

602049

GEOCHEMICAL SURVEY, LEACH HOT SPRINGS,
PERSHING COUNTY, NEVADA

During the period October 30, 1978 to November 2, 1978, a total of twenty water samples were collected from the Leach Hot Springs area. This included fourteen nondiluted water samples which were subsequently analyzed for sixteen elements, pH and specific conductance. Six samples from hot springs were collected for silica concentration analyses; these samples were diluted with nine parts of distilled water to one part raw sample. All samples were collected directly into chemically sterile plastic containers. Field observations were limited to a water temperature reading and a visual estimation of flow rate.

The sample locations and field observations are noted below.

The chemical analyses are appended.

Samples from Leach Hot Springs (L1 - L6, L1A - L6A, L12 and L13)

Samples L1 - L6, L1A - L6A, L12 and L13 were collected from Leach Hot Springs; a group of springs in the NW-1/4 of the SE-1/4 of Section 36, T 32N, R 38E. A visual estimation of the flow of the spring orifices indicates that the total flow is similar to that quoted by Olmsted et al, 1975. However, individual orifices appear to have changed their flow rates. Using the numbering system of Olmsted et al 1975, p. 188 the following observations were made:

Springs 8 and 10 are no longer flowing.

Springs 9, 11, and 21 had a flow of less than 0.06 liters per second.

Springs 5, 15, and 23 have increased flow rates.

All springs are depositing silica; sulphur is present around the orifice of spring number 15.

SAMPLES L1 AND L1A

Location: Taken from Olmsted's Spring Number 7, see Olmsted et al 1975, p. 188.

Temperature: 68° C

Estimated Flow: 0.40 liters per second.

Samples Collected: L1A - total sample.

L1 - diluted 9:1.

SAMPLES L2A AND L2

Location: Olmsted Spring Number 1.

Temperature: 81° C.

Estimated Flow: 2 liters per second.

Samples Collected: L2A - total sample.

L2 - diluted 9:1.

SAMPLES L3A AND L3

Location: Olmsted Spring Number 5.
Temperature: 81° C.
Estimated Flow: 0.05 liters per second.
Samples Collected: L3A - total sample.
L3 - diluted 9:1.

SAMPLES L4A AND L4

Location: Olmsted Spring Number 12
Temperature: 94.5° C.
Estimated Flow: 0.40 liters per second.
Samples Collected: L4A - total sample.
L4 - diluted 9:1.

SAMPLES L5A AND L5

Location: Olmsted Spring Number 15.
Temperature: 95° C boiling.
Estimated Flow: 0.02 liters per second, surging.
Samples Collected: L5A - total sample.
L5 - diluted 5:1.

SAMPLES L6A AND L6

Location: Olmsted Spring Number 23.
Temperature: 81° C.
Estimated Flow: 3 liters per second.
Samples Collected: L6A - total sample.
L6 - diluted 9:1.

SAMPLE L12

Location: Olmsted Spring Number 25.
Temperature: 68° C.
Estimated Flow: 0.10 liters per second.
Sample Collected: L12 - total sample.

SAMPLE L13

Location: Olmsted Spring Number 17.
Temperature: 74° C.
Estimated Flow: 0.5 liters per second.
Sample Collected: L13 - total sample.

SAMPLE L7

Location: Un-named warm spring in NW-1/4 of SW-1/4 of Section 36, T 32N, R 38E, 1300 feet south-southwest of Leach Hot Springs.
Temperature: 34° C.
Estimated Flow: Not known, sample collected from large circular pool with radius of 6 feet and depth of 3 feet. Orifice could not be located.
Sample Collected: L7 - total sample.

SAMPLE L8

Location: Sample collected from water pipe of un-named, developed, cold spring. SW-1/4 of the SE-1/4 of Section 10, T 30N, R 38E, 150 yards south of well marked on USGS Leach Hot Springs topographic sheet.
Temperature: 11° C.
Estimated Flow: 0.02 liters per second.
Sample Collected: L8 - total sample.

SAMPLE L9

Location: From Manganese Spring, shown on USGS Leach Hot Springs topographic sheet. NW-1/4 of the SE-1/4, Section 1, T 32N, R 39E.
Temperature: 10° C.
Estimated Flow: 0.02 liters per second.
Sample Collected: L9 - total sample.

SAMPLE L10

Location: From Petain Spring, shown on USGS Leach Hot Springs topographic sheet. SE-1/4 of NE-1/4 of Section 18, T 31N, R 40E.

Temperature: 14° C.

Estimated Flow: 0.05 liters per second.

Sample Collected: L10 - total sample.

SAMPLE L11

Location: From water well named as the Goldbanks Windmill on USGS Mt. Tobin topographic sheet. NW-1/4 of SE-1/4, Section 16, T 30N, R 39E.

Temperature: 11° C.

Estimated Flow: Not available.

Sample Collected: L11 - total sample.

SAMPLE L14

Location: From cold springs in Washoke Canyon, shown on USGS Leach Hot Springs topographic sheet. Sample taken from the most easterly of three groups of springs. NE-1/4 of NE-1/4, Section 5, T 32N, R 39E.

Temperature: 13° C.

Estimated Flow: 0.05 liters per second.

Sample Collected: L14 - total sample.

References

Olmsted, 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. USGS Open File Report 75-56.

USGS Topographic Sheets - 15 minute series:

Leach Hot Springs Quadrangle

Mount Tobin Quadrangle

Prepared By: Dr. D. R. Wall - Aminoil USA, Inc.
Mr. R. E. Dunlap - Aminoil USA, Inc.

LABORATORIES 425 SOUTH E STREET P. O. BOX 1895 SANTA ROSA, CALIFORNIA 95403 TELEPHONE (707) 544-8807

November 30, 1978

Aminoil USA, Inc.
 PO Box 11279
 Santa Rosa, CA 95406

Attn: Roger Wall

Gentlemen:

The results of analyses performed on samples submitted on November 3, 1978, are complete and tabulated below:

Analyses Number	1178-10957	1178-10958	1178-10959	1178-10960	1178-10961	1178-10962
Sample Description	L 1A	L 2A	L 3A	L 4A	L 5A	L 6A

ANALYSES

pH	7.9	7.4	7.6	9.6	7.1	7.5
Spec. Cond. umhos/cm	780.	750.	750.	770.	570.	730.
Sodium mg/l	170.	160.	160.	170.	86.	160.
Potassium mg/l	12.	12.	12.	14.	12.	11.
Lithium mg/l	0.85	0.80	0.80	0.87	0.52	0.87
Boron mg/l	1.62	0.18	0.16	0.15	0.10	1.7
Bicarbonate mg/l	390.	390.	390.	270.	17.	380.
Carbonate mg/l	<1.	<1.	<1.	80.	<1.	<1.
Sulfate mg/l	47.	49.	47.	46.	160.	46.
Chloride mg/l	25.	21.	23.	25.	9.6	21.
Fluoride mg/l	6.6	6.6	6.6	7.1	2.3	6.6
Calcium mg/l	13.	13.	14.	5.5	8.6	13.
Magnesium mg/l	1.7	1.6	1.6	0.6	1.4	1.8
Arsenic mg/l	<0.01	<0.01	<0.01	0.015	0.026	<0.01
Zinc mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	0.04	0.02	0.02	0.03	0.02	0.02
Manganese mg/l	0.05	<0.05	<0.05	<0.05	<0.05	0.06
Silica mg/l	-	-	-	-	-	-

Analyses Number	1178-10951	1178-10952	1178-10953	1178-10954	1178-10955	1178-10956
Sample Description	L.1 9:1 dil	L.2 9:1 dil	L.3 9:1 dil	L.4 9:1 dil	L.5 9:1 dil	L.6 9:1 dil

ANALYSES

Silica mg/l	10.	12.	10.	21.	20.	9.6
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Analyses No.	1178-10963	1178-10964	1178-10965	1178-10966
Sample Description	L.7	L.8	L.9	L.10

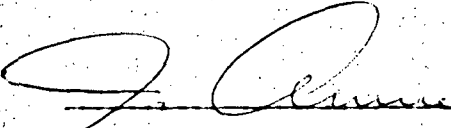
ANALYSES

pH	7.8	8.1	8.0	8.0
Spec. Cond. umhos/cm.	780.	830.	660.	500.
Sodium mg/l	170.	87.	31.	27.
Potassium mg/l	12.	1.0	1.2	4.6
Lithium mg/l	0.89	<0.05	<0.05	<0.05
Boron mg/l	1.7	0.35	0.15	0.10
Bicarbonate mg/l	400.	600.	240.	220.
Carbonate mg/l	<1.	<1.	<1.	<1.
Sulfate mg/l	44.	52.	84.	31.
Chloride mg/l	30.	96.	34.	37.
Fluoride mg/l	6.6	0.96	0.5	0.5
Calcium mg/l	14.	74.	79.	66.
Magnesium mg/l	1.9	27.	23.	10.
Arsenic mg/l	<0.01	<0.01	<0.01	<0.01
Zinc mg/l	<0.05	<0.05	0.35	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	0.04	0.03	0.04	0.03
Manganese mg/l	<0.05	<0.05	<0.05	<0.05
Silica mg/l	100.	34.	23.	54.

Analyses No.	1178-10967	1178-10968	1178-10969	1178-10970
Sample Description	L.11	L.12	L.13	L.14
<u>ANALYSES</u>				
pH	8.1	8.0	7.8	7.7
Spec. Cond. umhos/cm	440.	750.	760.	520.
Sodium mg/l	28.	170.	160.	30.
Potassium mg/l	2.8	12.	12.	2.1
Lithium mg/l	<0.05	0.90	0.83	<0.05
Boron mg/l	0.05	1.3	1.3	0.22
Bicarbonate mg/l	170.	390.	390.	200.
Carbonate mg/l	<1.	<1.	<1.	<1.
Sulfate mg/l	30.	47.	50.	36.
Chloride mg/l	40.	28.	25.	50.
Fluoride mg/l	0.26	6.6	7.1	2.7
Calcium mg/l	50.	13.	13.	65.
Magnesium mg/l	9.2	1.6	1.5	12.
Arsenic mg/l	<0.01	<0.01	<0.01	0.012
Zinc mg/l	0.10	<0.05	<0.05	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	<0.01	0.02	0.03	0.02
Manganese mg/l	<0.05	0.06	0.06	<0.05
Silica mg/l	46.	110.	110.	46.

Very truly yours,

BRELJE AND RACE LABORATORIES


J. AMUNDSEN, Director

JA:ym

HYDROTHERMAL ALTERATION STUDY LEACH HOT SPRINGS

In conjunction with the photogeologic studies conducted by Mr. D. Anderson, under contract to Aminoil USA, Inc., the area around Leach Hot Springs was mapped by two Aminoil employees. The results of this mapping are presented as an 1" = 1000' map, appended to this report.

The Leach Hot Springs are presently depositing siliceous sinter; native sulfur occurs around one orifice. The hot springs fault is marked by a well defined fault scarp trending NE from the hot springs and having a maximum surface expression of 40 feet. The scarp shows only minor modification by erosion. On the upthrown side of the fault there occurs grey lithified sinter (see sample description below). Immediately to the east of the grey lithified sinter the colluvium contains an abundance of red lithified sinter; this has the appearance of silicified fault gouge possibly belonging to the Kaipato formation. The latter interpretation is unconfirmed but is consistent with the gravity interpretation of a shallow, high density basement. The geophysical data in this area collected by L. B. L. could be explained by this interpretation or by a silica mound as suggested by L. B. L. workers.

Six samples were collected for thin section descriptions: One sample each of the grey and red lithified sinter from the hot springs fault scarp (4 and 5), one sample from Tertiary outcrops labeled as sediments on previous geologic maps (sample 6), and three samples from the siliceous sinter of the Goldbank Hills (samples 1, 2, and 3).

Sample 1 - siliceous sinter. Location: Goldbank Hills NE 1/4 of NE 1/4 of Section 14, T 30N, R 38E. Marked on USGS Leach Hot Springs sheet as "Furnaces".

Macroscopic description: yellowish-tan, white, and gray colored fragmental siliceous sinter; fragments are predominantly white to yellowish-tan, angular to subrounded pieces of opal cemented by white and gray opal and chalcedony; hematite is present in splotches and distinct veinlets; porosity is extremely low (< 5%).

Microscopic description: opaline and chalcedonized, i. e., most of the chalcedony is reconstituted opal that has formed both at the outer margins and in the interior of the opal fragments; chalcedony veins and some quartz veinlets are present from a later episode of thermal fluids as they cement the chalcedonized opal fragments.

Sample 2 - chalcedonic sinter. Location: as for Sample One

Macroscopic description: predominantly gray and white colored mosaic-like chalcedonic sinter; translucent gray chalcedony surrounds opaque white to yellowish-white opal; some clear quartz is present; porosity is fair (5 - 10%?).

Microscopic description: quartz and feldspar grains are cemented in a completely chalcedonized opaline mass; this mass was fragmented and then cemented by chalcedony which also lines the vugs.

Sample 3 - opaline sinter. Location: as for Sample One

Macroscopic description: white, chalky, porous opaline sinter; some opaline laminations present, porosity is well developed (30-40%?), and permeability is in the darcy range.

Microscopic description: the rock is all opal; the opaline laminations parallel one another and are approximately 3 to 3.5 mm apart.

Sample 4 - opaline sinter. Location: Hot Springs fault immediately east of Leach Hot Springs. SE 1/4 of NE 1/4 of Section 36, T 32N, R 38E. Grey lithified sinter.

Macroscopic description: yellowish-gray, earthy, porous mosaic of opaline sinter; some small tubes (1mm in diameter) are present, formed as water droplets moved along precipitating silica - these lend a fossiliferous appearance to the sinter; porosity is fairly good (10-20%) and permeability is in the darcy range.

Microscopic description: fragmental opaline sinter with pebble, granule, and sand sized fragments of opal; bits of quartz, feldspar, lith. frags, and the opaline tubes are cemented in a mass of opal.

Sample 5 - chalcedonic sinter. Location: as for Sample 4. Red lithified sinter.

Macroscopic description: variable gray and brown agate-like mosaic of chalcedonic sinter; some yellow, earthy opal is present; little porosity.

Microscopic description: the rock is mainly dense chalcedony formed when the opal was chalcedonized; the rock was then fractured with some sulfate being precipitated in the fractures; this was followed by some silica solution which deposited chalcedony within the pore space left after the sulfate was precipitated.

Sample 6 - tuff. Location: Near the "mouth" of Sheep Canyon. SE 1/4 of SE 1/4 of Section 18, T 32N, R 39E.

Macroscopic description: tan colored, earthy, sparsely lithic tuff; it is finely granular in appearance.

Microscopic description: quartz, feldspar, variable lithic fragments, and glass shards set in a groundmass of glass dust; dissimilar orientation of glass shards and fragments suggest this to be a tuff, not a tuffaceous sediment or welded tuff.










D. R. Wall
R. E. Dunlap
M. K. Twichell

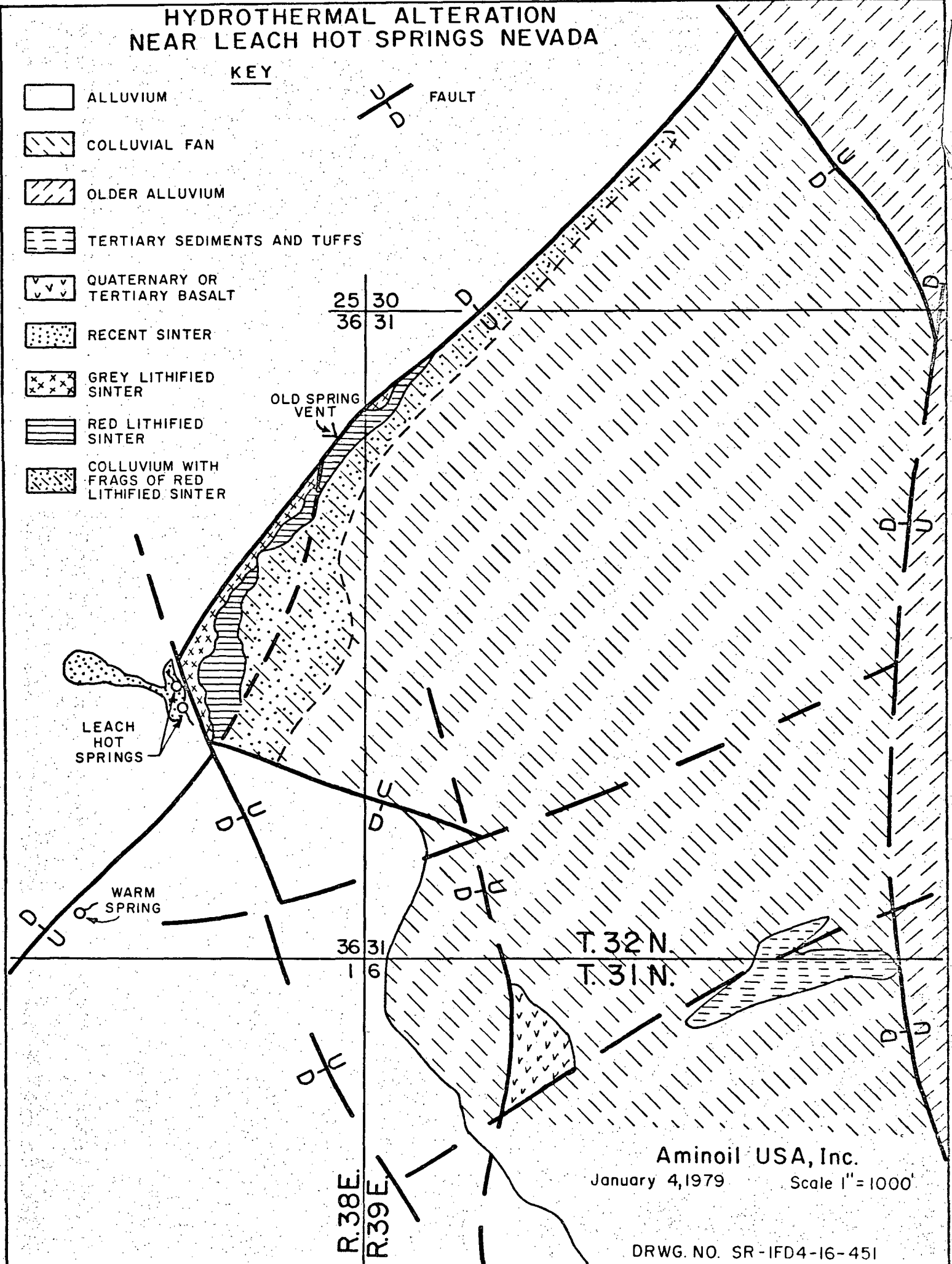
Prepared by D. R. Wall
Field work by R. E. Dunlap
Thin section descriptions by M. K. Twichell

4/12/79

HYDROTHERMAL ALTERATION NEAR LEACH HOT SPRINGS NEVADA

KEY

-  ALLUVIUM
-  COLLUVIAL FAN
-  OLDER ALLUVIUM
-  TERTIARY SEDIMENTS AND TUFFS
-  QUATERNARY OR TERTIARY BASALT
-  RECENT SINTER
-  GREY LITHIFIED SINTER
-  RED LITHIFIED SINTER
-  COLLUVIUM WITH FRAGS OF RED LITHIFIED SINTER



Aminoil USA, Inc.

January 4, 1979

Scale 1" = 1000'

DRWG. NO. SR-IFD4-16-451

GEOCHEMICAL SURVEY, LEACH HOT SPRINGS,
PERSHING COUNTY, NEVADA

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The sample locations and field observations are noted below.

The chemical analyses are appended.

Samples from Leach Hot Springs (L1 - L6, L1A - L6A, L12 and L13)

Samples L1 - L6, L1A - L6A, L12 and L13 were collected from Leach Hot Springs; a group of springs in the NW-1/4 of the SE-1/4 of Section 36, T 32N, R 38E. A visual estimation of the flow of the spring orifices indicates that the total flow is similar to that quoted by Olmsted et al, 1975. However, individual orifices appear to have changed their flow rates. Using the numbering system of Olmsted et al 1975, p. 188 the following observations were made:

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Springs 9, 11, and 21 had a flow of less than 0.06 liters per second.

Springs 5, 15, and 23 have increased flow rates.

All springs are depositing silica; sulphur is present around the orifice of spring number 15.

SAMPLES L1 AND L1A

Location: Taken from Olmsted's Spring Number 7, see Olmsted et al 1975, p. 188.

Temperature: 68° C

Estimated Flow: 0.40 liters per second.

Samples Collected: L1A - total sample.

L1 - diluted 9:1.

SAMPLES L2A AND L2

Location: Olmsted Spring Number 1.

Temperature: 81° C.

Estimated Flow: 2 liters per second.

Samples Collected: L2A - total sample.

L2 - diluted 9:1.

SAMPLES L3A AND L3

Location: Olmsted Spring Number 5.
Temperature: 81° C.
Estimated Flow: 0.05 liters per second.
Samples Collected: L3A - total sample.
L3 - diluted 9:1.

SAMPLES L4A AND L4

Location: Olmsted Spring Number 12
Temperature: 94.5° C.
Estimated Flow: 0.40 liters per second.
Samples Collected: L4A - total sample.
L4 - diluted 9:1.

SAMPLES L5A AND L5

Location: Olmsted Spring Number 15.
Temperature: 95° C boiling.
Estimated Flow: 0.02 liters per second, surging.
Samples Collected: L5A - total sample.
L5 - diluted 5:1.

SAMPLES L6A AND L6

Location: Olmsted Spring Number 23.
Temperature: 81° C.
Estimated Flow: 3 liters per second.
Samples Collected: L6A - total sample.
L6 - diluted 9:1.

SAMPLE L12

Location: Olmsted Spring Number 25.
Temperature: 68° C.
Estimated Flow: 0.10 liters per second.
Sample Collected: L12 - total sample.

SAMPLE L13

Location: Olmsted Spring Number 17.
Temperature: 74° C.
Estimated Flow: 0.5 liters per second.
Sample Collected: L13 - total sample.

SAMPLE L7

Location: Un-named warm spring in NW-1/4 of SW-1/4 of Section 36, T 32N, R 38E, 1300 feet south-southwest of Leach Hot Springs.
Temperature: 34° C.
Estimated Flow: Not known, sample collected from large circular pool with radius of 6 feet and depth of 3 feet. Orifice could not be located.
Sample Collected: L7 - total sample.

SAMPLE L8

Location: Sample collected from water pipe of un-named, developed, cold spring. SW-1/4 of the SE-1/4 of Section 10, T 30N, R 38E, 150 yards south of well marked on USGS Leach Hot Springs topographic sheet.
Temperature: 11° C.
Estimated Flow: 0.02 liters per second.
Sample Collected: L8 - total sample.

SAMPLE L9

Location: From Manganese Spring, shown on USGS Leach Hot Springs topographic sheet. NW-1/4 of the SE-1/4, Section 1, T 32N, R 39E.
Temperature: 10° C.
Estimated Flow: 0.02 liters per second.
Sample Collected: L9 - total sample.

SAMPLE L10

Location: From Petain Spring, shown on USGS Leach Hot Springs topographic sheet. SE-1/4 of NE-1/4 of Section 18, T 31N, R 40E.

Temperature: 14° C.

Estimated Flow: 0.05 liters per second.

Sample Collected: L10 - total sample.

SAMPLE L11

Location: From water well named as the Goldbanks Windmill on USGS Mt. Tobin topographic sheet. NW-1/4 of SE-1/4, Section 16, T 30N, R 39E.

Temperature: 11° C.

Estimated Flow: Not available.

Sample Collected: L11 - total sample.

SAMPLE L14

Location: From cold springs in Washoke Canyon, shown on USGS Leach Hot Springs topographic sheet. Sample taken from the most easterly of three groups of springs. NE-1/4 of NE-1/4, Section 5, T 32N, R 39E.

Temperature: 13° C.

Estimated Flow: 0.05 liters per second.

Sample Collected: L14 - total sample.

References

Olmsted, 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. USGS Open File Report 75-56.

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Leach Hot Springs Quadrangle

Mount Tobin Quadrangle

Prepared By: Dr. D. R. Wall - Aminoil USA, Inc.
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November 30, 1978

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ANALYSES

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Spec. Cond. umhos/cm	780.	750.	750.	770.	570.	730.
Sodium mg/l	170.	160.	160.	170.	86.	160.
Potassium mg/l	12.	12.	12.	14.	12.	11.
Lithium mg/l	0.85	0.80	0.80	0.87	0.52	0.87
Boron mg/l	1.62	0.18	0.16	0.15	0.10	1.7
Bicarbonate mg/l	390.	390.	390.	270.	17.	380.
Carbonate mg/l	<1.	<1.	<1.	80.	<1.	<1.
Sulfate mg/l	47.	49.	47.	46.	160.	46.
Chloride mg/l	25.	21.	23.	25.	9.6	21.
Fluoride mg/l	6.6	6.6	6.6	7.1	2.3	6.6
Calcium mg/l	13.	13.	14.	5.5	8.6	13.
Magnesium mg/l	1.7	1.6	1.6	0.6	1.4	1.8
Arsenic mg/l	<0.01	<0.01	<0.01	0.015	0.026	<0.01
Zinc mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	0.04	0.02	0.02	0.03	0.02	0.02
Manganese mg/l	0.05	<0.05	<0.05	<0.05	<0.05	0.06
Silica mg/l	-	-	-	-	-	-

Analyses Number	1178-10951	1178-10952	1178-10953	1178-10954	1178-10955	1178-10956
Sample Description	L.1 9:1 dil	L.2 9:1 dil	L.3 9:1 dil	L.4 9:1 dil	L.5 9:1 dil	L.6 9:1 dil

ANALYSES

Silica mg/l	10.	12.	10.	21.	20.	9.6
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Analyses No.	1178-10963	1178-10964	1178-10965	1178-10966
Sample Description	L.7	L.8	L.9	L.10

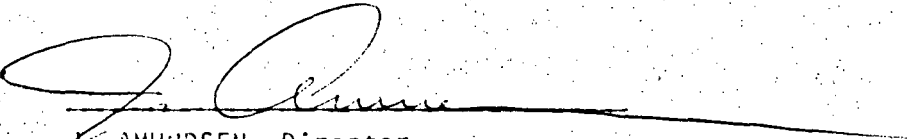
ANALYSES

pH	7.8	8.1	8.0	8.0
Spec. Cond. umhos/cm	780.	830.	660.	500.
Sodium mg/l	170.	87.	31.	27.
Potassium mg/l	12.	1.0	1.2	4.6
Lithium mg/l	0.89	<0.05	<0.05	<0.05
Boron mg/l	1.7	0.35	0.15	0.10
Bicarbonate mg/l	400.	600.	240.	220.
Carbonate mg/l	<1.	<1.	<1.	<1.
Sulfate mg/l	44.	52.	84.	31.
Chloride mg/l	30.	96.	34.	37.
Fluoride mg/l	6.6	0.96	0.5	0.5
Calcium mg/l	14.	74.	79.	66.
Magnesium mg/l	1.9	27.	23.	10.
Arsenic mg/l	<0.01	<0.01	<0.01	<0.01
Zinc mg/l	<0.05	<0.05	0.35	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	0.04	0.03	0.04	0.03
Manganese mg/l	<0.05	<0.05	<0.05	<0.05
Silica mg/l	100.	34.	23.	54.

Analyses No.	1178-10967	1178-10968	1178-10969	1178-10970
Sample Description	L.11	L.12	L.13	L.14
<u>ANALYSES</u>				
pH	8.1	8.0	7.8	7.7
Spec. Cond. umhos/cm	440.	750.	760.	520.
Sodium mg/l	28.	170.	160.	30.
Potassium mg/l	2.8	12.	12.	2.1
Lithium mg/l	<0.05	0.90	0.83	<0.05
Boron mg/l	0.05	1.3	1.3	0.22
Bicarbonate mg/l	170.	390.	390.	200.
Carbonate mg/l	<1.	<1.	<1.	<1.
Sulfate mg/l	30.	47.	50.	36.
Chloride mg/l	40.	28.	25.	50.
Fluoride mg/l	0.26	6.6	7.1	2.7
Calcium mg/l	50.	13.	13.	65.
Magnesium mg/l	9.2	1.6	1.5	12.
Arsenic mg/l	<0.01	<0.01	<0.01	0.012
Zinc mg/l	0.10	<0.05	<0.05	<0.05
Barium mg/l	<0.5	<0.5	<0.5	<0.5
Antimony mg/l	<0.01	0.02	0.03	0.02
Manganese mg/l	<0.05	0.06	0.06	<0.05
Silica mg/l	46.	110.	110.	46.

Very truly yours,

BRELJE AND RACE LABORATORIES



J. AMUNDSEN, Director

JA:ym

HYDROTHERMAL ALTERATION STUDY LEACH HOT SPRINGS

In conjunction with the photogeologic studies conducted by Mr. D. Anderson, under contract to Aminoil USA, Inc., the area around Leach Hot Springs was mapped by two Aminoil employees. The results of this mapping are presented as an 1" = 1000' map, appended to this report.

The Leach Hot Springs are presently depositing siliceous sinter; native sulfur occurs around one orifice. The hot springs fault is marked by a well defined fault scarp trending NE from the hot springs and having a maximum surface expression of 40 feet. The scarp shows only minor modification by erosion. On the upthrown side of the fault there occurs grey lithified sinter (see sample description below). Immediately to the east of the grey lithified sinter the colluvium contains an abundance of red lithified sinter; this has the appearance of silicified fault gouge possibly belonging to the Kaipato formation. The latter interpretation is unconfirmed but is consistent with the gravity interpretation of a shallow, high density basement. The geophysical data in this area collected by L. B. L. could be explained by this interpretation or by a silica mound as suggested by L. B. L. workers.

Six samples were collected for thin section descriptions: One sample each of the grey and red lithified sinter from the hot springs fault scarp (4 and 5), one sample from Tertiary outcrops labeled as sediments on previous geologic maps (sample 6), and three samples from the siliceous sinter of the Goldbank Hills (samples 1, 2, and 3).

Sample 1 - siliceous sinter. Location: Goldbank Hills NE 1/4 of NE 1/4 of Section 14, T 30N, R 38E. Marked on USGS Leach Hot Springs sheet as "Furnaces".

Macroscopic description: yellowish-tan, white, and gray colored fragmental siliceous sinter; fragments are predominantly white to yellowish-tan, angular to subrounded pieces of opal cemented by white and gray opal and chalcedony; hematite is present in splotches and distinct veinlets; porosity is extremely low (< 5%).

Microscopic description: opaline and chalcedonized, i. e., most of the chalcedony is reconstituted opal that has formed both at the outer margins and in the interior of the opal fragments; chalcedony veins and some quartz veinlets are present from a later episode of thermal fluids as they cement the chalcedonized opal fragments.

Sample 2 - chalcedonic sinter. Location: as for Sample One

Macroscopic description: predominantly gray and white colored mosaic-like chalcedonic sinter; translucent gray chalcedony surrounds opaque white to yellowish-white opal; some clear quartz is present; porosity is fair (5 - 10%?).

Microscopic description: quartz and feldspar grains are cemented in a completely chalcedonized opaline mass; this mass was fragmented and then cemented by chalcedony which also lines the vugs.

Sample 3 - opaline sinter. Location: as for Sample One

Macroscopic description: white, chalky, porous opaline sinter; some opaline laminations present, porosity is well developed (30-40%?), and permeability is in the darcy range.

Microscopic description: the rock is all opal; the opaline laminations parallel one another and are approximately 3 to 3.5 mm apart.

Sample 4 - opaline sinter. Location: Hot Springs fault immediately east of Leach Hot Springs. SE 1/4 of NE 1/4 of Section 36, T 32N, R 38E. Grey lithified sinter.

Macroscopic description: yellowish-gray, earthy, porous mosaic of opaline sinter; some small tubes (1mm in diameter) are present, formed as water droplets moved along precipitating silica - these lend a fossiliferous appearance to the sinter; porosity is fairly good (10-20%) and permeability is in the darcy range.

Microscopic description: fragmental opaline sinter with pebble, granule, and sand sized fragments of opal; bits of quartz, feldspar, lith. frags, and the opaline tubes are cemented in a mass of opal.

Sample 5 - chalcedonic sinter. Location: as for Sample 4. Red lithified sinter.

Macroscopic description: variable gray and brown agate-like mosaic of chalcedonic sinter; some yellow, earthy opal is present; little porosity.

Microscopic description: the rock is mainly dense chalcedony formed when the opal was chalcedonized; the rock was then fractured with some sulfate being precipitated in the fractures; this was followed by some silica solution which deposited chalcedony within the pore space left after the sulfate was precipitated.

Sample 6 - tuff. Location: Near the "mouth" of Sheep Canyon. SE 1/4 of SE 1/4 of Section 18, T 32N, R 39E.

Macroscopic description: tan colored, earthy, sparsely lithic tuff; it is finely granular in appearance.

Microscopic description: quartz, feldspar, variable lithic fragments, and glass shards set in a groundmass of glass dust; dissimilar orientation of glass shards and fragments suggest this to be a tuff, not a tuffaceous sediment or welded tuff.










D. R. Wall
R. E. Dunlap
M. K. Twichell

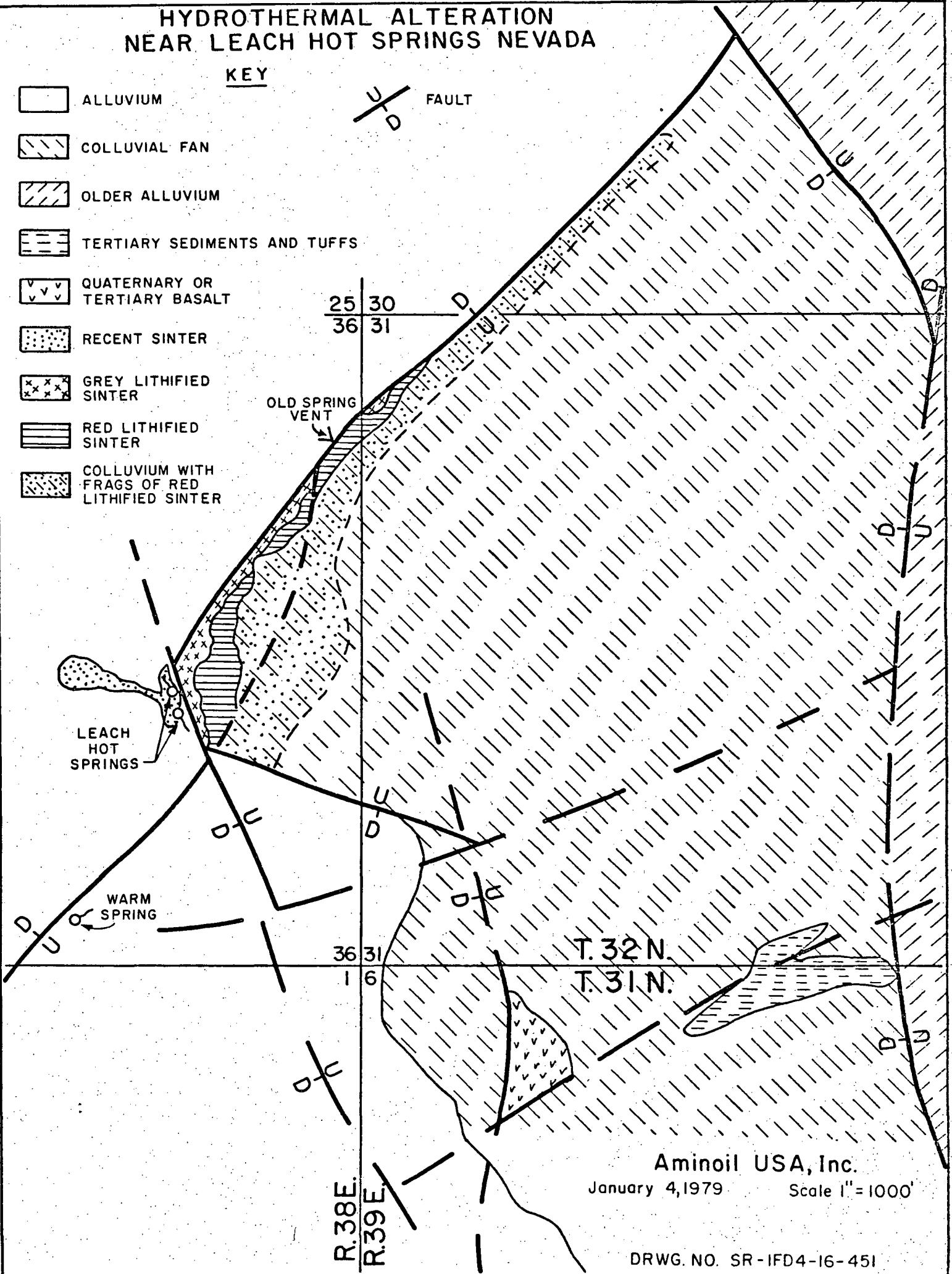
Prepared by D. R. Wall
Field work by R. E. Dunlap
Thin section descriptions by M. K. Twichell

4/12/79

HYDROTHERMAL ALTERATION NEAR LEACH HOT SPRINGS NEVADA

KEY

-  ALLUVIUM
-  COLLUVIAL FAN
-  OLDER ALLUVIUM
-  TERTIARY SEDIMENTS AND TUFFS
-  QUATERNARY OR TERTIARY BASALT
-  RECENT SINTER
-  GREY LITHIFIED SINTER
-  RED LITHIFIED SINTER
-  COLLUVIUM WITH FRAGS OF RED LITHIFIED SINTER



Aminoil USA, Inc.

January 4, 1979

Scale 1" = 1000'

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