REVIEW OF

HYDROGEOCHEMISTRY OF THE

DEETH, NEVADA

AREA

for

AMAX EXPLORATION, INC.

by

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This is a review of the chemical composition of 20 ground water samples from the Deeth, Nevada, area requested by AMAX geologist Dean Pilkington during a visit by the author to Denver in April 1981. The samples were all collected and analysed by AMAX personnel since 1977. The data are summarized and shown as processed in tables 1 to 3. For discussion the samples are referred to a numbering system of 1 to 20 (1.00 to 20.00 in the tables); column CODE of table 1 lists the original AMAX sample numbers. LOC gives locations, which are plotted on figure 1.

Several of the chemical analyses are incomplete, lacking either alkalinity or sulfate and chloride. Where missing, the concentrations of these in meq/l have been estimated assuming ionic balance of the analysis; SO_4 and Cl are of necessity combined. These concentrations estimated as difference are tabulated by hand as additions to the printed portion of table 2. Ionic balance calculations for the complete analyses (except one) show an excess of cations over anions (table 2, column DIF); the cause of this is uncertain. Of the chemical geothermometers (table 3), the most significant and interesting here are the quartz, conductive (QTZC), chalcedony (CHAL), Na-K-Ca (NKC), Mg-corrected Na-K-Ca (CMG) and Na-K (NAK) temperatures.

Several salient characteristics of the data are as follows:

1. There are three principal composition groups (figure 2): a) $Na-HCO_3$ waters in Mary's River Valley north of Deeth (samples 2, 3, 5, 17, 18--all in T38N, R59 and 60E); b) $Na-Ca-HCO_3$ waters, with higher Cl and SO_4, from west of Deeth (samples 4, 10, 11); and c) $Ca-Na-HCO_3-SO_4$ waters from localities scattered throughout the area.

2. The $Na-HCO_3$ waters north of Deeth include the Mary's River Hot Springs which issue at 37°-38°C near the south end of Twin Buttes. These thermal waters (samples 17, 18) differ from the cool groundwaters of the group (samples 2, 3, 5) in having lower Na/K and much higher SiO_2, which is a characteristic thermal pattern.

3. All of the $Na-HCO_3$ waters are notably low in Ca and Mg and high in F. Compositions suggest circulation in Tertiary tuffaceous sediments and a lack of association with carbonate rocks. This includes the Mary's River Hot Springs (samples 17, 18), in spite of their location 1/2 to 1-1/2 miles S of outcrops of Paleozoic carbonate rocks at Twin Buttes. ??

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4. This fact should be combined with the results of gradient drilling and stratigraphic tests, and the springs' topographic settings, to judge whether the spring waters can have heated to at least 40°C within volcanics directly beneath, or whether lateral migration from a more distant source is implied. If the depth of circulation suggested by the regional thermal gradient is greater than the thickness of the volcanics, it may also (or instead) be that the spring waters rise from a perched aquifer heated by conduction from an anomaly beneath.

5. The $Na-Ca-HCO_3$ waters west of Deeth and the scattered Ca $Na-HCO_3-SO_4$ waters are all cool to only slightly thermal (26°C) and generally unremarkable. Na/K is notably low in the $Na-Ca-HCO_3$ group (samples 4, 9, 10, 11), perhaps as a function of local rock composition. SO_4 probably comes from oxidation of sulfide minerals.

6. The 52°C thermal spring north of Twin Buttes in T39N, R59E (sample 19) is an $Na-Ca-K-HCO_3$ water distinct from the groups above. Ca, Ca/Mg and P_{CO_2} (Table 3) suggest circulation through carbonate rocks as well as volcanics. It might be a mixture of components from carbonate and volcanic aquifers. The water of sample 20, although from some distance away, exemplifies a possible $Ca-Mg$ HCO_3 component. However, F in hot spring 19 is notably low compared to its level in springs 17 and 18. If mixing of F-rich volcanic and Ca-rich carbonate waters has occurred, the low F suggests heating and removal of F into fluorite (CaF) following the mixing event.

7. SiO_2 in hot springs 19 is only 37 mg/l, which is notably low. The water may be in equilibrium with chalcedony (see Figure 3) or alternatively may have mixed with cool, low silica water at a very late stage during ascent to the surface. Equilibrium with chalcedony is consistent with the suggestion of point 6; late stage mixing is not.

8. Chemical geothermometers applied to the hot springs give:

| | | Temperature, °C | | | | | |
| | | silica | | | | | |
Sample	Orifice	quartz	chalcedony	amorphous	Na-K-Ca	Na-K-Ca-Mg	Na-K
Mary's R.H.S.							
#17	38	161	137	39	197	189	186
#18	37	150	125	29	196	178	201
H.S. north of Twin Buttes							
#19	52	88	57	-26	208	74	262

In evaluating these temperatures several facts should be considered:

a. Silica in 17 and 18 may result from dissolution of the amorphous solid (volcanic glass) or equilibration (and loss) of dissolved SiO_2 with amorphous silica during cooling (figure 3). Mixing is not indicated.

b. Flow rates of thermal springs 17 and 18 are low enough to have allowed both loss of silica and conductive cooling. However, if reservoir temperatures are on the order of 200°C, the conductive heat loss to only 38°C is considerable. Higher orifice temperatures would be more encouraging, but excess cooling could happen during lateral flow in the subsurface from a relatively distant point of upwelling.

c. The Na-K-Ca temperatures are not uniquely high. Several cool, lower silica waters have basic cation temperatures near or above 200°C (Table 3, numbers 4, 5, 9, 10, 11) due either to low Ca or low Na/K.

d. None of the waters except 17, 18 and 5 has an Mg-corrected Na-K-Ca temperature above 160°C.

e. The Na-K temperatures are not uniquely high. Many of the cool waters have Na-K temperatures near or above 200°C, but all of these have lower salinities than do the hot springs.

f. Silica in 19 is too low to be explained by simple mixing of a cool component with a hot component above about 120-130°C. Equilibrium with chalcedony is suggested.

9. On balance, a prediction of temperatures as high as 190° to 200°C in the system which feeds the Mary's River Hot Springs (17, 18) is allowable. The prospect warrants further investigation, with acknowledgement that the geochemistry is uncertain and presents a level of risk perhaps higher than would be preferred. It is strongly recommended that sulfate-water oxygen isotope analyses of springs 17, 18 and 19 be obtained for the purpose of isotope geothermometry. Isotope temperatures below c.100-120°C would be a strong negative factor. The results of temperature gradient drilling should be reviewed for solid evidence of real temperatures above 40°C, to allow confidence in assuming that the high SiO_2 levels in springs 17 and 18 are not merely the result of dissolution of volcanic glass at that temperature.
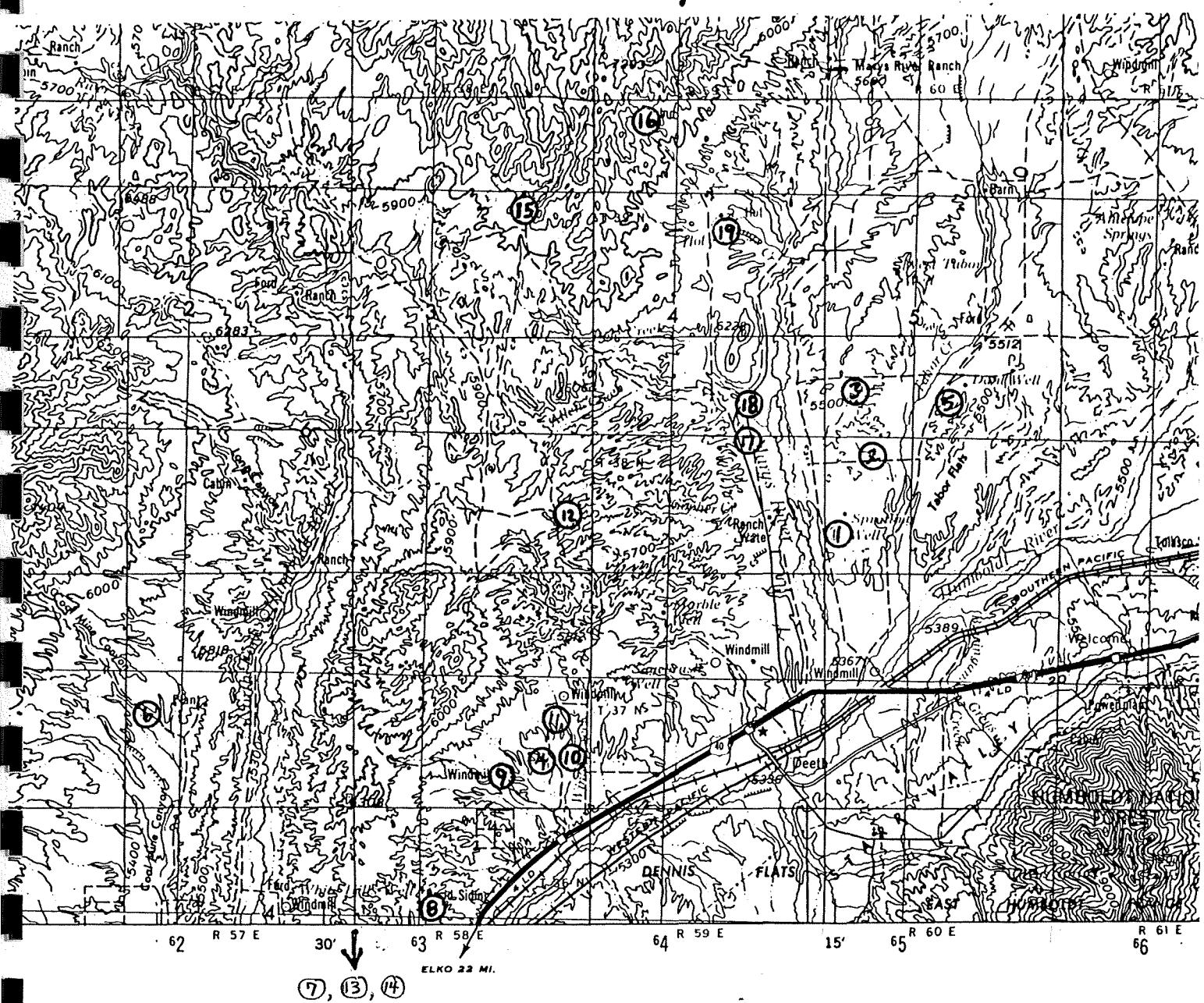
FIGURE 1. Sample location map

Source of base: portion of wells, Nevada, Utah, Idaho AMS sheet (1:250,000).
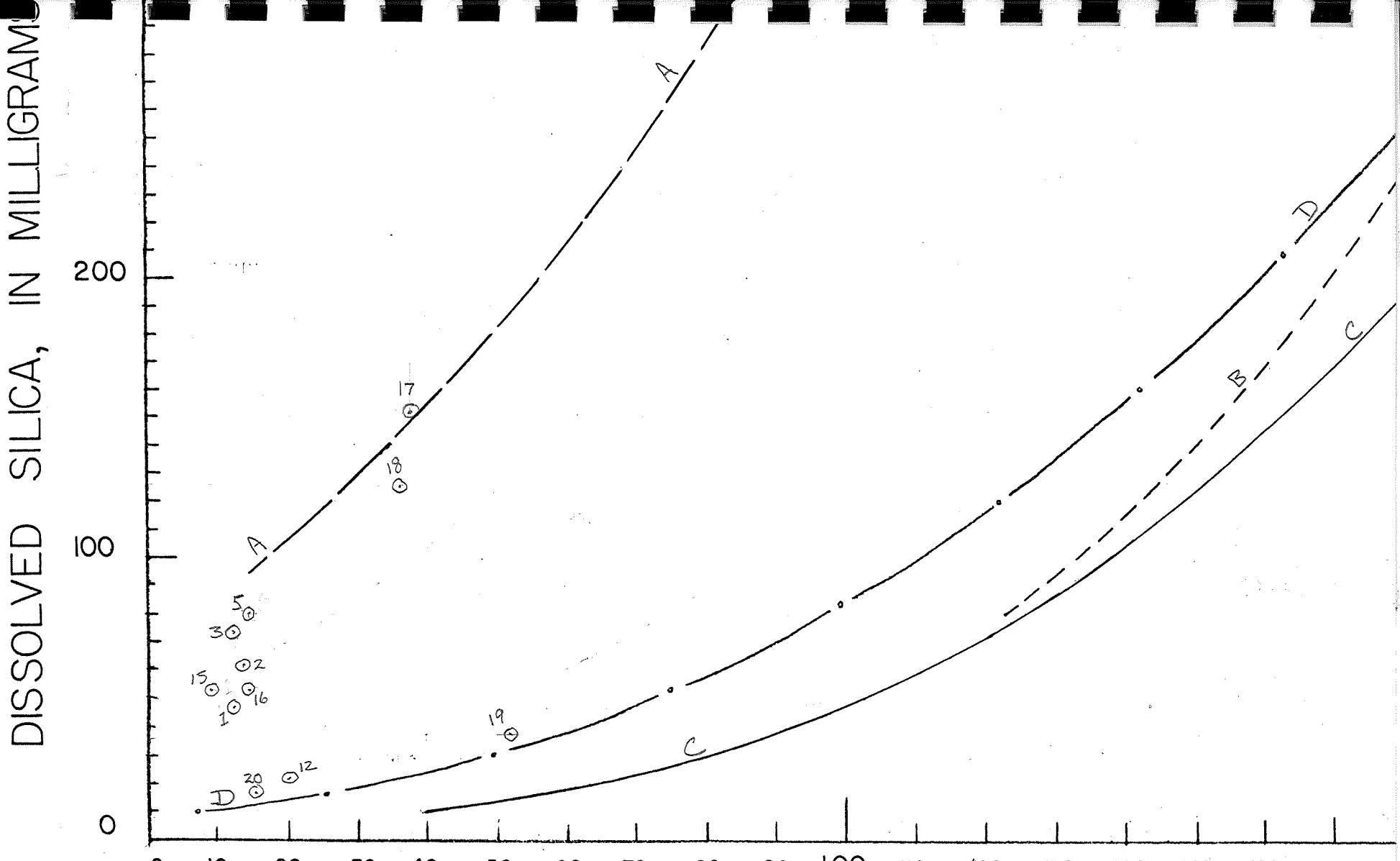
Fig. 3. SiO₂ versus enthalpy, groundwaters of the Deeth, Nevada area.

A = Amorphous Silica
B = Quartz (maximum steam loss)
C = Quartz
D = Chalcedony

TABLE 1. Chemical analyses in mg/l,
groundwaters of Deeth, Nevada

Column headings (some may not appear):

N = sample number for tabulation
CODE = AMAX sample number
LOC = location (all Elko County)
DATE = sample collection date, yr-mo-day
CA ... CL, F = ionic species, concentrations in mg/l
SIO2 = silica in mg/l
TDSS = total dissolved solids by summation of CA through CL, plus SIO2
EC = conductivity at 25°C, micromhos/cm
B = atomic boron in mg/l
NH3 = total dissolved ammonia species in mg/l
FLOW = flow in liters per minute

Note = All 9's or blank means no data are available, does not apply,
       or insufficient data are available to permit calculation.
       0.0 means below detection limit of analysis.

Detection limits:

   MG = no data
   SO$_4$ = 5 mg/l
   B   = 0.1 mg/l

LIN#	N	CODE	LOC	TC	FLOW
1	1.00	W14975	SW/4S30T38NR60E	13	8
2	2.00	W14976	SW/4S17T38NR60E	14	20
3	3.00	W14977	NWSES7T38NR60E	13	20
4	4.00	W14978	SW/4S26T37NR58E	16	120
5	5.00	W11524	SENENWS10T38R60E	15	80
6	6.00	W11525	NESENES19T37NR57E	17	0
7	7.00	W11526	SWNWNES29T35NR57E	16	20
8	8.00	W11527	NWNENWS16T36NR58E	15	40
9	9.00	W11528	SWNWNES34T37NR58E	14	60
10	10.00	W11529	NWNWSWS25T37NR58E	14	0
11	11.00	W11530	NWSENWS24T37NR58E	18	60
12	12.00	W11531	NESWSWS25T38NR58E	20	0
13	13.00	W11545	SESWNWS23T36NR58E	10	0
14	14.00	W11546	NWNESES29T35NR59E	26	4
15	15.00	W10572	NESESWS14T39NR58E	9	12
16	16.00	W10573	NWSWNES5T39NR59E	15	20
17	17.00	W10574	SESWSES14T38NR59E	38	20
18	18.00	W10575	SWNWSWS11T38NR59E	37	40
19	19.00	W10576	NWNWNES22T39NR59E	52	60
20	20.00	W10624	SENESWS13T40NR60E	16	120

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Na/K

LIN#	TC	PH	CA	MG	NA		K	LI
1	13	8.20	14.0	8.5	470.0	[43]	11.0	1.00
2	14	9.20	1.3	0.3	390.0	[70]	5.6	1.00
3	13	9.50	1.0	0.1	140.0	[29]	4.8	1.00
4	16	8.50	4.3	0.8	87.0		12.0	1.00
5	15	9.48	1.0	0.0	230.0	[8.5]	27.0	0.00
6	17	7.52	80.0	25.0	38.0		2.8	0.00
7	16	7.02	110.0	13.0	33.0		26.0	0.20
8	15	8.19	34.0	10.0	120.0		12.0	0.10
9	14	8.54	5.0	2.0	110.0		11.0	0.00
10	14	7.90	20.0	2.0	120.0		24.0	0.00
11	18	7.99	20.0	4.0	88.0		20.0	0.10
12	20	8.79	31.0	6.0	8.0		26.0	0.00
13	10	8.29	60.0	28.0	840.0		47.0	0.20
14	26	7.50	95.0	18.0	57.0		12.0	0.00
15	9	7.12	20.0	5.7	19.0		7.0	0.00
16	15	7.62	35.0	5.5	31.0		5.3	0.00
17	38	8.15	3.0	0.4	500.0	[15]	34.0	0.00
18	37	7.85	7.0	0.7	400.0	[12]	33.0	0.10
19	52	6.80	47.0	14.0	260.0	[6.2]	42.0	0.80
20	16	8.28	60.0	20.0	5.5		0.5	0.00

LIN#	HCO3	CO3	SO4	CL	SIO2	TDSS	EC	B	F	NH3
1	9999.9	999.9	780.0	90.0	47	99999	2364	5.40	1.00	99.999
2	9999.9	999.9	62.0	20.0	62	99999	1609	3.30	10.00	99.999
3	9999.9	999.9	17.0	6.2	72	99999	619	0.60	4.20	99.999
4	9999.9	999.9	22.0	16.0	80	99999	474	0.50	3.50	99.999
5	220.0	173.0	0.0	5.0	80	625	99999	1.30	8.90	0.300
6	223.0	0.0	150.0	24.0	20	450	99999	0.40	0.20	0.000
7	425.0	0.0	0.0	11.0	78	482	99999	0.00	0.10	0.600
8	254.0	0.0	100.0	16.0	63	481	99999	20.00	1.70	0.000
9	178.0	20.0	18.0	17.0	69	340	99999	0.30	4.00	0.000
10	275.0	0.0	9999.9	9999.9	51	99999	99999	0.00	99.99	0.300
11	202.0	0.0	32.0	18.0	54	336	99999	0.00	3.80	0.000
12	98.0	20.0	21.0	12.0	20	193	99999	0.30	0.20	2.400
13	778.0	0.0	9999.9	9999.9	44	99999	99999	0.20	99.99	0.200
14	319.0	0.0	9999.9	9999.9	43	99999	99999	0.00	99.99	0.600
15	114.2	0.0	7.0	6.6	52	174	99999	0.00	0.20	0.000
16	159.6	0.0	0.0	6.1	52	214	99999	0.00	0.20	0.000
17	988.0	0.0	0.0	29.0	150	1206	99999	0.00	22.00	0.260
18	790.0	0.0	0.0	23.0	125	980	99999	1.70	17.00	0.370
19	744.0	0.0	12.0	19.0	37	800	99999	1.60	2.00	4.610
20	197.6	0.0	11.0	1.5	14	210	99999	0.00	0.10	0.000

TABLE 2. Analysis in milliequivalents, calculated conductivity,
ionic balance, ionic ratios,
ground waters of Deeth, Nevada

Column headings:

N = sample number for tabulation
CA ... CL, F = concentration in milliequivalents/liter
B = concentration of boron in millimoles/liter
ECOBS = measured conductivity, micromhos/cm at 25°C (laboratory)
ECCAL = calculated conductivity
OBCA = ECOBS/ECCAL
SCAT = sum of cations CA ... K (meq/l)
SAN = sum of anions HCO3 ... CL, F, (meq/l)
DIF = ((SCAT - SAN)/(SCAT + SAN)) x 100
CAF = CA/SCAT
MGF = MG/SCAT
NKF = (NA + K)/SCAT
HCF = (HCO3 + CO3)/(HCO3 + CO3 + SO4 + CL)
SOF = SO4/(HCO3 + CO3 + SO4 + CL)
CLF = CL/(HCO3 + CO3 + SO4 + CL)
BCL = (B/CL) x 100
I = Ionic strength (calculated using molar concentrations)
NACA = Na/Ca
NAK = Na/K
FCL = (F/Cl)x100

Note: All 9's means no data are available, or insufficient data
       to permit calculation.
       0.0 means below detection limit of analysis

N	CA	MG	NA	K	HCO3	CO3	SO4	CL
1.00	0.70	0.70	20.44	0.28	999.99	99.99	16.24	2.54
2.00	0.06	0.02	16.96	0.14	999.99	99.99	1.29	0.56
3.00	0.05	0.01	6.09	0.12	999.99	99.99	0.35	0.17
4.00	0.21	0.07	3.78	0.31	999.99	99.99	0.46	0.45
5.00	0.05	0.00	10.00	0.69	3.61	5.77	0.00	0.14
6.00	3.99	2.06	1.65	0.07	3.65	0.00	3.12	0.68
7.00	5.49	1.07	1.43	0.67	6.96	0.00	0.00	0.31
8.00	1.70	0.82	5.22	0.31	4.16	0.00	2.08	0.45
9.00	0.25	0.16	4.78	0.28	2.92	0.67	0.37	0.48
10.00	1.00	0.16	5.22	0.61	4.51	0.00	999.99	999.99
11.00	1.00	0.33	3.83	0.51	3.31	0.00	0.67	0.51
12.00	1.55	0.49	0.35	0.67	1.61	0.67	0.44	0.34
13.00	2.99	2.30	36.53	1.20	12.75	0.00	999.99	999.99
14.00	4.74	1.48	2.48	0.31	5.23	0.00	999.99	999.99
15.00	1.00	0.47	0.83	0.18	1.87	0.00	0.15	0.19
16.00	1.75	0.45	1.35	0.14	2.62	0.00	0.00	0.17
17.00	0.15	0.03	21.74	0.87	16.19	0.00	0.00	0.82
18.00	0.35	0.06	17.39	0.84	12.95	0.00	0.00	0.65
19.00	2.35	1.15	11.31	1.07	12.19	0.00	0.25	0.54
20.00	2.99	1.64	0.24	0.01	3.24	0.00	0.23	0.04

Handwritten annotations:

HCO3+CO3 as difference
SCAT – SO4 – CL

3.34 (row 1)
15.35 (row 2)
5.75 (row 3)
3.46 (row 4)

SO4 + CL as difference
SCAT – HCO3 – CO3

2.48 (row 10)
30.28 (row 13)
3.78 (row 14)

N	B	F	NH3	NO3
1.00	0.500	0.053	9.9999	0.000
2.00	0.305	0.526	9.9999	0.000
3.00	0.056	0.221	9.9999	0.000
4.00	0.046	0.184	9.9999	0.000
5.00	0.120	0.468	0.0176	0.000
6.00	0.037	0.011	0.0000	0.000
7.00	0.000	0.005	0.0352	0.000
8.00	1.850	0.089	0.0000	0.000
9.00	0.028	0.211	0.0000	0.000
10.00	0.000	9.999	0.0176	0.000
11.00	0.000	0.200	0.0000	0.000
12.00	0.028	0.011	0.1409	0.000
13.00	0.019	9.999	0.0117	0.000
14.00	0.000	9.999	0.0352	0.000
15.00	0.000	0.011	0.0000	0.000
16.00	0.000	0.011	0.0000	0.000
17.00	0.000	1.158	0.0153	0.000
18.00	0.157	0.895	0.0217	0.000
19.00	0.148	0.105	0.2706	0.000
20.00	0.000	0.005	0.0000	0.000

LIN#	ECOBS	ECCAL	OBCA	SCAT	SAN	SUM	DIF	I
1	2364	99999	9.999	22.116	99.999	999.999	99.99	9.999
2	1609	99999	9.999	17.192	99.999	999.999	99.99	9.999
3	619	99999	9.999	6.269	99.999	999.999	99.99	9.999
4	474	99999	9.999	4.370	99.999	999.999	99.99	9.999
5	99999	1197	9.999	10.742	9.981	20.723	3.67	0.013
6	99999	831	9.999	7.772	7.465	15.237	2.02	0.012
7	99999	781	9.999	8.658	7.280	15.939	8.64	0.011
8	99999	773	9.999	8.044	6.785	14.829	8.49	0.010
9	99999	522	9.999	5.479	4.648	10.127	8.20	0.006
10	99999	99999	9.999	6.994	99.999	999.999	99.99	9.999
11	99999	523	9.999	5.665	4.684	10.349	9.48	0.006
12	99999	353	9.999	3.053	3.059	6.112	-0.09	0.005
13	99999	99999	9.999	43.025	99.999	999.999	99.99	9.999
14	99999	99999	9.999	9.006	99.999	999.999	99.99	9.999
15	99999	234	9.999	2.472	2.214	4.686	5.51	0.003
16	99999	315	9.999	3.682	2.798	6.480	13.65	0.004
17	99999	1903	9.999	22.794	18.167	40.961	11.30	0.021
18	99999	1546	9.999	18.645	14.490	33.135	12.54	0.017
19	99999	1397	9.999	15.877	13.084	28.960	9.64	0.016
20	99999	406	9.999	4.891	3.515	8.406	16.37	0.007

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FRACTIONS CALCULATED W/ HCO3+CO3 as
difference SCAT-SO4-CL

LIN#	CAF	MGF	NKF	HCF	SOF	CLF	BCL		HCF	SOF	CLF
1	0.032	0.032	0.937	9.999	9.999	9.999	19.68		0.151	0.734	0.115
2	0.004	0.001	0.995	9.999	9.999	9.999	54.12		0.892	0.075	0.033
3	0.008	0.001	0.991	9.999	9.999	9.999	31.74		0.917	0.056	0.034
4	0.049	0.015	0.936	9.999	9.999	9.999	10.25		0.792	0.105	0.103
5	0.005	0.000	0.995	0.985	0.000	0.015	85.28				
6	0.514	0.265	0.222	0.490	0.419	0.091	5.47				
7	0.634	0.123	0.243	0.957	0.000	0.043	0.00				
8	0.211	0.102	0.687	0.622	0.311	0.067	410.00				
9	0.046	0.030	0.924	0.808	0.084	0.108	5.79				
10	0.143	0.024	0.834	9.999	9.999	9.999	999.99				
11	0.176	0.058	0.766	0.738	0.149	0.113	0.00				
12	0.507	0.162	0.332	0.746	0.143	0.111	8.20				
13	0.070	0.054	0.877	9.999	9.999	9.999	999.99				
14	0.526	0.164	0.309	9.999	9.999	9.999	999.99				
15	0.404	0.190	0.407	0.849	0.066	0.084	0.00				
16	0.474	0.123	0.403	0.938	0.000	0.062	0.00				
17	0.007	0.001	0.992	0.952	0.000	0.048	0.00				
18	0.019	0.003	0.978	0.952	0.000	0.048	24.24				
19	0.148	0.073	0.780	0.939	0.019	0.041	27.62				
20	0.612	0.336	0.052	0.923	0.065	0.012	0.00				

TABLE 3 . Chemical geothermometers, ground waters of Deeth, Nevada

Column headings:

N = sample number for tabulation
TC = temperature in degrees Centigrade

Silica geothermometers (0-250°C; SiO_2 in ppm)

OTZC = quartz, conductive cooling $T°C = (1309/(5.19-\log SiO2))-273.15$
QTZA = quartz, adiabatic cooling $T°C = (1522/(5.75-\log SiO2))-273.15$
CHAL = chalcedony, conductive cooling $T°C = (1032/(4.69-\log SiO2))-273.15$
AMOR = amorphous silica, conductive $T°C = (731/(4.52-\log SiO2))-273.15$
      cooling

NaKCa geothermometer (4-340°C; Na, K, Ca in moles/liter)

SQ = $(Ca)^{1/2}/Na$
B43 = temperature for B = 4/3
B13 = temperature for B = 1/3
NKC = NaKCa temperature =
     B43 for SQ>1 and T°C<100
     B13 for SQ<1 or B43>100

$$T°C = \left(\frac{1647}{\log\left(\frac{Na}{K}\right) + B\log(SQ) + 2.24}\right) - 273.15$$

Mg-corrected NaKCa geothermometer

R = (Mg/(Mg+Ca+K)) x 100, units in equivalents/l.
DMG = Mg-correction, T°C, for 1<R<50 and NKC>70°C. If R>50 assume that the underground temperature is relatively cool. If R<1 correction is negligible (Ref. 1).
CMG = Mg-corrected NaKCa temperature T°C = NKC-DMG (for DMG>0).

P_{CO_2}-corrected NaKCa geothermometer

PH = sample pH, field measurement if available.
HCO3 = HCO_3, meq/l
PCO2 = P_{CO_2} at sample temperature, $-\log P_{CO_2} = pH -\log(HCO3)-7.689$
     $-4.22(10^{-3})T°C - 3.54(10^{-5}(T°C)^2$

PCC = P_{CO_2}-corrected NaKCa temperature.

$$T°C = \left(\frac{1647}{\log\left(\frac{Na}{K}\right) + \frac{4}{3}\log(SQ) + 3.6 + .253\log P_{CO_2}}\right) - 273.15$$

Applicable only to water equilibrated at less than 75°C.

NaK geothermometer (>150°C; Na, K in ppm)

NAK = NaK temperature $\qquad T°C = \dfrac{1217}{\log(Na/K)+1.483} -273.15$

Note: All 9's means no data or geothermometer inapplicable.

Ref. 1: Fournier, R. O. and Potter II, R. W., 1979, Geochim. Cosmochim.
Acta, 43, 1543-1550.

N	TC	QTZC	QTZA	BCR	CHAL	AMOR	SQ	B43	B13	NKC	CMG	PCC	NAK
1.00	13	99	100	2	69	-16	0.91	134	130	130	32	999	118
2.00	14	112	111	14	83	-5	0.34	174	123	123	116	999	93
3.00	13	120	118	21	91	1	0.82	158	148	148	147	999	140
4.00	16	125	122	26	97	6	2.74	148	201	201	138	999	246
5.00	15	125	122	26	97	6	0.50	276	226	226	226	999	231
6.00	17	63	69	-30	31	-46	27.04	26	130	26	999	-13	192
7.00	16	124	121	25	96	5	36.51	80	259	80	80	18	494
8.00	15	113	112	15	84	-4	5.58	96	170	96	64	49	217
9.00	14	117	116	19	89	-1	2.34	143	185	185	75	94	217
10.00	14	103	103	6	73	-13	4.28	137	214	214	157	74	285
11.00	18	105	106	8	76	-11	5.84	125	216	216	107	69	299
12.00	20	63	69	-30	31	-46	79.95	93	362	93	92	63	980
13.00	10	96	97	-1	66	-19	1.06	165	168	168	41	93	172
14.00	26	95	97	-2	64	-20	19.64	65	187	65	999	14	290
15.00	9	104	104	6	74	-12	27.04	69	214	69	999	19	362
16.00	15	104	104	6	74	-12	21.92	55	174	55	999	12	268
17.00	38	161	153	61	137	39	0.40	257	197	197	189	999	186
18.00	37	150	143	51	125	29	0.76	212	196	196	178	999	201
19.00	52	88	91	-8	57	-26	3.03	149	208	208	74	51	262
20.00	16	51	57	-41	18	-56	161.78	-18	115	-18	999	-40	209

N	R	DMG	CMG	PH	HCO3	PCO2	PCC
1.00	41.6	98	32	8.20	999.99	9.9999	999
2.00	10.6	8	116	9.20	999.99	9.9999	999
3.00	4.5	1	147	9.50	999.99	9.9999	999
4.00	11.2	62	138	8.50	999.99	9.9999	999
5.00	0.0	0	226	9.48	3.61	0.0001	999
6.00	33.6	999	999	7.52	3.65	0.0065	-13
7.00	14.8	-23	80	7.02	6.96	0.0388	18
8.00	29.1	31	64	8.19	4.16	0.0015	49
9.00	23.7	110	75	8.54	2.92	0.0005	94
10.00	9.3	57	157	7.90	4.51	0.0032	74
11.00	17.9	109	107	7.99	3.31	0.0020	69
12.00	18.2	1	92	8.79	1.61	0.0002	63
13.00	35.4	127	41	8.29	12.75	0.0036	93
14.00	22.7	999	999	7.50	5.23	0.0110	14
15.00	28.5	999	999	7.12	1.87	0.0076	19
16.00	19.4	999	999	7.62	2.62	0.0036	12
17.00	3.1	8	189	8.15	16.19	0.0091	999
18.00	4.6	17	178	7.85	12.95	0.0143	999
19.00	25.2	134	74	6.80	12.19	0.1951	51
20.00	35.4	999	999	8.28	3.24	0.0010	-40
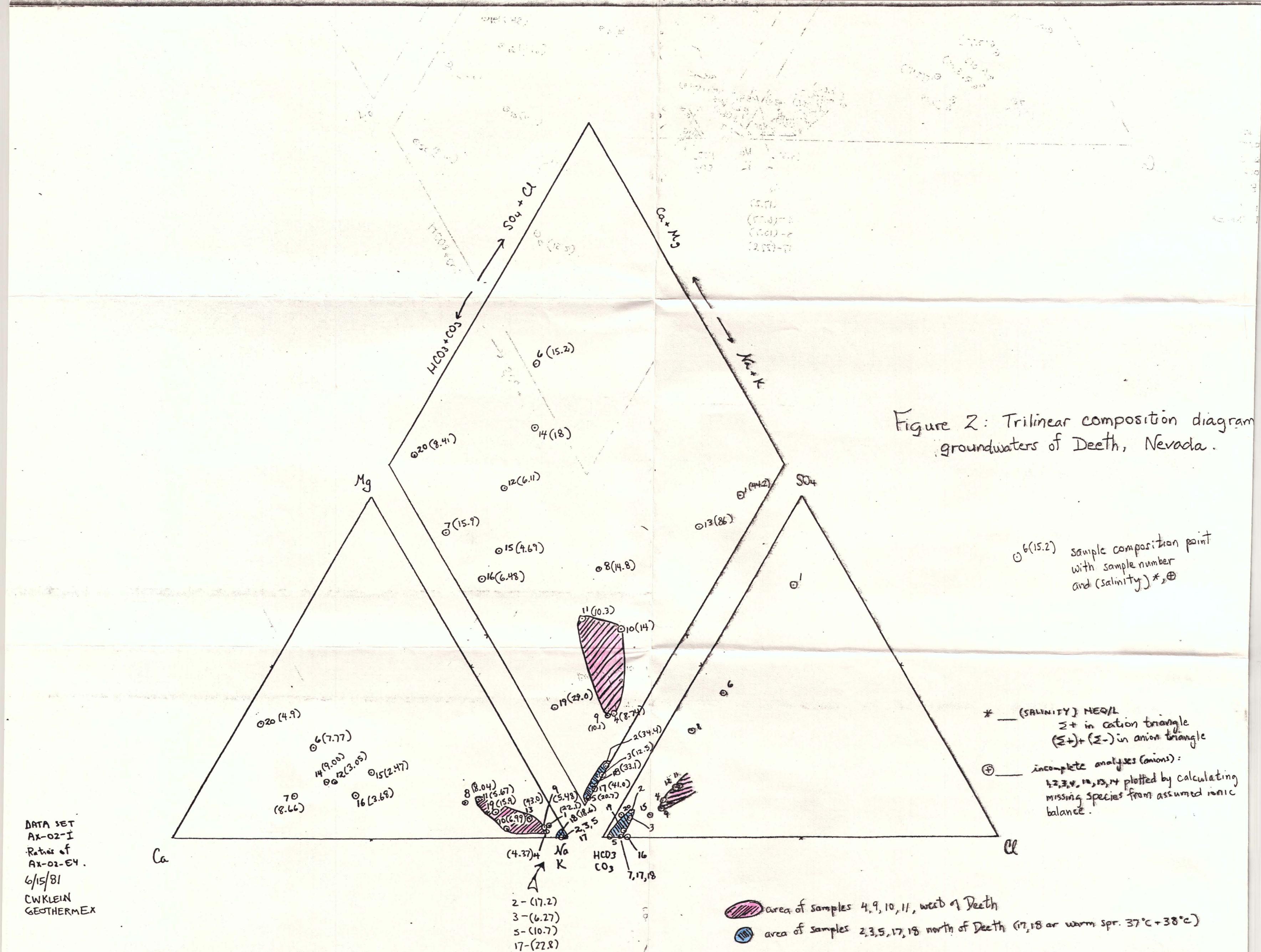
Figure 2: Trilinear composition diagram groundwaters of Deeth, Nevada.

⊙⁶(15.2) sample composition point with sample number and (salinity) *,⊕

*____ (SALINITY) MEQ/L
Σ+ in cation triangle
(Σ+)+(Σ-) in anion triangle

⊕____ incomplete analyses (anions):
1,2,3,4,10,13,14 plotted by calculating missing species from assumed ionic balance.

DATA SET
AX-02-I
Retire of
AX-02-E4.
6/15/81
CWKLEIN
GEOTHERMEX

2 − (17.2)
3 − (6.27)
5 − (10.7)
17 − (22.8)

⬤ area of samples 4,9,10,11, west of Deeth
⬤ area of samples 2,3,5,17,18 north of Deeth (17,18 ar warm spr. 37°C + 38°C)