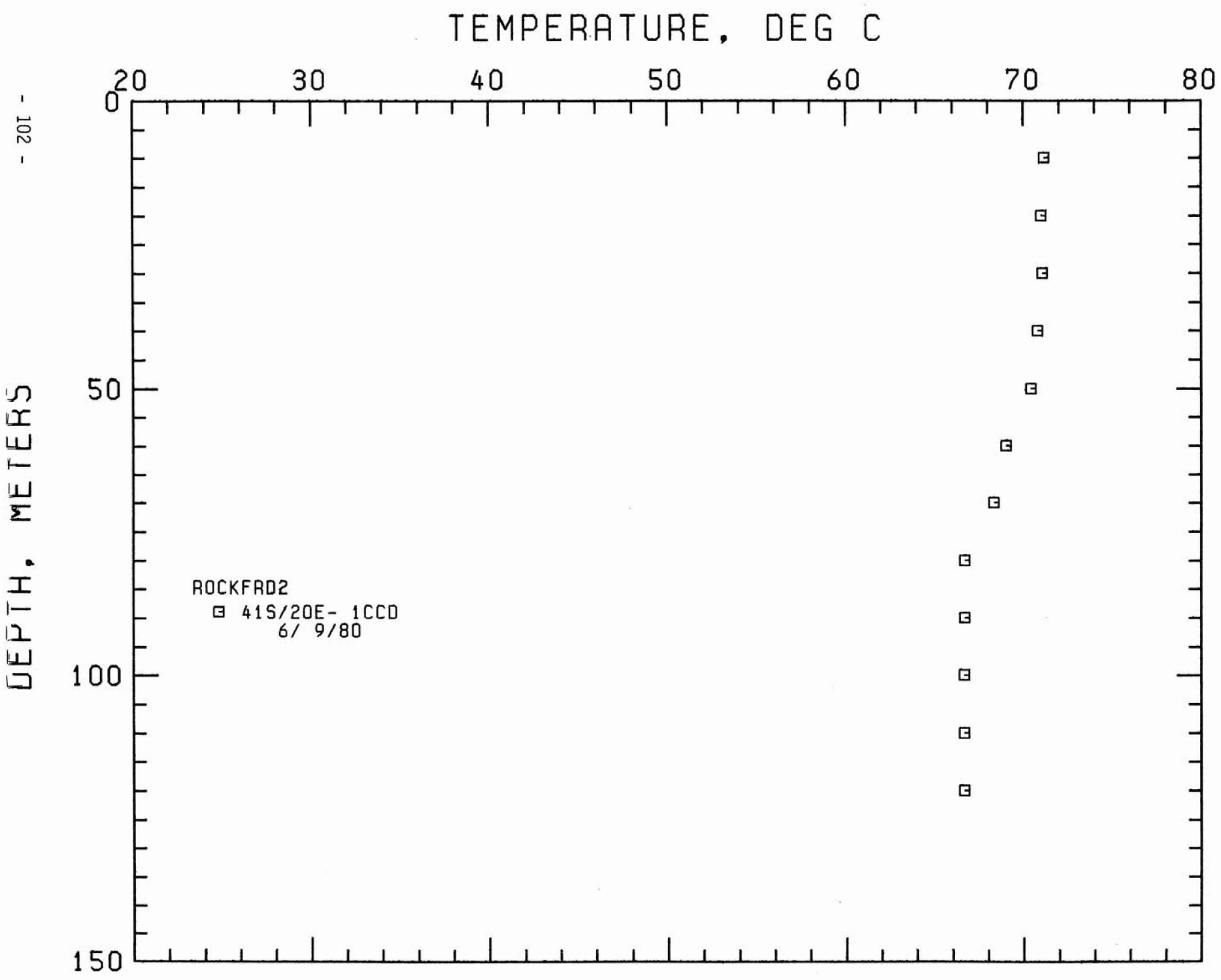
DATE MEASURED: 6/ 9/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
230.0	754.4	60.780	141.40	44.0	2.4
235.0	770.8	61.010	141.82	46.0	2.5
240.0	787.2	61.210	142.18	40.0	2.2
245.0	803.6	61.420	142.56	42.0	2.3
250.0	820.0	61.610	142.90	38.0	2.1
255.0	836.4	61.790	143.22	36.0	2.0
260.0	852.8	62.020	143.64	46.0	2.5
265.0	869.2	62.220	144.00	40.0	2.2
270.0	885.6	62.440	144.39	44.0	2.4
275.0	902.0	62.670	144.81	46.0	2.5
280.0	918.4	62.880	145.18	42.0	2.3
285.0	934.8	63.140	145.65	52.0	2.9
290.0	951.2	63.340	146.01	40.0	2.2
295.0	967.6	63.580	146.44	48.0	2.6
300.0	984.0	63.810	146.86	46.0	2.5
305.0	1000.4	64.070	147.33	52.0	2.9
310.0	1016.8	64.340	147.81	54.0	3.0
315.0	1033.2	64.630	148.33	58.0	3.2
320.0	1049.6	64.920	148.86	58.0	3.2
325.0	1066.0	65.140	149.25	44.0	2.4
330.0	1082.4	65.360	149.65	44.0	2.4
335.0	1098.8	65.600	150.08	48.0	2.6
340.0	1115.2	65.840	150.51	48.0	2.6
345.0	1131.6	66.110	151.00	54.0	3.0
350.0	1148.0	66.340	151.41	46.0	2.5
355.0	1164.4	66.640	151.95	60.0	3.3
360.0	1180.8	66.890	152.40	50.0	2.7
365.0	1197.2	67.140	152.85	50.0	2.7
370.0	1213.6	67.460	153.43	64.0	3.5
375.0	1230.0	67.810	154.06	70.0	3.8
380.0	1246.4	68.120	154.62	62.0	3.4
385.0	1262.8	68.420	155.16	60.0	3.3
390.0	1279.2	68.710	155.68	58.0	3.2
395.0	1295.6	68.950	156.11	48.0	2.6
400.0	1312.0	69.220	156.60	54.0	3.0
405.0	1328.4	69.510	157.12	58.0	3.2
410.0	1344.8	69.750	157.55	48.0	2.6
415.0	1361.2	69.900	157.82	30.0	1.6


TEMPERATURE, DEG C
20
30
40
50
60
70
80
0
50
100
150
200
250
300
350
400
450
DEPTH, METERS
- 100 -
ROCKFRD1
41S/20E- 1CAD
6/ 9/80

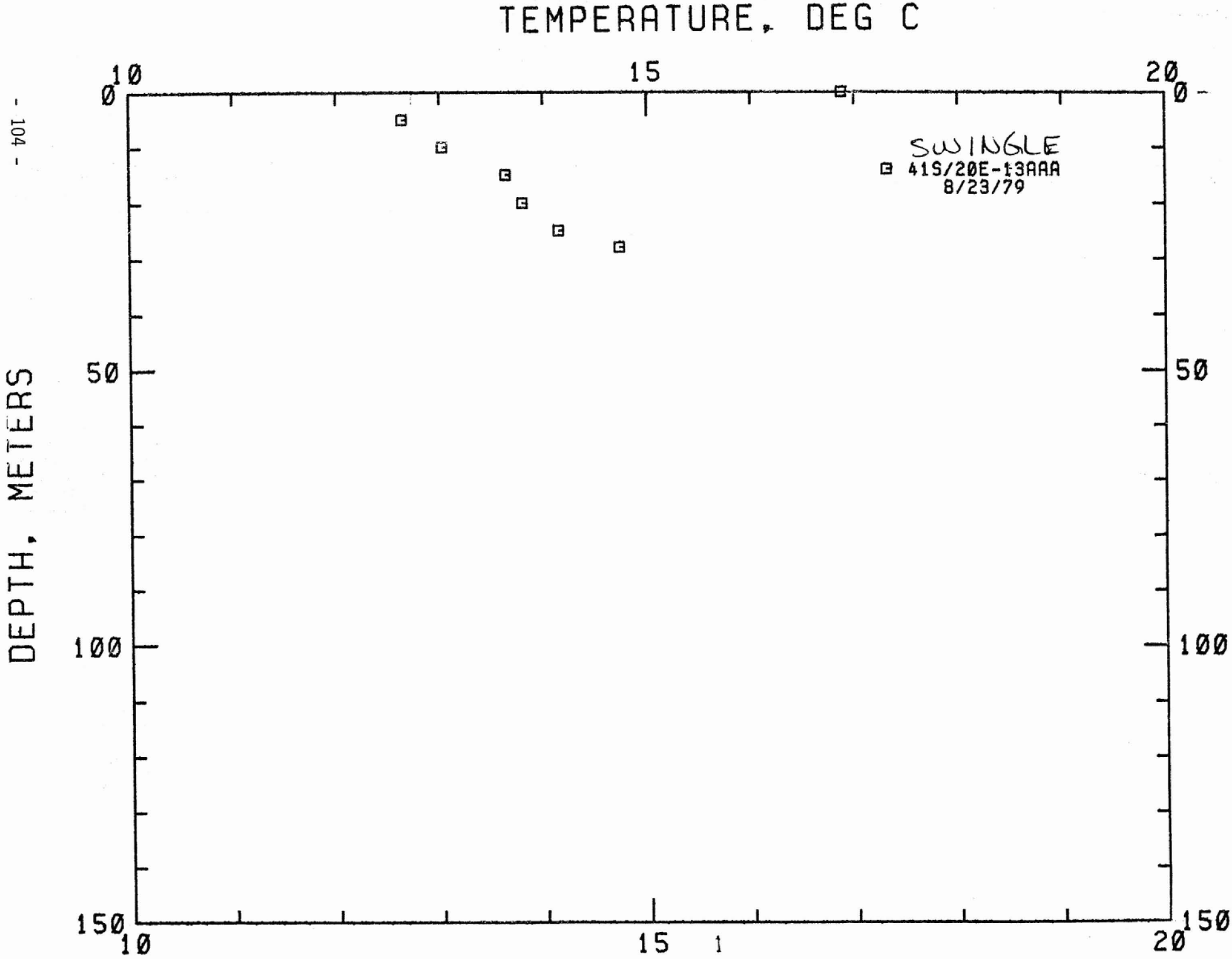
LOCATION: KLAMATH FALLS AMS, ORE
41S/20E- 1CCD
HOLE NAME: ROCKFRD2
DATE MEASURED: 6/ 9/80

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
10.0	32.8	71.180	160.12	0.0	0.0
20.0	65.6	71.030	159.85	-15.0	-0.8
30.0	98.4	71.070	159.93	4.0	0.2
40.0	131.2	70.800	159.44	-27.0	-1.5
50.0	164.0	70.440	158.79	-36.0	-2.0
60.0	196.8	69.030	156.25	-141.0	-7.7
70.0	229.6	68.350	155.03	-68.0	-3.7
80.0	262.4	66.700	152.06	-165.0	-9.1
90.0	295.2	66.700	152.06	0.0	0.0
100.0	328.0	66.670	152.01	-3.0	-0.2
110.0	360.8	66.670	152.01	0.0	0.0
120.0	393.6	66.660	151.99	-1.0	-0.1


TEMPERATURE, DEG C
20
30
40
50
60
70
80
0
50
100
150
DEPTH, METERS
ROCKFRD2
41S/20E- 1CCD
6/ 9/80

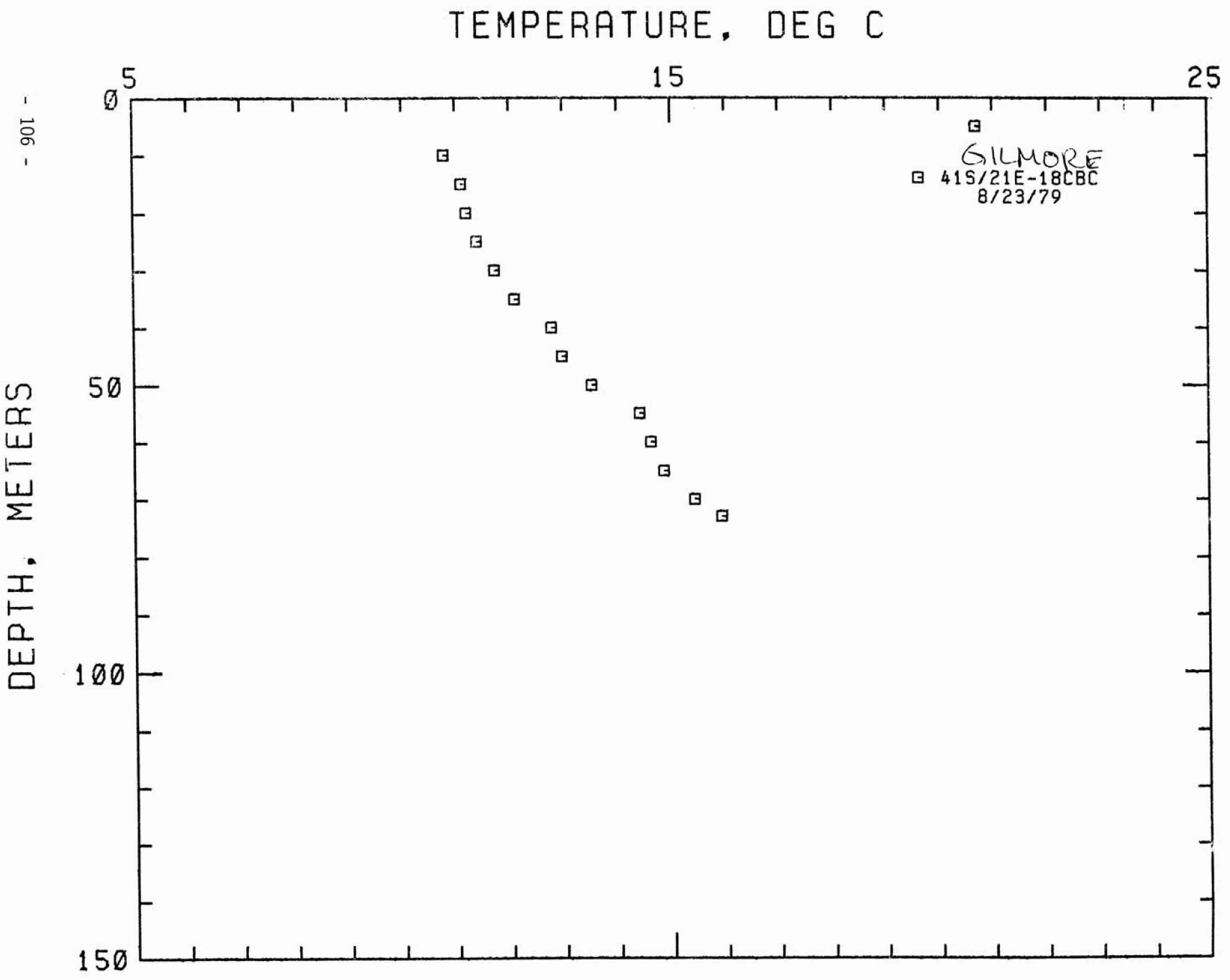
LOCATION: KLAMATH FALLS AMS, ORE
41S/20E-13AAA
HOLE NAME: SWINGLE
DATE MEASURED: 8/23/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
0.0	0.0	16.880	62.38	0.0	0.0
5.0	16.4	12.640	54.75	-848.0	-46.5
10.0	32.8	13.030	55.45	78.0	4.3
15.0	49.2	13.640	56.55	122.0	6.7
20.0	65.6	13.800	56.84	32.0	1.8
25.0	82.0	14.150	57.47	70.0	3.8
28.0	91.8	14.730	58.51	193.3	10.6


TEMPERATURE, DEG C
10
15
20
0
50
100
150
DEPTH, METERS
SWINGLE
41S/20E-13AAA
8/23/79

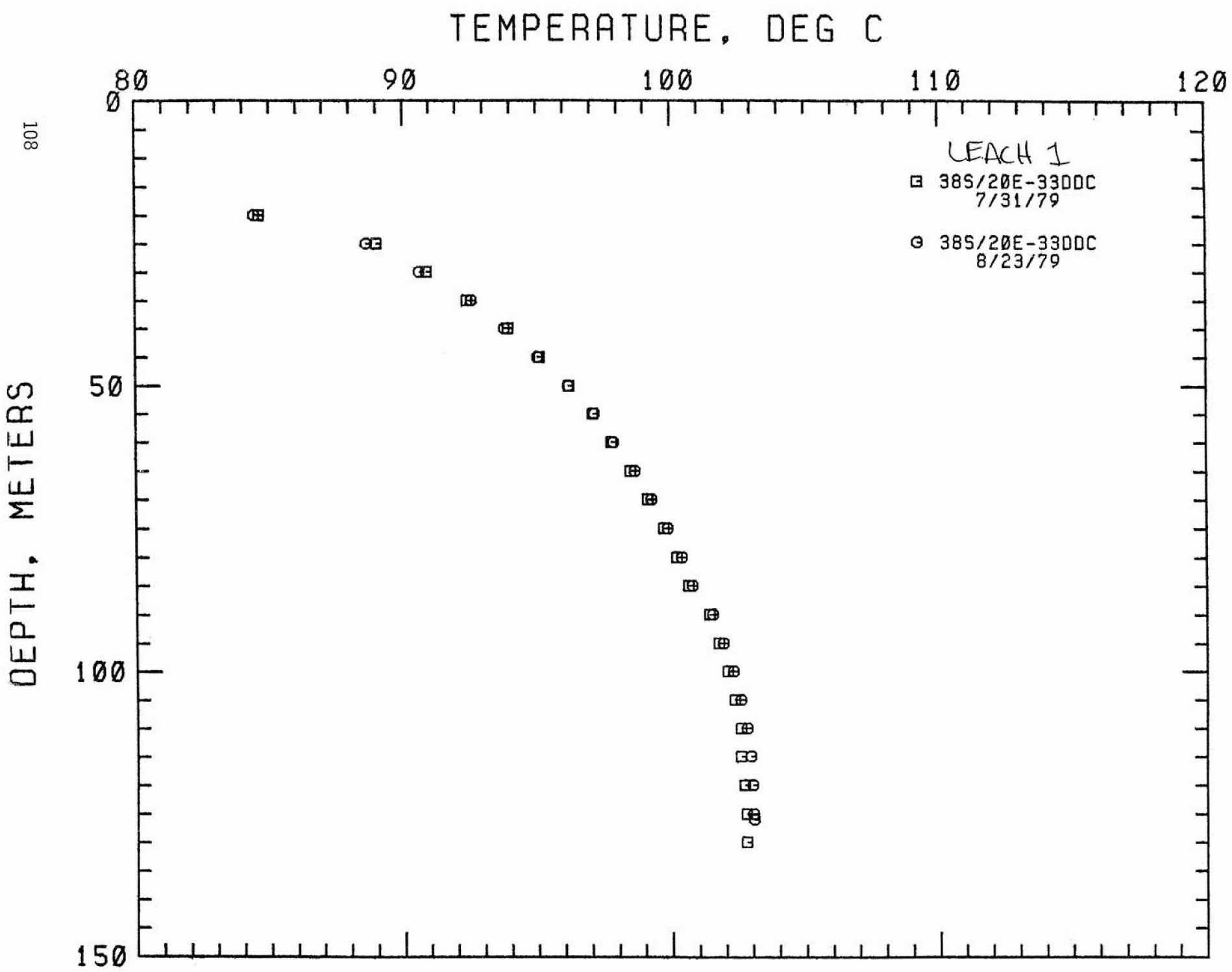
LOCATION: KLAMATH FALLS AMS, ORE
41S/21E-18CBC
HOLE NAME: GILMORE
DATE MEASURED: 8/23/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
5.0	16.4	20.690	69.24	0.0	0.0
10.0	32.8	10.790	51.42	-1980.0	-108.7
15.0	49.2	11.110	52.00	64.0	3.5
20.0	65.6	11.200	52.16	18.0	1.0
25.0	82.0	11.400	52.52	40.0	2.2
30.0	98.4	11.730	53.11	66.0	3.6
35.0	114.8	12.100	53.78	74.0	4.1
40.0	131.2	12.780	55.00	136.0	7.5
45.0	147.6	12.980	55.36	40.0	2.2
50.0	164.0	13.530	56.35	110.0	6.0
55.0	180.4	14.400	57.92	174.0	9.5
60.0	196.8	14.610	58.30	42.0	2.3
65.0	213.2	14.850	58.73	48.0	2.6
70.0	229.6	15.420	59.76	114.0	6.3
73.0	239.4	15.930	60.67	170.0	9.3


TEMPERATURE, DEG C
5
15
25
Ø
50
100
150
DEPTH, METERS
GILMORE
41S/21E-18CBC
8/23/79

LOCATION: KLAMATH FALLS AMS, OREGON
38S/20E-33DDC
HOLE NAME: LEACH 1
DATE MEASURED: 8/23/79

DEPTH METERS	DEPTH FEET	TEMPERATURE DEG C	TEMPERATURE DEG F	GEOTHERMAL GRADIENT DEG C/KM	GEOTHERMAL GRADIENT DEG F/100 FT
20.0	65.6	84.440	183.99	0.0	0.0
25.0	82.0	88.640	191.55	840.0	46.1
30.0	98.4	90.630	195.13	398.0	21.8
35.0	114.8	92.560	198.61	386.0	21.2
40.0	131.2	93.800	200.84	248.0	13.6
45.0	147.6	95.050	203.09	250.0	13.7
50.0	164.0	96.190	205.14	228.0	12.5
55.0	180.4	97.140	206.85	190.0	10.4
60.0	196.8	97.860	208.15	144.0	7.9
65.0	213.2	98.640	209.55	156.0	8.6
70.0	229.6	99.270	210.69	126.0	6.9
75.0	246.0	99.860	211.75	118.0	6.5
80.0	262.4	100.390	212.70	106.0	5.8
85.0	278.8	100.770	213.39	76.0	4.2
90.0	295.2	101.540	214.77	154.0	8.5
95.0	311.6	101.920	215.46	76.0	4.2
100.0	328.0	102.290	216.12	74.0	4.1
105.0	344.4	102.560	216.61	54.0	3.0
110.0	360.8	102.790	217.02	46.0	2.5
115.0	377.2	102.920	217.26	26.0	1.4
120.0	393.6	102.990	217.38	14.0	0.8
125.0	410.0	103.020	217.44	6.0	0.3
126.0	413.3	103.040	217.47	20.0	1.1

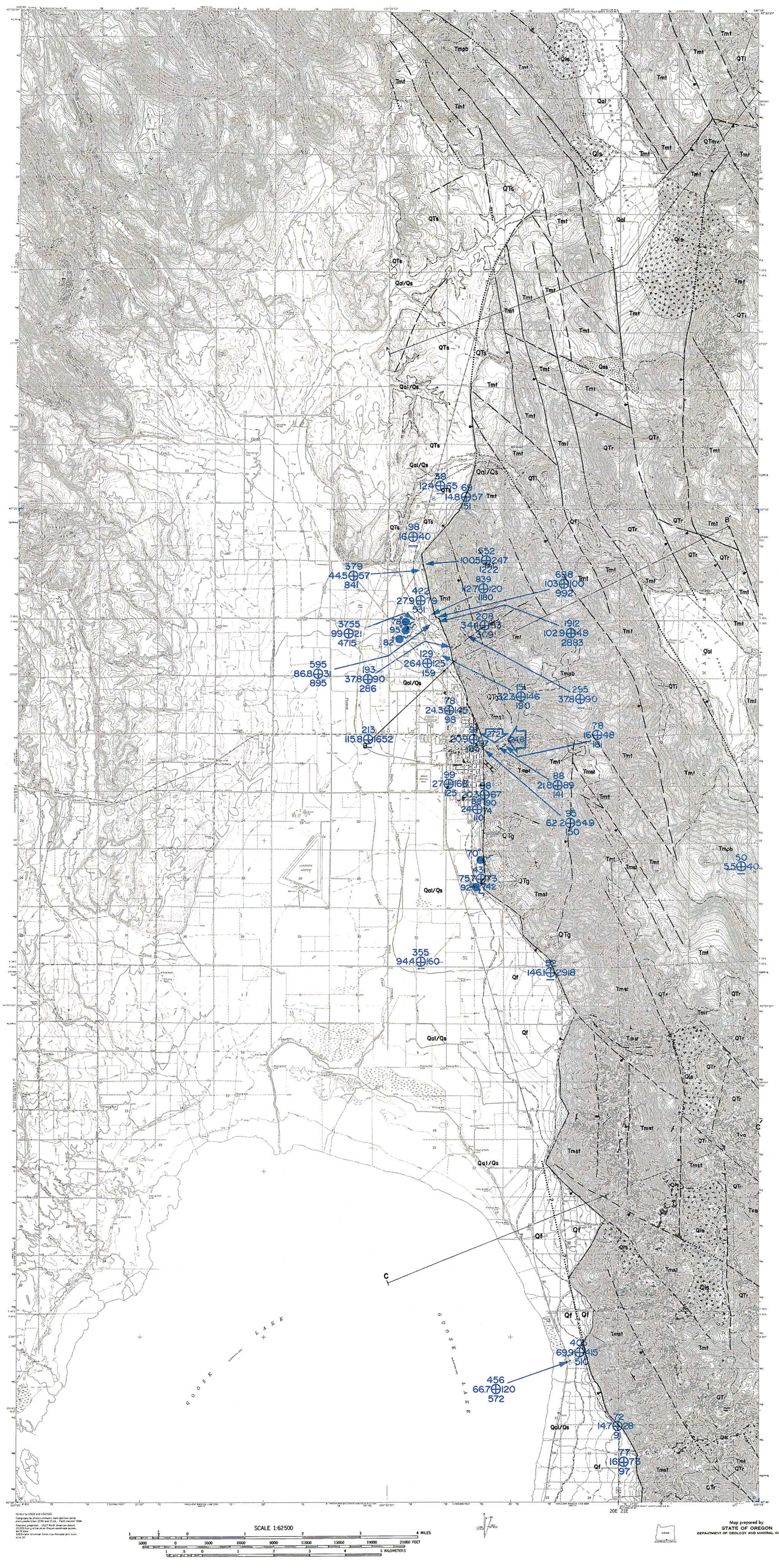

TEMPERATURE, DEG C
80
90
100
110
120
0
50
100
150
DEPTH, METERS
LEACH 1
38S/20E-33DDC
7/31/79
38S/20E-33DDC
8/23/79

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

PLATE I

OPEN FILE REPORT #O-80-9

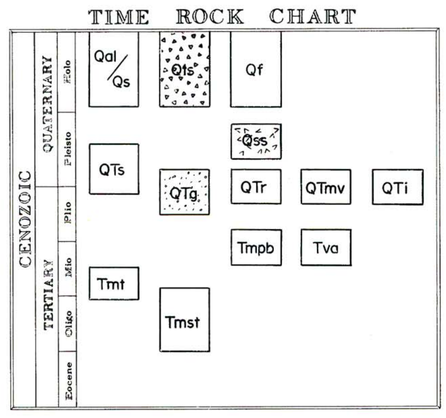
GENERALIZED GEOLOGIC MAP OF THE LAKEVIEW AREA, OREGON



Contour by USGS and USFOR
Topography by photogrammetric methods from aerial photographs taken 1950 and 1963. Field checked 1964
Polyconic projection. 1927 North American datum
10,000-foot grid based on Oregon coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 10

Map prepared by
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

TIME ROCK CHART



Geology by David E. Brown, modified from Walker, 1963.

EXPLANATION

Qal/Qs — Undifferentiated alluvium and sediments: Includes lacustrine and fluviatile gravel, sand, and silt, including undifferentiated evaporite deposits

Qls — Landslide deposits

Qf — Alluvial fan deposits: Unconsolidated to partially cemented, partially stratified sand, gravel, and boulders found at the mouths of elevated canyons

Qss — Siliceous sinter: Pleistocene (?) hot springs or geyser deposits, including silica, opal, and micrite

QTs — Sediments: Pliocene to Pleistocene, semi-consolidated, stratified, lacustrine and fluviatile silt, sand, gravels, and evaporite deposits

QTg — Terrace gravels: Pliocene to Pleistocene (?) sand and gravels found as elevated terraces along range fronts

QTmv — Mafic vent complex: Pliocene to Pleistocene (?), reddish, mostly unconsolidated cinders, scoria, and agglomerate. Forms incised, erosionally modified cinder cones

QTr — Rhyodacite: Pliocene to Pleistocene (?) exogenous domes and related flows of rhyodacitic composition

QTi — Intrusives: Pliocene to Pleistocene (?) dikes, necks and plugs of basalt, andesite, or gabbro. Age is uncertain

Tmpb — Basalt: Miocene to Pliocene (?), dark-gray, olivine-bearing, subophitic, diktytaxitic basalt. Found as ridge-capping units

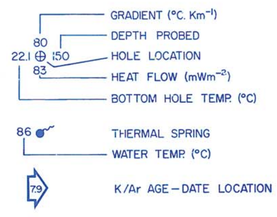
Tva — Andesite: Miocene to Pliocene (?) andesitic flows. Found as ridge-capping units

Tmt — Tuffs: Oligocene (?) to Miocene tuff of rhyolitic and dacitic composition, tuffaceous sedimentary rocks, and areally restricted rhyodacitic and andesitic flows

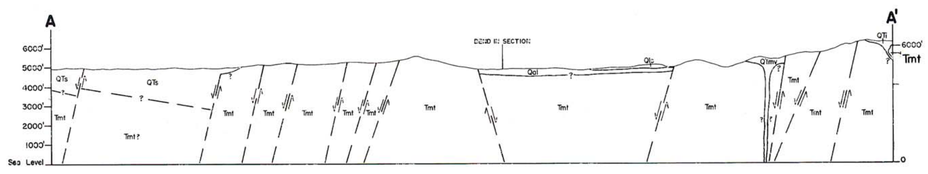
Tmst — Tuffs: Oligocene (?) to Miocene tuff, tuff breccia, tuffaceous sedimentary rocks, claystones, hornblende andesite flows, and basalt flows

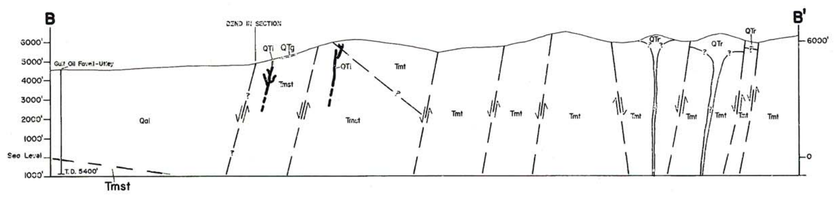
GEOLOGIC SYMBOLS

- Contact
- Normal faults - dashed where inferred, dotted where concealed; ball and bar indicate downthrown side
- Generalized strike and dip, interpreted from aerial photos
- Area of recent hydrothermal rock alteration
- Narrow discontinuous basalt dikes



Geologic Cross Sections





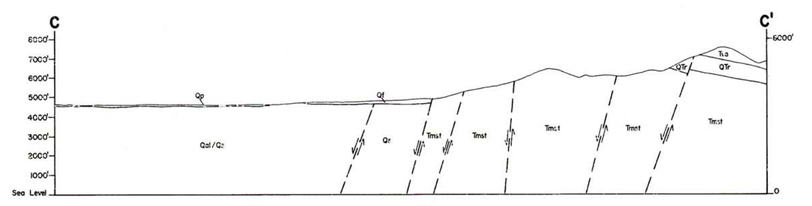


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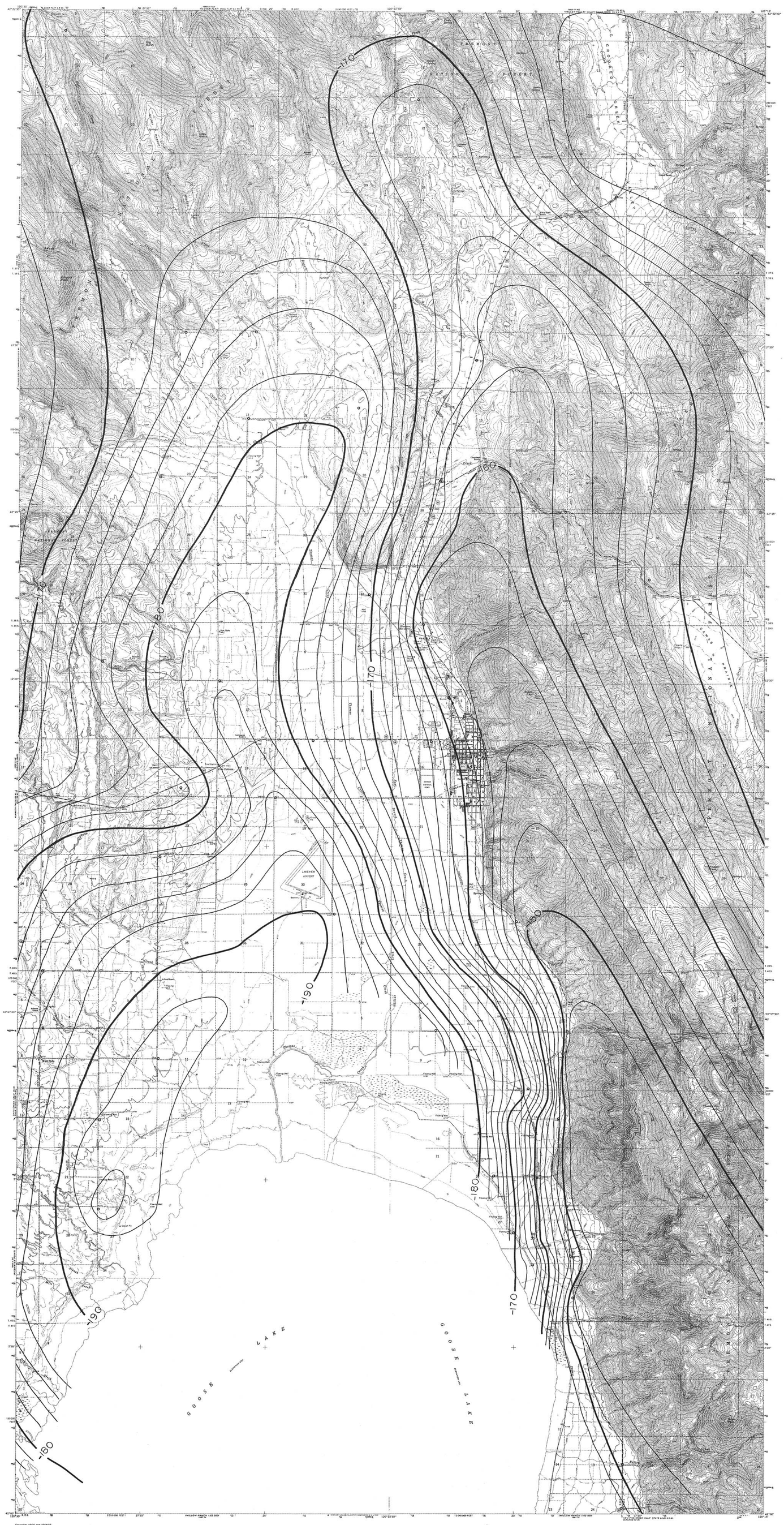
PLATE II

OPEN FILE REPORT #0-80-9

COMPLETE BOUGUER GRAVITY ANOMALY MAP OF THE LAKEVIEW AREA, OREGON



EXPLANATION

-180 Gravity contour in mgal

Gravity station location

Contour interval = 2 mgal

Reduction density = 2.67 gcm^{-3}

Theoretical gravity: (I.G.F., 1980)

Data compiled and reduced by the Oregon State University Geophysics Group, 1980.

Data taken from the Oregon State University Land Gravity Library after Thiruvathukal, 1968 and Blank, 1973.

SCALE 1:62500

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1960 and 1963. Field checked 1964

Projection: Oregon coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 10.

Map prepared by
STATE OF OREGON
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