UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SELECTED DATA FOR HYDROTHERMAL CONVECTION SYSTEMS IN THE UNITED STATES WITH ESTIMATED TEMPERATURES $\geq 90^{\circ}C$: BACK-UP DATA FOR U.S. GEOLOGICAL SURVEY CIRCULAR 790

By

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature

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CONTENTS

INTRODUCTION

This report presents a compilation of data used by Brook and others (1979) in determining the accessible resource base for identified hydrothermal convection systems $\geq$ 90°C in the United States (U.S. Geological Survey Circular 790, Assessment of Geothermal Resources of the United States — 1978). Geographic, geologic, chemical, isotopic, volumetric, and bibliographic data and calculated thermal energy contents are listed for all vapor-dominated and hot-water systems with estimated reservoir temperatures $\geq$ 90°C and reservoir depths less than 3 km known to the authors in mid 1978. Systems with lower temperatures are discussed by Sammel (1979) in Circular 790. Much of the data is the same as that presented by Renner and others (1976), but numerous revisions have been made and additional information has been added to update the data base. Data presented here is stored in the U.S. Geological Survey's geothermal computer file GEOTHERM (Swanson, 1977).

Data for individual hydrothermal convection systems in each State are arranged geographically from north to south and west to east without regard to the type or temperature of the system. Locations of the systems and corresponding reference numbers are shown on map 1 accompanying U.S. Geological Survey Circular 790. All references are listed in a single bibliography at the end of this report.

EXPLANATION OF THE DATA SHEETS

The various entries contained in the data sheets are generally self-explanatory. Scientific notation is used throughout the report and is symbolized as follows: KM**2 = km^2; KM**3 = km^3; and 10**18 = 10^{18}. All temperatures are in degrees Celsius (°C). Individual entries are discussed below. Only entries containing information are displayed.

Field Name. -- Either the name of the geothermal field, the principal hot spring, or a nearby geographic feature which identifies the hydrothermal convection system. Names are taken from published literature and topographic maps. Alternate names are given in parenthesis.

KGRA or Other Name. -- The name of the KGRA (Known Geothermal Resources Area) which includes the hydrothermal convection system, or other names which have been used for the system.

Circular Reference. -- An arbitrary number assigned to the system for bookkeeping and map location purposes. The circular reference corresponds to the number assigned to each system listed by Brook and others (1979) in Circular 790.

Geographic Locality

The geographic location of the spring, well, or field is given by state, county, latitude, longitude, the most detailed topographic map covering the area, township, range, section, quarter section, and the reference base and meridian. Longitude and latitude locations are given to the nearest tenth of a minute.

General Information

Waring Number. -- and Waring Figure. -- The figure and spring or well number assigned to the system by Waring (1965).

Elevation. -- Surface elevations were taken from USGS topographic maps and converted to meters from feet by multiplying by 0.3048.

Area of surface expression. -- Areal extent of hot springs, hot spring deposits, or surface alteration are given in square kilometers (km**2). This area is not the result of geophysical measurements. Areas are not reported for single springs or wells or where the data is insufficient to indicate areal extent.

Surface activity. -- The type of surface activity related to the geothermal system: hot springs, geysers, fumaroles, and acid-sulfate springs.

Associated deposits. -- Lists the deposits associated with the spring or occuring in the area: usually travertine or sinter.

Number of springs. --, Spring temperature. --, and Discharge (L/MIN). --The number of thermal springs issuing in a system, their reported range of temperatures (in ^{o}C), and the total discharge (liters per minute) of all the thermal springs and wells in the system.

Number of wells. --, Well depths. --, and Maximum well temperature (^{o}C). --These items list the number of thermal wells and their depths in meters. The maximum well temperature (in ^{o}C) includes the depth at which the maximum temperature was encountered if this depth differs from the maximum depth of the well.

Rock types. -- The dominant rock types in the area.

Geophysics. -- The types of geophysical information available in the area.

Chemistry

This section includes the sample source, collection date, chemical composition, isotopic composition, and discharge rate of the sampled spring or well. Chemical compositions are in milligrams per liter. Isotopic compositions for the water and the dissolved sulfate are expressed in the δ-notation (listed as DEL in the tables):

$$\delta = \frac{R_x - R_{std}}{R_{std}} \times 10^3, \quad (1)$$

where $R_x = (D/H)_x$ or $(^{18}O/^{16}O)_x$ of the sample and R_{std} is the corresponding ratio for Standard Mean Ocean Water (SMOW). Total alkalinity is reported as bicarbonate (HCO_3) or distributed as carbonate (CO_3) and bicarbonate (HCO_3) at the spring temperature and pH. Appreciable noncarbonate alkalinity is present in some of the high pH waters.

Geothermometers

The silica and cation geothermometers are calculated from equations given in Fournier (1975). The geothermal equations have all been derived using molal concentrations. However, chemical analyses are generally reported in terms of milligrams per liter which is a molarity concentration. The difference between molarity (moles of solute per 1000 milliters of solution) is insignificant except in brines and was ignored. Molarity units (mg/L and moles/L) were used in the silica and cation geothermometers, respectively. Equations for the individual geothermometers are listed below:

Cation Geothermometers

<u>Na-K-Ca geothermometer</u>

$$t_{^oC} = \frac{1647}{(\log (Na/K) + \beta \log (\sqrt{Ca}/Na) - 2.24)} - 273.15, \quad (2)$$

where $\beta = 1/3$ for water equilibrated above 100^oC, and $\beta = 4/3$ for water equilibrated below 100^oC.

Na-K geothermometer

$$t_{^oC} = \frac{777}{(0.47 + \log (Na/K)} - 273.15 \qquad (3)$$

Silica Geothermometers

Quartz adiabatic

$$t_{^oC} = \frac{1522}{(5.75 - \log SiO_2)} - 273.15 \qquad (4)$$

Quartz conductive

$$t_{^oC} = \frac{1309}{(5.19 - \log SiO_2)} - 273.15 \qquad (5)$$

Chalcedony

$$t_{^oC} = \frac{1032}{(4.69 - \log SiO_2)} - 273.15 \qquad (6)$$

Alpha-cristobalite

$$t_{^oC} = \frac{1000}{(4.78 - \log SiO_2)} - 273.15 \qquad (7)$$

Opal (i.e. amorphous-silica)

$$t_{^oC} = \frac{731}{(4.52 - \log SiO_2)} - 273.15 \qquad (8)$$

Sulfate-Water Isotope Geothermometers

The equations for the sulfate-water isotope geothermometers are discussed in some detail by McKenzie and Truesdell (1977). The calculations were carried out using the following equations:

$$\alpha\ SO_4\text{-}H_2O = \frac{1000 + \delta^{18}O_{(SO_4)}}{1000 + \delta^{18}O_{(H_2O)}} \tag{9}$$

and

$$1000 \ln \alpha_{SO_4 - H_2O} = \left(\frac{288 \times 10^6}{T^2}\right) - 4.1 \tag{10}$$

where T is in Kelvin (K).

Conductive heat loss

Conductive heat loss was assumed in nonboiling springs and total condensed samples from steam wells. Temperatures may be calculated for these systems by using equations (9) and (10).

One-step steam loss

One-step steam loss occurs in geysers and steam wells with two phase (steam-water) discharge where only the water fraction is sampled. In order to use equations (9) and (10), the oxygen isotopic composition of the reservoir water must be calculated.

The oxygen isotopic composition of the reservoir water can be calculated from the equation

$$\frac{1000 + \delta^{18}O_{(H_2O)r}}{1000 + \delta^{18}O_{(H_2O)s}} = \eta + (1 - \eta)(1/\alpha_{lv}) \simeq \alpha_{lv}^{(\eta - 1)} \tag{11}$$

where

$\alpha\, {}^{18}O_{(H_2O)r}$ = $\alpha\, {}^{18}O$ value of the geothermal reservoir water

$\alpha\, {}^{18}O_{(H_2O)s}$ = $\alpha\, {}^{18}O$ value of surface water

η = fraction liquid = (Hvs - Hlr)/(Hvs - Hls)

Hlr = enthalpy of liquid water at the reservoir temperature

Hls = enthalpy of liquid water at the spring temperature

Hvs = enthalpy of steam at the spring temperature

lv = $({}^{18}O/{}^{16}O)$ H_2O liquid/$({}^{18}O/{}^{16}O)$ H_2O vapor.

Values of α_{lv} can be expressed over the range 3°C to 360°C by

$$1000 \ln \alpha_{lv} = -3.494 + 1.2051\ (10^3/T) + 0.7664\ (10^6/T^2), \qquad (12)$$

where T is in Kelvin (K). The temperature used in equation (12) is the temperature of steam-water separation.

The value of $\alpha\, {}^{18}O\ (H_2O)r$ calculated from the above equations can then be used to calculate the $\alpha_{SO_4-H_2O}$ factor (equation 9) which is then used in the temperature dependent ${}^{18}O$ fractionation equation (10).

Continuous steam loss

The continuous steam-loss model should only be used in areas where steam has continuously separated from the thermal water as it rose to the surface. In such situations, fumaroles and steaming ground are physically separated from the hot springs.

The temperature of isotopic equilibrium is determined by iteration of the equations:

$$\ln \frac{1000 + \alpha\, {}^{18}O_{(H_2O)r}}{1000 + \alpha\, {}^{18}O_{(H_2O)s}} = \int_{Hls}^{Hlr} (1 - 1/\alpha_{lv}) \frac{dH}{Hvs - H} \qquad (13)$$

Reservoir Properties

This section lists values for the primary reservoir variables — temperature, area, and thickness — which are used to calculate the thermal energy content (that is, the accessible resource base) for each system. Minimum, maximum, and most likely values for each variable are a result of our judgment based on geology, geothermometry, geophysics, and (or) downhole measurements. A geothermal reservoir is a complex, heterogenous volume of rock and water. We assume that each of the values estimated for the geothermal reservoir represents an integrated value that is characteristic for the reservoir as a unit. That is, it is probable that an estimated value is no less than the minimum or no greater than the maximum when the entire reservoir is considered, even though higher or lower values, especially temperature, may be locally encountered. Minimum and maximum values thus are not total ranges of the reservoir variables. The most likely value is thought to be the most representative estimate for the entire reservoir. The mean and standard deviation (STD. DEV.) for each variable are calculated from the minimum, maximum, and most likely values.

Subsurface temperature ($^{\circ}$C). -- Each temperature estimate is coded to indicate which geothermometer or other source was used. If no code is given, the temperature was subjectively estimated considering several lines of evidence. For alkaline waters with pH of 8 and above, the quartz conductive and chalcedony geothermometers were corrected to compensate for the effects of dissociated silicic acid (see discussion in Brook and others, 1979). If the quartz or chalcedony geothermometer was reduced by 10°C or more, the pH-corrected value was either used as an estimate or recorded in the comment section. This pH correction was not used where the spring or well discharged carbon dioxide. Magnesium corrections on the Na-K-Ca geothermometer were carried out using preliminary graphs provided by R.O. Fournier. Fournier and Potter (1978) have subsequently developed an equation for the correction. Values calculated from their equation may differ slightly from those reported here.

Depth to top (km). -- Depth to the top of the reservoir is based on drill data where available. Otherwise, standard estimates of 0.5, 2.0, and 1.5 km are assumed.

Thickness (km). -- Thickness estimates are based on drill data where available. Otherwise, standard estimates of 1.0, 2.5, and 1.5 are assumed for the minimum, maximum, and most likely, respectively. Base depth of the reservoir is considered to be 3 km unless drill data indicate otherwise.

Subsurface area (km^2). -- Extent of the reservoir in the subsurface within the temperature limits defined for the reservoir. The area is generally determined from various geological and geophysical data which is given on the following line. If data was not available, standard estimates of 1, 3, and 2 km^2 were assumed for the minimum, maximum, and most likely, respectively.

Volume (km^3). -- Mean volume is calculated from the mean thickness and mean subsurface area. The method of calculating the standard deviation is given by Nathenson (1978).

Thermal energy (10^{18} Joules). Thermal energy (Q) of each system is calculated from the equation:

$$Q = \rho c \cdot \bar{V} \cdot (\bar{T} - T_o) \tag{13}$$

where

ρc = volumetric specific heat of rock plus water (= 2.7 $J/cm^3 - {}^oC$)

V = mean volume (converted to cm^3)

T = mean temperature (^oC)

T_o = reference temperature (15^oC)

The volumetric specific heat (ρc) is calculated assuming the rock specific heat to be 2.5 $J/cm^3-{}^oC$ and the reservoir porosity to be 15 percent. The method of calculating the standard deviation is given in Nathenson (1978).

Comments

Comments about the springs, the geothermal system, thermal wells, geothermometers, unusual chemical constituents, and other miscellaneous items.

References

The principal references containing data or descriptions used to prepare the data sheets.

DATA SHEETS

Alaska

FIELD NAME................ OKPILAK SPRINGS
CIRCULAR REFERENCE........ 001

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 69-18. N
LONGITUDE.................. 144-02. W
MAPS....................... MT. MICHELSON B-1 1:63,360

GENERAL INFORMATION
SURFACE ACTIVITY.................... HOT SPRING
SPRING TEMPERATURES (C)............. 48.5

CHEMISTRY
SAMPLE SOURCE.... MILLER

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
48.5	56	9.8	0.1	120	4.5	85		200	31

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.3			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	133
NA-K-CA (4/3)...........	90
NA-K....................	92

SILICA

ADIABATIC...............	107
CONDUCTIVE..............	107
CHALCEDONY..............	78
CRISTOBALITE............	57
OPAL....................	-9

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	78 (D)	107 (A)	90 (I)	92	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.69	STD. DEV. = 0.20

REFERENCES: MILLER, UNPUB. DATA

COMPILED BY: BROOK, C.

OKPILAK SPRINGS , ALASKA

FIELD NAME................ SERPENTINE SPRINGS (ARCTIC)
CIRCULAR REFERENCE........ 002

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 65-51. N
LONGITUDE................. 164-42. W
MAPS...................... BENDELEBEN D-6, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
05N	25W	12	KATEEL RIVER

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 4
AREA OF SURFACE EXPRESSION (KM**2). 0.2
ELEVATION (M)...................... 122
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE
NO. OF SPRINGS..................... 2 GROUPS 0.8 KM APART
SPRING TEMPERATURES (C)............ 60 TO 77
DISCHARGE (L/MIN).................. 133
ROCK TYPES: GRANITE NEAR FAULT CONTACT WITH METASEDIMENTS

CHEMISTRY
SAMPLE SOURCE.... MILLER AND OTHERS, 1975
FLOW (L/MIN)..... 132

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
77	90	75	0.35	800	41	57	1.3	1	1450

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.91			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	161
NA-K-CA (4/3)	151
NA-K	117
SILICA	
ADIABATIC	128
CONDUCTIVE	131
CHALCEDONY	104
CRISTOBALITE	81
OPAL	12

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	104 (D)	161 (I)	131 (A)	132	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.05 STD. DEV. = 0.31

REFERENCES: WARING, 1917, 1965; SAINSBURY AND OTHERS, 1969; MILLER, 1973; MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

SERPENTINE SPRINGS (ARCTIC) , ALASKA

FIELD NAME................ PILGRIM (KRUZGAMEPA) HOT SPRINGS
KGRA OR OTHER NAME........ PILGRIM SPRINGS KGRA
CIRCULAR REFERENCE........ 003

GEOGRAPHIC LOCALITY

STATE..................... ALASKA
LATITUDE.................. 65-06. N
LONGITUDE................. 164-55. W
MAPS...................... BENDELEBEN A-6, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04S	31W	36	SE OF SE	KATEEL RIVER

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 6
AREA OF SURFACE EXPRESSION (KM**2). 0.2
ELEVATION (M)...................... 5
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 55 TO 88
DISCHARGE (L/MIN).................. LT 50
ROCK TYPES: QUATERNARY ALLUVIUM OVERLYING GRANITIC-METAMORPHIC COMPLEX
GEOPHYSICS: AEROMAGNETIC

CHEMISTRY

SAMPLE SOURCE.... MILLER AND OTHERS, 1975
FLOW (L/MIN)..... 38

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	100	530	1.4	1450	61	30.1		24	3346

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.7		6.75		-14.91	-121.9

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	146
NA-K-CA (4/3)...........	120
NA-K..................	101
SILICA	
ADIABATIC..............	133
CONDUCTIVE.............	137
CHALCEDONY.............	110
CRISTOBALITE...........	87
OPAL..................	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	110 (D)	146 (I)	137 (A)	131	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.04 STD. DEV. = 0.30

COMMENTS: 0.25 KM**2 AREA PERMANENTLY THAWED. THERMAL WATER USED IN BATH HOUSES AND FOR AGRICULTURE.

REFERENCES: WARING, 1917, 1965; SAINSBURY AND OTHERS, 1969; MILLER, 1973; MILLER AND OTHERS, 1975; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

PILGRIM (KRUZGAMEPA) HOT SPRINGS, ALASKA

FIELD NAME................ LAVA CREEK
CIRCULAR REFERENCE........ 004

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 65-13. N
LONGITUDE.................. 162-54. W
MAPS....................... BENDELEBEN A-2, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
03S	21W		KATEEL RIVER

GENERAL INFORMATION
ELEVATION (M)...................... 244
SURFACE ACTIVITY................... HOT SPRING
SPRING TEMPERATURES (C)............ 50 TO 65
ROCK TYPES: QUARTZ MONZONITE NEAR CONTACT WITH PRECAMBRIAN MIGMATITE

CHEMISTRY
SAMPLE SOURCE.... MILLER AND OTHERS, 1975
COLLECTION DATE.. 1974/00/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
50	84	2.0	LT 0.1	79	1.8	120.9	5	53	5.9

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.6			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	117
NA-K-CA (4/3)	90
NA-K	59
SILICA	
ADIABATIC	125
CONDUCTIVE	128
CHALCEDONY	100
CRISTOBALITE	77
OPAL	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (E,I)	128 (A)	90 (E,I)	103	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.79 STD. DEV. = 0.24

REFERENCES: MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

LAVA CREEK, ALASKA

FIELD NAME................. CLEAR CREEK
CIRCULAR REFERENCE........ 005

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 64-51. N
LONGITUDE................. 162-18. W
MAPS...................... SOLOMON D-1, 1163,360

GENERAL INFORMATION
ELEVATION (M)..................... 183
SURFACE ACTIVITY.................. HOT SPRINGS
NO. OF SPRINGS.................... 2
SPRING TEMPERATURES (C)........... 60 TO 67
DISCHARGE (L/MIN)................. 1000
ROCK TYPES: QUARTZ MONZONITE

CHEMISTRY
SAMPLE SOURCE.... MILLER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	83	2.0	LT 0.1	55	1.6	10.2		27	4.2

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.3			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	122
NA-K-CA (4/3)...........	82
NA-K..................	74

SILICA

ADIABATIC..............	124
CONDUCTIVE.............	127
CHALCEDONY.............	99
CRISTOBALITE...........	76
OPAL..................	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	82 (I)	127 (A)	99 (D)	103	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.79	STD. DEV. = 0.24

COMMENTS: HIGH FLOW RATE SUGGESTS THAT SUBSURFACE TEMPERATURES MAY BE NEARER MINIMUM TEMPERATURE.

REFERENCES: MILLER, 1973; MILLER AND OTHERS, 1972, 1975; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

CLEAR CREEK , ALASKA

FIELD NAME................ SOUTH
CIRCULAR REFERENCE........ 006

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 66-09. N
LONGITUDE................. 157-07. W
MAPS...................... SHUNGNAK 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
10N	06E		KATEEL RIVER

GENERAL INFORMATION
ELEVATION (M)...................... 244
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 50
ROCK TYPES: QUARTZ MONZONITE

CHEMISTRY
SAMPLE SOURCE.... MILLER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
50	65	5.9	0.01	83	2.1			122	6

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	115
NA-K-CA (4/3)...........	72
NA-K....................	65

SILICA

ADIABATIC...............	113
CONDUCTIVE..............	114
CHALCEDONY..............	86
CRISTOBALITE............	64
OPAL....................	-3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	72 (I)	114 (A)	86 (D)	91	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.68	STD. DEV. = 0.21

REFERENCES: MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

SOUTH , ALASKA

FIELD NAME................ DULBI
CIRCULAR REFERENCE........ 007

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 65-16. N
LONGITUDE................. 155-16. W
MAPS...................... MELOZITNA B-5, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
03S	18E	06?	KATEEL RIVER

GENERAL INFORMATION
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... SEVERAL
ROCK TYPES: HORNFELSIC GRAYWACKE AND MUDSTONE

CHEMISTRY
SAMPLE SOURCE.... USGS FILE DATA
COLLECTION DATE.. 1974/09/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	82	15	LT 1	200	12	80		280	44

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
22	2.3	8.3			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	159
NA-K-CA (4/3)..........	123
NA-K..................	131

SILICA

ADIABATIC..............	124
CONDUCTIVE.............	126
CHALCEDONY.............	99
CRISTOBALITE...........	76
OPAL...................	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	159 (I)	126 (A)	128	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	1.02	STD. DEV. = 0.31

COMMENTS: MAY BE A MIXED WATER

REFERENCES: MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

DULBI , ALASKA

FIELD NAME................ MELOZI (MELOZITNA) HOT SPRINGS
CIRCULAR REFERENCE........ 008

GEOGRAPHIC LOCALITY

STATE...................... ALASKA
LATITUDE................... 65-08. N
LONGITUDE.................. 154-40. W
MAPS....................... MELOZITNA A-4, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
04S	20E	23	KATEEL RIVER

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 10
ELEVATION (M)...................... 275
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... ONE MAIN SPRING
SPRING TEMPERATURES (C)............ 55 TO 56
DISCHARGE (L/MIN).................. 498
ROCK TYPES: QUARTZ MONZONITE

CHEMISTRY

SAMPLE SOURCE.... MILLER AND OTHERS, 1975
FLOW (L/MIN)..... 498
COLLECTION DATE.. 1959/00/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56	78	11	2.8			32	31	61	92

GEOTHERMOMETERS (C)

SILICA

ADIABATIC...............	121
CONDUCTIVE..............	124
CHALCEDONY..............	96
CRISTOBALITE............	73
OPAL....................	5

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD, DEV.
SUBSURFACE TEMP (C)	92 (D)	124 (A)	124 (A)	113	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.88 STD. DEV. = 0.26

COMMENTS: H2S ODOR

REFERENCES: WARING, 1917, 1965; MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

MELOZI (MELOZITNA) HOT SPRINGS, ALASKA

FIELD NAME................ LITTLE MELOZITNA HOT SPRINGS
CIRCULAR REFERENCE........ 009

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 65-28. N
LONGITUDE.................. 153-20. W
MAPS....................... MELOZITNA B-1, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
01N	27E	29	NW OF SW	KATEEL RIVER

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 11
ELEVATION (M)...................... 275
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 38
ROCK TYPES: GRANITE

CHEMISTRY
SAMPLE SOURCE.... WARING, 1917

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
38	80								

GEOTHERMOMETERS (C)

SILICA

ADIABATIC..............	122
CONDUCTIVE.............	125
CHALCEDONY.............	97
CRISTOBALITE...........	74
OPAL...................	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	97 (D)	125 (A)	125 (A)	116	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.91 STD. DEV. = 0.26

COMMENTS: H2S ODOR. CHEMICAL ANALYSIS MAY BE UNRELIABLE

REFERENCES: WARING, 1917, 1965; MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

LITTLE MELOZITNA HOT SPRINGS, ALASKA

FIELD NAME................. REED RIVER HOT SPRING
CIRCULAR REFERENCE........ 010

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE.................. 67-17. N
LONGITUDE................. 154-55. W
MAPS...................... SURVEY PASS 1:250,000

GENERAL INFORMATION
SURFACE ACTIVITY................... HOT SPRING
SPRING TEMPERATURES (C)............ 50
ROCK TYPES: GRANITIC ROCK INTRUDING LIMESTONE

CHEMISTRY
SAMPLE SOURCE.... MILLER, UNPUB. DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
50	82	24	1.1	160	12	360		50	15

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.2		7.8			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	163
NA-K-CA (4/3)	108
NA-K	153

SILICA

ADIABATIC	124
CONDUCTIVE	126
CHALCEDONY	99
CRISTOBALITE	76
OPAL	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	126 (A)	126 (A)	117	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.92 STD. DEV. = 0.26

COMMENTS: NA-K-CA TEMPERATURES PROBABLY UNRELIABLE BECAUSE OF CARBONATE BEDROCK.

REFERENCES: MILLER, UNPUB. DATA, MULL AND OTHERS, 1976

COMPILED BY: BROOK, C.

REED RIVER HOT SPRING , ALASKA

FIELD NAME................ KANUTI
CIRCULAR REFERENCE........ 011

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 66-20. N
LONGITUDE................. 150-48. W
MAPS...................... BETTLES, 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
18N	15W	36	FAIRBANKS

GENERAL INFORMATION
ELEVATION (M)...................... 290
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 66
ROCK TYPES: MAFIC VOLCANIC ROCKS COVERED BY ALLUVIUM

CHEMISTRY
SAMPLE SOURCE.... MILLER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
66		2.7	0.3	111	3.7	169		21	28

GEOTHERMOMETERS (C)
CATION
NA-K-CA (1/3)........... 136
NA-K-CA (4/3)........... 114
NA-K.................... 84

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	85 (H)	120 (J)	120 (J)	108	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.84 STD. DEV. = 0.25

COMMENTS: STRONG H2S ODOR. ONLY A PARTIAL CHEMICAL ANALYSIS IS AVAILABLE.

REFERENCES: MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

KANUTI, ALASKA

FIELD NAME................. TOLOVANA
CIRCULAR REFERENCE........ 012

GEOGRAPHIC LOCALITY

STATE...................... ALASKA
LATITUDE.................. 65-16. N
LONGITUDE................. 148-50. W
MAPS...................... LIVENGOOD B-4, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05N	06W	07	SE	FAIRBANKS

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 17
ELEVATION (M)...................... 297
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52 TO 60
DISCHARGE (L/MIN).................. SMALL
ROCK TYPES: MUDSTONE

CHEMISTRY

SAMPLE SOURCE.... ANDERSON, 1970

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	75	82	1.2	321	23	49		40	615

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.7			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	162
NA-K-CA (4/3)	110
NA-K	148

SILICA

ADIABATIC	120
CONDUCTIVE	122
CHALCEDONY	93
CRISTOBALITE	71
OPAL	3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	93 (D)	162 (I)	122 (A)	126	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.00 STD. DEV. = 0.31

COMMENTS: GEOTHERMOMETERS ARE QUESTIONABLE DUE TO SMALL FLOW OF SPRING.

REFERENCES: WARING, 1917, 1965; ANDERSON, 1970; CHAPMAN AND OTHERS, 1971; MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

TOLOVANA, ALASKA

FIELD NAME................ MANLEY (BAKER) HOT SPRINGS
CIRCULAR REFERENCE........ 013

GEOGRAPHIC LOCALITY

STATE..................... ALASKA
LATITUDE.................. 65-00. N
LONGITUDE................. 150-38. W
MAPS...................... TANANA A-2, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
02N	15W	17	NE	FAIRBANKS

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 14
ELEVATION (M)...................... 107
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 3
SPRING TEMPERATURES (C)............ 56 TO 59
DISCHARGE (L/MIN).................. 550
ROCK TYPES: BLACK HORNFELS INTRUDED BY GRANITE

CHEMISTRY

SAMPLE SOURCE.... MILLER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
59	65	4	1	130	4.5	89.6	0.4	54	134

F	B	Ph	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.5		7.7		-18.09	-141.9

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	137
NA-K-CA (4/3)	113
NA-K	86
SILICA	
ADIABATIC	113
CONDUCTIVE	114
CHALCEDONY	86
CRISTOBALITE	64
OPAL	-3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	83 (J)	114 (A)	86 (D)	94	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.71 STD. DEV. = 0.21

COMMENTS: WATER USED FOR BATH HOUSE AND IRRIGATION. WARING (1917) REPORTS ABOUT 0.25 KM**2 UNDER CULTIVATION.

REFERENCES: WARING, 1917, 1965; MILLER AND OTHERS, 1975

COMPILED BY: BROOK, C.

MANLEY (BAKER) HOT SPRINGS, ALASKA

FIELD NAME................ CHENA
CIRCULAR REFERENCE........ 014

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 65-03. N
LONGITUDE................. 146-03. W
MAPS...................... CIRCLE A-5, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
03N	08E	26	SW OF SE	FAIRBANKS

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 18
ELEVATION (M)...................... 396
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SULFUR
NO. OF SPRINGS..................... 10
SPRING TEMPERATURES (C)............ 22 TO 67
DISCHARGE (L/MIN).................. 830
ROCK TYPES: GRANITIC ROCK, SCHIST

CHEMISTRY
SAMPLE SOURCE.... MILLER, 1973
FLOW (L/MIN)..... 830

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
57	85	1.3	0.13	110	3.3	115	14	68	29

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
18.6		9.1		-19.30	-153.0

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	137
NA-K-CA (4/3)..........	129
NA-K.................	76

SILICA

ADIABATIC..............	125
CONDUCTIVE.............	128
CHALCEDONY.............	101
CRISTOBALITE...........	78
OPAL...................	9

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	67 (E)	137 (I)	97 (B)	100	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.77 STD. DEV. = 0.25

COMMENTS: TEMPERATURE ESTIMATED FROM THE NA-K-CA GEOTHERMOMETER MAY BE TOO HIGH. HIGH FLOW RATE SUGGESTS THAT SUBSURFACE TEMPERATURE MAY BE NEARER TO THE MINIMUM ESTIMATE. SULFUR DEPOSITION. WARING (1965) REPORTS THAT THE WATER IS USED FOR BATHING AND IRRIGATION.

REFERENCES: WARING, 1917, 1965; MILLER, 1973; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

CHENA , ALASKA

FIELD NAME................ CIRCLE
CIRCULAR REFERENCE........ 015

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 65-29. N
LONGITUDE................. 144-39. W
MAPS...................... CIRCLE B-2, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
08N	15E	34	FAIRBANKS

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 19
ELEVATION (M)...................... 274
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE, SULFUR, ALUM
NO. OF SPRINGS..................... 11
SPRING TEMPERATURES (C)............ 38 TO 57
DISCHARGE (L/MIN).................. 494
ROCK TYPES: SCHIST AND INTRUDED GRANITE

CHEMISTRY
SAMPLE SOURCE.... MILLER, 1973
FLOW (L/MIN)..... 494

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
54	95	20.8	0.3	230	9.8	185		96	249

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.7	1.1	7.6		-20.6	-162.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	143
NA-K-CA (4/3)	108
NA-K	102
SILICA	
ADIABATIC	130
CONDUCTIVE	134
CHALCEDONY	107
CRISTOBALITE	84
OPAL	14

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (D)	143 (I)	134 (A)	128	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.02 STD. DEV. = 0.29

COMMENTS: WARING (1965) REPORTS THAT THE WATER IS USED FOR BATHING AND IRRIGATION.

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

CIRCLE, ALASKA

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FIELD NAME................ GREAT SITKIN ISLAND
CIRCULAR REFERENCE........ 016

   GEOGRAPHIC LOCALITY
      STATE..................... ALASKA
      LATITUDE.................. 52-04.    N
      LONGITUDE................. 176-05.    W
      MAPS...................... ADAK 1:250,000

   GENERAL INFORMATION
      WARING FIGURE......................  9
      WARING NUMBER......................  34
      AREA OF SURFACE EXPRESSION (KM**2).  0.1
      ELEVATION (M)......................  610
      SURFACE ACTIVITY...................  FUMAROLES, HOT SPRINGS
      NO. OF SPRINGS.....................  12
      SPRING TEMPERATURES (C)............  88       TO 99
      ROCK TYPES: ANDESITE, BASALT
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RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (0)	200 (0)	125 (0)	142	21

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	0) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.14 STD. DEV. = 0.38

COMMENTS: NO WATER CHEMISTRY. AREA OF HOLOCENE VOLCANISM.

REFERENCES: WARING, 1917, 1965; BYERS AND BRANNOCK, 1949; SIMONS AND MATHEWSON, 1955; MILLER, 1973; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

GREAT SITKIN ISLAND , ALASKA

FIELD NAME................ HOT SPRINGS COVE
KGRA OR OTHER NAME........ GEYSER SPRING BASIN KGRA
CIRCULAR REFERENCE........ 017

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 53-14. N
LONGITUDE.................. 168-21. W
MAPS....................... UMNAK 1:250,000

GENERAL INFORMATION
WARING FIGURE....................... 9
WARING NUMBER....................... 43
AREA OF SURFACE EXPRESSION (KM**2). 0.01
ELEVATION (M)....................... 60
SURFACE ACTIVITY.................... HOT SPRINGS, GEYSERS
NO. OF SPRINGS...................... 5
SPRING TEMPERATURES (C)............. 35 TO 89
DISCHARGE (L/MIN)................... 360
ROCK TYPES: ANDESITE, ARGILLITE, KERATOPHYRE, DIABASE

CHEMISTRY
SAMPLE SOURCE.... BYERS AND BRANNOCK, 1949

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
89	110	170	1.2	680	32	71		49	1250

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
0.7		6.86		-8.99	-67.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	148
NA-K-CA (4/3)	114
NA-K	110
SILICA	
ADIABATIC	137
CONDUCTIVE	143
CHALCEDONY	116
CRISTOBALITE	92
OPAL	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	143 (A)	200 (N)	148 (I)	164	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: SPRING DISTRIBUTION

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.34 STD. DEV. = 0.39

COMMENTS: LOCATED NEAR OKMOK CALDERA. THERMAL SPRINGS ALSO OCCUR AT BEACH 1 KM TO NORTH.

REFERENCES: WARING, 1917, 1965; BYERS, 1959; BYERS AND BRANNOCK, 1949; BEIKMAN, 1975

COMPILED BY: BROOK, C.

HOT SPRINGS COVE, ALASKA

FIELD NAME................ GEYSER BIGHT
KGRA OR OTHER NAME........ GEYSER SPRING BASIN KGRA
CIRCULAR REFERENCE........ 018

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 53-13. N
LONGITUDE.................. 168-28. W
MAPS....................... UMNAK 1:250,000

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 41
AREA OF SURFACE EXPRESSION (KM**2). 3.5
ELEVATION (M)...................... 60-305
SURFACE ACTIVITY................... HOT SPRINGS, FUMAROLES, GEYSER
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... 22
SPRING TEMPERATURES (C)............ 53 TO 102
DISCHARGE (L/MIN).................. 4200
ROCK TYPES: ANDESITE

CHEMISTRY
SAMPLE SOURCE.... MILLER, UNPUB. DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
102	255	20	LT 0.1	480	32	52		170	640

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.2	50	8.3	-4.05	-8.06	

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	177
NA-K-CA (4/3)	174
NA-K	141

SILICA

ADIABATIC	182
CONDUCTIVE	197
CHALCEDONY	179
CRISTOBALITE	148
OPAL	73

SULFATE

CONDUCTIVE	322
ONE-STEP STEAM LOSS	264
CONTINUOUS STEAM LOSS	282

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	177 (I)	264 (K)	182 (C)	208	20

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	4	10	5	6.3	1.3

BASED ON: SPRING DISTRIBUTION

VOLUME (KM**3)	10.6	STD. DEV. = 3.0
THERMAL ENERGY(10**18 J).	5.49	STD. DEV. = 1.66

COMMENTS: 3 THERMAL AREAS IN ZONE 2 KM LONG. FUMAROLES LOCATED AT HIGHER ELEVATIONS.

REFERENCES: WARING, 1917, 1965; BYERS, 1959; BYERS AND BRANNOCK, 1949; BEIKMAN, 1975; MILLER, UNPUB. DATA

COMPILED BY: BROOK, C.

GEYSER BIGHT, ALASKA

FIELD NAME................ HOT SPRING ON UMNAK ISLAND
KGRA OR OTHER NAME........ GEYSER SPRING BASIN KGRA
CIRCULAR REFERENCE........ 019

GEOGRAPHIC LOCALITY

STATE..................... ALASKA
LATITUDE.................. 53-14. N
LONGITUDE................. 168-18. W
MAPS...................... UMNAK 1:250,000

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 42
ELEVATION (M)...................... 25
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 65
ROCK TYPES: ARGILLITE, KERATOPHYRE, DIABASE

CHEMISTRY

SAMPLE SOURCE.... MILLER, UNPUB. DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
65	93	220	2.8	460	16	77	LT 1	150	960

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
0.8	36	6.4		-8.48	-68.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	127
NA-K-CA (4/3)	78
NA-K	87
SILICA	
ADIABATIC	129
CONDUCTIVE	133
CHALCEDONY	106
CRISTOBALITE	83
OPAL	13

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	78 (I)	133 (A)	106 (D)	106	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.82	STD. DEV. = 0.25

COMMENTS: LOCATED ABOUT 2.5 KM SOUTHEAST OF HOT SPRINGS COVE THERMAL AREA. THE 2 AREAS MAY BE RELATED.

REFERENCES: WARING, 1965; BEIKMAN, 1975; MILLER, UNPUB. DATA

COMPILED BY: BROOK, C.

HOT SPRING ON UMNAK ISLAND, ALASKA

FIELD NAME................ HOT SPRINGS BAY (AKUTAN ISLAND)
CIRCULAR REFERENCE........ 020

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 54-10. N
LONGITUDE.................. 165-50. W
MAPS....................... UNIMAK 1:250,000

GENERAL INFORMATION
WARING FIGURE....................... 9
WARING NUMBER....................... 46
SURFACE ACTIVITY.................... HOT SPRINGS, FUMAROLES
NO. OF SPRINGS...................... 4
SPRING TEMPERATURES (C)............ 67 TO 84
ROCK TYPES: BASALT, ANDESITE

CHEMISTRY
SAMPLE SOURCE.... BYERS AND BARTH, 1953

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
83	128	9.9	1.4	288	21	192		39	350

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O	
		7.0							

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	179
NA-K-CA (4/3)..........	167
NA-K.................	150

SILICA

ADIABATIC.............	145
CONDUCTIVE............	151
CHALCEDONY............	126
CRISTOBALITE..........	101
OPAL..................	30

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	126 (D)	151 (A)	136 (J)	138	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.10 STD. DEV. = 0.31

COMMENTS: LOCATED NEAR ACTIVE AKUTAN VOLCANO

REFERENCES: WARING 1917, 1965; BYERS AND BARTH, 1953; BEIKMAN, 1975

COMPILED BY: BROOK, C.

HOT SPRINGS BAY (AKUTAN ISLAND) , ALASKA

FIFLD NAME................ EAST OF COLD BAY
CIRCULAR REFERENCE........ 021

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE.................. 55-13. N
LONGITUDE................. 162-29. W
MAPS...................... COLD BAY 1:250,000

GENERAL INFORMATION
ELEVATION (M)...................... NEAR SEA LEVEL
SURFACE ACTIVITY.................. HOT SPRINGS
SPRING TEMPERATURES (C)............ 54
ROCK TYPES: ANDESITE

CHEMISTRY
SAMPLE SOURCE.... MILLER, 1973

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
54	68	229	7	780	34	694			1390

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.5			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	144
NA-K-CA (4/3)..........	110
NA-K.................	104

SILICA

ADIABATIC.............	115
CONDUCTIVE............	117
CHALCEDONY............	88
CRISTOBALITE..........	66
OPAL..................	-1

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	88 (D)	144 (I)	117 (A)	116	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.91 STD. DEV. = 0.28

COMMENTS: AREA OF HOLOCENE VOLCANISM.

REFERENCES: MILLER, 1973; BEIKMAN, 1975

COMPILED BY: BROOK, C.

EAST OF COLD BAY, ALASKA

FIELD NAME................ NORTH END OF TENAKEE INLET
CIRCULAR REFERENCE........ 022

GEOGRAPHIC LOCALITY

STATE...................... ALASKA
LATITUDE.................. 58-02. N
LONGITUDE................. 136-01. W
MAPS...................... MT. FAIRWEATHER A-1, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
44S	57E	24?	COPPER RIVER

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 64
ELEVATION (M)...................... 85
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 12
SPRING TEMPERATURES (C)............ 27 TO 82
DISCHARGE (L/MIN).................. 38
ROCK TYPES: DIORITE, GRANITE

CHEMISTRY

SAMPLE SOURCE.... WARING, 1917
FLOW (L/MIN)..... 38

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
82	119	21	2.3	137	4.1	48		226	33

GEOTHERMOMETERS (C)
CATION

NA-K-CA (1/3)...........	120
NA-K-CA (4/3)...........	72
NA-K....................	76

SILICA

ADIABATIC...............	141
CONDUCTIVE..............	147
CHALCEDONY..............	122
CRISTOBALITE............	97
OPAL....................	26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	120 (I)	147 (A)	122 (D)	130	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.03 STD. DEV. = 0.29

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

NORTH END OF TENAKEE INLET, ALASKA

FIELD NAME................ HOONIAH HOT SPRINGS (WHITE SULPHUR SPRINGS)
CIRCULAR REFERENCE........ 023

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 57-48. N
LONGITUDE................. 136-20. W
MAPS...................... SITKA D-8 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
47S	56E	09	COPPER RIVER

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 65
ELEVATION (M)...................... 12
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 3
SPRING TEMPERATURES (C)............ 29 TO 44
DISCHARGE (L/MIN).................. 114
ROCK TYPES: SCHIST

CHEMISTRY
SAMPLE SOURCE.... WARING, 1917
FLOW (L/MIN)..... 114

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
44	98	85				18		35	42

GEOTHERMOMETERS (C)

SILICA

ADIABATIC	132
CONDUCTIVE	136
CHALCEDONY	109
CRISTOBALITE	85
OPAL	16

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	109 (D)	136 (A)	136 (A)	127	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.01 STD. DEV. = 0.29

COMMENTS: WATER USED FOR BATHING.

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

HOONIAH HOT SPRINGS (WHITE SULPHUR SPRINGS) , ALASKA

FIELD NAME................ NEAR FISH BAY
CIRCULAR REFERENCE........ 024

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE................... 57-22. N
LONGITUDE.................. 135-23. W
MAPS....................... SITKA B-5 1:63,360

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 68
ELEVATION (M)...................... NEAR SEA LEVEL
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 24
SPRING TEMPERATURES (C)............ 17 TO 47
DISCHARGE (L/MIN).................. 95
ROCK TYPES: FAULTED SCHIST

CHEMISTRY
SAMPLE SOURCE.... WARING, 1917

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
47	110	13	2.4			43		24	45

GEOTHERMOMETERS (C)
SILICA

ADIABATIC..............	137
CONDUCTIVE.............	143
CHALCEDONY.............	116
CRISTOBALITE...........	92
OPAL...................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	70	143 (A)	143 (A)	119	17

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.93 STD. DEV. = 0.31

COMMENTS: MINIMUM TEMPERATURE VALUE IS ESTIMATED. WATER USED FOR BATHING.

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

NEAR FISH BAY , ALASKA

FIELD NAME................ GODDARD HOT SPRINGS (SITKA)
CIRCULAR REFERENCE........ 025

GEOGRAPHIC LOCALITY
STATE..................... ALASKA
LATITUDE.................. 56-50. N
LONGITUDE................. 135-22. W
MAPS...................... PORT ALEXANDER D-5 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
58S	64E		COPPER RIVER

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 70
ELEVATION (M)...................... NEAR SEA LEVEL
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 3
SPRING TEMPERATURES (C)............ 51 TO 65
DISCHARGE (L/MIN).................. 49
ROCK TYPES: GRANITE CUT BY DIABASE DIKES

CHEMISTRY
SAMPLE SOURCE.... MILLER, 1973
FLOW (L/MIN)..... 49

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
67	120	380	1	1500	61	8		110	2780

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.4		7.4		-11.10	-82.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	147
NA-K-CA (4/3)	129
NA-K	98
SILICA	
ADIABATIC	141
CONDUCTIVE	148
CHALCEDONY	122
CRISTOBALITE	97
OPAL	26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	122 (D)	148 (A,I)	148 (A,I)	139	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.12 STD. DEV. = 0.32

COMMENTS: BATHING RESORT

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

GODDARD HOT SPRINGS (SITKA) , ALASKA

FIELD NAME................ SHAKES SPRINGS (CHIEF SHAKES)
CIRCULAR REFERENCE........ 026

GEOGRAPHIC LOCALITY
STATE...................... ALASKA
LATITUDE.................. 56-43. N
LONGITUDE................. 132-02. W
MAPS...................... PETERSBURG C-1, 1:63,360

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
59S	85E	28	SW OF SW	COPPER RIVER

GENERAL INFORMATION
WARING FIGURE...................... 9
WARING NUMBER...................... 73
ELEVATION (M)...................... 30
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52
DISCHARGE (L/MIN).................. 380
ROCK TYPES: GRANITE

CHEMISTRY
SAMPLE SOURCE.... WARING, 1917
FLOW (L/MIN)..... 380

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	108	13	0.2	87	9.2	43		142	6.5

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	175
NA-K-CA (4/3)...........	105
NA-K....................	190

SILICA

ADIABATIC...............	136
CONDUCTIVE..............	142
CHALCEDONY..............	115
CRISTOBALITE............	91
OPAL....................	21

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	115 (D)	175 (I)	142 (A)	144	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.16 STD. DEV. = 0.34

COMMENTS: CHEMICAL DATA MAY NOT BE RELIABLE. USED IN BATH HOUSE.

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

SHAKES SPRINGS (CHIEF SHAKES) , ALASKA

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FIELD NAME................ BAILEY BAY HOT SPRINGS
CIRCULAR REFERENCE........ 027

   GEOGRAPHIC LOCALITY
      STATE..................... ALASKA
      LATITUDE.................. 55-59.0  N
      LONGITUDE................. 131-39.5  W
      MAPS...................... KETCHIKAN D-5,  1:63,360

      TOWNSHIP     RANGE     SECTION                    BASE & MERIDIAN
        68S         89E      09      SE OF SW           COPPER RIVER

   GENERAL INFORMATION
      WARING FIGURE......................  9
      WARING NUMBER......................  76
      AREA OF SURFACE EXPRESSION (KM**2),  145
      ELEVATION (M)......................  NEAR SEA LEVEL
      SURFACE ACTIVITY...................  HOT SPRINGS
      NO. OF SPRINGS.....................  9
      SPRING TEMPERATURES (C)............  63       TO 88
      DISCHARGE (L/MIN)..................  314
      ROCK TYPES: GRANITE

   CHEMISTRY
      SAMPLE SOURCE....  USGS FILE DATA
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TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
88	160	2	0	78	4.2	118		44	47

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.22			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	155
NA-K-CA (4/3)	122
NA-K	121

SILICA

ADIABATIC	156
CONDUCTIVE	165
CHALCEDONY	142
CRISTOBALITE	115
OPAL	42

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	155 (I)	165 (A)	165 (A)	162	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J)	1.32	STD. DEV. = 0.37

COMMENTS: WATER USED FOR BATHING.

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

BAILEY BAY HOT SPRINGS, ALASKA

FIELD NAME................ BELL ISLAND HOT SPRINGS
CIRCULAR REFERENCE........ 028

GEOGRAPHIC LOCALITY

STATE...................... ALASKA
LATITUDE................... 55-56. N
LONGITUDE.................. 131-34. W
MAPS....................... KETCHIKAN D-5, 1:63,360

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
68S	90E	31	COPPER RIVER

GENERAL INFORMATION

WARING FIGURE...................... 9
WARING NUMBER...................... 79
ELEVATION (M)...................... NEAR SEA LEVEL
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 43 TO 72
DISCHARGE (L/MIN).................. 38
ROCK TYPES: GRANITE CUT BY PEGMATITE DIKES

CHEMISTRY

SAMPLE SOURCE.... USGS FILE DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
72	125	10	0	197	6.6	53		79	189

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.95			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	135
NA-K-CA (4/3)...........	110
NA-K....................	84

SILICA

ADIABATIC...............	143
CONDUCTIVE..............	150
CHALCEDONY..............	125
CRISTOBALITE............	100
OPAL....................	29

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	93 (E)	150 (A)	135 (I)	126	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	1.00	STD. DEV. = 0.30

REFERENCES: WARING, 1917, 1965; MILLER, 1973

COMPILED BY: BROOK, C.

BELL ISLAND HOT SPRINGS , ALASKA

Arizona

FIELD NAME................ POWER RANCHES INC. WELLS
CIRCULAR REFERENCE........ 029

GEOGRAPHIC LOCALITY
STATE..................... ARIZONA
COUNTY.................... MARICOPA
LATITUDE.................. 33-17.1 N
LONGITUDE................. 111-41.2 W
MAPS...................... HIGLEY 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
02S	06E	01	SW	GILA AND SALT RIVER

GENERAL INFORMATION
ELEVATION (M)...................... 409
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING
DISCHARGE (L/MIN).................. 19000
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 2808 TO 3188
MAXIMUM WELL TEMP (C).............. 184 AT DEPTH (M) 3188
ROCK TYPES: ALLUVIUM OVERLYING ANDESITE (?) OR GRANITE (?)

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	150	180	165	165	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	2.0	2.5	2.0		
THICKNESS (KM)	0.5	1.0	1.0	0.8	0.1
SUBSURFACE AREA (KM**2)	2	6	2	3.3	0.9

BASED ON: WELL DISTRIBUTION

VOLUME (KM**3)........... 2.8 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.12 STD. DEV. = 0.36

COMMENTS: TWO WELLS ABOUT 1 KM APART AND ABOUT 3 KM DEEP; BOTTOM HOLE TEMPERATURES OF 163 AND 184 C.

REFERENCES: RENNER AND OTHERS, 1976; HAHMAN AND OTHERS, 1978

COMPILED BY: BROOK, C.

POWER RANCHES INC. WELLS, ARIZONA

FIELD NAME................ EAGLE CREEK
CIRCULAR REFERENCE........ 030

GEOGRAPHIC LOCALITY
STATE...................... ARIZONA
COUNTY..................... GREENLEE
LATITUDE................... 33-02.8 N
LONGITUDE.................. 109-26.4 W
MAPS....................... CLIFTON 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04S	28E	35	NW OF NE	GILA AND SALT RIVER

GENERAL INFORMATION
WARING FIGURE..................... 2
WARING NUMBER..................... 167
ELEVATION (M)..................... 1122
SURFACE ACTIVITY.................. WARM SPRINGS
NO. OF SPRINGS.................... 2
SPRING TEMPERATURES (C)........... 32 TO 36
DISCHARGE (L/MIN)................. LT 10 L/MIN
ROCK TYPES: TERTIARY (?) BASALT
GEOPHYSICS: GRAVITY, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... LOW
COLLECTION DATE.. 1974/12/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
35	64	16	2.1	190	7.8	283		45	120

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
10	0.12	8.24				-12.01		-89.0

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	140
NA-K-CA (4/3)...........	104
NA-K..................	99

SILICA

ADIABATIC...............	113
CONDUCTIVE..............	114
CHALCEDONY..............	85
CRISTOBALITE............	63
OPAL....................	-4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	85 (D)	114 (A)	85 (D)	95	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.72 STD. DEV. = 0.21

COMMENTS: GEOTHERMOMETERS MAY BE UNRELIABLE BECAUSE OF VERY LOW FLOW RATE. EQUILIBRIUM WITH AMORPHOUS SILICA POSSIBLE AT SURFACE TEMPERATURE. SUPERSATURATED WITH CALCITE. TEMPERATURE OF RESERVOIR MAY BE LOWER THAN REPORTED HERE.

REFERENCES: LINDGREN, 1905; SAUCK AND SUMNER, 1970; WEST AND SUMNER, 1973; RENNER AND OTHERS, 1976; MARINER AND OTHERS, 1977A

COMPILED BY: BROOK, C.

EAGLE CREEK , ARIZONA

FIELD NAME................. NORTH OF CLIFTON
CIRCULAR REFERENCE......... 031

GEOGRAPHIC LOCALITY
STATE..................... ARIZONA
COUNTY.................... GREENLEE
LATITUDE.................. 33-04.7 N
LONGITUDE................. 109-18.2 W
MAPS...................... CLIFTON 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04S	30E	18	SW OF SW	GILA AND SALT RIVER

GENERAL INFORMATION
ELEVATION (M)...................... 1068
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ NONE
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 44 TO 59
ROCK TYPES: QUARTZITE OVERLYING GRANITE
GEOPHYSICS: GRAVITY, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... VERY LOW
COLLECTION DATE.. 1974/12/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
59	95	740	20	2600	170	145		68	5500

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.8	1.2	7.07		-10.95	-84.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	174
NA-K-CA (4/3)	165
NA-K	139
SILICA	
ADIABATIC	130
CONDUCTIVE	134
CHALCEDONY	107
CRISTOBALITE	84
OPAL	14

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (D)	164 (N,J)	164 (N,J)	145	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.17 STD. DEV. = 0.35

COMMENTS: WATER MAY BE PRECIPITATING CALCITE. PROBABLY A MIXED WATER. WARM SPRINGS (39 C) IN CLIFTON KGRA 3 KM TO SOUTH MAY BE PART OF THIS SYSTEM.

REFERENCES: LINDGREN, 1905; SAUCK AND SUMNER, 1970; WEST AND SUMNER, 1973; MARINER AND OTHERS, 1977A; J.P. CALZIA, UNPUB. MAP; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

NORTH OF CLIFTON, ARIZONA

FIELD NAME................ GILLARD HOT SPRINGS
KGRA OR OTHER NAME........ GILLARD HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 032

GEOGRAPHIC LOCALITY
STATE...................... ARIZONA
COUNTY..................... GREENLEE
LATITUDE................... 32-58.5 N
LONGITUDE.................. 109-21.0 W
MAPS....................... GUTHRIE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05S	29E	27	NE OF NE	GILA AND SALT RIVER

GENERAL INFORMATION
ELEVATION (M)...................... 1025
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 82
ROCK TYPES: TERTIARY BASALT AND INTERBEDDED FANGLOMERATE
GEOPHYSICS: GRAVITY, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
COLLECTION DATE.. 1974/12/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
82	95	22	0.8	450	14	216		180	490

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
11	0.41	7.35	-0.31	-10.87	-86.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	138
NA-K-CA (4/3)..........	130
NA-K..................	79
SILICA	
ADIABATIC.............	130
CONDUCTIVE............	134
CHALCEDONY............	107
CRISTOBALITE..........	84
OPAL..................	14
SULFATE	
CONDUCTIVE............	169
ONE-STEP STEAM LOSS....	157
CONTINUOUS STEAM LOSS..	159

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (D)	169 (K)	134 (A)	137	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.09 STD. DEV. = 0.33

REFERENCES: HEM, 1950; SAUCK AND SUMNER, 1970; WEST AND SUMNER, 1973; MARINER AND OTHERS, 1977A; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C. AND MARINER, R.

GILLARD HOT SPRINGS , ARIZONA

FIELD NAME................ SAN SIMON WELL
CIRCULAR REFERENCE........ 033

GEOGRAPHIC LOCALITY
STATE..................... ARIZONA
COUNTY.................... COCHISE
LATITUDE.................. 32-24.0 N
LONGITUDE................. 109-18.0 W
MAPS...................... MARTIN WELL 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
12S	30E	08	SE	GILA AND SALT RIVER

GENERAL INFORMATION
SURFACE ACTIVITY.................... NONE. FOUND BY DRILLING
NO. OF WELLS........................ 1
MAXIMUM WELL TEMP (C)............... 1951
ROCK TYPES: ALLUVIUM OVERLYING GRANITIC (?) ROCKS

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	125	145	134 (M)	135	4

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.5	2.0	2.0		
THICKNESS (KM)	1.0	1.5	1.0	1.2	0.1
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 2.3 STD. DEV. = 0.5
THERMAL ENERGY(10**18 J). 0.75 STD. DEV. = 0.17

COMMENTS: REPORTED LOCATION MAY BE IN ERROR. MINIMUM AND MAXIMUM TEMPERATURES ARE SUBJECTIVE ESTIMATES.

REFERENCES: SWANBERG AND OTHERS, 1977

COMPILED BY: MARINER, R. AND BROOK, C.

SAN SIMON WELL, ARIZONA

California

FIELD NAME................ FORT BIDWELL AREA
CIRCULAR REFERENCE........ 034

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... MODOC
LATITUDE.................. 41-51.8 N
LONGITUDE................. 120-09.6 W

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
46N	16E	17	NW OF NE	MT DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 12
ELEVATION (M)...................... 1414
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 36 TO 45
ROCK TYPES: TERTIARY RHYOLITE

CHEMISTRY
SAMPLE SOURCE.... REED, 1975
FLOW (L/MIN)..... 400
COLLECTION DATE.. 1973/06/26

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
45.1	82	4.2	0.1	110	9.5	131		86	31

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.2	0.61	7.85			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	179
NA-K-CA (4/3)...........	141
NA-K....................	167
SILICA	
ADIABATIC...............	124
CONDUCTIVE..............	126
CHALCEDONY..............	99
CRISTOBALITE............	76
OPAL....................	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	179 (I)	126 (A)	135	17

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	1.08	STD. DEV. = 0.34

COMMENTS: LOW SURFACE TEMPERATRE AND HIGH FLOW RATE SUGGESTS THAT SURFACE TEMPERATURES MAY BE NEARER TO MINIMUM ESTIMATE OR THAT THE WATER MAY BE MIXED.

REFERENCES: DUFFIELD AND FOURNIER, 1974; REED, 1975

COMPILED BY: BROOK, C.

FORT BIDWELL AREA , CALIFORNIA

FIELD NAME................ SURPRISE VALLEY AREA
KGRA OR OTHER NAME........ LAKE CITY-SURPRISE VALLEY KGRA
CIRCULAR REFERENCE........ 035

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... MODOC
LATITUDE................... 41-40.0 N
LONGITUDE.................. 120-12.0 W
MAPS....................... CEDARVILLE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
44N	15E	24	SW OF NE	MT, DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 14-18
AREA OF SURFACE EXPRESSION (KM**2). 1
ELEVATION (M)....................... 1366
SURFACE ACTIVITY.................... HOT SPRINGS (VIOLENT MUD ERUPTION IN 1951)
ASSOCIATED DEPOSITS................. SINTER
NO. OF SPRINGS...................... MORE THAN 15 IN 4 GROUPS
SPRING TEMPERATURES (C)............. 62 TO 98
DISCHARGE (L/MIN)................... 1350
NO. OF WELLS........................ 8
WELL DEPTHS (M)..................... 28 TO 2085
MAXIMUM WELL TEMP (C)............... 160 AT DEPTH (M) 1155
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY RHYOLITE
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, AMT

CHEMISTRY
SAMPLE SOURCE.... REED, 1975 (SEYFERTH HOT SPRINGS)
FLOW (L/MIN)..... 500
COLLECTION DATE.. 1973/07/26

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
85	110	28	LT 0.1	300	9.0	63	0	370	220

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.4	7.6	7.66	-5.62	-14.05	-121.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	129
NA-K-CA (4/3)..........	101
NA-K..................	76
SILICA	
ADIABATIC..............	137
CONDUCTIVE.............	143
CHALCEDONY.............	116
CRISTOBALITE...........	92
OPAL..................	22
SULFATE	
CONDUCTIVE.............	205
ONE-STEP STEAM LOSS....	185
CONTINUOUS STEAM LOSS..	189

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	129 (I)	185	143 (A)	152	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	40	250	95	128.3	44.5

BASED ON: ESTIMATES OF RENNER AND OTHERS (1976) AND WATER QUALITY HAZARD AREA

VOLUME (KM**3)........... 213.9 STD. DEV. = 85.3
THERMAL ENERGY(10**18 J). 79.31 STD. DEV. = 32.50

COMMENTS: SYSTEM INCLUDES MUD VOLCANO AREA, SEYFERTH HOT SPRINGS, LEONARDS HOT SPRINGS, AND HOT SPRINGS MOTEL. WATER CHEMISTRY FOR THE 4 SPRING GROUPS IS SIMILAR AND SUGGESTS A SINGLE SYSTEM. REPORTED WELL TEMPERATURE IS FROM THE MUD VOLCANO AREA. WATER QUALITY AREA IS DEFINED BY HIGH BORON CONCENTRATIONS.

REFERENCES: WHITE, 1955; WARING, 1965; DUFFIELD AND FOURNIER, 1974; REED, 1975; CALIFORNIA DEPARTMENT OF WATER RESOURCES, 1963; CHAPMAN AND BISHOP, 1968

COMPILED BY: BROOK, C.

SURPRISE VALLEY AREA, CALIFORNIA

FIELD NAME................ WEST VALLEY RESERVOIR HOT SPRING
CIRCULAR REFERENCE........ 036

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... MODOC
LATITUDE.................. 41-11.5 N
LONGITUDE................. 120-23.1 W
MAPS...................... TULE MOUNTAIN 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
39N	14E	29	NW OF NE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1460
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 1?
SPRING TEMPERATURES (C)............ 77.3
DISCHARGE (L/MIN).................. 12
ROCK TYPES: BASALT

CHEMISTRY
SAMPLE SOURCE.... REED, 1975
FLOW (L/MIN)..... 12
COLLECTION DATE.. 1973/07/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
77.3	130	19	LT 0.1	330	11	63	0	510	150

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.0	4.5	7.79		-14.13	-118.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	138
NA-K-CA (4/3)	120
NA-K	84
SILICA	
ADIABATIC	145
CONDUCTIVE	152
CHALCEDONY	127
CRISTOBALITE	102
OPAL	31

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	138 (I)	152 (A)	138 (I)	143	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.15 STD. DEV. = 0.32

REFERENCES: REED, 1975

COMPILED BY: BROOK, C.

WEST VALLEY RESERVOIR HOT SPRING, CALIFORNIA

FIELD NAME................ BASSETT HOT SPRING
CIRCULAR REFERENCE........ 037

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... LASSEN
LATITUDE................... 41-08.7 N
LONGITUDE.................. 121-06.6 W
MAPS....................... BIEBER 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38N	07E	12	NW OF SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 28
ELEVATION (M)...................... 1265
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 17
SPRING TEMPERATURES (C)............ 79
DISCHARGE (L/MIN).................. 200
ROCK TYPES: SANDSTONE OVERLYING BASALT (?)

CHEMISTRY
SAMPLE SOURCE.... REED, 1975
FLOW (L/MIN)..... 200
COLLECTION DATE.. 1973/08/14

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
79	68	30	LT 0.1	220	3.2	30	1	370	93

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.0	2.5	8.53		-14.67	-116.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	96
NA-K-CA (4/3)...........	62
NA-K..................	33
SILICA	
ADIABATIC...............	115
CONDUCTIVE..............	117
CHALCEDONY..............	88
CRISTOBALITE............	66
OPAL....................	-1

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	88 (D)	117 (A)	88 (D)	98	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.74 STD. DEV. = 0.22

REFERENCES: WARING, 1965; REED, 1975

COMPILED BY: BROOK, C.

BASSETT HOT SPRING, CALIFORNIA

FIELD NAME................ KELLY HOT SPRING
CIRCULAR REFERENCE........ 038

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... MODOC
LATITUDE.................. 41-27.5 N
LONGITUDE................. 120-50.0 W
MAPS...................... CANBY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
42N	10E	29	NE OF NW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 8
ELEVATION (M)...................... 1326
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 91.5
DISCHARGE (L/MIN).................. 1250
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 978 TO 1035
MAXIMUM WELL TEMP (C).............. 116 AT DEPTH (M) 1035
ROCK TYPES: PLIOCENE (?) PYROCLASTICS AND BASALT FLOWS
GEOPHYSICS: GRAVITY

CHEMISTRY
SAMPLE SOURCE.... REED, 1975
FLOW (L/MIN)..... 1250
COLLECTION DATE.. 1973/07/23

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
91.5	110	20	LT 0.1	250	6.5	45	1	300	160

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.1	3.8	8.08	-4.73	-13.54	-115.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	123
NA-K-CA (4/3)...........	95
NA-K....................	67
SILICA	
ADIABATIC...............	137
CONDUCTIVE..............	143
CHALCEDONY..............	116
CRISTOBALITE............	92
OPAL....................	22
SULFATE	
CONDUCTIVE..............	198
ONE-STEP STEAM LOSS.....	181
CONTINUOUS STEAM LOSS...	185

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	95 (I)	143 (A)	116 (D,M)	118	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.9	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.93 STD. DEV. = 0.27

COMMENTS: CHALCEDONY TEMPERATURE (MOST LIKELY) CORRESPONDS TO MAXIMUM REPORTED WELL TEMPERATURE. HIGH TEMPERATURE CALCULATED FROM THE SULFATE GEOTHERMOMETER. TEMPERATURES MAY BE INACCURATE. MIXING CALCULATIONS WITH A LOW SILICA (30 MG/L) COLD WATER (10 C) INDICATE A POSSIBLE TEMPERATURE OF 185 C. HOWEVER, PROOF OF MIXING IS NOT AVAILABLE.

REFERENCES: DUFFIELD AND FOURNIER, 1974; REED, 1975; CHAPMAN AND OTHERS, 1978

COMPILED BY: BROOK, C.

KELLY HOT SPRING, CALIFORNIA

FIELD NAME................. BIG BEND HOT SPRINGS
CIRCULAR REFERENCE........ 039

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... SHASTA
LATITUDE................... 41-01.3 N
LONGITUDE.................. 121-55.1 W
MAPS....................... BIG BEND 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
37N	01W	36	SW OF NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 24
ELEVATION (M)...................... 512
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 6
SPRING TEMPERATURES (C)............ 38 TO 82
DISCHARGE (L/MIN).................. 341
ROCK TYPES: QUARTZ DIORITE DIKE IN SEDIMENTARY STRATA

CHEMISTRY
SAMPLE SOURCE.... BERKSTRESSER, 1968
FLOW (L/MIN)..... 37.8

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
82	73	88	0.6	565	20	40		276	850

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.2	32	8.1			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	137
NA-K-CA (4/3)...........	110
NA-K..................	88

SILICA

ADIABATIC..............	118
CONDUCTIVE.............	120
CHALCEDONY.............	92
CRISTOBALITE...........	70
OPAL..................	2

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	92 (D)	137 (I)	120 (A)	116	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.91 STD. DEV. = 0.27

REFERENCES: WARING, 1965; BERKSTRESSER, 1968

COMPILED BY: BROOK, C.

BIG BEND HOT SPRINGS, CALIFORNIA

FIELD NAME................ LASSEN
KGRA OR OTHER NAME........ LASSEN VOLCANIC NATIONAL PARK
CIRCULAR REFERENCE........ 040

GEOGRAPHIC LOCALITY

STATE..................... CALIFORNIA
COUNTY.................... SHASTA, PLUMAS, TEHAMA
LATITUDE.................. 40-26.0 N
LONGITUDE................. 121-26.0 W
MAPS...................... LASSEN VOLCANIC NATIONAL PARK AND VICINITY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
30N	05E	21	SW	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 25-27, 34-38
AREA OF SURFACE EXPRESSION (KM**2). 2
ELEVATION (M)...................... 1830
SURFACE ACTIVITY................... HOT SPRINGS, FUMAROLES, ROCK ALTERATION
NO. OF SPRINGS..................... ABOUT 75
SPRING TEMPERATURES (C)............ 50 TO 95
DISCHARGE (L/MIN).................. 735
ROCK TYPES: ANDESITE, DACITE, RHYOLITE

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	215	255	240	237	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	10	70	47	42.3	12.4

BASED ON: RENNER ET AL, 1976 (DISTRIBUTION OF VENT AREAS)

VOLUME (KM**3)........... 70.6 STD. DEV. = 24.8
THERMAL ENERGY(10**18 J). 42.23 STD. DEV. = 14.92

COMMENTS: PROBABLY THE ONLY MAJOR VAPOR-DOMINATED SYSTEM IN THE U.S. OUTSIDE OF THE GEYSERS. GEOTHERMOMETERS ARE NOT APPLICABLE BECAUSE OF ACID-SULFATE SPRING WATERS. TEMPERATURE ESTIMATES BASED ON COMPARISON WITH THE GEYSERS AS SURFACE EXPRESSIONS AND LOW-CL WATERS ARE SIMILAR TO THE GEYSERS. AREA WITHDRAWN FROM COMMERCIAL EXPLORATION OR DEVELOPMENT BECAUSE OF NATIONAL PARK STATUS.

REFERENCES: DAY AND ALLEN, 1924, 1925; WILLIAMS, 1932; WARING, 1965; RENNER AND OTHERS, 1976; BOWEN, 1978

COMPILED BY: BROOK, C.

LASSEN, CALIFORNIA

FIELD NAME................. MORGAN SPRINGS-GROWLER SPRINGS AREA
KGRA OR OTHER NAME........ LASSEN KGRA
CIRCULAR REFERENCE........ 041

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... TEHAMA
LATITUDE................... 40-23.0 N
LONGITUDE.................. 121-31.0 W
MAPS....................... LASSEN VOLCANIC NATIONAL PARK AND VICINITY 1:62,500; LASSEN PEAK, 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
29N	04E	11	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 33
AREA OF SURFACE EXPRESSION (KM**2). 3
ELEVATION (M)....................... 1495
SURFACE ACTIVITY.................... HOT SPRINGS
ASSOCIATED DEPOSITS................. SINTER
NO. OF SPRINGS...................... 25
SPRING TEMPERATURES (C)............ 32 TO 95
DISCHARGE (L/MIN)................... 350
ROCK TYPES: DACITE, ANDESITE

CHEMISTRY
SAMPLE SOURCE.... J. THOMPSON, UNPUB. DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
95	231	80	0.05	1450	203	65		73	2273

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.95	-3.58	-9.14	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	230
NA-K-CA (4/3)...........	254
NA-K....................	227
SILICA	
ADIABATIC...............	176
CONDUCTIVE..............	190
CHALCEDONY..............	170
CRISTOBALITE............	141
OPAL....................	66
SULFATE	
CONDUCTIVE..............	272
ONE-STEP STEAM LOSS....	235
CONTINUOUS STEAM LOSS..	245

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	176 (C)	245 (K)	230 (I)	217	15

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	8	5	5.0	1.2

BASED ON: SPRING DISTRIBUTION AND ESTIMATES OF RENNER ET AL, 1976

VOLUME (KM**3)............ 8.3 STD. DEV. = 2.6
THERMAL ENERGY(10**18 J). 4.54 STD. DEV. = 1.46

COMMENTS: TWO GROUPS OF THERMAL SPRINGS ABOUT 1.2 KM APART. CHEMICAL ANALYSIS FROM GROWLER SPRINGS. WATER CHEMISTRY OF BOTH SPRINGS IS SIMILAR. SO4 GEOTHERMOMETER FOR MORGAN SPRING GIVES 234 C. SILICA GEOTHERMOMETERS MAY BE UNRELIABLE. SYSTEM MAY BE LARGER AND IS PROBABLY RELATED TO THE ADJACENT LASSEN VAPOR-DOMINATED SYSTEM.

REFERENCES: WARING, 1965; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

MORGAN SPRINGS-GROWLER SPRINGS AREA , CALIFORNIA

FIELD NAME................ WENDEL-AMEDEE AREA
KGRA OR OTHER NAME........ WENDEL-AMEDEE KGRA, HONEY LAKE
CIRCULAR REFERENCE........ 042

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... LASSEN
LATITUDE.................. 40-18.0 N
LONGITUDE................. 120-11.0 W
MAPS...................... WENDEL 1:62,500; LITCHFIELD 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
28N	16E	08	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 30, 31
AREA OF SURFACE EXPRESSION (KM**2). 1.0
ELEVATION (M)...................... 1231
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 10
SPRING TEMPERATURES (C)............ 71 TO 96
DISCHARGE (L/MIN).................. 3596
NO. OF WELLS....................... 6
WELL DEPTHS (M).................... 58 TO 1538
MAXIMUM WELL TEMP (C).............. 107 AT DEPTH (M) 338
ROCK TYPES: PLIOCENE BASALT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
FLOW (L/MIN)..... 1200

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
95.5	125	20	LT 0.1	280	8.0	53		340	185

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.2	5.6	8.26		-14.09	-118.8

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	128
NA-K-CA (4/3)...........	104
NA-K....................	73

SILICA

ADIABATIC...............	143
CONDUCTIVE..............	150
CHALCEDONY..............	125
CRISTOBALITE............	100
OPAL....................	29

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (M)	143 (C)	128 (I)	126	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	4	10	5	6.3	1.3

BASED ON: WELL AND SPRING DISTRIBUTION AND GEOLOGY

VOLUME (KM**3)........... 10.6 STD. DEV. = 3.0

THERMAL ENERGY(10**18 J). 3.16 STD. DEV. = 0.92

COMMENTS: CHEMICAL ANALYSIS AND TEMPERATURE CALCULATIONS FOR WENDEL HOT SPRINGS. CHEMICAL COMPOSITION OF AMEDEE HOT SPRINGS IS SIMILAR. WELL TEMPERATURES MAY BE HIGHER THAN REPORTED HERE (107 C). FLOW RATE AND ISOTOPIC DATA FROM REED (1975).

REFERENCES: WARING, 1965; KOENIG, 1970; REED, 1975; MARINER AND OTHERS, 1976B; USGS FILE DATA

COMPILED BY: BROOK, C.

WENDEL-AMEDEE AREA, CALIFORNIA

FIELD NAME................. SIERRA VALLEY AREA
CIRCULAR REFERENCE........ 043

GEOGRAPHIC LOCALITY

STATE...................... CALIFORNIA
COUNTY..................... PLUMAS, SIERRA
LATITUDE................... 39-42.7 N
LONGITUDE.................. 120-19.3 W
MAPS....................... PORTOLA 1:62,500; SIERRAVILLE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
22N	15E	32	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 41A
ELEVATION (M)...................... 1487
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING
NO. OF WELLS....................... 8
WELL DEPTHS (M).................... 99? TO 680
ROCK TYPES: LACUSTRINE DEPOSITS OVERLYING RHYOLITE TUFF AND BRECCIA; GRANITE BASEMENT

CHEMISTRY

SAMPLE SOURCE.... REED, 1975
FLOW (L/MIN)..... 50
COLLECTION DATE.. 1973/06/20

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
94.2	98	39	0.1	450	13	50	1	370	540

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.6	8.8	7.97		-13.93	-117.8

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	131
NA-K-CA (4/3)...........	112
NA-K....................	74

SILICA

ADIABATIC...............	132
CONDUCTIVE..............	136
CHALCEDONY..............	109
CRISTOBALITE............	85
OPAL....................	16

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	109 (D)	136 (A)	131 (I)	125	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	1.0	0.5		
THICKNESS (KM)	0.5	1.5	1.0	1.0	0.2
SUBSURFACE AREA (KM**2)	4	16	10	10.0	2.4

BASED ON: WELL DISTRIBUTION AND GEOLOGY

VOLUME (KM**3)........... 10.0 STD. DEV. = 3.2
THERMAL ENERGY(10**18 J). 2.98 STD. DEV. = 0.98

COMMENTS: AREA INCLUDES MARBLE HOT SPRINGS (WELLS). 1 GEOTHERMAL TEST WELL; OTHER 7 WELLS ARE ARTESIAN AND USED FOR STOCK WATERING. SURFACE TEMPERATURES RANGE FROM 39 TO 94 C. TOTAL DISCHARGE EXCEEDS 240 L/MIN.

REFERENCES: REED, 1975

COMPILED BY: BROOK, C.

SIERRA VALLEY AREA, CALIFORNIA

FIELD NAME................ WILBUR SPRINGS AREA
CIRCULAR REFERENCE........ 044

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... COLUSA
LATITUDE.................. 39-02.2 N
LONGITUDE................. 122-25.2 W
MAPS...................... WILBUR SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
14N	05W	28	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 66-69
ELEVATION (M)...................... 412
SURFACE ACTIVITY................... HOT SPRINGS, SULFUR FUMING
ASSOCIATED DEPOSITS................ TRAVERTINE AT SOME SPRINGS
NO. OF SPRINGS..................... 20 IN 4 GROUPS
SPRING TEMPERATURES (C)............ 18 TO 67
DISCHARGE (L/MIN).................. LT 100
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 374 TO 1146
MAXIMUM WELL TEMP (C).............. 141 AT DEPTH (M) 1132
ROCK TYPES: SERPENTINITE, CHERT, GRAYWACKE, ALTERED BASALT

CHEMISTRY
SAMPLE SOURCE.... BARNES AND OTHERS, 1973; WHITE AND OTHERS, 1973
FLOW (L/MIN)..... 60
COLLECTION DATE.. 1969/12/02

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	200	2.8	38	8500	440	7130		390	9700

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.5	310	6.87		+4.90	-24.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	240
NA-K-CA (4/3)	781
NA-K	118
SILICA	
ADIABATIC	168
CONDUCTIVE	180
CHALCEDONY	159
CRISTOBALITE	130
OPAL	56

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	141 (M)	150	141 (M)	144	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.0		
THICKNESS (KM)	1.0	2.0	1.5	1.5	0.2
SUBSURFACE AREA (KM**2)	4	15	6	8.3	2.4

BASED ON: DISTRIBUTION OF THERMAL SPRINGS AND HG MINERALIZATION

VOLUME (KM**3)............ 12.5 STD. DEV. = 4.0
THERMAL ENERGY(10**18 J). 4.35 STD. DEV. = 1.40

COMMENTS: WATER BELIEVED TO BE IN PART CONNATE. GEOTHERMOMETRY IS NOT RELIABLE BECAUSE OF NEAR-SURFACE REACTION BETWEEN WATER AND SERPENTINE. MAXIMUM TEMPERATURE IS ESTIMATED.

REFERENCES: WARING, 1965; BARNES AND OTHERS, 1973; WHITE AND OTHERS, 1973

COMPILED BY: BROOK, C.

WILBUR SPRINGS AREA , CALIFORNIA

FIELD NAME................ CHALK MOUNTAIN AREA
KGRA OR OTHER NAME........ GEYSERS-CALISTOGA KGRA
CIRCULAR REFERENCE........ 045

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
LATITUDE.................. 39-04.8 N
LONGITUDE................. 122-35.0 W
MAPS...................... CLEARLAKE OAKS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
14N	07W	12	SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 51A
AREA OF SURFACE EXPRESSION (KM**2). 0.3
ELEVATION (M)...................... 366
SURFACE ACTIVITY................... WARM SPRINGS, FUMAROLES
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 3
SPRING TEMPERATURES (C)............ 20 TO 24
DISCHARGE (L/MIN).................. 11
ROCK TYPES: ALTERED DACITE

CHEMISTRY
SAMPLE SOURCE.... THOMPSON AND OTHERS, 1978
FLOW (L/MIN)..... 0.4
COLLECTION DATE.. 1976/06/26

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
24	91	66	495	1600	196	3300		32	2410

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		6.6			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	225
NA-K-CA (4/3)	263
NA-K	209

SILICA

ADIABATIC	128
CONDUCTIVE	132
CHALCEDONY	105
CRISTOBALITE	81
OPAL	12

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	105 (D)	128 (C)	105 (D)	113	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.88 STD. DEV. = 0.25

COMMENTS: PRESENCE OF SULFUR FUMING AND HYDROTHERMALLY ALTERED ROCK SUGGESTS A HYDROTHERMAL SYSTEM EVEN THOUGH SURFACE TEMPERATURES ARE QUITE LOW. GEOTHERMOMETRY IS PROBABLY NOT RELIABLE BECAUSE OF LOW FLOW RATE, HIGH MG AND HCO3, AND LIKELYHOOD OF NEAR-SURFACE WATER-ROCK REACTIONS. TEMPERATURES MAY BE HIGHER OR LOWER THAN REPORTED HERE. MAY HAVE HEAT SOURCE IN THE CLEAR LAKE VOLCANIC FIELD.

REFERENCES: THOMPSON AND OTHERS, 1978; WARING, 1965

COMPILED BY: BROOK, C.

CHALK MOUNTAIN AREA , CALIFORNIA

FIELD NAME................ SULPHUR BANK MINE (HOT BOLATA)
KGRA OR OTHER NAME........ GEYSERS-CALISTOGA KGRA
CIRCULAR REFERENCE........ 046

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... LAKE
LATITUDE.................. 39-01.0 N
LONGITUDE................. 122-39.0 W
MAPS...................... CLEARLAKE OAKS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
13N	07W	05	SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 57
AREA OF SURFACE EXPRESSION (KM**2). 0.5
ELEVATION (M)....................... 396
SURFACE ACTIVITY.................... HOT SPRINGS, FUMAROLES
ASSOCIATED DEPOSITS................. CINNABAR AND SULFUR
NO. OF SPRINGS...................... 10
SPRING TEMPERATURES (C)............. 28 TO 69
NO. OF WELLS........................ 4
WELL DEPTHS (M)..................... 161 TO 1215
MAXIMUM WELL TEMP (C)............... 186 AT DEPTH (M) 427
ROCK TYPES: ALTERED QUATERNARY BASALT FLOWS OVERLYING FRANCISCAN ROCKS
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY

CHEMISTRY
SAMPLE SOURCE.... BERKSTRESSER, 1968

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
99	203	26	23	1340	44	2600		680	900

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.4	828	8.1		+4.58	-26.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	156
NA-K-CA (4/3)	201
NA-K	83
SILICA	
ADIABATIC	169
CONDUCTIVE	181
CHALCEDONY	160
CRISTOBALITE	131
OPAL	57

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	186 (M)	210	186 (M)	194	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.4	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	6	4	4.0	0.8

BASED ON: ESTIMATES OF RENNER ET AL (1976)

VOLUME (KM**3)............ 6.7 STD. DEV. = 1.9
THERMAL ENERGY(10**18 J). 3.22 STD. DEV. = 0.91

COMMENTS: BELIEVED TO BE MIXTURE OF METEORIC AND METAMORPHIC WATERS. GEOTHERMOMETRY IS NOT RELIABLE. MAXIMUM TEMPERATURE BASED ON COMPARISON TO CLEAR LAKE VOLCANIC FIELD TO WHICH SULPHUR BANK MAY BE RELATED. ISOTOPIC DATA FROM WHITE AND OTHERS (1973).

REFERENCES: WARING, 1965; STANLEY AND OTHERS, 1973; WHITE AND OTHERS, 1973; CHAPMAN, 1975; BERKSTRESSER, 1968; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

SULPHUR BANK MINE (HOT BOLATA), CALIFORNIA

FIELD NAME................ CLEAR LAKE VOLCANIC FIELD AREA
KGRA OR OTHER NAME........ GEYSERS-CALISTOGA KGRA
CIRCULAR REFERENCE........ 047

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... LAKE
LATITUDE.................. 38-55.0 N
LONGITUDE................. 122-43.0 W
MAPS...................... CLEARLAKE HIGHLANDS 1:24,000; KELSEYVILLE 1:24,000

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 55, 56, 58, 59
ELEVATION (M)...................... 760
SURFACE ACTIVITY................... HOT SPRINGS, FUMAROLES
ASSOCIATED DEPOSITS................ SULFUR
NO. OF SPRINGS..................... SEVERAL IN 4 OR 5 MAIN GROUPS
SPRING TEMPERATURES (C)............ 30 TO 52
DISCHARGE (L/MIN).................. GREATER THAN 2000
NO. OF WELLS....................... 2
MAXIMUM WELL TEMP (C).............. 210 AT DEPTH (M) 2000
ROCK TYPES: QUATERNARY RHYOLITE, DACITE, BASALT
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY

CHEMISTRY
SAMPLE SOURCE.... GOFF AND OTHERS, 1977 (HOWARD SPRING)
FLOW (L/MIN)..... 250

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
42	160	32	320	240	23	1660		2	460

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
LT 0.1	39	6.58				-7.26		-57.8

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	180
NA-K-CA (4/3)	132
NA-K	179

SILICA

ADIABATIC	156
CONDUCTIVE	165
CHALCEDONY	142
CRISTOBALITE	115
OPAL	42

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	165 (A)	210 (N)	195 (N)	190	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	10	100	40	50.0	18.7

BASED ON: GEOLOGY, SPRING DISTRIBUTION, AND GRAVITY

VOLUME (KM**3)............ 83.3 STD. DEV. = 35.3
THERMAL ENERGY(10**18 J). 39.37 STD. DEV. = 16.86

COMMENTS: GEOTHERMOMETRY MAY NOT BE RELIABLE FOR THIS AND OTHER SURFACE WATERS IN THE CLEAR LAKE AREA BECAUSE OF HIGH CO2 AND MG CONCENTRATIONS AND LIKELYHOOD OF WATER REACTING WITH SERPENTINITE. MAXIMUM AND MOST LIKELY TEMPERATURES ARE REPORTED BY GOFF AND OTHERS (1977); MAXIMUM CORRESPONDS TO THEIR CALCULATED WELL TEMPERATURE (210). TEMPERATURES AS HIGH AS 270 C (UNCONFIRMED HEARSAY) SUPPOSEDLY OCCUR AT ABOUT 3000 M IN ANOTHER WELL. ALTHOUGH THE AREA MAY BE LARGER, THERE IS NO EVIDENCE THAT THE VOLCANIC FIELD IS UNDERLAIN BY A SINGLE HYDROTHERMAL SYSTEM. RATHER, THERE MAY BE SEVERAL ISOLATED SYSTEMS SEPARATED BY HOT, DRY ROCK. AREA ALONG KONOCTI BAY FAULT ZONE MAY BE MOST LIKELY TARGET.

REFERENCES: WARING, 1965; STANLEY AND OTHERS, 1973; CHAPMAN, 1975; HEARN AND OTHERS, 1976; GOFF AND OTHERS, 1977; IYER AND OTHERS, 1978

COMPILED BY: BROOK, C.

CLEAR LAKE VOLCANIC FIELD AREA, CALIFORNIA

FIELD NAME................ THE GEYSERS
KGRA OR OTHER NAME........ GEYSERS-CALISTOGA KGRA
CIRCULAR REFERENCE........ 048

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... SONOMA AND LAKE
LATITUDE.................. 38-48.0 N
LONGITUDE................. 122-48.0 W
MAPS...................... GEYSERS 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
11N	09W	13	NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 62, 63, 72, 73, 74
AREA OF SURFACE EXPRESSION (KM**2). 1
ELEVATION (M)...................... 550
SURFACE ACTIVITY................... FUMAROLES, HOT SPRINGS, ROCK ALTERATION
NO. OF SPRINGS..................... 20
SPRING TEMPERATURES (C)............ 20 TO 101
DISCHARGE (L/MIN).................. 100
NO. OF WELLS....................... MORE THAN 210
WELL DEPTHS (M).................... 60 TO 2900
MAXIMUM WELL TEMP (C).............. 240 AT DEPTH (M) 1200
ROCK TYPES: FRANCISCAN ASSEMBLAGE (SERPENTINE, GRAYWACKE, GREENSTONE)
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, MICROEARTHQUAKE, SEISMIC NOISE

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	215	255	240	237	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.04	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	60	120	120	100.0	14.1

BASED ON: WELL DISTRIBUTION, GRAVITY SURVEY, GEOLOGY

VOLUME (KM**3)........... 166.7 STD. DEV. = 39.3
THERMAL ENERGY(10**18 J). 99.75 STD. DEV. = 23.85

COMMENTS: VAPOR-DOMINATED SYSTEM. WATER CHEMISTRY NOT APPLICABLE TO GEOTHERMOMETER CALCULATIONS. TEMPERATURES BASED ON AND EXTRAPOLATED FROM TEMPERATURE-DEPTH CURVES (HITE AND FEHLBERG, 1976). OVER 200 WELLS HAVE BEEN DRILLED SINCE THE 1950'S. RESERVOIR PROBABLY CONTINUES DEEPER THAN 3 KM. CURRENT INSTALLED GENERATING CAPACITY IS 663 MW. HEAT PRODUCTION ABOUT 80 TIMES ESTIMATED NATURAL HEAT FLOW. TOTAL GENERATING CAPACITY OF FIELD IS ESTIMATED IN EXCESS OF 1800 MW BY YEAR 2000.

REFERENCES: ALLEN AND DAY, 1927; CHAPMAN, 1975; HITE AND FEHLBERG, 1976; ISHERWOOD, 1976; MCLAUGHLIN AND STANLEY, 1976; REED AND CAMPBELL, 1976; GOFF AND OTHERS, 1977; RENNER AND OTHERS, 1976; PACIFIC GAS AND ELECTRIC CO., 1977; IYER AND OTHERS, 1978; SMITH AND OTHERS, 1978

COMPILED BY: BROOK, C.

THE GEYSERS , CALIFORNIA

FIELD NAME................ SKAGGS HOT SPRINGS
CIRCULAR REFERENCE........ 049

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... SONOMA
LATITUDE.................. 38-41.5 N
LONGITUDE................. 123-01.5 W
MAPS...................... SKAGGS SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
10N	11W	25NW OF NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE..................... 8
WARING NUMBER..................... 71
ELEVATION (M)..................... 98
SURFACE ACTIVITY.................. HOT SPRINGS
NO. OF SPRINGS.................... 3
SPRING TEMPERATURES (C)........... 49 TO 57
DISCHARGE (L/MIN)................. 57
ROCK TYPES: FRANCISCAN SEDIMENTARY ROCKS

CHEMISTRY
SAMPLE SOURCE.... BERKSTRESSER, 1968
FLOW (L/MIN)..... 15

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56	124	14	4.5	945	29	2470		5	54

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.2			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	152
NA-K-CA (4/3)	194
NA-K	78
SILICA	
ADIABATIC	143
CONDUCTIVE	150
CHALCEDONY	124
CRISTOBALITE	99
OPAL	28

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	95 (J)	150 (A)	95 (J)	113	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.88 STD. DEV. = 0.28

COMMENTS: GEOTHERMOMETRY MAY BE INACCURATE DUE TO LOW FLOW RATE.

REFERENCES: WARING, 1965; BERKSTRESSER, 1968

COMPILED BY: BROOK, C.

SKAGGS HOT SPRINGS, CALIFORNIA

FIELD NAME................ CALISTOGA HOT SPRINGS
KGRA OR OTHER NAME........ GEYSERS-CALISTOGA KGRA
CIRCULAR REFERENCE........ 050

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... NAPA
LATITUDE.................. 38-34.9 N
LONGITUDE................. 122-34.4 W
MAPS...................... CALISTOGA 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
09N	06W	31	NW OF SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 81
ELEVATION (M)...................... 107
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SILICA DEPOSITS IN WELL PIPES
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 52 TO 78
DISCHARGE (L/MIN).................. 30
NO. OF WELLS....................... SEVERAL
WELL DEPTHS (M).................... 46(?) TO 610
MAXIMUM WELL TEMP (C).............. 137 AT DEPTH (M) 610(?)
ROCK TYPES: FAULTED TUFF (PLIOCENE?)

CHEMISTRY
SAMPLE SOURCE.... THOMPSON AND OTHERS, 1978
FLOW (L/MIN)..... 80
COLLECTION DATE.. 1976/09/25

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
100	150	25		193	8.7	184		13	206

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.4			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	141
NA-K-CA (4/3)	97
NA-K	107
SILICA	
ADIABATIC	153
CONDUCTIVE	161
CHALCEDONY	137
CRISTOBALITE	111
OPAL	39

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	137 (M,D)	153 (C)	141 (I)	144	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.6	1.5	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	6	4.5	4.2	0.8

BASED ON: WELL DISTRIBUTION AND ESTIMATES OF RENNER ET AL (1976)

VOLUME (KM**3)........... 6.9 STD. DEV. = 1.9
THERMAL ENERGY(10**18 J). 2.41 STD. DEV. = 0.67

COMMENTS: 3 WELLS DRILLED BY CALISTOGA POWER CO.; DEEPEST ABOUT 610 M; NOW ABANDONED. OTHER WELLS USED FOR BATHING AND HEALTH RESORTS. CHEMICAL ANALYSIS FROM GEYSERING WELL 3 KM NORTHWEST OF MAIN DEVELOPED AREA WHERE WATER CHEMISTRY AND ESTIMATED SUBSURFACE TEMPERATURES ARE SIMILAR.

REFERENCES: WARING, 1965; MCNITT, 1963; KOENIG, 1970; RENNER AND OTHERS, 1976; THOMPSON AND OTHERS, 1978

COMPILED BY: BROOK, C.

CALISTOGA HOT SPRINGS , CALIFORNIA

FIELD NAME................ GROVERS HOT SPRINGS
CIRCULAR REFERENCE........ 051

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... ALPINE
LATITUDE.................. 38-41.9 N
LONGITUDE................. 119-51.6 W
MAPS...................... MARKLEEVILLE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
10N	19E	24	SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 113
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 1800
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2 MAIN SPRINGS AND SEVERAL SEEPS
SPRING TEMPERATURES (C)............ 53 TO 64
DISCHARGE (L/MIN).................. 400
ROCK TYPES: FAULT CONTACT BETWEEN PLIOCENE ANDESITE FLOWS AND MESOZOIC GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
64	100	31	1.9	440	13	776		160	190

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.2	3.1	6.79		-15.62	-115.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	133
NA-K-CA (4/3)	117
NA-K	75
SILICA	
ADIABATIC	133
CONDUCTIVE	137
CHALCEDONY	110
CRISTOBALITE	87
OPAL	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	110 (D)	137 (A)	130 (J)	126	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.00 STD. DEV. = 0.28

COMMENTS: STATE PARK. WATER USED FOR BATHING.

REFERENCES: MARINER AND OTHERS, 1977B; FETH AND OTHERS, 1964; CURTIS, 1951

COMPILED BY: BROOK, C.

GROVERS HOT SPRINGS , CALIFORNIA

FIELD NAME................ FALES HOT SPRINGS
CIRCULAR REFERENCE........ 052

GEOGRAPHIC LOCALITY

STATE..................... CALIFORNIA
COUNTY.................... MONO
LATITUDE.................. 38-20.0 N
LONGITUDE................. 119-24.0 W
MAPS...................... FALES HOT SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
06N	23E	24	SE	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 114
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 2236
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 20
SPRING TEMPERATURES (C)............ 36 TO 61
DISCHARGE (L/MIN).................. MORE THAN 1000
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 126
ROCK TYPES: PLIOCENE ANDESITE OVERLYING GRANITIC ROCKS

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
61	114	41	10	560	37	1130		260	160

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.7	8.2	6.55	-4.29	-17.46	-132.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	173
NA-K-CA (4/3)...........	159
NA-K....................	140
SILICA	
ADIABATIC...............	139
CONDUCTIVE..............	145
CHALCEDONY..............	119
CRISTOBALITE............	94
OPAL....................	24
SULFATE	
CONDUCTIVE..............	134
ONE-STEP STEAM LOSS.....	125
CONTINUOUS STEAM LOSS..	126

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	84 (J)	145 (A)	119 (D)	116	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.91 STD. DEV. = 0.28

COMMENTS: CO2-CHARGED WATER. TRAVERTINE MAY BE PRECIPITATING. GEOTHERMOMETRY MAY BE INACCURATE.

REFERENCES: WARING, 1965; MARINER AND OTHERS, 1977B

COMPILED BY: BROOK, C.

FALES HOT SPRINGS , CALIFORNIA

FIELD NAME................ BUCKEYE HOT SPRING
CIRCULAR REFERENCE........ 053

GEOGRAPHIC LOCALITY

STATE...................... CALIFORNIA
COUNTY..................... MONO
LATITUDE................... 38-14.3 N
LONGITUDE.................. 119-19.6 W
MAPS....................... MATTERHORN PEAK 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04N	24E	04	NE	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 115
ELEVATION (M)...................... 2100
SURFACE ACTIVITY................... HOT SPRING
ASSOCIATED DEPOSITS................ TRAVERTINE
SPRING TEMPERATURES (C)............ 60 TO 64
DISCHARGE (L/MIN).................. 400
ROCK TYPES: TILL OVERLYING QUARTZ MONZONITE

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	75	22	4.2	310	10	429		340	28

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.1	1.1	7.33		-17.66	-137.9

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	134
NA-K-CA (4/3)...........	111
NA-K....................	81
SILICA	
ADIABATIC...............	120
CONDUCTIVE..............	122
CHALCEDONY..............	93
CRISTOBALITE............	71
OPAL....................	3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (J)	122 (A)	93 (D)	101	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.77 STD. DEV. = 0.23

REFERENCES: WARING, 1965; CHESTERMAN, 1975; MARINER AND OTHERS, 1977B

COMPILED BY: BROOK, C.

BUCKEYE HOT SPRING, CALIFORNIA

FIELD NAME................. TRAVERTINE HOT SPRINGS AREA
CIRCULAR REFERENCE........ 054

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... MONO
LATITUDE................... 38-14.8 N
LONGITUDE.................. 119-12.1 W
MAPS....................... BODIE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05N	25E	34	SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 116, 117
AREA OF SURFACE EXPRESSION (KM**2). 0.2
ELEVATION (M)...................... 2059
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... ABOUT 25 IN 2 GROUPS 2.5 KM APART
SPRING TEMPERATURES (C)............ 40 TO 69
DISCHARGE (L/MIN).................. 135
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 300
ROCK TYPES: PLIOCENE ANDESITE AND BASALT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
69	100	64	18	1100	55	1800		920	200

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.5	9.9	6.73		-17.46	-139.3

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	167
NA-K-CA (4/3)...........	176
NA-K....................	115
SILICA	
ADIABATIC...............	133
CONDUCTIVE..............	137
CHALCEDONY..............	110
CRISTOBALITE............	87
OPAL....................	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (J)	137 (A)	110 (D)	111	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE AND SPRING DISTRIBUTION

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.87 STD. DEV. = 0.26

COMMENTS: AREA INCLUDES THE HOT SPRINGS ABOUT 2.5 KM SOUTH. CHEMISTRY OF BOTH SPRINGS IS SIMILAR SUGGESTING A SINGLE SYSTEM.

REFERENCES: MARINER AND OTHERS, 1977B

COMPILED BY: BROOK, C.

TRAVERTINE HOT SPRINGS AREA , CALIFORNIA

FIELD NAME................. NORTH SHORE MONO LAKE (BLACK ROCK POINT HOT SPRING)
KGRA OR OTHER NAME........ MONO-LONG VALLEY KGRA
CIRCULAR REFERENCE........ 055

GEOGRAPHIC LOCALITY

STATE...................... CALIFORNIA
COUNTY..................... MONO
LATITUDE................... 38-02.4 N
LONGITUDE.................. 119-04.8 W
MAPS....................... BODIE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
02N	26E	11	MT. DIABLO

GENERAL INFORMATION

ELEVATION (M)........................ 1964
SURFACE ACTIVITY..................... HOT SPRINGS
ASSOCIATED DEPOSITS.................. TRAVERTINE
SPRING TEMPERATURES (C).............. 66
DISCHARGE (L/MIN).................... 150
NO. OF WELLS......................... 1 ABOUT 3 KM SOUTH
WELL DEPTHS (M)...................... 743
MAXIMUM WELL TEMP (C)................ 57 AT DEPTH (M) 743
ROCK TYPES: QUATERNARY LAKE DEPOSITS AND PYROCLASTICS

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
66	76	13	2.9	430	8.8	454		100	350

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	7.7	7.68		-15.69	-126.9

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	123
NA-K-CA (4/3)...........	125
NA-K....................	52
SILICA	
ADIABATIC...............	120
CONDUCTIVE..............	122
CHALCEDONY..............	94
CRISTOBALITE............	72
OPAL....................	4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	85 (J)	122 (A)	94 (D)	100	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.77 STD. DEV. = 0.23

COMMENTS: SPRINGS ARE COVERED AND INACCESSIBLE; SAMPLE FROM OUTFLOW PIPE 150 M FROM SOURCE.

REFERENCES: MARINER AND OTHERS, 1977B; AXTELL, 1972

COMPILED BY: BROOK, C.

NORTH SHORE MONO LAKE (BLACK ROCK POINT HOT SPRING, CALIFORNIA

FIELD NAME................ LONG VALLEY CALDERA
KGRA OR OTHER NAME........ MONO-LONG VALLEY KGRA
CIRCULAR REFERENCE........ 056

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... MONO
LATITUDE.................. 37-40.0 N
LONGITUDE................. 118-52.0 W
MAPS...................... MT. MORRISON 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
03S	28E	32	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 122-125
AREA OF SURFACE EXPRESSION (KM**2). 10
ELEVATION (M)...................... 2165
SURFACE ACTIVITY................... HOT SPRINGS, FUMAROLES
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... 40
SPRING TEMPERATURES (C)............ 60 TO 94
DISCHARGE (L/MIN).................. GREATER THAN 1300
NO. OF WELLS....................... 12
WELL DEPTHS (M).................... 103 TO 2109
MAXIMUM WELL TEMP (C).............. 181 AT DEPTH (M) 300
ROCK TYPES: RHYOLITIC TUFFS, FLOWS, AND DOMES
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW, RESISTIVITY, AMT, MICROEARTHQUAKE, SEISMIC NOISE, P-WAVE DELAY

CHEMISTRY
SAMPLE SOURCE.... MARINER AND WILLEY, 1976

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
94	340	0.9	0.1	390	45	416	16.6	130	280

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12	15	9.2	-7.59	-14.16	-115.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	238
NA-K-CA (4/3)	344
NA-K	201
SILICA	
ADIABATIC	200
CONDUCTIVE	219
CHALCEDONY	205
CRISTOBALITE	172
OPAL	94
SULFATE	
CONDUCTIVE	245
ONE-STEP STEAM LOSS	216
CONTINUOUS STEAM LOSS	223

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	200	250	230	227	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.5	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	45	120	80	81.7	15.3

BASED ON: AMT AND MAGNETIC SURVEYS, GEOLOGY, WELL DATA, AND M. SOREY, (PERSONAL COMMUNICATION, 1978)

VOLUME (KM**3)........... 136.1 STD. DEV. = 36.4
THERMAL ENERGY(10**18 J). 77.79 STD. DEV. = 21.15

COMMENTS: A DEEP (2109 M) TEST WELL IN THE EASTERN PART OF THE CALDERA HAD A MAXIMUM TEMPERATURE OF 72 C. HIGH-TEMPERATURE SYSTEM PROBABLY CONFINED TO THE WESTERN PART OF THE CALDERA WEST OF THE HILTON CREEK FAULT. ENTHALPY-CHLORIDE RELATIONSHIPS INDICATE A POSSIBLE MAXIMUM TEMPERATURE OF 282 C.

REFERENCES: BAILEY AND OTHERS, 1976; MARINER AND WILLEY, 1976; HOOVER AND OTHERS, 1976; KANE AND OTHERS, 1976; WILLIAMS AND OTHERS, 1977; SMITH AND REX, 1977; FOURNIER, SOREY, AND OTHERS, 1978; STANLEY AND OTHERS, 1976

COMPILED BY: BROOK, C.

LONG VALLEY CALDERA , CALIFORNIA

FIELD NAME................. COSO AREA
KGRA OR OTHER NAME........ COSO HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 057

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... INYO
LATITUDE................... 36-03.0 N
LONGITUDE.................. 117-47.0 W
MAPS....................... HAIWEE RESERVOIR 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
22S	38E	04	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 141A, 142
AREA OF SURFACE EXPRESSION (KM**2). 0.5
ELEVATION (M)....................... 1098
SURFACE ACTIVITY.................... HOT SPRINGS, FUMAROLES
ASSOCIATED DEPOSITS................. SINTER
NO. OF SPRINGS...................... 10
SPRING TEMPERATURES (C)............. 60 TO 97
DISCHARGE (L/MIN)................... SMALL
NO. OF WELLS........................ 2
WELL DEPTHS (M)..................... 114 TO 1477
MAXIMUM WELL TEMP (C)............... 189 AT DEPTH (M) 628
ROCK TYPES: RHYOLITE AND BASALT OVERLYING GRANITIC AND METAMORPHIC ROCKS
GEOPHYSICS: HEAT FLOW, MAGNETIC, GRAVITY, RESISTIVITY, AMT, MICROEARTHQUAKE, SEISMIC GROUND NOISE

CHEMISTRY
SAMPLE SOURCE.... AUSTIN AND PRINGLE, 1970
COLLECTION DATE.. 1968/03/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
142	154	74.4	1.0	1632	244			52.8	3042

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.2	71.6	8.5	-1.94	-5.89	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	238
NA-K-CA (4/3)...........	275
NA-K....................	236
SILICA	
ADIABATIC...............	154
CONDUCTIVE..............	163
CHALCEDONY..............	139
CRISTOBALITE............	113
OPAL....................	40
SULFATE	
CONDUCTIVE..............	324
ONE-STEP STEAM LOSS.....	285
CONTINUOUS STEAM LOSS..	296

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	190	240	230	220	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	2.0	0.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	17	40	25	27.3	4.8

BASED ON: RESISTIVITY, HEAT FLOW, MAGNETIC SURVEYS

VOLUME (KM**3)...........	45.6	STD. DEV. = 11.7
THERMAL ENERGY(10**18 J).	25.21	STD. DEV. = 6.64

COMMENTS: AREA INCLUDES COSO HOT SPRINGS AND DEVIL'S KITCHEN FUMAROLIC AREA. CHEMICAL ANALYSIS FOR COSO WELL NO. 1; WATER BOILED DURING SAMPLING. FOURNIER AND OTHERS (1978) CALCULATE SUBSURFACE TEMPERATURES OF 240 TO 275 C USING ENTHALPY-CHLORIDE RELATIONS.

REFERENCES: WARING, 1965; AUSTIN AND PRINGLE, 1970; COMBS, 1975; COMBS AND ROTSTEIN, 1976; DUFFIELD AND BACON, 1977; FOURNIER, THOMPSON, AND OTHERS, 1978; FOX, 1978A, B; GALBRAITH, 1978; HULEN, 1978; U.S. GEOLOGICAL SURVEY, 1976

COMPILED BY: BROOK, C.

COSO AREA , CALIFORNIA

FIELD NAME................ RANDSBURG AREA
KGRA OR OTHER NAME........ RANDSBURG KGRA
CIRCULAR REFERENCE........ 058

GEOGRAPHIC LOCALITY

STATE...................... CALIFORNIA
COUNTY..................... SAN BERNARDINO
LATITUDE................... 35-23.0 N
LONGITUDE.................. 117-32.2 W
MAPS....................... KLINKER MOUNTAIN 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
29S	41E	25	SE OF NW	MT. DIABLO

GENERAL INFORMATION

ELEVATION (M)...................... 990
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 235
MAXIMUM WELL TEMP (C).............. 115 AT DEPTH (M) 235
ROCK TYPES: ANDESITE OVERLYING QUARTZ MONZONITE AND SCHIST
GEOPHYSICS: HEAT FLOW (J. SASS, UNPUB.)

CHEMISTRY

SAMPLE SOURCE.... R. MARINER, UNPUB. DATA
COLLECTION DATE.. 1977/01/31

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
BOILING	LT 1	LT 0.5	LT 0.5	LT 0.5	LT 0.1	47		20	2

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
LT 0.1	LT 0.02	6.88			

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	115 (M)	250	150	172	29

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.2	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	4	8	5	5.7	0.8

BASED ON: HEAT FLOW SURVEY

VOLUME (KM**3)........... 9.4 STD. DEV. = 2.3
THERMAL ENERGY(10**18 J). 3.99 STD. DEV. = 1.22

COMMENTS: MAXIMUM AND MOST LIKELY TEMPERATURES ARE ESTIMATES. HOT WATER FLASHES IN BOREHOLE. CHEMICAL ANALYSIS OF STEAM CONDENSATE. GEOTHERMOMETRY NOT APPLICABLE. ISOTOPES UNRELIABLE BECAUSE OF REPEATED FLASHING. 15 MG/L NH3 AS (N).

REFERENCES: KOENIG, 1970; MOYLE, 1974

COMPILED BY: BROOK, C.

RANDSBURG AREA, CALIFORNIA

FIELD NAME................ TECOPA HOT SPRINGS
CIRCULAR REFERENCE........ 059

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... INYO
LATITUDE.................. 35-53.2 N
LONGITUDE................. 116-14.2 W
MAPS...................... TECOPA 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
21N	07E	28, 33	SAN BERNARDINO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 146
ELEVATION (M)...................... 415
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2 OR MORE
SPRING TEMPERATURES (C)............ 42 TO 48
DISCHARGE (L/MIN).................. 15
ROCK TYPES: TUFFACEOUS LACUSTRINE DEPOSITS

CHEMISTRY
SAMPLE SOURCE.... R.H. MARINER, UNPUB. DATA
FLOW (L/MIN)..... GT 100
COLLECTION DATE.. 1977/01/31

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
48	100	2	0.22	885	17	686	13	580	545

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.0	9.2	8.45			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	145
NA-K-CA (4/3)	241
NA-K	48
SILICA	
ADIABATIC	133
CONDUCTIVE	137
CHALCEDONY	110
CRISTOBALITE	87
OPAL	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	97 (E)	145 (I)	137 (A)	126	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.00 STD. DEV. = 0.30

COMMENTS: GEOTHERMOMETERS MAY BE UNRELIABLE BECAUSE OF LIKELYHOOD OF WATER REACTIONS WITH TUFFACEOUS LACUSTRINE DEPOSITS.

REFERENCES: WARING, 1965

COMPILED BY: BROOK, C.

TECOPA HOT SPRINGS, CALIFORNIA

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FIELD NAME................ SCOVERN HOT SPRING
KGRA OR OTHER NAME........ NEILLS HOT SPRING (AGUA CALIENTE)
CIRCULAR REFERENCE........ 060

   GEOGRAPHIC LOCALITY
      STATE..................... CALIFORNIA
      COUNTY.................... KERN
      LATITUDE.................. 35-37.1  N
      LONGITUDE................. 118-28.4  W
      MAPS...................... LAKE ISABELLA SOUTH  1:24,000

   GENERAL INFORMATION
      WARING FIGURE.....................  8
      WARING NUMBER.....................  149
      ELEVATION (M).....................  762
      SURFACE ACTIVITY..................  HOT SPRING
      NO. OF SPRINGS....................  1?
      SPRING TEMPERATURES (C)...........  53.5
      DISCHARGE (L/MIN).................  435
      ROCK TYPES: GRANITIC ROCKS

   CHEMISTRY
      SAMPLE SOURCE....  R. MARINER, UNPUB. DATA
      COLLECTION DATE..  1977/01/03
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TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
53.5	64	2.8	0.18	145	3.0	288	LT 1	8	38

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.2	2.4	7.49				

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	119
NA-K-CA (4/3)...........	108
NA-K..................	53

SILICA

ADIABATIC..............	113
CONDUCTIVE.............	114
CHALCEDONY.............	85
CRISTOBALITE...........	63
OPAL..................	-4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	85 (D)	119 (I)	114 (A)	106	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.82	STD. DEV. = 0.24

COMMENTS: SPRING ISSUES FROM IRON STAND PIPE.

REFERENCES: WARING, 1965

COMPILED BY: BROOK, C.

SCOVERN HOT SPRING, CALIFORNIA

FIELD NAME................ SESPE HOT SPRINGS
KGRA OR OTHER NAME........ SESPE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 061

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... VENTURA
LATITUDE.................. 34-35.7 N
LONGITUDE................. 118-59.9 W
MAPS...................... DEVILS HEART PEAK 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
06N	20W	21	SE OF SE	SAN BERNARDINO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 111
AREA OF SURFACE EXPRESSION (KM**2). 0.2
ELEVATION (M)...................... 869
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 36 TO 90
DISCHARGE (L/MIN).................. 470
ROCK TYPES: FAULTED GRANITE

CHEMISTRY
SAMPLE SOURCE.... R. MARINER, UNPUB. DATA
COLLECTION DATE.. 1977/01/31

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
89	98	22	0.11	330	14	70	LT 1	290	290

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12	13	7.74	+5.72	-9.62	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	148
NA-K-CA (4/3)...........	126
NA-K....................	102
SILICA	
ADIABATIC...............	132
CONDUCTIVE..............	136
CHALCEDONY..............	109
CRISTOBALITE............	85
OPAL....................	16
SULFATE	
CONDUCTIVE..............	111
ONE-STEP STEAM LOSS.....	109
CONTINUOUS STEAM LOSS..	109

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	109 (D)	148 (I)	136 (A)	131	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.04 STD. DEV. = 0.30

REFERENCES: WARING, 1965; MOYLE, 1974

COMPILED BY: BROOK, C.

SESPE HOT SPRINGS , CALIFORNIA

FIELD NAME................. ARROWHEAD HOT SPRINGS
CIRCULAR REFERENCE........ 062

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... SAN BERNARDINO
LATITUDE................... 34-11.2 N
LONGITUDE.................. 117-15.9 W
MAPS....................... SAN BERNARDINO NORTH 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
01N	04W	11	NE	SAN BERNARDINO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 162
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)....................... 610
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... SEVERAL IN 2 GROUPS
SPRING TEMPERATURES (C)............. 43 TO 86
DISCHARGE (L/MIN)................... 200
ROCK TYPES: FRACTURED GRANITE AND GNEISS

CHEMISTRY
SAMPLE SOURCE.... R. MARINER, UNPUB. DATA
COLLECTION DATE.. 1977/01/31

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
80.5	100	27	0.14	295	14	74	LT 1	520	76

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.0	2.8	7.72			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	150
NA-K-CA (4/3)	119
NA-K	111
SILICA	
ADIABATIC	133
CONDUCTIVE	137
CHALCEDONY	110
CRISTOBALITE	87
OPAL	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	110 (D)	150 (I)	137 (A)	132	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.06 STD. DEV. = 0.31

REFERENCES: WARING, 1965

COMPILED BY: BROOK, C.

ARROWHEAD HOT SPRINGS , CALIFORNIA

FIELD NAME................ PILGER ESTATES HOT SPRINGS
CIRCULAR REFERENCE........ 063

GEOGRAPHIC LOCALITY

STATE..................... CALIFORNIA
COUNTY.................... RIVERSIDE
LATITUDE.................. 33-26.0 N
LONGITUDE................. 115-41.1 W
MAPS...................... FRINK NW 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
08S	12E	36	SAN BERNARDINO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 176A
ELEVATION (M)...................... 61
SURFACE ACTIVITY................... HOT WATER WELL
SPRING TEMPERATURES (C)............ 79 TO 82
DISCHARGE (L/MIN).................. MORE THAN 3000
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 92
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY INTRUSIVE ROCKS

CHEMISTRY

SAMPLE SOURCE.... MOYLE, 1974
COLLECTION DATE.. 1965/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
82	79	107	16	888	33	268		225	1360

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.7			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	145
NA-K-CA (4/3)	132
NA-K	92

SILICA

ADIABATIC	122
CONDUCTIVE	124
CHALCEDONY	96
CRISTOBALITE	74
OPAL	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (D)	124 (A)	96 (J)	105	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.81 STD. DEV. = 0.24

REFERENCES: WARING, 1965; MOYLE, 1974

COMPILED BY: BROOK, C.

PILGER ESTATES HOT SPRINGS, CALIFORNIA

FIELD NAME................. SALTON SEA AREA
KGRA OR OTHER NAME........ SALTON SEA KGRA
CIRCULAR REFERENCE........ 064

GEOGRAPHIC LOCALITY

STATE...................... CALIFORNIA
COUNTY..................... IMPERIAL
LATITUDE................... 33-12.0 N
LONGITUDE.................. 115-36. W
MAPS....................... NILAND 1:24,000; OBSIDIAN BUTTE 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
11S	13E	22	SAN BERNARDINO

GENERAL INFORMATION

WARING FIGURE....................... 8
WARING NUMBER....................... 182A
ELEVATION (M)....................... -70
SURFACE ACTIVITY.................... HOT SPRINGS AND FUMAROLES NOW COVERED BY SALTON SEA. AREA IDENTIFIED BY HEAT FLOW ANOMALY AND FOUND BY DRILLING.
NO. OF SPRINGS...................... ORIGINALLY 4
SPRING TEMPERATURES (C)............. 72 TO 101
DISCHARGE (L/MIN)................... SMALL
NO. OF WELLS........................ ABOUT 21
WELL DEPTHS (M)..................... 700 TO 2400
MAXIMUM WELL TEMP (C)............... 360 AT DEPTH (M) 2135
ROCK TYPES: QUATERNARY DELTAIC SEDIMENTS INTRUDED BY RHYOLITE DOMES
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	300	340	330	323	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.35	1.2	0.5		
THICKNESS (KM)	1.5	2.3	2.0	1.9	0.2
SUBSURFACE AREA (KM**2)	23	104	54	60.3	16.7

BASED ON: ESTIMATES OF RENNER ET AL (1976) AND MAGNETIC ANOMALY

VOLUME (KM**3)........... 116.6 STD. DEV. = 33.9
THERMAL ENERGY(10**18 J). 97.11 STD. DEV. = 28.33

COMMENTS: HYPERSALINE BRINE; GEOTHERMOMETRY QUESTIONABLE. DEPTH ESTIMATES FROM WELL DATA. THICKNESS ESTIMATES FROM RENNER ET AL (1976). RESERVOIR IS SEPARATED INTO AN UPPER, UNALTERED (?) PART AND A LOWER, ALTERED PART BY AN IMPERMEABLE AND CONTINUOUS SHALE LAYER. GEOTHERMAL LOOP EXPERIMENTAL FACILITY IS CURRENTLY BEING TESTED.

REFERENCES: HELGESON, 1968; MUFFLER AND WHITE, 1969; GRISCOM AND MUFFLER, 1971; ROBINSON, ELDERS, AND MUFFLER, 1976; QUONG, 1976; SCHROEDER, 1976; RENNER AND OTHERS, 1976; MORSE, 1977

COMPILED BY: BROOK, C.

SALTON SEA AREA , CALIFORNIA

FIELD NAME................ WESTMORLAND
CIRCULAR REFERENCE........ 064A

GEOGRAPHIC LOCALITY

STATE..................... CALIFORNIA
COUNTY.................... IMPERIAL
LATITUDE.................. 33-05.0 N
LONGITUDE................. 115-39.0 W
MAPS...................... CALIPATRIA SW AND WESTMORLAND 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
12S	13E		SAN BERNARDINO

GENERAL INFORMATION

ELEVATION (M)...................... -61
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING
NO. OF WELLS....................... 6
WELL DEPTHS (M).................... 458 TO 2592
ROCK TYPES: DELTAIC SEDIMENTS

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	200	235	215	217	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.0	1.5	1.1		
THICKNESS (KM)	1.0	2.0	1.6	1.5	0.2
SUBSURFACE AREA (KM**2)	45	135	60	80.0	19.7

BASED ON: ESTIMATES BASED ON PERSONAL COMMUN.

VOLUME (KM**3)........... 122.7 STD. DEV. = 34.6
THERMAL ENERGY(10**18 J). 66.79 STD. DEV. = 19.00

COMMENTS: MOST LIKELY TEMPERATURE IS THE WEIGHTED AVERAGE OF 5 TEMPERATURES AT 1920 M DEPTH. SYSTEM MAY BE AN EXTENSION OF THE SALTON SEA FIELD.

REFERENCES: SMITH, J.L., ORAL COMMUNICATION, 1978

COMPILED BY: BROOK, C.

WESTMORLAND , CALIFORNIA

FIELD NAME................ BRAWLEY
KGRA OR OTHER NAME........ BRAWLEY KGRA
CIRCULAR REFERENCE........ 065

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... IMPERIAL
LATITUDE.................. 33-03.0 N
LONGITUDE................. 115-32.0 W
MAPS...................... WESTMORLAND 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
13S	14E	15	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)..................... -46
SURFACE ACTIVITY.................. NONE. IDENTIFIED BY HEAT FLOW ANOMALY. FOUND BY DRILLING
NO. OF WELLS...................... ABOUT 6
WELL DEPTHS (M)................... 1534 TO 4100
MAXIMUM WELL TEMP (C)............. 262 AT DEPTH (M) 2406
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: RESISTIVITY, HEAT FLOW (TEMPERATURE GRADIENT), GRAVITY

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	230	280	250	253	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.5	2.2	1.9		
THICKNESS (KM)	1.0	1.5	1.5	1.3	0.1
SUBSURFACE AREA (KM**2)	13	40	24	25.7	5.5

BASED ON: TEMPERATURE GRADIENT CONTOURS AND D.E. WHITE, ORAL COMMUN., 1978

VOLUME (KM**3)............ 34.2 STD. DEV. = 8.0
THERMAL ENERGY(10**18 J). 22.02 STD. DEV. = 5.25

COMMENTS: BRINE FLUID CONTAINING 59,000 PPM TDS. NO CHEMISTRY AVAILABLE. THICKNESS AND DEPTH ESTIMATES BASED ON LIMITED WELL DATA (R. BUTLER, PERSONAL COMMUN., 1978).

REFERENCES: U.S. BUREAU OF RECLAMATION, 1972; MEIDAV AND FURGERSON, 1972; DUTCHER AND OTHERS, 1972; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

BRAWLEY , CALIFORNIA

FIELD NAME................. GLAMIS (EAST BRAWLEY)
KGRA OR OTHER NAME......... GLAMIS KGRA
CIRCULAR REFERENCE......... 066

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... IMPERIAL
LATITUDE................... 32-58.0 N
LONGITUDE.................. 115-11.0 W
MAPS....................... GLAMIS NW 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
14S	17E	02	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)........................ 37
SURFACE ACTIVITY..................... NONE. IDENTIFIED BY HEAT FLOW ANOMALY
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: TEMPERATURE GRADIENT

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	105	170	120	132	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: TEMPERATURE GRADIENT ANOMALY

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.05 STD. DEV. = 0.32

COMMENTS: TEMPERATURES ASSUMED TO BE SIMILAR TO THOSE ESTIMATED FOR THE DUNES AREA.

REFERENCES: U.S. BUREAU OF RECLAMATION, 1972; REX AND OTHERS, 1971

COMPILED BY: BROOK, C.

GLAMIS (EAST BRAWLEY) , CALIFORNIA

FIELD NAME................ GLAMIS EAST
KGRA OR OTHER NAME........ GLAMIS KGRA
CIRCULAR REFERENCE........ 067

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... IMPERIAL
LATITUDE.................. 33-00.0 N
LONGITUDE................. 115-02.1 W
MAPS...................... GLAMIS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
13S	18E	33	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)...................... 107
SURFACE ACTIVITY................... NONE. IDENTIFIED BY HEAT FLOW ANOMALY
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: TEMPERATURE GRADIENT

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	105	170	120	132	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	5	3	3.0	0.8

BASED ON: RENNER ET AL (1976) AND TEMPERATURE GRADIENT CONTOURS

VOLUME (KM**3)........... 5.0 STD. DEV. = 1.7
THERMAL ENERGY(10**18 J). 1.57 STD. DEV. = 0.56

COMMENTS: TEMPERATURES ASSUMED TO BE SIMILAR TO THOSE ESTIMATED FOR THE DUNES AREA.

REFERENCES: U.S. BUREAU OF RECLAMATION, 1972; REX AND OTHERS, 1971; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

GLAMIS EAST , CALIFORNIA

FIELD NAME................. EAST MESA
KGRA OR OTHER NAME........ EAST MESA KGRA
CIRCULAR REFERENCE........ 068

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... IMPERIAL
LATITUDE................... 32-47.0 N
LONGITUDE.................. 115-15.0 W
MAPS....................... HOLTVILLE EAST 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16S	17E	06	SE	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)........................ 8
SURFACE ACTIVITY.................... NONE. IDENTIFIED BY HEAT FLOW ANOMALY. FOUND BY DRILLING
NO. OF WELLS........................ 20 OR MORE, SOME OF WHICH ARE INJECTION WELLS.
WELL DEPTHS (M)..................... 915 TO 2772
MAXIMUM WELL TEMP (C)............... 204 AT DEPTH (M) 2355
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: HEAT FLOW, GRAVITY, RESISTIVITY, MICROEARTHQUAKE, SEISMIC NOISE

CHEMISTRY
SAMPLE SOURCE.... U.S. BUREAU OF RECLAMATION, 1977
COLLECTION DATE.. 1976/06/09

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
	320	1360	17.2	8100	1050	202	0.0	42.8	15850

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		5.45			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	231
NA-K-CA (4/3)...........	279
NA-K....................	216

SILICA

ADIABATIC...............	196
CONDUCTIVE..............	214
CHALCEDONY..............	199
CRISTOBALITE............	166
OPAL....................	90

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	165	200	180	182	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.8	2.0	1.8		
THICKNESS (KM)	1.0	1.2	1.2	1.1	0.0
SUBSURFACE AREA (KM**2)	16	40	40	32.0	5.7

BASED ON: WELL DISTRIBUTION, HEAT FLOW DATA; ALSO SWANBERG, 1976

VOLUME (KM**3)...........	36.3	STD. DEV. = 6.6
THERMAL ENERGY(10**18 J).	16.32	STD. DEV. = 3.05

COMMENTS: BRINE FLUIDS, GEOTHERMOMETRY QUESTIONABLE. CHEMICAL ANALYSIS FOR UNFLASHED FLUID FROM WELLHEAD MESA 6-1. THICKNESS AND DEPTH ESTIMATES FROM WELL DATA. A 10 MW POWER PLANT IS UNDER CONSTRUCTION.

REFERENCES: U.S. BUREAU OF RECLAMATION, 1972, 1974, 1977; SWANBERG, 1976; BIEHLER, 1971; BARKMAN AND OTHERS, 1976; NARASIMHAN AND OTHERS, 1977; COMBS AND JARZABEK, 1978

COMPILED BY: BROOK, C.

EAST MESA , CALIFORNIA

FIELD NAME................ DUNES
KGRA OR OTHER NAME........ DUNES KGRA
CIRCULAR REFERENCE........ 069

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
COUNTY.................... IMPERIAL
LATITUDE.................. 32-48.2 N
LONGITUDE................. 115-00.8 W
MAPS...................... GLAMIS SE 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
15S	19E	28	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)...................... 75
SURFACE ACTIVITY................... NONE. IDENTIFIED BY ANOMALOUS HEAT FLOW.
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 612
MAXIMUM WELL TEMP (C).............. 103 AT DEPTH (M) ABOUT 280
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: TEMPERATURE GRADIENT, GRAVITY, TELLURIC

CHEMISTRY
SAMPLE SOURCE.... COPLEN AND KOLESAR, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
100	118	136	1.7	1262	103	76	0.04	178	2021

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		6.58		-10.77	-94

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	189
NA-K-CA (4/3)	185
NA-K	161
SILICA	
ADIABATIC	141
CONDUCTIVE	147
CHALCEDONY	121
CRISTOBALITE	96
OPAL	25

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	105	170	120	132	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.2	1.5	0.2		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	3	8	5	5.3	1.0

BASED ON: TEMPERATURE GRADIENT CONTOURS

VOLUME (KM**3)........... 8.9 STD. DEV. = 2.4
THERMAL ENERGY(10**18 J). 2.80 STD. DEV. = 0.83

COMMENTS: CHEMICAL ANALYSIS FROM 104-116 M PERFORATION IN WELL DWR#1. CALCITE-WATER OXYGEN ISOTOPE EQUILIBRIUM INDICATES 117 C (COPLEN, 1973). CALCITE MAY BE PRECIPATING IN SUBSURFACE.

REFERENCES: REX AND OTHERS, 1971; U.S. BUREAU OF RECLAMATION, 1972; COPLEN, 1973; COPLEN AND KOLESAR, 1974; COMBS AND WILT, 1976.

COMPILED BY: BROOK, C.

DUNES , CALIFORNIA

FIELD NAME................. BORDER
KGRA OR OTHER NAME........ EAST MESA KGRA
CIRCULAR REFERENCE........ 070

GEOGRAPHIC LOCALITY
STATE...................... CALIFORNIA
COUNTY..................... IMPERIAL
LATITUDE................... 32-44.0 N
LONGITUDE.................. 115-07.0 W
MAPS....................... MIDWAY WELL 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16S	18E	28	NW	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)...................... 37
SURFACE ACTIVITY................... NONE. IDENTIFIED BY HEAT FLOW ANOMALY
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: HEAT FLOW, RESISTIVITY, GRAVITY, MICROEARTHQUAKE, SEISMIC NOISE

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	150 (O)	170 (O)	160 (O)	160	4

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.8	2.0	1.8		
THICKNESS (KM)	1.0	1.2	1.2	1.1	0.0
SUBSURFACE AREA (KM**2)	2.6	5	3	3.5	0.5

BASED ON: ESTIMATES OF RENNER ET AL (1976), TEMPERATURE GRADIENT DATA

VOLUME (KM**3)............ 4.0 STD. DEV. = 0.6
THERMAL ENERGY(10**18 J). 1.57 STD. DEV. = 0.25

COMMENTS: DEPTH TO RESERVOIR AND THICKNESS ESTIMATES ARE ASSUMED USING ANALOGY TO EAST MESA TEST SITE.

REFERENCES: DUTCHER AND OTHERS, 1972; U.S. BUREAU OF RECLAMATION, 1972, 1974; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

BORDER, CALIFORNIA

FIELD NAME................ HEBER
KGRA OR OTHER NAME........ HEBER KGRA
CIRCULAR REFERENCE........ 071

GEOGRAPHIC LOCALITY
STATE..................... CALIFORNIA
LATITUDE.................. 32-43.0 N
LONGITUDE................. 115-31.7 W
MAPS...................... HEBER 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
16S	14E	29	SAN BERNARDINO

GENERAL INFORMATION
ELEVATION (M)...................... -1.5
SURFACE ACTIVITY................... NONE. IDENTIFIED BY HEAT FLOW ANOMALY, FOUND BY DRILLING.
NO. OF WELLS....................... 11
WELL DEPTHS (M).................... 916 TO 3360
ROCK TYPES: SANDY DELTAIC SEDIMENTS
GEOPHYSICS: HEAT FLOW, RESISTIVITY, GRAVITY

CHEMISTRY
SAMPLE SOURCE.... GEONOMICS, INC., 1976

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
	268	781	3.8	4563	197			150	8076

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		6.5			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	162
NA-K-CA (4/3)...........	180
NA-K....................	103
SILICA	
ADIABATIC...............	185
CONDUCTIVE..............	201
CHALCEDONY..............	183
CRISTOBALITE............	152
OPAL....................	76

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	160	185	180	175	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.6	1.8	1.5		
THICKNESS (KM)	1.2	2.4	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	30	55	40	41.7	5.1

BASED ON: TANSEV AND WASSERMAN (1976) AND TEMPERATURE GRADIENT CONTOURS

VOLUME (KM**3)...........	70.8	STD. DEV. = 13.8
THERMAL ENERGY(10**18 J).	30.60	STD. DEV. = 6.06

COMMENTS: CHEMICAL ANALYSIS FOR WELL J.D. JACKSON #1. AVERAGE BOTTOM HOLE TEMPERATURE OF PRODUCING WELLS IS 179-181 C. MAXIMUM TEMPERATURE REPORTED FOR THE FIELD IS 191 C (TANSEV AND WASSERMAN, 1977).

REFERENCES: U.S. BUREAU OF RECLAMATION, 1972; GEONOMICS, INC., 1976; TANSEV AND WASSERMAN, 1977; MEIDAV AND FURGERSON, 1972; BIEHLER, 1971

COMPILED BY: BROOK, C.

HEBER , CALIFORNIA

Colorado

FIELD NAME................ ROUTT HOT SPRINGS
CIRCULAR REFERENCE........ 072

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... ROUTT
LATITUDE.................. 40-33.6 N
LONGITUDE................. 106-51.0 W
MAPS...................... ROCKY REAK 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
07N	84W	18	SW OF SE	6TH PRINCIPAL MERIDIAN

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 2
ELEVATION (M)...................... 2266
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 51 TO 64
DISCHARGE (L/MIN).................. 200-300
ROCK TYPES: PRECAMBRIAN GNEISS AND GRANITE

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976
FLOW (L/MIN)..... 133
COLLECTION DATE.. 1976/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
64	89	7.7	0.1	160	8.8	139		45	130

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
17	0.28	7.8			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	157
NA-K-CA (4/3)..........	126
NA-K..................	123
SILICA	
ADIABATIC.............	127
CONDUCTIVE............	131
CHALCEDONY............	103
CRISTOBALITE..........	80
OPAL..................	11

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	103 (D)	157 (I)	131 (A)	130	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.04 STD. DEV. = 0.31

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

ROUTT HOT SPRINGS , COLORADO

FIELD NAME................ PENNY (AVALANCHE) HOT SPRINGS
CIRCULAR REFERENCE........ 073

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... PITKIN
LATITUDE.................. 39-13.6 N
LONGITUDE................. 107-13.5 W
MAPS...................... REDSTONE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
10S	88W	04	NE OF NW	6TH PRINCIPAL MERIDIAN

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 8
ELEVATION (M)...................... 2110
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL FOR 0.8 KM ALONG RIVER
SPRING TEMPERATURES (C)............ 40 TO 56
DISCHARGE (L/MIN).................. 750
ROCK TYPES: TERTIARY GRANODIORITE INTRUDING PALEOZOIC SEDIMENTARY ROCKS

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (GRANGES SPRING)
FLOW (L/MIN)..... 45
COLLECTION DATE.. 1975/09/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56	81	440	55	400	38	565		1400	260

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.7	0.65	9.27				

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	166
NA-K-CA (4/3)	90
NA-K	178
SILICA	
ADIABATIC	123
CONDUCTIVE	126
CHALCEDONY	98
CRISTOBALITE	75
OPAL	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I)	126 (A)	98 (D)	105	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.81 STD. DEV. = 0.24

COMMENTS: CHEMICAL ANALYSIS FOR GRANGES SPRING: REPORTED PH (9.2) ASSUMED TO BE IN ERROR AS OTHER SPRINGS HAVE A PH OF 6.3.

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

PENNY (AVALANCHE) HOT SPRINGS , COLORADO

FIELD NAME................. MT. PRINCETON HOT SPRINGS AREA
KGRA OR OTHER NAME........ CHALK CREEK AREA
CIRCULAR REFERENCE........ 074

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... CHAFFEE
LATITUDE.................. 38-43.9 N
LONGITUDE................. 106-10.2 W
MAPS...................... PONCHA SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
15S	78W	19	6TH PRINCIPAL MERIDIAN

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 20
AREA OF SURFACE EXPRESSION (KM**2). 5.0
ELEVATION (M)...................... 2486
SURFACE ACTIVITY................... NUMEROUS THERMAL SPRINGS AND SHALLOW WELLS
ASSOCIATED DEPOSITS................ ZEOLITIC ALTERATION
NO. OF SPRINGS..................... ABOUT 34
SPRING TEMPERATURES (C)............ 39 TO 85
DISCHARGE (L/MIN).................. 675
NO. OF WELLS....................... 5
WELL DEPTHS (M).................... 12 TO 55
ROCK TYPES: TERTIARY QUARTZ MONZONITE

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (HORTENSE HOT SPRING, PRINCETON HOT SPRING)
FLOW (L/MIN)..... 64
COLLECTION DATE.. 1976/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
83	88	4.7	0	94	3.2	86		98	10

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
15	0.04	8.2	-3.75	-16.40	-117.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	131
NA-K-CA (4/3)...........	93
NA-K..................	85
SILICA	
ADIABATIC..............	127
CONDUCTIVE.............	130
CHALCEDONY.............	103
CRISTOBALITE...........	80
OPAL..................	11
SULFATE	
CONDUCTIVE.............	140
ONE-STEP STEAM LOSS....	133
CONTINUOUS STEAM LOSS..	134

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	93 (I)	140 (K)	103 (D)	112	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	2.0	1.0		
THICKNESS (KM)	1.0	2.3	1.5	1.6	0.3
SUBSURFACE AREA (KM**2)	2	6	4	4.0	0.8

BASED ON: SPRING AND WELL DISTRIBUTION

VOLUME (KM**3)........... 6.4 STD. DEV. = 1.7
THERMAL ENERGY(10**18 J). 1.68 STD. DEV. = 0.48

COMMENTS: CHEMICAL ANALYSIS FOR HORTENSE HOT SPRING. ISOTOPIC DATA FROM MT. PRINCETON HOT SPRING. THERMAL WELLS USED FOR SPACE HEATING, GREENHOUSES, AND BATHING. ZEOLITIZATION IS PROBABLY NOT ACTIVE.

REFERENCES: BARRETT AND PEARL, 1976, 1978; OLSON AND DELLECHAIE, 1976; SHARP, 1970; WARING, 1965

COMPILED BY: MARINER, R. AND BROOK, C.

MT. PRINCETON HOT SPRINGS AREA, COLORADO

FIELD NAME................ PONCHA HOT SPRINGS
KGRA OR OTHER NAME........ PONCHA KGRA
CIRCULAR REFERENCE........ 075

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... CHAFFEE
LATITUDE.................. 38-29.8 N
LONGITUDE................. 106-04.6 W
MAPS...................... BONANZA 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
49N	08E	15	NEW MEXICO

GENERAL INFORMATION
WARING FIGURE..................... 2
WARING NUMBER..................... 21
ELEVATION (M)..................... 2428
SURFACE ACTIVITY.................. HOT SPRINGS
ASSOCIATED DEPOSITS............... TRAVERTINE
NO. OF SPRINGS.................... 5
SPRING TEMPERATURES (C)........... 50 TO 71
DISCHARGE (L/MIN)................. 895
ROCK TYPES: PRECAMBRIAN GRANITE AND GNEISS

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (SPRING B)
FLOW (L/MIN)..... 114
COLLECTION DATE.. 1975/06/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
66	83	18	0.5	190	7.8	214		190	48

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12	0.07				

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	139
NA-K-CA (4/3)	101
NA-K	99
SILICA	
ADIABATIC	124
CONDUCTIVE	127
CHALCEDONY	99
CRISTOBALITE	76
OPAL	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	98 (D)	127 (A)	101 (I)	109	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.84 STD. DEV. = 0.24

COMMENTS: ANALYSIS FROM SPRING B; OTHER SPRINGS HAVE PH OF 7.5-8.0. TWO GROUPS OF SPRINGS. MOST OF THE WATER IS PIPED 8 KM TO SALIDA FOR USE IN SWIMMING POOL. ASSOCIATED WITH FLUORITE DEPOSITS.

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

PONCHA HOT SPRINGS, COLORADO

FIELD NAME................. WAUNITA HOT SPRINGS
CIRCULAR REFERENCE......... 076

GEOGRAPHIC LOCALITY
STATE...................... COLORADO
COUNTY..................... GUNNISON
LATITUDE................... 38-30.8 N
LONGITUDE.................. 106-30.5 W
MAPS....................... PITKIN 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
49N	04E	10-11	NEW MEXICO

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 14
ELEVATION (M)...................... 2727
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL IN 2 GROUPS
SPRING TEMPERATURES (C)............ 62 TO 80
DISCHARGE (L/MIN).................. MORE THAN 600
ROCK TYPES: MESOZOIC SANDSTONE AND SHALE ON NORTH SIDE OF TERTIARY INTRUSIVE DOME

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (UPPER WAUNITA HOT SPRINGS)
FLOW (L/MIN)..... 114
COLLECTION DATE.. 1975/10/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
80	110	5.9	LT 0.2	160	10	119		190	15

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
18	0.06	8.4			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	165
NA-K-CA (4/3)	139
NA-K	135
SILICA	
ADIABATIC	137
CONDUCTIVE	143
CHALCEDONY	116
CRISTOBALITE	92
OPAL	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	116 (D)	165 (I)	143 (A)	141	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.14 STD. DEV. = 0.33

COMMENTS: ANALYSIS FOR SPRING C, UPPER WAUNITA HOT SPRINGS. WATER USED FOR SPACE HEATING AND BATHING.

REFERENCES: BARRETT AND PEARL, 1976, 1978; HEDLUND AND OLSON, 1975

COMPILED BY: MARINER, R. AND BROOK, C.

WAUNITA HOT SPRINGS , COLORADO

FIELD NAME................. CEBOLLA (POWDERHORN) HOT SPRINGS
CIRCULAR REFERENCE........ 077

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... GUNNISON
LATITUDE.................. 38-16.4 N
LONGITUDE................. 107-05.9 W
MAPS...................... POWDERHORN 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
46N	02W	04	NW OF NE	NEW MEXICO

GENERAL INFORMATION
WARING FIGURE..................... 2
WARING NUMBER..................... 15
ELEVATION (M)..................... 2466
SURFACE ACTIVITY.................. HOT SPRINGS
ASSOCIATED DEPOSITS............... FOSSIL TRAVERTINE AND SINTER
NO. OF SPRINGS.................... 3
SPRING TEMPERATURES (C)........... 38 TO 41
DISCHARGE (L/MIN)................. MORE THAN 11
ROCK TYPES: PRECAMBRIAN METAMORPHIC ROCKS, CAMBRIAN AND ORDOVICIAN INTRUSIVE ROCKS AND OLIGOCENE VOLCANICLASTIC ROCKS.

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (SPRING A)
FLOW (L/MIN)..... 11
COLLECTION DATE.. 1976/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
38	92	120	51	310	66	1180	0	120	120

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.8	1.1	6.4			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	219
NA-K-CA (4/3)	143
NA-K	293
SILICA	
ADIABATIC	129
CONDUCTIVE	133
CHALCEDONY	105
CRISTOBALITE	82
OPAL	13

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	47 (J)	133 (A)	105 (D)	95	18

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE AND SPRING DEPOSIT DISTRIBUTION

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.72 STD. DEV. = 0.26

COMMENTS: ANALYSIS FOR SPRING A. CO2-CHARGED WATER; GEOTHERMOMETRY MAY BE UNRELIABLE. MOST OF THERMAL ACTIVITY IN AREA PROBABLY OCCURRED DURING THE OLIGOCENE. PRESENT ACTIVITY ASSOCIATED WITH A FAULT.

REFERENCES: BARRETT AND PEARL, 1976, 1978; HEDLUND AND OLSON, 1975

COMPILED BY: MARINER, R. AND BROOK, C.

CEBOLLA (POWDERHORN) HOT SPRINGS, COLORADO

FIELD NAME................ PARADISE HOT SPRING
CIRCULAR REFERENCE........ 078

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... DOLORES
LATITUDE.................. 37-45.2 N
LONGITUDE................. 108-07.9 W
MAPS...................... GROUNDHOG MOUNTAIN 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
40N	11W	06	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)...................... 2745
SURFACE ACTIVITY................... HOT SPRINGS
SPRING TEMPERATURES (C)............ 40 TO 46
DISCHARGE (L/MIN).................. 114
ROCK TYPES: SANDSTONE, SHALES, AND SILTSTONE

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976
FLOW (L/MIN)..... 114
COLLECTION DATE.. 1976/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
42	150	170	28	1900	370	697		110	3100

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.7	4.3	6.8			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	250
NA-K-CA (4/3)...........	268
NA-K..................	278
SILICA	
ADIABATIC..............	153
CONDUCTIVE.............	161
CHALCEDONY.............	137
CRISTOBALITE...........	111
OPAL..................	39

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	130	170 (J)	161 (A)	154	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	1.25	STD. DEV. = 0.36

COMMENTS: SALINE WATER, CHEMICAL GEOTHERMOMETERS UNRELIABLE. REPORTED TEMPERATURES ARE PROBABLY TOO HIGH.

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R.

PARADISE HOT SPRING , COLORADO

FIELD NAME................ WAGON WHEEL GAP HOT SPRINGS
CIRCULAR REFERENCE........ 079

GEOGRAPHIC LOCALITY

STATE..................... COLORADO
COUNTY.................... MINERAL
LATITUDE.................. 37-41.1 N
LONGITUDE................. 106-49.8 W
MAPS...................... SPAR CITY 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
41N	01E	35	SE OF SE	NEW MEXICO

GENERAL INFORMATION

WARING FIGURE...................... 2
WARING NUMBER...................... 31
ELEVATION (M)...................... 2588
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ FOSSIL TRAVERTINE AND SINTER
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 48 TO 57
DISCHARGE (L/MIN).................. 245
ROCK TYPES: TERTIARY TUFFS AND VOLCANICS

CHEMISTRY

SAMPLE SOURCE.... BARRETT AND PEARL, 1976 (4UR RANCH SPRING)
FLOW (L/MIN)..... 100
COLLECTION DATE.. 1976/04/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
57	84	66	15	490	48	1020		200	200

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.6	2.6	6.7				

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	188
NA-K-CA (4/3)	154
NA-K	181
SILICA	
ADIABATIC	125
CONDUCTIVE	128
CHALCEDONY	100
CRISTOBALITE	77
OPAL	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	86 (J)	128 (A)	100 (D)	105	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.81 STD. DEV. = 0.24

COMMENTS: ANALYSIS FOR 4UR RANCH SPRING. ASSOCIATED WITH FLUORITE DEPOSITS. GEOTHERMOMETERS MAY BE UNRELIABLE BECAUSE OF HIGH CO2 CONTENT.

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

WAGON WHEEL GAP HOT SPRINGS , COLORADO

FIELD NAME................. SAND DUNES SWIMMING POOL WELL
CIRCULAR REFERENCE........ 080

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... ALAMOSA
LATITUDE.................. 37-46.7 N
LONGITUDE................. 105-51.3 W
MAPS...................... DEADMAN CAMP 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
41N	10E	27	NE OF NE	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)...................... 2375
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING.
WELL DEPTHS (M).................... 1342
ROCK TYPES: ALLUVIUM OF SAN LUIS VALLEY
GEOPHYSICS: REGIONAL GRAVITY, REGIONAL HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976
COLLECTION DATE.. 1975/08/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
44	120	3.2	0.4	81	8.6	176		23	4.7

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.7	0.51	8.3			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	187
NA-K-CA (4/3)	140
NA-K	191
SILICA	
ADIABATIC	141
CONDUCTIVE	148
CHALCEDONY	122
CRISTOBALITE	97
OPAL	26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	122 (D)	152 (J)	148 (A)	141	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.0	2.0	1.5		
THICKNESS (KM)	1.0	2.0	1.5	1.5	0.2
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)........... 3.0 STD. DEV. = 0.7
THERMAL ENERGY(10**18 J). 1.02 STD. DEV. = 0.26

COMMENTS: CHALCEDONY TEMPERATURE COMPARES FAVORABLY TO BOTTOM HOLE TEMPERATURE FOR MAPCO STATE WELL 16 KM TO THE SOUTHEAST. THERMAL WATERS BELIEVED TO BE FAULT CONTROLLED IN AREA OF ABOVE-NORMAL HEAT FLOW. AREA MAY BE LARGER.

REFERENCES: BARRETT AND PEARL, 1976, 1978; REITER, 1975

COMPILED BY: MARINER, R. AND BROOK, C.

SAND DUNES SWIMMING POOL WELL , COLORADO

FIELD NAME................. MAPCO STATE WELL 1-32
CIRCULAR REFERENCE........ 081

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... ALAMOSA
LATITUDE.................. 37-40.2 N
LONGITUDE................. 105-40.0 W
MAPS...................... MEDANO RANCH 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
40N	12E	32	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)....................... 2375
SURFACE ACTIVITY.................... NONE, FOUND BY DRILLING
NO. OF WELLS........................ 1
WELL DEPTHS (M)..................... 2890
MAXIMUM WELL TEMP (C)............... 128 AT DEPTH (M) 2890
ROCK TYPES: ALLUVIUM OF SAN LUIS VALLEY
GEOPHYSICS: REGIONAL GRAVITY, REGIONAL HEAT FLOW

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90	135	128 (M)	118	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	2.0	3.0	2.5		
THICKNESS (KM)	0.5	1.0	1.0	0.8	0.1
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 1.7 STD. DEV. = 0.4
THERMAL ENERGY(10**18 J). 0.46 STD. DEV. = 0.12

COMMENTS: MINIMUM AND MAXIMUM TEMPERATURES CALCULATED FOR 2 AND 3 KM DEPTHS, RESPECTIVELY, ASSUMING A CONSTANT GEOTHERMAL GRADIENT OF 45 C/KM. AREA MAY BE LARGER.

REFERENCES: BARRETT AND PEARL, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

MAPCO STATE WELL 1-32 , COLORADO

FIELD NAME................ SPLASHLAND HOT WATER WELL
CIRCULAR REFERENCE........ 082

GEOGRAPHIC LOCALITY
STATE..................... COLORADO
COUNTY.................... ALAMOSA
LATITUDE.................. 37-29.3 N
LONGITUDE................. 105-51.4 W
MAPS...................... ALAMOSA EAST 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38N	10E	34	SE OF SE	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)...................... 2375
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING.
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 610
ROCK TYPES: ALLUVIUM OF THESAN LUIS VALLEY
GEOPHYSICS: REGIONAL GRAVITY, REGIONAL HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... BARRETT AND PEARL, 1976
COLLECTION DATE.. 1975/08/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
40	110	4.1	0.4	72	9.9	151		29	6.4

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O	
4.2	0.34	8.3							

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	197
NA-K-CA (4/3)...........	137
NA-K....................	224

SILICA

ADIABATIC...............	137
CONDUCTIVE..............	143
CHALCEDONY..............	116
CRISTOBALITE............	92
OPAL....................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	116 (D)	165 (J)	143 (A)	141	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.0	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.14 STD. DEV. = 0.33

COMMENTS: SYSTEM IS PROBABLY SIMILAR TO THE ONE AT SAND DUNES SWIMMING POOL.

REFERENCES: BARRETT AND PEARL, 1976, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

SPLASHLAND HOT WATER WELL , COLORADO

Hawaii

FIELD NAME................. STEAMING FLATS (SULPHUR BANK) AREA
CIRCULAR REFERENCE........ 083

GEOGRAPHIC LOCALITY
STATE..................... HAWAII
COUNTY.................... HAWAII
LATITUDE.................. 19-26.5 N
LONGITUDE................. 155-16.0 W
MAPS...................... KILAUEA CRATER 1:24,000

GENERAL INFORMATION
WARING FIGURE...................... 10
WARING NUMBER...................... 4
AREA OF SURFACE EXPRESSION (KM**2). 5
ELEVATION (M)...................... 1208
SURFACE ACTIVITY................... FUMAROLES
SPRING TEMPERATURES (C)............ 97
ROCK TYPES: BASALT

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (0)	240 (0)	150 (0)	163	29

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.33 STD. DEV. = 0.46

COMMENTS: SYSTEM MAY BE HOTTER AND MORE EXTENSIVE

REFERENCES: WARING, 1965; WHITE AND WARING, 1963; PETERSON, 1967; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

STEAMING FLATS (SULPHUR BANK) AREA, HAWAII

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FIELD NAME................ KAMAILI HOMESTEADS (1955 ERUPTION) AREA
KGRA OR OTHER NAME........ EAST RIFT
CIRCULAR REFERENCE........ 084

   GEOGRAPHIC LOCALITY
      STATE..................... HAWAII
      COUNTY.................... HAWAII
      LATITUDE.................. 19-26.5  N
      LONGITUDE................. 154-57.0  W
      MAPS...................... PAHOA SOUTH 1:24,000

   GENERAL INFORMATION
      ELEVATION (M)..................... 300
      SURFACE ACTIVITY.................. AREA OF RECENT LAVA ERUPTIONS
      NO. OF WELLS...................... 3
      WELL DEPTHS (M)................... 56      TO 211
      MAXIMUM WELL TEMP (C)............. 113     AT DEPTH (M) 211
      ROCK TYPES: BASALT
      GEOPHYSICS:  RESISTIVITY, GRAVITY, MAGNETIC, MICROEARTHQUAKE, GROUND-NOISE
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RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	240	290	290	273	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.7	1.5	1.0		
THICKNESS (KM)	0.5	2.0	1.4	1.3	0.3
SUBSURFACE AREA (KM**2)	2	15	5	7.3	2.8

BASED ON: GRAVITY ANOMALY AND RESISTIVITY LOW

VOLUME (KM**3)........... 9.5 STD. DEV. = 4.3
THERMAL ENERGY(10**18 J). 6.65 STD. DEV. = 3.05

COMMENTS: LOCATED ABOUT 6 KM SOUTHWEST OF KAPOHO RESERVOIR AREA. NO SURFACE EXPRESSION. NO WATER CHEMISTRY. AREA IDENTIFIED BY GEOPHYSICAL ANOMALIES AND MAY BE SIMILAR TO KAPOHO RESERVOIR. DEPTH OF GRAVITY ANOMALY OCCURS AT 1 KM. ZONE OF LOW RESISTIVITY OCCURS BETWEEN 0.7 KM AND 2.1 KM, PROPOSED TO BE A SELF-SEALED SYSTEM.

REFERENCES: FURUMOTO, 1976; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

KAMAILI HOMESTEADS (1955 ERUPTION) AREA , HAWAII

FIELD NAME................. KAPOHO RESERVOIR (PUULENA AREA)
KGRA OR OTHER NAME........ WELL HGP-A
CIRCULAR REFERENCE........ 085

GEOGRAPHIC LOCALITY
STATE..................... HAWAII
COUNTY.................... HAWAII
LATITUDE.................. 19-28.5 N
LONGITUDE................. 154-53.8 W
MAPS...................... PAHOA SOUTH 1:24,000

GENERAL INFORMATION
ELEVATION (M)..................... 185
SURFACE ACTIVITY.................. AREA OF RECENT LAVA ERUPTIONS
NO. OF WELLS...................... 2
WELL DEPTHS (M)................... 200 TO 1967
MAXIMUM WELL TEMP (C)............. 358 AT DEPTH (M) 1967
ROCK TYPES: BASALT
GEOPHYSICS: RESISTIVITY, GRAVITY, MAGNETIC, MICROEARTHQUAKE, GROUND-NOISE

CHEMISTRY
SAMPLE SOURCE.... KIHARA AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
146-153	420	40	1	600	123				925

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		LT 5			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	244
NA-K-CA (4/3)...........	231
NA-K....................	286
SILICA	
ADIABATIC...............	214
CONDUCTIVE..............	237
CHALCEDONY..............	226
CRISTOBALITE............	191
OPAL....................	112

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	244 (I)	290 (M)	290 (M)	275	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	2.2	2.5	2.2		
THICKNESS (KM)	0.5	1.8	0.5	0.9	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: RESISTIVITY LOW					

VOLUME (KM**3)...........	1.9	STD. DEV. = 0.7
THERMAL ENERGY(10**18 J).	1.31	STD. DEV. = 0.52

COMMENTS: TEMPERATURE CURVE INDICATES THAT THE MAXIMUM TEMPERATURE OF 358 DEG C AT 1967 M (TD) IS IN A ZONE OF CONDUCTIVE HEAT FLOW. THE CURVE IS ISOTHERMAL BETWEEN 1220 M AND 1769 M; THIS INTERVAL IS CONSIDERED AS THE RESERVOIR.

REFERENCES: FURUMOTO, 1976, 1978; KIHARA AND OTHERS, 1977; CHEN AND OTHERS, 1978

COMPILED BY: BROOK, C.

KAPOHO RESERVOIR (PUULENA AREA) , HAWAII

Idaho

FIELD NAME................ RED RIVER HOT SPRINGS
CIRCULAR REFERENCE........ 086

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... IDAHO
LATITUDE................... 45-47.2 N
LONGITUDE.................. 115-11.9 W
MAPS....................... SABLE HILL 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
28N	10E	03	SE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 10
ELEVATION (M)...................... 1585
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER (?)
NO. OF SPRINGS..................... 9
SPRING TEMPERATURES (C)............ 37 TO 55
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 132
COLLECTION DATE.. 1972/08/21

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	76	2.7	0	81	1.6	36	36	44	4.4

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
23		8.6				

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GEOTHERMOMETERS (C)
   CATION
     NA-K-CA (1/3)...........  110
     NA-K-CA (4/3)...........   80
     NA-K....................   50
   SILICA
     ADIABATIC...............  120
     CONDUCTIVE..............  122
     CHALCEDONY..............   94
     CRISTOBALITE............   72
     OPAL....................    4

RESERVOIR PROPERTIES         MINIMUM       MAXIMUM       MOST LIKELY       MEAN         STD. DEV.
   SUBSURFACE TEMP (C)       80 (I)        112 (B)       83 (E)             92            7

                         UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT
       A) QUARTZ CONDUCTIVE                F) CRISTOBALITE                    K) SULFATE GEOTHERMOMETER
       B) QUARTZ CONDUCTIVE, PH-CORRECTED  G) AMORPHOUS SILICA                L) SURFACE TEMPERATURE
       C) QUARTZ ADIABATIC                 H) NA-K                            M) WELL TEMPERATURE
       D) CHALCEDONY                       I) NA-K-CA                         N) MIXING MODEL
       E) CHALCEDONY, PH-CORRECTED         J) NA-K-CA, MG-CORRECTED           O) RENNER AND OTHERS, 1976

                             MINIMUM       MAXIMUM       MOST LIKELY       MEAN         STD. DEV.
   DEPTH TO TOP (KM)         0.5           2.0           1.5
   THICKNESS (KM)            1.0           2.5           1.5               1.7          0.3
   SUBSURFACE AREA (KM**2)   1             3             2                 2.0          0.4
      BASED ON:  STANDARD ESTIMATE

   VOLUME (KM**3)...........  3.3          STD. DEV. =  0.9
   THERMAL ENERGY(10**18 J).  0.69         STD. DEV. =  0.20

COMMENTS:  A VERY DILUTE, HIGH PH WATER.

REFERENCES:  YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

RED RIVER HOT SPRINGS , IDAHO
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FIELD NAME................ RIGGINS HOT SPRINGS
CIRCULAR REFERENCE........ 087

GEOGRAPHIC LOCALITY
STATE.................... IDAHO
COUNTY................... IDAHO
LATITUDE................. 45-25.0 N
LONGITUDE................ 116-10.2 W
MAPS..................... RIGGINS HOT SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
24N	02E	14	SW OF NE OF SE	BOISE

GENERAL INFORMATION
WARING FIGURE..................... 4
WARING NUMBER..................... 13
ELEVATION (M)..................... 610
SURFACE ACTIVITY.................. HOT SPRINGS
ASSOCIATED DEPOSITS............... TRAVERTINE
NO. OF SPRINGS.................... 4
DISCHARGE (L/MIN)................. 190
ROCK TYPES: ALLUVIUM OVERLYING PALEOZOIC AND MESOZOIC GNEISSES

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 190
COLLECTION DATE.. 1972/08/01

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
42	72	6.2	0.1	160	3.4	11	25	300	8

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.1		8.6			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	116
NA-K-CA (4/3)	95
NA-K	54

SILICA

ADIABATIC	118
CONDUCTIVE	120
CHALCEDONY	91
CRISTOBALITE	69
OPAL	1

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	91 (D)	120 (A)	95 (I)	102	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.78 STD. DEV. = 0.23

REFERENCES: YOUNG AND MITCHELL, 1973; HAMILTON, 1969

COMPILED BY: MARINER, R.

RIGGINS HOT SPRINGS , IDAHO

FIELD NAME................ KRIGBAUM HOT SPRINGS
CIRCULAR REFERENCE........ 088

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... ADAMS
LATITUDE.................. 44-58.1 N
LONGITUDE................. 116-11.4 W
MAPS...................... BAKER 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
19N	02E	22	SW OF NE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 17
ELEVATION (M)...................... 1433
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 40 TO 43
DISCHARGE (L/MIN).................. 151
ROCK TYPES: CRETACEOUS GRANITE NEAR MIOCENE BASALT

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 80
COLLECTION DATE.. 1972/06/29

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
43	73	5.3	0.2	140	3.3	81	9	190	26

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.8		8.8			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	120
NA-K-CA (4/3)	96
NA-K	61
SILICA	
ADIABATIC	118
CONDUCTIVE	120
CHALCEDONY	92
CRISTOBALITE	70
OPAL	2

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	92 (D)	120 (A)	96 (I)	103	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. =	0.9
THERMAL ENERGY(10**18 J).	0.79	STD. DEV. =	0.23

REFERENCES: YOUNG AND MITCHELL, 1973; WARING, 1965

COMPILED BY: MARINER, R.

KRIGBAUM HOT SPRINGS, IDAHO

FIELD NAME................ WHITE LICKS HOT SPRINGS
CIRCULAR REFERENCE........ 089

GEOGRAPHIC LOCALITY
STATE.................... IDAHO
COUNTY................... ADAMS
LATITUDE................. 44-40.9 N
LONGITUDE................ 116-13.8 W
MAPS..................... CASCADE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16N	02E	33	SW OF NW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 19
ELEVATION (M)...................... 1484
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... NUMEROUS
SPRING TEMPERATURES (C)............ 63 TO 67
DISCHARGE (L/MIN).................. 115
ROCK TYPES: MIOCENE BASALT AND CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
67	105	39	LT 0.1	390	16	71		630	150

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.8		7.82	-4.24	-15.25	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	144
NA-K-CA (4/3)...........	118
NA-K....................	99
SILICA	
ADIABATIC...............	135
CONDUCTIVE..............	140
CHALCEDONY..............	114
CRISTOBALITE............	89
OPAL....................	19
SULFATE	
CONDUCTIVE..............	162
ONE-STEP STEAM LOSS.....	148
CONTINUOUS STEAM LOSS..	151

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	114 (D)	162 (K)	140 (A)	139	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.11 STD. DEV. = 0.32

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C., MARINER, R.

WHITE LICKS HOT SPRINGS , IDAHO

FIELD NAME................ VULCAN HOT SPRINGS
KGRA OR OTHER NAME........ VULCAN HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 090

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... VALLEY
LATITUDE................... 44-34.0 N
LONGITUDE.................. 115-41.5 W
MAPS....................... WARM LAKE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
14N	06E	11	SE OF NW	BOISE

GENERAL INFORMATION
WARING FIGURE........................ 4
WARING NUMBER........................ 32
ELEVATION (M)........................ 1707
SURFACE ACTIVITY..................... HOT SPRINGS
ASSOCIATED DEPOSITS.................. SINTER
NO. OF SPRINGS....................... 13
SPRING TEMPERATURES (C).............. 84 (?) TO 87
DISCHARGE (L/MIN).................... 1900
ROCK TYPES: CRETACEOUS GRANITE WITH PEGMATITE VEINS

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/07

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
87	105	1.6		99	3.3	123		35	15

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
23	0.13	8.81		+3.44		-18.79		

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	138
NA-K-CA (4/3)	122
NA-K	84
SILICA	
ADIABATIC	135
CONDUCTIVE	140
CHALCEDONY	114
CRISTOBALITE	89
OPAL	19
SULFATE	
CONDUCTIVE	56
ONE-STEP STEAM LOSS	58
CONTINUOUS STEAM LOSS	59

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (L)	140 (A)	138 (I)	122	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.96 STD. DEV. = 0.29

COMMENTS: PH-CORRECTED CHALCEDONY INDICATES 86 C; PH-CORRECTED QUARTZ 114 C. ESTIMATED AQUIFER TEMPERATURES ARE PROBABLY TOO HIGH. SO4-ISOTOPE GEOTHERMOMETER INDICATES LESS THAN THE SPRING TEMPERATURE. LOSS OF ONLY 1.6 MG/L CA WOULD HAVE INCREASED THE NA-K-CA GEOTHERMOMETER FROM 100 TO 138 C, IMPLYING POSSIBLE CALCITE PRECIPITATION IN THE SUBSURFACE.

REFERENCES: WARING, 1965; YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

VULCAN HOT SPRINGS, IDAHO

FIELD NAME................ CABARTON HOT SPRINGS
CIRCULAR REFERENCE........ 091

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... VALLEY
LATITUDE.................. 44-25.0 N
LONGITUDE................. 116-01.7 W
MAPS...................... SMITHS FERRY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
13N	04E	31	NE OF SW	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1438
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... NUMEROUS
SPRING TEMPERATURES (C)............ 56 TO 70.5
DISCHARGE (L/MIN).................. 265
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/08/03

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
70.5	78	1.7	0	100	1.9	70	26	46	49

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
11		7.7			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	114
NA-K-CA (4/3)	99
NA-K	48

SILICA

ADIABATIC	121
CONDUCTIVE	124
CHALCEDONY	96
CRISTOBALITE	73
OPAL	5

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (D)	124 (A)	99 (I)	106	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.82 STD. DEV. = 0.24

COMMENTS: A VERY DILUTE WATER. LOSS OF SEVERAL MG/L CALCIUM COULD BE INCREASING THE TEMPERATURE ESTIMATED FROM THE NA-K-CA GEOTHERMOMETER.

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

CABARTON HOT SPRINGS, IDAHO

FIELD NAME................ BOILING SPRINGS
CIRCULAR REFERENCE........ 092

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... VALLEY
LATITUDE................... 44-21.9 N
LONGITUDE.................. 115-51.4 W
MAPS....................... BOILING SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
12N	05E	22	NW OF NW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 38
ELEVATION (M)...................... 1234
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, MINOR CARBONATE
NO. OF SPRINGS..................... SEVERAL IN 3 MAIN GROUPS
SPRING TEMPERATURES (C)............ 80 TO 86
DISCHARGE (L/MIN).................. 624
ROCK TYPES: CRETACEOUS GRANITE WITH PEGMATITE VEINS

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/08

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
86	86	1.4		74	1.9	126		110	14

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
13	0.09	8.70	+0.30	-17.76	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	100
NA-K....................	66
SILICA	
ADIABATIC...............	126
CONDUCTIVE..............	129
CHALCEDONY..............	101
CRISTOBALITE............	78
OPAL....................	10
SULFATE	
CONDUCTIVE..............	86
ONE-STEP STEAM LOSS.....	86
CONTINUOUS STEAM LOSS...	86

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	86 (L,K)	112 (B)	100 (I)	99	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.76 STD. DEV. = 0.22

COMMENTS: CHALCEDONY WITH PH-CORRECTION INDICATES 83 C. REPORTED DEPOSITION OF ZEOLITES, CALCITE, AND MERCURY MINERALS.

REFERENCES: WARING, 1965; DICKSON AND TUNELL, 1968; YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R, BROOK, C.

BOILING SPRINGS , IDAHO

FIELD NAME................ CRANE CREEK - COVE CREEK AREA
KGRA OR OTHER NAME........ CRANE CREEK KGRA
CIRCULAR REFERENCE........ 093

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... WASHINGTON
LATITUDE.................. 44-18.3 N
LONGITUDE................. 116-44.7 W
MAPS...................... CRANE CREEK RESERVOIR 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
11N	03W	07	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 732
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER AND TRAVERTINE
NO. OF SPRINGS..................... ABOUT 4 IN 2 GROUPS 11 KM APART
SPRING TEMPERATURES (C)............ 57 TO 92
DISCHARGE (L/MIN).................. 220
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 550 TO 610
ROCK TYPES: TERTIARY BASALT AND FLUVIAL DEPOSITS
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND WHITEHEAD, 1975
FLOW (L/MIN)..... 17
COLLECTION DATE.. 1973/08/02

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
92	180	29	0.5	280	18	201		250	200

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.8	-7.99	-14.39	-150

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	163
NA-K-CA (4/3)	126
NA-K	137
SILICA	
ADIABATIC	162
CONDUCTIVE	173
CHALCEDONY	151
CRISTOBALITE	123
OPAL	50
SULFATE	
CONDUCTIVE	249
ONE-STEP STEAM LOSS	218
CONTINUOUS STEAM LOSS	226

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	151 (D)	200	163 (I)	171	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	5	50	15	23.3	9.6

BASED ON: SPRING DISTRIBUTION, AREA OF ALTERATION, AMT SURVEY

VOLUME (KM**3)	38.9	STD. DEV. = 17.9
THERMAL ENERGY(10**18 J)	16.41	STD. DEV. = 7.65

COMMENTS: SPRINGS AT CRANE CREEK AND COVE CREEK HAVE SIMILAR CHEMISTRY AND ARE IN A ZONE OF ALTERATION AND MERCURY MINERALIZATION. SPRINGS ARE ABOUT 11 KM APART AND MAY BE SEPARATE SYSTEMS AS REFLECTED BY MINIMUM AREA ESTIMATE.

REFERENCES: YOUNG AND WHITEHEAD, 1975A; RIGHTMIRE AND OTHERS, 1976

COMPILED BY: MARINER, R., BROOK, C.

CRANE CREEK - COVE CREEK AREA , IDAHO

FIELD NAME................ WEISER AREA
CIRCULAR REFERENCE........ 094

GEOGRAPHIC LOCALITY
STATE.................... IDAHO
COUNTY................... WASHINGTON
LATITUDE................. 44-17.9 N
LONGITUDE................ 117-02.9 W
MAPS..................... OLDS FERRY SE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
11N	06W	10	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 21
ELEVATION (M)...................... 671
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 25 TO 77
DISCHARGE (L/MIN).................. 20
NO. OF WELLS....................... 6 SHALLOW WELLS
WELL DEPTHS (M).................... 28 TO 183
MAXIMUM WELL TEMP (C).............. 77 AT DEPTH (M) 31
ROCK TYPES: PLEISTOCENE AND PLIOCENE FLUVIAL AND LAKE DEPOSITS
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, GROUND TEMPERATURE

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND WHITEHEAD, 1975
COLLECTION DATE.. 1972/08/02

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
70.5	140	2.9		140	5.0	35	38	150	56

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O	
3.3		9.3				-13.4		-149	

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	142
NA-K-CA (4/3)...........	127
NA-K....................	89

SILICA

ADIABATIC...............	149
CONDUCTIVE..............	157
CHALCEDONY..............	133
CRISTOBALITE............	107
OPAL....................	35

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (E)	157 (A)	142 (I)	130	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	5	2	2.7	0.8

BASED ON: SPRING AND WELL DISTRIBUTION, GROUND TEMPERATURE ANOMALY

VOLUME (KM**3)........... 4.4 STD. DEV. = 1.7
THERMAL ENERGY(10**18 J). 1.38 STD. DEV. = 0.55

COMMENTS: SULFATE ISOTOPE GEOTHERMOMETER ON SEVERAL SAMPLES RANGE FROM 219 TO 235 C. ISOTOPIC DATA FROM RIGHTMIRE AND OTHERS (1976).

REFERENCES: YOUNG AND WHITEHEAD, 1975A; RIGHTMIRE AND OTHERS, 1976

COMPILED BY: MARINER, R., BROOK, C.

WEISER AREA , IDAHO

FIELD NAME................ ROYSTONE HOT SPRINGS
CIRCULAR REFERENCE........ 095

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... GEM
LATITUDE.................. 43-57.2 N
LONGITUDE................. 116-21.2 W
MAPS...................... MONTOUR 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
07N	01E	08	NE OF SE OF SE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 66
ELEVATION (M)...................... 768
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 45 TO 55
DISCHARGE (L/MIN).................. 76
ROCK TYPES: ALLUVIUM NEAR MIOCENE BASALT, OVERLYING CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 76
COLLECTION DATE.. 1972/11/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	120	8.7	0.6	160	7.7	187		110	62

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
16		7.5			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	150
NA-K-CA (4/3)..........	117
NA-K..................	112
SILICA	
ADIABATIC.............	141
CONDUCTIVE............	148
CHALCEDONY............	122
CRISTOBALITE..........	97
OPAL..................	26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	122 (D)	148 (A)	135 (J)	135	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.08 STD. DEV. = 0.31

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

ROYSTONE HOT SPRINGS, IDAHO

FIELD NAME................. BONNEVILLE HOT SPRINGS
CIRCULAR REFERENCE........ 096

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... BOISE
LATITUDE................... 44-09.5 N
LONGITUDE.................. 115-18.4 W
MAPS....................... CHALLIS 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
10N	10E	31	SW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 80
ELEVATION (M)...................... 1585
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE
NO. OF SPRINGS..................... 8
SPRING TEMPERATURES (C)............ 68 TO 85
DISCHARGE (L/MIN).................. 1370
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/05

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
85	99	1.9		81	2.8	101		46	7.6

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
17	0.06	9.32	-1.01	-18.46	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	136
NA-K-CA (4/3)..........	108
NA-K..................	86
SILICA	
ADIABATIC.............	132
CONDUCTIVE............	137
CHALCEDONY............	110
CRISTOBALITE..........	86
OPAL..................	16
SULFATE	
CONDUCTIVE............	91
ONE-STEP STEAM LOSS....	90
CONTINUOUS STEAM LOSS..	90

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (B)	136 (A,I)	91 (K)	105	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)..........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.81	STD. DEV. = 0.25

COMMENTS: CALCITE MAY BE PRECIPITATING IN THE SUBSURFACE; IF THE CALCIUM CONCENTRATION IS DOUBLED, THE NA-K-CA GEOTHERMOMETER WOULD GIVE 91 C.

REFERENCES: YOUNG AND MITCHELL, 1973; WARING, 1965

COMPILED BY: MARINER, R.

BONNEVILLE HOT SPRINGS, IDAHO

FIELD NAME................ PAYETTE RIVER AREA NEAR BANKS
CIRCULAR REFERENCE........ 097

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... BOISE
LATITUDE.................. 44-05.1 N
LONGITUDE................. 116-03.0 W
MAPS...................... BANKS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
09N	03E	25	NE OF NW	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1158
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 78.5
DISCHARGE (L/MIN).................. 76
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/08

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
78.5	101	4.5	0.01	130	5.2	167		77	35

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12	0.25	8.03			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	143
NA-K-CA (4/3)	116
NA-K	97

SILICA

ADIABATIC	133
CONDUCTIVE	138
CHALCEDONY	111
CRISTOBALITE	87
OPAL	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	111 (D)	143 (I)	138 (A)	131	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.04 STD. DEV. = 0.30

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R., BROOK, C.

PAYETTE RIVER AREA NEAR BANKS , IDAHO

FIELD NAME................ NEINMEYER HOT SPRINGS
CIRCULAR REFERENCE........ 098

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... ELMORE
LATITUDE................... 43-45.5 N
LONGITUDE.................. 115-34.7 W
MAPS....................... BARBER FLAT 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
05N	07E	24	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 116
ELEVATION (M)...................... 1158
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... 13
SPRING TEMPERATURES (C)............ 68 TO 76
DISCHARGE (L/MIN).................. 1320
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/06

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
75	100	1.5		62	1.6	106		28	2

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
10	0.03	9.35	-1.12	-18.35	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	121
NA-K-CA (4/3)	90
NA-K	66
SILICA	
ADIABATIC	133
CONDUCTIVE	137
CHALCEDONY	110
CRISTOBALITE	87
OPAL	17
SULFATE	
CONDUCTIVE	93
ONE-STEP STEAM LOSS	91
CONTINUOUS STEAM LOSS	91

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I)	100	93 (K)	94	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.71 STD. DEV. = 0.20

COMMENTS: PH-CORRECTED QUARTZ = 85 C. PROBABLY A DEEP CIRCULATING WATER WITH AN AQUIFER TEMPERATURE NEAR 90 C.

REFERENCES: YOUNG AND MITCHELL, 1973; WARING, 1965

COMPILED BY: MARINER, R.

NEINMEYER HOT SPRINGS , IDAHO

FIELD NAME................ LATTY HOT SPRINGS
CIRCULAR REFERENCE........ 099

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... ELMORE
LATITUDE................... 43-07.0 N
LONGITUDE.................. 115-18.3 W
MAPS....................... BENNETT MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
03S	10E	31	NW OF SE OF SE	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1189
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 55
ROCK TYPES: PLEISTOCENE BASALTS; VITRIC TUFFS

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/07/05

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	100	0.4		54	1.7	90	33	10	2.7

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7		8.4			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	137
NA-K-CA (4/3)...........	124
NA-K..................	80
SILICA	
ADIABATIC..............	133
CONDUCTIVE.............	137
CHALCEDONY.............	110
CRISTOBALITE...........	87
OPAL..................	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	110 (D)	137 (A,I)	125	124	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.98 STD. DEV. = 0.28

COMMENTS: PH-CORRECTION ON THE SILICA WOULD REDUCE THESE ESTIMATES 8 C. A VERY DILUTE WATER IN WHICH THE CHEMICAL GEOTHERMOMETERS MAY NOT BE VALID.

REFERENCES: YOUNG AND MITCHELL, 1973; MALDE AND OTHERS, 1963

COMPILED BY: MARINER, R.

LATTY HOT SPRINGS , IDAHO

FIELD NAME................ RADIO TOWERS AREA
CIRCULAR REFERENCE........ 100

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... ELMORE
LATITUDE.................. 43-02.2 N
LONGITUDE................. 115-27.4 W
MAPS...................... BENNETT MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04S	08E	36	NE OF NW OF NW	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 968
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING
DISCHARGE (L/MIN).................. 30
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 580
ROCK TYPES: PLIOCENE AND PLEISTOCENE SEDIMENTS

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 30
COLLECTION DATE.. 1972/06/06

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
38	86	3.2	0.2	160	3.7	447		5.4	10

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3		7.8			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	114
NA-K....................	59
SILICA	
ADIABATIC...............	126
CONDUCTIVE..............	129
CHALCEDONY..............	101
CRISTOBALITE............	78
OPAL....................	10

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	101 (D)	150	124 (I)	125	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.99 STD. DEV. = 0.29

COMMENTS: A VERY DILUTE WATER; GEOTHERMOMETERS MAY BE UNRELIABLE. GEOTHERMAL TEST WELL ABOUT 0.5 KM NORTH HAD A MAXIMUM TEMPERATURE OF 189 C AT 2.7 KM.

REFERENCES: YOUNG AND MITCHELL, 1973; RALSTON AND CHAPMAN, 1968

COMPILED BY: MARINER, R. AND BROOK, C.

RADIO TOWERS AREA , IDAHO

FIELD NAME................ GRAVEL PITS AREA
CIRCULAR REFERENCE........ 101

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... ELMORE
LATITUDE................... 42-56.3 N
LONGITUDE.................. 115-29.6 W
MAPS....................... HAMMETT 1:24,000; GLENNS FERRY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05S	08E	34	SE	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 762
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING
ASSOCIATED DEPOSITS................ TRAVERTINE
SPRING TEMPERATURES (C)............ 34
DISCHARGE (L/MIN).................. 7.6
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 403
ROCK TYPES: PLIOCENE AND PLEISTOCENE SEDIMENTS

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 8
COLLECTION DATE.. 1972/07/05

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
34	58	9.1	1	320	11	797		6.5	59

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.2		7.7			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	144
NA-K-CA (4/3)	141
NA-K	86

SILICA

ADIABATIC	109
CONDUCTIVE	109
CHALCEDONY	79
CRISTOBALITE	58
OPAL	-8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	79 (D)	120 (J)	109 (A)	103	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J)	0.79	STD. DEV. = 0.23

COMMENTS: CHEMICAL GEOTHERMOMETERS QUESTIONABLE BECAUSE OF THE LOW FLOW-RATE.

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

GRAVEL PITS AREA, IDAHO

FIELD NAME................ BRUNEAU-GRAND VIEW AREA
KGRA OR OTHER NAME........ BRUNEAU KGRA, CASTLE CREEK KGRA
CIRCULAR REFERENCE........ 102

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... OWYHEE
LATITUDE.................. 42-56.0 N
LONGITUDE................. 115-56.0 W
MAPS...................... HOT SPRINGS, JACKASS BUTTE, LITTLE VALLEY, SUGAR VALLEY, BRUNEAU, GRANDVIEW 1:24,000; BRUNEAU, GRAND VIEW, BIG FOOT BUTTE, INDIAN COVE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
06S	04E		BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 160-169
ELEVATION (M)...................... 808
SURFACE ACTIVITY................... HOT SPRINGS AND WELLS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 11 TO 41
DISCHARGE (L/MIN).................. 10,000 (COMBINED SPRING AND WELL DISCHARGE)
NO. OF WELLS....................... MORE THAN 80
WELL DEPTHS (M).................... 46 TO 3000
MAXIMUM WELL TEMP (C).............. 83 AT DEPTH (M) WELL HEAD
ROCK TYPES: LACUSTRINE AND FLUVIAL TUFFACEOUS SEDIMENTS, SILICIC AND BASALTIC VOLCANIC ROCKS
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, AMT

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND WHITEHEAD, 1975
COLLECTION DATE.. 1973/06/07

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
83	110	2.1	0	110	1.7	22	64	62	15

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
15		9.3		-17.5	-146

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	106
NA-K-CA (4/3)	91
NA-K	36

SILICA

ADIABATIC	137
CONDUCTIVE	143
CHALCEDONY	116
CRISTOBALITE	92
OPAL	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I,E)	120	110	107	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.9	2.0	2.0		
THICKNESS (KM)	1.0	1.7	1.0	1.2	0.2
SUBSURFACE AREA (KM**2)	1000	2250	1200	1483.3	274.1

BASED ON: WELL DISTRIBUTION, ESTIMATE OF RENNER ET AL (1976), AND AMT SURVEY

VOLUME (KM**3)............ 1829.4 STD. DEV. = 419.8
THERMAL ENERGY(10**18 J). 452.79 STD. DEV. = 108.60

COMMENTS: SEVERAL WATER WELLS 300 TO 1000 M DEEP USED FOR IRRIGATION. TWO DEEP TEST WELLS TO 3 KM. MAY BE A STACKED SYSTEM. SULFATE-ISOTOPE GEOTHERMOMETER FOR 6 SAMPLES GIVES 95 TO 131 C.

REFERENCES: YOUNG AND WHITEHEAD, 1975B; RIGHTMIRE AND OTHERS, 1976; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R. AND BROOK, C.

BRUNEAU-GRAND VIEW AREA , IDAHO

FIELD NAME................ MURPHY HOT SPRINGS
KGRA OR OTHER NAME........ KITTY'S HOT HOLE
CIRCULAR REFERENCE........ 103

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... OWYHEE
LATITUDE................... 42-01.8 N
LONGITUDE.................. 115-22.0 W
MAPS....................... TWIN FALLS 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16S	09E	24	NW OF NW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 1698
ELEVATION (M)...................... 1554
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2
ROCK TYPES: PLIOCENE SILICIC VOLCANIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 265
COLLECTION DATE.. 1972/05/23

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
51	83	0.6	0	30	2	67	1	4.7	2.3

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.6		7.1			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	160
NA-K-CA (4/3)	112
NA-K	141

SILICA

ADIABATIC	124
CONDUCTIVE	127
CHALCEDONY	99
CRISTOBALITE	76
OPAL	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	51 (L)	160 (I)	99 (D)	103	22

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.79 STD. DEV. = 0.30

COMMENTS: A VERY DILUTE WATER, CHEMICAL GEOTHERMOMETERS MAY BE UNRELIABLE.

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R. AND BROOK, C.

MURPHY HOT SPRINGS, IDAHO

FIELD NAME................. OWL CREEK HOT SPRINGS
CIRCULAR REFERENCE........ 104

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... LEMHI
LATITUDE................... 45-20.5 N
LONGITUDE.................. 114-27.0 W
MAPS....................... SHOUP 1:62,500

GENERAL INFORMATION
ELEVATION (M)....................... 1158
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... 2
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/04

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
50	89	4.4	0.04	120	5	203		53	6.4

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
19	0.1	8.47			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	144
NA-K-CA (4/3)	114
NA-K	100

SILICA

ADIABATIC	127
CONDUCTIVE	131
CHALCEDONY	103
CRISTOBALITE	80
OPAL	11

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	103 (D)	144 (I)	131 (A)	126	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.00 STD. DEV. = 0.29

COMMENTS: PH-CORR. QUARTZ COND. = 122 DEG. C.

REFERENCES: USGS, UNPUB. DATA

COMPILED BY: MARINER, R.

OWL CREEK HOT SPRINGS , IDAHO

FIELD NAME................ BIG CREEK HOT SPRINGS
CIRCULAR REFERENCE........ 105

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... LEMHI
LATITUDE.................. 45-18.8 N
LONGITUDE................. 114-19.2 W
MAPS...................... SHOUP 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
23N	18E	22	SW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 52
ELEVATION (M)...................... 1698
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER AND TRAVERTINE
NO. OF SPRINGS..................... 15
SPRING TEMPERATURES (C)............ 82 TO 93
DISCHARGE (L/MIN).................. 284
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE..... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/04

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
93	140	5.0	0.2	230	16	478		47	29

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
16	0.5	7.45	-4.19	-19.94	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	179
NA-K-CA (4/3)	173
NA-K	145
SILICA	
ADIABATIC	149
CONDUCTIVE	157
CHALCEDONY	133
CRISTOBALITE	107
OPAL	35
SULFATE	
CONDUCTIVE	106
ONE-STEP STEAM LOSS	105
CONTINUOUS STEAM LOSS	105

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	149 (C)	179 (I)	157 (A)	162	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.32 STD. DEV. = 0.37

COMMENTS: SULFATE-ISOTOPE GEOTHERMOMETER INDICATES 105 DEG. C PERHAPS DUE TO OXIDATION OF SULFIDE TO SULFATE PRIOR TO SAMPLE COLLECTION.

REFERENCES: YOUNG AND MITCHELL, 1973; USGS, UNPUB. DATA

COMPILED BY: BROOK, C. AND MARINER, R.

BIG CREEK HOT SPRINGS , IDAHO

FIELD NAME................. SHARKEY HOT SPRINGS
CIRCULAR REFERENCE........ 106

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... LEMHI
LATITUDE................... 45-00.8 N
LONGITUDE.................. 113-36.3 W
MAPS....................... GOLDSTONE MTN. 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
20N	24E	34	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 7
WARING NUMBER...................... 60
ELEVATION (M)...................... 1692
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
SPRING TEMPERATURES (C)............ 63
DISCHARGE (L/MIN).................. 30
ROCK TYPES: OLIGOCENE SILICIC VOLCANIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/05

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
63	94	5.7	0.36	290	16	472		155	53

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
11	1.6	8.16	-3.59	-19.79	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	170
NA-K-CA (4/3)...........	172
NA-K....................	124
SILICA	
ADIABATIC..............	130
CONDUCTIVE.............	134
CHALCEDONY.............	107
CRISTOBALITE...........	83
OPAL...................	14
SULFATE	
CONDUCTIVE.............	102
ONE-STEP STEAM LOSS....	98
CONTINUOUS STEAM LOSS..	98

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	102 (K)	134 (A)	107 (D)	114	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.89 STD. DEV. = 0.26

COMMENTS: MG-CORRECTED NA-K-CA GEOTHERMOMETER GIVES 160 C. SPRING APPEARS TO BE DEPOSITING TRAVERTINE; NA-K-CA GEOTHERMOMETER PROBABLY UNRELIABLE.

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C. AND MARINER, R.

SHARKEY HOT SPRINGS , IDAHO

FIELD NAME................ SUNBEAM HOT SPRINGS
CIRCULAR REFERENCE........ 107

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... CUSTER
LATITUDE................... 44-16.1 N
LONGITUDE.................. 114-44.9 W
MAPS....................... SUNBEAM 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
11N	15E	19	SW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 93
ELEVATION (M)...................... 1823
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE AND SINTER
NO. OF SPRINGS..................... NUMEROUS
SPRING TEMPERATURES (C)............ 65 TO 76
DISCHARGE (L/MIN).................. 1678
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1978/05/05

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
76	88	1.5		89	2.2	130		35	10

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
15	0.19	8.75			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	106
NA-K...................	64

SILICA

ADIABATIC..............	127
CONDUCTIVE.............	130
CHALCEDONY.............	103
CRISTOBALITE...........	80
OPAL...................	11

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	81 (E)	130 (A)	124 (I)	112	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.87 STD. DEV. = 0.26

COMMENTS: PH CORR. QUARTZ = 110 DEG. C; IF 1.5 MG/L CA LOST THEN NA-K-CA REDUCED TO 89 DEG C, SUGGESTING THAT CALCITE MAY BE PRECIPITATING IN THE SUBSURFACE.

REFERENCES: YOUNG AND MITCHELL, 1973; CHOATE, 1962

COMPILED BY: MARINER, R.

SUNBEAM HOT SPRINGS , IDAHO

FIELD NAME................. SLATE CREEK HOT SPRINGS
CIRCULAR REFERENCE........ 108

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... CUSTER
LATITUDE.................. 44-10.1 N
LONGITUDE................. 114-37.4 W
MAPS...................... LIVINGSTON CREEK 1162,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
10N	16E	30	NE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 99
ELEVATION (M)...................... 2146
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 8
SPRING TEMPERATURES (C)............ 32 TO 50
DISCHARGE (L/MIN).................. 700
ROCK TYPES: PALEOZOIC ARGILLITE

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/07/11

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
50	86	8.1	0.1	83	4.5	110		110	7

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
8.7		8.00						

GEOTHERMOMETERS (C)
  CATION
    NA-K-CA (1/3)........... 145
    NA-K-CA (4/3)........... 90
    NA-K.................... 122
  SILICA
    ADIABATIC............... 126
    CONDUCTIVE.............. 129
    CHALCEDONY.............. 101
    CRISTOBALITE............ 78
    OPAL.................... 10

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I)	129 (A)	101 (D)	107	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.82 STD. DEV. = 0.24

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

SLATE CREEK HOT SPRINGS , IDAHO

FIELD NAME................ MAGIC RESERVOIR AREA
KGRA OR OTHER NAME........ LAVA CREEK HOT SPRING
CIRCULAR REFERENCE........ 109

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... BLAINE
LATITUDE.................. 43-19.7 N
LONGITUDE................. 114-23.9 W
MAPS...................... BELLEVUE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
01S	17E	23	NE OF NE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 146
ELEVATION (M)...................... 1465
SURFACE ACTIVITY................... FLOWING WELL
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... NONE
DISCHARGE (L/MIN).................. 20
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 79
ROCK TYPES: TERTIARY RHYOLITIC TUFFS

CHEMISTRY
SAMPLE SOURCE.... MITCHELL, 1976
FLOW (L/MIN)..... 20

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
72	105	20	0.1	321	23	735	0	52	85

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		6.9	-7.85	-16.97	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	174
NA-K-CA (4/3)...........	151
NA-K..................	148
SILICA	
ADIABATIC..............	135
CONDUCTIVE.............	140
CHALCEDONY.............	114
CRISTOBALITE...........	89
OPAL..................	19
SULFATE	
CONDUCTIVE.............	192
ONE-STEP STEAM LOSS....	172
CONTINUOUS STEAM LOSS..	177

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	114 (D)	192 (K)	140 (A)	149	16

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.20 STD. DEV. = 0.37

COMMENTS: ISOTOPES FROM R. MARINER, UNPUB. DATA.

REFERENCES: MITCHELL, 1976A; YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R. AND BROOK, C.

MAGIC RESERVOIR AREA, IDAHO

FIELD NAME................ WORSWICK (WASEWICK) HOT SPRINGS
CIRCULAR REFERENCE........ 110

GEOGRAPHIC LOCALITY

STATE..................... IDAHO
COUNTY.................... CAMAS
LATITUDE.................. 43-33.5 N
LONGITUDE................. 114-47.2 W
MAPS...................... SYDNEY BUTTE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
03N	14E	28	NE OF SW	BOISE

GENERAL INFORMATION

WARING FIGURE...................... 4
WARING NUMBER...................... 136
ELEVATION (M)...................... 1814
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 50 TO 81
DISCHARGE (L/MIN).................. 1764
ROCK TYPES: CRETACEOUS GRANITE

CHEMISTRY

SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 1764
COLLECTION DATE.. 1972/07/10

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
81	96	1.8	0	69	1.9	51	28	35	5

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
15		7.3			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	93
NA-K....................	71
SILICA	
ADIABATIC...............	131
CONDUCTIVE..............	135
CHALCEDONY..............	108
CRISTOBALITE............	84
OPAL....................	15

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	81 (L)	107 (D)	93 (I)	94	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.71 STD. DEV. = 0.20

REFERENCES: WARING, 1965; YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C. AND MARINER, R.

WORSWICK (WASEWICK) HOT SPRINGS , IDAHO

FIELD NAME................ WARDROP HOT SPRINGS
KGRA OR OTHER NAME........ HOT SPRINGS RANCH
CIRCULAR REFERENCE........ 111

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... CAMAS
LATITUDE.................. 43-23.0 N
LONGITUDE................. 114-55.9 W
MAPS...................... FAIRFIELD 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
01N	13E	32	NW OF SW	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 137
ELEVATION (M)...................... 1573
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
DISCHARGE (L/MIN).................. 730
ROCK TYPES: ALLUVIUM OVERLYING CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MITCHELL, 1976
FLOW (L/MIN)..... 95

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
67	78	1	0	56	2	58	30	12	5.7

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		9.2			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	136
NA-K-CA (4/3)	107
NA-K	89
SILICA	
ADIABATIC	121
CONDUCTIVE	124
CHALCEDONY	96
CRISTOBALITE	73
OPAL	5

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	67 (L)	136 (I)	89 (B)	97	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.74 STD. DEV. = 0.25

COMMENTS: A VERY DILUTE WATER IN WHICH SMALL CHANGES IN CA OR K COULD HAVE A PRONOUNCED EFFECT ON THE NA-K-CA GEOTHERMOMETER.

REFERENCES: MITCHELL, 1976A; YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R. AND BROOK, C.

WARDROP HOT SPRINGS , IDAHO

FIELD NAME................ BARRON'S HOT SPRINGS
CIRCULAR REFERENCE........ 112

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... CAMAS
LATITUDE................... 43-17.5 N
LONGITUDE.................. 114-54.4 W
MAPS....................... FAIRFIELD 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
01S	13E	34	NE OF NW	BOISE

GENERAL INFORMATION
ELEVATION (M)....................... 1541
SURFACE ACTIVITY.................... HOT SPRINGS
ASSOCIATED DEPOSITS................. TRAVERTINE
NO. OF SPRINGS...................... SEVERAL
SPRING TEMPERATURES (C)............. 62 TO 73
DISCHARGE (L/MIN)................... 117
NO. OF WELLS........................ 1
ROCK TYPES: ALLUVIUM OVERLYING QUATERNARY BASALT

CHEMISTRY
SAMPLE SOURCE.... MITCHELL, 1976
FLOW (L/MIN)..... 40

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
70	77	3.6	0.1	99	2.5	226	0	13	15

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.3			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	121
NA-K-CA (4/3)	91
NA-K	65

SILICA

ADIABATIC	121
CONDUCTIVE	123
CHALCEDONY	95
CRISTOBALITE	72
OPAL	4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I)	123 (A)	95 (D)	103	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.79 STD. DEV. = 0.23

REFERENCES: MITCHELL, 1976A; YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C. AND MARINER, R.

BARRON'S HOT SPRINGS, IDAHO

FIELD NAME................ WHITE ARROW HOT SPRINGS
CIRCULAR REFERENCE........ 113

GEOGRAPHIC LOCALITY
STATE.................... IDAHO
COUNTY................... GOODING
LATITUDE................. 43-02.9 N
LONGITUDE................ 114-57.2 W
MAPS..................... DAVIS MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
04S	13E	30	SE OF NE	BOISE

GENERAL INFORMATION
WARING FIGURE...................... 4
WARING NUMBER...................... 170, 172
ELEVATION (M)...................... 1013
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 65
DISCHARGE (L/MIN).................. 3122
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 49
ROCK TYPES: ALLUVIUM NEAR PLIOCENE BASALT

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 3126
COLLECTION DATE.. 1972/05/26

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
65	97	1.2	0	91	1.6	141	22	15	6.6

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12		7.5			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	112
NA-K-CA (4/3)..........	100
NA-K..................	43
SILICA	
ADIABATIC..............	131
CONDUCTIVE.............	136
CHALCEDONY.............	109
CRISTOBALITE...........	85
OPAL..................	15

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (I)	109 (D)	100 (I)	103	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2.5	5	3	3.5	0.5

BASED ON: SPRING AND WELL DISTRIBUTION

VOLUME (KM**3)........... 5.8 STD. DEV. = 1.4
THERMAL ENERGY(10**18 J). 1.39 STD. DEV. = 0.34

COMMENTS: AREA INCLUDES 49 M DEEP WELL AT CHALK MINE ABOUT 2 KM TO THE EAST. OTHER THERMAL SPRINGS AND WELLS ARE IN THE VICINITY.

REFERENCES: YOUNG AND MITCHELL, 1973; WARING, 1965; STEARNS AND OTHERS, 1938

COMPILED BY: BROOK, C.

WHITE ARROW HOT SPRINGS , IDAHO

FIELD NAME................. BANBURY AREA
CIRCULAR REFERENCE........ 114

GEOGRAPHIC LOCALITY

STATE..................... IDAHO
COUNTY.................... TWIN FALLS
LATITUDE.................. 42-41.4 N
LONGITUDE................. 114-50.0 W
MAPS...................... THOUSAND SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
08S	14E	30-33	BOISE

GENERAL INFORMATION

WARING FIGURE...................... 4
WARING NUMBER...................... 173-175
ELEVATION (M)...................... 890
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52 TO 59
DISCHARGE (L/MIN).................. 1550
ROCK TYPES: PLEISTOCENE AND PLIOCENE SEDIMENTS OVERLYING PLIOCENE AND OLDER SILICIC AND BASALTIC VOLCANICS

CHEMISTRY

SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/05/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
59	97	1.1	0	100	1.5	88	38	26	27

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
15		8.5			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	108
NA-K-CA (4/3)	101
NA-K	35

SILICA

ADIABATIC	131
CONDUCTIVE	136
CHALCEDONY	109
CRISTOBALITE	85
OPAL	15

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	108 (I,D)	136 (A)	108 (I)	117	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	7	25	16	16.0	3.7

BASED ON: SPRING DISTRIBUTION

VOLUME (KM**3)........... 26.7 STD. DEV. = 8.0
THERMAL ENERGY(10**18 J). 7.37 STD. DEV. = 2.26

COMMENTS: A VERY DILUTE, HIGH PH WATER. AREA INCLUDES BANBURY AND MIRACLE HOT SPRINGS, AND DEEP CREEK AND SALMON FALLS CREEK AREAS. ANALYSIS FOR MIRACLE HOT SPRINGS.

REFERENCES: YOUNG AND MITCHELL, 1973; STEARNS AND OTHERS, 1938

COMPILED BY: MARINER, R. AND BROOK, C.

BANBURY AREA, IDAHO

FIELD NAME................ RAFT RIVER AREA
KGRA OR OTHER NAME........ RAFT RIVER KGRA
CIRCULAR REFERENCE........ 115

GEOGRAPHIC LOCALITY

STATE...................... IDAHO
COUNTY..................... CASSIA
LATITUDE................... 42-06.1 N
LONGITUDE.................. 113-22.8 W
MAPS....................... CHOKECHERRY 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
15S	26E	23-25	BOISE

GENERAL INFORMATION

WARING FIGURE....................... 4
WARING NUMBER....................... 184
ELEVATION (M)....................... 1478
SURFACE ACTIVITY.................... HOT WELLS, WARM SEEPS
ASSOCIATED DEPOSITS................. TRAVERTINE
NO. OF WELLS........................ 4 DEEP TEST WELLS
WELL DEPTHS (M)..................... 866 TO 1996
MAXIMUM WELL TEMP (C)............... 147 AT DEPTH (M) 785
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY TUFFACEOUS SEDIMENTS AND SILICIC VOLCANIC ROCKS
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, AMT, SP, SEISMIC REFRACTION

CHEMISTRY

SAMPLE SOURCE.... STOKER, R., PERSONAL COMMUNICATION, 1978; KUNZE, 1977, P.30

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
	158	193	0.6	1185	97.2	54		53.3	2170

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
			-4.34	-17.42	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	184
NA-K-CA (4/3)...........	169
NA-K..................	162
SILICA	
ADIABATIC..............	155
CONDUCTIVE.............	164
CHALCEDONY.............	141
CRISTOBALITE...........	114
OPAL..................	42
SULFATE	
CONDUCTIVE.............	135
ONE-STEP STEAM LOSS....	131
CONTINUOUS STEAM LOSS..	131

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	135 (K)	164 (A)	147 (M)	149	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.1	1.3	1.3		
THICKNESS (KM)	1.0	1.7	1.0	1.2	0.2
SUBSURFACE AREA (KM**2)	5	30	15	16.7	5.1

BASED ON: WELL DISTRIBUTION; GEOLOGY AND GEOPHYSICS

VOLUME (KM**3)........... 20.6 STD. DEV. = 7.0
THERMAL ENERGY(10**18 J). 7.42 STD. DEV. = 2.54

COMMENTS: CHEMICAL ANALYSIS IS THE MEAN OF SEVERAL SAMPLES FROM WELL RRGE-3; ISOTOPIC DATA FROM WELL RRGE-2. TWO SHALLOW WELLS (126 AND 165 M) HAVE SURFACE TEMPERATURES OF 93 AND 90 C, RESPECTIVELY. PRODUCING ZONES FOR DEEP TEST WELLS OCCUR BETWEEN 1144 AND 1830 M WITH AVERAGE EFFECTIVE PERMEABLE PRODUCING THICKNESS OF ABOUT 183 M. STABILIZED RESERVOIR TEMPERATURE 147-149 C.

REFERENCES: WILLIAMS AND OTHERS, 1976; KUNZE, 1977; KUNZE AND OTHERS, 1977; YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C. AND MARINER, R.

RAFT RIVER AREA , IDAHO

FIELD NAME................ ASHTON WARM SPRINGS
CIRCULAR REFERENCE........ 116

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... FREMONT
LATITUDE.................. 44-05.7 N
LONGITUDE................. 111-27.5 W
MAPS...................... ASHTON 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
09N	42E	23	NW OF NE OF SE	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1582
SURFACE ACTIVITY................... HOT SPRINGS
ROCK TYPES: PLEISTOCENE BASALT

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 8
COLLECTION DATE.. 1972/08/28

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
41	110	1.1	0.1	36	1.6	92		4.7	2.9

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.2		7.6			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	139
NA-K-CA (4/3)...........	91
NA-K..................	105

SILICA

ADIABATIC..............	137
CONDUCTIVE.............	143
CHALCEDONY.............	116
CRISTOBALITE...........	92
OPAL..................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	41 (L)	143 (A)	91 (I)	92	21

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.69 STD. DEV. = 0.27

COMMENTS: LOW FLOW RATE; VERY DILUTE WATER; CHEMICAL GEOTHERMOMETERS MAY BE UNRELIABLE.

REFERENCES: YOUNG AND MITCHELL, 1973; STEARNS AND OTHERS, 1939

COMPILED BY: MARINER, R.

ASHTON WARM SPRINGS , IDAHO

FIELD NAME................ NEWDALE AREA
CIRCULAR REFERENCE........ 117

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... FREMONT
LATITUDE.................. 43-53.2 N
LONGITUDE................. 111-35.4 W
MAPS...................... NEWDALE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
07N	41E	35	SE OF SE OF SW	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1564
SURFACE ACTIVITY................... NONE, FOUND BY DRILLING
NO. OF WELLS....................... SEVERAL
ROCK TYPES: TERTIARY SILICIC VOLCANIC ROCKS(?)

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/08/09

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
36	75	28	6.3	78	8.6	240		33	24

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
5.4		7.9						

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	169
NA-K-CA (4/3)...........	84
NA-K...................	195
SILICA	
ADIABATIC..............	120
CONDUCTIVE.............	122
CHALCEDONY.............	93
CRISTOBALITE...........	71
OPAL...................	3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	84 (I)	122 (A)	93 (D)	100	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	10	100	50	53.3	18.4

BASED ON: BLACKWELL, D., UNPUB. DATA AND WELL DISTRIBUTION

VOLUME (KM**3)...........	88.9	STD. DEV. =	35.4
THERMAL ENERGY(10**18 J).	20.32	STD. DEV. =	8.35

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R.

NEWDALE AREA, IDAHO

FIELD NAME................ MAPLE GROVE HOT SPRINGS
CIRCULAR REFERENCE........ 118

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... FRANKLIN
LATITUDE.................. 42-18.2 N
LONGITUDE................. 111-42.2 W
MAPS...................... ONEIDA NARROW RESERVOIR 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
13S	41E	07	SW OF NE	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1525
SURFACF ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
ROCK TYPES: PALEOZOIC QUARTZITE(?)

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
FLOW (L/MIN)..... 1325
COLLECTION DATE.. 1972/05/10

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
76	55	89	24	490	110	491	0	260	630

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.1		7.3			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	236
NA-K-CA (4/3)..........	187
NA-K...................	303
SILICA	
ADIABATIC..............	106
CONDUCTIVE.............	106
CHALCEDONY.............	77
CRISTOBALITE...........	56
OPAL...................	-10

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	77 (D,L)	106 (A)	95 (J)	93	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.70 STD. DEV. = 0.20

COMMENTS: HIGH FLOW RATE SUGGESTS THAT SUBSURFACE TEMPERATURE IS PROBABLY NEAR SURFACE TEMPERATURE.

REFERENCES: YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C.

MAPLE GROVE HOT SPRINGS , IDAHO

FIELD NAME................ RIVERDALE AREA (BFN MEEK WELL)
CIRCULAR REFERENCE........ 119

GEOGRAPHIC LOCALITY
STATE...................... IDAHO
COUNTY..................... FRANKLIN
LATITUDE................... 42-09.9 N
LONGITUDE.................. 111-50.4 W
MAPS....................... RIVERDALE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
14S	39E	36	SE OF NE	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1448
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 12
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY TUFFACEOUS SEDIMENTS(?)

CHEMISTRY
SAMPLE SOURCE.... YOUNG AND MITCHELL, 1973
COLLECTION DATE.. 1972/05/11

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
44.5	80	25	7.1	360	24	524		15	320

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
10		7.3			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	170
NA-K-CA (4/3)	147
NA-K	141
SILICA	
ADIABATIC	122
CONDUCTIVE	125
CHALCEDONY	97
CRISTOBALITE	74
OPAL	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	75 (J)	125 (A)	97 (D)	99	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.76 STD. DEV. = 0.23

REFERENCES: MITCHELL, 1976B; YOUNG AND MITCHELL, 1973

COMPILED BY: MARINER, R. AND BROOK, C.

RIVERDALE AREA (BEN MEEK WELL), IDAHO

FIELD NAME................ WAYLAND (BATTLE CREEK) HOT SPRINGS
CIRCULAR REFERENCE........ 120

GEOGRAPHIC LOCALITY
STATE..................... IDAHO
COUNTY.................... FRANKLIN
LATITUDE.................. 42-08.0 N
LONGITUDE................. 111-55.6 W
MAPS...................... BANIDA 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
15S	39E	08	SE OF NW	BOISE

GENERAL INFORMATION
ELEVATION (M)...................... 1396
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 43 TO 84
DISCHARGE (L/MIN).................. 2215
ROCK TYPES: ALLUVIUM OVERLYING PALEOZOIC LIMESTONE(?)

CHEMISTRY
SAMPLE SOURCE.... MITCHELL, 1976
FLOW (L/MIN)..... 50

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
82	109	174	19	3161	552	696		35	5241

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6		6.7			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	254
NA-K-CA (4/3)..........	315
NA-K.................	260

SILICA

ADIABATIC.............	137
CONDUCTIVE............	142
CHALCEDONY............	116
CRISTOBALITE..........	91
OPAL.................	21

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	82 (L)	142 (A)	116 (D)	113	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.88 STD. DEV. = 0.27

COMMENTS: A SALINE WATER; GEOTHERMOMETRY, ESPECIALLY NA-K-CA, MAY NOT BE RELIABLE.

REFERENCES: MITCHELL, 1976B; YOUNG AND MITCHELL, 1973

COMPILED BY: BROOK, C. AND MARINER, R.

WAYLAND (BATTLE CREEK) HOT SPRINGS, IDAHO

FIELD NAME................ SQUAW HOT SPRINGS AREA
CIRCULAR REFERENCE........ 121

GEOGRAPHIC LOCALITY

STATE...................... IDAHO
COUNTY..................... FRANKLIN
LATITUDE................... 42-07.1 N
LONGITUDE.................. 111-55.7 W
MAPS....................... WESTON 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
15S	39E	17	SW OF NW	BOISE

GENERAL INFORMATION

ELEVATION (M)...................... 1366
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 69 TO 73
DISCHARGE (L/MIN).................. 590
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 6.7
ROCK TYPES: ALLUVIUM OVERLYING TUFFACEOUS SEDIMENTARY ROCKS(?)

CHEMISTRY

SAMPLE SOURCE.... MITCHELL, 1976 (WELL-WATER SAMPLE)
FLOW (L/MIN)..... 115

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
84	124	279	24	4368	782	791		35	7398

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.3		6.5			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	258
NA-K-CA (4/3)	328
NA-K	264
SILICA	
ADIABATIC	143
CONDUCTIVE	150
CHALCEDONY	124
CRISTOBALITE	99
OPAL	28

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	84 (L)	150 (A)	124 (D)	119	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J)	0.94	STD. DEV. = 0.29

COMMENTS: MG-CORRECTED NA-K-CA GREATER THAN 200 C; SALINE WATER IN WHICH THE CHEMICAL GEOTHERMOMETERS MAY NOT BE ACCURATE; AVAILABLE DATA DOES NOT DEMONSTRATE MIXING.

REFERENCES: MITCHELL, 1976B

COMPILED BY: MARINER, R.

SQUAW HOT SPRINGS AREA, IDAHO

Montana

FIELD NAME................ MARYSVILLE TEST WELL
KGRA OR OTHER NAME........ MARYSVILLE KGRA
CIRCULAR REFERENCE........ 122

GEOGRAPHIC LOCALITY
STATE..................... MONTANA
COUNTY.................... LEWIS AND CLARK
LATITUDE.................. 46-45.2 N
LONGITUDE................. 112-22.6 W
MAPS...................... GRANITE BUTTE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
12N	06W	32	SW OF NE	MONTANA

GENERAL INFORMATION
SURFACE ACTIVITY.................... NONE. FOUND BY DRILLING
NO. OF WELLS........................ 1
WELL DEPTHS (M)..................... 2071
MAXIMUM WELL TEMP (C)............... 103 AT DEPTH (M) 915
ROCK TYPES: SHALE
GEOPHYSICS: HEAT FLOW, GRAVITY, MAGNETIC, ELECTRICAL RESISTIVITY

CHEMISTRY
SAMPLE SOURCE.... LEONARD AND OTHERS, 1978
COLLECTION DATE.. 1975/08/29

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
96.5	69	7.7	0.5	210	10	260	0	180	51

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
20	0.1	7.9				

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	154
NA-K-CA (4/3)...........	135
NA-K....................	111

SILICA

ADIABATIC...............	116
CONDUCTIVE..............	117
CHALCEDONY..............	89
CRISTOBALITE............	67
OPAL....................	-1

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	103 (M)	145 (J)	117 (A)	122	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	1.0	1.0	1.0		
THICKNESS (KM)	1.0	2.0	1.5	1.5	0.2
SUBSURFACE AREA (KM**2)	6	18	6	10.0	2.8

BASED ON: HEAT FLOW SURVEY AND USGS FILE DATA

VOLUME (KM**3)...........	15.0	STD. DEV. = 4.7
THERMAL ENERGY(10**18 J).	4.32	STD. DEV. = 1.42

COMMENTS: AREA IDENTIFIED BY HIGH HEAT FLOW AND CORRESPONDING GRAVITY AND MAGNETIC LOWS. MAGMA CHAMBER POSTULATED TO BE AT 5-6 KM DEPTH.

REFERENCES: BLACKWELL, 1969, 1970; BLACKWELL AND BAAG, 1973; BLACKWELL AND OTHERS, 1974; LEONARD AND OTHERS, 1978

COMPILED BY: BROOK, C.

MARYSVILLE TEST WELL, MONTANA

FIELD NAME................ BROADWATER (HELENA) HOT SPRINGS
CIRCULAR REFERENCE........ 123

GEOGRAPHIC LOCALITY

STATE...................... MONTANA
COUNTY..................... LEWIS AND CLARK
LATITUDE................... 46-35.7 N
LONGITUDE.................. 112-06.7 W
MAPS....................... HELENA 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
10N	04W	28	NE	MONTANA

GENERAL INFORMATION

WARING FIGURE...................... 2
WARING NUMBER...................... 7
ELEVATION (M)...................... 1190
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 59 TO 66.4
DISCHARGE (L/MIN).................. 110
NO. OF WELLS....................... 4
WELL DEPTHS (M).................... 61 TO 73.2
MAXIMUM WELL TEMP (C).............. 68 AT DEPTH (M) 36.6
ROCK TYPES: QUARTZ MONZONITE INTRUDED INTO DOLOMITE

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1976
FLOW (L/MIN)..... LT 50
COLLECTION DATE.. 1974/08/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
62	98	11	0.9	165	5.8	218		170	33

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.4	0.80	8.53			-147.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	134
NA-K-CA (4/3)	100
NA-K	87
SILICA	
ADIABATIC	132
CONDUCTIVE	136
CHALCEDONY	109
CRISTOBALITE	85
OPAL	16

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	97 (E)	136 (A)	120 (J)	118	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.92 STD. DEV. = 0.27

REFERENCES: KNOPF, 1963; WARING, 1965; MARINER AND OTHERS, 1976A; LEONARD AND OTHERS, 1978

COMPILED BY: BROOK, C.

BROADWATER (HELENA) HOT SPRINGS , MONTANA

FIELD NAME................. ALHAMBRA HOT SPRINGS
CIRCULAR REFERENCE........ 124

GEOGRAPHIC LOCALITY

STATE.....................	MONTANA
COUNTY....................	JEFFERSON
LATITUDE..................	46-26.8 N
LONGITUDE.................	111-59.0 W
MAPS......................	CLANCY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
08N	03W	16	NE	MONTANA

GENERAL INFORMATION

WARING FIGURE......................	2	
WARING NUMBER......................	18	
ELEVATION (M)......................	1305	
SURFACE ACTIVITY...................	HOT SPRINGS AND SEEPS	
ASSOCIATED DEPOSITS................	ANCIENT TRAVERTINE DEPOSIT	
NO. OF SPRINGS.....................	4 MAIN SPRINGS	
SPRING TEMPERATURES (C)............	50	TO 59.4
DISCHARGE (L/MIN)..................	385	
NO. OF WELLS.......................	7	
WELL DEPTHS (M)....................	20	TO 95
MAXIMUM WELL TEMP (C)..............	54.8	AT DEPTH (M) 25.0

ROCK TYPES: QUARTZ MONZONITE, ALASKITE

CHEMISTRY

SAMPLE SOURCE....	MARINER AND OTHERS, 1976
FLOW (L/MIN).....	40
COLLECTION DATE..	1974/08/23

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56.5	66	18	3.5	220	9.5	484		89	10

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.4	0.24	7.23	-3.49	-19.23	-146.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	144
NA-K-CA (4/3)...........	110
NA-K....................	103
SILICA	
ADIABATIC...............	114
CONDUCTIVE..............	115
CHALCEDONY..............	86
CRISTOBALITE............	65
OPAL....................	-2
SULFATE	
CONDUCTIVE..............	99
ONE-STEP STEAM LOSS....	95
CONTINUOUS STEAM LOSS..	95

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	86 (D,J)	115 (A)	86 (D,J)	96	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.73 STD. DEV. = 0.21

COMMENTS: WARING (1965) REPORTS 22 SPRINGS WITH TEMPERATURES OF 32-57 DEG C.

REFERENCES: WARING, 1965; CHADWICK AND KACZMAREK, 1975; MARINER AND OTHERS, 1976A; LEONARD AND OTHERS, 1978

COMPILED BY: BROOK, C.

ALHAMBRA HOT SPRINGS, MONTANA

FIELD NAME................ BOULDER HOT SPRINGS
KGRA OR OTHEP NAME........ BOULDER HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 125

GEOGRAPHIC LOCALITY
STATE..................... MONTANA
COUNTY.................... JEFFERSON
LATITUDE.................. 46-12.0 N
LONGITUDE................. 112-05.6 W
MAPS...................... BOULDER, 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05N	04W	10	NE OF SW	MONTANA

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 19
ELEVATION (M)...................... 1476
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... SEVERAL IN 2 GROUPS
SPRING TEMPERATURES (C)............ 62 TO 76
DISCHARGE (L/MIN).................. LARGE
ROCK TYPES: GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
FLOW (L/MIN)..... LARGE
COLLECTION DATE.. 1974/08/22

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
76	108	2.2	LT 0.1	120	3.8	168		74	19

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
11	0.56	8.50	-5.45	-18.91	-146.5

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	136
NA-K-CA (4/3)..........	122
NA-K..................	80

SILICA

ADIABATIC..............	136
CONDUCTIVE.............	142
CHALCEDONY.............	115
CRISTOBALITE...........	91
OPAL...................	21

SULFATE

CONDUCTIVE.............	130
ONE-STEP STEAM LOSS....	124
CONTINUOUS STEAM LOSS..	125

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	130 (K)	142 (A)	136 (I)	136	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.09 STD. DEV. = 0.31

COMMENTS: WARING (1965) REPORTS SURFACE TEMPERATURES AS HIGH AS 86 DEG C.

REFERENCES: WEED, 1900, 1905, 1912; WHITE, 1955; WARING, 1965; CHADWICK AND KACZMAREK, 1975; MARINER AND OTHERS, 1976A; LEONARD AND OTHERS, 1978

COMPILED BY: BROOK, C.

BOULDER HOT SPRINGS , MONTANA

FIELD NAME................ GREGSON (FAIRMONT) HOT SPRINGS
CIRCULAR REFERENCE........ 126

GEOGRAPHIC LOCALITY
STATE..................... MONTANA
COUNTY.................... DEER LODGE
LATITUDE.................. 46-02.6 N
LONGITUDE................. 112-48.6 W
MAPS...................... ANACONDA 1162,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
03N	10W	02	SE OF NW	MONTANA

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 17
ELEVATION (M)...................... 1568
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 68 TO 73
DISCHARGE (L/MIN).................. 1150
ROCK TYPES: TERTIARY RHYOLITE OVERLYING QUARTZ MONZONITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
COLLECTION DATE.. 1974/08/19

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
70	85	3.9	LT 0.1	165	3.9	166		180	17

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
18	0.30	8.41			-18.60	-149.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	124
NA-K-CA (4/3)	112
NA-K	61
SILICA	
ADIABATIC	125
CONDUCTIVE	128
CHALCEDONY	101
CRISTOBALITE	78
OPAL	9

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	101 (D)	128 (A)	124 (I)	118	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.92 STD. DEV. = 0.26

COMMENTS: WATER USED TO HEAT GREENHOUSE.

REFERENCES: KONIZESKI AND OTHERS, 1962; WARING, 1965; MARINER AND OTHERS, 1976A

COMPILED BY: BROOK, C.

GREGSON (FAIRMONT) HOT SPRINGS, MONTANA

FIELD NAME................. NORRIS (HAPGOOD, BEARTRAP) HOT SPRINGS
CIRCULAR REFERENCE......... 127

GEOGRAPHIC LOCALITY
STATE...................... MONTANA
COUNTY..................... MADISON
LATITUDE................... 45-34.5 N
LONGITUDE.................. 111-41.0 W
MAPS....................... NORRIS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
03S	01W	14	NE OF SE	MONTANA

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 32
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 41 TO 52.5
DISCHARGE (L/MIN).................. 425
NO. OF WELLS....................... 1
ROCK TYPES: GNEISS (SYENITE?)

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
COLLECTION DATE.. 1974/08/21

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52.5	88	17	3.2	180	10	380		130	23

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.4	0.10	7.58			-148.4

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	153
NA-K-CA (4/3)..........	111
NA-K..................	124

SILICA

ADIABATIC..............	127
CONDUCTIVE.............	130
CHALCEDONY.............	103
CRISTOBALITE...........	80
OPAL...................	11

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (J)	130 (A)	103 (D)	107	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.82 STD. DEV. = 0.25

REFERENCES: PEALE, 1896; WARING, 1965; MARINER AND OTHERS, 1976A; LEONARD AND OTHERS, 1978; CHADWICK AND KACZMAREK, 1975; CHADWICK, 1978

COMPILED BY: BROOK, C.

NORRIS (HAPGOOD, BEARTRAP) HOT SPRINGS, MONTANA

FIELD NAME................ SILVER STAR (BARKEL'S) HOT SPRINGS
CIRCULAR REFERENCE........ 128

GEOGRAPHIC LOCALITY
STATE..................... MONTANA
COUNTY.................... MADISON
LATITUDE.................. 45-41.5 N
LONGITUDE................. 112-17.2 W
MAPS...................... TWIN BRIDGES, 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
02S	06W	01	SW	MONTANA

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 30
ELEVATION (M)...................... 1400
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 67 TO 73
DISCHARGE (L/MIN).................. 150-200
ROCK TYPES: TERTIARY LAKE BEDS OVERLYING GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
COLLECTION DATE.. 1974/08/18

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
71.5	110	9.3	0.3	170	6.4	170		190	31

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.7	0.25	8.17	-5.46	-18.48	-145.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	139
NA-K-CA (4/3)...........	109
NA-K....................	93
SILICA	
ADIABATIC..............	137
CONDUCTIVE.............	143
CHALCEDONY.............	116
CRISTOBALITE...........	92
OPAL...................	22
SULFATE	
CONDUCTIVE.............	135
ONE-STEP STEAM LOSS....	128
CONTINUOUS STEAM LOSS..	129

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	116 (D)	143 (A)	135 (K,I)	131	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.05 STD. DEV. = 0.30

REFERENCES: SAHINEN, 1939; WARING, 1965; MARINER AND OTHERS, 1976A; LEONARD AND OTHERS, 1978; CHADWICK, 1978

COMPILED BY: BROOK, C.

SILVER STAR (BARKEL'S) HOT SPRINGS, MONTANA

FIELD NAME................ ENNIS (THEXTON) HOT SPRINGS
CIRCULAR REFERENCE........ 129

GEOGRAPHIC LOCALITY
STATE..................... MONTANA
COUNTY.................... MADISON
LATITUDE.................. 45-22.0 N
LONGITUDE................. 111-44.8 W
MAPS...................... ENNIS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
05S	01W	28	SW OF SE	MONTANA

GENERAL INFORMATION
SURFACE ACTIVITY.................... HOT SPRING
NO. OF SPRINGS...................... 1
SPRING TEMPERATURES (C)............ 83
DISCHARGE (L/MIN).................. 115
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 100
MAXIMUM WELL TEMP (C).............. 89 AT DEPTH (M) 30
ROCK TYPES: ALLUVIUM OVERLYING GNEISS

CHEMISTRY
SAMPLE SOURCE.... LEONARD AND OTHERS, 1978
FLOW (L/MIN)..... LT 75
COLLECTION DATE.. 1976/04/01

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
83	96	5.8	0.6	340	17	442	0	220	120

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
11	0.61	7.7	-1.80	-19.09	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	167
NA-K-CA (4/3)..........	178
NA-K..................	115
SILICA	
ADIABATIC.............	131
CONDUCTIVE............	135
CHALCEDONY............	108
CRISTOBALITE..........	84
OPAL..................	15
SULFATE	
CONDUCTIVE............	92
ONE-STEP STEAM LOSS....	91
CONTINUOUS STEAM LOSS..	91

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	108 (D)	145 (J)	135 (A)	129	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.03 STD. DEV. = 0.30

REFERENCES: LEONARD AND OTHERS, 1978; CHADWICK, 1978

COMPILED BY: BROOK, C.

ENNIS (THEXTON) HOT SPRINGS , MONTANA

Nevada

FIELD NAME................ BALTAZOR HOT SPRINGS
KGRA OR OTHER NAME........ BALTAZOR HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 130

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... HUMBOLDT
LATITUDE.................. 41-55.3 N
LONGITUDE................. 118-42.6 W
MAPS...................... DENIO 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
46N	28E	13	NW	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1284
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 80
DISCHARGE (L/MIN).................. 100
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... SHALLOW
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY VOLCANIC ROCKS; CRETACEOUS TO TERTIARY GRANODIORITE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975
FLOW (L/MIN)..... 100

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
80	160	8.4	LT 0.1	180	8.7	139		220	48

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.1	2.9	8.00		-3.98	-15.26	-125.3

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	152
NA-K-CA (4/3)	124
NA-K	112
SILICA	
ADIABATIC	156
CONDUCTIVE	165
CHALCEDONY	142
CRISTOBALITE	115
OPAL	42
SULFATE	
CONDUCTIVE	158
ONE-STEP STEAM LOSS	148
CONTINUOUS STEAM LOSS	150

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	152 (I)	165 (A)	158 (K)	158	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	6	4	3.7	1.0
BASED ON: AMT SURVEY					

VOLUME (KM**3)	6.1	STD. DEV. = 2.1
THERMAL ENERGY(10**16 J)	2.36	STD. DEV. = 0.81

COMMENTS: AREA OF HIGH HEAT FLOW NEARBY. ONE SHALLOW WELL FLOWS 90 C WATER AT 25 LPM.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN, 1964; USGS FILE DATA; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R., BROOK, C.

BALTAZOR HOT SPRINGS, NEVADA

FIELD NAME................ DYKE HOT SPRINGS
CIRCULAR REFERENCE........ 131

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... HUMBOLDT
LATITUDE.................. 41-34.0 N
LONGITUDE................. 118-33.7 W
MAPS...................... DUFFER PEAK 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
43N	30E	25	SE OF SE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1256
SURFACE ACTIVITY................... HOT SPRINGS
DISCHARGE (L/MIN).................. 100
ROCK TYPES: QUATERNARY ALLUVIUM; TRIASSIC AND JURASSIC METAMORPHIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
66	85	1.8	LT 0.1	150	4.3	243		82	21

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.0	1.0	8.9		-16.29	-128.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	137
NA-K-CA (4/3)	136
NA-K	73
SILICA	
ADIABATIC	125
CONDUCTIVE	128
CHALCEDONY	101
CRISTOBALITE	78
OPAL	9

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	76 (E)	137 (I)	106 (B)	106	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.82 STD. DEV. = 0.26

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN, 1964; SMITH, 1973

COMPILED BY: MARINER, R.

DYKE HOT SPRINGS, NEVADA

FIELD NAME................ PINTO HOT SPRINGS (EAST AND WEST)
KGRA OR OTHER NAME........ PINTO HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 132

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... HUMBOLDT
LATITUDE.................. 41-21.0 N
LONGITUDE................. 118-47.0 W
MAPS...................... VYA 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
40N	28E	19	SE OF NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 9
ELEVATION (M)...................... 1372
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER AND TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 92
NO. OF WELLS....................... ONE (WEST)
ROCK TYPES: CRETACEOUS OR TERTIARY GRANODIORITE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, TELLURIC CURRENT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
93	150	14	0.4	330	23	495	1	120	160

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12	7.5	7.14	-7.09	-14.20	-129.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	176
NA-K-CA (4/3)...........	163
NA-K....................	145
SILICA	
ADIABATIC...............	153
CONDUCTIVE..............	161
CHALCEDONY..............	137
CRISTOBALITE............	111
OPAL....................	39
SULFATE	
CONDUCTIVE..............	232
ONE-STEP STEAM LOSS.....	207
CONTINUOUS STEAM LOSS..	213

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	153 (C)	190	176 (I)	173	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	3	10	5	6.0	1.5

BASED ON: SPRING DISTRIBUTION, AMT, GRAVITY

VOLUME (KM**3)........... 10.0 STD. DEV. = 3.1

THERMAL ENERGY(10**18 J). 4.27 STD. DEV. = 1.35

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; WILLDEN, 1964; HOOVER AND BATZLE, 1977

COMPILED BY: MARINER, R.

PINTO HOT SPRINGS (EAST AND WEST) , NEVADA

FIELD NAME................ DOUBLE HOT SPRINGS AREA
KGRA OR OTHER NAME........ DOUBLE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 133

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... HUMBOLDT
LATITUDE................... 41-02.9 N
LONGITUDE.................. 119-01.7 W
MAPS....................... VYA 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
36N	26E	04	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 12
ELEVATION (M)....................... 1290
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... SEVERAL
DISCHARGE (L/MIN)................... 175
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY BASALT AND ASH-FLOW RHYOLITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
80	105	4.8	0.1	180	4.5	261	2	120	59

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
10	1.8	7.93		-15.93	-128.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	127
NA-K-CA (4/3)...........	113
NA-K....................	64
SILICA	
ADIABATIC...............	135
CONDUCTIVE..............	140
CHALCEDONY..............	114
CRISTOBALITE............	89
OPAL....................	19

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	114 (D)	140 (A)	127 (I)	127	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	12	8	7.3	2.1

BASED ON: THERMAL SPRINGS AND HIGH GROUND TEMPERATURES ALONG LINEAR TREND

VOLUME (KM**3)............ 12.2 STD. DEV. = 4.2
THERMAL ENERGY(10**18 J). 3.70 STD. DEV. = 1.27

REFERENCES: MARINER AND OTHERS, 1974A, 1975; HOSE AND TAYLOR, 1974; WILLDEN, 1964; WARING, 1965; OLMSTED AND OTHERS, 1975

COMPILED BY: MARINER, R.

DOUBLE HOT SPRINGS AREA , NEVADA

FIELD NAME................ BLACK ROCK POINT AREA
KGRA OR OTHER NAME........ DOUBLE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 134

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-57.0 N
LONGITUDE................. 119-00.2 W
MAPS...................... LOVELOCK 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
36N	26E	34?	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 16
ELEVATION (M)...................... 1220
SURFACE ACTIVITY................... HOT SPRINGS
ROCK TYPES: QUATERNARY PLAYA DEPOSITS; TERTIARY VOLCANIC AND SEDIMENTARY ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
90	120	35	4	1500	20	932		290	787

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.10			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	116
NA-K-CA (4/3)...........	151
NA-K..................	29

SILICA

ADIABATIC..............	141
CONDUCTIVE.............	148
CHALCEDONY.............	122
CRISTOBALITE...........	97
OPAL..................	26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	116(I)	148 (A)	122 (D)	129	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	1.02	STD. DEV. = 0.29

REFERENCES: MARINER AND OTHERS, 1974A; TATLOCK, 1969; OLMSTED AND OTHERS, 1975; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

BLACK ROCK POINT AREA , NEVADA

FIELD NAME................ BUTTE SPRINGS (TREGO)
KGRA OR OTHER NAME........ TREGO KGRA
CIRCULAR REFERENCE........ 135

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-46.0 N
LONGITUDE................. 119-07.0 W
MAPS...................... LOVELOCK 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
34N	26E	31	NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 63
ELEVATION (M)...................... 1219
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
ROCK TYPES: QUATERNARY DUNE SANDS; CRETACEOUS GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
COLLECTION DATE.. 1975/08/21

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
84.5	79	11	0.2	430	8.6	162		180	500

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.1	5.0	7.93			-14.87	-127.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	129
NA-K....................	51
SILICA	
ADIABATIC...............	122
CONDUCTIVE..............	124
CHALCEDONY..............	96
CRISTOBALITE............	74
OPAL....................	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (D)	124 (A,I)	124 (A,I)	115	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.90 STD. DEV. = 0.26

REFERENCES: MARINER AND OTHERS, 1976C; WARING, 1965; TATLOCK, 1969; OLMSTED AND OTHERS, 1975; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

BUTTE SPRINGS (TREGO) , NEVADA

FIELD NAME................ FLY RANCH (WARDS) HOT SPRINGS
KGRA OR OTHER NAME........ FLY RANCH KGRA
CIRCULAR REFERENCE........ 136

GEOGRAPHIC LOCALITY

STATE..................... NEVADA
COUNTY.................... WASHOE
LATITUDE.................. 40-52.0 N
LONGITUDE................. 119-20.9 W
MAPS...................... LOVELOCK 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
34N	23E	01	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 37
ELEVATION (M)...................... 1234
SURFACE ACTIVITY................... ARTESIAN WELLS
ASSOCIATED DEPOSITS................ TRAVERTINE
DISCHARGE (L/MIN).................. 500
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 244 TO 305
MAXIMUM WELL TEMP (C).............. 108
ROCK TYPES: QUATERNARY ALLUVIUM; UPPER TERTIARY BASALT, TUFFS, AND SEDIMENTARY ROCK
GEOPHYSICS: MAGNETIC, MICROEARTHQUAKE, SEISMIC GROUNDNOISE, RESISTIVITY, SP

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
80	82	31	4.2	340	17	458	4	46	240

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.0	1.9	7.91		-14.72	-120.7

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	153
NA-K-CA (4/3)	125
NA-K	115

SILICA

ADIABATIC	124
CONDUCTIVE	126
CHALCEDONY	99
CRISTOBALITE	76
OPAL	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	126 (A)	100 (J)	108	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	4	3	2.7	0.6

BASED ON: G. KELLER, UNPUB. TEMPERATURE GRADIENT DATA

VOLUME (KM**3)............ 4.4 STD. DEV. = 1.3
THERMAL ENERGY(10**18 J). 1.12 STD. DEV. = 0.35

REFERENCES: MARINER AND OTHERS, 1974A, 1975; USGS FILE DATA

COMPILED BY: MARINER, R.

FLY RANCH (WARDS) HOT SPRINGS , NEVADA

FIELD NAME................ GREAT BOILING SPRINGS (GERLACH)
KGRA OR OTHER NAME........ GERLACH KGRA
CIRCULAR REFERENCE........ 137

GEOGRAPHIC LOCALITY

STATE.................... NEVADA
COUNTY................... WASHOE
LATITUDE................. 40-39.7 N
LONGITUDE................ 119-21.7 W
MAPS..................... GERLACH 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
32N	23E	15	NW	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 38
AREA OF SURFACE EXPRESSION (KM**2). 0.6
ELEVATION (M)...................... 1207
SURFACE ACTIVITY................... HOT SPRINGS AND POOLS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... APPROX. 70
SPRING TEMPERATURES (C)............ 20 TO 90
DISCHARGE (L/MIN).................. 1000
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 150
MAXIMUM WELL TEMP (C).............. 110 AT DEPTH (M) 150?
ROCK TYPES: QUATERNARY ALLUVIUM AND LAKE SEDIMENTS, CRETACEOUS TO TERTIARY GRANODIORITE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, RESISTIVITY, MICROEARTHQUAKE, TEMPERATURE GRADIENT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
86	165	68	1.2	1400	130	83	1	400	2200

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.5	9.9	7.20	+6.53	-10.83	-100.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	205
NA-K-CA (4/3)...........	230
NA-K....................	175
SILICA	
ADIABATIC...............	158
CONDUCTIVE..............	167
CHALCEDONY..............	144
CRISTOBALITE............	117
OPAL....................	44
SULFATE	
CONDUCTIVE..............	93
ONE-STEP STEAM LOSS.....	92
CONTINUOUS STEAM LOSS..	92

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	158 (C)	205 (I)	170	178	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.46 STD. DEV. = 0.42

COMMENTS: THE SULFATE-ISOTOPE GEOTHERMOMETER INDICATES A TEMPERATURE NEAR BOILING; DISSOLUTION OF SALINE DEPOSITS POSSIBLE.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; OLMSTED AND OTHERS, 1975; WARING, 1965; RENNER AND OTHERS, 1976; USGS FILE DATA

COMPILED BY: MARINER, R.

GREAT BOILING SPRINGS (GERLACH) , NEVADA

FIELD NAME................ SAN EMEDIO DESERT AREA
KGRA OR OTHER NAME........ SAN EMEDIO DESERT KGRA
CIRCULAR REFERENCE........ 138

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... WASHOE
LATITUDE................... 40-24. N
LONGITUDE.................. 119-25. W
MAPS....................... KUMIVA PEAK 1162,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
29N	23E		MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1231
SURFACE ACTIVITY................... HOT SEEP SPRINGS
ASSOCIATED DEPOSITS................ SINTER AND TRAVERTINE
NO. OF SPRINGS..................... THREE GROUPS
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY BASALT, ANDESITE, AND TUFFACEOUS SEDIMENTS
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1976
FLOW (L/MIN)..... LT 1
COLLECTION DATE.. 1975/08/20

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
95	215	160	2.3	1500	120	129		240	2300

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.2	7.2	6.63		-11.61	-106.4

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	189
NA-K-CA (4/3)	191
NA-K	159

SILICA

ADIABATIC	172
CONDUCTIVE	185
CHALCEDONY	165
CRISTOBALITE	135
OPAL	61

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	125	189 (I)	185 (A)	166	15

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.36 STD. DEV. = 0.40

COMMENTS: NEGLIGIBLE FLOW RATES MAKE QUANTITATIVE INTERPRETATION OF THE GEOTHERMOMETERS IMPOSSIBLE. NEAR SURFACE REACTIONS PROBABLE. MINIMUM TEMPERATURE ESTIMATED ASSUMING CONDUCTIVE COOLING. TEMPERATURES MAY BE 200 C OR HIGHER.

REFERENCES: MARINER AND OTHERS, 1976C

COMPILED BY: MARINER, R.

SAN EMEDIO DESERT AREA, NEVADA

FIELD NAME................ THE NEEDLES (NEEDLE ROCKS, PYRAMID LAKE)
CIRCULAR REFERENCE........ 139

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... WASHOE
LATITUDE................... 40-08.8 N
LONGITUDE.................. 119-40.5 W
MAPS....................... THE NEEDLE ROCKS 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
26N	21E	06	SW OF SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 49
ELEVATION (M)....................... 1158
SURFACE ACTIVITY.................... HOT SPRINGS
ASSOCIATED DEPOSITS................. TRAVERTINE
NO. OF SPRINGS...................... SEVERAL
NO. OF WELLS........................ 3
WELL DEPTHS (M)..................... 1219 (?)TO 1795
MAXIMUM WELL TEMP (C)............... 116
ROCK TYPES: QUATERNARY ALLUVIUM AND TUFA; OLIVINE BASALT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56	110	260	0.1	1100	160	24	1	340	1900

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.0	6.1	8.43		-6.33	-106.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	214
NA-K-CA (4/3)..........	183
NA-K..................	232
SILICA	
ADIABATIC..............	137
CONDUCTIVE.............	143
CHALCEDONY.............	116
CRISTOBALITE...........	92
OPAL..................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	115 (D)	137 (C)	116 (M)	123	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.97 STD. DEV. = 0.27

COMMENTS: SAMPLE FROM LEAKING STEAM WELL (FLASHING AT THE SURFACE)

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; BONHAM, 1969; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

THE NEEDLES (NEEDLE ROCKS, PYRAMID LAKE), NEVADA

FIELD NAME................ MOANA AREA
KGRA OR OTHER NAME........ MOANA SPRINGS KGRA
CIRCULAR REFERENCE........ 140

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... WASHOE
LATITUDE.................. 39-29.7 N
LONGITUDE................. 119-48.9 W
MAPS...................... RENO 1:24,000; MT. ROSE 1:62,500; MT. ROSE NE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
19N	19E	26	NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 55A
ELEVATION (M)...................... 1384
SURFACE ACTIVITY................... INACTIVE SPRINGS
NO. OF SPRINGS..................... NONE
NO. OF WELLS....................... MORE THAN 20
WELL DEPTHS (M).................... 20 TO 307
MAXIMUM WELL TEMP (C).............. 96 AT DEPTH (M) 94
ROCK TYPES: MIOCENE TO LATE PLIOCENE DIATOMITE, SANDSTONE, AND CONGLOMERATE; TERTIARY VOLCANIC FLOWS; GRANITE AND METAMORPHICS OF PRE-TERTIARY AGE

CHEMISTRY
SAMPLE SOURCE.... BATEMAN AND SCHEIBACH, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
90	135	29	0.8	203	7.4	146		348	42

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	1.8	7.65				

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	132
NA-K-CA (4/3)	89
NA-K	90

SILICA

ADIABATIC	147
CONDUCTIVE	155
CHALCEDONY	130
CRISTOBALITE	104
OPAL	33

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (M)	155 (A)	96 (M)	116	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	1.0	0.5		
THICKNESS (KM)	2.0	2.5	2.1	2.2	0.1
SUBSURFACE AREA (KM**2)	2	6	4	4.0	0.8

BASED ON: WELL DISTRIBUTION

VOLUME (KM**3)........... 8.8 STD. DEV. = 1.8

THERMAL ENERGY(10**18 J). 2.39 STD. DEV. = 0.61

COMMENTS: NA-K-CA GEOTHERMOMETER AGREES WITH THE OBSERVED WELL TEMPERATURE; CONTACT WITH DIATOMITE POSSIBLE AND MAY CAUSE THE LARGE SILICA CONCENTRATION.

REFERENCES: BATEMAN AND SCHEIBACH, 1975; ATKINSON, 1978

COMPILED BY: MARINER, R.

MOANA AREA, NEVADA

FIELD NAME................ STEAMBOAT SPRINGS
KGRA OR OTHER NAME........ STEAMBOAT SPRINGS KGRA
CIRCULAR REFERENCE........ 141

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... WASHOE
LATITUDE................... 39-23.0 N
LONGITUDE.................. 119-45.0 W
MAPS....................... MT. ROSE 1:62,500; VIRGINIA CITY 1:62,500; RENO 1:250,000; STEAMBOAT 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
18N	20E	33	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 56, 55 E,F
AREA OF SURFACE EXPRESSION (KM**2). 5.7
ELEVATION (M)...................... 1420
SURFACE ACTIVITY................... HOT SPRINGS, FUMAROLE, GEYSER(S)
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... MANY (74)
SPRING TEMPERATURES (C)............ 45 TO 96
DISCHARGE (L/MIN).................. 250
NO. OF WELLS....................... 6 DEEP EXPLORATION WELLS
WELL DEPTHS (M).................... 218 TO 558
MAXIMUM WELL TEMP (C).............. 186 AT DEPTH (M) 221
ROCK TYPES: PLIOCENE-PLEISTOCENE VOLCANICS, PRE-TERTIARY GRANITE, METAMORPHICS
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, SP, AMT, TELLURIC CURRENT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975
FLOW (L/MIN)..... 10

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
94	270	16	0.7	680	66	364	2	73	837

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.1	47	7.19	-3.28	-10.44	-116.7

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	207
NA-K-CA (4/3)...........	233
NA-K....................	180

SILICA

ADIABATIC...............	185
CONDUCTIVE..............	201
CHALCEDONY..............	184
CRISTOBALITE............	153
OPAL....................	77

SULFATE

CONDUCTIVE..............	231
ONE-STEP STEAM LOSS.....	207
CONTINUOUS STEAM LOSS..	213

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	186 (M)	207 (K)	207 (I)	200	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	1.0	0.3		
THICKNESS (KM)	2.0	2.7	2.7	2.5	0.2
SUBSURFACE AREA (KM**2)	4	25	6	11.7	4.7

BASED ON: SPRING DISTRIBUTION, RESISTIVITY, AND ESTIMATE OF RENNER AND OTHERS, 1976

VOLUME (KM**3)........... 28.8 STD. DEV. = 11.9
THERMAL ENERGY(10**18 J). 14.37 STD. DEV. = 5.94

COMMENTS: SULFATE ISOTOPE GEOTHERMOMETER BASED ON SAMPLE COLLECTED BY N. NEHRING. EXTENSIVE SINTER DEPOSITS. ABOUT 35 WELLS USED MOSTLY FOR SPA SUPPLY.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; RENNER AND OTHERS, 1976; WHITE, 1968; WHITE AND OTHERS, 1964; THOMPSON AND WHITE, 1964

COMPILED BY: MARINER, R.

STEAMBOAT SPRINGS , NEVADA

FIELD NAME................ WABUSKA HOT SPRINGS
KGRA OR OTHER NAME........ WABUSKA KGRA
CIRCULAR REFERENCE........ 142

GEOGRAPHIC LOCALITY

STATE...................... NEVADA
COUNTY..................... LYON
LATITUDE................... 39-09.7 N
LONGITUDE.................. 119-11.0 W
MAPS....................... WABUSKA 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
15N	25E	16	SE	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE........................ 8
WARING NUMBER........................ 62
ELEVATION (M)........................ 1310
SURFACE ACTIVITY..................... HOT SPRINGS
ASSOCIATED DEPOSITS.................. TRAVERTINE
NO. OF SPRINGS....................... SEVERAL
SPRING TEMPERATURES (C).............. 59 TO 97
NO. OF WELLS......................... AT LEAST 3
WELL DEPTHS (M)...................... 149 TO 678
MAXIMUM WELL TEMP (C)................ 106
ROCK TYPES: ALLUVIUM; MIOCENE-PLEISTOCENE BASALT & ANDESITE; MESOZOIC METAMORPHICS
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
94	110	39	0.1	300	14	74		620	55

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.2	10	8.06	-3.22	-15.38	-129.7

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	146
NA-K-CA (4/3)...........	109
NA-K....................	109
SILICA	
ADIABATIC...............	137
CONDUCTIVE..............	143
CHALCEDONY..............	116
CRISTOBALITE............	92
OPAL....................	22
SULFATE	
CONDUCTIVE..............	146
ONE-STEP STEAM LOSS.....	140
CONTINUOUS STEAM LOSS..	141

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	106 (M)	146 (I)	140 (K)	131	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	30	2	11.0	6.7
BASED ON: AMT					

VOLUME (KM**3)........... 18.3 STD. DEV. = 11.9
THERMAL ENERGY(10**18 J). 5.73 STD. DEV. = 3.75

REFERENCES: MARINER AND OTHERS, 1974A, 1975; MOORE, 1969; WARING, 1965

COMPILED BY: MARINER, R.

WABUSKA HOT SPRINGS , NEVADA

FIELD NAME................ LEE HOT SPRINGS
CIRCULAR REFERENCE........ 143

GEOGRAPHIC LOCALITY

STATE...................... NEVADA
COUNTY..................... CHURCHILL
LATITUDE................... 39-12.6 N
LONGITUDE.................. 118-43.4 W
MAPS....................... ALLEN SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16N	29E	34	NW OF NE	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 74A
ELEVATION (M)...................... 4020
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 78 TO 88
DISCHARGE (L/MIN).................. 130
ROCK TYPES: MIOCENE TO PLIOCENE VOLCANIC ROCKS

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975
FLOW (L/MIN)..... 130

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
88	180	44	0.6	450	26	114		470	380

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O	
7.9	2.4	7.40		-8.03		-13.21		-125.8	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	162
NA-K-CA (4/3)..........	137
NA-K..................	128
SILICA	
ADIABATIC.............	162
CONDUCTIVE............	173
CHALCEDONY............	151
CRISTOBALITE..........	123
OPAL..................	50
SULFATE	
CONDUCTIVE............	282
ONE-STEP STEAM LOSS....	239
CONTINUOUS STEAM LOSS..	251

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	162 (C,I)	173 (A)	162 (C,I)	166	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.36 STD. DEV. = 0.38

COMMENTS: THE SULFATE ISOTOPE GEOTHERMOMETER INDICATES A VERY HIGH TEMPERATURE (239 TO 282 C); THE PRESENCE OF TRAVERTINE RATHER THAN SINTER FAVORS THE LOWER TEMPERATURE.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN AND SPEED, 1974

COMPILED BY: MARINER, R.

LEE HOT SPRINGS , NEVADA

FIELD NAME................ SODA LAKE AREA
KGRA OR OTHER NAME........ STILLWATER-SODA LAKE KGRA
CIRCULAR REFERENCE........ 144

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... CHURCHILL
LATITUDE.................. 39-34.0 N
LONGITUDE................. 118-51.1 W
MAPS...................... SODA LAKE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
20N	28E	28	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)..................... 1200
SURFACE ACTIVITY.................. FUMAROLE AND WARM GROUND
NO. OF WELLS...................... 2
WELL DEPTHS (M)................... 152 TO 1313
MAXIMUM WELL TEMP (C)............. 152 AT DEPTH (M) 152
ROCK TYPES: PLEISTOCENE LAKE DEPOSITS AND BASALTIC TUFF
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, TEMPERATURE SURVEY

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
144	160	82	2.1	1000	48	144		360	1500

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
0.6	5.7	7.86	+0.28	-13.48	-109.3

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	161
NA-K-CA (4/3)..........	159
NA-K.................	112

SILICA

ADIABATIC.............	156
CONDUCTIVE............	165
CHALCEDONY............	142
CRISTOBALITE..........	115
OPAL..................	42

SULFATE

CONDUCTIVE............	127
ONE-STEP STEAM LOSS....	129
CONTINUOUS STEAM LOSS..	129

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	144 (M)	165 (A)	161 (I)	157	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.0	1.0		
THICKNESS (KM)	1.0	2.7	1.5	1.7	0.4
SUBSURFACE AREA (KM**2)	1	28	5	11.3	5.9

BASED ON: SHALLOW TEMPERATURE SURVEY

VOLUME (KM**3)........... 19.6 STD. DEV. = 11.3
THERMAL ENERGY(10**18 J). 7.51 STD. DEV. = 4.32

COMMENTS: CHALCEDONY GEOTHERMOMETER INDICATES 142 DEG C; PERMEABILITY OF AQUIFER IS VERY LOW; ONLY TOTAL DEPTH AVAILABLE ON THE DEEPER WELL.

REFERENCES: MORRISON, 1964; MARINER AND OTHERS, 1975; OLMSTED AND OTHERS, 1975

COMPILED BY: MARINER, R.

SODA LAKE AREA, NEVADA

FIELD NAME................ STILLWATER AREA
KGRA OR OTHER NAME........ STILLWATER-SODA LAKE KGRA
CIRCULAR REFERENCE........ 145

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... CHURCHILL
LATITUDE.................. 39-31.3 N
LONGITUDE................. 118-33.1 W
MAPS...................... STILLWATER 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
19N	31E	07	SW	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1189
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING
WELL DEPTHS (M).................... 1292
MAXIMUM WELL TEMP (C).............. 156 AT DEPTH (M) 430
ROCK TYPES: ALLUVIUM AND TERTIARY BASALT
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, TEMPERATURE SURVEY

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
96	170	108	1.7	1480	42	90		190	2200

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.0	15	7.57	-3.14	-12.36	-110.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	140
NA-K-CA (4/3)	150
NA-K	73
SILICA	
ADIABATIC	159
CONDUCTIVE	169
CHALCEDONY	146
CRISTOBALITE	119
OPAL	46
SULFATE	
CONDUCTIVE	191
ONE-STEP STEAM LOSS	177
CONTINUOUS STEAM LOSS	179

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	140 (I)	177 (K)	159 (C)	159	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.4	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	14	66	26	35.3	11.1

BASED ON: SHALLOW TEMPERATURE SURVEY

VOLUME (KM**3)........... 58.9 STD. DEV. = 21.8
THERMAL ENERGY(10**18 J). 22.84 STD. DEV. = 8.56

COMMENTS: WELL DATA FROM THE O'NEILL-OLIPHANT REYNOLDS #1 GEOTHERMAL TEST WELL.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN AND SPEED, 1974; MORRISON, 1964; OLMSTED AND OTHERS, 1975; RENNER AND OTHERS, 1975

COMPILED BY: MARINER, R.

STILLWATER AREA , NEVADA

FIELD NAME................ FERNLEY AREA
KGRA OR OTHER NAME........ BRADY-HAZEN KGRA
CIRCULAR REFERENCE........ 146

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... LYON
LATITUDE.................. 39-35.9 N
LONGITUDE................. 119-06.4 W
MAPS...................... TWO TIPS 1162,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
20N	26E	18	SE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1241
NO. OF WELLS....................... 3
WELL DEPTHS (M).................... 91 TO 229
MAXIMUM WELL TEMP (C).............. 132
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY BASALT, ANDESITE, AND TUFFACEOUS SEDIMENTARY ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
86	150	70	1.5	620	38	100		400	820

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.2	5.6	7.05	-5.61	-13.30	-121.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	166
NA-K-CA (4/3)...........	145
NA-K....................	133
SILICA	
ADIABATIC...............	153
CONDUCTIVE..............	161
CHALCEDONY..............	137
CRISTOBALITE............	111
OPAL....................	39
SULFATE	
CONDUCTIVE..............	220
ONE-STEP STEAM LOSS.....	196
CONTINUOUS STEAM LOSS..	202

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	161 (A)	220 (K)	166 (I)	182	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.51 STD. DEV. = 0.44

REFERENCES: MARINER AND OTHERS, 1975

COMPILED BY: MARINER, R.

FERNLEY AREA, NEVADA

FIELD NAME................ BRADY HOT SPRINGS
KGRA OR OTHER NAME........ BRADY-HAZEN KGRA
CIRCULAR REFERENCE........ 147

GEOGRAPHIC LOCALITY

STATE...................... NEVADA
COUNTY..................... CHURCHILL
LATITUDE................... 39-47.2 N
LONGITUDE.................. 119-00.0 W
MAPS....................... FIRE BALL RIDGE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
22N	26E	12	SW	MT, DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 72
ELEVATION (M)...................... 1256
SURFACE ACTIVITY................... FUMAROLE
ASSOCIATED DEPOSITS................ SINTER, TRAVERTINE
NO. OF WELLS....................... MORE THAN 13
WELL DEPTHS (M).................... 73 TO 2219
MAXIMUM WELL TEMP (C).............. 214
ROCK TYPES: PLIOCENE-PLEISTOC&NE BASALT; QUATERNARY ALLUVIUM
GEOPHYSICS: HEAT FLOW, GRAVITY, MAGNETICS

CHEMISTRY

SAMPLE SOURCE.... USGS FILE DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
BOILING	150	52	0.4	100	40	102		270	1400

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.7	5.5	6.99 AT 16 DEG C			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	246
NA-K-CA (4/3)	129
NA-K	434
SILICA	
ADIABATIC	153
CONDUCTIVE	161
CHALCEDONY	137
CRISTOBALITE	111
OPAL	39

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	140	170	155	155	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	1.5	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	30	7	13.0	6.1

BASED ON: TEMPERATURE GRADIENT SURVEY

VOLUME (KM**3)	21.7	STD. DEV. = 11.1
THERMAL ENERGY(10**18 J).	8.19	STD. DEV. = 4.22

COMMENTS: HOT SPRINGS BECAME INACTIVE AFTER SEVERAL GEOTHERMAL WELLS WERE DRILLED IN THE EARLY 1960'S. GEOTHERMAL FLUID WITH A WORKING TEMPERATURE OF 154 C (H. FALK, PERSONAL COMMUN., 1978) CURRENTLY USED IN A COMMERCIAL VEGETABLE DRYING OPERATION.

REFERENCES: OLMSTED AND OTHERS, 1975; GARSIDE, 1974

COMPILED BY: MARINER, R. AND BROOK, C.

BRADY HOT SPRINGS , NEVADA

FIELD NAME................ DESERT PEAK AREA
KGRA OR OTHER NAME........ BRADY-HAZEN KGRA
CIRCULAR REFERENCE........ 148

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... CHURCHILL
LATITUDE................... 39-45.7 N
LONGITUDE.................. 118-57.0 W
MAPS....................... DESERT PEAK 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
22N	27E	21	NE OF NE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)....................... 1403
SURFACE ACTIVITY.................... NONE, FOUND BY DRILLING
NO. OF WELLS........................ 3
WELL DEPTHS (M)..................... TO 2337
ROCK TYPES: TERTIARY ANDESITE, BASALT, SILICEOUS ASH FLOW TUFFS, AND JURASSIC METAVOLCANICS

CHEMISTRY
SAMPLE SOURCE.... BENOIT, 1978

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
	440	90	1.0	2000	240	43		90	3600

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
			-5.26	-12.52	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	225
NA-K-CA (4/3)	269
NA-K	206
SILICA	
ADIABATIC	217
CONDUCTIVE	241
CHALCEDONY	231
CRISTOBALITE	195
OPAL	116
SULFATE	
CONDUCTIVE	229
ONE-STEP STEAM LOSS	206
CONTINUOUS STEAM LOSS	211

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	208 (M)	229 (K)	225 (I)	221	5

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.0	1.5		
THICKNESS (KM)	1.0	2.7	1.5	1.7	0.4
SUBSURFACE AREA (KM**2)	10	50	30	30.0	8.2

BASED ON: GEOLOGIC INFERENCE

VOLUME (KM**3)........... 52.0 STD. DEV. = 18.0
THERMAL ENERGY(10**18 J). 28.88 STD. DEV. = 10.01

COMMENTS: WELLS B 21-2(200 C) AND B 21-1(208 C) ARE BOTH CAPABLE OF TOTAL FLOW OF OVER 204,300 KG/HR; CHEMICALLY VERY DIFFERENT FROM BRADY HOT SPRINGS; RESERVOIR DEVELOPER THINKS THE HEAT COMES FROM DEEP CIRCULATION. THICKNESS ESTIMATES BASED ON WELL DATA.

REFERENCES: BENOIT, 1978

COMPILED BY: MARINER, R.

DESERT PEAK AREA, NEVADA

FIELD NAME................. DIXIE HOT SPRINGS
KGRA OR OTHER NAME......... DIXIE VALLEY KGRA
CIRCULAR REFERENCE......... 149

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... CHURCHILL
LATITUDE................... 39-47.9 N
LONGITUDE.................. 118-04.0 W
MAPS....................... DIXIE HOT SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
22N	35E	05	SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 71A
ELEVATION (M)....................... 1045
SURFACE ACTIVITY.................... HOT SPRINGS AND SEEPS
DISCHARGE (L/MIN)................... SEVERAL 100
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY VOLCANIC ROCKS; MESOZOIC INTRUSIVE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, SEISMIC REFRACTION

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
72	115	3.6	0.02	190	6.5	111	11	111	126

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
16.3	0.89	8.60	-2.09	-15.89	-126.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	143
NA-K-CA (4/3)..........	137
NA-K...................	86
SILICA	
ADIABATIC..............	139
CONDUCTIVE.............	145
CHALCEDONY.............	119
CRISTOBALITE...........	95
OPAL...................	24
SULFATE	
CONDUCTIVE.............	127
ONE-STEP STEAM LOSS....	120
CONTINUOUS STEAM LOSS..	121

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	127 (K)	145 (A)	145 (A)	139	4

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.12 STD. DEV. = 0.31

REFERENCES: MARINER AND OTHERS, 1974A, 1975; PAGE, 1965; WARING, 1965; RENNER AND OTHERS, 1976; THOMPSON AND OTHERS, 1967; USGS FILE DATA

COMPILED BY: MARINER, R.

DIXIE HOT SPRINGS , NEVADA

FIELD NAME................ COLADO AREA
CIRCULAR REFERENCE........ 150

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-14.9 N
LONGITUDE................. 118-24.7 W
MAPS...................... OREANA 1:62,500; LOVELOCK 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
28N	32E	33	SE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)..................... 1231
SURFACE ACTIVITY.................. NONE
NO. OF SPRINGS.................... NONE
NO. OF WELLS...................... 2
ROCK TYPES: PLAYA DEPOSITS OVERLYING TERTIARY RHYOLITE AND MESOZOIC SEDIMENTS
GEOPHYSICS: GRAVITY, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. USGS FILE DATA
COLLECTION DATE.. 1976/07/27

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	85	110	6.5	1450	120	199		120	2400

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.6	8.7	7.56 AT 38 DEG C			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	194
NA-K-CA (4/3)	205
NA-K	163
SILICA	
ADIABATIC	125
CONDUCTIVE	128
CHALCEDONY	101
CRISTOBALITE	78
OPAL	9

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	61 (M)	128 (A)	101 (D)	97	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.73 STD. DEV. = 0.24

COMMENTS: MAGNESIUM CORRECTED NA-K-CA GEOTHERMOMETER INDICATES 160 DEG C; MIXING POSSIBLE; WELLS ARE ADJACENT TO THE COLADO KGRA AND HAVE PUMPED DISCHARGE RATES OF SEVERAL THOUSAND L/M.

REFERENCES: STEWART AND CARLSON, 1974

COMPILED BY: MARINER, R.

COLADO AREA , NEVADA

FIELD NAME................ HUMBOLDT HOUSE
CIRCULAR REFERENCE........ 151

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-32.1 N
LONGITUDE................. 118-16.1 W
MAPS...................... LOVELOCK 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
31N	33E	21	SE OF NE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)...................... 1375(?)
SURFACE ACTIVITY................... THERMAL WATER DISCHARGING FROM A SULPHUR EXPLORATION WELL
ASSOCIATED DEPOSITS................ SULFER, TRAVERTINE, AND SINTER(?)
NO. OF WELLS....................... 3
ROCK TYPES: PLAYA DEPOSITS OVERLYING TRIASSIC CARBONATES(?)
GEOPHYSICS: GRAVITY, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... PHILLIPS-CAMPBELL E-1, USGS FILE DATA
COLLECTION DATE.. 1978/06/22

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
BOILING	340	43	3.6	1350	230	202		18	2230

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.2	8.1		-4.57	-14.89	

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	249
NA-K-CA (4/3)	295
NA-K	256

SILICA

ADIABATIC	200
CONDUCTIVE	219
CHALCEDONY	205
CRISTOBALITE	172
OPAL	94

SULFATE

CONDUCTIVE	172
ONE-STEP STEAM LOSS	162
CONTINUOUS STEAM LOSS	164

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	172 (K)	249 (I)	230 (J)	217	16

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.82 STD. DEV. = 0.53

COMMENTS: CHEMICAL ANALYSIS FROM TOTAL-FLOW SAMPLE. THE OTHER DEEP EXPLORATION WELL WAS DRILLED BY UNION OIL CO. IN NE NE SEC. 3, T.31N., R. 33E.

REFERENCES: USGS, UNPUB. DATA

COMPILED BY: BROOK, C. AND MARINER, R.

HUMBOLDT HOUSE, NEVADA

FIELD NAME................ KYLE HOT SPRINGS
KGRA OR OTHER NAME........ KYLE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 152

GEOGRAPHIC LOCALITY

STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-24.4 N
LONGITUDE................. 117-52.9 W
MAPS...................... KYLE HOT SPRINGS 1162.500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
29N	36E	01	SW	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 66
ELEVATION (M)...................... 1390
SURFACE ACTIVITY................... HOT SPRING AND SEEPS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 38 TO 77
DISCHARGE (L/MIN).................. 20
ROCK TYPES: QUATERNARY ALLUVIUM AND PALEOZOIC METAMORPHIC ROCKS
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW, RESISTIVITY, SP, TELLURIC

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
77	150	95	25.5	540	80	544		51	770

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.7	3.8	6.50	-3.93	-15.50	-130.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	211
NA-K-CA (4/3)...........	169
NA-K....................	235
SILICA	
ADIABATIC...............	153
CONDUCTIVE..............	161
CHALCEDONY..............	137
CRISTOBALITE............	111
OPAL....................	39
SULFATE	
CONDUCTIVE..............	154
ONE-STEP STEAM LOSS.....	144
CONTINUOUS STEAM LOSS..	146

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	154 (K)	161 (A)	161 (A)	159	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	16	5	7.7	3.0

BASED ON: ACTIVE AND INACTIVE SPRING DEPOSITS AND GRAVITY ANOMALY

VOLUME (KM**3)............ 12.8 STD. DEV. = 5.6
THERMAL ENERGY(10**18 J). 4.96 STD. DEV. = 2.19

COMMENTS: MG-CORRECTED NA-K-CA GEOTHERMOMETER INDICATES 75 C; LOW FLOW RATE MAY HAVE PERMITTED EXTENSIVE NEAR-SURFACE REACTION WITH THE COUNTRY ROCK.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; TATLOCK, 1969; WARING, 1965; GOLDSTEIN AND OTHERS, 1976; SASS AND OTHERS, 1976

COMPILED BY: MARINER, R.

KYLE HOT SPRINGS, NEVADA

FIELD NAME................ SOU (GILBERT'S) HOT SPRINGS
KGRA OR OTHER NAME........ DIXIE VALLEY KGRA
CIRCULAR REFERENCE........ 153

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... PERSHING
LATITUDE................... 40-05.4 N
LONGITUDE.................. 117-43.5 W
MAPS....................... CAIN MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
26N	38E	29	SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 68
ELEVATION (M)...................... 1122
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY FLOWS AND VOLCANIC RELATED SEDIMENTS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
73	65	110	22	165	26	312		370	110

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.1			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	189
NA-K-CA (4/3)...........	99
NA-K....................	244

SILICA

ADIABATIC..............	113
CONDUCTIVE.............	114
CHALCEDONY.............	86
CRISTOBALITE...........	64
OPAL...................	-3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	79 (J)	114 (A)	86 (D)	93	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATES

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.70 STD. DEV. = 0.21

REFERENCES: MARINER AND OTHERS, 1974A; WARING, 1965; TATLOCK, 1969; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

SOU (GILBERT'S) HOT SPRINGS , NEVADA

FIELD NAME................ LEACH HOT SPRINGS
KGRA OR OTHER NAME........ LEACH HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 154

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... PERSHING
LATITUDE.................. 40-36.2 N
LONGITUDE................. 117-38.7 W
MAPS...................... LEACH HOT SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
32N	38E	36	SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 64
ELEVATION (M)...................... 1421
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER AND TUFA
NO. OF SPRINGS..................... 30
SPRING TEMPERATURES (C)............ 34 TO 95
DISCHARGE (L/MIN).................. 690
ROCK TYPES: QUATERNARY ALLUVIUM, TERTIARY SEDIMENTARY ROCKS, BASALT OF UNKNOWN AGE, PALEOZOIC ROCK
GEOPHYSICS: HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975
COLLECTION DATE.. 1972/00/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
92	135	8.8	0.5	160	13	366	1	53	29

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.8	1.2	7.40	-5.22	-15.70	-128.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	176
NA-K-CA (4/3)	139
NA-K	161
SILICA	
ADIABATIC	147
CONDUCTIVE	155
CHALCEDONY	130
CRISTOBALITE	104
OPAL	33
SULFATE	
CONDUCTIVE	170
ONE-STEP STEAM LOSS	159
CONTINUOUS STEAM LOSS	161

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	155 (A)	170 (K)	160 (J)	162	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	3.5	9	5	5.8	1.2

BASED ON: HEAT FLOW AND SHALLOW TEMPERATURE SURVEYS

VOLUME (KM**3)........... 9.7 STD. DEV. = 2.7
THERMAL ENERGY(10**18 J). 3.85 STD. DEV. = 1.06

COMMENTS: DIFFERENCES IN SURFACE TEMPERATURES ARE APPARENTLY RELATED TO THE FLOW RATES.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; OLMSTED AND OTHERS, 1975; WARING, 1965; SASS AND OTHERS, 1977

COMPILED BY: MARINER, R.

LEACH HOT SPRINGS , NEVADA

FIELD NAME................ GOLCONDA HOT SPRINGS
CIRCULAR REFERENCE........ 155

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... HUMBOLDT
LATITUDE................... 40-57.7 N
LONGITUDE.................. 117-29.6 W
MAPS....................... GOLCONDA 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
36N	40E	29	SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 19
ELEVATION (M)...................... 1329
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 12
SPRING TEMPERATURES (C)............ 49 TO 74
DISCHARGE (L/MIN).................. 750
ROCK TYPES: QUATERNARY ALLUVIUM; CAMBRIAN QUARTZITE; TERTIARY VOLCANIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
74	66	33	6.8	130	22	429		56	18

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.8	1.1	6.53			-15.65	-125.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	201
NA-K-CA (4/3)	121
NA-K	255
SILICA	
ADIABATIC	114
CONDUCTIVE	115
CHALCEDONY	86
CRISTOBALITE	65
OPAL	-2

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	86 (D,I)	115 (A)	86 (D,I)	96	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.73 STD. DEV. = 0.21

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; WILLDEN, 1964; ERICKSON AND MARSH, 1974; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

GOLCONDA HOT SPRINGS, NEVADA

FIELD NAME................ HOT POT (BLOSSOM HOT SPRINGS)
CIRCULAR REFERENCE........ 156

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... HUMBOLDT
LATITUDE................... 40-55.3 N
LONGITUDE.................. 117-06.5 W
MAPS....................... HOT POT 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
35N	43E	11	SW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 19
ELEVATION (M)...................... 1353
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 1
DISCHARGE (L/MIN).................. 265
ROCK TYPES: QUATERNARY ALLUVIUM, TERTIARY BASALT(?), AND CAMBRIAN QUARTZITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
58	80	29	5	288	33	823		60	28

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.0			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	194
NA-K-CA (4/3)...........	154
NA-K....................	200

SILICA

ADIABATIC...............	122
CONDUCTIVE..............	125
CHALCEDONY..............	97
CRISTOBALITE............	74
OPAL....................	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	97 (D)	125 (A)	114 (J)	112	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.87	STD. DEV. = 0.25

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN, 1964; HOSE AND TAYLOR, 1974

COMPILED BY: MARINER, R.

HOT POT (BLOSSOM HOT SPRINGS) , NEVADA

FIELD NAME................ HOT SPRINGS RANCH
CIRCULAR REFFRENCE........ 157

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... HUMBOLDT
LATITUDE.................. 40-45.7 N
LONGITUDE................. 117-29.5 W
MAPS...................... EONA MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
33N	40E	05	SE	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)..................... 1475
SURFACE ACTIVITY.................. HOT SPRINGS
ASSOCIATED DEPOSITS............... MINOR TRAVERTINE
NO. OF WELLS...................... 1
WELL DEPTHS (M)................... 937
ROCK TYPES: CAMBRIAN PHYLLITIC SHALE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
85	125	16	0.9	200	18	385		140	41

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.40		-15.74	-131.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	180
NA-K-CA (4/3)...........	139
NA-K....................	172
SILICA	
ADIABATIC...............	143
CONDUCTIVE..............	150
CHALCEDONY..............	125
CRISTOBALITE............	100
OPAL....................	29

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	125 (D)	160 (J)	150 (A)	145	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.17 STD. DEV. = 0.33

COMMENTS: SPRING WATER SUPERSATURATED WITH RESPECT TO CALCITE.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WILLDEN, 1964

COMPILED BY: MARINER, R.

HOT SPRINGS RANCH , NEVADA

FIELD NAME................. BUFFALO VALLEY HOT SPRINGS
CIRCULAR REFERENCE........ 158

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... LANDER
LATITUDE................... 40-22.1 N
LONGITUDE.................. 117-19.5 W
MAPS....................... BUFFALO SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
29N	41E	23	SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 6
WARING NUMBER....................... 78
ELEVATION (M)....................... 1405
SURFACE ACTIVITY.................... HOT SPRINGS AND SEEPS
ASSOCIATED DEPOSITS................. TRAVERTINE
NO. OF SPRINGS...................... 100 TO 200
SPRING TEMPERATURES (C)............. AMBIENT TO 79
DISCHARGE (L/MIN)................... 36
ROCK TYPES: QUATERNARY ALLUVIUM; QUATERNARY BASALT; TERTIARY TUFF

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
49	80	45	4.9	250	34	813		110	29

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	2.3	6.53	-3.22	-15.85	-131.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	197
NA-K-CA (4/3)	140
NA-K	223
SILICA	
ADIABATIC	122
CONDUCTIVE	125
CHALCEDONY	97
CRISTOBALITE	74
OPAL	6
SULFATE	
CONDUCTIVE	140
ONE-STEP STEAM LOSS	128
CONTINUOUS STEAM LOSS	130

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	97 (D)	140 (K)	135 (J)	124	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1.2	6	3	3.4	1.0

BASED ON: TEMPERATURE GRADIENT SURVEY

VOLUME (KM**3)............ 5.7 STD. DEV. = 2.0
THERMAL ENERGY(10**18 J). 1.67 STD. DEV. = 0.60

COMMENTS: LOW FLOW RATE; GEOTHERMOMETERS ARE SEMIQUANTITATIVE AT BEST. NA-K-CA GEOTHERMOMETER RELATIVELY INSENSITIVE TO LOSS OF CALCIUM.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; OLMSTED AND OTHERS, 1975; WARING, 1965; STEWART AND MCKEE, 1970

COMPILED BY: MARINER, R.

BUFFALO VALLEY HOT SPRINGS, NEVADA

FIELD NAME................ SMITH CREEK VALLEY AREA
CIRCULAR REFERENCE........ 159

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... LANDER
LATITUDE.................. 39-18.7 N
LONGITUDE................. 117-32.5 W
MAPS...................... MILLETT 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
17N	39E	11	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 847
ELEVATION (M)...................... 1859
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
DISCHARGE (L/MIN).................. 75
ROCK TYPES: QUATERNARY ALLUVIUM, TERTIARY (OLIGOCENE-MIOCENE) ASH-FLOW RHYOLITE

CHEMISTRY
FLOW (L/MIN)..... 25

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
86	110	4.8	0.06	170	8.4	246	5	102	22

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.9	0.66	7.72	-4.06	-16.48	-130.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	156
NA-K-CA (4/3)	138
NA-K	114
SILICA	
ADIABATIC	137
CONDUCTIVE	143
CHALCEDONY	116
CRISTOBALITE	92
OPAL	22
SULFATE	
CONDUCTIVE	143
ONE-STEP STEAM LOSS	136
CONTINUOUS STEAM LOSS	137

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	116 (D)	156 (I)	143 (A,K)	138	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.11 STD. DEV. = 0.32

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; MCKEE, 1968; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

SMITH CREEK VALLEY AREA , NEVADA

FIELD NAME................ SPENCER HOT SPRINGS
CIRCULAR REFERENCE........ 160

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... LANDER
LATITUDE.................. 39-19.5 N
LONGITUDE................. 116-51.5 W
MAPS...................... SPENCER HOT SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
			MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 83
ELEVATION (M)...................... 1731
SURFACE ACTIVITY................... HOT SPRINGS AND ARTESIAN WELLS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
DISCHARGE (L/MIN).................. 50
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY ASH-FLOW TUFF; JURASSIC GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
72	77	43	9.4	200	36	672		51	22

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.7	2.6	6.50		-16.01	-135.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	210
NA-K-CA (4/3)	140
NA-K	265
SILICA	
ADIABATIC	121
CONDUCTIVE	123
CHALCEDONY	95
CRISTOBALITE	72
OPAL	4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	88 (J)	123 (A)	95 (D)	102	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.78 STD. DEV. = 0.23

REFERENCES: MARINER AND OTHERS, 1974A, 1975; MCKEE, 1968; STEWART AND MCKEE, 1970; WARING, 1965; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

SPENCER HOT SPRINGS , NEVADA

FIELD NAME................ DARROUGH HOT SPRINGS
KGRA OR OTHER NAME........ DARROUGH HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 161

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... NYE
LATITUDE.................. 38-49.3 N
LONGITUDE................. 117-10.8 W
MAPS...................... TONOPAH 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
11N	43E	8	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 118
ELEVATION (M)...................... 1707
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ MINOR TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
DISCHARGE (L/MIN).................. SEVERAL 100
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 278
MAXIMUM WELL TEMP (C).............. 129 AT DEPTH (M) 278(?)
ROCK TYPES: QUATERNARY ALLUVIUM, PALEOZOIC RHYOLITE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
95	98	1.3	0.1	110	2.6	146	3	53	12

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
14	0.22	8.30		-15.50	-122.5

GEOTHERMOMETERS (C)
CATION

NA-K-CA (1/3)...........	126
NA-K-CA (4/3)...........	119
NA-K..................	61

SILICA

ADIABATIC...............	132
CONDUCTIVE..............	136
CHALCEDONY..............	109
CRISTOBALITE............	85
OPAL....................	16

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	129 (M)	136 (A)	132 (C)	132	1

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.0	1.5		
THICKNESS (KM)	1.0	2.7	1.5	1.7	0.4
SUBSURFACE AREA (KM**2)	2	20	3	8.3	4.1
BASED ON: AMT					

VOLUME (KM**3)........... 14.4 STD. DEV. = 7.9
THERMAL ENERGY(10**18 J). 4.58 STD. DEV. = 2.50

COMMENTS: BOILING WELL FLOWS AT 4300 L/MIN.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; KLEINHAMPL AND ZIONY, 1967; GARSIDE, 1974; USGS FILE DATA

COMPILED BY: MARINER, R.

DARROUGH HOT SPRINGS, NEVADA

FIELD NAME................ BEOWAWE HOT SPRINGS (ABANDONED STEAM WELL)
KGRA OR OTHER NAME........ BEOWAWE KGRA
CIRCULAR REFERENCE........ 162

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... EUREKA
LATITUDE.................. 40-34.2 N
LONGITUDE................. 116-34.8 W
MAPS...................... DUNPHY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
31N	48E	17	NW	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE..................... 8
WARING NUMBER..................... 38
ELEVATION (M)..................... 1524
ASSOCIATED DEPOSITS............... SINTER, HOT SPRINGS, GEYSER, FUMAROLE
NO. OF WELLS...................... 12
WELL DEPTHS (M)................... 72 TO 2917
MAXIMUM WELL TEMP (C)............. 211 AT DEPTH (M) 2917
ROCK TYPES: QUATERNARY ALLUVIUM: MIOCENE BASALT AND ANDESITE
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, SP, SEISMIC GROUND NOISE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
BOILING	500	1.3	0.2	250	38	505	81	64	70

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
18	2.5	9.38	-10.01	-14.76	-130.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	242
NA-K-CA (4/3)	292
NA-K	239
SILICA	
ADIABATIC	226
CONDUCTIVE	252
CHALCEDONY	245
CRISTOBALITE	207
OPAL	128
SULFATE	
CONDUCTIVE	295
ONE-STEP STEAM LOSS	251
CONTINUOUS STEAM LOSS	264

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	211 (M)	251 (K)	226 (C)	229	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.9	1.4	1.1		
THICKNESS (KM)	1.0	2.1	1.5	1.5	0.2
SUBSURFACE AREA (KM**2)	4	8	4	5.3	0.9

BASED ON: SPRINGS AND WELL DISTRIBUTION AND FAULT TREND

VOLUME (KM**3)........... 8.2 STD. DEV. = 1.9
THERMAL ENERGY(10**18 J). 4.73 STD. DEV. = 1.11

COMMENTS: MINIMUM TEMPERATURE WAS MEASURED IN A 2917 M WELL (M. LANE, PERSONAL COMMUN., 1978). ANALYSIS FROM STEAM WELL; ISOTOPIC DATA FROM SPRING. DEPTH TO RESERVOIR AND THICKNESS BASED ON DRILL DATA.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; GILLULY AND GATES, 1975; STEWART AND MCKEE, 1970; HOSE AND TAYLOR, 1974; OESTERLING, 1962

COMPILED BY: MARINER, R. AND BROOK, C.

BEOWAWE HOT SPRINGS (ABANDONED STEAM WELL), NEVADA

FIELD NAME................ HOT SPRINGS POINT
KGRA OR OTHER NAME........ HOT SPRINGS POINT KGRA
CIRCULAR REFERENCE........ 163

GEOGRAPHIC LOCALITY

STATE...................... NEVADA
COUNTY..................... EUREKA
LATITUDE................... 40-24.2 N
LONGITUDE.................. 116-31.0 W
MAPS....................... CRESCENT VALLEY 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
29N	48E	11	NE	MT. DIABLO

GENERAL INFORMATION

WARING FIGURE...................... 8
WARING NUMBER...................... 88A
ELEVATION (M)...................... 1442
SURFACE ACTIVITY................... HOT SPRINGS, POOLS, AND SEEPS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 2
DISCHARGE (L/MIN).................. 125
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 125
MAXIMUM WELL TEMP (C).............. 74
ROCK TYPES: MIOCENE AND PLIOCENE BASALTS, ORDOVICIAN CHERTS AND QUARTZITE
GEOPHYSICS: GRAVITY

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
54	67	53	35	230	58	913		7.0	1.0

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.6	2.1	6.63		-15.97	-136.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	233
NA-K-CA (4/3)	158
NA-K	325
SILICA	
ADIABATIC	115
CONDUCTIVE	116
CHALCEDONY	87
CRISTOBALITE	65
OPAL	-2

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	74 (M)	116 (A)	87 (D)	92	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.70 STD. DEV. = 0.21

COMMENTS: MG-CORRECTED NA-K-CA GEOTHERMOMETER INDICATES A TEMPERATURE LESS THAN THE SURFACE TEMPERATURE. HIGH MG CONCENTRATION MAY RESULT FROM EXTENSIVE WATER-ROCK REACTION AT OR NEAR THE SURFACE.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; GILLULY AND GATES, 1965

COMPILED BY: MARINER, R.

HOT SPRINGS POINT , NEVADA

FIELD NAME................ HOT SULPHUR SPRINGS (TUSCARORA)
CIRCULAR REFERENCE........ 164

GEOGRAPHIC LOCALITY

STATE..................... NEVADA
COUNTY.................... ELKO
LATITUDE.................. 41-28.2 N
LONGITUDE................. 116-09.0 W
MAPS...................... TUSCARORA 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
41N	52E	08	SE OF NE	MT. DIABLO

GENERAL INFORMATION

ELEVATION (M)...................... 1768
SURFACE ACTIVITY................... HOT SPRINGS
ROCK TYPES: TERTIARY LACUSTRINE ROCKS

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974
COLLECTION DATE.. 1972/00/00

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
90	165	12	0.3	160	16	345		61	22

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
10	1.2	7.3		-16.78	-134.9

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	184
NA-K-CA (4/3)...........	139
NA-K....................	184

SILICA

ADIABATIC...............	158
CONDUCTIVE..............	167
CHALCEDONY..............	144
CRISTOBALITE............	117
OPAL....................	44

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	144 (D)	184 (I)	167 (A)	165	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.35 STD. DEV. = 0.39

REFERENCES: MARINER AND OTHERS, 1975; HOSE AND TAYLOR, 1974; GRANGER AND OTHERS, 1957; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

HOT SULPHUR SPRINGS (TUSCARORA) , NEVADA

FIELD NAME................ CARLIN AREA
CIRCULAR REFERENCE........ 165

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... ELKO
LATITUDE.................. 40-42.0 N
LONGITUDE................. 116-08.0 W
MAPS...................... CARLIN 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
33N	52E	33	MT. DIABLO

GENERAL INFORMATION
ELEVATION (M)..................... 1500
SURFACE ACTIVITY.................. HOT SPRINGS
ROCK TYPES: QUATERNARY ALLUVIUM; TERTIARY VOLCANIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
79	70	60	15	45	16	335		52	12

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.60		-16.64	-132.7

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	218
NA-K-CA (4/3)..........	81
NA-K.................	403
SILICA	
ADIABATIC.............	117
CONDUCTIVE............	118
CHALCEDONY............	90
CRISTOBALITE..........	68
OPAL.................	0

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	81 (I)	118 (A)	90 (D)	96	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.73 STD. DEV. = 0.22

COMMENTS: PH NOT DETERMINED IN THE FIELD.

REFERENCES: MARINER AND OTHERS, 1974A; GRANGER AND OTHERS, 1957; SMITH AND KETNER, 1972

COMPILED BY: MARINER, R.

CARLIN AREA , NEVADA

FIELD NAME................ HOT HOLE (ELKO HOT SPRINGS)
KGRA OR OTHER NAME........ ELKO HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 166

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... ELKO
LATITUDE.................. 40-49.1 N
LONGITUDE................. 115-46.5 W
MAPS...................... ELKO WEST 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
34N	55E	21	NE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 32
ELEVATION (M)...................... 1542
SURFACE ACTIVITY................... HOT SPRING
ASSOCIATED DEPOSITS................ TRAVERTINE
ROCK TYPES: TERTIARY LIMESTONE, VOLCANIC AND LACUSTRINE ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
56	65	60	15.5	120	39	488	1	72	16

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.9	0.70	7.21		-15.31	-144.7

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	234
NA-K-CA (4/3)	127
NA-K	381

SILICA

ADIABATIC	113
CONDUCTIVE	114
CHALCEDONY	86
CRISTOBALITE	64
OPAL	-3

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	80 (J)	114 (A)	86 (D)	93	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.70	STD. DEV. = 0.21

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; GRANGER AND OTHERS, 1957; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

HOT HOLE (ELKO HOT SPRINGS) , NEVADA

FIELD NAME................ MINERAL (SAN JACINTO) HOT SPRINGS
CIRCULAR REFERENCE........ 167

GEOGRAPHIC LOCALITY
STATE..................... NEVADA
COUNTY.................... ELKO
LATITUDE.................. 41-47.3 N
LONGITUDE................. 114-43.3 W
MAPS...................... DELEPLAIN 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
45N	64E	16	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE...................... 8
WARING NUMBER...................... 22B
ELEVATION (M)...................... 1615
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL SPRINGS
SPRING TEMPERATURES (C)............ 25 TO 60
DISCHARGE (L/MIN).................. 4500
NO. OF WELLS....................... SEVERAL SHALLOW WELLS
ROCK TYPES: TEPTIARY LACUSTRINE SEDIMENTS, VOLCANIC FLOWS, AND GRANITE(?)

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974
FLOW (L/MIN)..... 4500

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	83	1.6	LT 0.01	75	2.2	108		45	15

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
8.9	0.47	9.1			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	129
NA-K-CA (4/3)..........	102
NA-K..................	75

SILICA

ADIABATIC.............	124
CONDUCTIVE............	127
CHALCEDONY............	99
CRISTOBALITE..........	76
OPAL..................	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (D,I)	128 (A,I)	100 (A,I)	109	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. =	0.9
THERMAL ENERGY(10**18 J).	0.85	STD. DEV. =	0.25

REFERENCES: MARINER AND OTHERS, 1974A; GRANGER AND OTHERS, 1957; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

MINERAL (SAN JACINTO) HOT SPRINGS , NEVADA

FIELD NAME................. HOT SULPHUR SPRINGS (SULPHUR SPRINGS)
CIRCULAR REFERENCE......... 168

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... ELKO
LATITUDE................... 41-09.4 N
LONGITUDE.................. 114-59.1 W
MAPS....................... OXLEY PEAK 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38N	62E	20	SE OF SE	MT. DIABLO

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 30
ELEVATION (M)....................... 1743
SURFACE ACTIVITY.................... HOT SPRINGS
ASSOCIATED DEPOSITS................. TRAVERTINE
NO. OF SPRINGS...................... SEVERAL
ROCK TYPES: TERTIARY VOLCANIC ROCKS OVERLYING PALEOZOIC LIMESTONE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974,1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	86	48	13	370	46	1230		12	37

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.4	0.73	6.60		-16.95	-136.6

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	199
NA-K-CA (4/3)...........	158
NA-K....................	211

SILICA

ADIABATIC...............	126
CONDUCTIVE..............	129
CHALCEDONY..............	101
CRISTOBALITE............	78
OPAL....................	10

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	85 (J)	129 (A)	102 (D)	105	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	2	6	4	4.0	0.8

BASED ON: SPRING DISTRIBUTION

VOLUME (KM**3)........... 6.7 STD. DEV. = 1.9

THERMAL ENERGY(10**18 J). 1.63 STD. DEV. = 0.48

COMMENTS: AN ANALYSIS WITH HIGHER SILICA CONCENTRATION IS NOT USED BECAUSE IT CONTAINS TWICE AS MUCH MAGNESIUM.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; WARING, 1965; GRANGER AND OTHERS, 1957

COMPILED BY: MARINER, R.

HOT SULPHUR SPRINGS (SULPHUR SPRINGS) , NEVADA

FIELD NAME................ SULPHUR HOT SPRINGS (HOT SULPHUR SPRINGS)
KGRA OR OTHER NAME........ RUBY VALLEY KGRA
CIRCULAR REFERENCE........ 169

GEOGRAPHIC LOCALITY

STATE..................... NEVADA
COUNTY.................... ELKO
LATITUDE.................. 40-35.2 N
LONGITUDE................. 115-17.1 W
MAPS...................... LAMOILLE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
31N	59E	11	NW	MT. DIABLO

GENERAL INFORMATION

ELEVATION (M)...................... 1844
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... 101
SPRING TEMPERATURES (C)............ 45 TO 95
DISCHARGE (L/MIN).................. 500
ROCK TYPES: QUATERNARY ALLUVIUM; MESOZOIC GRANITE, OLDER METAMORPHICS
GEOPHYSICS: AMT, GRAVITY, MAGNETIC, TELLURIC, TEMPERATURE SURVEY

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
93	210	1.0	0.03	135	8.9	244	15	40	23

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
17.7	0.20	8.53	-5.05	-16.09	-130.1

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	181
NA-K-CA (4/3)...........	190
NA-K....................	140
SILICA	
ADIABATIC...............	171
CONDUCTIVE..............	183
CHALCEDONY..............	163
CRISTOBALITE............	134
OPAL....................	59
SULFATE	
CONDUCTIVE..............	161
ONE-STEP STEAM LOSS.....	153
CONTINUOUS STEAM LOSS..	154

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	171 (C)	183 (A)	181 (I)	178	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	8	5	4.7	1.4

BASED ON: SHALLOW TEMPERATURE SURVEY AND AMT

VOLUME (KM**3)............ 7.8 STD. DEV. = 2.8
THERMAL ENERGY(10**18 J). 3.43 STD. DEV. = 1.25

COMMENTS: SULFATE-ISOTOPE TEMPERATURE(150 DEG C) MAY BE DUE IN PART TO THE OXIDATION OF SULFIDE TO SULFATE AT THE SURFACE.

REFERENCES: MARINER AND OTHERS, 1974A, 1975; OLMSTED AND OTHERS, 1975; GRANGER AND OTHERS, 1957; RENNER AND OTHERS, 1976

COMPILED BY: MARINER, R.

SULPHUR HOT SPRINGS (HOT SULPHUR SPRINGS) , NEVADA

FIELD NAME................ CHERRY CREEK AREA
CIRCULAR REFERENCE........ 170

GEOGRAPHIC LOCALITY
STATE...................... NEVADA
COUNTY..................... WHITE PINE
LATITUDE................... 39-51.0 N
LONGITUDE.................. 114-54.3 W
MAPS....................... ELY 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
23N	63E	06	

GENERAL INFORMATION
WARING FIGURE....................... 8
WARING NUMBER....................... 957
ELEVATION (M)....................... 1859
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... SEVERAL
ROCK TYPES: TERTIARY GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
61	105	12	0.3	150	4.8	380		1	16

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.2	0.35	7.77		-16.20	-127.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	128
NA-K-CA (4/3)	90
NA-K	81
SILICA	
ADIABATIC	135
CONDUCTIVE	140
CHALCEDONY	114
CRISTOBALITE	89
OPAL	19

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (I)	140 (A)	114 (D)	115	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.90 STD. DEV. = 0.27

REFERENCES: MARINER AND OTHERS, 1975

COMPILED BY: MARINER, R.

CHERRY CREEK AREA , NEVADA

New Mexico

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FIELD NAME................ VALLES CALDERA
KGRA OR OTHER NAME........ BACA LOCATION NO. 1 KGRA
CIRCULAR REFERENCE........ 171

   GEOGRAPHIC LOCALITY
      STATE...................... NEW MEXICO
      COUNTY..................... SANDOVAL
      LATITUDE................... 35-54.0  N
      LONGITUDE.................. 106-32.0  W
      MAPS....................... VALLE SAN ANTONIO 1:24,000; JEMEZ SPRINGS 1:62,500

      TOWNSHIP      RANGE      SECTION                       BASE & MERIDIAN
        20N          03E       35                            NEW MEXICO

   GENERAL INFORMATION
      WARING FIGURE.....................  2
      WARING NUMBER.....................  11, 12
      ELEVATION (M).....................  2650
      SURFACE ACTIVITY..................  HOT SPRINGS, FUMAROLES
      NO. OF SPRINGS....................  SEVERAL IN 3 GROUPS
      SPRING TEMPERATURES (C)...........  25       TO 87
      DISCHARGE (L/MIN).................  GT 2080
      NO. OF WELLS......................  17
      WELL DEPTHS (M)...................  800      TO 2745
      MAXIMUM WELL TEMP (C).............  332      AT DEPTH (M) 1500
      ROCK TYPES: RHYOLITE FLOWS AND TUFFS AND ANDESITE OVERLYING(?) SANDSTONES AND LIMESTONES
      GEOPHYSICS:  REGIONAL AEROMAGNETIC AND GRAVITY
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RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	250	290	278 (M)	273	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.4	1.5	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	25	160	40	75.0	30.2

BASED ON: WELL DISTRIBUTION, GEOLOGY, AEROMAGNETIC SURVEY

VOLUME (KM**3)........... 125.0 STD. DEV. = 56.3
THERMAL ENERGY(10**18 J). 86.96 STD. DEV. = 39.29

COMMENTS: ONE GROUP OF ACID-SULFATE SPRINGS , EXTENSIVE HYDROTHERMAL ALTERATION, AND ASSOCIATED GAS SEEPS IN SOUTHWEST QUADRANT OF PLEISTOCENE CALDERA. VAPOR-DOMINATED AREAS OF LIMITED EXTENT LOCALLY OVERLIE HOT-WATER RESERVOIR. A 50 MW GENERATING PLANT IS PLANNED.

REFERENCES: WARING, 1965; SUMMERS, 1965A, B; SMITH AND OTHERS, 1970; LAMBERT, 1976; CORDELL, 1976; R.L. SMITH, PERSONAL COMMUN., 1978; DONDANVILLE, 1978

COMPILED BY: BROOK, C.

VALLES CALDERA, NEW MEXICO

FIELD NAME................. JEMEZ SPRINGS (OJOS CALIENTES)
CIRCULAR REFERENCE........ 172

GEOGRAPHIC LOCALITY
STATE...................... NEW MEXICO
COUNTY..................... SANDOVAL
LATITUDE................... 35-46.3 N
LONGITUDE.................. 106-41.4 W
MAPS....................... JEMEZ SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
18N	02E	23	NEW MEXICO

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 15
ELEVATION (M)...................... 1891
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 10
SPRING TEMPERATURES (C)............ 34 TO 76
DISCHARGE (L/MIN).................. 756
ROCK TYPES: ALLUVIUM OVERLYING LIMESTONE

CHEMISTRY
SAMPLE SOURCE.... TRAINER, 1974; USGS FILE DATA
FLOW (L/MIN)..... 4.9
COLLECTION DATE.. 1972/12/02

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
75	79	130	4.8	640	82	732	1.5	53	920

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	7.4	6.3		-10.52	-82.1

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	202
NA-K-CA (4/3)..........	163
NA-K..................	215

SILICA

ADIABATIC.............	122
CONDUCTIVE............	124
CHALCEDONY............	96
CRISTOBALITE..........	74
OPAL..................	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (D)	124 (A)	96 (D)	105	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.81 STD. DEV. = 0.24

COMMENTS: MAY BE DEPOSITING CALCITE IN THE SUBSURFACE. WARING (1965) REPORTS 50 SPRINGS IN 2 GROUPS. WATER MAY BE DERIVED IN PART FROM RESERVOIR BENEATH VALLES CALDERA.

REFERENCES: WARING, 1965; SUMMERS, 1965A,B; TRAINER, 1974; SMITH AND OTHERS, 1970

COMPILED BY: BROOK, C.

JEMEZ SPRINGS (OJOS CALIENTES), NEW MEXICO

FIELD NAME................ SPENCE SPRING
KGRA OR OTHER NAME........ BACA LOCATION NO. 1 KGRA
CIRCULAR REFERENCE........ 173

GEOGRAPHIC LOCALITY
STATE..................... NEW MEXICO
COUNTY.................... SANDOVAL
LATITUDE.................. 35-51.0 N
LONGITUDE................. 106-37.8 W
MAPS...................... JEMEZ SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
19N	03E	28	NW	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)...................... 2237
SURFACE ACTIVITY................... HOT SPRING
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 41
DISCHARGE (L/MIN).................. 167
ROCK TYPES: RHYOLITE OVERLYING SANDSTONE AND LIMESTONE

CHEMISTRY
SAMPLE SOURCE.... TRAINER, 1974: USGS FILE DATA
FLOW (L/MIN)..... 167
COLLECTION DATE.. 1972/12/01

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
41	100	6.0	1.7	55	1.8	144	1.0	18	12

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
0.7	0.07	8.0		-11.89	-86.8

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	120
NA-K-CA (4/3)...........	63
NA-K....................	82

SILICA

ADIABATIC...............	133
CONDUCTIVE..............	137
CHALCEDONY..............	110
CRISTOBALITE............	87
OPAL....................	17

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	63 (I)	137 (A)	110 (D)	103	15

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.79 STD. DEV. = 0.26

REFERENCES: SMITH AND OTHERS, 1970; TRAINER, 1974

COMPILED BY: BROOK, C.

SPENCE SPRING , NEW MEXICO

FIELD NAME................ SAN FRANCISCO (LOWER FRISCO) HOT SPRINGS
KGRA OR OTHER NAME........ LOWER FRISCO HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 174

GEOGRAPHIC LOCALITY
STATE..................... NEW MEXICO
COUNTY.................... CATRON
LATITUDE.................. 33-14.7 N
LONGITUDE................. 108-52.8 W
MAPS...................... WILSON MOUNTAIN 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
12S	20W	23	NEW MEXICO

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 25
ELEVATION (M)...................... 1390
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 8
SPRING TEMPERATURES (C)............ 37
DISCHARGE (L/MIN).................. LT 50
ROCK TYPES: TERTIARY BASALT
GEOPHYSICS: GRAVITY

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
37	84	46	6.2	270	15	121		39	430

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.4	0.26	7.35		-10.44	-78.6

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	151
NA-K-CA (4/3)..........	106
NA-K..................	124

SILICA

ADIABATIC.............	125
CONDUCTIVE............	128
CHALCEDONY............	100
CRISTOBALITE..........	77
OPAL..................	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D,J)	128 (A)	99 (D,J)	109	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. =	0.9
THERMAL ENERGY(10**18 J).	0.84	STD. DEV. =	0.24

COMMENTS: SMALL SPRINGS AND SEEPS ARE SCATTERED FOR 2 KM ALONG THE SAN FRANCISCO RIVER.

REFERENCES: WARING, 1965; SUMMERS, 1965A, B; MARINER AND OTHERS, 1977A; RAMBERG AND OTHERS, 1978

COMPILED BY: BROOK, C.

SAN FRANCISCO (LOWER FRISCO) HOT SPRINGS, NEW MEXICO

FIELD NAME................ RADIUM HOT SPRINGS
KGRA OR OTHER NAME........ RADIUM SPRINGS KGRA
CIRCULAR REFERENCE........ 175

GEOGRAPHIC LOCALITY

STATE..................... NEW MEXICO
COUNTY.................... DONA ANA
LATITUDE.................. 32-30.0 N
LONGITUDE................. 106-55.5 W
MAPS...................... SAN DIEGO MOUNTAIN 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
21S	01W	10	NW OF NE	NEW MEXICO

GENERAL INFORMATION

WARING FIGURE...................... 2
WARING NUMBER...................... 38
ELEVATION (M)...................... 1220
SURFACE ACTIVITY................... EXTINCT HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF WELLS....................... 1
ROCK TYPES: SANDSTONE AND LIMESTONE
GEOPHYSICS: RESISTIVITY, GRAVITY

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1977

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	78	120	15	1100	160	414		260	1650

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	0.68	7.13			-9.06	-74.6

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	222
NA-K-CA (4/3)	213
NA-K	232

SILICA

ADIABATIC	121
CONDUCTIVE	124
CHALCEDONY	96
CRISTOBALITE	73
OPAL	5

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	74 (M)	124 (A)	96 (D)	98	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE AND IN PART RESISTIVITY

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.75 STD. DEV. = 0.23

COMMENTS: WARING (1965) REPORTS 2 SPRINGS WITH TEMPERATURES OF 74 AND 85 C. MARINER AND OTHERS (1977) REPORT THAT ORIGINAL SPRINGS ARE DRY. TEMPERATURE AND CHEMICAL ANALYSIS FROM PUMPED WELL. SPRING WATER SUPER-SATURATED WITH CALCITE; NA-K-CA GEOTHERMOMETER UNRELIABLE.

REFERENCES: WARING, 1965; SUMMERS, 1965A, B; JIRACEK AND SMITH, 1976; MARINER AND OTHERS, 1977A; DECKER AND OTHERS, 1975; SEAGER, 1975; SWANBERG, 1975

COMPILED BY: BROOK, C.

RADIUM HOT SPRINGS, NEW MEXICO

FIELD NAME................. LIGHTNING DOCK AREA
KGRA OR OTHER NAME........ LIGHTNING DOCK KGRA
CIRCULAR REFERENCE........ 176

GEOGRAPHIC LOCALITY
STATE...................... NEW MEXICO
COUNTY..................... HIDALGO
LATITUDE................... 32-08.9 N
LONGITUDE.................. 108-49.9 W
MAPS....................... SWALLOW FORK PEAK 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
25S	19W	07	NW OF SE	NEW MEXICO

GENERAL INFORMATION
ELEVATION (M)....................... 1280
SURFACE ACTIVITY.................... NONE, FOUND BY DRILLING.
NO. OF WELLS........................ 4
WELL DEPTHS (M)..................... 27 TO 173
MAXIMUM WELL TEMP (C)............... 107 AT DEPTH (M) 90?
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY ANDESITIC TO RHYOLITIC ROCKS
GEOPHYSICS: RESISTIVITY, GRAVITY

CHEMISTRY
SAMPLE SOURCE.... SWANBERG, 1978

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
81	143	23.2	0.8	318.6	21.1	103.7		480	87.6

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
12	0.5	8.16						

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	168
NA-K-CA (4/3)...........	142
NA-K....................	140
SILICA	
ADIABATIC...............	150
CONDUCTIVE..............	158
CHALCEDONY..............	134
CRISTOBALITE............	108
OPAL....................	36

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (M)	168 (I)	158 (A)	144	13

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.09	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: DIPOLE-DIPOLE RESISTIVITY AND SHALLOW TEMPERATURE SURVEYS

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.16 STD. DEV. = 0.35

COMMENTS: CHEMICAL ANALYSIS FROM MCCANT'S WELL; HOT WATER (100 C) OCCURS AT SHALLOW DEPTH (26 M) IN FRACTURED TUFF. OIL TEST WELL (COCKRELL NO-1, FEDERAL) 3 KM NORTH RECORDED 122 C AT 2254 M. NEAR-SURFACE WARM AREA OF 3 KM**2 DEFINED BY AREA OF RAPID SNOW MELT AND ANOMALOUS TEMPERATURES AT 1 M DEPTH.

REFERENCES: KINTZINGER, 1956; SUMMERS, 1965A, B; DEAL AND ELSTON, 1978; JIRACEK AND SMITH, 1976; SWANBERG, 1978; USGS FILE DATA ; RAMBERG AND OTHERS, 1978

COMPILED BY: BROOK, C.

LIGHTNING DOCK AREA , NEW MEXICO

Oregon

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FIELD NAME................ MT. HOOD AREA
KGRA OR OTHER NAME........ MT, HOOD KGRA
CIRCULAR REFERENCE........ 177

   GEOGRAPHIC LOCALITY
      STATE..................... OREGON
      COUNTY.................... WASCO/CLACKAMAS
      LATITUDE.................. 45-22.5  N
      LONGITUDE................. 121-42.5  W
      MAPS...................... CATHEDRAL RIDGE 1:24,000; TIMBERLINE LODGE 1:24,000

      TOWNSHIP     RANGE     SECTION                       BASE & MERIDIAN
        02S         09E      29                            WILLAMETTE

   GENERAL INFORMATION
      WARING FIGURE..................... 6
      WARING NUMBER..................... 1
      AREA OF SURFACE EXPRESSION (KM**2). 0.1L
      ELEVATION (M)..................... 3050
      SURFACE ACTIVITY.................. FUMAROLES AND ACID-SULFATE SPRINGS
      NO. OF SPRINGS.................... SEVERAL
      SPRING TEMPERATURES (C)........... 49      TO 90
      ROCK TYPES: QUATERNARY ANDESITIC LAVA AND TUFF
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RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	90 (0)	150 (0)	125 (0)	122	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
0) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.96 STD. DEV. = 0.29

COMMENTS: FUMAROLE GASES ARF MORE THAN 97% WATER VAPOR WITH THE REMAINDER CO2 AND H2S. MAY BE A SMALL VAPOR DOMINATED SYSTEM.

REFERENCES: AYRES AND CRESWELL, 1951; WARING, 1965; RENNER AND OTHER, 1976

COMPILED BY: MARINER, R.

MT. HOOD AREA , OREGON

FIELD NAME................ CAREY(AUSTIN) HOT SPRINGS
KGRA OR OTHER NAME........ CAREY HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 178

GEOGRAPHIC LOCALITY

STATE..................... OREGON
COUNTY.................... CLACKAMAS
LATITUDE.................. 45-01.2 N
LONGITUDE................. 122-00.6 W
MAPS...................... FISH CREEK MTN. 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
06S	07E	30	NW	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 4
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 503
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 80 TO 91
DISCHARGE (L/MIN).................. 950
ROCK TYPES: PLIOCENE TO RECENT BASALTIC FLOW AND PYROCLASTIC ROCKS

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
86	81	35	0.1	300	7.1	56		140	430

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.4	2.6	7.63		-2.41	-12.22	-94.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	118
NA-K-CA (4/3)...........	87
NA-K..................	61
SILICA	
ADIABATIC.............	123
CONDUCTIVE............	126
CHALCEDONY............	98
CRISTOBALITE..........	75
OPAL..................	7
SULFATE	
CONDUCTIVE............	181
ONE-STEP STEAM LOSS....	167
CONTINUOUS STEAM LOSS..	170

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (I)	126 (A)	98 (D)	104	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.80 STD. DEV. = 0.24

COMMENTS: SULFATE - ISOTOPES INDICATE 181 DEG C, MAY BE UNRELIABLE DUE TO OXIDATION OF H2S OR INDICATE A VERY DEEP RESERVOIR

REFERENCES: MARINER AND OTHERS, 1974B, 1975; PECK AND OTHERS, 1964; WARING, 1965

COMPILED BY: MARINER, R.

CAREY(AUSTIN) HOT SPRINGS , OREGON

FIELD NAME................. BREITENBUSH HOT SPRINGS
KGRA OR OTHER NAME......... BREITENBUSH HOT SPRINGS KGRA
CIRCULAR REFERENCE......... 179

GEOGRAPHIC LOCALITY

STATE..................... OREGON
COUNTY.................... MARION
LATITUDE.................. 44-46.9 N
LONGITUDE................. 121-58.5 W
MAPS...................... BREITENBUSH HOT SPRINGS 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
09S	07E	20	NE	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE....................... 6
WARING NUMBER....................... 6
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)....................... 683
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... 40
SPRING TEMPERATURES (C)............ 60 TO 92
DISCHARGE (L/MIN).................. 3400
ROCK TYPES: MIOCENE BASALT, TUFF-BRECCIA, TUFFS, AND ALTERED ROCK
GEOPHYSICS: GRAVITY, MAGNETIC, AMT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
92	83	100	1.3	720	31	142		140	1300

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.4	4.1	7.31	-2.67	-11.66	-97.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	149
NA-K-CA (4/3)...........	128
NA-K....................	103
SILICA	
ADIABATIC...............	124
CONDUCTIVE..............	127
CHALCEDONY..............	99
CRISTOBALITE............	76
OPAL....................	8
SULFATE	
CONDUCTIVE..............	195
ONE-STEP STEAM LOSS.....	179
CONTINUOUS STEAM LOSS..	182

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	149 (I)	127 (A)	125	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE AND AMT

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.99 STD. DEV. = 0.29

COMMENTS: SULFATE-ISOTOPE GEOTHERMOMETER INDICATES 195 DEG C AND MAY INDICATE A DEEP RESERVOIR

REFERENCES: MARINER AND OTHERS, 1974B, 1975; PECK AND OTHERS, 1964; WARING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R.

BREITENBUSH HOT SPRINGS , OREGON

FIELD NAME................ KAHNEETAH HOT SPRINGS
CIRCULAR REFERENCE........ 180

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... WASCO
LATITUDE................... 44-51.9 N
LONGITUDE.................. 121-12.9 W
MAPS....................... EAGLE BUTTE 1:24,000; BEND 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
08S	13E	20	WILLAMETTE

GENERAL INFORMATION
ELEVATION (M)...................... 448
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52
DISCHARGE (L/MIN).................. 200
ROCK TYPES: OLIGOCENE AND MIOCENE RHYOLITES AND TUFFS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	104	3.2	0.05	325	3.4	493	9	34	155

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
21	2.6	8.32		-14.75	-118.9

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	102
NA-K-CA (4/3)...........	120
NA-K....................	17

SILICA

ADIABATIC...............	135
CONDUCTIVE..............	139
CHALCEDONY..............	113
CRISTOBALITE............	89
OPAL....................	19

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	102 (I)	113 (D)	113 (D)	109	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.85 STD. DEV. = 0.24

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WATERS, 1968; HODGE, 1941

COMPILED BY: MARINER, R.

KAHNEETAH HOT SPRINGS , OREGON

FIELD NAME................. BELKNAP HOT SPRINGS
KGRA OR OTHER NAME........ BELKNAP-FOLEY HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 181

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... LANE
LATITUDE................... 44-11.6 N
LONGITUDE.................. 122-03.2 W
MAPS....................... MCKENZIE BRIDGE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16S	06E	11	SE OF NW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 18
ELEVATION (M)...................... 824
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 3
SPRING TEMPERATURES (C)............ 64 TO 71
DISCHARGE (L/MIN).................. 300
ROCK TYPES: OLIVINE BASALT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
71	96	210	0.2	690	15	17		170	1300

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.2	6.4	7.62	+0.35	-11.74	-95.8

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	113
NA-K-CA (4/3)...........	82
NA-K....................	56
SILICA	
ADIABATIC...............	131
CONDUCTIVE..............	135
CHALCEDONY..............	108
CRISTOBALITE............	84
OPAL....................	15
SULFATE	
CONDUCTIVE..............	148
ONE-STEP STEAM LOSS....	138
CONTINUOUS STEAM LOSS..	139

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	82 (I)	148 (K)	108 (D)	113	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)...........	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J).	0.88	STD. DEV. = 0.28

COMMENTS: MAY BE PART OF A LARGER SYSTEM WHICH INCLUDES FOLEY HOT SPRINGS

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WARING, 1965; PECK AND OTHERS, 1964

COMPILED BY: MARINER, R.

BELKNAP HOT SPRINGS , OREGON

FIELD NAME................ FOLEY HOT SPRINGS
KGRA OR OTHER NAME........ BELKNAP-FOLEY HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 182

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... LANE
LATITUDE.................. 44-09.8 N
LONGITUDE................. 122-05.9 W
MAPS...................... MCKENZIE BRIDGE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
16S	06E	28	NW OF NW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE..................... 6
WARING NUMBER..................... 19
ELEVATION (M)..................... 518
SURFACE ACTIVITY.................. HOT SPRINGS
NO. OF SPRINGS.................... 4
SPRING TEMPERATURES (C)........... 72 TO 79
ROCK TYPES: BASALT

CHEMISTRY
SAMPLE SOURCE.... R. BOWEN, UNPUB. ANALYSIS
COLLECTION DATE.. 1976/03/08

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
78	60	494	0.8	475	11.2	16		550	1304

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.1			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	106
NA-K-CA (4/3)...........	52
NA-K....................	61
SILICA	
ADIABATIC...............	110
CONDUCTIVE..............	111
CHALCEDONY..............	81
CRISTOBALITE............	60
OPAL....................	-7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	81 (D)	111 (A)	106 (I)	99	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.76 STD. DEV. = 0.22

COMMENTS: MAY BE PART OF THE SAME SYSTEM AS BELKNAP HOT SPRINGS 6KM NE OF FOLEY H.S.

REFERENCES: WARING, 1965

COMPILED BY: MARINER, R.

FOLEY HOT SPRINGS , OREGON

FIELD NAME................ MCCREDIE (WININO) HOT SPRINGS
KGRA OR OTHER NAME........ MCCREDIE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 183

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... LANE
LATITUDE................... 43-42.6 N
LONGITUDE.................. 122-17.3 W
MAPS....................... OAKRIDGE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
21S	04E	36	NW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 22
ELEVATION (M)...................... 634
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 15
DISCHARGE (L/MIN).................. 76
ROCK TYPES: ANDESITE, DACITE, AND RHYODACITE TUFFS, DOMES, AND FLOWS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
73	79	460	0.9	1000	22	21		240	2200

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.7	18	7.29			-94.0

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	114
NA-K-CA (4/3)	81
NA-K	56

SILICA

ADIABATIC	122
CONDUCTIVE	124
CHALCEDONY	96
CRISTOBALITE	74
OPAL	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	81 (I)	96 (D)	96 (D)	91	4

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J)	0.68	STD. DEV. = 0.19

REFERENCES: WARING, 1965; MARINER AND OTHERS, 1975

COMPILED BY: BROOK, C.

MCCREDIE (WININO) HOT SPRINGS , OREGON

FIELD NAME................ NEWBERRY CALDERA
KGRA OR OTHER NAME........ NEWBERRY CALDERA KGRA
CIRCULAR REFERENCE........ 184

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... DESCHUTES
LATITUDE.................. 43-43.0 N
LONGITUDE................. 121-14.0 W
MAPS...................... CRESCENT 1:250,000; PAULINA PEAK 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
21S	13E	29	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 32,33
ELEVATION (M)...................... 1950
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL IN 2 GROUPS
SPRING TEMPERATURES (C)............ 21 TO 62
DISCHARGE (L/MIN).................. 38
ROCK TYPES: PLEISTOCENE AND HOLOCENE ANDESITE AND BASALT; CALDERA STRUCTURE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
62	36	38	16	32	3.8	184		58	0.4

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
0.2	0.9	6.49		-9.42	-76.2

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	155
NA-K-CA (4/3)...........	44
NA-K....................	205

SILICA

ADIABATIC...............	90
CONDUCTIVE..............	87
CHALCEDONY..............	56
CRISTOBALITE............	37
OPAL....................	-26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	180	280	230	230	20

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	10	50	25	28.3	8.2

BASED ON: GEOLOGIC INFERENCE

VOLUME (KM**3)...........	47.2	STD. DEV. = 16.5
THERMAL ENERGY(10**18 J).	27.41	STD. DEV. = 9.99

COMMENTS: CHEMICAL ANALYSIS FROM HOT SPRINGS AT EAST LAKE. CHEMICAL COMPOSITION OF HOT SPRINGS AT BOTH EAST LAKE AND PAULINA LAKE INDICATES THAT THE WATERS ARE HEATED LAKE WATERS; GEOTHERMOMETRY IS UNRELIABLE. TEMPERATURE ESTIMATES ARE BASED ON COMPARISON WITH OTHER QUATERNARY CALDERAS.

REFFRENCES: WARING, 1965; MARINER AND OTHERS, 1975; USGS FILE DATA

COMPILED BY: BROOK, C.

NEWBERRY CALDERA, OREGON

FIELD NAME................ UMPQUA HOT SPRINGS
CIRCULAR REFERENCE........ 185

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... DOUGLAS
LATITUDE.................. 43-17.5 N
LONGITUDE................. 122-22.0 W
MAPS...................... TOKETEE FALLS 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
26S	04E	20	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 24
ELEVATION (M)...................... 799
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 41 TO 46
DISCHARGE (L/MIN).................. 19
ROCK TYPES: QUATERNARY BASALT OVERLYING TERTIARY ANDESITIC TUFFS

CHEMISTRY
SAMPLE SOURCE.... USGS FILE DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
46	90	340	41	2400	63	1380		190	3500

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.5	41	6.37			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	135
NA-K-CA (4/3)	141
NA-K	67

SILICA

ADIABATIC	128
CONDUCTIVE	131
CHALCEDONY	104
CRISTOBALITE	81
OPAL	12

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (J)	131 (A)	104 (D)	112	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 0.87 STD. DEV. = 0.25

COMMENTS: CARBON DIOXIDE CHARGED WATER, GEOTHERMOMETERS MAY NOT BE RELIABLE.

REFERENCES: WARING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R. AND BROOK, C.

UMPQUA HOT SPRINGS, OREGON

FIELD NAME................ KLAMATH HILLS AREA
KGRA OR OTHER NAME........ KLAMATH FALLS KGRA
CIRCULAR REFERENCE........ 186

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... KLAMATH
LATITUDE................... 42-03.0 N
LONGITUDE.................. 121-44.5 W
MAPS....................... KLAMATH FALLS 1:62,500; MERRILL 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
40S	09E	34	NE	WILLAMETTE

GENERAL INFORMATION
ELEVATION (M)........................ 1256
SURFACE ACTIVITY..................... NONE. FOUND BY DRILLING
ASSOCIATED DEPOSITS.................. SILICIFIED ROCKS
NO. OF WELLS......................... SEVERAL
WELL DEPTHS (M)...................... 47 TO 127
MAXIMUM WELL TEMP (C)................ 93 AT DEPTH (M) 127?
ROCK TYPES: LACUSTRINE AND FLUVIATILE TUFFACEOUS DEPOSITS OVERLYING BASALT
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... SAMMEL, 1976 (LISKEY WELL)
COLLECTION DATE.. 1974/05/09

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
93	90	15	LT 0.1	200	4.0	48	2	360	59

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.9	-2.13	-14.95	-116.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	111
NA-K-CA (4/3)	82
NA-K	51
SILICA	
ADIABATIC	128
CONDUCTIVE	131
CHALCEDONY	104
CRISTOBALITE	81
OPAL	12
SULFATE	
CONDUCTIVE	138
ONE-STEP STEAM LOSS	133
CONTINUOUS STEAM LOSS	134

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	104 (D)	138 (K)	131 (A)	124	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.05	1.5	0.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	9	9	6.3	1.9

BASED ON: AREAS OF 60 C ISOTHERM, CONVECTIVE HEAT FLOW, AND ALTERATION

VOLUME (KM**3)........... 10.6 STD. DEV. = 3.8
THERMAL ENERGY(10**18 J). 3.12 STD. DEV. = 1.13

COMMENTS: LOCATED ABOUT 20 KM SOUTH OF KLAMATH FALLS; GEOLOGY AND SYSTEM CHARACTERISTICS ARE SIMILAR. 9 KM**2 AREA OF SILICIFIED ROCKS. HOT WATER FROM ONE WELL USED IN GREENHOUSE.

REFERENCES: PETERSON AND MCINTYRE, 1970; SAMMEL, 1976

COMPILED BY: MARINER, R. AND BROOK, C.

KLAMATH HILLS AREA, OREGON

FIELD NAME................ KLAMATH FALLS AREA
KGRA OR OTHER NAME........ KLAMATH FALLS KGRA
CIRCULAR REFERENCE........ 187

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... KLAMATH
LATITUDE................... 42-14.0 N
LONGITUDE.................. 121-46.0 W
MAPS....................... KLAMATH FALLS 1:62,500; MERRILL 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
38S	09E	21	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE......................... 6
WARING NUMBER......................... 27, 28
ELEVATION (M)......................... 1525
SURFACE ACTIVITY...................... HOT SPRINGS, HOT WATER WELLS
ASSOCIATED DEPOSITS................... SINTER
NO. OF SPRINGS........................ SEVERAL AT OLENE GAP
SPRING TEMPERATURES (C)............... 74
DISCHARGE (L/MIN)..................... 30
NO. OF WELLS.......................... SEVERAL
WELL DEPTHS (M)....................... 41 TO 551
MAXIMUM WELL TEMP (C)................. 99 AT DEPTH (M) 530
ROCK TYPES: LACUSTRINE AND FLUVIATILE TUFFACEOUS DEPOSITS OVERLYING BASALT
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW, AMT

CHEMISTRY
SAMPLE SOURCE.... SAMMEL, 1976 (WELL OIT #6)
COLLECTION DATE.. 1975/03/31

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
88	90	24.2	LT 0.1	195	3.9	44		400	58

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		8.2	-4.82	-13.73	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	108
NA-K-CA (4/3)..........	71
NA-K.................	51
SILICA	
ADIABATIC.............	128
CONDUCTIVE............	131
CHALCEDONY............	104
CRISTOBALITE..........	81
OPAL..................	12
SULFATE	
CONDUCTIVE............	196
ONE-STEP STEAM LOSS....	179
CONTINUOUS STEAM LOSS..	183

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (M)	131 (A)	104 (D)	111	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.04	0.5	0.2		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	6	150	50	68.7	30.1

BASED ON: 60 C ISOTHERM AND AMT SURVEY

VOLUME (KM**3)........... 114.4 STD. DEV. = 55.4
THERMAL ENERGY(10**18 J). 29.77 STD. DEV. = 14.61

COMMENTS: AREA INCLUDES SPRINGS AT OLENE GAP; HOT SPRINGS AT KLAMATH FALLS ARE INACTIVE. ABOUT 8 KM**2 AREA OF SILIFICATION AT KLAMATH FALLS. LUND AND OTHERS (1974) REPORT MAXIMUM WELL TEMPERATURE OF 113 C. OXYGEN ISOTOPES AND SULFATE GEOTHERMOMETER FOR OLENE GAP SPRING. HIGH SULFATE TEMPERATURES PROBABLY INDICATE A VERY DEEP AQUIFER IN A STACKED SYSTEM (SAMMEL, UNPUB. DATA). LARGE AREA OF WARM WATER. THERMAL WATER PROBABLY ASCENDS ALONG FAULTS AND SPREADS OUT IN NEAR-SURFACE AQUIFERS. STEAM REPORTED IN SOME WELLS.

REFERENCES: SAMMEL, 1976; LUND AND OTHERS, 1974; MARINER AND OTHERS, 1974B; PETERSON AND MCINTYRE, 1970; USGS FILE DATA

COMPILED BY: MARINER, R. AND BROOK, C.

KLAMATH FALLS AREA, OREGON

FIELD NAME................ SUMMER LAKE HOT SPRINGS
KGRA OR OTHER NAME........ SUMMER LAKE HOT SPRING KGRA
CIRCULAR REFERENCE........ 188

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... LAKE
LATITUDE................... 42-43.5 N
LONGITUDE.................. 120-38.7 W
MAPS....................... SLIDE MTN. 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
33S	17E	12	NE	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE....................... 6
WARING NUMBER....................... 42
ELEVATION (M)....................... 1307
SURFACE ACTIVITY.................... HOT SPRINGS
ASSOCIATED DEPOSITS................. SINTER
NO. OF SPRINGS...................... 3
SPRING TEMPERATURES (C)............. 43
DISCHARGE (L/MIN)................... 75
ROCK TYPES: TERTIARY ANDESITE OVERLAIN BY QUAT. AND TERTIARY SEDIMENTARY ROCKS
GEOPHYSICS: AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
43	94	2.1	0.1	390	4.6	406	10	120	280

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.2	6.9	8.43	-4.00	-13.32	-115.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	112
NA-K-CA (4/3)	149
NA-K	22
SILICA	
ADIABATIC	130
CONDUCTIVE	134
CHALCEDONY	107
CRISTOBALITE	83
OPAL	14
SULFATE	
CONDUCTIVE	189
ONE-STEP STEAM LOSS	162
CONTINUOUS STEAM LOSS	169

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	107 (D)	134 (A)	112 (I)	118	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	8	5	4.7	1.4
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 7.8 STD. DEV. = 2.8
THERMAL ENERGY(10**18 J). 2.16 STD. DEV. = 0.80

COMMENTS: SULFATE GEOTHERMOMETER GIVES 189 C AND MAY INDICATE A VERY DEEP RESERVOIR IN A STACKED SYSTEM.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER, 1963; WARING, 1965

COMPILED BY: MARINER, R.

SUMMER LAKE HOT SPRINGS , OREGON

FIELD NAME................ LAKEVIEW AREA (HUNTERS AND BARRY RANCH HOT SPRINGS)
KGRA OR OTHER NAME........ LAKEVIEW KGRA
CIRCULAR REFERENCE........ 189

GEOGRAPHIC LOCALITY

STATE...................... OREGON
COUNTY..................... LAKE
LATITUDE................... 42-12.0 N
LONGITUDE.................. 120-21.6 W
MAPS....................... LAKE VIEW NW 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
39S	20E	15	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 45,47
AREA OF SURFACE EXPRESSION (KM**2). 5.0
ELEVATION (M)...................... 1464
SURFACE ACTIVITY................... HOT SPRINGS, GEYSERING WELL
ASSOCIATED DEPOSITS................ TRAVERTINE AND SINTER
NO. OF SPRINGS..................... 16
SPRING TEMPERATURES (C)............ 88 TO 96
DISCHARGE (L/MIN).................. 2500
NO. OF WELLS....................... 2
WELL DEPTHS (M).................... 189 TO 1658
ROCK TYPES: QUATERNARY TO LATE TERTIARY BASALTS AND ANDESITES

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
96	140	13	0.1	210	8.5	79		260	120

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.4	6.9	7.77	-3.69	-14.32	-119.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	143
NA-K-CA (4/3)...........	114
NA-K..................	98
SILICA	
ADIABATIC..............	149
CONDUCTIVE.............	157
CHALCEDONY.............	133
CRISTOBALITE...........	107
OPAL..................	35
SULFATE	
CONDUCTIVE.............	168
ONE-STEP STEAM LOSS....	158
CONTINUOUS STEAM LOSS..	160

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	143 (I)	158 (K)	149 (C)	150	3

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	2.0	1.8	0.3
SUBSURFACE AREA (KM**2)	2	15	8	8.3	2.7

BASED ON: SPRING DISTRIBUTION

VOLUME (KM**3)........... 15.3 STD. DEV. = 5.6
THERMAL ENERGY(10**18 J). 5.57 STD. DEV. = 2.04

COMMENTS: WATER COMPOSITION FROM HUNTERS HOT SPRINGS; BARRY RANCH INCLUDED IN THE AREA. SEVERAL SHALLOW WELLS NEAR HUNTERS HOT SPRINGS HAVE BEEN DEVELOPED FOR RESIDENTIAL HEATING.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER, 1963; WARING, 1965; PETERSON AND MCINTYRE, 1970

COMPILED BY: MARINER, R.

LAKEVIEW AREA (HUNTERS AND BARRY RANCH HOT SPRINGS, OREGON

FIELD NAME................ CRUMPS SPRING
KGRA OR OTHER NAME........ CRUMP GEYSER KGRA
CIRCULAR REFERENCE........ 190

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... LAKE
LATITUDE.................. 42-13.8 N
LONGITUDE................. 119-53.0 W
MAPS...................... ADEL 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38S	24E	34	SW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 49C, 49D
AREA OF SURFACE EXPRESSION (KM**2). 1.0
ELEVATION (M)...................... 1525
SURFACE ACTIVITY................... HOT SPRINGS AND SEEPS, GEYSERING WELL
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... SEVERAL IN 2 GROUPS
SPRING TEMPERATURES (C)............ 37 TO 78
DISCHARGE (L/MIN).................. 0 TO 50
NO. OF WELLS....................... 1
WELL DEPTHS (M).................... 504
MAXIMUM WELL TEMP (C).............. 121 AT DEPTH (M) 201
ROCK TYPES: MIOCENE TO PLIOCENE BASALT OVERLAIN BY QUATERNARY ALLUVIUM

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
78	180	16	0.2	280	11	153		200	240

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O
4.9	13.6	7.26		-4.71		-13.28		-115.5

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	144
NA-K-CA (4/3)	122
NA-K	96
SILICA	
ADIABATIC	162
CONDUCTIVE	173
CHALCEDONY	151
CRISTOBALITE	123
OPAL	50
SULFATE	
CONDUCTIVE	202
ONE-STEP STEAM LOSS	182
CONTINUOUS STEAM LOSS	186

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	144 (I)	185	173 (A)	167	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.2	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	8	4	4.3	1.4
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 7.2 STD. DEV. = 2.8
THERMAL ENERGY(10**18 J). 2.97 STD. DEV. = 1.16

COMMENTS: A SHALLOW WELL (CRUMPS GEYSER) ERUPTS EVERY FEW HOURS.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; PETERSON, 1959; WARING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R. AND BROOK, C.

CRUMPS SPRING , OREGON

FIELD NAME................ FISHER HOT SPRING
KGRA OR OTHER NAME........ CRUMP GEYSER KGRA
CIRCULAR REFERENCE........ 191

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... LAKE
LATITUDE.................. 42-17.9 N
LONGITUDE................. 119-46.5 W
MAPS...................... CRUMP LAKE 1:24,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38S	25E	10	NW OF NW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE..................... 6
WARING NUMBER..................... 49A
ELEVATION (M)..................... 1385
SURFACE ACTIVITY.................. HOT SPRINGS
NO. OF SPRINGS.................... 1
SPRING TEMPERATURES (C)........... 68
DISCHARGE (L/MIN)................. 75
ROCK TYPES: MIOCENE TO PLIOCENE BASALT OVERLAIN BY QUATERNARY ALLUVIUM

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
68	77	8.4	1.0	92	7.9	105	1	59	56

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.5	2.2	7.93			-117.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	169
NA-K-CA (4/3)...........	112
NA-K....................	167
SILICA	
ADIABATIC...............	121
CONDUCTIVE..............	123
CHALCEDONY..............	95
CRISTOBALITE............	72
OPAL....................	4

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	95 (D)	123 (A,J)	123 (A,J)	114	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.89 STD. DEV. = 0.26

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965

COMPILED BY: MARINER, R.

FISHER HOT SPRING , OREGON

FIELD NAME................ WEBERG HOT SPRINGS
CIRCULAR REFERENCE........ 192

GEOGRAPHIC LOCALITY

STATE..................... OREGON
COUNTY.................... GRANT
LATITUDE.................. 44-00.0 N
LONGITUDE................. 119-38.8 W
MAPS...................... BURNS 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
18S	26E	18	WILLAMETTE

GENERAL INFORMATION

ELEVATION (M)...................... 1525
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 1
SPRING TEMPERATURES (C)............ 46
DISCHARGE (L/MIN).................. 40
ROCK TYPES: ARKOSIC SANDSTONE AND VOLCANIC ROCKS OF JURASSIC AGE.

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
46	82	38	7.8	610	36	439	1	204	24

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.9	15	6.53		-15.14	-122.1

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	169
NA-K-CA (4/3)...........	162
NA-K....................	130

SILICA

ADIABATIC...............	124
CONDUCTIVE..............	126
CHALCEDONY..............	99
CRISTOBALITE............	76
OPAL....................	7

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	126 (A)	100 (J)	108	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.84 STD. DEV. = 0.24

COMMENTS: CO2 CHARGED WATER, CHEMICAL GEOTHERMOMETERS MAY BE UNRELIABLE.

REFERENCES: MARINER AND OTHERS, 1974B, 1975

COMPILED BY: MARINER, R.

WEBERG HOT SPRINGS, OREGON

FIELD NAME................ HARNEY LAKE AREA
CIRCULAR REFERENCE........ 193

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... HARNEY
LATITUDE.................. 43-10.9 N
LONGITUDE................. 119-03.2 W
MAPS...................... BURNS 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
27S	29E	36	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE..................... 6
WARING NUMBER..................... 64
ELEVATION (M)..................... 1250
SURFACE ACTIVITY.................. HOT SPRINGS
SPRING TEMPERATURES (C)........... 68
DISCHARGE (L/MIN)................. 550
ROCK TYPES: PLIOCENE BASALT, TUFFS AND WELDED TUFFS
GEOPHYSICS: HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
68	92	12	1.8	630	13	566	1	140	590

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.3	11.3	7.26			-128.5

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	130
NA-K-CA (4/3)..........	150
NA-K..................	53

SILICA

ADIABATIC..............	129
CONDUCTIVE.............	133
CHALCEDONY.............	105
CRISTOBALITE...........	82
OPAL..................	13

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	105 (D,J)	133 (A)	105 (D,J)	114	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.89 STD. DEV. = 0.26

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND SWANSON, 1967; GREENE AND OTHERS, 1972; BOWEN AND OTHERS, 1977

COMPILED BY: MARINER, R.

HARNEY LAKE AREA, OREGON

FIELD NAME................ CRANE HOT SPRINGS
CIRCULAR REFERENCE........ 194

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... HARNEY
LATITUDE.................. 43-26.4 N
LONGITUDE................. 118-38.4 W
MAPS...................... CRANE 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
24S	33E	34	SW OF NE	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 53
ELEVATION (M)...................... 1254
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 50 TO 78
DISCHARGE (L/MIN).................. 550
ROCK TYPES: PLIOCENE AND PLEISTOCENE PYROCLASTIC ROCKS; PLIOCENE BASALT AND ANDESITE

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
78	83	3.7	0.1	170	3.9	202	3	86	79

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.0	7.9	8.10		-16.17	-133.5

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	124
NA-K-CA (4/3)...........	113
NA-K....................	59

SILICA

ADIABATIC...............	124
CONDUCTIVE..............	127
CHALCEDONY..............	99
CRISTOBALITE............	76
OPAL....................	8

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	99 (D)	127 (A)	124 (I)	117	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.91 STD. DEV. = 0.26

REFERENCES: LEONARD, 1970; GREENE AND OTHERS, 1972; MARINER AND OTHERS, 1974B, 1975

COMPILED BY: MARINER, R.

CRANE HOT SPRINGS , OREGON

FIELD NAME................. RIVERSIDE AREA
CIRCULAR REFERENCE........ 195

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... MALHEUR
LATITUDE................... 43-28.0 N
LONGITUDE.................. 118-11.3 W
MAPS....................... BURNS 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
24S	37E	20	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 84
ELEVATION (M)...................... 1098
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 41 TO 63
DISCHARGE (L/MIN).................. 200
ROCK TYPES: MIOCENE BASALT
GEOPHYSICS: HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
63	110	34	0.5	240	9.7	160		290	140

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.8	6.6	7.43		-15.15	-134.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	137
NA-K-CA (4/3)...........	96
NA-K....................	98
SILICA	
ADIABATIC...............	137
CONDUCTIVE..............	143
CHALCEDONY..............	116
CRISTOBALITE............	92
OPAL....................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	96 (I)	143 (A)	116 (D)	118	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.93 STD. DEV. = 0.28

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; WARING, 1965

COMPILED BY: MARINER, R.

RIVERSIDE AREA, OREGON

FIELD NAME................. MICKEY SPRINGS
KGRA OR OTHER NAME........ ALVORD KGRA
CIRCULAR REFERENCE........ 196

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... HARNEY
LATITUDE................... 42-40.5 N
LONGITUDE.................. 118-20.7 W
MAPS....................... ADEL 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
33S	35E	13	WILLAMETTE

GENERAL INFORMATION
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 1238
SURFACE ACTIVITY................... HOT SPRINGS AND MUD POTS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... 4 TO 6
SPRING TEMPERATURES (C)............ 73
DISCHARGE (L/MIN).................. 100
ROCK TYPES: MIOCENE ANDESITIC TUFF-BRECCIA, BASALTS, AND ANDESITE
GEOPHYSICS: GRAVITY, MAGNETIC, AMT, HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
73	200	0.9	0.1	550	35	774	11	230	240

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
16	10.5	8.05	-7.91	-13.42	-124.3

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	207
NA-K-CA (4/3)...........	330
NA-K....................	136
SILICA	
ADIABATIC...............	168
CONDUCTIVE..............	180
CHALCEDONY..............	159
CRISTOBALITE............	130
OPAL....................	56
SULFATE	
CONDUCTIVE..............	273
ONE-STEP STEAM LOSS.....	227
CONTINUOUS STEAM LOSS..	240

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	180 (A)	227 (K)	207 (I)	205	10

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	18	4	7.7	3.7
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 12.8 STD. DEV. = 6.7
THERMAL ENERGY(10**18 J). 6.54 STD. DEV. = 3.46

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R.

MICKEY SPRINGS, OREGON

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FIELD NAME................ ALVORD HOT SPRINGS
KGRA OR OTHER NAME........ ALVORD KGRA
CIRCULAR REFERENCE........ 197

   GEOGRAPHIC LOCALITY
      STATE..................... OREGON
      COUNTY.................... HARNEY
      LATITUDE.................. 42-32.6  N
      LONGITUDE................. 118-31.6  W
      MAPS...................... ADEL 1:250,000

      TOWNSHIP     RANGE     SECTION                    BASE & MERIDIAN
        34S         34E      33                         WILLAMETTE

   GENERAL INFORMATION
      WARING FIGURE.......................  6
      WARING NUMBER.......................  68
      AREA OF SURFACE EXPRESSION (KM**2).  0.5
      ELEVATION (M).......................  1250
      SURFACE ACTIVITY....................  HOT SPRINGS
      NO. OF SPRINGS......................  SEVERAL
      SPRING TEMPERATURES (C).............  76
      DISCHARGE (L/MIN)...................  500
      ROCK TYPES: MIOCENE RHYODACITE, BASLAT AND ANDESITE
      GEOPHYSICS:  GRAVITY, MAGNETIC, HEAT FLOW, AMT

   CHEMISTRY
      SAMPLE SOURCE....  MARINER AND OTHERS, 1974, 1975
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TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
76	120	12	2.2	960	69	1196	1	220	780

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
10.2	30	6.73	-6.05	-13.23	-123.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	199
NA-K-CA (4/3)...........	257
NA-K....................	148
SILICA	
ADIABATIC...............	141
CONDUCTIVE..............	148
CHALCEDONY..............	122
CRISTOBALITE............	97
OPAL....................	26
SULFATE	
CONDUCTIVE..............	231
ONE-STEP STEAM LOSS.....	201
CONTINUOUS STEAM LOSS...	209

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	148 (A)	231 (K)	164 (J)	181	18

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	6	2	3.0	1.1
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 5.0 STD. DEV. = 2.1
THERMAL ENERGY(10**18 J). 2.24 STD. DEV. = 0.96

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; WARING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R.

ALVORD HOT SPRINGS, OREGON

FIELD NAME................. HOT (BORAX) LAKE AREA
KGRA OR OTHER NAME......... ALVORD KGRA
CIRCULAR REFERENCE......... 198

GEOGRAPHIC LOCALITY

STATE...................... OREGON
COUNTY..................... HARNEY
LATITUDE................... 42-20.1 N
LONGITUDE.................. 118-36.0 W
MAPS....................... ADEL 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
37S	33E	15	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 69,70
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 1235
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 36 TO 96
DISCHARGE (L/MIN).................. 3500
ROCK TYPES: QUATERNARY ALLUVIUM AND PLAYA DEPOSITS, MIOCENE TO PLIOCENE BASALTS
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW, AMT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974
FLOW (L/MIN)..... 15

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
96	160	14	0.3	450	28	374	4	434	250

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.2	14	7.30	-8.58	-14.36	-125.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	176
NA-K-CA (4/3)...........	178
NA-K....................	134
SILICA	
ADIABATIC...............	156
CONDUCTIVE..............	165
CHALCEDONY..............	142
CRISTOBALITE............	115
OPAL....................	42
SULFATE	
CONDUCTIVE..............	265
ONE-STEP STEAM LOSS.....	231
CONTINUOUS STEAM LOSS..	240

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	165 (C)	231 (K)	176 (I)	191	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	10	4	5.0	1.9
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 8.3 STD. DEV. = 3.5
THERMAL ENERGY(10**18 J). 3.95 STD. DEV. = 1.71

COMMENTS: SAMPLED SPRING ALONG FRACTURE NORTH OF HOT LAKE, NO EVIDENCE OF MIXING OF WATERS ISSUING ALONG THE FRACTURE.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; WARING, 1965; USGS FILE DATA

COMPILED BY: MARINER, R.

HOT (HORAX) LAKE AREA , OREGON

FIELD NAME................ TROUT CREEK AREA
CIRCULAR REFERENCE........ 199

GEOGRAPHIC LOCALITY
STATE..................... OREGON
COUNTY.................... HARNEY
LATITUDE.................. 42-11.4 N
LONGITUDE................. 118-23.0 W
MAPS...................... ADEL 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
39S	37E	16	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 6
WARING NUMBER...................... 72
ELEVATION (M)...................... 1738
SURFACE ACTIVITY................... HOT SPRINGS AND SEEPS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52
DISCHARGE (L/MIN).................. 200
ROCK TYPES: MIOCENE TO PLIOCENE BASALT, ANDESITE, AND RHYOLITE FLOWS
GEOPHYSICS: HEAT FLOW

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	105	18	0.8	270	10.8	439	1	204	24

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
12.8	0.89	6.77	-9.22	-16.17	-127.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	143
NA-K-CA (4/3)...........	118
NA-K....................	97
SILICA	
ADIABATIC...............	135
CONDUCTIVE..............	140
CHALCEDONY..............	114
CRISTOBALITE............	89
OPAL....................	19
SULFATE	
CONDUCTIVE..............	235
ONE-STEP STEAM LOSS.....	196
CONTINUOUS STEAM LOSS..	207

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	140 (A)	180	143 (I)	154	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.25 STD. DEV. = 0.36

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1965; WARING, 1965; BOWEN AND OTHERS, 1977

COMPILED BY: MARINER, R.

TROUT CREEK AREA, OREGON

FIELD NAME................ MCDERMITT AREA
CIRCULAR REFERENCE........ 200

GEOGRAPHIC LOCALITY

STATE..................... OREGON
COUNTY.................... MALHEUR
LATITUDE.................. 42-04.7 N
LONGITUDE................. 117-45.6 W
MAPS...................... JORDAN VALLEY 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
40S	42E	25	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 86
ELEVATION (M)...................... 1891
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 52
DISCHARGE (L/MIN).................. 750
ROCK TYPES: TERTIARY AND QUATERNARY PEDIMENT GRAVELS, MIOCENE BASALT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
52	72	0.6	0.1	130	1.0	237	13	52	14

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.6	1.1	8.79		-16.95	-134.6

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)..........	90
NA-K-CA (4/3)..........	104
NA-K..................	3
SILICA	
ADIABATIC.............	118
CONDUCTIVE............	120
CHALCEDONY............	91
CRISTOBALITE..........	69
OPAL..................	1

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	84 (E)	120 (A)	90 (I)	98	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.75 STD. DEV. = 0.22

COMMENTS: RESERVOIR TEMPERATURE MAY BE LESS THAN 90 DEG C.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER AND REPENNING, 1966; WARING, 1965

COMPILED BY: MARINER, R.

MCDERMITT AREA, OREGON

FIELD NAME................ MEDICAL HOT SPRINGS
CIRCULAR REFERENCE........ 201

GEOGRAPHIC LOCALITY
STATE...................... OREGON
COUNTY..................... UNION
LATITUDE................... 45-01.1 N
LONGITUDE.................. 117-37.5 W

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
06S	41E	25	NE	MEDICAL SPRINGS 1:24,000

GENERAL INFORMATION
WARING FIGURE....................... 6
WARING NUMBER....................... 12
ELEVATION (M)....................... 1060
SURFACE ACTIVITY.................... HOT SPRINGS
NO. OF SPRINGS...................... 2 GROUPS
SPRING TEMPERATURES (C)............. 60
DISCHARGE (L/MIN)................... 200
ROCK TYPES: MIOCENE BASALTS AND ANDESITES; PALEOZOIC METAVOLCANIC ROCKS

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	80	72	0.2	190	7.0	26		400	77

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
1.2	2.2	8.23			-16.99	-130.2

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	125
NA-K-CA (4/3)...........	66
NA-K....................	91
SILICA	
ADIABATIC...............	122
CONDUCTIVE..............	125
CHALCEDONY..............	97
CRISTOBALITE............	74
OPAL....................	6

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	66 (I)	125 (A)	97 (D)	96	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.73 STD. DEV. = 0.23

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WALKER, 1973; WARING, 1965

COMPILED BY: MARINER, R.

MEDICAL HOT SPRINGS , OREGON

FIELD NAME................ LITTLE VALLEY AREA
CIRCULAR REFERENCE........ 202

GEOGRAPHIC LOCALITY

STATE..................... OREGON
COUNTY.................... MALHEUR
LATITUDE.................. 43-53.5 N
LONGITUDE................. 117-30.0 W
MAPS...................... HARPER 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
19S	43E	30	NW	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 76
ELEVATION (M)...................... 756
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... SEVERAL
DISCHARGE (L/MIN).................. 550
ROCK TYPES: PLIOCENE BASALTS, VOLCANIC DERIVED SEDIMENTARY ROCK

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
70	115	3.2		160	3.2	127	1	110	74

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.8	4.7	8.71	-8.63	-16.52	-139.7

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	118
NA-K-CA (4/3)...........	109
NA-K....................	51
SILICA	
ADIABATIC...............	139
CONDUCTIVE..............	145
CHALCEDONY..............	119
CRISTOBALITE............	95
OPAL....................	24
SULFATE	
CONDUCTIVE..............	215
ONE-STEP STEAM LOSS.....	189
CONTINUOUS STEAM LOSS...	195

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	118 (D,I)	145 (A)	118 (D,I)	127	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.01 STD. DEV. = 0.29

COMMENTS: SULFATE ISOTOPE GEOTHERMOMETER INDICATES A HIGHER TEMPERATURE (215 DEG C) AND MAY INDICATE A DEEP SYSTEM.

REFERENCES: MARINER AND OTHERS, 1974B, 1975; CORCORAN AND OTHERS, 1962

COMPILED BY: MARINER, R.

LITTLE VALLEY AREA, OREGON

FIELD NAME................. NEAL HOT SPRINGS
CIRCULAR REFERENCE........ 203

GEOGRAPHIC LOCALITY

STATE...................... OREGON
COUNTY..................... MALHEUR
LATITUDE................... 44-01.4 N
LONGITUDE.................. 117-27.6 W
MAPS....................... JAMIESON 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
18S	43E	09	NW	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 75
ELEVATION (M)...................... 793
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ SINTER
SPRING TEMPERATURES (C)............ 87
DISCHARGE (L/MIN).................. 100
ROCK TYPES: MIOCENE(?) FLOWS(BASALTIC)

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1974, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
87	180	8.8	0.2	190	16	198		120	120

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
9.4	4.1	7.32	-8.37	-16.52	-138.7

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	181
NA-K-CA (4/3)	151
NA-K	165
SILICA	
ADIABATIC	162
CONDUCTIVE	173
CHALCEDONY	151
CRISTOBALITE	123
OPAL	50
SULFATE	
CONDUCTIVE	210
ONE-STEP STEAM LOSS	189
CONTINUOUS STEAM LOSS	194

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	173 (A)	210 (K)	181 (I)	188	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.56 STD. DEV. = 0.44

REFERENCES: MARINER AND OTHERS, 1974B, 1975; WARING, 1965; WALKER, 1973

COMPILED BY: MARINER, R.

NEAL HOT SPRINGS, OREGON

FIELD NAME................ VALE HOT SPRINGS
KGRA OR OTHER NAME........ VALE HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 204

GEOGRAPHIC LOCALITY

STATE...................... OREGON
COUNTY..................... MALHEUR
LATITUDE................... 43-59.4 N
LONGITUDE.................. 117-14.0 W
MAPS....................... VALE EAST 1:24,000; BOISE 1:250,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
18S	45E	20	WILLAMETTE

GENERAL INFORMATION

WARING FIGURE...................... 6
WARING NUMBER...................... 77
ELEVATION (M)...................... 671
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... TWO GROUPS
SPRING TEMPERATURES (C)............ 73 TO 97
DISCHARGE (L/MIN).................. 76
ROCK TYPES: TUFFACEOUS LACUSTRINE DEPOSITS OVERLYING TERTIARY BASALT AND RHYOLITE
GEOPHYSICS: GRAVITY, HEAT FLOW, AMT, MAGNETIC

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1975

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
73	130	19	0.8	310	16	143		100	360

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.1	9.4	7.47	-3.91	-15.00	-135.0

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	157
NA-K-CA (4/3)...........	135
NA-K....................	118
SILICA	
ADIABATIC...............	145
CONDUCTIVE..............	152
CHALCEDONY..............	127
CRISTOBALITE............	102
OPAL....................	31
SULFATE	
CONDUCTIVE..............	161
ONE-STEP STEAM LOSS.....	149
CONTINUOUS STEAM LOSS...	151

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	152 (A)	161 (K)	157 (I)	157	2

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	10	150	50	70.0	29.4
BASED ON: AMT SURVEY					

VOLUME (KM**3)........... 116.7 STD. DEV. = 54.5
THERMAL ENERGY(10**18 J). 44.62 STD. DEV. = 20.85

COMMENTS: SULFATE ISOTOPES ON A SAMPLE COLLECTED BY H. YOUNG FROM A 90 DEG C SPRING; SULFATE DETERMINATION ON THE SAMPLE COLLECTED BY MARINER AND OTHERS INDICATED 201 DEG C. AREA INCLUDES COW HOLLOW HEAT FLOW ANOMALY.

REFERENCES: MARINER AND OTHERS, 1975; HOOVER AND LONG, 1975; BOWEN AND BLACKWELL, 1975

COMPILED BY: MARINER, R. AND BROOK, C.

VALE HOT SPRINGS, OREGON

Utah

FIELD NAME................. ABRAHAM (BAKER, CRATER) HOT SPRINGS
KGRA OR OTHER NAME........ CRATER SPRINGS KGRA
CIRCULAR REFERENCE........ 205

GEOGRAPHIC LOCALITY
STATE..................... UTAH
COUNTY.................... JUAB
LATITUDE.................. 39-36.8 N
LONGITUDE................. 112-43.9 W
MAPS...................... BAKER HOT SPRINGS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
14S	08W	10	SALT LAKE

GENERAL INFORMATION
WARING FIGURE...................... 7
WARING NUMBER...................... 24
ELEVATION (M)...................... 1408
SURFACE ACTIVITY................... HOT SPRINGS AND WARM, MOIST VAPORS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 4
SPRING TEMPERATURES (C)............ 43 TO 84
DISCHARGE (L/MIN).................. MORE THAN 1000
ROCK TYPES: QUATERNARY BASALT OVERLYING LACUSTRINE DEPOSITS
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... 1000
COLLECTION DATE.. 1974/12/15

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
84	69	340	52	830	57	156	LT 1	680	1500

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.5	0.86	6.48	+12.77	-16.09	-126.3

GEOTHERMOMETERS (C)
CATION
NA-K-CA (1/3)........... 164
NA-K-CA (4/3)........... 121
NA-K.................... 144
SILICA
ADIABATIC............... 116
CONDUCTIVE.............. 117
CHALCEDONY.............. 89
CRISTOBALITE............ 67
OPAL.................... -1
SULFATE
CONDUCTIVE.............. 22
ONE-STEP STEAM LOSS..... 25
CONTINUOUS STEAM LOSS... 26

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	86 (J)	117 (A)	89 (D)	97	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	6	4	3.7	1.0

BASED ON: AMT AND GRAVITY SURVEYS

VOLUME (KM**3)............ 6.1 STD. DEV. = 2.1
THERMAL ENERGY(10**18 J). 1.36 STD. DEV. = 0.48

COMMENTS: THE VERY LOW TEMPERATURE ESTIMATED FROM THE SO4 GEOTHERMOMETER MAY INDICATE A LOW TEMPERATURE SOURCE FOR THE SULFATE ONLY.

REFERENCES: MARINER AND OTHERS, 1977A; MUNDORFF, 1970; SMITH, 1974; SHUEY, 1974; JOHNSON, 1974; USGS FILE DATA; NASH AND OTHERS, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

ABRAHAM (BAKER, CRATER) HOT SPRINGS , UTAH

FIELD NAME................ MONROE-RED HILL HOT SPRINGS
KGRA OR OTHER NAME........ MONROE-JOSEPH KGRA
CIRCULAR REFERENCE........ 206

GEOGRAPHIC LOCALITY
STATE..................... UTAH
COUNTY.................... SEVIER
LATITUDE.................. 38-38.2 N
LONGITUDE................. 112-06.2 W
MAPS...................... MONROE 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
25S	03W	10-11	SALT LAKE

GENERAL INFORMATION
WARING FIGURE...................... 7
WARING NUMBER...................... 48
AREA OF SURFACE EXPRESSION (KM**2). 0.1
ELEVATION (M)...................... 1676
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 3 MAIN SPRINGS
SPRING TEMPERATURES (C)............ 41 TO 76
DISCHARGE (L/MIN).................. MORE THAN 1200
ROCK TYPES: PLIOCENE LATITE, BASALTIC ANDESITE, AND RHYOLITE
GEOPHYSICS: TEMPERATURE GRADIENT (D. CHAPMAN, UNPUB. DATA)

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... 175
COLLECTION DATE.. 1974/12/16

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
76.5	58	290	34	590	60	416		890	660

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
2.8	2.8	6.25	+8.21	-16.95	-127.3

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	180
NA-K-CA (4/3)...........	123
NA-K....................	186
SILICA	
ADIABATIC...............	109
CONDUCTIVE..............	109
CHALCEDONY..............	79
CRISTOBALITE............	58
OPAL....................	-8
SULFATE	
CONDUCTIVE..............	40
ONE-STEP STEAM LOSS.....	42
CONTINUOUS STEAM LOSS..	42

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	79 (D)	114 (J)	109 (A)	101	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1.5	5	2	2.8	0.8

BASED ON: SPRING AND SPRING DEPOSIT DISTRIBUTION AND UNPUB. TEMPERATURE GRADIENT SURVEY

VOLUME (KM**3)............	4.7	STD. DEV. = 1.6
THERMAL ENERGY(10**18 J).	1.09	STD. DEV. = 0.38

COMMENTS: ANALYSIS FOR RED HILL HOT SPRING. MONROE AND RED HILL HOT SPRINGS HAVE VIRTUALLY IDENTICAL CHEMICAL AND ISOTOPIC COMPOSITIONS AND ARE CONSIDERED TO BE PART OF THE SAME SYSTEM. GYPSUM AND JAROSITE MAY BE INTERFERING WITH THE SO4 GEOTHERMOMETER.

REFERENCES: MARINER AND OTHERS, 1977A; MUNDORFF, 1970; CALLAGHAN AND PARKER, 1961

COMPILED BY: MARINER, R. AND BROOK, C.

MONROE-RED HILL HOT SPRINGS , UTAH

FIELD NAME................. JOSEPH HOT SPRINGS
KGRA OR OTHER NAME........ MONROE-JOSEPH KGRA
CIRCULAR REFERENCE........ 207

GEOGRAPHIC LOCALITY
STATE...................... UTAH
COUNTY..................... SEVIER
LATITUDE................... 38-36.7 N
LONGITUDE.................. 112-11.2 W
MAPS....................... MONROE 1162,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
25S	04W	20	SALT LAKE

GENERAL INFORMATION
WARING FIGURE...................... 7
WARING NUMBER...................... 49
ELEVATION (M)...................... 1676
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 60 TO 64
DISCHARGE (L/MIN).................. 114
ROCK TYPES: PLIOCENE LATITE, RHYOLITE, AND BASALTIC ANDESITE
GEOPHYSICS: AMT

CHEMISTRY
SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... LT 20
COLLECTION DATE.. 1974/12/17

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
63	90	260	44	1450	50	408		1200	1700

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.0	4.9	6.51		-17.32	-133.4

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	142
NA-K-CA (4/3)...........	131
NA-K....................	86
SILICA	
ADIABATIC..............	128
CONDUCTIVE.............	131
CHALCEDONY.............	104
CRISTOBALITE...........	81
OPAL...................	12

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	87 (J)	131 (A)	104 (D)	107	9

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.83 STD. DEV. = 0.25

COMMENTS: ESTIMATED RESERVOIR TEMPERATURES ARE SIMILAR TO MONROE RED HILL SYSTEM 8 KM ENE OF JOSEPH.

REFERENCES: MARINER AND OTHERS, 1977A; MUNDORFF, 1970; CALLAGHAN AND PARKER, 1961

COMPILED BY: MARINER, R. AND BROOK, C.

JOSEPH HOT SPRINGS, UTAH

FIELD NAME................ COVE FORT - SULPHURDALE
KGRA OR OTHER NAME........ COVE FORT - SULPHURDALE KGRA
CIRCULAR REFERENCE........ 208

GEOGRAPHIC LOCALITY

STATE...................... UTAH
COUNTY..................... MILLARD AND BEAVER
LATITUDE................... 38-36.4 N
LONGITUDE.................. 112-33.0 W
MAPS....................... COVE FORT 1:62,500

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
25S	06W	32	SALT LAKE

GENERAL INFORMATION

ELEVATION (M)....................... 1951
SURFACE ACTIVITY.................... H_2S GAS SEEPS
ASSOCIATED DEPOSITS................. SULFER AND SINTER
NO. OF SPRINGS...................... NONE
NO. OF WELLS........................ 3
WELL DEPTHS (M)..................... 582 TO 2226
MAXIMUM WELL TEMP (C)............... 179 AT DEPTH (M) 2226
ROCK TYPES: OLIGOCENE LATITE AND ANDESITE OVERLYING MESOZOIC AND PALEOZOIC SANDSTONE, SHALE, AND CARBONATE ROCKS. PLEISTOCENE(?) BASALT NEARBY
GEOPHYSICS: TEMPERATURE GRADIENT

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	150	180	170	167	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.6	2.0	1.5		
THICKNESS (KM)	1.0	2.4	1.5	1.6	0.3
SUBSURFACE AREA (KM**2)	15	35	22	24.0	4.1

BASED ON: TEMPERATURE GRADIENT SURVEY

VOLUME (KM**3)........... 39.2 STD. DEV. = 9.8
THERMAL ENERGY(10**18 J). 16.05 STD. DEV. = 4.06

COMMENTS: MINIMUM, MAXIMUM, AND MOST LIKELY TEMPERATURES ARE BASED ON MEASURED TEMPERATURES FROM A SINGLE WELL AT 610, 2226, AND 1830 M RESPECTIVELY. SUBSURFACE TEMPERATURES MAY BE HIGHER IN OTHER LOCATIONS. SULFUR DEPOSITS IN ZONE 9 KM LONG.

REFERENCES: RODRIGUEZ, 1960; UNION OIL CO., 1976; N.J. STEFANIDES, PERSONAL COMMUNICATION, 1978

COMPILED BY: MARINER, R. AND BROOK, C.

COVE FORT - SULPHURDALE , UTAH

FIELD NAME................ ROOSEVELT (MCKEANS) HOT SPRINGS
KGRA OR OTHER NAME........ ROOSEVELT HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 209

GEOGRAPHIC LOCALITY
STATE..................... UTAH
COUNTY.................... BEAVER
LATITUDE.................. 38-30.0 N
LONGITUDE................. 112-50.9 W
MAPS...................... RICHFIELD 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
27S	09W	03	NW	SALT LAKE

GENERAL INFORMATION
WARING FIGURE...................... 7
WARING NUMBER...................... 51
ELEVATION (M)...................... 1585
SURFACE ACTIVITY................... SEEPS
ASSOCIATED DEPOSITS................ SINTER
NO. OF SPRINGS..................... SEVERAL SEEPS
NO. OF WELLS....................... 7
WELL DEPTHS (M).................... 382 TO 2234
MAXIMUM WELL TEMP (C).............. 269? AT DEPTH (M) 1867?
ROCK TYPES: TERTIARY GRANITE INTRUDED INTO PRECAMBRIAN GNEISS
GEOPHYSICS: GRAVITY, MAGNETIC, HEAT FLOW, RESISTIVITY, GROUND NOISE

CHEMISTRY
SAMPLE SOURCE.... MUNDORF, 1970
COLLECTION DATE.. 1957/09/11

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
55	313	22		2500	488	156		73	4240

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
7.5	38	7.9			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)	284
NA-K-CA (4/3)	446
NA-K	278

SILICA

ADIABATIC	195
CONDUCTIVE	213
CHALCEDONY	197
CRISTOBALITE	165
OPAL	88

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	243 (M)	284 (I)	269 (M)	265	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	2.0	0.8		
THICKNESS (KM)	1.5	2.5	2.0	2.0	0.2
SUBSURFACE AREA (KM**2)	6	50	15	23.7	9.5

BASED ON: AREA OF KNOWN PRODUCTION AND HEAT FLOW SURVEY (D. CHAPMAN, UNPUB. DATA)

VOLUME (KM**3)	47.3	STD. DEV. = 19.7
THERMAL ENERGY(10**18 J).	31.99	STD. DEV. = 13.35

COMMENTS: SPRINGS ARE INACTIVE. SINTER DEPOSITS ALONG 4.8 KM TREND. MINIMUM AND MOST LIKELY TEMEPERATURES ARE RECORDED MAXIMUM TEMPERATURES IN TWO WELLS AT 382 AND 1867 M, RESPECTIVELY. SEVEN WELLS ARE CAPABLE OF PRODUCING OVER 4.5 X 10**5 KG/HR TOTAL MASS FLOW AT 260 C (CIANCANELLI AND CORMAN, 1978). 55 MW CAPACITY PROJECTED.

REFERENCES: MUNDORFF, 1970; PETERSON, 1973; CIANCANELLI AND CORMAN, 1978; THERMAL POWER CO., 1978; NASH AND OTHERS, 1978; K. DAVIS, PERSONAL COMMUNICATION, 1978

COMPILED BY: BROOK, C. AND MARINER, R.

ROOSEVELT (MCKEANS) HOT SPRINGS , UTAH

FIELD NAME................ THERMO HOT SPRINGS
KGRA OR OTHER NAME........ THERMO HOT SPRINGS KGRA
CIRCULAR REFERENCE........ 210

GEOGRAPHIC LOCALITY

STATE..................... UTAH
COUNTY.................... BEAVER
LATITUDE.................. 38-11. N
LONGITUDE................. 113-12.2 W
MAPS...................... THERMO 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
30S	12W	28	SW OF NE	SALT LAKE

GENERAL INFORMATION

WARING FIGURE...................... 7
WARING NUMBER...................... 52
AREA OF SURFACE EXPRESSION (KM**2). 1.8
ELEVATION (M)...................... 1535
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 20
SPRING TEMPERATURES (C)............ 78 TO 89.5
DISCHARGE (L/MIN).................. 500 OR MORE
NO. OF WELLS....................... 1
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY BASALT AND RHYOLITE FLOWS
GEOPHYSICS: AMT

CHEMISTRY

SAMPLE SOURCE.... MARINER AND OTHERS, 1977
FLOW (L/MIN)..... 30
COLLECTION DATE.. 1974/12/17

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
89.5	113	71	10	380	52	356	2	480	225

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.6	0.93	7.98	-2.52	-14.32	-118.3

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)..........	202
NA-K-CA (4/3)..........	152
NA-K..................	224

SILICA

ADIABATIC.............	139
CONDUCTIVE............	144
CHALCEDONY............	118
CRISTOBALITE..........	94
OPAL..................	23

SULFATE

CONDUCTIVE............	151
ONE-STEP STEAM LOSS....	144
CONTINUOUS STEAM LOSS..	145

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	130 (J)	151 (K)	144 (A)	142	4

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	10	4	5.0	1.9
BASED ON: AMT SURVEY					

VOLUME (KM**3)...........	8.3	STD. DEV. = 3.5
THERMAL ENERGY(10**18 J).	2.85	STD. DEV. = 1.21

REFERENCES: MARINER AND OTHERS, 1977A; MUNDORFF, 1970; PETERSON, 1973; NASH AND OTHERS, 1978; USGS FILE DATA

COMPILED BY: MARINER, R. AND BROOK, C.

THERMO HOT SPRINGS, UTAH

FIELD NAME................ NEWCASTLE AREA
KGRA OR OTHER NAME........ NEWCASTLE KGRA
CIRCULAR REFERENCE........ 211

GEOGRAPHIC LOCALITY
STATE..................... UTAH
COUNTY.................... IRON
LATITUDE.................. 37-39.7 N
LONGITUDE................. 113-33.7 W
MAPS...................... CEDAR CITY 1:250,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
36N	15W	20	NE OF NW	SALT LAKE

GENERAL INFORMATION
ELEVATION (M)...................... 1605
SURFACE ACTIVITY................... NONE. FOUND BY DRILLING
NO. OF WELLS....................... 1 DEEP IRRIGATION WELL
WELL DEPTHS (M).................... 152
MAXIMUM WELL TEMP (C).............. 108 AT DEPTH (M) 85
ROCK TYPES: ALLUVIUM OVERLYING TERTIARY ASH-FLOW TUFFS AND OTHER VOLCANIC ROCKS.
GEOPHYSICS: HEAT FLOW, AMT, MAGNETIC

CHEMISTRY
SAMPLE SOURCE.... RUSH, F., UNPUB. DATA
COLLECTION DATE.. 1975/12/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
100	110	52	1.3	260	14	62		550	53

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.0	0.65	7.3			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	148
NA-K-CA (4/3)...........	100
NA-K....................	121

SILICA

ADIABATIC...............	137
CONDUCTIVE..............	143
CHALCEDONY..............	116
CRISTOBALITE............	92
OPAL....................	22

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	100 (I)	148 (I)	143 (A)	130	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	2.0	1.0		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	8	2	3.7	1.5

BASED ON: HEAT FLOW SURVEY

VOLUME (KM**3)............ 6.1 STD. DEV. = 2.9
THERMAL ENERGY(10**18 J). 1.90 STD. DEV. = 0.91

COMMENTS: MINIMUM TEMPERATURE FOR 4/3 CA; MAXIMUM FOR 1/3 CA. SEVERAL SHALLOW WELLS CONTAIN THERMAL WATER.

REFERENCES: RUSH, 1977; SHUEY AND OTHERS, 1973

COMPILED BY: MARINER, R. AND BROOK, C.

NEWCASTLE AREA, UTAH

Washington

FIELD NAME................ BAKER HOT SPRING
CIRCULAR REFERENCE........ 212

GEOGRAPHIC LOCALITY
STATE..................... WASHINGTON
COUNTY.................... WHATCOM
LATITUDE.................. 48-45.9 N
LONGITUDE................. 121-40.2 W
MAPS...................... MT. SHUKSAN 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
38N	09E	20	NW OF SW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 1
ELEVATION (M)...................... 439
SURFACE ACTIVITY................... HOT SPRING
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 12
SPRING TEMPERATURES (C)............ 42 TO 44
DISCHARGE (L/MIN).................. 26
ROCK TYPES: TERTIARY BASALT OVERLYING GRANITE

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1977/07/21

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
44	103	5.5	0.18	170	9.6	165		87	110

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
3.2	2.7	8.56			

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	162
NA-K-CA (4/3)...........	140
NA-K...................	126

SILICA

ADIABATIC..............	134
CONDUCTIVE.............	139
CHALCEDONY.............	112
CRISTOBALITE...........	88
OPAL...................	18

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	102 (E)	162 (I)	139 (A)	134	12

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9

THERMAL ENERGY(10**18 J). 1.07 STD. DEV. = 0.32

COMMENTS: MAY BE A MIXED WATER, BUT MIXING MODELS DO NOT SOLVE.

REFERENCES: WARING, 1965; CAMPBELL AND OTHERS, 1970; LIVINGSTON, 1972

COMPILED BY: BROOK, C.

BAKER HOT SPRING, WASHINGTON

FIELD NAME................ GAMMA HOT SPRINGS
CIRCULAR REFERENCE........ 213

GEOGRAPHIC LOCALITY
STATE..................... WASHINGTON
COUNTY.................... SNOHOMISH
LATITUDE.................. 48-10.0 N
LONGITUDE................. 121-02.0 W
MAPS...................... GLACIER PEAK 1:62,500

GENERAL INFORMATION
ELEVATION (M)...................... 1220
SURFACE ACTIVITY................... HOT SPRINGS
DISCHARGE (L/MIN).................. 13
ROCK TYPES: DACITE TO RHYODACITE TUFFS

CHEMISTRY
SAMPLE SOURCE.... TABOR AND CROWDER, 1969
FLOW (L/MIN)..... 13
COLLECTION DATE.. 1962/08/28

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
60	150	47	2.6	491	77	269		43	728

F	B	PH		DEL O(18) SO4		DEL O(18) H2O		DEL D H2O	
	12	7.87							

GEOTHERMOMETERS (C)

CATION

NA-K-CA (1/3)...........	219
NA-K-CA (4/3)...........	191
NA-K....................	243

SILICA

ADIABATIC...............	153
CONDUCTIVE..............	161
CHALCEDONY..............	137
CRISTOBALITE............	111
OPAL....................	39

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	140	195 (J)	161 (A)	165	11

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)........... 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.35 STD. DEV. = 0.39

COMMENTS: RECENT ATTEMPTS TO LOCATE THIS SPRING HAVE NOT BEEN SUCCESSFUL. AREA IS WITHIN THE GLACIER PEAK WILDERNESS AREA.

REFERENCES: TABOR AND CROWDER, 1969

COMPILED BY: BROOK, C.

GAMMA HOT SPRINGS , WASHINGTON

FIELD NAME................. OHANAPECOSH HOT SPRINGS
CIRCULAR REFERENCE........ 214

GEOGRAPHIC LOCALITY
STATE..................... WASHINGTON
COUNTY.................... LEWIS
LATITUDE.................. 46-44.2 N
LONGITUDE................. 121-33.6 W
MAPS...................... PACKWOOD 1:62,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
14N	10E	04	NE OF NW	WILLAMETTE

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 11
ELEVATION (M)...................... 586
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE
NO. OF SPRINGS..................... 5
SPRING TEMPERATURES (C)............ 43 TO 49
DISCHARGE (L/MIN).................. 225
ROCK TYPES: BASALT

CHEMISTRY
SAMPLE SOURCE.... MARINER, R., UNPUB. DATA
COLLECTION DATE.. 1977/07/24

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
48	100	60	4.9	920	52	1060		170	880

F	B	PH		DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
5.2		6.8		+0.32	-15.26	

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)...........	170
NA-K-CA (4/3)...........	172
NA-K....................	126
SILICA	
ADIABATIC...............	133
CONDUCTIVE..............	137
CHALCEDONY..............	110
CRISTOBALITE............	87
OPAL....................	17
SULFATE	
CONDUCTIVE..............	108
ONE-STEP STEAM LOSS.....	101
CONTINUOUS STEAM LOSS...	102

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	108 (K)	137 (A)	135 (J)	127	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.00 STD. DEV. = 0.29

COMMENTS: LOCATED IN MT. RAINIER NATIONAL PARK.

REFERENCES: FISKE AND OTHERS, 1963; WARING, 1965; CAMPBELL AND OTHERS, 1970; LIVINGSTON, 1972

COMPILED BY: BROOK, C.

OHANAPECOSH HOT SPRINGS , WASHINGTON

Wyoming

FIELD NAME................ YELLOWSTONE CALDERA AREA
KGRA OR OTHER NAME........ YELLOWSTONE NATIONAL PARK
CIRCULAR REFERENCE........ 215

GEOGRAPHIC LOCALITY
STATE...................... WYOMING
COUNTY..................... YELLOWSTONE
LATITUDE................... 44-28.0 N
LONGITUDE.................. 110-50. W
MAPS....................... OLD FAITHFUL, WEST THUMB, CANYON VILLAGE, NORRIS JUNCTION, MADISON JUNCTION, AND MAMMOTH 1:62,500

GENERAL INFORMATION
WARING FIGURE.......................... 5
WARING NUMBER.......................... 1-96
AREA OF SURFACE EXPRESSION (KM**2). 355
ELEVATION (M)....................... 2288
SURFACE ACTIVITY.................... GEYSERS, FUMAROLES; HOT SPRINGS, ACID-SULFATE SPRINGS
ASSOCIATED DEPOSITS................ SINTER TRAVERTINE
NO. OF SPRINGS..................... SEVERAL THOUSAND
SPRING TEMPERATURES (C)............ 50 TO 96
DISCHARGE (L/MIN).................. 185,000
NO. OF WELLS....................... 13 RESEARCH WELLS
WELL DEPTHS (M).................... TO 332
MAXIMUM WELL TEMP (C).............. 237 AT DEPTH (M) 332
ROCK TYPES: PLEISTOCENE RHYOLITIC TUFFS, FLOWS, AND DOMES
GEOPHYSICS: GRAVITY, MAGNETIC, RESISTIVITY, HEAT FLOW, P-WAVE DELAY, SEISMIC NOISE, MICROEARTHQUAKE

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	230	300	270	267	14

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.3	2.5	2.0		
THICKNESS (KM)	1.0	2.0	2.0	1.7	0.2
SUBSURFACE AREA (KM**2)	375	1900	1000	1091.7	313.0

BASED ON: AREAS OF SURFACE ACTIVITY, CALDERA, CALDERA MINUS AREAS OF RESURGENT DOMES, RESPECTIVELY

VOLUME (KM**3)........... 1819.4 STD. DEV. = 586.3
THERMAL ENERGY(10**18 J). 1236.31 STD. DEV. = 405.20

COMMENTS: RESERVOIR ASSUMED TO BE LATERALLY EXTENSIVE AND INTERCONNECTED. AT LEAST ONE VAPOR-DOMINATED AREA (MUD VOLCANO) OF LIMITED EXTENT HAS DEVELOPED OVER A SMALL PART OF THE HOT-WATER SYSTEM. MIXING MODELS AND SULFATE-ISOTOPE GEOTHERMOMETERS INDICATES POSSIBLE TEMPERATURES OF 360 C IN THE DEEP RESERVOIR. AREA WITHDRAWN FROM COMMERCIAL EXPLORATION BECAUSE OF NATIONAL PARK STATUS.

REFERENCES: MCKENZIE AND TRUESDELL, 1977; FOURNIER AND OTHERS, 1976; WHITE AND OTHERS, 1975; TRUESDELL AND FOURNIER, 1976; MORGAN AND OTHERS, 1976; THOMPSON AND OTHERS, 1975; WHITE AND OTHERS, 1971; ALLEN AND DAY, 1935; EATON AND OTHERS, 1975

COMPILED BY: MARINER, R. AND BROOK, C.

YELLOWSTONE CALDERA AREA, WYOMING

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FIELD NAME................ MUD VOLCANO AREA
KGRA OR OTHER NAME........ YELLOWSTONE NATIONAL PARK
CIRCULAR REFERENCE........ 215A

   GEOGRAPHIC LOCALITY
      STATE..................... WYOMING
      COUNTY.................... YELLOWSTONE
      LATITUDE.................. 44-37.5  N
      LONGITUDE................. 110-26.0  W
      MAPS...................... CANYON VILLAGE 1:62,500

   GENERAL INFORMATION
      WARING FIGURE....................... 5
      WARING NUMBER....................... 61A - 61D
      AREA OF SURFACE EXPRESSION (KM**2).  5
      ELEVATION (M)....................... 2318
      SURFACE ACTIVITY.................... HOT SPRINGS, FUMAROLES
      ASSOCIATED DEPOSITS................. SINTER
      NO. OF SPRINGS...................... 50
      SPRING TEMPERATURES (C)............. 22      TO 90
      DISCHARGE (L/MIN)................... 100
      NO. OF WELLS........................ 1 RESEARCH HOLE
      WELL DEPTHS (M)..................... 106
      MAXIMUM WELL TEMP (C)............... 191     AT DEPTH (M) 105
      ROCK TYPES: GLACIAL DEPOSITS OVERLYING PLEISTOCENE RHYOLITE TUFFS AND FLOWS
      GEOPHYSICS:  GRAVITY, MAGNETIC, RESISTIVITY, MICROEARTHQUAKE, SEISMIC NOISE
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RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	200 (O)	240 (O)	230 (O)	223	8

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPFRATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.1	0.3	0.2		
THICKNESS (KM)	1.2	1.4	1.3	1.3	0.0
SUBSURFACE AREA (KM**2)	4	10	5	6.3	1.3

BASED ON: ESTIMATES OF RENNER ET AL (1976)

VOLUME (KM**3)........... 8.2 STD. DEV. = 1.7
THERMAL ENERGY(10**18 J). 4.63 STD. DEV. = 0.99

COMMENTS: VAPOR-DOMINATED SYSTEM OF PROBABLE LIMITED EXTENT OVERLYING YELLOWSTONE CALDERA HOT-WATER SYSTEM AT 1.5 KM DEPTH. WELL DATA FORMED BASIS OF VAPOR-DOMINATED MODEL PROPOSED BY WHITE AND OTHERS (1971).

REFERENCES: WHITE AND OTHERS, 1971; ZOHDY AND OTHERS, 1973; RENNER AND OTHERS, 1976

COMPILED BY: BROOK, C.

MUD VOLCANO AREA, WYOMING

FIELD NAME................ HUCKLEBERRY HOT SPRINGS
CIRCULAR REFERENCE........ 216

GEOGRAPHIC LOCALITY
STATE...................... WYOMING
COUNTY..................... TETON
LATITUDE................... 44-07.0 N
LONGITUDE.................. 110-41.0 W
MAPS....................... HUCKLEBERRY MTN. 1162,500

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
48N	115	08	NE OF NW	6TH PRINCIPAL MERIDAN

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 100
ELEVATION (M)...................... 2079
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2 SMALL GROUPS
DISCHARGE (L/MIN).................. 380
ROCK TYPES: TERTIARY LAVA OVERLYING CRETACEOUS SHALE

CHEMISTRY
SAMPLE SOURCE.... USGS FILE DATA

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
71	124	12		201	7.8	372		12	102

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
		7.1			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	141
NA-K-CA (4/3)	112
NA-K	95
SILICA	
ADIABATIC	143
CONDUCTIVE	150
CHALCEDONY	124
CRISTOBALITE	99
OPAL	28

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	124 (D,J)	150 (A)	124 (D,J)	133	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 1.06 STD. DEV. = 0.30

REFERENCES: RENNER AND OTHERS, 1976; WARING, 1965; HAGUE AND OTHERS, 1896, 1899

COMPILED BY: MARINER, R.

HUCKLEBERRY HOT SPRINGS , WYOMING

FIELD NAME................ GRANITE HOT SPRINGS
CIRCULAR REFERENCE........ 217

GEOGRAPHIC LOCALITY
STATE..................... WYOMING
COUNTY.................... TETON
LATITUDE.................. 43-22. N
LONGITUDE................. 110-27. W
MAPS...................... GRANITE FALLS 1:24,000

TOWNSHIP	RANGE	SECTION	BASE & MERIDIAN
39N	113W	06	6TH PRINCIPAL MERIDAN

GENERAL INFORMATION
WARING FIGURE...................... 2
WARING NUMBER...................... 102
ELEVATION (M)...................... 2147
SURFACE ACTIVITY................... HOT SPRINGS
NO. OF SPRINGS..................... 2
SPRING TEMPERATURES (C)............ 44
DISCHARGE (L/MIN).................. 1200
ROCK TYPES: GRANITE

CHEMISTRY
SAMPLE SOURCE.... USGS FILE DATA
COLLECTION DATE.. 1977/09/13

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
44	62	29	5.6	210	11	198		160	150

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
6.3	0.88	7.66			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	148
NA-K-CA (4/3)	103
NA-K	119
SILICA	
ADIABATIC	111
CONDUCTIVE	112
CHALCEDONY	83
CRISTOBALITE	62
OPAL	-5

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	83 (D,J)	112 (A)	83 (D,J)	93	7

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE
B) QUARTZ CONDUCTIVE, PH-CORRECTED
C) QUARTZ ADIABATIC
D) CHALCEDONY
E) CHALCEDONY, PH-CORRECTED
F) CRISTOBALITE
G) AMORPHOUS SILICA
H) NA-K
I) NA-K-CA
J) NA-K-CA, MG-CORRECTED
K) SULFATE GEOTHERMOMETER
L) SURFACE TEMPERATURE
M) WELL TEMPERATURE
N) MIXING MODEL
O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4
BASED ON: STANDARD ESTIMATE					

VOLUME (KM**3)	3.3	STD. DEV. = 0.9
THERMAL ENERGY(10**18 J)	0.70	STD. DEV. = 0.21

COMMENTS: THERMAL WATER USED IN SWIMMING POOL.

REFERENCES: WARING, 1965

COMPILED BY: MARINER, R.

GRANITE HOT SPRINGS , WYOMING

FIELD NAME................ AUBURN HOT SPRINGS
CIRCULAR REFERENCE........ 218

GEOGRAPHIC LOCALITY

STATE..................... WYOMING
COUNTY.................... LINCOLN
LATITUDE.................. 42-49.5 N
LONGITUDE................. 111-00.0 W
MAPS...................... AUBURN 1:125,000

TOWNSHIP	RANGE	SECTION		BASE & MERIDIAN
33N	119	23	SW OF NW	6TH PRINCIPAL MERIDIAN

GENERAL INFORMATION

WARING FIGURE...................... 2
WARING NUMBER...................... 103
ELEVATION (M)...................... 1829
SURFACE ACTIVITY................... HOT SPRINGS
ASSOCIATED DEPOSITS................ TRAVERTINE MOUNDS
NO. OF SPRINGS..................... SEVERAL
SPRING TEMPERATURES (C)............ 16 TO 59.5
DISCHARGE (L/MIN).................. 150
ROCK TYPES: TRIASSIC OR JURASSIC LIMESTONE

CHEMISTRY

SAMPLE SOURCE.... USGS FILE DATA
COLLECTION DATE.. 1977/09/14

TEMP(C)	SIO2	CA	MG	NA	K	HCO3	CO3	SO4	CL
59.5	50	400	68	1550	160	920		1150	2050

F	B	PH	DEL O(18) SO4	DEL O(18) H2O	DEL D H2O
4.0	2.9	6.38			

GEOTHERMOMETERS (C)

CATION	
NA-K-CA (1/3)	196
NA-K-CA (4/3)	174
NA-K	188
SILICA	
ADIABATIC	103
CONDUCTIVE	102
CHALCEDONY	72
CRISTOBALITE	51
OPAL	-14

RESERVOIR PROPERTIES	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
SUBSURFACE TEMP (C)	72 (D)	102 (A)	96 (J)	90	6

UNCODED TEMPERATURE INDICATES SUBJECTIVE JUDGEMENT

A) QUARTZ CONDUCTIVE	F) CRISTOBALITE	K) SULFATE GEOTHERMOMETER
B) QUARTZ CONDUCTIVE, PH-CORRECTED	G) AMORPHOUS SILICA	L) SURFACE TEMPERATURE
C) QUARTZ ADIABATIC	H) NA-K	M) WELL TEMPERATURE
D) CHALCEDONY	I) NA-K-CA	N) MIXING MODEL
E) CHALCEDONY, PH-CORRECTED	J) NA-K-CA, MG-CORRECTED	O) RENNER AND OTHERS, 1976

	MINIMUM	MAXIMUM	MOST LIKELY	MEAN	STD. DEV.
DEPTH TO TOP (KM)	0.5	2.0	1.5		
THICKNESS (KM)	1.0	2.5	1.5	1.7	0.3
SUBSURFACE AREA (KM**2)	1	3	2	2.0	0.4

BASED ON: STANDARD ESTIMATE

VOLUME (KM**3)............ 3.3 STD. DEV. = 0.9
THERMAL ENERGY(10**18 J). 0.67 STD. DEV. = 0.2?

COMMENTS: GAS DISCHARGE IS PRINCIPALLY CARBON DIOXIDE; WATERS ARE HIGH IN SULFIDE (25MG/L).

REFERENCES: RUBEY, 1958; WARING, 1965

COMPILED BY: MARINER, R.

AUBURN HOT SPRINGS, WYOMING

REFERENCES

Allen, E.T., and Day, A.L., 1927, Steam wells and other thermal activity at "The Geysers," California: Carnegie Institution of Washington Publication 378, 106 p.

_____ 1935, Hot springs of the Yellowstone National Park: Carnegie Institution of Washington Publication 466, 525 p.

Anderson, G.S., 1970, Hydrologic reconnaissance of the Tanana Basin, central Alaska: U.S. Geological Survey Hydrologic Investigations Atlas, HA-319.

Atkinson, D.J., 1978, Geothermal development in Reno: Geothermal Resources Council, Transactions, v. 2, p. 21-22.

Austin, C.F., and Pringle, J.K., 1970, Geologic investigations at the Coso thermal area: Naval Weapons Center Technical Publication 4878, 40 p.

Axtell, L.H., 1972, Mono Lake geothermal wells abandoned: California Geology, v. 25, no. 3, p. 66-67.

Ayers, F.D., and Creswell, A.E., 1951, The Mount Hood fumaroles (Oregon): Mazama, v. 33, no. 13, p. 33-40.

Bailey, R.A., Dalrymple, G.B., and Lanphere, M.A., 1976, Volcanism, structure, and geochronology of Long Valley caldera, Mono County, California: Journal of Geophysical Research, v. 81, p. 725-744.

Barkman, J.H., Campbell, D.A., Smith, J.L., and Rex, R.W., 1976, East Mesa — geology, reservoir properties, and an approach to reserve determination, in Kruger, P., and Ramey, H.J., Jr., eds., Second workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 116-125.

Barnes, Ivan, O'Neil, J.R., Rapp, J.B., and White, D.E., 1973, Silica-carbonate alteration of serpentine -- Wall rock alteration in mercury deposits of the California Coast Ranges: Economic Geology, v. 68, p. 388-398.

Barrett, J.K., and Pearl, R.H., 1976, Hydrogeological data of thermal springs and wells in Colorado: Colorado Geological Survey Information Series No. 6, 124 p.

_____ 1978, An appraisal of Colorado's geothermal resources: Colorado Geological Survey Bulletin 39, in press.

Bateman, R.L., and Scheibach, R.B., 1975, Evaluation of geothermal activity in the Truckee Meadows, Washoe County, Nevada: Nevada Bureau of Mines and Geology Report 25, 38 p.

Beikman, H.M., 1975, Preliminary geologic map of the Alaska Peninsula and Aleutian Islands: U.S. Geological Survey Map MF-674.

Benoit, W.R., 1978, The discovery and geology of the Desert Peak, Nevada, geothermal field, in Energy exploration and politics: California Division of Oil and Gas, 11 p.

Berkstresser, C.F., Jr., 1968, Data for springs in the northern Coast Ranges and Klamath Mountains of California: U.S. Geological Survey Open-File Report, 49 p.

Biehler, S., 1971, Gravity studies in the Imperial Valley, in Cooperative geological-geophysical-geochemical investigations of geothermal resources in the Imperial Valley area of California: University of California, Riverside, Education Research Service, p. 29-41.

Blackwell, D.D., 1969, Heat flow determinations in the northwestern United States: Journal of Geophysical Research, v. 74, p. 992-1007.

______ 1970, Heat flow near Marysville, Montana (abs): EOS (American Geophysical Union Transactions), v. 51, p. 824.

Blackwell, D.D., and Baag, C., 1973, Heat flow in a blind geothermal area near Marysville, Montana: Geophysics, v. 38, p. 941-956.

Blackwell, D.D., Brott, C.A., Goforth, T.T., Holdaway, M.J., Morgan, P., Petefish, D., Rape, T., Steele, J.L., Spafford, R.E., and Waibel A.F., 1974, Geological and geophysical exploration at Marysville geothermal area — 1973 results to RANN, National Science Foundation: Battelle-Northwest, Rogers Engineering Co., Inc., Southern Methodist University, and Systems, Science and Software, 104 p.

Bonham, H.R., 1969, Geology and mineral deposits of Washoe and Story Counties, Nevada: Nevada Bureau of Mines Bulletin 70, 140 p.

Bowen, P.A., 1978, Pleistocene volcanism near Lassen Peak, California (abs.): Geological Society of America Abstracts with Programs, Cordilleran Section, v. 10, no. 3, p. 97.

Bowen, R.G., and Blackwell, D.D., 1975, The Cow Hollow geothermal anomaly: Ore Bin, v. 37, p. 109-121.

Bowen, R.G., Blackwell, D.D., and Hull, D.A., 1977, Geothermal exploration studies in Oregon: Oregon Department of Geology and Mineral Industries Miscellaneous Paper 19, 50 p.

Brook, C.A., Mariner, R.H., Mabey, D.R., Swanson, J.R., Guffanti, Marianne, and Muffler, L.J.P., 1979, Hydrothermal convection systems with reservoir temperatures 90°C, in Muffler, L.J.P., ed., Assessment of geothermal resources of the United States - 1978: U.S. Geological Survey Circular 790, in press.

Byers, F.M. Jr., 1959, Geology of Umnak and Bogoslof Islands, Aleutian Islands, Alaska: U.S. Geological Survey Bulletin 1028-L, p. 267-369.

Byers, F.M., Jr., and Barth, T.F.W., 1953, Volcanic activity of Akun and Akutan Island: Pacific Scientific Congress 7th, Auckland and Christchurch, New Zealand, Proceedings, v. 2, Geology, p. 382-397.

Byers, F.M., Jr., and Brannock, W.W., 1949, Volcanic activity on Umnak and Great Sitkin Islands, 1946-1948: American Geophysical Union Transactions, v. 30, no. 5, p. 719-734.

California Department of Water Resources, 1963, Northeastern counties ground water investigation: California Department of Water Resources Bulletin 98, 2 vols.

Callagham, Eugene, and Parker, R.L., 1961, Geology of the Monroe Quadrangle, Utah: U.S. Geological Survey Quadrangle Map GQ-155.

Campbell, K.V., Miers, J.H., Nichols, B.M., Oliphant, Jerrelyn, Pytlak, Shirley, Race, R.W., Shaw, G.H., and Gresens, R.L., 1970, A survey of thermal springs in Washington State: Northwest Science, v. 44, no. 1, p. 1-11.

Chadwick, R.A., 1978, Geothermal reconnaissance of southwestern Montana: Final technical report to the U.S. Geological Survey under the geothermal Research Program for the period June 18, 1975 to June 18, 1978, grant no. 14-08-0001-G-238 and 334, 42 p.

Chadwick, R.A., and Kaczmarek, M.B., 1975, Geothermal investigations of selected Montana hot springs: Montana Geological Society, 22nd Annual Publication, 1975, 209-216.

Chapin, C.E., Chamberlin, R.M., Osburn, G.R., White, D.W., and Sanford, A.R., 1978, Exploration framework of the Socorro geothermal area, New Mexico: New Mexico Geological Society Special Publication No. 7, p. 115-129.

Chapman, R.H., 1975, Geophysical study of the Clear Lake region, California: California Division of Mines and Geology Special Report 116, 23 p.

Chapman, R.H., and Bishop, C.C., 1968, Alturas sheet: California Division of Mines and Geology, Bouguer Gravity Map of California.

Chapman, R.H., Chase, G.W., and Taylor, G.C., 1978, Preliminary results of a gravity survey in the Kelly Hot Springs area, Modoc County, California: California Division of Mines and Geology Open-File Report 78-5, 12 p.

Chapman, R.M., Weber, F.R., and Taber, Bond, 1971, Preliminary geologic map of the Livengood Quadrangle, Alaska: U.S. Geological Survey Open-File Report.

Chent, B.H., Kihara, D.H., Yuen, P.C., and Takahashi, P.K., 1978, Well test results from HGP-A: Geothermal Resources Council, Transactions, v. 2, p. 99-102.

Chesterman, C.W., 1975, Geology of the Matterhorn Peak 15-minute quadrangle, Mono and Tuolumne Counties, California: California Division of Mines and Geology Map Sheet 22, scale 1:48,000

Choate, Raoul, 1962, Geology and ore deposits of the Stanley area (Idaho): Idaho Bureau of Mines and Geology Pamphlet 126, 122 p.

Ciancanelli, E.V., and Corman, F.D., 1978, Geology of the Roosevelt geothermal field, Beaver County, Utah: Canadian Geothermal Resources Association Newsletter, no. 2, p. 3.

Combs, J., 1975, Heat flow and microearthquake studies, Coso geothermal area, China Lake, California: Advanced Research Projects Agency, Contract No. N00123-74C-2099, Final Report.

Combs, Jim, and Jarzabek, Dave, 1978, Seismic wave attenuation anomalies in the East Mesa geothermal field, Imperial Valley, California: Preliminary results: Geothermal Resources Council, Transactions, v. 2, p. 109-112.

Combs, Jim, and Rotstein, Y., 1976, Microearthquake studies at the Coso geothermal area, China Lake, California: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 2, p. 909-916.

Combs, J., and Wilt, M., 1976, Telluric mapping, telluric profiling, and self-potential surveys of the Dunes, geothermal anomaly, Imperial Valley, California: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 2, p. 917-928.

Coplen, T.B., 1973, Isotopic composition of calcite and water from the Dunes DWR # 1 geothermal test corehole, Imperial Valley, California (abs.): EOS (American Geophysical Union Transactions), v. 54, p. 448.

Coplen, T.B., and Kolesar, Peter, 1974, Investigations of the Dunes geothermal anomaly, Imperial Valley, California, part 1, geochemistry of geothermal fluids: University of California, Riverside, 21 p.

Corcoran, R.E., Doak, R.A., Porter, P.W., Pritchett, F.I., and Privrasky, N.C., 1962, Geology of the Mitchell Butte Quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Geologic Map Series 2.

Cordell, Lindrith, 1976, Aeromagnetic and gravity studies of the Rio Grande graben in New Mexico between Belen and Pilar: New Mexico Geological Society Special Publication No. 6, p. 62-70.

Curtis, G.H., 1951, The geology of the Topaz Lake Quadrangle and eastern half of the Ebbetts Pass Quadrangle: University of California Ph.D. thesis, 310 p.

Day, A.L., and Allen, E.T., 1924, The source of the heat and the source of the water in the hot springs of Lassen National Park: Journal of Geology, v. 32, no. 3, p. 178-190.

_____1925, The volcanic activity and hot spring of Lassen Peak: Carnegie Institution of Washington Publication 360, 190 p.

Deal, E.G., and Elston, W.E., 1978, Geology of Lightning Dock KGRA and vicinity, Pyramid Mountains and Animas Valley, Hidalgo County, New Mexico: Unpublished report.

Decker, E.R., Cook, F.A., Ramberg, I.B., and Smithson, S.B., 1975, Significance of geothermal and gravity studies in the Las Cruces area: New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces County, p. 251-259.

Dickson, F.W., and Tunell, George, 1968, Mercury and antimony deposits associated with active hot springs in the Western United States, in Ore deposits of the United States, 1933-1967: New York, American Institute of Mining and Metallurgic Engineers, v. 2, p. 1673-1701.

Dondanville, R.F., 1978, Geologic characteristics of the Valles caldera geothermal system, New Mexico: Geothermal Resources Council, Transactions, v. 2, p. 157-160.

Duffield, W.A., and Bacon, C.R., 1977, Preliminary geologic map of the Coso volcanic field and adjacent areas: U.S. Geological Survey Open-File Map 77-311.

Duffield, W.A., and Fournier, R.O., 1974, Reconnaissance study of the geothermal resources of Modoc County, California: U.S. Geological Survey Open-File Report, 19 p.

Dutcher, L.C., Hardt, W.F., and Moyle, W.R., Jr., 1972, Preliminary appraisal of ground water in storage with reference to geothermal resources in the Imperial Valley area, California: U.S. Geological Survey Circular 649, 57 p.

Eaton, G.P., Christiansen, R.L., Iyer, H.M., Pitt, A.M., Mabey, D.R., Blank, H.R., Jr., Zietz, I., and Gettings, M.E., 1975, Magma beneath Yellowstone National Park: Science, v. 188, no. 4190, p. 787-796.

Erickson, R.L., and Marsh, S.P., 1974, Geologic map of the Golconda Quadrangle, Humboldt County, Nevada: U.S. Geological Survey Geologic Quadrangle Map GQ-1174.

Feth, J.H., Roberson, C.E., and Polzer, W.L., 1964, Sources of mineral constituents in water from granitic rocks, Sierra Nevada, California and Nevada: U.S. Geological Survey Water-Supply Paper 1535-I, p. I1-I70.

Fiske, R.S., Hopson, C.A., and Waters, A.C., 1963, Geology of Mount Rainier National Park, Washington: U.S. Geological Survey Professional Paper 444, 93 p.

Fournier, R.O., 1975, Chemical geothermometers and mixing models for geothermal systems, in Advisory Group on the Application of Nuclear Techniques to Geothermal Studies, 1975, Pisa, Italy: Geothermics, v. 5, p. 41-50.

Fournier, R.O., and Potter, R.W., II, 1978, A magnesium correction for the Na-K-Ca geothermometer: U.S. Geological Survey Open-File Report 78-986, 24 p.

Fournier, R.O., Sorey, M.L., Mariner, R.H., and Truesdell, 1978, Chemical and isotopic prediction of aquifer temperatures in the geothermal system at Long Valley, California: Journal of Volcanology and Geothermal Research, in press.

Fournier, R.O., Thompson, J.M., and Austin, C.F., 1978, Chemical analysis and preliminary interpretation of waters collected from the CGEH No. 1 geothermal well at Coso, California: U.S. Geological Survey Open-File Report 78-434, 10 p.

Fournier, R.O., White, D.E., and Truesdell, A.H., 1976, Convective heat flow in Yellowstone National Park: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 1, p. 731-739.

Fox, R.C., 1978a, Dipole-dipole resistivity survey of a portion of the Coso Hot Springs KGRA, Inyo County, California: University of Utah Research Institute-Earth Science Laboratory, Department of Energy Contract EY-76-S-07-1601, 21 p.

_____1978b, Low-altitude aeromagnetic survey of a portion of the Coso Hot Springs KGRA, Inyo County, California: University of Utah Research Institute-Earth Science Laboratory, Department of Energy Contract EY-76-S-07-1601, 19 p.

Furumoto, A.S., 1976, A coordinated exploration program for geothermal sources on the Island of Hawaii: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, !975, v. 2, p. 993-1001.

_____1978, The relationship of a geothermal reservoir to the geological structure of the east rift of Kilauea Volcano, Hawaii: Geothermal Resources Council, Transactions, v. 2, p. 199-201.

Galbraith, R.M., 1978, Geological and geophysical analysis of Coso Geothermal Exploration Hole No. 1 (CGEH-1), Coso Hot Springs KGRA, California: University of Utah Research Institute-Earth Science Laboratory, Department of Energy Contract EG-78-C-07-1701, 39 p.

Garside, L.J., 1974, Geothermal Exploration and Development in Nevada through 1973: Nevada Bureau of Mines and Geology, Report No. 21, 12 p.

Geonomics, Inc., 1976, A comparison of hydrothermal reservoirs of the western United States: Electric Power Research Institute Topical Report 3, EPRI ER-364, 170 p.

Gilluly, James, and Gates, Olcott, 1965, Tectonic and igneous geology of the northern Shoshone Range, Nevada: U.S. Geological Survey Professional Paper 465, 153 p.

Goff, F.E., Donnelly, J.M., Thompson, J.M., and Hearn, B.C., Jr., 1977, Geothermal prospecting in The Geysers-Clear Lake area, northern California Geology, v. 5, p. 509-515.

Goldstein, N.E, Beyer, H., Corwin, R., di Somma, D.E., Majer, E., McEvilly, T.V., Morrison, H.F., Wollenberg, H.A., and Grannell, R., 1976, Geoscience studies in Buena Vista Valley, Nevada: Berkeley, University of California, Lawrence Berkeley Laboratory LBL-5913, 41 p.

Granger, A.E., Mendell, M.B., Simmons, G.C., and Lee, Florence, 1957, Geology and mineral resources of Elko County, Nevada: Nevada Bureau of Mines Bulletin 54, 190 p.

Greene, R.C., Walker, G.W., and Corcoran, R.E., 1972, Geologic map of the Barns Quadrangle, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-680.

Griscom, Andrew, and Muffler, L.J.P., 1971, Aeromagnetic map and interpretation of the Salton Sea geothermal area, California: U.S. Geological Survey Geophysical Investigations Map GP-754.

Hague, Arnold, Iddings, J.P., Weed, W.H., Walcott, C.D., Girty, G.H., Stanton, T.W., and Knowlton, F.H., 1899, Geology of the Yellowstone National Park, part 2, descriptive geology, petrography, and paleontology: U.S. Geological Survey Monograph 32, 893 p.

Hague, Arnold, Weed, W.H., Iddings, J.P., 1896, Geology of the Yellowstone National Park, Wyoming: U.S. Geological Survey Geologic Atlas, Folio 30.

Hahman, W.R., Sr., Stone, C., and Witcher, J.C., 1978, Geothermal energy resources of Arizona--geothermal map no. 1: Arizona Bureau of Geology and Mineral Technology.

Hamilton, Warren, 1969, Reconnaissance geologic map of the Riggins Quadrangle, west-central Idaho: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-579.

Hearn, B.C., Jr., Donnelly, J.M., and Goff, F.E., 1976, Geology and geochronolgy of the Clear Lake Volcanics, California: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 1, p. 423-428.

Hedlund, D.C., and Olsen, J.C., 1975, Geologic map of the Powderhorn Quadrangle, Gunnison and Saguache Counties, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-1178.

Helgeson, H.C., 1968, Geologic and thermodynamic characteristics of the Salton Sea geothermal system: American Journal of Science, v. 266, no. 3, p. 129-166.

Hem, J.D., 1950, Quality of water of the Gila River basin above Coolidge Dam, Arizona: U.S. Geological Survey Water-Supply Paper 1104, 230 p.

Hite, J.R., and Fehlberg, E.L., 1976, Steam zone temperature gradients at The Geysers, in Kruger, P., and Ramey, H.J., Jr., eds., Second workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 16-20.

Hodge, E.T., 1941, Geology of the Madras Quadrangle: Oregon State College, Studies in Geology, no. 1, geologic map.

Hoover, D.B., and Batzle, M.L., 1977, Audio-magnetotelluric data log and station location map for Pinto Hot Springs Known Geothermal Resources Area, Nevada: U.S. Geological Survey Open-File Report 77-65-A.

Hoover, D.B., Frischknecht, F.C., and Tippens, C.L., 1976, Audiomagnetotelluric sounding as a reconnaissance exploration technique in Long Valley, California: Journal of Geophysical Research, v. 81, p. 801-809.

Hoover, D.B., and Long, C.L., 1975, Audio-magnetotelluric methods in reconnaissance geothermal exploration: U.S. Geological Survey Open-File Report 75-362, 25 p.

Hose, R.K., and Taylor, B.E., 1974, Geothermal systems of northern Nevada: U.S. Geological Survey Open-File Report 74-271, 27 p.

Hulen, J.B., 1978, Geology and alteration of the Coso geothermal area, Inyo County, California: University of Utah Research Institute-Earth Science Laboratory, Department of Energy Contract EG-78-C-07-1701, 28 p.

Isherwood, W.F., 1976, Gravity and magnetic studies of The Geysers-Clear Lake region, California: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, v. 2, p. 1065-1073.

Iyer, H.M., Oppenheimer, D.H., and Hitchcock, Tim, 1978, Teleseismic P-delays at The Geysers-Clear Lake, California geothermal region: Geothermal Resources Council, Transactions, v. 2, p. 317-319.

Jiracek, G.R., and Smith, Christian, 1976, Deep resistivity investigations at two known geothermal resource areas (KGRA's) in New Mexico: Radium Springs and Lightning Dock: New Mexico Geological Society Special Publication No. 6, p. 71-76.

Johnson, E.H., 1974, Resistivity and induced polarization survey of a basalt flow in a geothermal environment, western Utah: University of Utah, Master's thesis, 69 p.

Kane, M.F., Mabey, D.R., and Brace, R. L., 1976, A gravity and magnetic investigation of the Long Valley caldera, Mono County, California: Journal of Geophysical Research, v. 81, p. 754-762.

Kihara, D., Chen, B., Yuen, P., and Takahashi, P., 1977, Summary of results of HGP-A well testing, in Kruger, P., and Ramey, H.J., Jr., eds., Third workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 188-144.

Kintzinger, P.R., 1956, Geothermal survey of hot ground near Lordsburg, New Mexico: Science, v. 124, p. 629.

Kleinhampl, F.J., and Ziony, J.I., 1967, Preliminary geologic map of northern Nye County, Nevada: U.S. Geological Survey Open-File Map.

Knopf, Adolf, 1963, Geology of the northern part of the Boulder batholith and adjacent area, Montana: U.S. Geological Survey Miscellaneous Investigations Map I-381.

Koenig, J.B., 1970, Geothermal exploration in the western United States: Geothermics Special Issue 2, v. 2, p. 1-13.

Konizeski, R.L., McMurtrey, R.G., and Brietkrietz, Alex, 1962, Preliminary report on the geology and ground-water resources of the southern part of the Deer Lodge Valley, Montana: Montana Bureau of Mines and Geology Bulletin 31, 24 p.

Kunze, J.F., ed., 1977, Geothermal r & d project report for period October 1, 1976 to March 31, 1977: E G & G Idaho, Inc./Idaho National Engineering Laboratory report TREE-1134, 160 p. (available from National Technical Information Service.)

Kunze, J.F., Stoker, R.C., and Allen, C.A., 1977, Update on the Raft River geothermal reservoir, in Kruger, P., and Ramey, H.J., eds., Third workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 125-129.

Lambert, S.J., 1976, Stable isotope studies of some active hydrothermal systems: California Institute of Technology, Ph.D. thesis, 362 p.

Leonard, A.R., 1970, Ground-water resources in Harney Valley, Oregon: Oregon State Ground Water Report no. 16, 85 p.

Leonard, R.B., Brosten, T.M., and Midtlyng, N.A., 1978, Selected data from thermal-spring areas, southwestern Montana: U.S. Geological Survey Open-File Report 78-438, 71 p.

Lindgren, Waldemar, 1905, Description of the Clifton Quadrangle, Arizona: U.S. Geological Survey Geologic Atlas, Folio 129, 13 p.

Livingstone, V.E., Jr., 1972, Geothermal energy in Washington, in Geothermal overviews of the Western United States: California Geothermal Resources Council, sec. L, 17 p.

Lund, J.W., Culver, G.G., and Svanevik, L.S., 1974, Utilization of geothermal energy in Klamath Falls: International Conference on Geothermal Energy for Industry, Agriculture, and Commerical Uses, Klamath Falls, Oregon, Oregon Institute of Technology, Proceedings, p. 146-178.

Malde, H.E., Powers, H.A., and Marshall, C.H., 1963, Reconnaissance geologic map of west-central Snake River Plain, Idaho: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-373.

McKee, E.H., 1968, Geologic map of the Spencer Hot Springs Quadrangle, Lander County, Nevada: U.S. Geological Survey Geologic Quadrangle Map GQ-770.

McKenzie, W.F., and Truesdell, A.H., 1977, Geothermal reservoir temperatures estimated from the oxygen isotope compositions of dissolved sulfate and water from hot springs and shallow drillholes: Geothermics, v. 5, p. 51-61.

McLaughlin, R.J., and Stanley, W.D., 1976, Pre-Tertiary geology and structural control of geothermal resources, The Geysers steam field, California: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 1, p. 475-485.

McNitt, J.R., 1963, Exploration and development of geothermal power in California: California Division of Mines and Geology, Special Report 75, 44 p.

Mariner, R.H., Presser, T.S., and Evans, W.C., 1976a, Chemical characteristics of the major thermal springs of Montana: U.S. Geological Survey Open- File Report 76-480, 31 p.

_____1976b, Chemical composition data and calculated aquifer temperatures for selected wells and springs of Honey Lake Valley, California: U.S. Geological Survey Open-File Report 76-783, 10 p.

_____1976c, Chemical data for eight springs in northwestern Nevada: U.S. Geological Survey Open-File Report, 13 p.

_____1977a, Chemical, isotopic, and gas compositions of selected thermal springs in Arizona, New Mexico, and Utah: U.S. Geological Survey Open-File Report 77-654, 42 p.

_____1977b, Hot springs of the central Sierra Nevada, California: U.S. Geological Survey Open-File Report 77-559, 27 p.

Mariner, R.H., Presser, T.S., Rapp, J.B., and Willey, L.M., 1975, The minor and trace elements, gas, and isotope compositions of the principal hot springs of Nevada and Oregon: U.S. Geological Survey Open-File Report, 27 p.

Mariner, R.H., Rapp, J.B., Willey, L.M., and Presser, T.S., 1974a, The chemical composition and estimated minimum thermal reservoir temperature of the principal hot springs of northern and central Nevada: U.S. Geological Survey Open-File Report, 32 p.

_____1974b, The chemical composition and estimated minimum thermal reservoir temperatures of selected hot springs in Oregon: U.S. Geological Survey Open-File Report, 27 p.

Mariner, R.H., and Willey, L.M., 1976, Geochemistry of thermal waters in Long Valley, Mono County, California: Journal of Geophysical Research, v. 81, p. 792-800.

Meidav, T., and Furgerson, R., 1972, Resistivity studies of the Imperial Valley, California: Geothermics, v. 1, no. 2, p. 47-62.

Miller, T.P., compiler, 1973, Distribution and chemical analyses of thermal springs in Alaska: U.S. Geological Survey Open-File Report.

Miller, T.P., Grybeck, D.G., Elliott, R.L., and Hudson, Travis, 1972, Preliminary geologic map of the eastern Solomon and southeastern Bendeleben Quadrangles, Eastern Seward Peninsula Alaska: U.S. Geological Survey Open-File Report.

Miller, T.P., Barnes, Ivan, and Patton, W.W., Jr., 1975, Geologic setting and chemical characteristics of hot springs in west-central Alaska: Journal of Research of the U.S. Geological Survey, v. 3, p. 149-162.

Mitchell, J.C., 1976a, Geothermal investigations in Idaho, part 7, geochemistry and geologic setting of the thermal waters of the Camas Prairie area, Blaine and Camas Counties, Idaho: Idaho Department of Water Resources Water Information Bulletin 30, 44 p.

_____1976b, Geothermal investigations in Idaho, part 5, geochemistry and geologic setting of the thermal waters of the northern Cache Valley area, Franklin County, Idaho: Idaho Department of Water Resources Water Information Bulletin 30, 47 p.

Moore, J.G., 1969, Geology and mineral deposits of Lyon, Douglas, and Ormsby Counties, Nevada: Nevada Bureau of Mines Bulletin 75, 45 p.

Morgan, Paul, Blackwell, D.D., Spafford, R.E., and Smith, R.B., 1976, Evidence from heat-flow measurements for laterally extensive goethermal fluid systems in the Yellowstone caldera, Yellowstone National Park, Wyoming, USA: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 2, p. 1155-1159.

Morrison, R.B., 1964, Lake Lahontan: Geology of southern Carson Desert, Nevada: U.S. Geological Survey Professional Paper 401, 156 p.

Morse, J.G., 1977, Well interference study of the multi-layered Salton Sea geothermal reservoir, in Kruger, P., and Ramey, H.J., eds., Third workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 145-150.

Moyle, W.R., Jr., 1974, Temperature and chemical data for selected thermal wells and springs in southeastern California: U.S. Geological Survey Water Resources Investigation 33-73, 12 p.

Muffler, L.J.P., and White, D.E., 1969, Active metamorphism of Upper Cenozoic sediments in Salton Sea geothermal field and the Salton Trough, southeastern California: Geologic Society of America Bulletin, v. 80, p. 157-182.

Mull, C.G., Tailleur, I.L., Mayfield, C.F., and Pessel, G.H., 1976, New structural and stratigraphic interpretations, central and western Brooks Range and Arctic Slope, in Cobb, E.H., ed., The United States Geological Survey in Alaska: Accomplishments during 1975: U.S. Geological Survey Circular 733, p. 24-26.

Mundorff, J.C., 1970, Major thermal springs of Utah: Utah Geology and Mineralogy Survey Water-Resources Bulletin 13, 60 p.

Narasimhan, T.N., Schroeder, R.C., Goranson, C.G., McEdwards, D.G., Campbell, D.A., and Barkman, J.H., 1977, Recent results from tests on the Republic geothermal wells at East Mesa, California, in Kruger, P., and Ramey, H.J., eds., Third workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 116-124.

Nash, W.P., Turley, Charles, Peterson, James, and Brown, F.H., 1978, Volcanism and the regional assessment of geothermal potential in west-central Utah: Geothermal Resources Council, Transactions, v. 2, p. 475-477.

Nathenson, Manuel, 1978, Methodology of determining the uncertainty in the accessible resource base of hydrothermal convection systems: U.S. Geological Survey Open-File Report 78-1003, 50 p.

Oesterling, W.A., 1962, Northwest thrusting in northeast Nevada — Wood Hills thrust (abs.): Geologic Society of America Special Paper 68, p. 46-47.

Olmstead, F.H., Glancy, P.A., Harrill, J.R., Rush, F.E., and VanDenburgh, A.S., 1975, Preliminary hydrogeologic appraisal of selected hydrothermal systems in northern and central Nevada: U.S. Geological Survey Open-File Report 75-56, 267 p.

Olson, H.J., and Dellechaie, F., 1976, The Mount Princeton geothermal area, Chaffee County, Colorado, in Epis, R.C., and Weimer, R.J., Studies in Colorado field geology: Professional Contributions of Colorado School of Mines, no. 8, p. 431-438.

Pacific Gas and Electric Co., 1977, Environmental data statement, Geysers Unit 17: San Francsico, Pacific Gas and Electric Co., 173 p.

Page, B.M., 1965, Preliminary geologic map of a part of the Stillwater Range, Churchill County, Nevada: Nevada Bureau of Mines Map 28.

Peale, A.C., 1896, Description of the Three Forks Quadrangle, Montana: U.S. Geological Survey Geologic Atlas, Folio 24, 6 p., 4 maps.

Peck, D.L., Griggs, A.B., Schlicker, H.G., Wells, F.G., and Dole, H.M., 1964, Geology of the central and northern part of the Western Cascade Range in Oregon: U.S. Geological Survey Professional Paper 449, 56 p.

Peterson, C.A., 1973, Roosevelt and Thermo Hot Springs, Beaver County, Utah, in Geology of the Milford area, 1973: Utah Geologic Association Publication 3, p. 73-74.

Peterson, D.W., 1967, Geologic map of the Kilauea Crater Quadrangle, Hawaii: U.S. Geological Survey Geologic Quadrangle Map GQ-667.

Peterson, N.V., 1959, Lake County's new continuous geyser: The Ore-Bin, v. 21, no. 9, p. 83-88.

Peterson, N.V., and McIntyre, J.R., 1970, The reconnaissance geology and mineral resources of eastern Klamath County and western Lake County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 66, 70 p.

Quong, Roland, 1976, Scaling characteristics in the Geothermal Loop Experimental Facility at Niland, California: Livermore, California, University of California, Lawrence Livermore Laboratory, 33 p.

Ralston, D.R., and Chapman, S.L., 1968, Ground-water resources of the Mountain Home area, Elmore County, Idaho: Idaho Department of Reclamation Water Information Bulletin 4, 63 p.

Ramberg, I.B., Cook, F.A., and Smithson, S.B., 1978, Structure of the Rio Grande rift in southern New Mexico and West Texas based on gravity interpretation: Geological Society of America Bulletin, v. 89, p. 107-123.

Reed, M.J., 1975, Chemistry of thermal water in selected geothermal areas of California: California Division of Oil and Gas Report No. TR15, 31 p.

Reed, M.J., and Campbell, G.E., 1976, Environmental impact of development in The Geysers geothermal field, USA: Proceedings Second United Nations Symposium on the Development and Utilization of Geothermal Resources, San Francisco, 1975, v. 2, p. 1399-1410.

Reiter, Marshall, 1975, Terrestrial heat flow along the Rio Grande Rift, New Mexico and southern Colorado: Geological Society of America Bulletin, v. 86, p. 811-818.

Renner, J.L., and others, 1976, Selected geothermal resources data: Hydrothermal convection systems in the states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming: Springfield, Virginia, National Technical Information Service, PB-205, 377, 357 p.

Rex, R.W., Babcock, E.A., Biehler, S., Combs, J., Coplen, T.B., Elders, W.A., Furgerson, R.B., Garfunkel, Z., Meidav, T., and Robinson, P.T., 1971, Cooperative geological-geophysical-geochemical investigations of geothermal resources in the Imperial Valley area of California: University of California, Riverside, 153 p.

Rightmire, C.T., Young, H.W., and Whitehead, R.L., 1976, Geothermal investigations in Idaho, part 4, isotopic and geochemical analyses of water from the Bruneau-Grand View and Weiser areas, southwest Idaho: Idaho Department of Water Resources Water Information Bulletin 30, 28 p.

Robinson, P.T., and Elders, W.A., and Muffler, L.J.P., 1976, Quaternary volcanism in the Salton Sea geothermal field, Imperial Valley, California: Geological Society of American Bulletin, v. 87, p. 374-360.

Rodriquez, E.L., 1960, Economic geology of the sulfur deposits at Sulfurdale, Utah: Utah University, M.S. thesis, 70 p.

Rubey, W.W., 1958, Geology of the Bedford Quadrangle, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ-109.

Rush, F.E., 1977, Subsurface temperature for some wells in western Utah: U.S. Geological Survey Open-File Report 77-132, 36 p.

Sahinen, U.M., 1939, Geology and ore deposits of the Rochester and adjacent mining districts, Madison County (Montana): Montana Bureau of Mines and Geology Memoir 19, 55 p.

Sainsbury, C.L., Kachadoorian, Reuben, Hudson, Travis, Smith, T.E., Richards, T.R., and Todd, W.E., 1969, Reconnaissance geologic maps and sample data Teller A-1, A-2, A-3, B-1, B-2, B-3, C-1, and Bendeleben A-6, B-6, C-6, D-5, D-6 quadrangles, Seward Peninsula, Alaska: U.S. Geological Survey Open-File Report.

Sammel, E.A., 1976, Hydrologic reconnaissance of the geothermal area near Klamath Falls, Oregon, with a section on preliminary interpretation of geophysical data by D.L. Peterson: U.S. Geological Survey Water-Resources Investigation Open-File Report WRI 76-127, 129 p.

_____1979, Occurrence of low-temperature geothermal waters in the United States, in Muffler, L.J.P., ed., Assessment of geothermal resources of the United States - 1978: U.S. Geological Survey, Circular 790, in press.

Sass, J.H., Wollenberg, H.A., di Somma, D.E., and Ziagos, J.P., 1976, Heat flow near Kyle Hot Springs, Buena Vista Valley, Nevada: U.S. Geological Survey Open-File Report 76-862, 16 p.

Sass, J.H., Ziagos, J.P., Wollenberg, H.A., Munroe, R.J., di Somma, D.E., and Lachenbruch, A.H., 1977, Application of heat-flow techniques to geothermal energy exploration, Leach Hot Springs area, Grass Valley, Nevada: U.S. Geological Survey Open-File Report 77-762, 125 p.

Sauck, W.A., and Sumner, J.S., 1970, Residual aeromagnetic map of Arizona: Arizona University, Department of Geosciences.

Schroeder, R.C., 1976, Reservoir engineering report for the Magma-SDG & E geothermal experimental site near the Salton Sea, California: Livermore, California, University of California, Lawrence Livermore Laboratory, 62 p.

Seager, W.R., 1975, Geologic map and sections of south half San Diego Mountain Quadrangle, New Mexico: New Mexico Bureau of Mines and Mineral Resources Geologic Map 35.

Sharp, W.N., 1970, Extensive zeolitization associated with hot springs in central Colorado: U.S. Geological Survey Professional Paper 700-B, p. B14-B20.

Shuey, R.T., 1974, Aeromagnetic map of Utah: University of Utah and Utah Geological and Mineralogical Survey.

Shuey, R.T., Schellinger, D.K., Johnson, E.H., and Alley, L.B., 1973, Aeromagnetics and the transition between the Colorado Plateau and the Basin Range provinces: Geology, v. 1, p. 107-111.

Simons, F.S., and Mathewson, D.E., 1955, Geology of Great Sitkin Island, Alaska: U.S. Geological Survey Bulletin 1028-B, p. 21-43.

Smith, J.G., 1973, Geologic map of the Duffer Peak Quadrangle, Humboldt County, Nevada: U.S. Geological Survey Miscellaneous Investigation Map I-606.

Smith, J.L., Isselhardt, C.F., and Matlick, 1978, Summary of 1977 geothermal drilling — western United States: Geothermal Energy Magazine, v. 6, no. 5, p. 11-19.

Smith, J.F., Jr., and Ketner, K.B., 1972, Generalized geologic map of the Carlin, Dixie Flats, Pine Valley, and Robinson Mountain Quadrangles, Elko and Eureka Counties, Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-481.

Smith, J.L., and Rex, R.W., 1977, Drilling results from the eastern Long Valley caldera: unpublished paper given at the American Nuclear Society meeting.

Smith, R.L., Bailey, R.A., and Ross, C.S., 1970, Geologic map of the Jemez Mountains, New Mexico: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-571.

Smith, T.B., 1974, Gravity study of the Fumarole Butte area, Juab and Millard Counties, Utah: University of Utah, Master's thesis, 45 p.

Stanley, W.D., Jackson, D.B., and Hearn, B.C., Jr., 1973, Preliminary results of geoelectrical investigations near Clear Lake, California: U.S. Geological Survey Open-File Report, 20 p.

Stanley, W.D., Jackson, D.B., and Zohdy, A.A.R., 1976, Deep electrical investigations in the Long Valley geothermal area, California: Journal of Geophysical Research, v. 81, p. 810-820.

Stearns, H.T., Bryan, L.L., and Crandall, Lynn, 1939, Geology and water resources of Mud Lake region, Idaho, including the Island Park area: U.S. Geological Survey Water-Supply Paper 818, 125 p.

Stearns, H.T., Crandall, Lynn, and Steward, W.G., 1938, Geology and ground-water resources of the Snake River Plain in southeastern Idaho: U.S. Geological Survey Water-Supply Paper 774, 268 p.

Stewart, J.H., and Carlson, J.E., 1974, Preliminary geologic map of Nevada: U.S. Geological Survey Miscellaneous Field Studies Map MF-609.

Stewart, J.H., and McKee, E.H., 1970, Geologic map of Lander County, Nevada: U.S. Geological Survey Open-File map.

Summers, W.K., 1965a, A preliminary report on New Mexico's geothermal energy resources: New Mexico Bureau of Mines and Mineral Resources Circular 80, 41 p.

_____1965b, Chemical characteristics of New Mexico's thermal waters — A critique: New Mexico Bureau of Mines and Mineral Resources Circular 83, 27 p.

Swanberg, C.A., 1975, Detection of geothermal components in ground waters of Dona Ana County, southern Rio Grande rift, New Mexico: New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces County, p. 175-180.

_____1976, The Mesa geothermal anomaly, Imperial Valley, California: A comparison and evaluation of results obtained from surface geophysics and deep drilling: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 2, p. 1217-1229.

Swanberg, C.A., Morgan, Paul, Stoyer, C.H., and Witcher, J.C., 1977, An appraisal study of the geothermal resources of Arizona and adjacent areas in New Mexico and Utah and their value for desalination and other uses: New Mexico Energy Institute, Report 006, 76 p.

Swanson, James, 1977, GEOTHERM user guide: U.S. Geological Survey Open-File Report 77-504, 53 p.

Tabor, R.W., and Crowder, D.F., 1969, On batholiths and volcanoes — Intrusion and eruption of late Cenozoic magmas in the Glacier Peak area, North Cascades, Washington: U.S. Geological Survey Professional Paper 604, 67 p.

Tansev, E.O., and Wasserman, M.L., 1977, Modeling the Heber geothermal reservoir, in Kruger, P., and Ramey, H.J., eds., Third workshop on geothermal reservoir engineering, summaries: Stanford, California, Stanford University Press, p. 107-115.9

Tatlock, D.B., 1969, Preliminary geologic map of Pershing County, Nevada: U.S. Geological Survey Open-File Map.

Thermal Power Company, 1978, open-file data submitted to Department of Energy/University of Utah Research Institute.

Thompson, G.A., Meister, L.J., Herring, A.T., Smith, T.E., Burke, D.B., Kovach, R.L., Burford, R.O., Salehi, A., and Wood, M.D., 1967, Geophysical study of basin-range structure, Dixie Valley region, Nevada: U.S. Air Force Cambridge Research Laboratories Special Report 66-848.

Thompson, G.A., and White, D.E., 1964, Regional geology of the Steamboat Springs area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-A, 51 p.

Thompson, J.M., Goff, F.E., and Donnelly, J.M., 1978, Chemical analyses of waters from springs and wells from the Clear Lake volcanic area, northern California: U.S. Geological Survey Open-File Report 78-425, 12 p.

Thompson, J.M., Presser, T.S., Barnes, R.B., and Bird, D.B., 1975, Chemical analysis of the waters of Yellowstone National Park, Wyoming, from 1965 to 1973: U.S. Geological Survey Open-File Report 75-25, 59 p.

Trainer, F.W., 1974, Ground water in the southwestern part of the Jemez Mountains volcanic region, New Mexico: New Mexico Geological Society Guidebook, 25th Field Conference, Ghost Ranch, p. 337-345.

Truesdell, A.H., and Fournier, R.O., 1976, Conditions in the deeper parts of the hot spring system of Yellowstone National Park, Wyoming: U.S. Geological Survey Open-File Report 76-428, 30 p.

Union Oil Company, 1976, Geologic report of the Cove Fort-Sulphurdale area, Millard and Beaver Counties, Utah: open-file report submitted in 1978 to Department of Energy/University of Utah Research Institute.

U.S. Bureau of Reclamation, 1972, Geothermal resource investigations, Imperial Valley, California: Developmental concepts: U.S. Department of the Interior, Bureau of Reclamation, 58 p.

_____1974, Geothermal resource investigations, East Mesa test site, Imperial Valley, California: Status report, November, 1974: U.S. Department of the Interior, Bureau of Reclamation, 64 p.

_____1977, Geothermal resource investigations, East Mesa test site, Imperial Valley, California: Status report, April, 1977: U.S. Department of the Interior, Bureau of Reclamation, 99 p.

U.S. Geological Survey, 1976, Residual magnetic intesity map, Coso Hot Springs, California: U.S. Geological Survey Open-File Report 76-698.

Walker, G.W., 1963, Reconnaissance geologic map of the eastern half of the Klamath Falls (AMS) Quadrangle, Lake and Klamath Counties, Oregon: U.S. Geological Survey Mineral Investigations Field Studies Map MF-260.

_____compiler, 1973, Preliminary geologic and tectonic maps of Oregon east of the 121st meridian: U.S. Geological Survey Miscellaneous Field Studies Map MF-495.

Walker, G.W., and Repenning, C.A., 1965, Reconnaissance geologic map of the Adel Quadrangle, Lake, Harney, and Malheur Counties, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-446.

_____1966, Reconnaissance geologic map of the west half of the Jordan Valley Quadrangle, Malheur County, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-457.

Walker, G.W., and Swanson, D.A., 1967, Summary report on the geology and mineral resources of the Harvey Lake and Malheur Lake areas of the Malheur National Wildlife Refuge, north-central Harney County, Oregon: U.S. Geological Survey Bulletin 1260-L, p. 1-17.

Waring, G.A., 1917, Mineral springs of Alaska: U.S. Geological Survey Water-Supply Paper 418, 114 p.

_____1965, Thermal springs of the United States and other countries of the world — A summary: U.S. Geological Survey Professional Paper 492, 383 p.

Waters, A.C., 1968, Reconnaissance geologic map of the Madras Quadrangle, Jefferson and Wasco Counties, Oregon: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-555.

Weed, W.H., 1900, Mineral-vein formation at Boulder Hot Springs, Montana: U.S. Geological Survey 21st Annual Report, pt. 2, p. 229-255.

_____1905, Economic value of hot springs and hot spring deposits: U.S. Geological Survey Bulletin 260-R, p. 598-604.

_____1912, Geology and ore deposits of the Butte district, Montana: U.S. Geological Survey Professional Paper 74, 262 p.

West, R.E., and Sumner, J.S., 1973, Bouguer gravity anomaly map of Arizona: Arizona University Department of Geosciences.

White, D.E., 1955, Thermal springs and epithermal ore deposits: Economic Geology 50th Anniversary Volume, p. 99-154.

_____1968, Hydrology, activity, and heat flow of the Steamboat Springs thermal system, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-C, p. C1-C109.

White, D.E., Barnes, Ivan, and O'Neil, J.R., 1973, Thermal and mineral waters of nonmeteoric orgin, California Coast Ranges: Geological Society of America Bulletin, v. 84, p. 547-560.

White, D.E., Fournier, R.O., Muffler, L.J.P., and Truesdell, A.H., 1975, Physical results of research drilling in thermal waters of Yellowstone National Park, Wyoming: U.S. Geological Survey Professional Paper 892, 70 p.

White, D.E., Muffler, L.J.P., and Truesdell, A.H., 1971, Vapor-dominated hydrothermal systems compared with hot-water systems: Economic Geology, v. 66, p. 75-97.

White, D.E., Thompson, G.A., and Sandberg, C.H., 1964, Rocks, structure, and geologic history of Steamboat Springs thermal area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-B, p. B1-B63.

White, D.E., and Waring, G.A., 1963, Volcanic emanations, in Fleischer, Michael, ed., Data of geochemistry: U.S. Geological Survey Professional Paper 440-K, p. K1-K29.

Willden, Ronald, 1964, Geology and mineral resources of Humbolt County, Nevada: Nevada Bureau of Mines Bulletin 59, 154 p.

Willden, Ronald, and Speed, R.C., 1974, Geology and mineral deposits of Churchill County, Nevada: Nevada Bureau of Mines and Geology Bulletin 83, 95 p.

Williams, D.L., Berkman, F., and Mankinen, E.A., 1977, Implications of a magnetic model of the Long Valley caldera, California: Journal of Geophysical Research, v. 82, p. 3030-3038.

Williams, Howel, 1932, Geology of the Lassen Volcanic National Park, California: University of California Department of Geological Sciences Bulletin, v. 21, no. 8, p. 195-385.

Williams, P.L., Mabey, D.R., Zohdy, A.A.R., Ackermann, H., Hoover, D.B., Pierce, K.L., and Oriel, S.S., 1976, Geology and geophysics of the southern Raft River Valley geothermal area, Idaho, USA: Proceedings Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v. 2, p. 1273-1282.

Young, H.W., and Whitehead, R.L., 1975a, Geothermal investigations in Idaho, part 3, an evaluation of thermal water in the Weiser area, Idaho: Idaho Department of Water Resources Water Information Bulletin 30, 35 p.

______1975b, Geothermal investigations in Idaho, part 2, an evaluation of thermal water in the Bruneau-Grand View area, southwest Idaho, with a section on A reconnaissance audio-magnetotelluric survey by D.B. Hoover and C.L. Tippens: Idaho Department of Water Resources Water Information Bulletin No. 30, 121 p.

Young, H.W., and Mitchell, J.C., 1973, Geothermal investigations in Idaho, part 1, geochemistry and geologic setting of selected thermal waters: Idaho Department of Water Administration Water Information Bulletin 30, 43 p.

Zohdy, A.A.R., Anderson, L.A., and Muffler, L.J.P., 1973, Resistivity, self-potential, and induced-polarization surveys of a vapor-dominated geothermal system: Geophysics, v. 38, p. 1130-1134.