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Hydrogeochemical Data for Thermal and Nonthermal Waters and Gases of the Valles Caldera— Southern Jemez Mountains Region, New Mexico

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DISCLAIMER

HYDROGEOCHEMICAL DATA FOR THERMAL AND NONTHERMAL WATERS AND GASES OF THE VALLES CALDERA--SOUTHERN JEMEZ MOUNTAINS REGION, NEW MEXICO

by

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ABSTRACT

This report presents field, chemical, gas, and isotopic data for thermal and nonthermal waters of the southern Jemez Mountains, New Mexico. This region includes all thermal and mineral waters associated with Valles Caldera and many of those located near the Nacimiento Uplift, north of San Ysidro. Waters of the region can be categorized into five general types: (1) surface and near-surface meteoric waters; (2) acid-sulfate waters at Sulphur Springs (Valles Caldera); (3) thermal meteoric waters in the ring fracture zone (Valles Caldera); (4) deep geothermal waters of the Baca geothermal field and derivative waters in the Soda Dam and Jemez Springs area (Valles Caldera); and (5) mineralized waters near San Ysidro. Some waters display chemical and isotopic characteristics intermediate between the types listed. Data in this report will help in interpreting the geothermal potential of the Jemez Mountains region and will provide background for investigating problems in hydrology, structural geology, hydrothermal alterations, and hydrothermal solution chemistry.

I. INTRODUCTION

This report is a revised edition of an earlier data report, LA-9367-OBES, Goff et al. (1982), and contains 107 additional listings including 9 analyses from wells in the Baca geothermal field. Other additions include tables of gas analyses and calculated temperatures from chemical geothermometers. The manner in which the samples are listed has been revised in this report; thermal and nonthermal waters are currently grouped according to their locations in the Jemez Mountains region.

The Jemez Mountains consist of volcanic rocks of basaltic to rhyolitic composition that overlie Tertiary to Paleozoic sediments on the western margin of the Rio Grande rift. Volcanic activity culminated in the Pleistocene with eruption of $\sim$600 km^3 of Bandelier Tuff and with formation of the Valles Caldera, a large well-preserved silicic cauldron. The Valles region contains a variety of hot springs having distinct geologic, chemical, and isotopic characteristics. Young, large silicic volcanic centers such as the Valles Caldera have great potential for geothermal energy because they overlie shallow magma reservoirs of batholithic proportions. A study of the chemistry of geothermal fluids can provide information on the hydrothermal systems and the geologic formations and structures through which they flow. The purpose of this report is to present field, chemical, and isotopic data for cold waters, thermal waters, and gases in the Jemez Mountains area and to characterize different water types and relate them to the hydrothermal systems. These data are presented to aid the overall assessment of geothermal resources of the Jemez Mountains and to provide data for other scientific investigations.

Different aspects of the geohydrology and geochemistry of waters in the Jemez Mountains have been described by Goff and Grigsby (1982), Goff et al. (1981), Goff and Sayer (1980), Goff et al. (1985), Goff et al. (1982), Trainer and Lyford (1979), Trainer (1974, 1975, 1978, 1984), Titus (1961), Purtymun and Johansen (1974), Purtymun et al. (1974, 1980), Purtymun (1977), Phillips et al. (1984), Vuataz and Goff (1986), White (1986), Grigsby et al. (1984), and Truesdell and Janik (1986).

II. SIMPLIFIED GEOLOGY

The geology of the Jemez Mountains has been described by Ross et al. (1961), Smith et al. (1961), Griggs (1964), Doell et al. (1968), Bailey et al. (1969), Laughlin (1981), Laughlin et al. (1983), Gardner and Goff (1984), Heiken and Goff (1983), Nielson and Hulen (1984), Gardner et al. (1986), Heiken et al. (1986), and Self et al. (1986). Smith, Bailey, and Ross (1970) published an excellent regional geologic map. The Jemez Mountains consist of an extensive pile of Tertiary and Quaternary lavas and tuffs (>13 to 0.1 Myr) overlying Precambrian granite, gneiss, and schist and the Paleozoic to Mesozoic sedimentary sequence of the Colorado Plateau (Figs. 1 and 2). The main Paleozoic units include the Pennsylvanian Madera Limestone and Sandia Formation and the red sandstones, siltstones, and shales of the Permian Abo

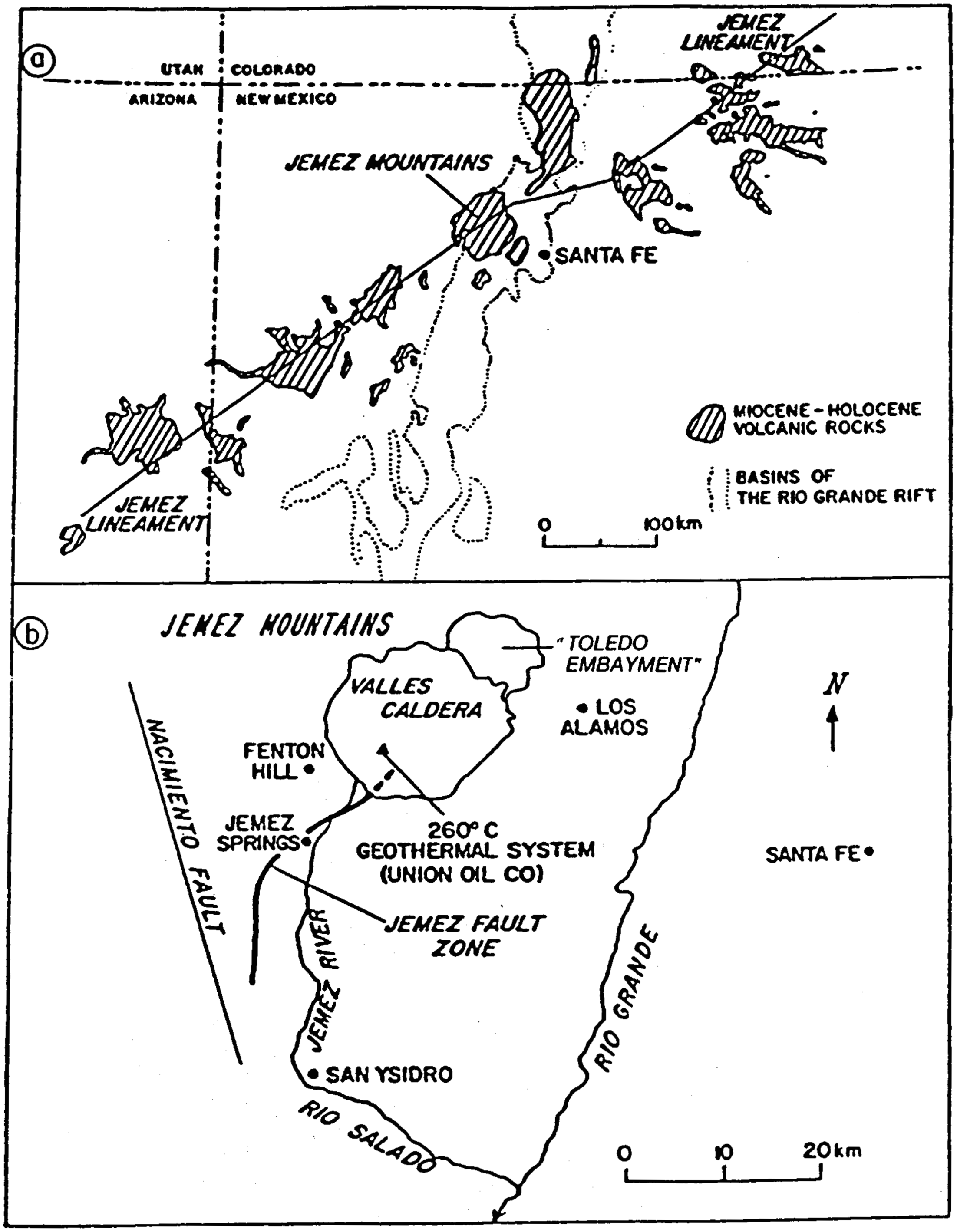


Fig. 1.
(a) Volcanic centers in relationship to the Rio Grande Rift and Jemez Lineament and (b) sketch of Jemez Mountains region.

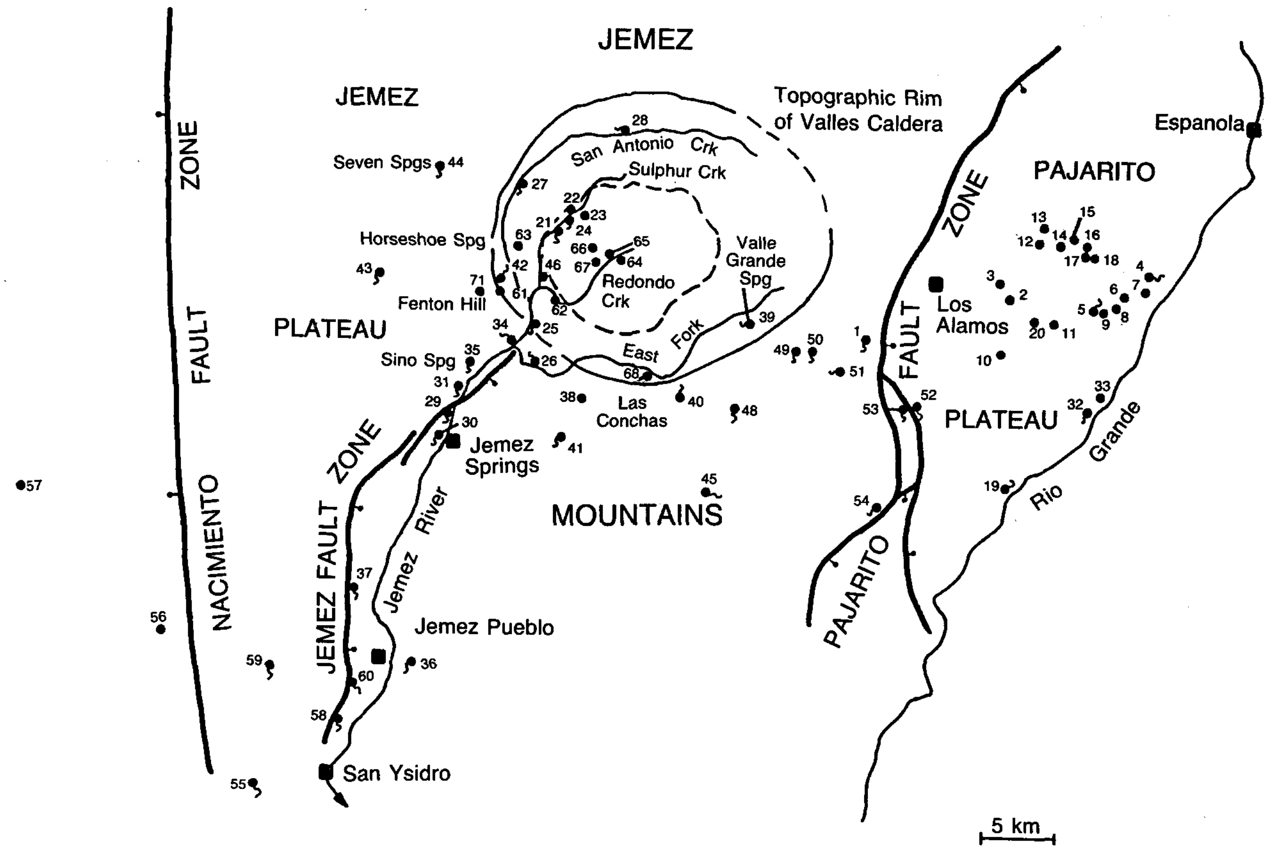


Fig. 2.
Map of Jemez Mountains region showing major faults. Numbers refer to spring and well locations listed in tables in Appendix B.

and Yeso Formations. Mesozoic units include the Jurassic Entrada Formation and the Triassic Chinle Formation. Mesozoic outcrops are located south of the Jemez Mountains near San Ysidro. The older Mesozoic units include the Entrada Formation sandstone, the Jurassic Todilto Formation evaporites (mainly gypsum), and the Jurassic Morrison Formation shale and sandstone.

Colorado Plateau rocks of this region are down-faulted to the east into the Rio Grande rift. Unconsolidated Tertiary sediments of the Santa Fe Formation thicken eastward toward the axis of the rift. The Jemez Mountains volcanics occur at the intersection of the rift with the northeast-trending Jemez Lineament, a line of Miocene to Quaternary volcanic fields extending across the northwest portion of New Mexico (Aldrich and Laughlin 1984).

Volcanic activity commenced with dominantly mafic to intermediate lava flows that are partly interbedded with the Tertiary sediments. These rocks are best exposed in the areas north, northeast, and south of the Valles

Caldera complex. Two major eruptions of Bandelier rhyolite tuff in the early Pleistocene resulted in the formation of the Toledo and Valles Calderas. Deposits of tuff up to 300 m thick occur to the west and east of the caldera forming the Jemez and Pajarito Plateaus, respectively. The final activity in the Jemez Mountains involved eruption of rhyolite domes, obsidian, and tuffs in the moat zone of the Valles Caldera (Smith et al. 1970, Bailey et al. 1969, Gardner and Goff 1984).

III. METHODS AND PROCEDURES FOR COLLECTION AND ANALYSIS OF WATERS

Before 1982 temperatures were recorded with mercury thermometers, and field pH was determined using a pH meter or using sensitive, limited-range pH test papers (Colorfast Indicator Strips nos. 9581, 9582, and 9583). After 1982, pH, temperature, conductivity, and Eh were measured in the field using a Presto-Tek model 500 digital recorder. Laboratory values of pH are not considered reliable because most waters gain or lose CO_2 gas after sampling and before laboratory analysis. This gain or loss alters the concentration of bicarbonate ions, which in turn changes the pH. Flow rates of springs were estimated visually or measured approximately with a bucket and stopwatch; flow rates of wells were obtained from measurements provided by well owners where possible. A compilation of photographs of thermal springs of the Jemez Mountains is presented in Appendix A (Figs. A-1 through A-11). Field data are recorded in Table B-I (all tables appear in Appendix B).

Samples of water for chemical analysis were filtered using a hand-operated vacuum pump system or a large syringe attached to a filter holder containing 0.45-μm filter paper. The filtered water was poured brimful into polyethylene bottles and sealed with Polyseal caps. Five types of samples were collected: (1) a 500-mℓ bottle of filtered unacidified water for anions, (2) a 250-mℓ bottle of filtered acidified water for cations, (3) a 125-mℓ bottle of filtered diluted water for silica, (4) a 500-mℓ glass bottle of unfiltered water for tritium analysis, and (5) a 125-mℓ glass bottle of unfiltered water for stable isotope analysis. The cation samples were acidified in the field so that the sample pH dropped below 2. Before 1982, the samples were acidified by the dropwise addition of dilute HCl. After March 1982, 20 drops of 70% HNO_3 were used to acidify the samples in the less mineralized waters, and 40 drops were used in the highly mineralized waters. The bottles used for silica analyses contained 90 mℓ of deionized water before

10 mℓ of sample were added. This dilution prevents polymerization of monomeric silica in more concentrated water samples before analysis. Samples for determination of Al were collected and analyzed according to our modified procedure of Barnes (1975). Major element analyses are presented in Table B-II.

Chemical analyses were performed by the following methods: SiO_2 by a colorimetric method using ammonium molybdate; Al, As, Ba, Ca, Fe, K, Li, Mg, Mn, Mo, Na, Si, Sr, and Zn by inductively coupled plasma (ICP) emission spectroscopy; Ag, Al^{+3}, Cd, Co, Cr, Cu, Cs, Ni, Pb, and Rb by atomic absorption (AA) spectroscopy using a graphite furnace; Br, Cl, NO_3, PO_4, and SO_4 by ion chromatography; B by colorimetry using azomethine-H or by ICP; F by selective ion electrode; low-level Na, K, and Li by flame atomic absorption; HCO_3^- and CO_3^{-2} by titration with H_2SO_4; S^{-2}, NH_4, and O_2 (dissociated) with electrodes (Trujillo et al., in prep.). All chemical analyses were performed at the Fenton Hill Laboratory (Los Alamos National Laboratory), and the data appear in Tables B-II and B-III.

Before 1982, oxygen-18 and deuterium analyses were performed by L. Merlivat of the Bureau des Isotopes Stables, Centre d'Etudes Nucléaires, Saclay, France; and after 1982, they were performed by Russ Harmon of the Stable Isotope Lab., Southern Methodist University, Dallas, Texas. Before 1982, tritium analyses were provided by Teledyne Isotopes, Westwood, New Jersey; after March 1982, samples were analyzed by H. Gote Ostlund, Tritium Laboratory at the University of Miami.

IV. GEOHYDROLOGY AND GEOCHEMISTRY

The waters described in this report can be divided into several groups on the basis of field, chemical, and isotopic characteristics. In this section each group is discussed separately, but the reader should refer to Figs. 3-5 for sample locations and to Figs. 6-14 for chemical and isotopic differences and similarities among water types.

A. Surface and Near-Surface Meteoric Water

Surface and near-surface meteoric waters are generally cold, potable, and dilute. Waters included in this group issue from water-supply and test wells in the Pajarito Plateau (LA sample numbers) and from cold springs, creeks, and wells throughout the Valles Caldera-southern Jemez Mountains

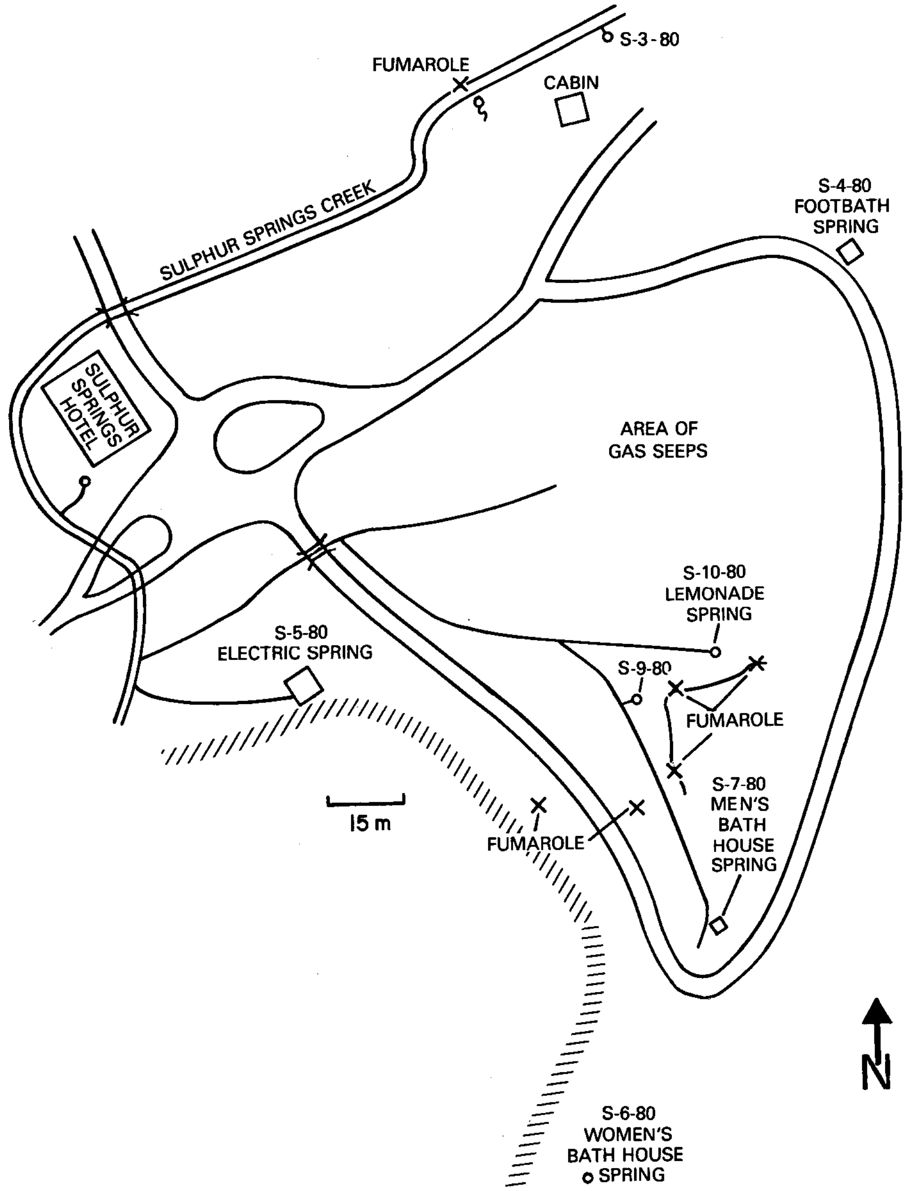


Fig. 3.
Sketch map of Sulphur Springs area (modified from Summers 1976).

region (VA sample numbers; see Figs. 2-5 for locations). Cold meteoric waters occur in three different geologic settings: (1) within late Tertiary to Quaternary volcanic rocks of the Jemez Mountains volcanic field, (2) within late Tertiary basin-fill sediments of the Rio Grande rift, and (3) within Paleozoic to Mesozoic sediments of the Colorado Plateau. These three different settings produce subtle differences in the chemistry of near-surface waters.

The hydrology of the Pajarito Plateau has been described by Purtymun and Johansen (1974), and the geochemistry of the waters with respect to

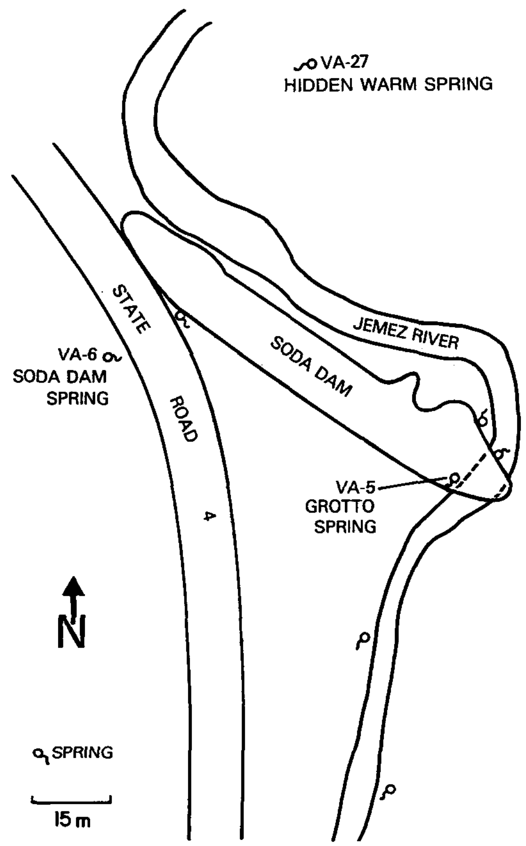
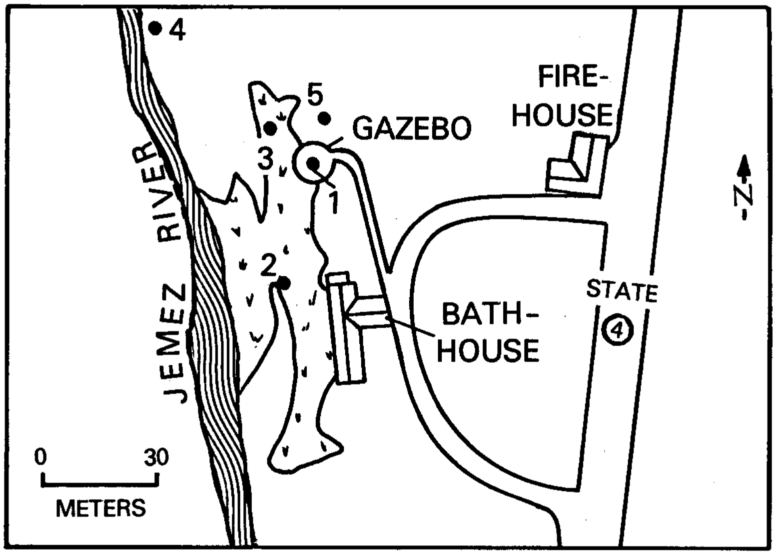


Fig. 4.
Sketch map of Soda Dam area.

geothermal potential has been discussed in detail by Goff and Sayer (1980). Hydrology of the southern Jemez Mountains is not known in detail although the Jemez River and tributaries drain Valles Caldera in a southerly direction.

In general, surface and near-surface waters of this category are calcium-bicarbonate waters although some of the Los Alamos water-supply wells and cold mineral springs in the Valles Caldera region are sodium-bicarbonate waters (Fig. 6). The waters can be characterized by low conductivity (since they are relatively dilute), low temperature, and pH near 7. They typically contain low concentrations of F, Cl, Li, B, and SiO_2 (Figs. 7a through 11a) indicating a low-temperature, near-surface environment (White 1957). The well waters of the Pajarito Plateau show a wider range in all these constituents than do most cold waters of the region, possibly because some waters have long resided in deep aquifers or have mixed with deep thermal/mineral water rising along faults in the Rio Grande rift (Goff and Sayer 1980). A few springs in the caldera region are anomalous in that they are somewhat mineralized but are



1. MAIN JEMEZ SPRING, VA-10
2. TRAVERTINE MOUND SPRING, VA-7
3. UNNAMED WARM SPRING, VA-12
4. BUDDHIST SPRING, VA-8
5. JEMEZ SPRINGS GEOTHERMAL WELL, VA-19

Fig. 5.
Sketch map of Jemez Springs area (modified from Summers 1976).

also cold (location nos. 34, 36, 37 and to a lesser extent location 31, Fig. 2; samples from Battleship Seep, Ponderosa Spring, Cañon Spring, and Panorama Spring, VA-39 and VA-40, Table B-II). These samples have much greater conductivity, comparatively high Na+K relative to Ca, high Cl relative to HCO_3, and relatively high F, B, and Li (see Figs. 8a, 9a, 10a, 11a, and 14a). Two of the springs (location nos. 34 and 36) also have very low SiO_2. These slightly mineralized meteoric waters issue from Mesozoic-Paleozoic sediments and either leach out evaporitic minerals from them or else contain an extremely small fraction of deep thermal water from Valles Caldera.

Trace elements in all waters in this group are fairly low (Table B-III). Strontium appears to be higher in waters issuing from Madera limestone (especially location nos. 34 and 36), suggesting that Sr is dissolved out of the carbonate rocks.

The tritium content of the surface waters in the Jemez Mountains is generally greater than 5 tritium units (T.U.), indicating that the waters are young, less than 50 years old (Table B-IV). The D and ^{18}O isotope ratios

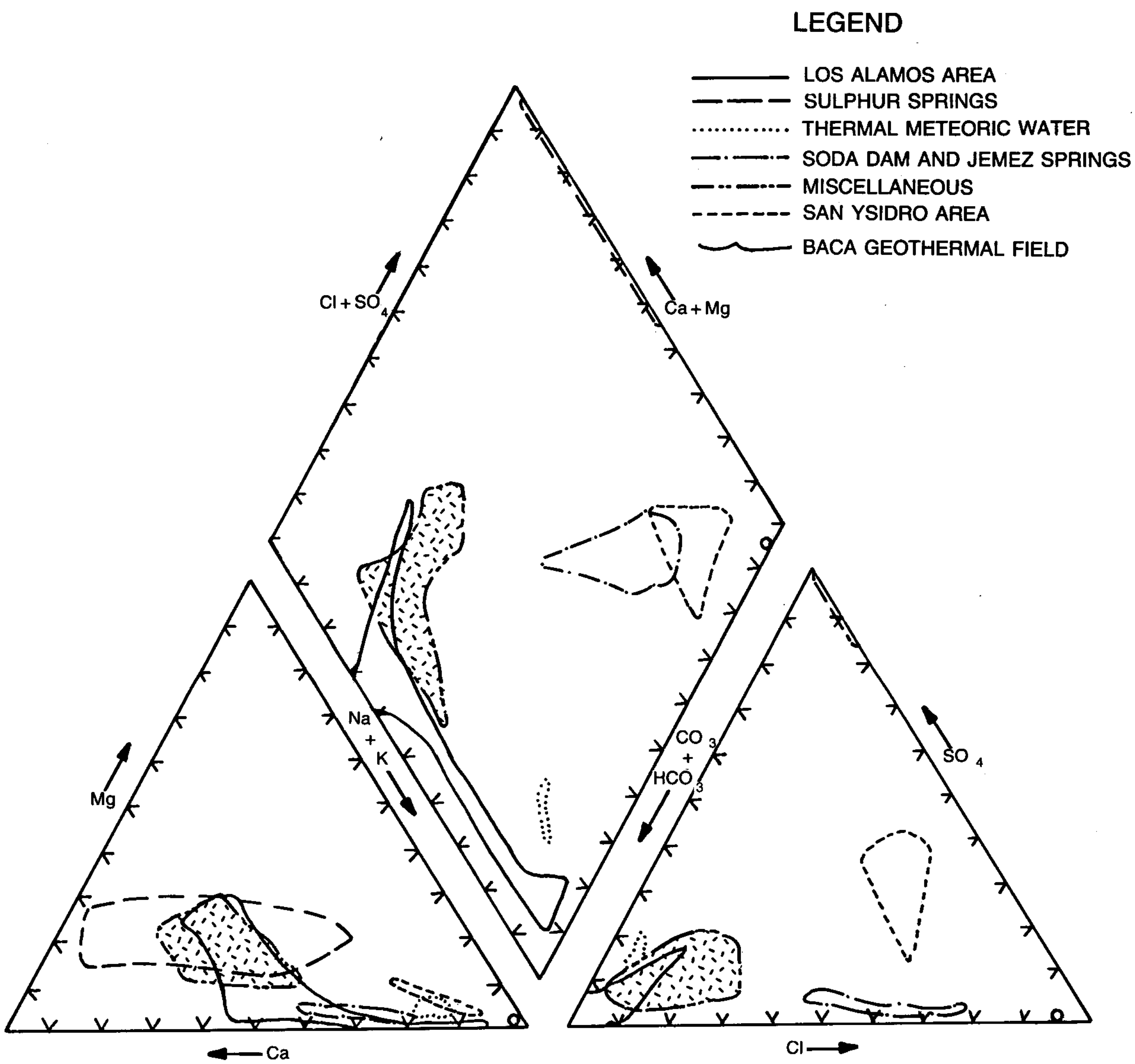


Fig. 6.
Piper diagram showing the range in chemical composition in equivalents of various types of water in southern Jemez Mountains, New Mexico. Patterns are added to help distinguish overlapping fields of data points.

(Fig. 13a) parallel the world meteoric water line (Craig 1961). The cold mineral waters described above are not isotopically distinct from other waters in this group.

B. Valles Caldera-Sulphur Springs Area

A suite of thermal and nonthermal acid-sulfate springs and mudpots and some associated dilute carbonated waters are located within the Valles Caldera near the western margin of the resurgent dome (Figs. 2 and 3). Discussion of

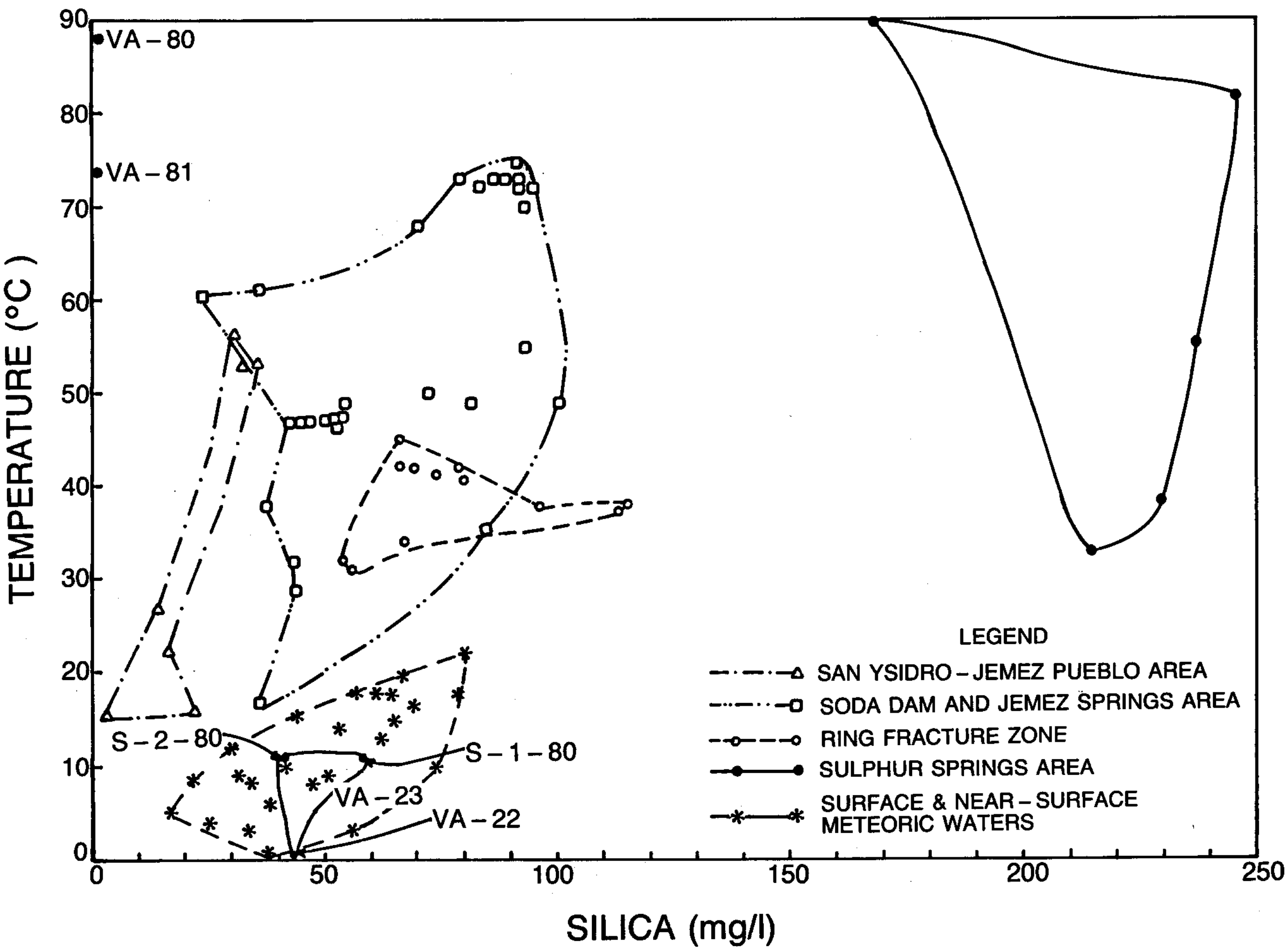


Fig. 7a.
Plot of SiO_2 vs. measured temperature for various types of water in the southern Jemez Mountains region, New Mexico. Note that waters from Sulphur Springs area fall into two distinct fields.

the chemistry and origin of the Sulphur Springs has been presented by Trainer (1974), Goff and Grigsby (1982), and Goff et al. (1985). Names used for various springs in Tables B-I through B-VI correspond with those presented by Summers (1976). Rhyolitic flows and tuffs and caldera fill deposits in the area have been extensively altered and leached to clays, silica minerals, authigenic feldspars, and sulfates. Native sulfur, pyrite, and aluminum sulfates have precipitated near fumaroles (Charles et al. 1986). The waters are characterized by a high conductivity (except for the dilute bubbling waters) and low pH, especially in the most concentrated waters. Most of the samples have moderate F and low B, Li, and Cl (Figs. 8a through 11a). The F concentrations are highest in the Cl-free waters. SiO_2 contents vary within

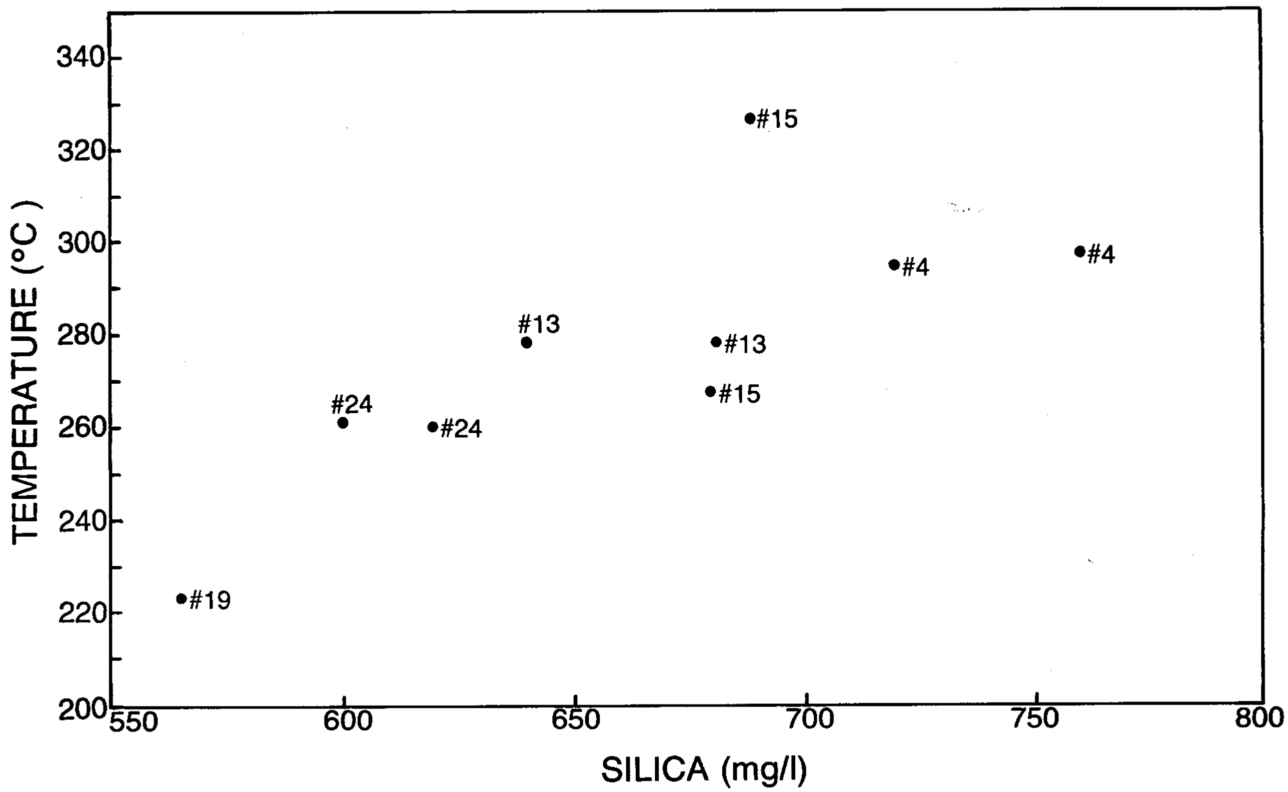


Fig. 7b.
Plot of SiO_2 vs. temperature, which was calculated using steam-enthalpy tables, for the Baca geothermal wells. Numbers represent the well from which the sample was taken.

the suite, but the waters can generally be divided into two groups: a high-temperature, high-SiO_2 group and a low-temperature, low-SiO_2 group (Fig. 7a). This relationship is, in part, a function of the increasing solubility of SiO_2 with increasing temperature.

Trace elements Zn, Cu, Cr, Co, and Ni show relatively high concentrations in acid waters that are also rich in Fe (Table B-III), a relationship probably due to the greater solubilities of these metals in acid waters.

The tritium contents of 2.1 and 2.3 T.U. in the mudpot and steam at the Men's Bathhouse indicate that the condensed steam originated from a deep source of relatively great age, greater than 50 years old. However, Footbath Spring and the Women's Bathhouse Spring appear to be mixtures of condensed steam and near-surface waters having an age between 20 and 30 years. The D and ^{18}O isotope ratios of the bubbling seep (sample VA-23, location no. 22, Fig. 2) of the unnamed acid spring (sample VA-14, location no. 21, Fig. 2) fall on the world meteoric line, the unnamed spring being more enriched in ^{18}O

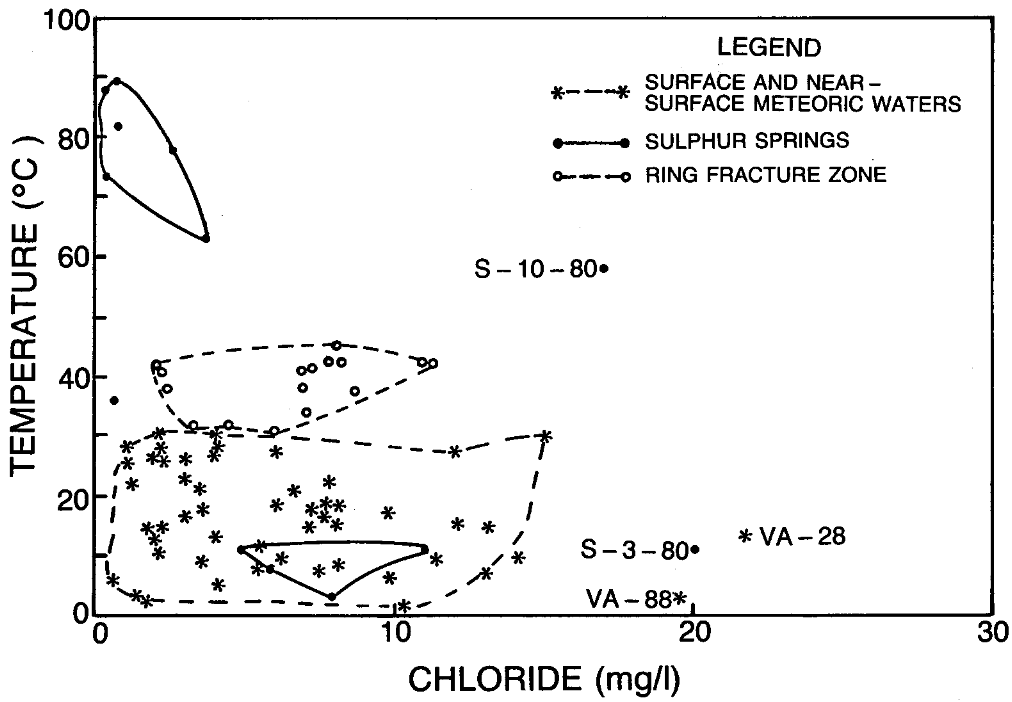


Fig. 8a.
Plot of Cl vs. measured temperature for meteoric waters and waters in the ring fracture zone and Sulphur Springs areas in the southern Jemez Mountains region, New Mexico. Sample numbers refer to waters that fall outside the fields of generalized water types.

and D (Fig. 13b). In contrast, the Men's Bathhouse mudpot consists mostly of condensed steam from depth and is very enriched in ^{18}O, probably the result of extensive surface evaporation.

The Sulphur Springs are typical of a vapor-dominated geothermal system (White et al. 1971) where water vapor, H_2S, and CO_2 rise from an underlying boiling water table. The known occurrence of a high-temperature (280°C) hydrothermal system beneath the resurgent dome of Valles Caldera (Goff et al. 1985) indicates that such a boiling water table may exist beneath Sulphur Springs. Condensation of the steam near the surface and surface oxidation of H_2S to H_2SO_4 results in acid-sulfate water. The flowing springs mix seasonally with surface meteoric water since they show lower flow rates and higher temperatures during the dry months of the year.

C. Valles Caldera-Ring Fracture Zone

The thermal meteoric waters of this zone consist of a group of warm springs in the western ring fracture zone, previously described by Goff and Grigsby (1982), Goff and Sayer (1980), and Trainer (1974). The waters are

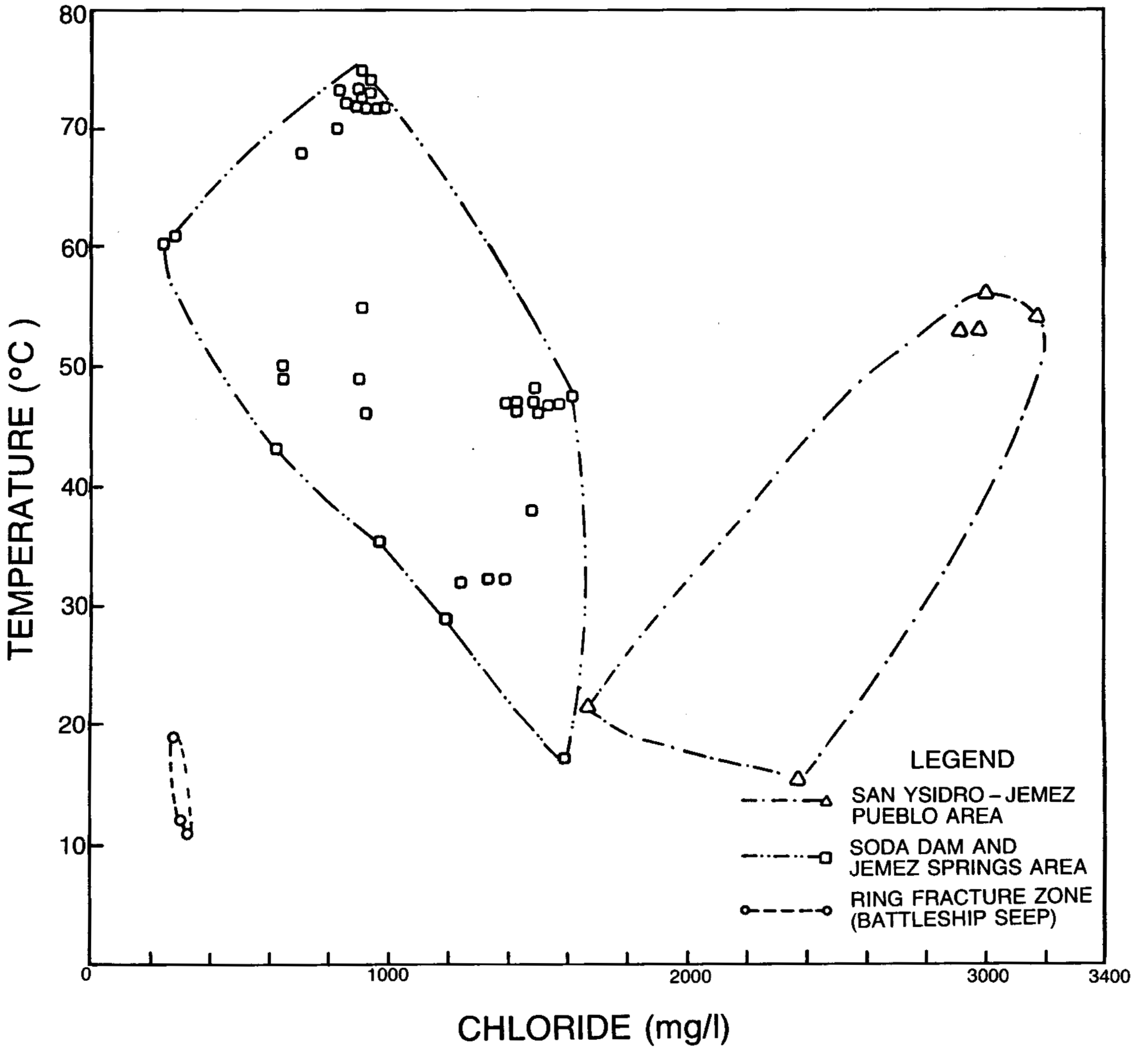


Fig. 8b.
Plot of Cl vs. temperature for waters in the San Ysidro and Soda Dam-Jemez Springs areas.

typically dilute, near neutral in pH, and moderate in temperature (31-45°C). They are sodium-bicarbonate waters displaying low concentrations of F, Cl, B, and Li (Figs. 8a, 9a, 10a, and 11a). The F, B, and Li contents are slightly higher than most of the surface waters in the caldera, and B and Li concentrations are both slightly enriched in samples with higher Cl. McCauley Spring differs from the others in that it contains more Ca and Mg and less alkalis. All samples show low concentrations of the trace elements analyzed (Table B-III). The D and ^{18}O isotopes fall close to the world meteoric line in a tight cluster (Fig. 13b). The generally low tritium content (0.2 to 2.3 T.U.), but low trace element content, of these waters indicates that they are

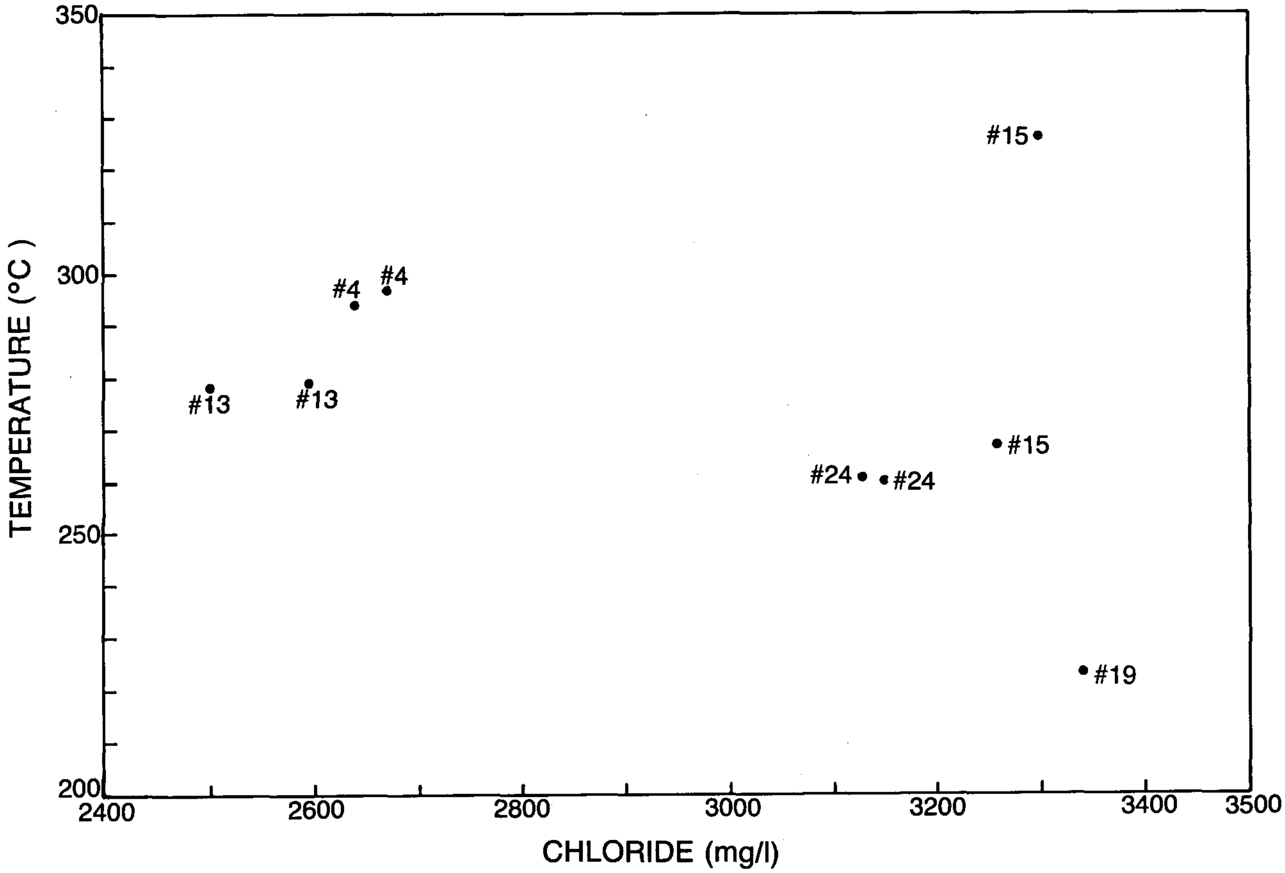


Fig. 8c.
Plot of Cl vs. temperature for the Baca geothermal wells. Temperatures were calculated using steam-enthalpy tables. Numbers refer to the well from which the sample was collected.

derived from relatively old groundwater circulating in the moat zone of the caldera.

These waters can be considered to be meteoric waters that have been heated during circulation in the ring fracture zone of the Valles Caldera. All waters of this type discharge near the youngest (less than 0.5 Myr) of the moat rhyolites erupted in the caldera. They are slightly depleted in Ca and Mg compared with surface waters in the caldera region because of the inverse relationship between carbonate solubility and temperature. Very slight mixing with deep thermal waters may have occurred in Spence, Little Spence, and possibly McCauley Hot Springs (location nos. 25 and 26, Fig. 2) because they have higher Li and Na than most of the meteoric waters in the Valles Caldera region.

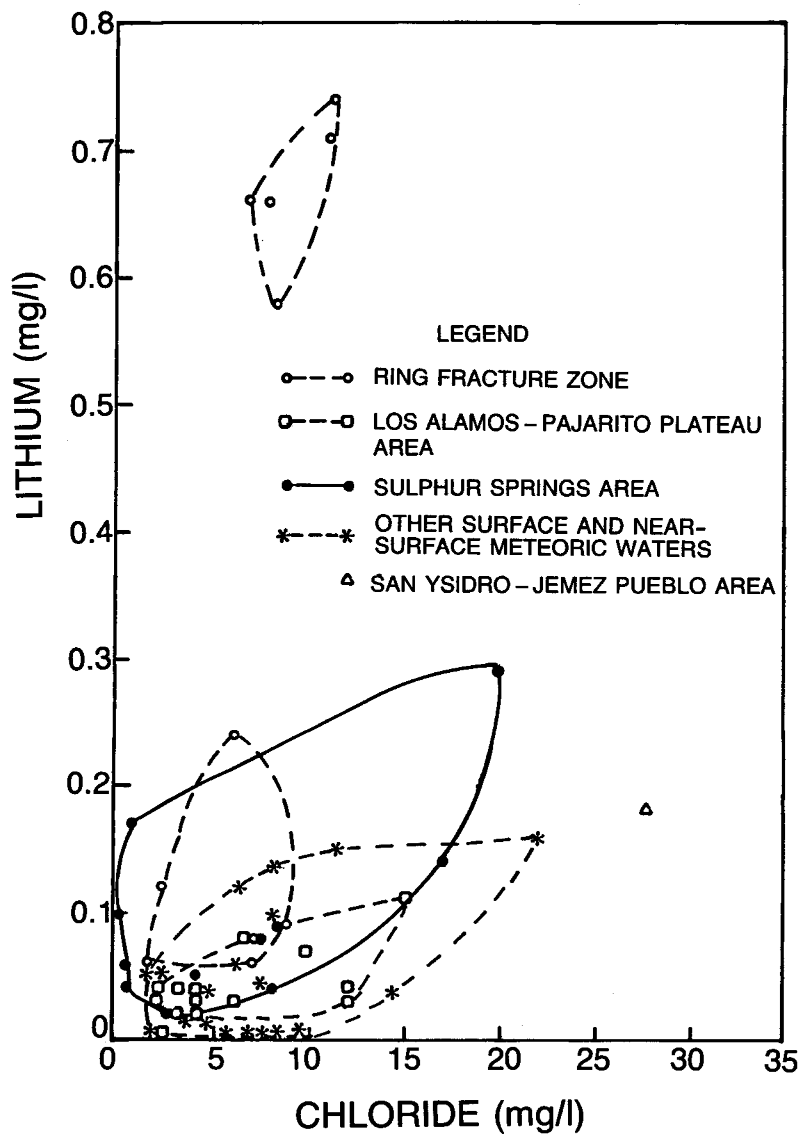


Fig. 9a.
Plot of Li vs. Cl for waters with Cl concentrations of less than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico.

D. Baca Geothermal Field

Several geothermal wells were drilled by Union Oil Company of California in the Redondo Creek area in the keystone graben of the resurgent dome. These wells, drilled on the Baca Location #1, intersect the deepest and highest temperature fluids encountered in the Valles Caldera area. The chemistry of these well waters has been discussed by White et al. (1984), Truesdell and Janik (1986), and White (1986).

The Baca well waters are high-temperature, near-neutral to slightly alkaline, sodium-chloride fluids; the highest temperature measured was

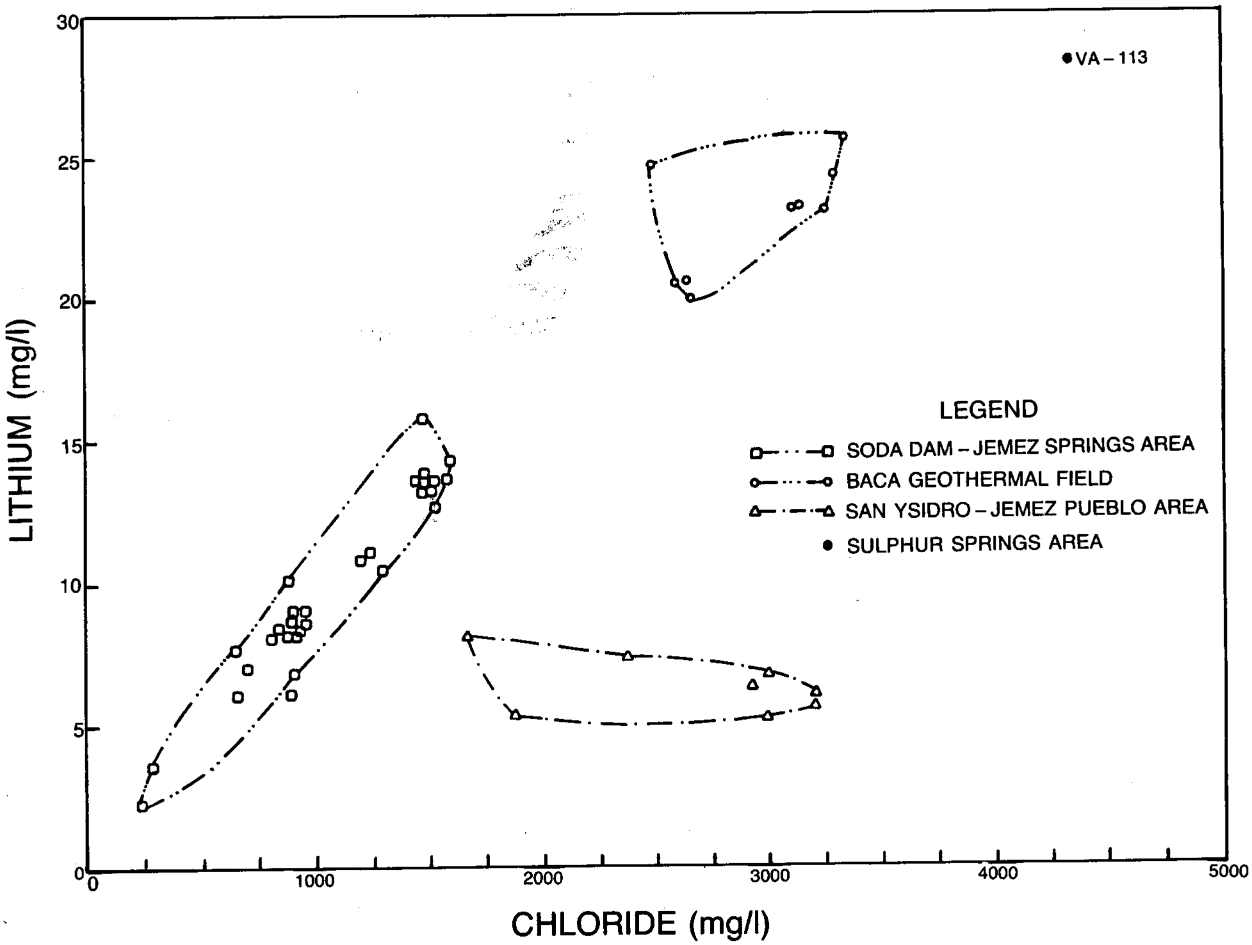


Fig. 9b.
Plot of Li vs. Cl for waters with Cl concentrations greater than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico. Sample VA-116, from the GRI well, plots out of the field of view. The sample number refers to waters that fall outside fields of generalized water types.

297°C at Baca well #4. They contain large amounts of B, Li, and SiO_2 and relatively low concentrations of HCO_3, Ca, and Mg (Figs. 7b, 8bc, 9b, and 10b, Table B-II). These concentrations are typical of fluids in equilibrium with intermediate to silicic volcanic reservoir rocks, such as Bandelier Tuff (White et al. 1984).

Other trace element concentrations are generally low; As is the notable exception. Up to 5 mg/ℓ of As has been detected in Baca Well #24 (Table B-III).

Tritium values of the Baca wells are all less than 1.1 T.U. (Table B-IV). This low value indicates that the wells tap a reservoir composed of waters older than 50 years.

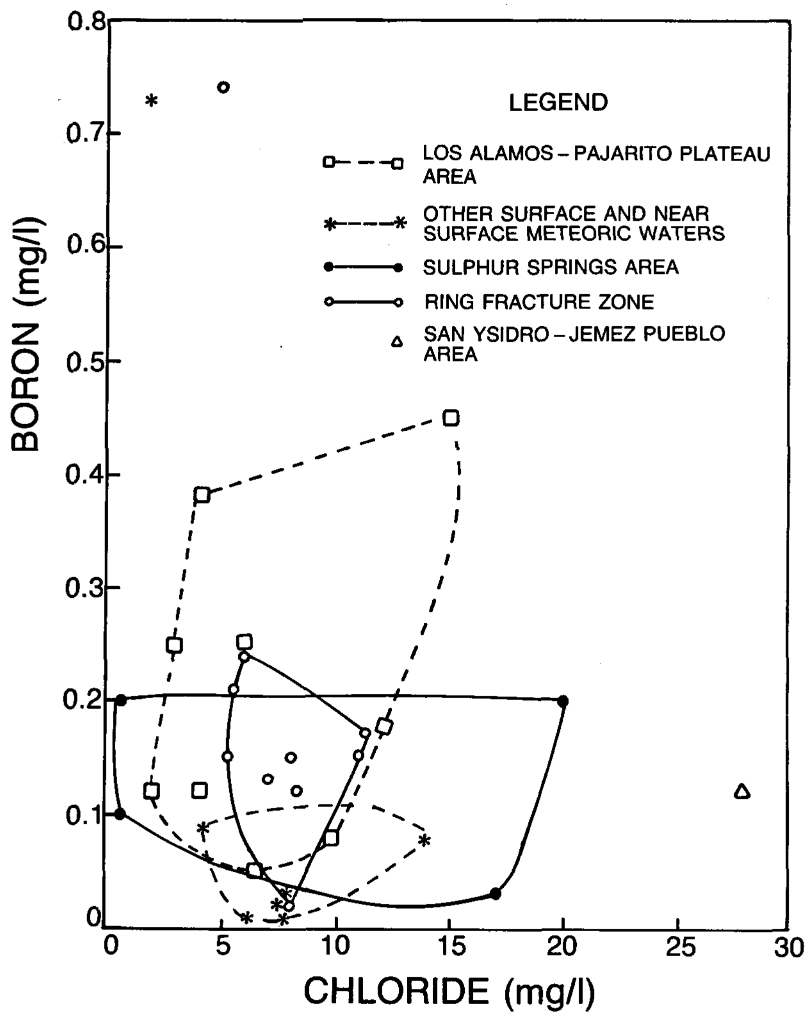


Fig. 10a.
Plot of B vs. Cl for waters with Cl concentrations less than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico.

Plots of δD and $\delta^{18}O$ of the Baca waters fall away from the world meteoric water line (Fig. 13b). These data show a distinct oxygen shift indicating an ^{18}O enrichment caused by high-temperature rock/water interaction.

E. Valles Caldera-Soda Dam and Jemez Springs Area

A number of deep thermal and derivative waters emerge as hot and warm springs along the trace of the Jemez fault zone in Cañon de San Diego. Springs at Soda Dam (Fig. 4) and springs near the village of Jemez Springs (Fig. 5) are included in this area. The Jemez fault zone extends southwest and south from the caldera for about 20 km. It was active before eruption of the Jemez Mountains volcanic field (Goff et al. 1981) and locally represents

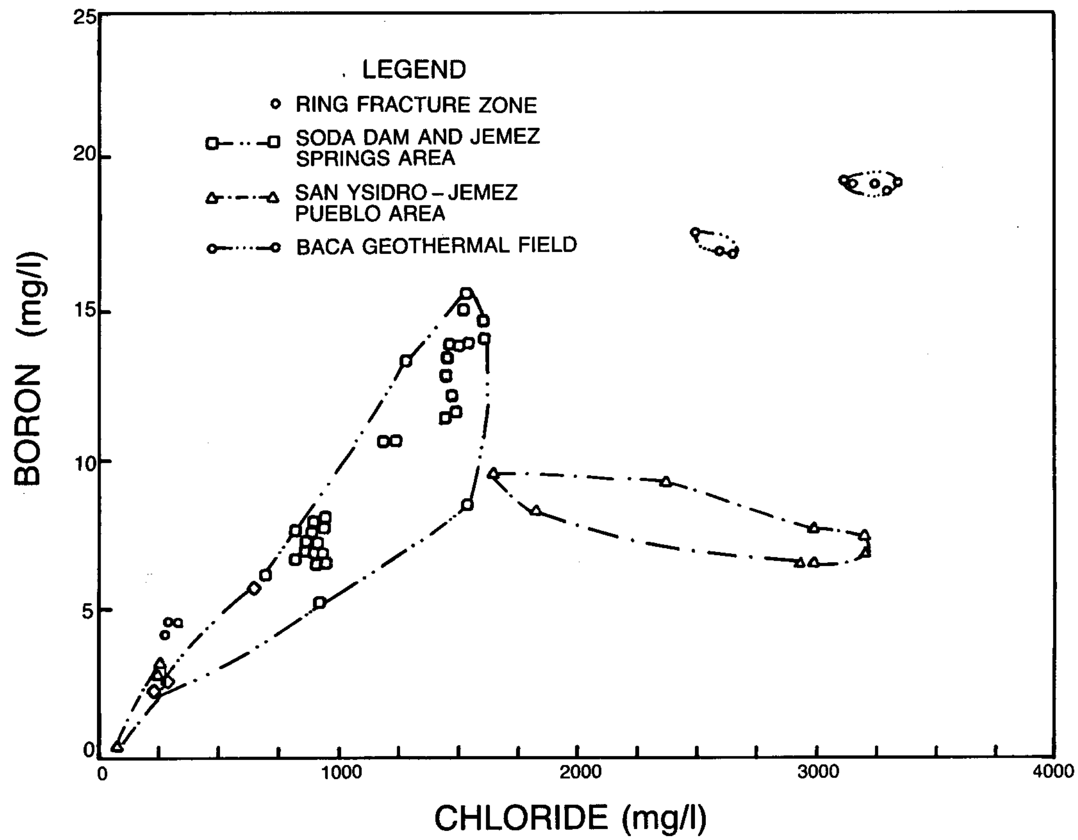


Fig. 10b.
Plot of B vs. Cl for water with Cl concentrations greater than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico.

the western boundary of the Rio Grande rift. The hot springs occur at intersections of the Jemez River with the fault and fracture zones. Chemical compositions and origin of these mineralized springs have been discussed by Goff et al. (1981), Trainer (1974), and in part by Goff and Grigsby (1982) and Goff and Sayer (1980). Soda Dam, Travertine Mound Spring, and some others are actively depositing carbonate travertine, and over 1 km^2 of ancient travertine overlies the bluff above Soda Dam on the western side of the Jemez River.

The springs display fairly high conductivity and are neutral to slightly acid sodium-chloride to calcium-bicarbonate waters. The Cl and Ca concentrations show a slight inverse relationship suggesting a mixing of deep thermal water and surface meteoric water. They contain moderate F and high Li and B concentrations with a marked trend of increasing B and Li with increasing Cl (Figs. 9b, 10b, and 11b).

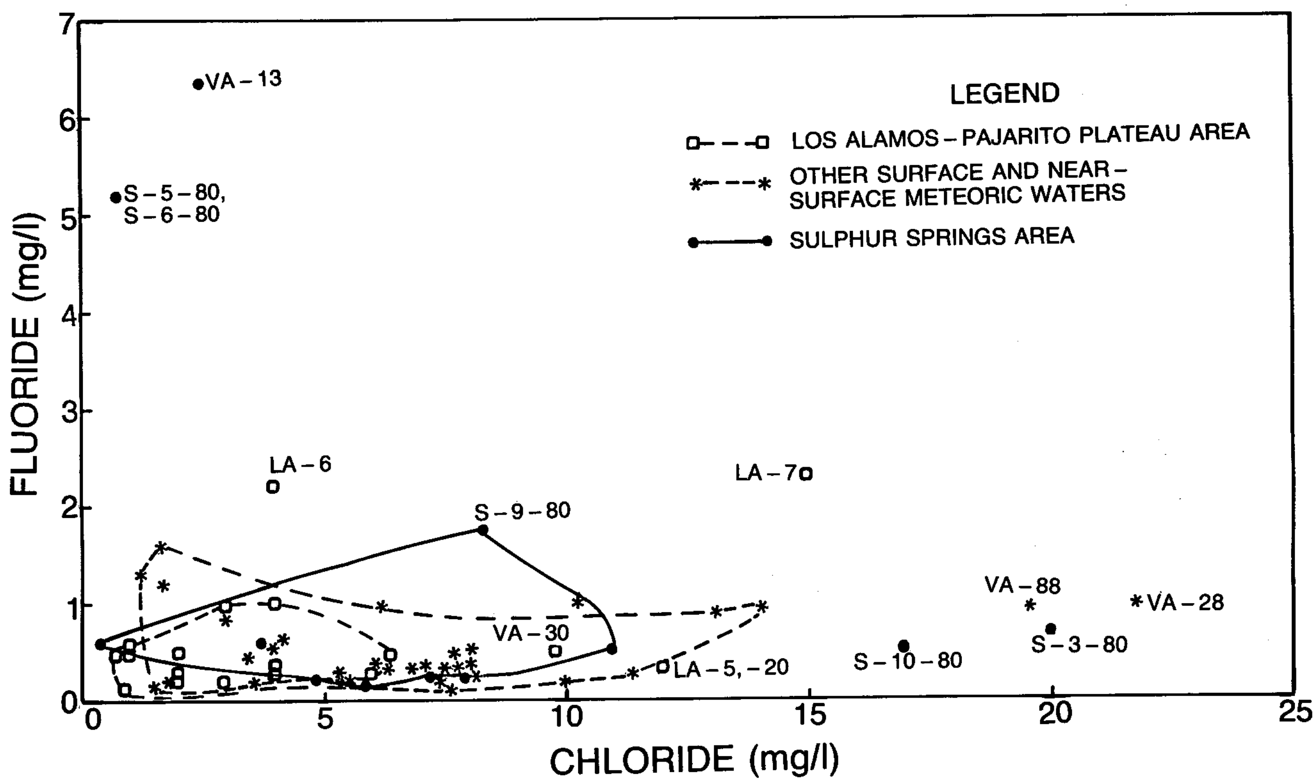


Fig. 11a.
Plot of F vs. Cl for thermal and nonthermal waters in the southern Jemez Mountains region, New Mexico. Sample numbers refer to waters that fall outside fields of generalized water types.

Strontium is a noteworthy minor element in these waters, ranging from 0.4 to 2 mg/ℓ (Table B-III). There is an approximate trend of increasing Sr with increasing Ca. The waters have probably derived most of their Ca and HCO_3 by flowing through fractured Paleozoic carbonate rocks, which are probably the main source of Sr. Arsenic is also enriched in these waters.

The D and ^{18}O isotopes fall away from the meteoric line of Craig (1961), showing a distinct trend of ^{18}O enrichment (Fig. 13b). Water from Travertine Mound Spring and from the well near the main Jemez Spring is isotopically most similar to meteoric water, and the main Jemez and Soda Dam Springs show the most relative enrichment in ^{18}O.

The tritium content of the springs is generally less than 7 T.U. and often less than 2 T.U., which implies a relatively old source water for the springs. The exception is at Buddhist Spring, which has a tritium content of 10 T.U. This higher tritium value is clearly the result of thermal water mixing with

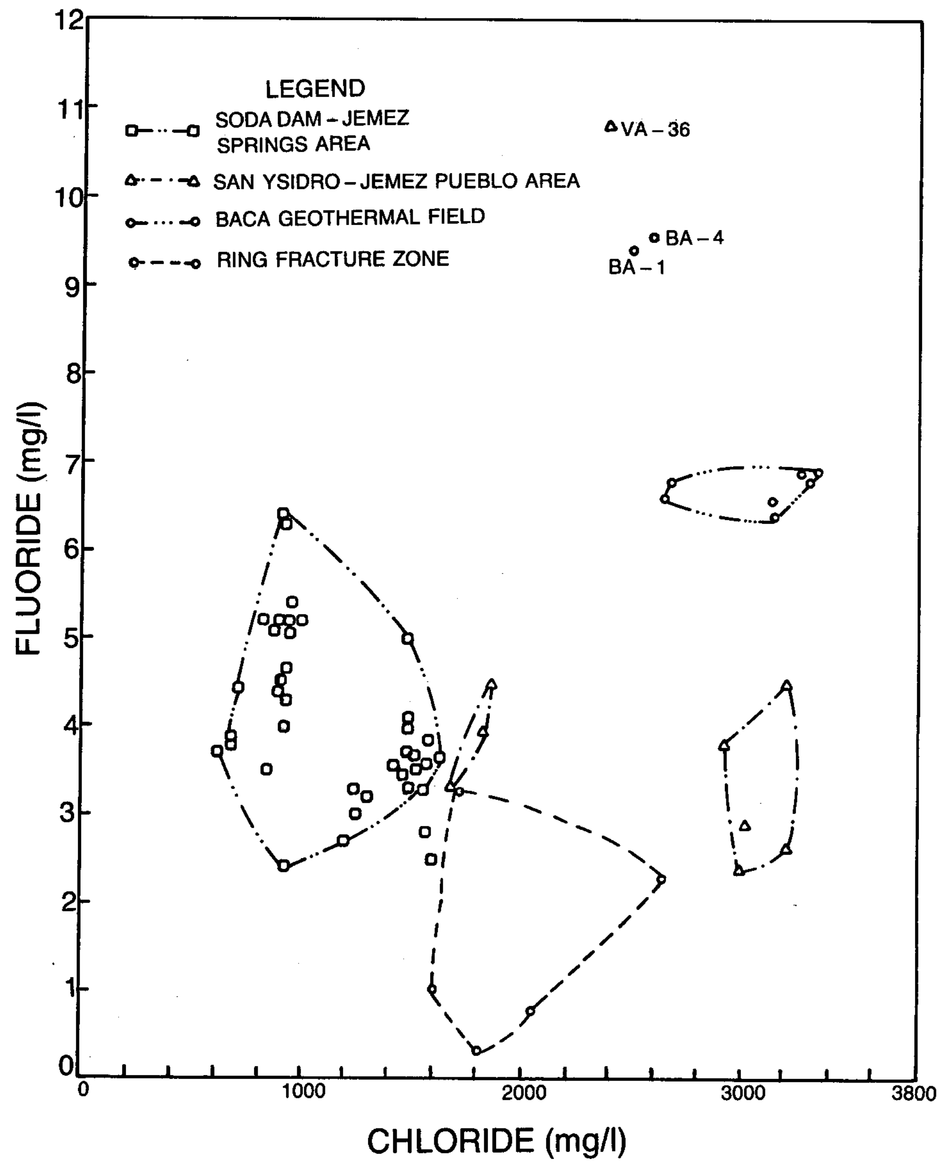


Fig. 11b.
Plot of F vs. Cl for high-chloride thermal waters in the southern Jemez Mountains region, New Mexico. Sample numbers refer to waters that fall outside fields of generalized water types.

younger near-surface and surface waters, and water from the nearby Jemez River is a likely contributor to the high tritium values of Buddhist Spring.

These thermal waters are probably derivatives of the deep geothermal fluids beneath Valles Caldera, which are almost pure NaCl waters (Trainer 1974, Goff et al. 1981). Mixing of this hot NaCl water with calcium-bicarbonate meteoric water has cooled it down and diluted it. This mixed water dissolves $CaCO_3$ while flowing southwest through shattered Paleozoic

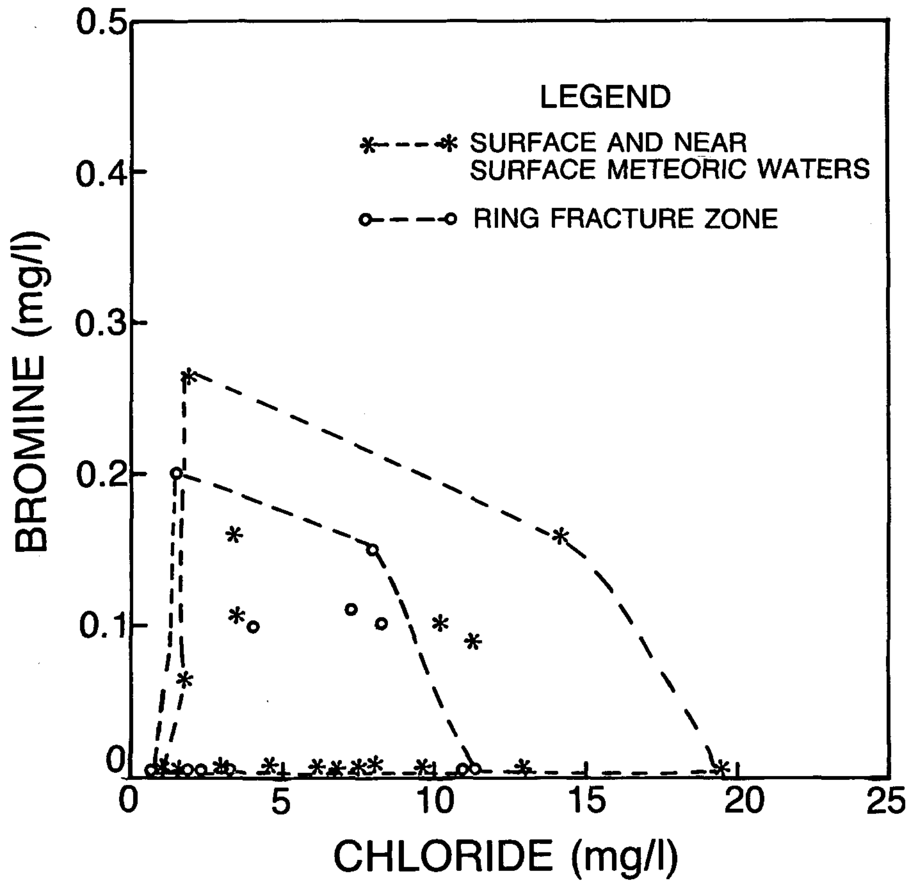


Fig 12a.
Plot of Br vs. Cl for waters with Cl concentrations less than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico. The only Br analyses available for low-Cl waters are from the ring fracture zone and surface and near-surface meteoric waters.

sediments along the Jemez fault zone, giving rise to the higher Ca and HCO_3 contents observed in the springs. This mixing is supported by oxygen isotopes, since the deep geothermal water from Valles Caldera is much more enriched in ^{18}O relative to meteoric water (Goff and Grigsby 1982, Vuataz and Goff 1986).

F. San Ysidro-Jemez Pueblo Area

A number of warm springs and hot and cold water wells including mineral and nonmineral waters were sampled in the San Ysidro-Jemez Pueblo area. Many of the samples were collected for isotope analysis up to two years before they were collected for chemical analysis. The chemistry of the waters in this

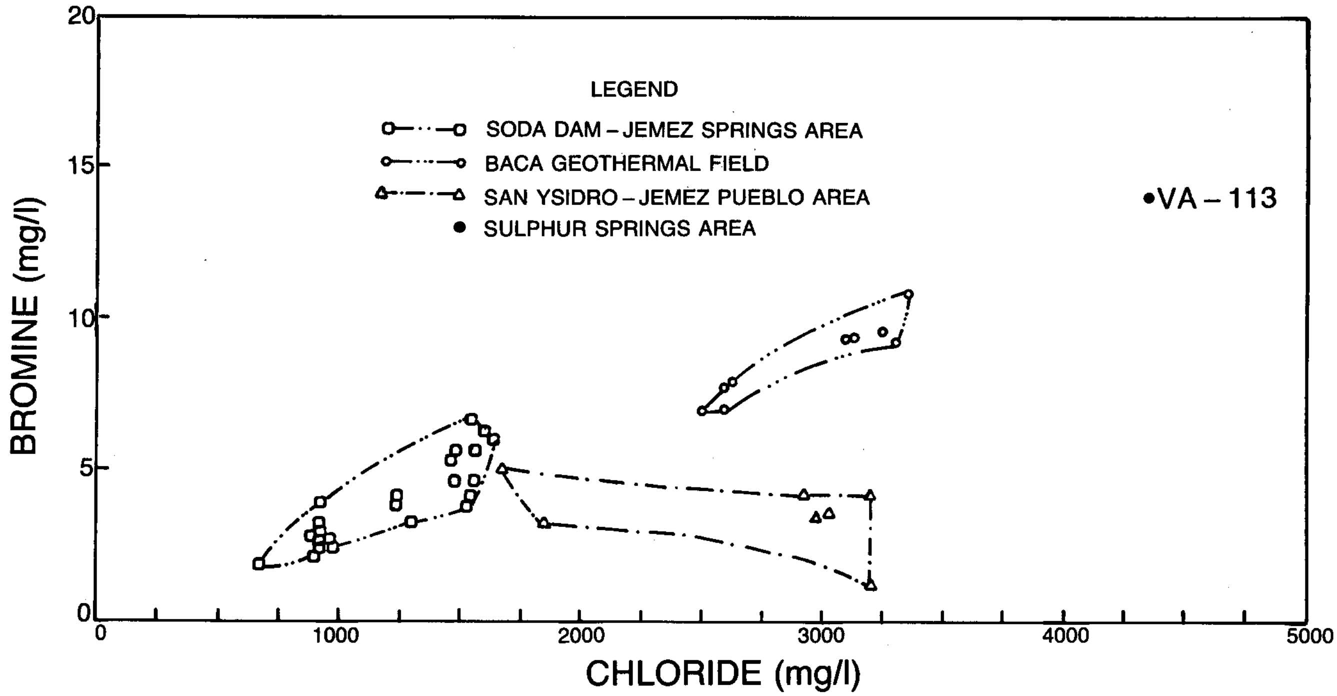


Fig. 12b.
Plot of Br vs. Cl for waters with Cl concentrations greater than 50 mg/ℓ in the southern Jemez Mountains region, New Mexico. Sample number refers to waters that fall outside fields of generalized water types. Sample VA-116, from the GRI well, plots out of the field of view.

area has been discussed by Goff et al. (1981), Goff and Sayer (1980), Mariner et al. (1977), Trainer (1974, 1975), and Vuataz and Goff (1986).

The waters are low to moderate temperature, near neutral, concentrated (except for dilute surface water) sodium chloride to sodium sulfate. They contain much more SO_4, Na, and Cl than do the thermal waters discharging along the Jemez fault zone (Table B-II), except for Owl Spring, which resembles surface meteoric calcium-bicarbonate water. The concentrated waters have very high Cl and moderate to high F, B, and Li contents (Figs. 8b, 9a, 10a, and 11b). Silica contents are much lower than are most other waters described in this report, although concentrations of silica increase with temperature (Fig. 7a).

Trace element concentrations are low except for Sr, which increases with Ca concentration (Table B-III). Strontium contents are much higher in this area than in waters from the Jemez fault zone, which have comparable Ca.

Most of the SO_4 in these waters may be derived from massive gypsum deposits (Jurassic Todilto Formation) near San Ysidro. Most of the springs issue from pre-Jurassic sediments, so the SO_4 is probably derived both from

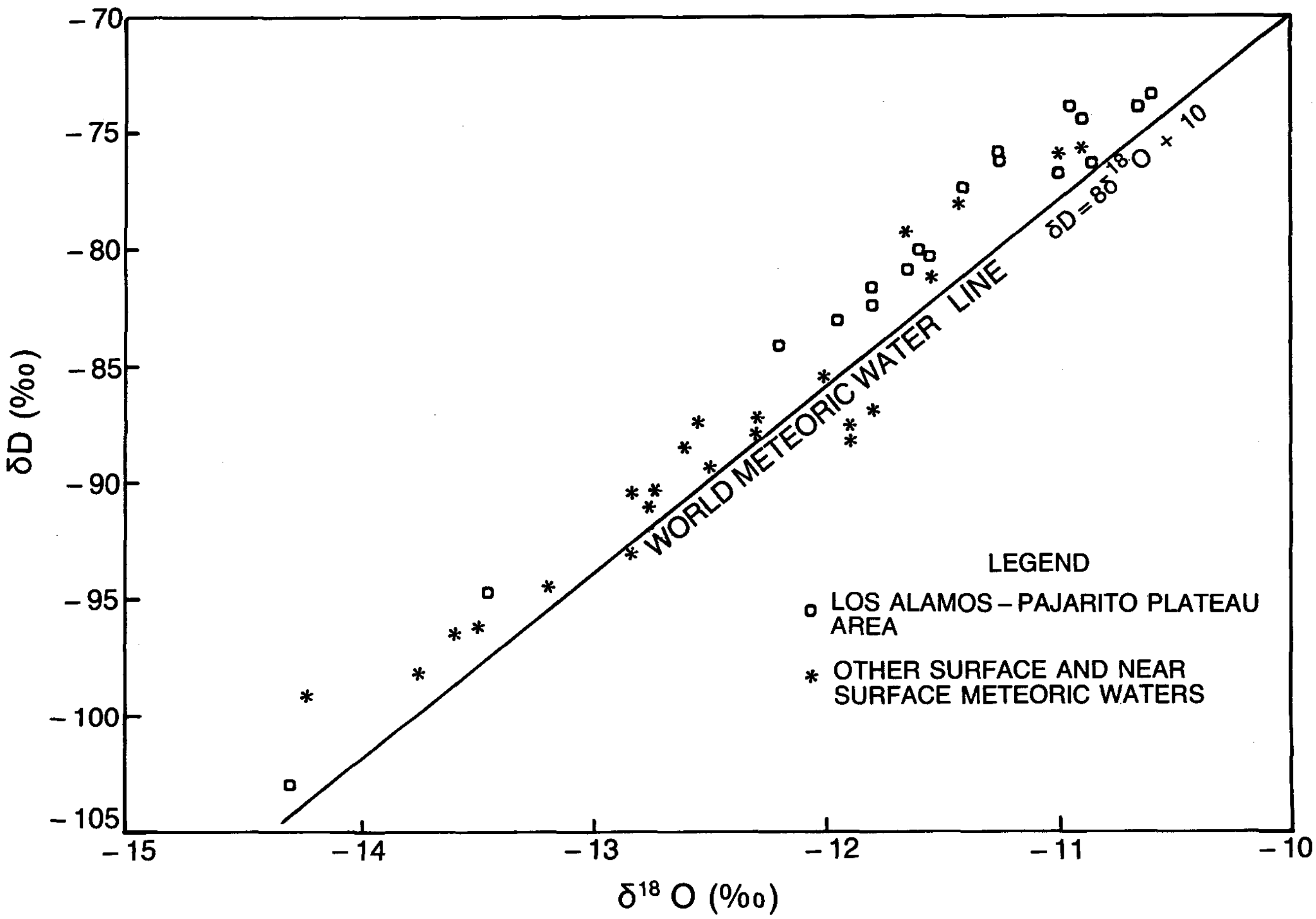


Fig. 13a.
Plot of δD vs. $\delta^{18}O$ for surface and near-surface meteoric waters in the Jemez Mountains and Los Alamos-Pajarito Plateau areas.

pore fluids in the rocks and from downward percolating groundwater. If we assume that Ca is also derived in part from gypsum, the higher Sr/Ca in these waters compared with the Jemez and Soda Dam Springs may result from greater leaching of Sr from gypsum than from carbonate.

Several chemical features make these waters distinct from the waters derived from the deep geothermal system in the Valles Caldera (Goff et al. 1981). The ratios Na/Cl and B/Cl in the Jemez Springs waters are 1.3-1.9 and 0.008-0.009, respectively, whereas the same ratios in the San Ysidro waters are 0.8-1.2 and 0.002-0.005, respectively. Li/Na ratios in waters from the Jemez Springs area are in the range 0.012-0.019 compared with 0.002-0.005 for waters from the San Ysidro region. Finally, the isotopic enrichment of ^{18}O in San Ysidro waters follows a parallel but different trend (Fig. 13b) than do deep caldera waters. The tritium values obtained for San Ysidro Springs and

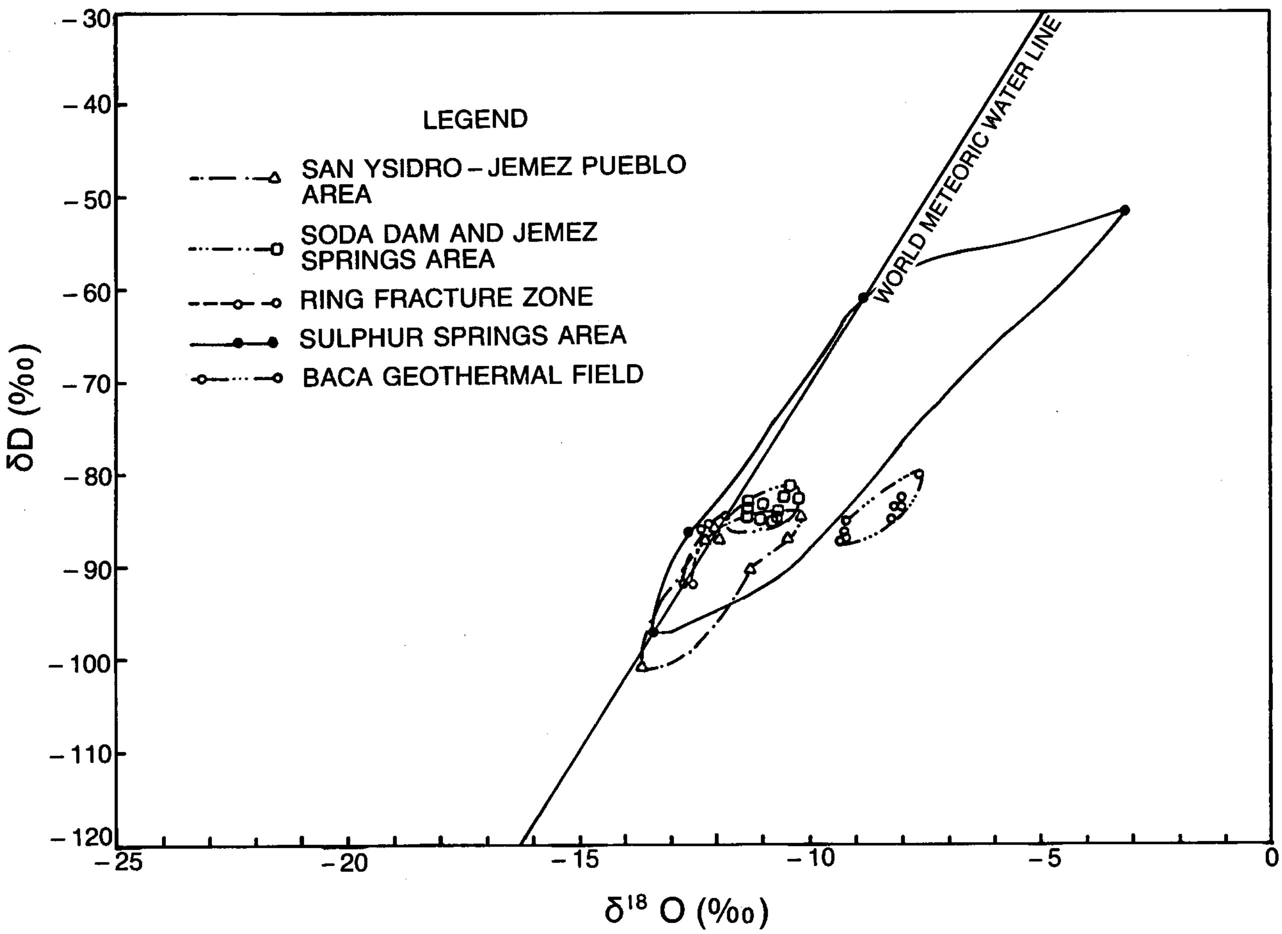


Fig. 13b.
Plot of δD vs. $\delta^{18}O$ for various types of water in the southern Jemez Mountains region, New Mexico.

the Zia hot well are 0.40 T.U. and 0.05 T.U., respectively. These waters are therefore very old, much greater than 50 years old. All these data indicate that the San Ysidro waters originate from a separate low-temperature geothermal system near the Nacimiento fault zone rather than from the one located beneath Valles Caldera.

V. SUMMARY

The geologic, chemical, and isotopic data presented here are sufficient to characterize the different thermal and nonthermal waters of the Valles Caldera-southern Jemez Mountains region. Further interpretations are beyond the scope of this report. However, the authors feel these data can be applied to the solution of other hydrologic and geochemical problems of the region.

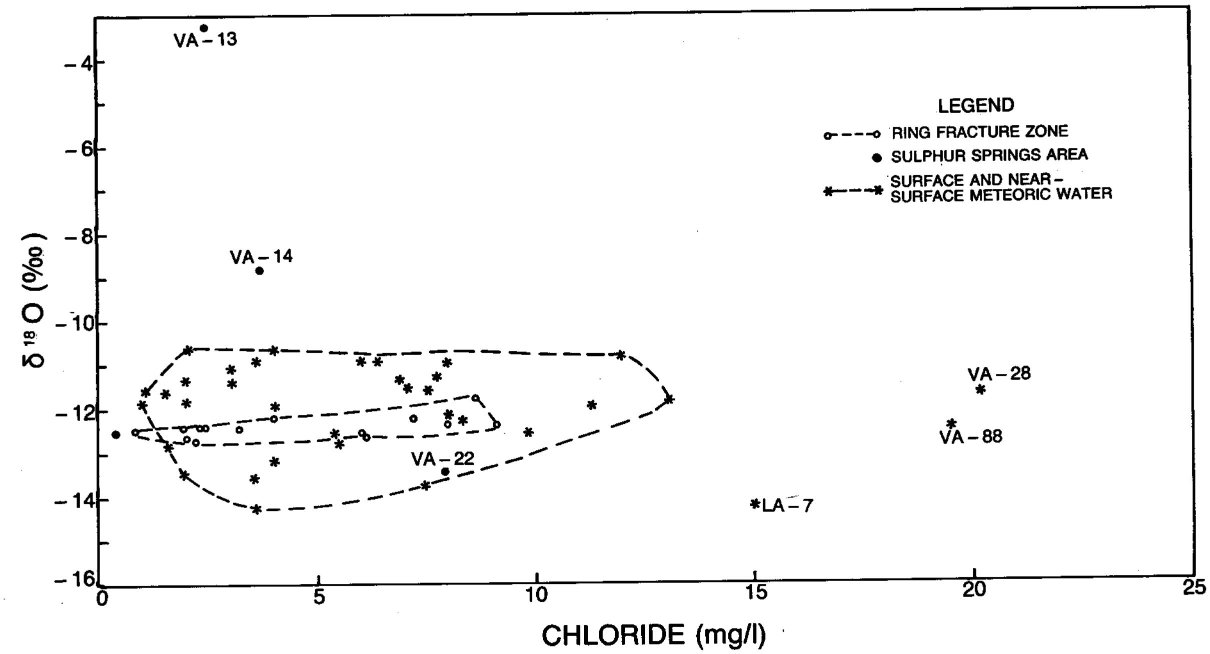


Fig. 14a.
Plot of $\delta^{18}O$ vs. Cl for low-chloride waters in the southern Jemez Mountains region, New Mexico. Sample numbers refer to waters that fall outside fields of generalized water types.

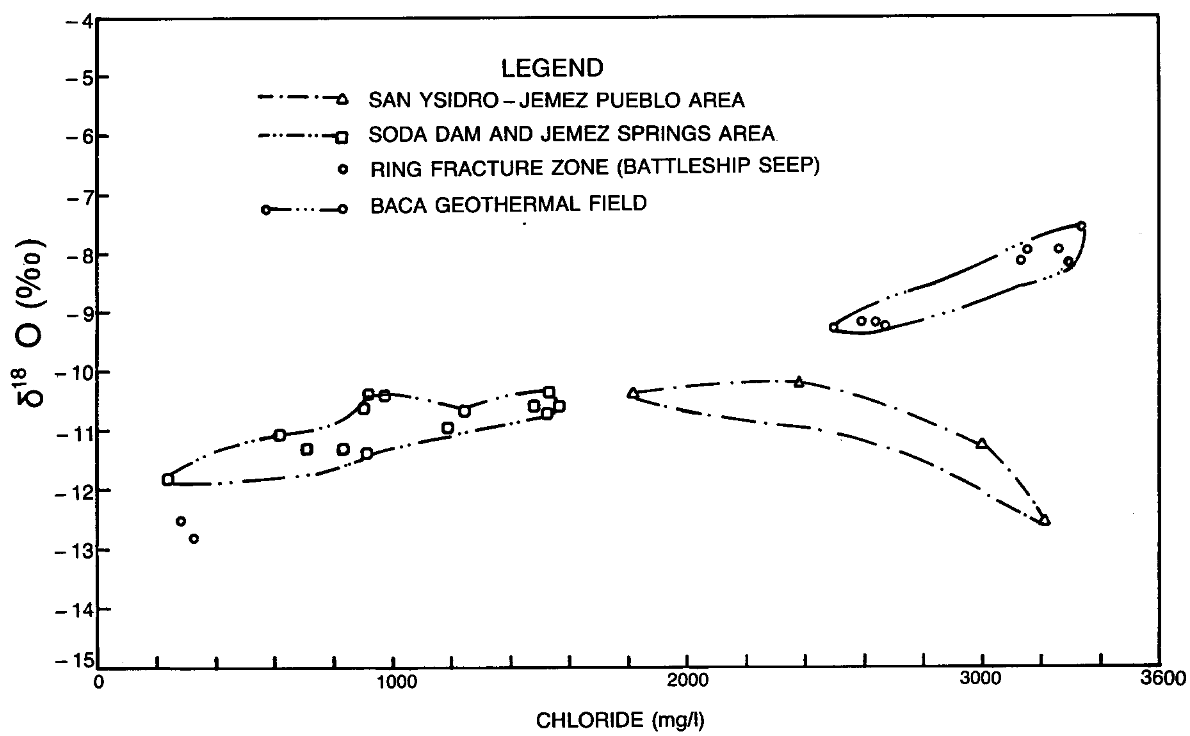


Fig. 14b.
Plot of $\delta^{18}O$ vs. Cl for high-chloride thermal waters in the southern Jemez Mountains region, New Mexico.

Perhaps, the most interesting problem would be to determine the age, geochemical evolution, and hydrologic balance of the high-temperature geothermal system within Valles Caldera.

ACKNOWLEDGMENTS

Many people at Los Alamos have contributed to the collection and analysis of waters listed in this report: Ron Aguilar, Kevin Ferdinand, Jamie Gardner, Chuck Grigsby, Kim Kariya, Tino Lucero, Dave Mann, Tamie McCormick, Suzanne Sayer, Bruce Stewart, and Rosemary Vidale. The previous work of Frank Trainer and Bill Purtymun is gratefully acknowledged. This work was supported by the US Department of Energy, Office of Basic Energy Sciences.

APPENDIX A

UNUSUAL SPRINGS OF VALLES CALDERA AND SOUTHERN JEMEZ MOUNTAINS, NEW MEXICO

I. SULPHUR SPRINGS, VALLES CALDERA

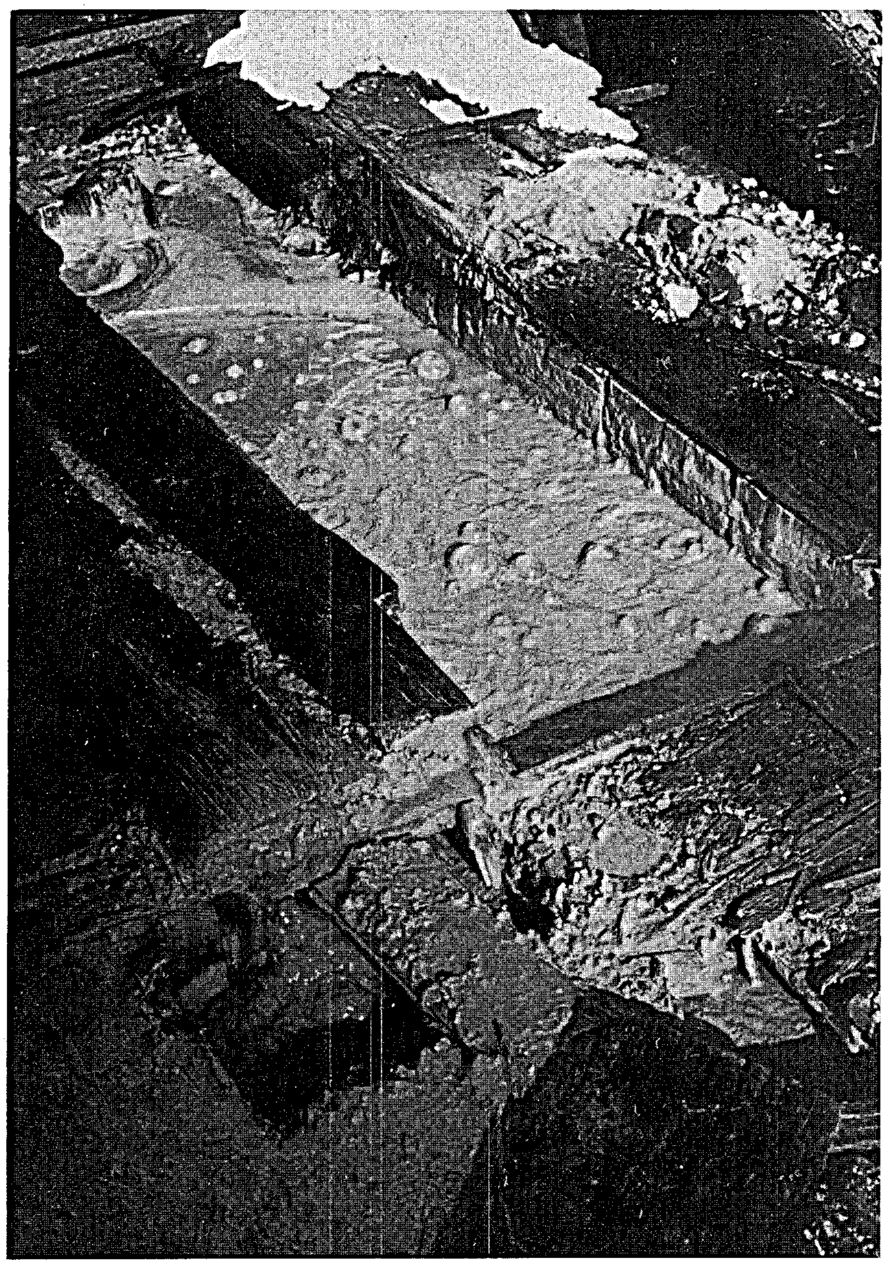


Fig. A-1.
Men's Bathhouse Mudpot in January 1979; pH ≈ 2.0; temperature ≈ 80°C. The bathhouse, which is now collapsed, once held several concrete pools of muddy acid-sulfate water at various temperatures suitable for bathing. The mudpot is on a small knoll from which several fumaroles, 93°C, discharge sulfurous gases.

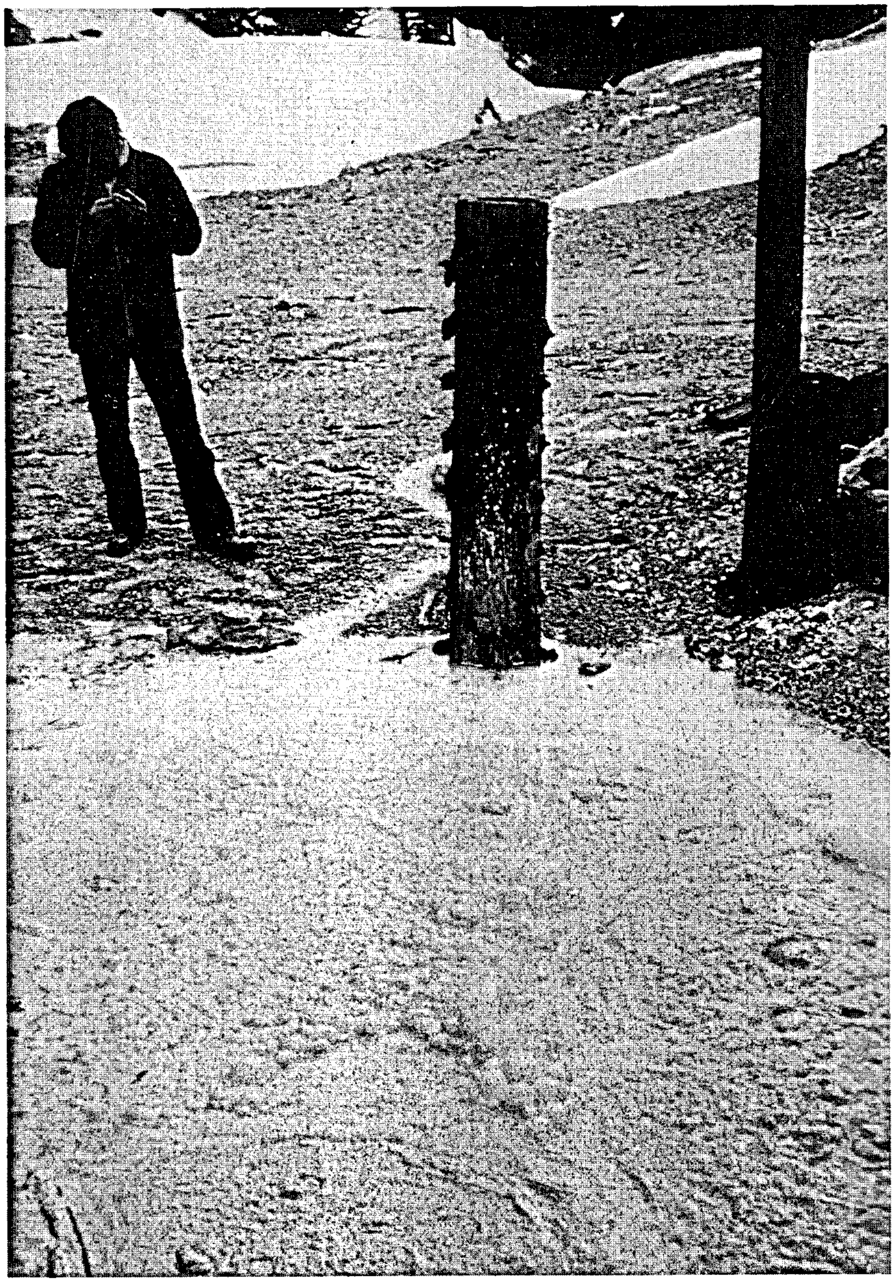


Fig. A-2.
Footbath Spring in March 1980; pH ≈ 1.0; temperature is highly variable. The pale yellow color of the suspended mud is due to colloidal sulfur.

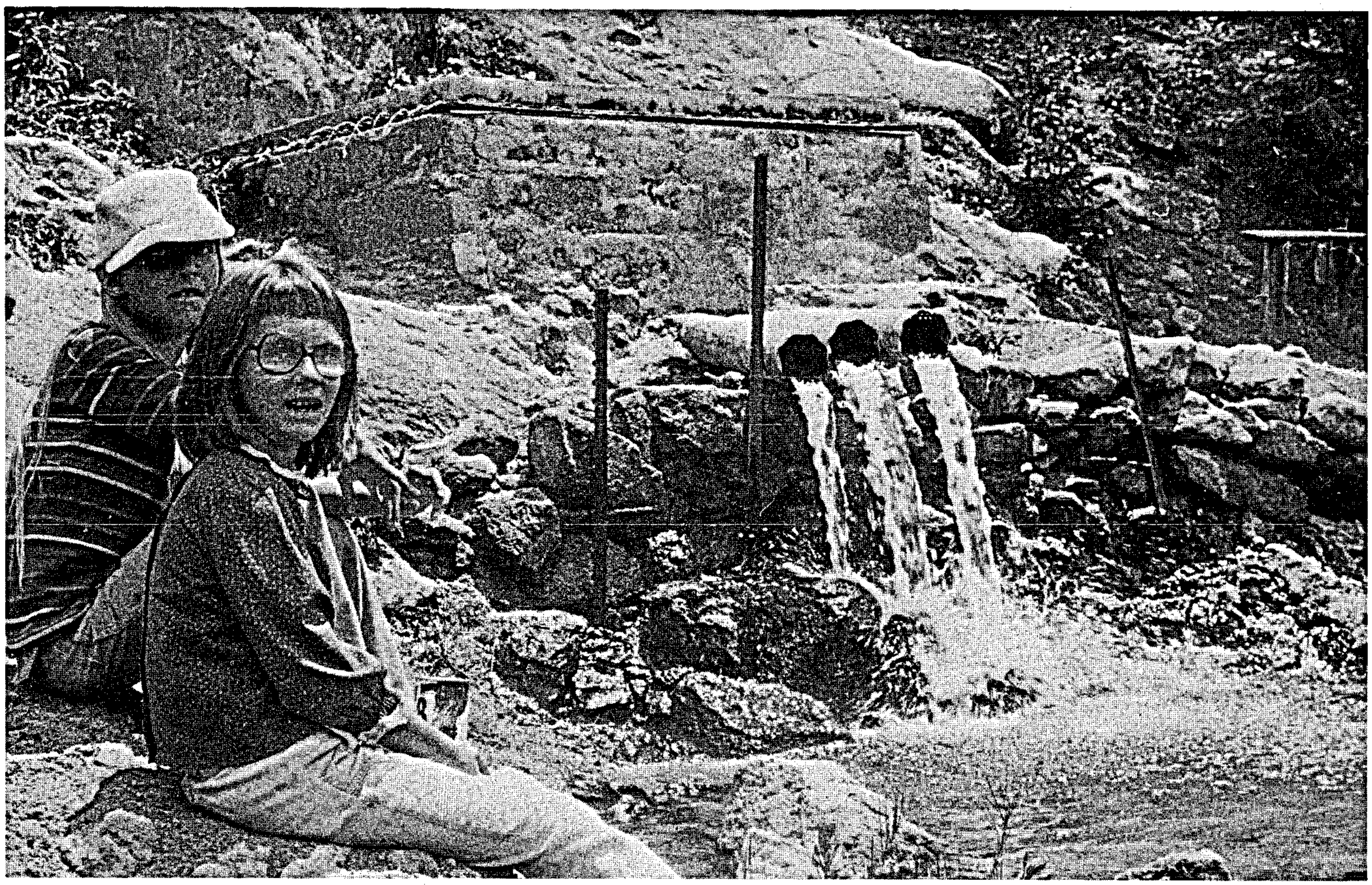


Fig. A-3.
San Antonio Hot Spring in July 1978; pH ≈ 7; temperature = 42°C. Spring discharges from concrete crib on fractured rhyolite about 60 m above San Antonio Creek, a favorite destination of cross-country skiers.

Fig. A-4.
McCauley Spring in July 1978; pH ≈ 6.5; temperature = 31°C. Visitors have built a rock swimming pool about 30 m wide and 1 m deep adjacent to the spring orifice. They have also stocked it with tropical freshwater fish.

III. JEMEZ FAULT ZONE, 10 km SOUTHWEST OF VALLES CALDERA

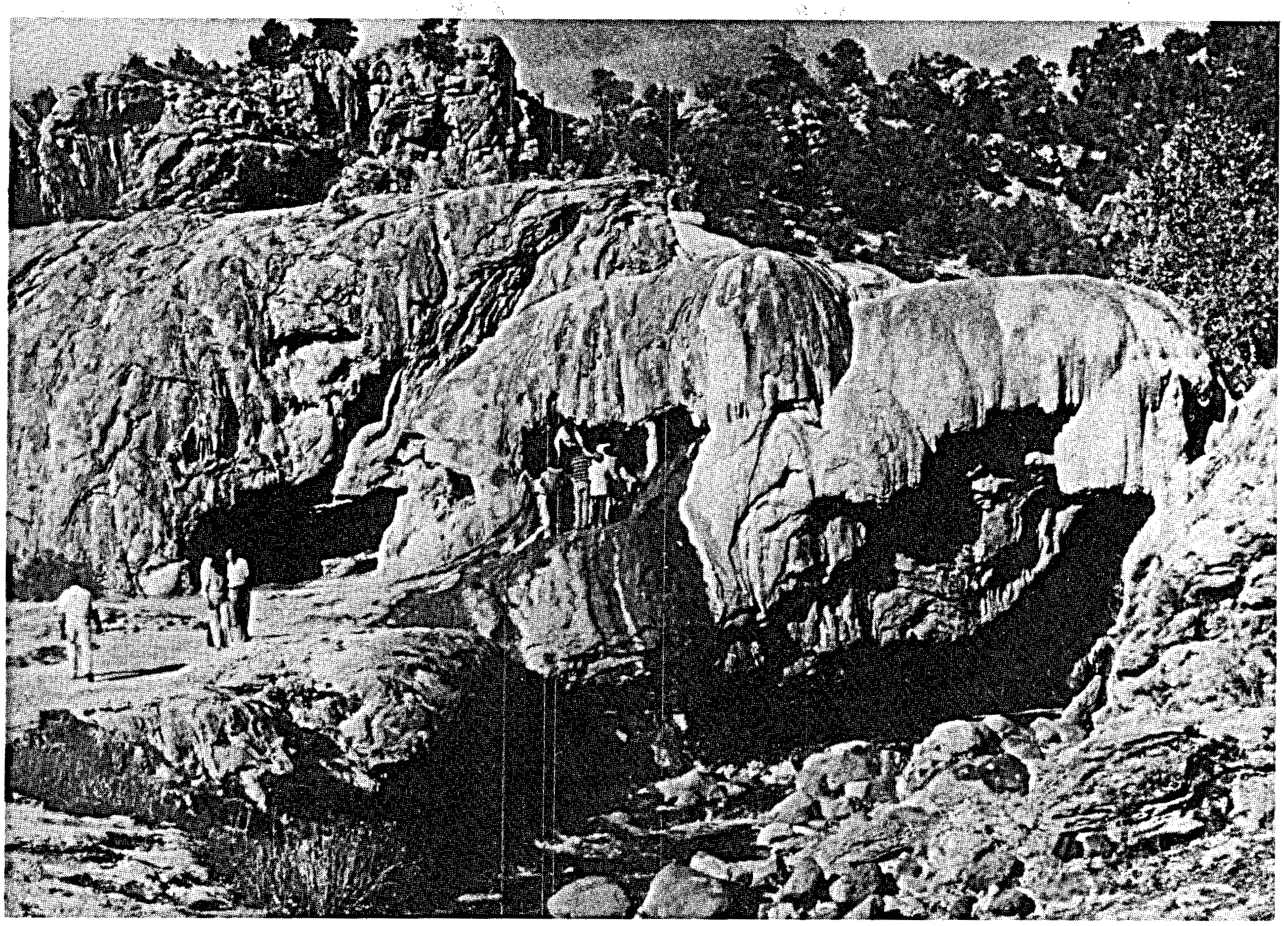


Fig. A-5.
Soda Dam looking north, April 1980. The dam is built of carbonate travertine deposited by bicarbonated hot springs, but construction of the present State Highway 4 (just to the left of the photograph) ruined the spring system. The existing dam is now disintegrating. The Jemez River has undercut the dam on the right of the photograph. Sightseers are standing at the entrance of Grotto Spring.

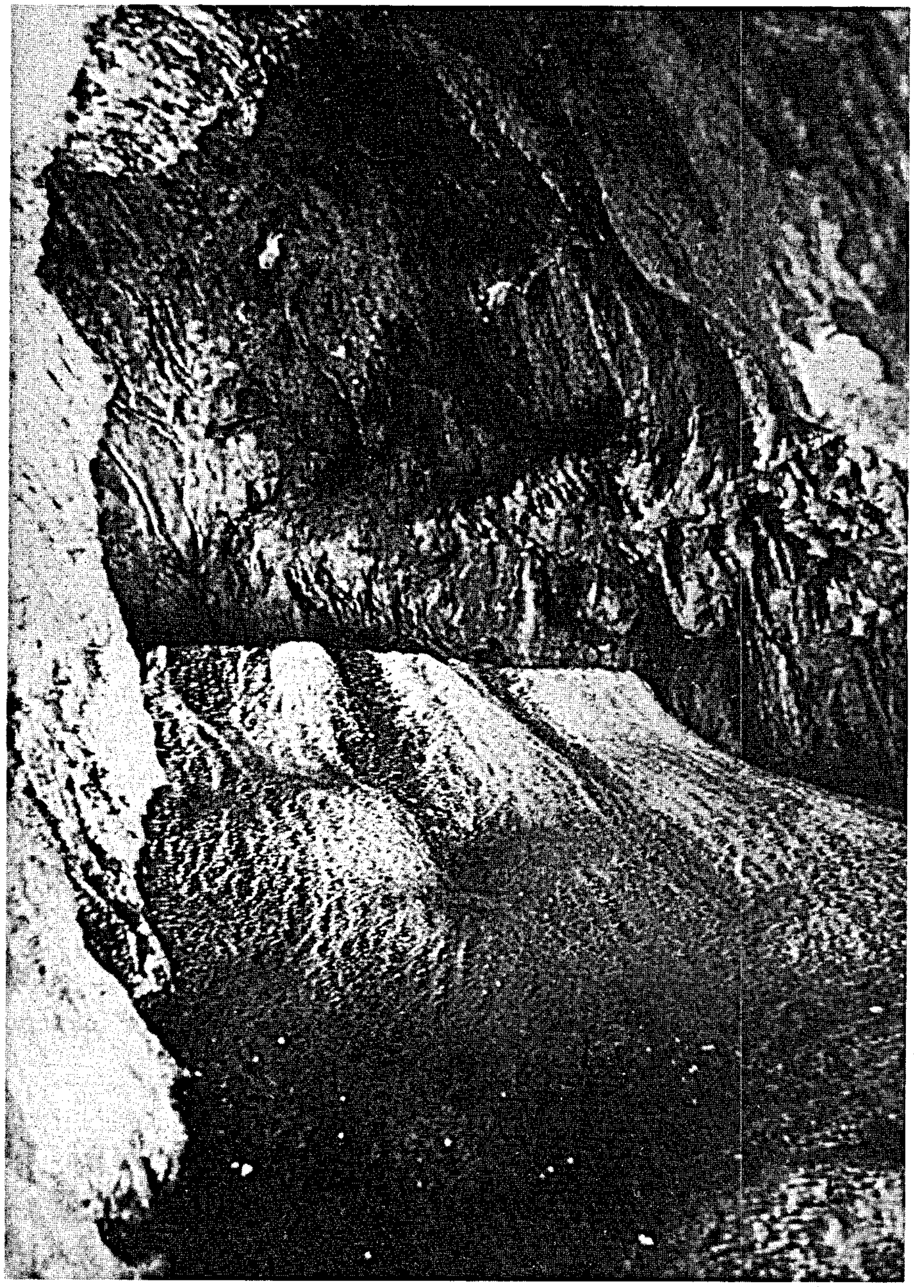


Fig. A-6.
Grotto Spring in October 1980; pH ≈ 7; temperature = 38°C. This spring discharges from the cave in Soda Dam shown on the previous page. Although cooler in temperature, Grotto Spring has chemistry identical to that of Soda Dam Spring.

Fig. A-7.
The main spring at Soda Dam in October 1980; pH ≈ 6.3; temperature = 47°C. Spring issues from a shear zone separating granite from vertically faulted sandstone along the edge of State Highway 4.

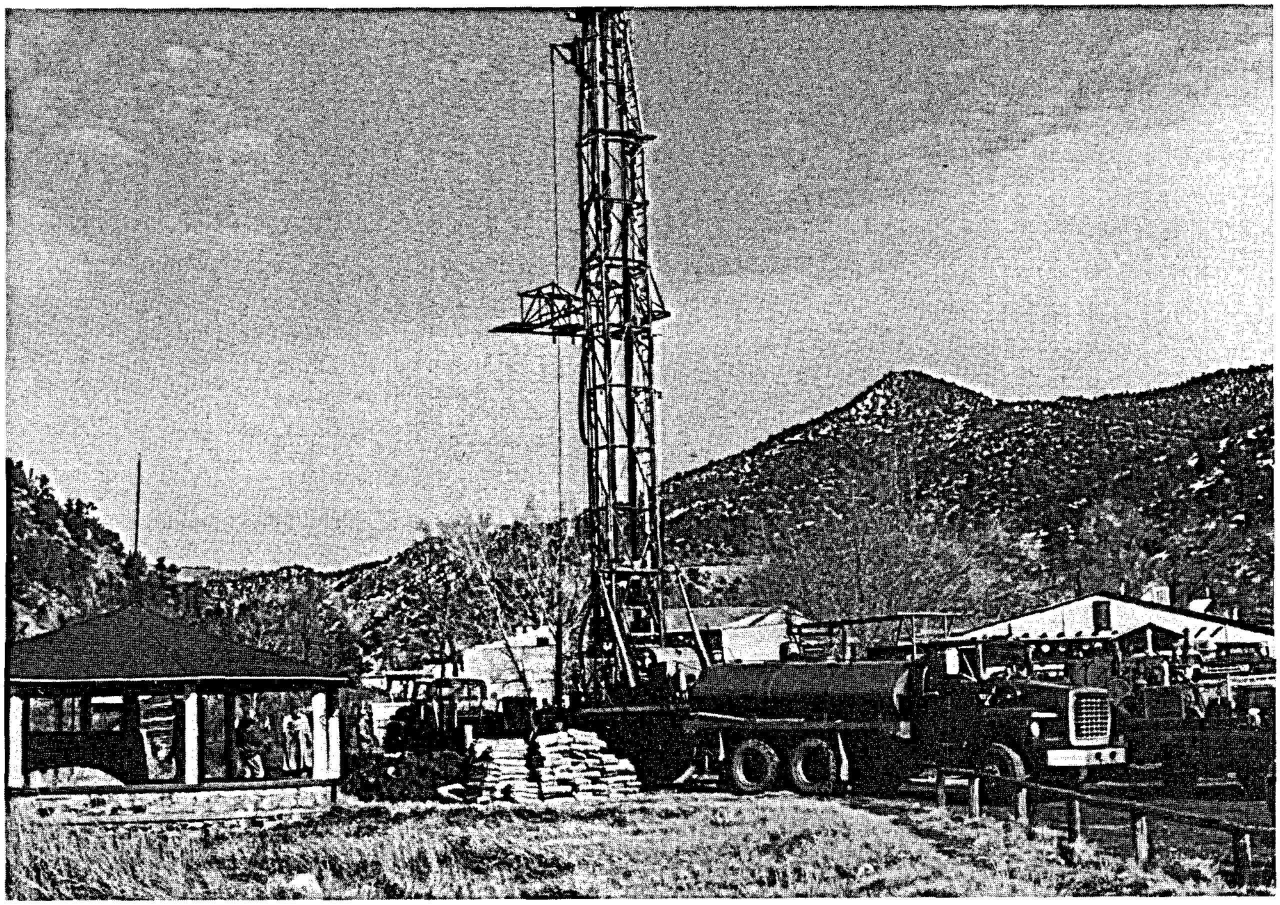


Fig. A-8.
Main Jemez Springs during drilling of Jemez Springs Geothermal Well, January 1979. The gazebo covers the main spring, really an old shallow well, that supplies water to the bathhouse (behind photographer). The geothermal well struck hottest water, 72°C, at 24-m depth, although total depth attained was 255 m. The hot water from this well is currently being used for space heating.

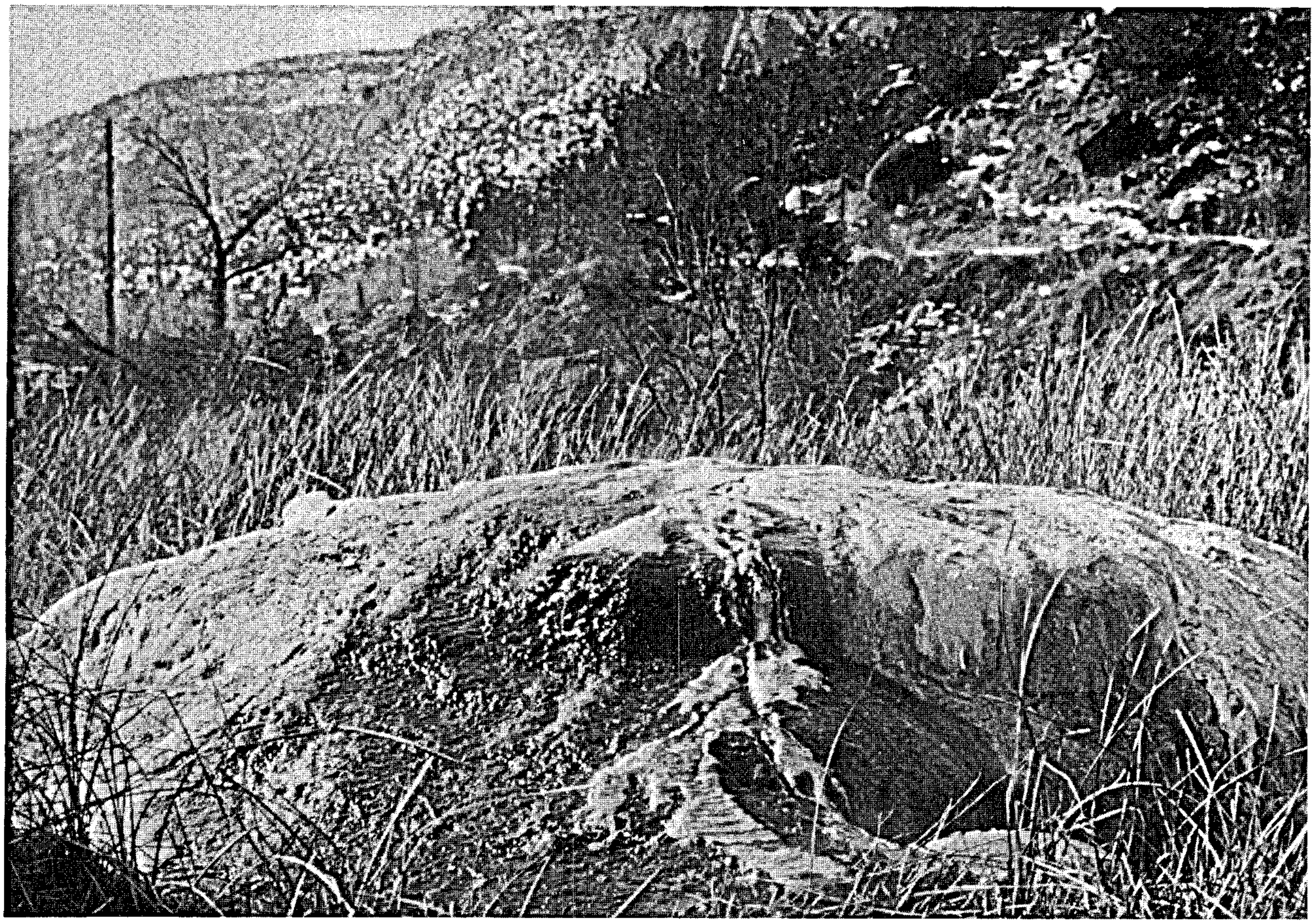


Fig. A-9.
Travertine Mound Spring in January 1979; pH ≈ 6.4; temperature = 72°C. This spring, which discharges between the bathhouse and the Jemez River, contains an extremely rare species of algae.

Fig. A-10.
San Ysidro Warm Spring in August 1979; pH ≈ 6.5; temperature ≈ 25°C. The spring discharges about 20 m north of State Highway 44 and resembles four or five others within 200 m. Water is rich in dissolved sulfate that is probably leached from gypsum-bearing rocks nearby.

Fig. A-11.
Zia Hot Well (Kaseman #2 Oil Test Well) in April 1980; pH ≈ 6.5; temperature = 54°C. The well was drilled in 1926 as an oil test well but struck hot water with an artesian flow of approximately 300 ℓ/min. A hotel built adjacent to the well burned down in the 1950s. Now unused, this well could supply substantial geothermal space heat or heat for greenhouses.

APPENDIX B

GEOCHEMICAL DATA OF THERMAL AND NONTHERMAL WATERS OF THE VALLES CALDERA

AND THE SOUTHERN JEMEZ MOUNTAINS, NEW MEXICO

TABLE B-I

LOCATION, FIELD DATA, AND REFERENCES FOR WATERS IN THE JEMEZ MOUNTAINS REGION, NEW MEXICO

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
Surface and Near-Surface Meteoric Waters												
1	Gallery Spring	LA-1	8/78	Lat 35°50'38" Long 106°22'17"	m	11	5.6	--	--	160	Spring issues from concrete gallery built in fractured Bandelier Tuff; Frijoles Quadrangle	G-S; G et al.; P79; T78 (R5)
2	T-3 Well	LA-2	8/78	Lat 35°52'23" Long 106°15'33"	m	13	6.5	--	--	0-12	Observation well ∿50 m deep, iron casing; in alluvium and Puye (?) Fm.; Frijoles Quadrangle	G-S
3	T-2 Well	LA-3	8/78	Lat 35°53'06" Long 106°16'12"	m	11	5.7	--	--	0-8	Observation well ∿50 m deep, iron casing; in alluvium and Puye (?) Fm.; Guaje Quadrangle	G-S
4	Sacred Spring	LA-4	8/78	Lat 35°53'35" Long 106°08'59"	m	14	5.7	--	--	Seep	Seep discharges from Santa Fe Fm.; Puye Quadrangle	G et al.; T78 (T6)
5	Basalt Spring	LA-5	8/78	Lat 35°52'03" Long 106°11'44"	m	15	5.8	--	--	4	Spring flows from contact of Cerros del Rio basalt and Puye Fm.; White Rock Quadrangle	G-S; G et al.
6	L-6 Well	LA-6	9/78	Lat 35°52'38" Long 106°10'25"	m	27	6.8	--	--	0-2160	Water-supply well drilled 625 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P77; P79
7	L-1B Well	LA-7	9/78	Lat 35°53'00" Long 106°09'22"	m	30	7.2	--	--	0-2180	Water-supply well drilled 694 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; P77; P79; P-C
8	L-5 Well	LA-8	9/78	Lat 35°53'18" Long 106°11'01"	m	26.5	6.5	--	--	0-1880	Water-supply well drilled to 623 m into Santa Fe Fm.; steel casing; White Rock Quadrangle	G-S; Gr; P77; P79; P-C
9	L-4 Well	LA-9	9/78	Lat 35°52'06" Long 106°11'30"	m	28	6.5	--	--	0-1560	Water-supply well drilled to 622 m into Santa Fe Fm.; steel casing; White Rock Quadrangle	G-S; Gr; P77; P79
10	PM-2 Well	LA-10	9/78	Lat 35°50'21" Long 106°15'53"	m	23.5	6.5	--	--	0-5520	Well drilled 800 m into Santa Fe Fm.; steel casing; Frijoles Quadrangle	G-S; P79
11	PM-1 Well	LA-11	9/78	Lat 35°51'32" Long 106°13'27"	m	28	6.5	--	--	0-2320	Well drilled 470 m into Santa Fe Fm.; steel casing; White Rock Quadrangle	G-S; P79

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
12	G-6 Well	LA-12	9/78	Lat 35°54'39" Long 106°14'07"	m	30.5	6.5	--	--	0-1100	Water-supply well drilled 617 m Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; P79
13	G-5 Well	LA-13	9/78	Lat 35°54'51" Long 106°13'37"	m	26.5	6.5	--	--	0-2100	Water-supply well drilled 614 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P79; P-C
14	G-4 Well	LA-14	9/78	Lat 35°54'35" Long 106°13'14"	m	26	6.5	--	--	0-1260	Water-supply well drilled 616 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P79
15	G-3 Well	LA-15	9/78	Lat 35°54'33" Long 106°12'41"	m	29	6.5	--	--	0-1620	Water-supply well drilled 614 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P79
16	G-2 Well	LA-16	9/78	Lat 35°54'22" Long 106°12'09"	m	30	6.5	--	--	0-1820	Water-supply well drilled 617 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P79
17	G-1A Well	LA-17	9/78	Lat 35°54'14" Long 106°11'59"	m	28	6.5	--	--	0-2060	Water-supply well drilled 637 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; P79;
18	G-1 Well	LA-18	9/78	Lat 35°54'06" Long 106°11'48"	m	26	6.5	--	--	0-1340	Water-supply well drilled 646 m into Santa Fe Fm.; steel casing; Puye Quadrangle	G-S; Gr; P79 P-C
19	Spring, White Rock Canyon	LA-19	9/78	Lat 35°45'07" Long 106°15'21"	m	19	6.5	--	--	6	Spring issues from Santa Fe Fm.; covered by volcanic colluvium; Frijoles Quadrangle	G-S; G et al.; T78 (K10)
20	PM-3 Well	LA-20	9/78	Lat 35°51'47" Long 106°14'41"	m	27.5	6.5	--	--	0-5600	Well drilled 786 m into Santa Fe Fm.; steel casing; White Rock Quadrangle	G-S; P79
32	Pajarito Spring	VA-29	7/79	Lat 35°48'08" Long 106°11'48"	m	20	5.9	--	210	>300	Spring issues from landslide in basalt; spring 4A of Purtyman; White Rock Quadrangle	P-P-O; T78 (K4)
33	Spring, White Rock Canyon	VA-30	7/79	Lat 35°48'15" Long 106°11'40"	m	18	6.0	--	--	1	Spring issues from alluvium west of Rio Grande; spring 4 of Purtyman; White Rock Quadrangle	P-P-O; T78 (K5)

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
52	Unnamed Cold Spring	VA-58	7/80	Lat 35°48'17" Long 106°19'55"	m	15	5.4	--	130	12	Spring flows from fractured Bandelier Tuff; Frijoles Quadrangle	
53	Unnamed Cold Spring	VA-59	7/80	Lat 35°48'18" Long 106°20'12"	m	17	5.6	--	130	24	Spring issues from fractured Bandelier Tuff; Frijoles Quadrangle	
28	San Antonio Creek	VA-24	2/29	Lat 35°58'17" Long 106°33'38"	m	2	--	--	--	>250	Creek sampled 5 m upstream of VA-20, Bathhouse Spring; Valle San Antonio Quadrangle	
28	San Antonio Creek	VA-95	3/82	Lat 35°58'17" Long 106°33'38"	m	3.0	7.41	386	124	>500	Creek sampled 5 m upstream of VA-20, Bathhouse Spring; Valle San Antonio Quadrangle	
28	San Antonio Creek	VA-104	8/82	Lat 35°58'17" Long 106°33'38"	m	22.4	--	--	111	--	Creek sampled 5 m upstream of VA-20, Bathhouse Spring; Valle San Antonio Quadrangle	
28	San Antonio Creek	VA-127	3/83	Lat 35°58'17" Long 106°33'38"	m	0.5	7.36	112	123	--	Creek sampled 5 m upstream of VA-20, Bathhouse Spring; Valle San Antonio Quadrangle	
29	Jemez River at Soda Dam	VA-52	4/80	Lat 35°47'29" Long 106°41'11"	m	5	5.30	--	--	>>500	River sampled 10 m upstream of Soda Dam travertine deposit; high water; Jemez Springs Quadrangle	P-W-A; T78
29	Jemez River at Soda Dam	VA-88	3/82	Lat 35°47'29" Long 106°41'11"	m	1.9	6.62	--	270	>>1000	River sampled 10 m upstream of Soda Dam travertine deposit; high water; Jemez Springs Quadrangle	
29	Jemez River at Soda Dam	VA-111	1/83	Lat 35°49'46" Long 106°41'11"	m	0.7	6.80	5	240	2000	River sampled 10 m upstream of Soda Dam travertine deposit; high water; Jemez Springs Quadrangle	
29	Jemez River at Soda Dam	VA-131	5/83	Lat 35°47'29" Long 106°41'11"	m	9	7.19	338[c]	--	--	River sampled 10 m upstream of Soda Dam travertine deposit; high water; Jemez Springs Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
31	Panorama Spring	VA-28	5/79	Lat 35°48'13" Long 106°41'10"	m	13	7.67	--	920	4	Spring issues from travertine and Madera limestone, 100 m above canyon floor; Jemez Springs Quadrangle	
31	Panorama Spring	VA-86	3/82	Lat 35°48'13" Long 106°41'10"	m	7.2	7.87	--	737	4	Spring issues from travertine and Madera limestone, 100 m above canyon floor; Jemez Springs Quadrangle	
31	Panorama Spring	VA-136	5/83	Lat 35°48'13" Long 106°41'10"	m	9	8.00	368[c]	810	--	Spring issues from travertine and Madera limestone, 100 m above canyon floor; Jemez Springs Quadrangle	
35	Sino Spring	VA-32	8/79	Lat 35°49'17" Long 106°40'42"	m	21	7.45	--	--	15	Spring flows from contact of andesite and Abo Formation; Jemez Springs Quadrangle	P-W-A; T78 (H1)
35	Sino Spring	VA-63	12/80	Lat 35°49'17" Long 106°40'42"	m	18	7.10	--	163	80	Spring flows from contact of andesite and Abo Formation; Jemez Springs Quadrangle	
35	Sino Spring	VA-69	6/81	Lat 35°49'17" Long 106°40'42"	m	22	7.77	290	160	80	Spring flows from contact of andesite and Abo Formation; Jemez Springs Quadrangle	
35	Sino Spring	VA-85	3/82	Lat 35°49'17" Long 106°40'42"	m	16.9	7.68	--	172	80	Spring flows from contact of andesite and Abo Formation; Jemez Springs Quadrangle	
35	Sino Spring	VA-102	8/82	Lat 35°49'17" Long 106°40'42"	m	21.3	--	--	150	--	Spring flows from contact of andesite and Abo Formation; Jemez Springs Quadrangle	
38	Indian Valley Well	VA-41	10/79	Lat 35°48'16" Long 106°35'10"	m	17.5	6.81	--	280	0	Well drilled 6+ m in alluvium and pumice; iron casing; Redondo Peak Quadrangle	
40	Unnamed Spring	VA-43	10/79	Lat 35°48'26" Long 106°30'30"	m	15	6.68	240	65	8	Spring flows from dacite colluvium; Redondo Peak Quadrangle	
40	Unnamed Spring	VA-139	5/83	Lat 35°48'26" Long 106°30'30"	m	3	6.98	411[c]	85	--	Spring flows from dacite colluvium; Redondo Peak Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
41	Unnamed Cold Spring	VA-44	10/79	Lat 35°46'36" Long 106°36'14"	m	8	6.91	--	210	2	Spring discharges from rock crib on andesite alluvium by dirt road; Redondo Peak Quadrangle	T78 (J2)
43	Unnamed Cold Spring	VA-46	10/79	Lat 35°52'33" Long 106°44'37"	m	10	6.42	--	126	40	Spring flows from contact of Bandelier Tuff and Abo Fm.; sampled from iron pipe; Seven Springs Quadrangle	T78 (N6)
44	Seven Springs Spring	VA-47	10/79	Lat 35°56'35" Long 106°42'15"	m	10	6.48	--	115	60	Spring discharges from fractured Bandelier Tuff; Seven Springs Quadrangle	T78 (N10)
44	Seven Springs Spring	VA-138	5/83	Lat 35°56'35" Long 106°42'15"	m	12	7.41	382[c]	112	--	Spring discharges from fractured Bandelier Tuff; Seven Springs Quadrangle	T78 (N10)
44	Cold Spring West of Caldera	VA-134	5/83	Lat 35°56'35" Long 106°42'15"	m	12	7.45	376[c]	115	--	Spring discharges from fractured Bandelier Tuff; Seven Springs Quadrangle	
45	Unnamed Cold Spring	VA-48	6/80	Lat 35°44'47" Long 106°28'55"	m	9	5.6	--	280	12	7 Springs issue from gully 1/2 km east at Albermarle ruins; from hypabyssal volcanics; Cañada Quadrangle	
46	Eddy's Well	VA-49	6/80	Lat 35°52'44" Long 106°37'28"	m	15	7.24	-60	550	0-20	Well 40+ m deep in alluvium and pumice; Valle San Antonio Quadrangle	
46	Henson's Well	VA-61	12/80	Lat 35°52'44" Long 106°37'28"	m	19	6.82	--	560	0-40	Well drilled 65 m into caldera fill; plastic pipe; Valle San Antonio Quadrangle	
48	Unnamed Cold Spring	VA-54	6/80	Lat 35°47'50" Long 106°28'08"	m	11	5.4	--	89	20	Spring issues from alluvium in Cañon del Norte; Bland Quadrangle	
49	Unnamed Cold Spring	VA-55	6/80	Lat 35°50'29" Long 106°25'25"	m	8.5	5.4	--	55	20	Spring issues from contact of latite and Bandelier Tuff; Bland Quadrangle	
50	Unnamed Cold Spring	VA-56	6/80	Lat 35°50'07" Long 106°24'42"	m	6.5	5.4	--	105	24	Spring discharges from contact of latite and Bandelier Tuff; Bland Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
51	Apache Spring	VA-57	7/80	Lat 35°49'30" Long 106°23'31"	m	9	5.3	--	137	15	Spring discharges from contact of latite and Bandelier Tuff; Bland Quadrangle	
54	Turkey Spring	VA-60	7/80	Lat 35°44'23" Long 106°21'35"	m	18	5.5	--	193	60	Spring flows from volcanic alluvium; Cochiti Dam Quadrangle	
54	Turkey Spring	VA-137	5/83	Lat 35°44'23" Long 106°21'35"	m	18	7.67	363[c]	196	--	Spring flows from volcanic alluvium; Cochiti Dam Quadrangle	
68	Las Conchas Spring	VA-124	1/84	Lat 35°49'16" Long 106°32'08"	m	14	6.75	344	95	>40	Redondo Peak Quadrangle	
Valles Caldera - Sulphur Springs Area												
21	Mudpot, Men's Bathhouse	VA-13	1/79	Lat 35°54'29" Long 106°36'54"	a	78	2.52	--	4050	0	Mudpot in concrete crib in collapsed bathhouse. From landslide in rhyolite; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	G-G; S; R; T78(P2)
21	Mudpot, Men's Bathhouse	S-7-80	9/80	Lat 35°54'29" Long 106°36'54"	a	82	2.0	--	10300	0	Mudpot in concrete crib in collapsed bathhouse. From landslide in rhyolite; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
21	Mudpot, Men's Bathhouse	VA-75	1/82	Lat 35°54'29" Long 106°36'54"	a	72	<2.5	11.85	--	0	Mudpot in concrete crib in collapsed bathhouse. From landslide in rhyolite; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
21	Steam, Men's Bathhouse	VA-81	3/82	Lat 35°54'29" Long 106°36'54"	a	73.6	2.88	169	1300	--	Mudpot in concrete crib in collapsed bathhouse. From landslide in rhyolite; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
21	Women's Bathhouse	S-6-80	3/82	Lat 35°54'29" Long 106°36'54"	a	88.0	4.30	219	12800	--	Spring issues from landslide; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
21	Women's Bathhouse	VA-76	1/82	Lat 35°54'29" Long 106°36'54"	a	89	<2.5	--	--	1/4	Spring issues from landslide; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
21	Footbath Springs	S-4-80	9/80	Lat 35°54'29" Long 106°36'54"	a	33	1.1	--	30200	0	Large bubbling pool with colloidal sulfur; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
21	Footbath Springs	VA-77	1/82	Lat 35°54'29" Long 106°36'54"	a	18	<2.5	--	--	1/4	Large bubbling pool with colloidal sulfur; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	
21	Footbath Springs	VA-79	3/82	Lat 35°54'29" Long 106°36'54"	a	14.6	1.95	--	18400	1/4	Large bubbling pool with colloidal sulfur; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	
21	Unnamed Spring	S-3-80	9/80	Lat 35°54'29" Long 106°36'54"	cm	11	3.6	--	1910	1/4	Spring discharges into Sulphur Creek; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	
21	Unnamed Hot Spring	S-9-80	9/80	Lat 35°54'29" Long 106°36'54"	a	--	2.03	--		1	Spring issues from alluvium; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	
21	Unnamed Hot Spring	VA-14	1/79	Lat 35°54'29" Long 106°36'54"	a	63	2.38	--	5800	2	Spring issues from alluvium; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	G-G
21	Electric Spring	S-5-80	9/80	Lat 35°54'29" Long 106°36'54"	a	36	1.5	--	12800	1/2	Spring flows from alluvium; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	S
21	Lemonade Spring	S-10-80	9/80	Lat 35°54'29" Long 106°36'54"	a	58	2.3	--	--	1/2	Spring issues from alluvium; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	S; T78 (P1)
21	Sulphur Creek	VA-78	1/82	Lat 35°54'29" Long 106°36'54"	m	0.5	6.0	--	--	>50	Collected near Bill Mondt's summer home; isotope only	
21	Steam, Main Fumarole	VA-80	3/82	Lat 35°54'29" Long 106°36'54"	a	88.0	4.30	219[c]	70	--	Main fumarole 25 m north of Men's Bathhouse Mudpot; from landslide	G et al.
22	Spring, Alamo Canyon	S-1-80	9/80	Lat 35°55'04" Long 106°35'53"	cm	11	4.2	430	0	--	Gaseous spring in alluvium and creek bed; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	S
22	Creek, Alamo Canyon	S-2-80	9/80	Lat 35°55'04" Long 106°35'53"	cm	11	3.1	--	340	4	Creek sampled 5 m upstream of S-1-80; Valle San Antonio Quadrangle	
22	Bubbling Seep	VA-23	3/79	Lat 35°55'04" Long 106°35'53"	cm	7	5.2	--	730	1	Bubbling seep 30 m north of S-1-80; from alluvium; $CO_2\uparrow$, $H_2S\uparrow$; Valle San Antonio Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
23	Bubbling Pool	VA-22	3/79	Lat 35°55'01" Long 106°35'39"	cm	0.5	4.5	--	280	8	Large bubbling pond 1/2 km east of S-1-80; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	G-G; T78 (P19)
24	Spring, Short Canyon	S-8-80	9/80	Lat 35°54'52" Long 106°36'07"	cm	8	4.1	--	500	1	Gaseous spring issues from alluvium; CO_2↑, H_2S↑; Valle San Antonio Quadrangle	
63	GRI Mudpit	VA-107	12/82	Lat 35°54'34" Long 106°37'53"	m	1.5	9.80	160	2500	--	Sample collected from hole chipped through frozen mudpit; Seven Springs Quadrangle	
63	GRI Well (Wellhead)	VA-108	12/82	Lat 35°54'34" Long 106°37'53"	m	-4	--	--	--	--	Gas sample collected from valve at wellhead; Seven Springs Quadrangle	
63	GRI Well at 4800 ft	VA-113	1/83	Lat 35°54'34" Long 106°37'53"	m	214	8.03	-60	13720	--	Sample collected from downhole sampling device; Seven Springs Quadrangle	
63	GRI Well at 4800 ft	VA-114	1/83	Lat 35°54'34" Long 106°37'53"	m	214	6.92	-125	--	--	Sample collected from downhole sampling device; Seven Springs Quadrangle	
63	GRI Well (Wellhead)	VA-115	1/83	Lat 35°54'34" Long 106°37'53"	m	--	--	--	--	--	Gas sample collected from valve at wellhead; Seven Springs Quadrangle	
63	GRI Well at 6300 ft	VA-116	1/83	Lat 35°54'34" Long 106°37'53"	m	232.6	7.10	90	30800	--	Sample collected from downhole sampling device; Seven Springs Quadrangle	
Valles Caldera - Ring Fracture Zone												
25	Spence Hot Spring	VA-1	7/78	Lat 35°50'58" Long 106°37'44"	tm	45	6.7	--	--	60	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	G-G; G-S; P-W-A; S; T74; T75; T78 (H42)
25	Spence Hot Spring	VA-68	6/81	Lat 35°50'58" Long 106°37'44"	tm	42	7.01	320	280	80	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	
25	Spence Hot Spring	VA-72	10/81	Lat 35°50'58" Long 106°37'44"	tm	42	7.45	375	275	20	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
25	Spence Hot Spring	VA-83	3/82	Lat 35°50'58" Long 106°37'44"	tm	41.6	7.87	--	275	160	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	
25	Spence Hot Spring	VA-105	9/82	Lat 35°50'58" Long 106°37'44"	tm	42.5	--	--	315	--	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	
25	Spence Hot Spring	VA-120	1/83	Lat 35°50'58" Long 106°37'44"	tm	42.3	7.60	28	293	160	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	
25	Little Spence Hot Spring	VA-2	7/78	Lat 35°50'58" Long 106°37'44"	tm	34	6.7	--	--	20	Spring issues from rhyolite talus near contact with Abo Formation; Jemez Springs Quadrangle	G-S
26	McCauley Spring	VA-3	7/78	Lat 35°49'12" Long 106°37'37"	tm	31	6.2	--	--	140	Spring flows from contact of rhyolite and Abo Formation; Jemez Springs Quadrangle	G-S; P-W-A; T78 (H39)
26	McCauley Spring	VA-87	3/82	Lat 35°49'12" Long 106°37'37"	tm	31.5	7.87	--	190	>400	Spring flows from contact of rhyolite and Abo Formation; Jemez Springs Quadrangle	
26	McCauley Spring	VA-119	1/83	Lat 35°49'12" Long 106°37'37"	tm	31.9	8.23	49	173	960	Spring flows from contact of rhyolite and Abo Formation; Jemez Springs Quadrangle	
27	San Antonio Hot Spring	VA-4	7/78	Lat 35°56'18" Long 106°38'44"	tm	42	6.8	--	--	150	Spring discharges from concrete crib on fractured rhyolite; Seven Springs Quadrangle	G-G; G-S; P-W-A; S; T75, T78 (P12)
27	San Antonio Hot Spring	VA-96	3/82	Lat 35°56'18" Long 106°38'44"	tm	40.8	7.26	374	140	125	Spring discharges from concrete crib on fractured rhyolite; Seven Springs Quadrangle	
27	San Antonio Hot Spring	VA-128	3/83	Lat 35°56'18" Long 106°38'44"	tm	41.3	7.88	84	127	--	Spring discharges from concrete crib on fractured rhyolite; Seven Springs Quadrangle	
28	Bathhouse Spring	VA-20	2/79	Lat 35°58'17" Long 106°33'38"	tm	38	6.1	--	163	12	Spring issues from south base of small rhyolite dome; covered by wood bathhouse; Valle San Antonio Quadrangle	T78 (P9)

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
28	Bathhouse Spring	VA-94	3/82	Lat 35°58'17" Long 106°33'38"	tm	37.4	7.72	386	178	18	Spring issues from south base of small rhyolite dome; covered by wood bathhouse; Valle San Antonio Quadrangle	
28	Bathhouse Spring	VA-126	3/83	Lat 35°58'17" Long 106°33'38"	tm	38.1	7.61	28	166	--	Spring issues from south base of small rhyolite dome; covered by wood bathhouse; Valle San Antonio Quadrangle	
34	Battleship Seep	VA-31	8/79	Lat 35°49'46" Long 106°38'42"	m	19	8.37	--	4200	1	Seep about 1/4 km WNW of Battleship Rock and just W of Hwy 4; from Madera limestone; Jemez Springs Quadrangle	P-P-O; T78 (K5)
34	Battleship Seep	VA-50	4/80	Lat 35°49'46" Long 106°38'42"	m	11	7.92	35	4200	1	Seep about 1/4 km WNW of Battleship Rock and just W of Hwy 4; from Madera limestone; Jemez Springs Quadrangle	
34	Battleship Seep	VA-133	5/83	Lat 35°49'46" Long 106°38'42"	m	12	8.27	364[c]	4300	--	Seep about 1/4 km WNW of Battleship Rock and just W of Hwy 4; from Madera limestone; Jemez Springs Quadrangle	
34	East Fork Jemez River	VA-84	3/82	Lat 35°49'46" Long 106°38'42"	m	4.4	8.06	--	125	>>500	100 m upstream of confluence with San Antonio Creek at Battleship Rock	
34	East Fork Jemez River	VA-106	9/82	Lat 35°49'46" Long 106°38'42"	m	--	--	--	--	--	100 m upstream of confluence with San Antonio Creek at Battleship Rock	
39	Valle Grande Spring	VA-42	10/79	Lat 35°51'30" Long 106°27'00"	m	15	7.20	160	88	30	Spring issues from rhyolite colluvium; Bland Quadrangle	
39	Valle Grande Spring	VA-82	3/82	Lat 35°51'30" Long 106°27'00"	m	13.6	7.36	--	82	30	Spring issues from rhyolite colluvium; Bland Quadrangle	
39	Valle Grande Spring	VA-117	1/83	Lat 35°52'30" Long 106°27'00"	m	13.8	6.90	408	76	30	Spring issues from rhyolite colluvium; Bland Quadrangle	
42	Horseshoe Spring	VA-45	10/79	Lat 35°52'41" Long 106°39'23"	m	12	6.89	--	240	12	Spring issues from rhyolite alluvium; Seven Springs Quadrangle	P-W-A; T78 (W15)

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
42	Horseshoe Spring	VA-118	1/83	Lat 35°52'41" Long 106°39'23"	m	11.3	7.44	73	279	25	Spring issues from rhyolite alluvium; Seven Springs Quadrangle	
61	PC1 at 225 ft	PC1-7	10/83	Lat 35°52'33" Long 106°39'42"	d	--	8.39[c]	437[c]	225[c]	1	Well at 225 ft; Seven Springs Quadrangle	
61	PC1 at 365-391 ft	PC1-8	10/83	Lat 35°52'33" Long 106°39'42"	d	--	8.05[c]	479[c]	200[c]	0	Well at 365-391 ft; static water at 285 ft	
61	PC1 at 685-691 ft	PC1-9	10/83	Lat 35°52'33" Long 106°39'42"	d	--	8.38[c]	284[c]	1325[c]	0	Well at 685-691 ft	
61	PC1 at 943 ft	PC1-10	10/83	Lat 35°52'33" Long 106°39'42"	d	--	8.80[c]	230[c]	1770[c]	0	Well at 943 ft; mud sample	
61	PC1 at 1100 ft	PC1-11	10/83	Lat 35°52'33" Long 106°39'42"	d	--	7.55[c]	350[c]	3700[c]	0	Well at 1100 ft; static level at 960 ft; would not bail	
61	PC1 at 1712 ft	PC1-1	4/84	Lat 35°52'33" Long 106°39'42"	d	--	7.21	317	9500	0	At 1712 m	
61	PC1 at 1937 ft	PC1-2	4/84	Lat 35°52'33" Long 106°39'42"	d	--	12.05	176	10800	0	At 1937 m	
61	PC1 at 1987 ft	PC1-3	4/84	Lat 35°52'33" Long 106°39'42"	d	--	12.17	125	14500	0	At 1987 m, top of cement	
61	PC1 at 1953 ft	PC1-4	4/84	Lat 35°52'33" Long 106°39'42"	d	--	7.63	347	11700	0	At 1953 m	
61	PC1 at 2036 ft	PC1-5	5/84	Lat 35°52'33" Long 106°39'42"	d	--	8.05	327	9300	0	At 2036 m	
71	PC2 at 587-600 ft	PC2-1	8/84	Lat 35°52'35" Long 106°41'15"	d	30	8.55	307	1196	--	Total depth well = 1830 ft	
71	PC2 at 630-635 ft	PC2-2	8/84	Lat 35°52'35" Long 106°41'15"	d	30	8.72	370	1232	--	Total depth well = 1830 ft	
71	PC2 at 1086 ft	PC2-3	9/84	Lat 35°52'35" Long 106°41'15"	d	--	8.56	390	1260	--	Lower Abo aquifer, sample is mixture of mud and water	
71	PC2 at 1350 ft	PC2-4	9/84	Lat 35°52'35" Long 106°41'15"	d	35	7.18	410	2310	--	Madera Formation	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
71	PC2 at 1360 ft	PC2-5	9/84	Lat 35°52'35" Long 106°41'15"	d	38	7.13	430	2370	--	Madera Formation	
71	PC2 at 1335 ft	PC2-6	9/84	Lat 35°52'35" Long 106°41'15"	d	40	7.17	392	4980	--	Madera Formation	
71	PC2 at 1490 ft	PC2-7	10/84	Lat 35°52'35" Long 106°41'15"	d	41	7.13	443	2610	--	Total depth well = 1830 ft	
Valles Caldera - Baca Geothermal Field[d]												
62	Redondo Creek at Union Gate	VA-129	5/83	Lat 35°52'22" Long 106°37'16"	m	4	6.87	325	120	--	At 2440 m; Valle San Antonio Quadrangle	
64	Baca Well #4	BA-2	6/82	Lat 35°53'21" Long 106°34'13"	d	294	7.28	99[c]	9100	--	Valle San Antonio Quadrangle $y^s = 0.281$, $p^s = 8.85$ bars ab.	
64	Baca Well #4	BA-5	7/82	Lat 35°53'21" Long 106°34'13"	d	297	7.20	--	9100	--	Valle San Antonio Quadrangle $y^s = 0.287$, $p^s = 9.23$ bars ab.	
65	Baca Well #13	BA-1	6/82	Lat 35°53'47" Long 106°34'04"	d	278	7.30	75[c]	8500	--	Valle San Antonio Quadrangle $y^s = 0.238$, $p^s = 9.05$ bars ab.	
65	Baca Well #13	BA-4	7/82	Lat 35°53'47" Long 106°34'04"	d	279	7.20	219[c]	8900	--	Valle San Antonio Quadrangle $y^s = 0.238$, $p^s = 9.12$ bars ab.	
66	Baca Well #15	BA-7	7/82	Lat 35°53'36" Long 106°34'48"	d	267	7.61	3	10400	--	Valle San Antonio Quadrangle $y^s = 0.208$, $p^s = 9.37$ bars ab.	
66	Baca Well #15	BA-8	9/82	Lat 35°53'36" Long 106°34'48"	d	326	7.12	107[c]	10600	--	Valle San Antonio Quadrangle $y^s = 0.359$, $p^s = 9.37$ bars ab.	
66	Baca Well #19	BA-9	10/82	Lat 35°53'36" Long 106°34'48"	d	223	8.45	213[c]	10900	--	Valle San Antonio Quadrangle $y^s = 0.202$, $p^s = 2.16$ bars ab.	
67	Baca Well #24	BA-3	6/82	Lat 35°53'04" Long 106°34'57"	d	260	7.25	245[c]	10600	--	Valle San Antonio Quadrangle $y^s = 0.189$, $p^s = 9.47$ bars ab.	
67	Baca Well #24	BA-6	7/82	Lat 35°53'04" Long 106°34'57"	d	261	7.43	139[c]	10400	--	Valle San Antonio Quadrangle $y^s = 0.193$, $p^s = 9.12$ bars ab.	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
Valles Caldera - Soda Dam and Jemez Springs Area												
29	Soda Dam Spring	VA-6	7/78	Lat 35°47'29" Long 106°41'11"	d	47	6.2	--	--	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	G-G; G et al.; G-S; P-W-A; S; T74; T75; T78 (H6)
29	Soda Dam Spring	VA-9	1/79	Lat 35°47'29" Long 106°41'11"	d	48	6.40	--	7050	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-26	5/79	Lat 35°47'29" Long 106°41'11"	d	47	6.52	--	6600	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-51	4/80	Lat 35°47'29" Long 106°41'11"	d	47	6.35	-325	5900	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-64	12/80	Lat 35°47'29" Long 106°41'11"	d	47	6.28	--	5600	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-70	6/81	Lat 35°47'29" Long 106°41'11"	d	47	6.28	-80	6700	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-73	10/81	Lat 35°47'29" Long 106°41'11"	d	47	6.30	-40	6700	40	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-89	3/82	Lat 35°47'29" Long 106°41'11"	d	47	6.45	--	6700	40	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-99	8/82	Lat 35°47'29" Long 106°41'11"	d	47.5	--	--	6900	--	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; CO_2↑, H_2S↑; Jemez Springs Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
29	Soda Dam Spring	VA-109	1/83	Lat 35°47'29" Long 106°41'11"	d	46.8	6.21	-240	7090	60	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; $CO_2\uparrow$, $H_2S\uparrow$; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-132	5/83	Lat 35°47'29" Long 106°41'11"	d	47	7.19	-375	6800	--	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; $CO_2\uparrow$, $H_2S\uparrow$; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-140	2/84	Lat 35°47'29" Long 106°41'11"	d	46.8	6.71	-200	7300	--	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; $CO_2\uparrow$, $H_2S\uparrow$; Jemez Springs Quadrangle	
29	Soda Dam Spring	VA-146	4/84	Lat 35°47'29" Long 106°41'11"	d	--	6.95	--	6700	--	Main spring discharges from faulted Paleozoic sediments in Jemez fault zone; $CO_2\uparrow$, $H_2S\uparrow$; Jemez Springs Quadrangle	
29	Grotto Spring	VA-5	7/78	Lat 35°47'29" Long 106°41'11"	d	38	6.8	-280	--	12	Spring flows from cave on east side of Soda Dam; Jemez Springs Quadrangle	G-S
29	Outfall of Soda Dam Spring	VA-65	12/80	Lat 35°47'29" Long 106°41'11"	d	17	8.13	--	6000	60	Sampled at point where water of Soda Dam Spring enters Jemez River; Jemez Springs Quadrangle	
29	Hidden Warm Spring	VA-27	5/79	Lat 35°47'29" Long 106°41'11"	d	29	6.28	-280	5700	2	Spring issues from alluvium east side Jemez River; Jemez Springs Quadrangle	
29	Hidden Warm Spring	VA-90	3/82	Lat 35°47'29" Long 106°41'11"	d	32	6.2	--	6000	6	Spring issues from alluvium east side Jemez River; Jemez Springs Quadrangle	
29	Hidden Warm Spring	VA-110	1/83	Lat 35°47'29" Long 106°41'11"	d	32.3	6.13	-180	6150	8	Spring issues from alluvium east side Jemez River; Jemez Springs Quadrangle	
29	Hidden Warm Spring	VA-141	2/84	Lat 35°47'29" Long 106°41'11"	d	32.2	6.42	-130	6260	--	Spring issues from alluvium east side Jemez River; Jemez Springs Quadrangle	
30	Main Jemez Spring	VA-10	1/79	Lat 35°46'24" Long 106°41'20"	d	55	7.01	--	4200	20	Spring discharges from concrete tank under gazebo; $CO_2\uparrow$; Jemez Springs Quadrangle	G-G; G et al; T75; T78 (H15)

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (μmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
30	Main Jemez Spring	VA-18	1/79	Lat 35°46'24" Long 106°41'20"	d	36	7.51	--	4250	0	Spring discharges from concrete tank under gazebo; CO_2↑; Jemez Springs Quadrangle	G et al.
30	Main Jemez Spring	VA-93	3/82	Lat 35°46'24" Long 106°41'20"	d	46.3	6.66	--	4270	20	Spring discharges from concrete tank under gazebo; CO_2↑; Jemez Springs Quadrangle	
30	Main Jemez Spring	VA-122	1/83	Lat 35°46'24" Long 106°41'20"	d	74.9	6.57	-230	4380	3	Spring discharges from concrete tank under gazebo; CO_2↑; Jemez Springs Quadrangle	
30	Main Jemez Spring	VA-143	2/84	Lat 35°46'24" Long 106°41'20"	d	74.7	6.50	-240	4460	--	Spring discharges from concrete tank under gazebo; CO_2↑; Jemez Springs Quadrangle	
30	Main Jemez Spring	VA-147	4/84	Lat 35°46'24" Long 106°41'20"	d	--	7.09	--	3900	--	Spring discharges from concrete tank under gazebo; CO_2↑; Jemez Springs Quadrangle	
30	Jemez Springs Geothermal Well	VA-121	1/83	Lat 35°46'24" Long 106°41'20"	m	73.3	6.50	-232	4280	64	Well drilled north of main Jemez Spring; Jemez Springs Quadrangle	
30	Jemez Springs Geothermal Well	VA-144	2/84	Lat 35°46'24" Long 106°41'20"	m	72.2	6.40	-90	4670	--	Well drilled north of main Jemez Spring	
30	Jemez Well/24 m	VA-19	1/79	Lat 35°46'24" Long 106°41'20"	d	68	6.64	--	3300	120	Well drilled north of main Jemez Spring; aquifer tapped at 24 m	G et al.
30	Jemez Well/24 m	VA-25	5/79	Lat 35°46'24" Long 106°41'20"	d	73.3	6.55	--	3500	8	Well drilled north of main Jemez Spring; aquifer tapped at 24 m	
30	Jemez Well/152 m	VA-15	1/79	Lat 35°46'24" Long 106°41'20"	d	60.5	6.69	--	1700	80	Well drilled north of main Jemez Spring; aquifer tapped at 152 m	G et al.
30	Jemez Well/152 m	VA-21	2/79	Lat 35°46'24" Long 106°41'20"	d	61	6.55	--	1830	20	Well drilled north of main Jemez Spring; aquifer tapped at 152 m	
30	Travertine Mound Spring	VA-7	1/79	Lat 35°46'24" Long 106°41'20"	d	70	6.28	--	4200	4	Spring issues from travertine mound west of bathhouse; CO_2↑; Jemez Springs Quadrangle	G et al.; T74; T78 (H14)

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
30	Travertine Mound Spring	VA-17	1/79	Lat 35°46'24" Long 106°41'20"	d	72	6.66	--	4100	4	Spring issues from travertine mound west of bathhouse; CO_2↑	G et al.
30	Travertine Mound Spring	VA-66	12/80	Lat 35°46'24" Long 106°41'20"	d	72	6.66	-205	3400	4	Spring issues from travertine mound west of bathhouse; CO_2↑	G et al.
30	Travertine Mound Spring	VA-71	6/81	Lat 35°46'24" Long 106°41'20"	d	72	6.12	-314	3900	4	Spring issues from travertine mound west of bathhouse; CO_2↑	
30	Travertine Mound Spring	VA-91	3/82	Lat 35°46'24" Long 106°41'20"	d	72.3	6.47	--	4540	4	Spring issues from travertine mound west of bathhouse; CO_2↑	
30	Travertine Mound Spring	VA-123	1/83	Lat 35°46'24" Long 106°41'20"	d	72.6	6.59	-270	4360	3	Spring issues from travertine mound west of bathhouse; CO_2↑	
30	Travertine Mound Spring	VA-142	2/84	Lat 35°46'24" Long 106°41'20"	d	72.9	6.20	-280	4740	--	Spring issues from travertine mound west of bathhouse; CO_2↑	
30	Buddhist Spring	VA-8	1/79	Lat 35°46'24" Long 106°41'20"	d	49	6.38	--	3300	4	Spring flows from manmade pool by Jemez River; CO_2↑; Jemez Springs Quadrangle	G et al.
30	Buddhist Spring	VA-16	1/79	Lat 35°46'24" Long 106°41'20"	d	50	6.59	-160	3300	4	Spring flows from manmade pool by Jemez River; CO_2↑	
30	Buddhist Spring	VA-92	3/82	Lat 35°46'24" Long 106°41'20"	d	43.2	6.49	--	3200	15	Spring flows from manmade pool by Jemez River; CO_2↑	
30	Unnamed Spring	VA-12	1/79	Lat 35°46'24" Long 106°41'20"	d	49	6.35	--	4100	4	Spring discharges from marsh 15 m NW of main Jemez Spring (now destroyed); CO_2↑; Jemez Springs Quadrangle	
<u>San Ysidro - Jemez Pueblo Area</u>												
36	Ponderosa Spring	VA-39	3/81	Lat 35°37'47" Long 106°42'29"	c	11	6.91	--	2500	seep	Spring discharges from Chinle Formation near contact w/ overlying Zia SS; tastes salty; Ponderosa Quadrangle	T78 (E1)
36	Ponderosa Spring	VA-135	5/83	Lat 35°37'47" Long 106°42'29"	c	15	6.90	19	2600	3	Spring discharges from Chinle Formation near contact w/ overlying Zia SS; tastes salty; Ponderosa Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
37	Cañon Spring	VA-40	4/81	Lat 35°40'20" Long 106°45'31"	m	18	7.58	--	1090	1	Spring issues from fault in Precambrian granite; Gilman Quadrangle	T78 (D6)
55	San Ysidro Warm Spring	VA-33	8/79	Lat 35°32'52" Long 106°49'32"	c	27	6.57	80	11550	1	Seep from travertine mound N of Hwy 44; Chinle Fm.; San Ysidro Quadrangle	T74; T78 (A1); M
55	San Ysidro Warm Spring	VA-130	5/83	Lat 35°32'52" Long 106°49'32"	c	22	6.97	354[c]	9400	--	Seep from travertine mound N of Hwy 44; Chinle Fm.; San Ysidro Quadrangle	
55	San Ysidro Warm Spring	VA-148	4/84	Lat 35°32'52" Long 106°49'32"	c	--	6.5	--	10000	--	Seep from travertine mound N of Hwy 44; Chinle Fm.; San Ysidro Quadrangle	
56	Zia Hot Well	VA-34	8/79	Lat 35°38'44" Long 106°53'19"	c	56	6.29	--	16600	150	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	T74; T78 (C3)
56	Zia Hot Well	VA-53	4/80	Lat 35°38'44" Long 106°53'19"	c	54	6.53	-150	16000	150	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	
56	Zia Hot Well	VA-67	3/81	Lat 35°38'44" Long 106°53'19"	c	53	6.72	--	15800	150	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	
56	Zia Hot Well	VA-74	10/81	Lat 35°37'44" Long 106°53'19"	c	53	6.40	90	15600	240	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	
56	Zia Hot Well	VA-125	2/83	Lat 35°38'44" Long 106°53'19"	c	53	6.98	-50	15700	320	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	
56	Zia Hot Well	VA-149	4/84	Lat 35°38'44" Long 106°53'19"	c	--	6.81	--	15500	--	Artesian well flows from concrete crib E of Hwy 44; Chinle Fm.; CO_2↑; Holy Ghost Spring Quadrangle	

TABLE B-I (cont)

Map No.	Name	Field No.	Date	Location	Water Type[a]	Temp (°C)	Field pH	Field Eh(mV)	Conduc. (µmhos/cm)	Flow Rate (ℓ/min)	Comments	Reference[b]
57	Unnamed Well	VA-35	8/79	Lat 35°42'32" Long 106°59'42"	m	21	--	--	--	1/2	Well drains into cattle trough above San Luis Tank; Morrison Fm(?); Holy Ghost Spring Quadrangle	
58	Salt Spring	VA-36	3/81	Lat 35°35'52" Long 106°45'34"	c	15.5	7.90	--	10500	1/2	Spring seeps from Chinle Fm. and Tertiary gravels; San Ysidro Quadrangle	T78 (A10)
59	Log Spring	VA-37	8/79	Lat 35°38'50" Long 106°50'57"	m	28.5	--	--	--	<1	Spring seeps from fault zone near contact of limestone and granite; Gilman Quadrangle	T78 (D4)
60	Owl Spring	VA-38	3/81	Lat 35°37'44" Long 106°45'48"	m	16	7.22	--	620	25	Spring flows from Madera Limestone; Gilman Quadrangle	P-W-A; T78 (A8)

[a]m = surface meteoric; cm = carbonated meteoric; a = acid sulphate; tm = thermal meteoric; d = deep geothermal + derivative; c = connate.

[b]G-G is Goff and Grigsby (1982); G et al. is Goff et al. (1981); G-S is Goff and Sayer (1980); Gr is Griggs (1964); M is Mariner et al. (1977); P77 is Purtymun (1977); P79 is Purtymun (1979); P-C is Purtymun and Cooper (1969); P-P-O is Purtymun et al. (1980); P-W-A is Purtymun et al. (1974); S is Summers (1976); T74 is Trainer (1974); T75 is Trainer (1975); T78 is Trainer (1978); Trainer's sample no. given in parentheses.

[c]Lab values.

[d]y^s = steam fraction, p^s = separation pressure.

TABLE B-II

MAJOR ELEMENT ANALYSES FOR WATERS IN THE JEMEZ MOUNTAINS REGION, NEW MEXICO (VALUES IN mg/ℓ)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
Surface and Near-Surface Meteoric Waters																			
1	Gallery Spring	LA-1	11	43	7.0	3.3	0.05	5.8	1.4	0.02	52	<5	<1	0.12	--	<0.05	119	0.91	0.99
2	T-3 Well	LA-2	13	15	14.0	5.0	0.05	11.0	1.9	0.03	102	5	4	0.26	--	<0.05	158	1.64	1.90
3	T-2 Well	LA-3	11	5	11.0	2.7	0.03	8.8	0.88	0.03	78	5	2	0.46	--	<0.05	114	1.18	1.46
4	Sacred Spring	LA-4	14	34	22	0.45	0.42	20	2.5	0.04	114	7	2	0.46	--	<0.05	203	2.07	2.10
5	Basalt Spring	LA-5	15	44	26	7.6	0.12	12	3.1	0.03	98	18	12	0.32	--	<0.05	221	2.53	2.34
6	L-6 Well	LA-6	27	33	2.8	0.15	0.05	72	0.8	0.04	170	6	4	2.2	--	<0.05	291	3.31	3.14
7	L-1B Well	LA-7	30	36	6.5	0.30	0.14	138	2.0	0.11	326	32	15	2.3	--	0.45	559	6.42	6.55
8	L-5 Well	LA-8	26.5	40	7.2	0.13	0.10	52	1.3	0.04	143	6	3	0.98	--	<0.05	254	2.67	2.61
9	L-4 Well	LA-9	28	39	10	0.22	0.07	21	1.7	0.03	85	5	4	0.33	--	0.38	167	1.48	1.63
10	PM-2 Well	LA-10	23.5	83	8.8	3.0	0.04	9.6	1.7	0.02	65	<5	3	0.19	--	0.25	180	1.15	
11	PM-1 Well	LA-11	28	82	26	6.8	0.14	18	3.6	0.03	146	6	6	0.26	--	0.25	295	2.74	2.70
12	G-6 Well	LA-12	30.5	55	15	2.3	0.06	15	2.0	<0.02	94	5	2	0.27	--	<0.05	191	1.65	1.72
13	G-5 Well	LA-13	26.5	59	17	3.9	0.08	11	1.8	<0.02	93	5	2	0.25	--	0.12	193	1.70	1.70
14	G-4 Well	LA-14	26	53	16	2.5	0.07	14	1.8	<0.02	92	5	2	0.27	--	0.12	187	1.66	1.68
15	G-3 Well	LA-15	29	59	11	1.2	0.06	22	1.6	<0.02	93	5	2	0.45	--	<0.05	195	1.65	1.71
16	G-2 Well	LA-16	30	77	11	0.61	0.08	33	2.5	0.02	122	5	4	1.0	--	0.12	256	2.10	2.27
17	G-1A Well	LA-17	28	78	11	0.58	0.08	24	2.8	<0.02	100	5	1	0.55	--	<0.05	223	1.72	1.80
18	G-1 Well	LA-18	26	84	13	0.68	0.08	22	3.1	<0.02	97	5	1	0.50	--	<0.05	226	1.74	1.75
19	Spring, White Rock Canyon	LA-19	19	71	12	3.1	0.05	11	1.4	0.03	74	<5	<1	0.45	--	<0.05	179	1.37	1.37
20	PM-3 Well	LA-20	27.5	91	26	8.7	0.12	16	3.3	0.04	146	6	12	0.28	--	0.18	164	2.80	2.87
32	Pajarito Spring	VA-29	20	67	19.6	5.3	0.132	11.8	2.08	0.08	100	7.5	6.4	0.46	--	0.05	220	1.99	2.00

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
33	Spring, White Rock Canyon	VA-30	18	63	29.3	6.9	0.225	14.4	2.4	0.07	--	8.8	9.8	0.48	--	0.07	136	2.73	0.48
52	Unnamed Cold Spring	VA-58	15	65	10.6	3.4	0.049	9.4	3.1	0.024	75	3.4	7.1	0.30	<0.2	<0.01	178	1.30	1.52
53	Unnamed Cold Spring	VA-59	17	69	10.4	3.4	0.051	9.0	3.2	0.024	73	2.4	7.5	0.35	<0.2	<0.01	179	1.28	1.48
27	San Antonio Creek	VA-104	22.4	--	--	--	--	--	--	--	51	8.70	1.24	1.33	<0.10	<0.01	--	--	--
28	San Antonio Creek	VA-24	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
28	San Antonio Creek	VA-95	3.0	56	9.8	1.56	0.06	11	2.24	0.10	46.4	9.8	1.6	1.6	<0.02	<0.01	140	1.17	1.09
28	San Antonio Creek	VA-127	0.5	38	10	2.0	0.10	10	2.4	0.06	39.0	3.5	6.1	0.97	--	--	112	1.17	0.94
29	Jemez River at Soda Dam	VA-52	5	17	11	1.4	0.038	5.6	2.0	0.040	52	9.0	4.0	0.56	<0.05	0.09	103	0.97	1.18
29	Jemez River at Soda Dam	VA-88	1.9	--	--	--	--	--	--	--	107	19.8	19.5	0.96	<0.02	--	--	--	--
29	Jemez River at Soda Dam	VA-111	0.7	--	--	--	--	--	--	--	101	14.7	10.3	1.00	0.10	--	--	--	--
29	Jemez River at Soda Dam	VA-131	9	32	20	2.5	0.09	17	5	0.15	56.7	14.2	11.3	0.28	0.09	0.11	159	2.09	1.56
31	Panorama Spring	VA-28	13	62	101	22.9	0.720	114	5.3	0.16	519	56.7	21.7	0.97	--	<0.1	905	12.05	10.35
31	Panorama Spring	VA-86	7.2	--	--	--	--	--	--	--	480	21.6	13.1	0.89	<0.02	--	--	--	--
31	Panorama Spring	VA-136	9	51.0	64	23.9	0.47	11	3	0.04	477	26	14.1	0.97	0.16	0.08	672	5.73	8.81
35	Sino Spring	VA-32	21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
35	Sino Spring	VA-63	18	78	11.2	3.6	0.06	14	0.2	0.12	82	5.0	6.0	0.32	<0.4	0.01	201	1.49	1.63
35	Sino Spring	VA-69	22	80	12.8	3.95	--	12	0.8	0.04	77	4.3	7.7	0.46	<0.1	0.02	199	1.51	1.59
35	Sino Spring	VA-85	16.9	--	--	--	--	--	--	--	75.6	4.8	3.0	0.86	<0.02	--	--	--	--
35	Sino Spring	VA-102	21.3	--	--	--	--	--	--	--	71	4.04	3.23	0.65	0.16	<0.01	--	--	--

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
38	Indian Valley Well	VA-41	17.5	77	23.5	6.2	0.160	22.0	4.78	0.044	137	6.2	7.3	0.17	--	<0.003	284	2.77	2.59
40	Unnamed Spring	VA-43	15	45	5.3	1.03	0.038	3.8	3.8	0.007	11	13.1	6.9	0.33	<0.1	<0.01	90.4	0.61	0.67
40	Unnamed Spring	VA-139	3	34.0	8	1.6	0.09	6	4	0.05	28.7	11.7	1.5	0.13	--	--	95.8	0.90	0.76
41	Unnamed Spring	VA-44	8	48	19.0	5.0	0.120	10.6	9.08	0.002	90	17.4	7.4	0.11	--	<0.002	207	2.06	2.05
43	Unnamed Spring	VA-46	10	74	10.7	1.50	0.072	11.6	2.53	0.04	57	4.4	3.5	0.44	--	<0.003	166	1.23	1.15
44	Seven Springs	VA-47	10	41	12.3	1.54	0.071	7.23	2.10	0.018	49	8.7	3.6	0.21	--	<0.003	126	1.11	1.10
44	Seven Springs	VA-138	12	30.0	11	1.4	0.05	8	4	0.05	53.7	5.9	1.9	0.25	0.27	--	117	1.12	1.07
44	Cold Spring west of Caldera	VA-134	--	30	12	1.5	0.06	8	3	0.03	53.7	5.5	1.9	0.25	0.06	0.73	117	1.15	1.06
45	Unnamed Cold Spring	VA-48	9	22	33	8.7	0.150	5.9	2.1	0.003	59	78	6.2	0.28	--	<0.01	215	2.68	2.78
46	Eddy's Well	VA-49	15	64	56	13.8	0.288	18	9.6	0.098	332	28.6	8.0	0.52	<0.1	<0.01	518	4.98	6.29
46	Henson's Well	VA-61	19	62	59	8.4	0.28	36	4.6	0.136	305	20.5	7.7	0.38	<0.4	0.01	504	5.34	5.66
48	Unnamed Cold Spring	VA-54	11	30	10.0	2.0	0.064	3.5	2.9	0.002	40	9.9	5.4	0.22	--	<0.01	104	0.89	1.03
49	Unnamed Cold Spring	VA-55	8.5	34	5.6	1.4	0.043	2.7	1.8	0.005	24	6.0	5.5	0.21	--	<0.01	80.7	0.53	0.68
50	Unnamed Cold Spring	VA-56	6.5	38	8.7	3.0	0.067	5.0	2.9	0.004	39	6.7	9.8	0.20	<0.5	<0.01	195	0.97	1.07
51	Apache Spring	VA-57	9	58	10.8	4.6	0.064	6.7	3.5	0.006	57	8.3	8.0	0.27	<0.2	<0.01	158	1.30	1.35
54	Turkey Spring	VA-60	18	61	20	5.5	0.066	10.1	1.7	0.010	103	4.2	8.0	0.38	<0.2	0.03	214	1.94	2.02
54	Turkey Spring	VA-137	18	57	20	5.2	0.10	11	3	0.04	106	3.7	3.6	0.20	0.11	--	210	1.99	1.93
68	Las Conchas Spring	VA-124	14	53	6.2	0.92	0.04	10.	29	--	40.3	2.2	1.7	1.20	--	--	118.5	0.89	0.82

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
Valles Caldera - Sulphur Springs Area																			
21	Mudpot, Men's Bathhouse	VA-13	78	221	2.1	1.25	0.03	2.1	8.2	0.02	0	786	2.48	6.36	--	<0.1	822	1.21	16.79
21	Mudpot, Men's Bathhouse	S-7-80	82	246	10	6.5	0.113	6.0	35	0.04	0	2500	<1	<0.20	--	0.1	2597	4.23	52.22
21	Mudpot, Men's Bathhouse	VA-75	72	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Steam, Men's Bathhouse	VA-81	73.6	<1	<1	<0.1	--	0.08	<0.1	--	0	2.2	<0.5	0.59	<0.02	<0.01	5.51	0.06	0.09
21	Women's Bathhouse	S-6-80	90	168	131	50.0	0.065	18.9	72	0.17	0	6400	<1	5.2	--	0.2	6850	13.37	133.55
21	Women's Bathhouse	VA-76	89	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Footbath Springs	S-4-80	33	214	56	26.5	0.098	10.8	94	0.10	0	7900	<0	10.6	--	0.2	8310	7.88	165.04
21	Footbath Springs	VA-77	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Footbath Springs	VA-79	14.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Unnamed Spring	S-3-80	11	59	280	33	0.610	25	27	0.29	0	1500	20	0.70	--	0.2	1950	18.52	31.83
21	Unnamed Hot Spring	S-9-80	--	243	165	40.0	0.027	16.4	6.4	0.09	0	1750	8.3	1.75	--	<0.03	2230	22.29	36.76
21	Unnamed Hot Spring	VA-14	63	230	90.8	16.2	0.22	14.6	18.7	0.05	0	2110	3.72	0.61	--	<0.1	2490	6.99	44.07
21	Electric Spring	S-5-80	36	228	114	23.0	0.140	8.5	66	0.06	0	4100	<1	5.2	--	<0.1	4580	9.66	85.66
21	Lemonade Spring	S-10-80	58	238	168	42	0.060	7.7	5.6	0.14	0	2740	17	0.52	--	0.03	3220	12.35	57.55
21	Sulphur Creek	VA-78	0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Steam, Main Fumarole	VA-80	88.0	<1	<1	0.03?	--	0.08	<0.1	--	0	4.5	<0.5	<0.02	<0.02	<0.01	95.3	0.06	0.11
22	Spring, Alamo Canyon	S-1-80	11	53	15.2	2.49	0.180	13.0	6.2	0.06	0	113	11	0.52	--	<0.1	215	1.70	2.69

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
22	Creek, Alamo Canyon	S-2-80	11	41	12.8	2.29	0.140	14.1	6.3	0.06	0	109	4.9	0.23	--	<0.1	191	1.61	2.42
22	Bubbling Seep	VA-23	7	51	83.5	12.0	0.68	32.8	7.9	0.08	178	254	7.2	0.23	--	<0.1	628	6.80	8.42
23	Bubbling Pool	VA-22	0.5	44	14.1	2.75	0.40	5.8	4.5	0.4	0	109	7.9	0.23	--	<0.1	189	1.36	2.50
24	Spring, Short Canyon	S-8-80	8	55	43	5.9	0.340	7.8	7.3	0.02	0	199	5.9	<0.20	--	<0.1	325	3.16	4.32
63	GRI Mudpit	VA-107	1.5	19	14.6	1.11	0.14	460	56	5.05	133	4.6	653	1.27	1.59	4.7	1360	23.00	20.97
63	GRI Well at 4800 ft	VA-113	214	395	80.5	2.89	2.29	2800	470	28.2	360	33	4350	6.9	14	39.3	8580	142.20	129.65
63	GRI Well at 4800 ft	VA-114	214	--	64.3	3.40	2.54	2880	499	37.4	--	--	--	--	--	33.2	--	--	--
63	GRI Well at 6300 ft	VA-116	232.6	450	46.0	0.45	1.98	5890	1020	68	382	95	9960	13.8	27	96.2	18100	294.55	289.90
Valles Caldera - Ring Fracture Zone																			
25	Spence Hot Spring	VA-1	45	66	5.5	1.9	0.03	50	1.3	0.66	144	16	8	0.55	--	0.15	294	2.73	2.95
25	Spence Hot Spring	VA-68	42	69	7.2	1.87	0.02	52	1.6	0.71	135	18	11	0.59	<0.1	0.15	297	2.92	2.93
25	Spence Hot Spring	VA-72	42	69	6.4	1.76	0.042	44	1.4	0.74	138	2.8	11.2	0.69	<0.02	0.17	276	2.52	2.67
25	Spence Hot Spring	VA-83	41.6	--	--	--	--	--	--	--	135	18.0	7.2	0.90	0.11?	--	161	--	--
25	Spence Hot Spring	VA-105	42.5	--	--	--	--	--	--	--	134	18.4	7.91	0.80	0.15	0.02	161	--	--
25	Spence Hot Spring	VA-120	42.3	66	5.9	1.57	0.08	50	1.4	0.58	140	17.1	8.2	0.76	0.10	0.12	292	2.72	2.92
25	Little Spence Hot Spring	VA-2	34	67	8.8	1.9	0.04	56	1.5	0.66	152	25	7	0.70	--	0.13	321	3.17	3.25
26	McCauley Spring	VA-3	31	56	8.5	4.9	0.02	18	0.8	0.24	86	7	6	0.85	--	0.24	189	1.67	1.77
26	McCauley Spring	VA-87	31.5	--	--	--	--	--	--	--	80.5	6.6	3.2	1.31	<0.02	--	--	--	--
26	McCauley Spring	VA-119	31.9	54	8.5	4.32	0.04	20	1.0	0.22	86.6	5.8	4.4	0.95	--	--	186	1.71	1.71
27	San Antonio Hot Spring	VA-4	42	79	2.3	0.30	0.02	21	1.7	<0.02	56	7	2	0.80	--	<0.05	170	1.10	1.16

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
27	San Antonio Hot Spring	VA-96	40.8	80	2.7	0.28	0.02	21	1.80	0.12	50.0	7.6	2.2	2.2	<0.02	<0.01	168	1.13	1.16
27	San Antonio Hot Spring	VA-128	41.3	74	3	0.5	0.06	23	1.8	0.06	57.3	9.5	7.0	0.79	--	--	167	1.25	1.38
28	Bathhouse Spring	VA-20	38	96	4.98	0.40	0.02	24.5	3.7	0.06	71	15	2.4	1.6	--	<0.1	220	1.45	1.63
28	Bathhouse Spring	VA-94	37.4	103	5.3	0.40	0.04	27	4.04	0.09	61.0	12.7	8.6	1.84	<0.02	<0.01	261	1.59	1.60
28	Bathhouse Spring	VA-126	38.1	105	6	1.0	0.09	27	4.2	0.08	75.6	15.2	6.9	1.46	0.2	--	498	1.68	1.83
34	Battleship Seep	VA-31	19	18	10.2	71.0	0.146	613	42.0	3.22	1745	373	284	4.95	--	4.15	3170	34.59	44.64
34	Battleship Seep	VA-50	11	17	35	46	0.810	940	47	4.0	1980	290	323	5.75	0.78	4.47	3690	46.14	47.11
34	Battleship Seep	VA-133	12	16.5	31	42.8	1.78	900	50	4.3	1966	295	299	5.73	0.89	4.45	3620	46.14	47.11
34	East Fork, Jemez River	VA-84	4.4	--	--	--	--	--	--	--	50.0	4.6	1.9	1.07	<0.02	--	--	--	--
34	East Fork, Jemez River	VA-106	--	--	--	--	--	--	--	--	43	3.80	2.36	0.55	<0.10	<0.10	--	--	--
39	Valle Grande Spring	VA-42	15	52	6.4	1.66	0.030	1.7	8.0	0.030	34	2.6	9.1	0.39	--	<0.01	116	0.74	0.89
39	Valle Grande Spring	VA-82	13.6	--	--	--	--	--	--	--	34.2	2.3	0.8	0.26	<0.02	--	--	--	--
39	Valle Grande Spring	VA-117	13.8	--	--	--	--	--	--	--	46.4	1.50	1.6	0.26	<0.1	--	--	--	--
42	Horseshoe Spring	VA-45	12	46	19.0	3.4	0.083	30.7	3.00	0.088	145	6.2	6.1	0.21	--	0.003	260	2.65	2.69
42	Horseshoe Spring	VA-118	11.3	56	28.8	4.48	0.13	35	3.1	--	151	5.14	4.0	0.38	0.1	--	288	3.41	2.72
61	PC1 at 225 ft	PC1-7	--	52	13.8	4.4	0.24	29	4.6	--	118	6.7	5.2	0.43	--	0.15	235	2.43	2.24
61	PC1 at 365-391 ft	PC1-8	--	53	8.9	2.4	0.15	30	3.8	--	110	6.2	5.3	0.27	--	0.21	220	2.05	2.10
61	PC1 at 685-691 ft	PC1-9	--	16	6.0	3.8	0.09	366	6.0	--	852	24.5	5.0	2.15	--	0.74	1280	16.69	14.73
61	PC1 at 943 ft	PC1-10	--	72	10.3	4.2	0.17	433	6.6	0.20	686	151	108	2.43	0.18	0.74	1480	19.89	17.56
61	PC1 at 1100 ft	PC1-11	--	30	78	73	1.24	740	55	1.64	2636	24.5	50.0	6.78	0.29	4.24	3700	43.76	45.49

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
61	PCI at 1712 ft	PC1-1	--	225	762	52.8	3.52	1390	153	10.8	1133	2157	1602	1.06	4.3	13.4	7510	108.34	108.72
61	PC1 at 1937 ft	PC1-2	--	165	2.6	0.12	0.12	2480	127	2.7	504[a]	1614	1700	3.29	5.0	6.47	4510	111.67	81.73
61	PC1 at 1987 ft	PC1-3	--	7	507	0.08	6.50	3030	189	1.8	24[a]	4210	2051	0.79	4.8	1.91	10000	162.23	145.54
61	PC1 at 1953 ft	PC1-4	--	101	545	24.6	2.32	2480	120	2.9	468	4105	1819	0.37	5.0	7.98	9680	140.61	144.46
61	PC1 at 2036 ft	PC1-5	--	108	30.0	3.6	0.30	2060	78	0.64	642	584	2648	2.30	3.3	10.40	6170	93.50	97.49
71	PC2 at 587-600 ft	PC2-1	30	16	5.1	3.1	0.08	257	7.0	0.06	715	44.7	3.3	1.79	<0.01	0.99	1058	11.91	13.51
71	PC2 at 630-635 ft	PC2-2	30	14	4.4	2.5	0.07	303	6.2	0.05	749	45.8	3.9	2.17	<0.01	1.00	1152	14.08	14.41
71	PC2 at 1086 ft	PC2-3	--	10	5.6	2.8	0.06	290	<2	<0.01	537	80.5	64.5	3.08	<0.05	0.63	1024	14.12	13.29
71	PC2 at 1350 ft	PC2-4	35	32	80	80.8	0.49	403	20	0.56	1698	78.5	36.2	2.07	0.22	1.28	2403	28.90	30.71
71	PC2 at 1360 ft	PC2-5	38	43	96	96.2	0.67	410	30	1.16	1886	26.3	37.8	2.28	0.20	1.76	2590	31.63	32.78
71	PC2 at 1335 ft	PC2-6	40	66	646	215	3.46	670	69	1.86	1102	2807	57	1.34	<0.1	2.30	5577	81.72	78.70
71	PC2 at 1490 ft	PC2-7	41	30	96	61.7	1.23	562	50	2.96	1729	178	44.6	6.50	0.34	2.97	2737	36.20	33.80
Valles Caldera - Baca Geothermal Field[b]																			
62	Redondo Creek at Union Gate	VA-129	4	25	10	1.4	0.06	9	4	0.06	26.8	12.5	10.7	0.13	0.09	0.06	100	1.12	1.01
64	Baca Well #4	BA-2	294	720	3.6	<0.01	0.10	1570	285	20.6	215	49	2640	6.6	7.80	--	4769	76.99	80.16
64	Baca Well #4	BA-5	297	760	3.7	<0.01	0.10	1560	280	20.0	190	49	2670	6.8	7.83	17.9	4719	74.58	80.61
65	Baca Well #13	BA-1	278	640	3.5	--	0.21	1550	255	24.7	221	49	2501	9.4	7.00	18.6	4529	73.00	76.41
65	Baca Well #13	BA-4	279	680	4.3	0.19	0.22	1540	255	20.5	236	47	2594	9.6	7.01	18.0	4644	73.44	79.20
66	Baca Well #15	BA-7	267	680	13.6	<0.01	0.25	1950	330	23.1	89	45	3257	6.9	9.59	25.4	5735	97.07	95.79
66	Baca Well #15	BA-8	326	689	14.2	<0.01	0.23	1910	350	24.3	75	37	3302	6.8	9.20	25.0	5783	98.15	96.52
66	Baca Well #19	BA-9	223	565?	13.1	0.02	0.30	1920	310	25.6	139	48	3340	6.9	10.85	26.8	6147	96.44	107.70
67	Baca Well #24	BA-3	260	620	17.2	<0.01	0.111	1870	230	23.2	89	48	3151	6.4	9.36	26.3	5382	88.06	92.68
67	Baca Well #24	BA-6	261	600	17.1	<0.01	0.12	1850	235	23.2	90	48	3128	6.6	9.42	26.5	5339	86.92	92.14

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
Valles Caldera - Soda Dam and Jemez Springs Area																			
29	Soda Dam Spring	VA-6	47	43	328	26	1.38	1010	174	13.2	886	37	1480	4.1	--	11.5	4014	68.82	57.26
29	Soda Dam Spring	VA-9	48	50	340	24.4	1.50	938	183	13.2	1510	38.4	1500	3.67	--	13.8	4620	66.39	68.06
29	Soda Dam Spring	VA-26	47	46	429	21.4	2.02	920	177	13.6	1490	49.4	1460	3.57	--	12.8	4630	69.70	66.82
29	Soda Dam Spring	VA-51	47	46	314	24	0.890	990	183	13.5	1000	39.1	1520	3.55	3.84	15.0	4150	67.36	60.27
29	Soda Dam Spring	VA-64	47	44	300	25	1.48	825	120	13.7	1250	36.1	1560	2.8	6.7	13.9	4200	57.98	65.39
29	Soda Dam Spring	VA-70	47	47	331	23.8	0.56	860	170	13.5	1390	41	1480	5.0	5.6	13.4	4380	62.21	65.65
29	Soda Dam Spring	VA-73	47	48	346	24.6	1.20	840	186	13.7	1500	36.7	1570	3.6	5.6	8.57	4539	62.95	70.40
29	Soda Dam Spring	VA-89	47	--	--	--	--	--	--	--	1490	35.5	1480	3.71	5.46	--	--	--	--
29	Soda Dam Spring	VA-99	47.5	--	--	--	--	--	--	--	1455	37.5	1614	3.68	6.0	14.1	--	--	--
29	Soda Dam Spring	VA-109	46.8	47	245	17.4	1.39	1030	160	12.7	1458	34	1536	3.28	4.07	15.7	4570	64.41	68.11
29	Soda Dam Spring	VA-132	47	42	315	22.7	1.40	980	186	15.8	1488	35	1477	3.51	4.6	13.9	4590	67.28	66.97
29	Soda Dam Spring	VA-140	46.8	47	342	21.9	2.84	960	160	13.8	1488	34	1480	3.33	4.6	12.1	4570	66.73	67.02
29	Soda Dam Spring	VA-146	--	46	--	--	--	--	--	--	1476	35	1567	3.85	4.6	--	--	--	--
29	Grotto Spring	VA-5	38	38	324	27	1.40	1000	174	13.2	834	41	1480	4.0	--	11.6	3950	68.27	56.48
29	Outfall of Soda Dam Spring	VA-65	17	36	138	26	1.27	943	160	14.3	610	40.5	1590	2.5	6.3	14.6	3580	56.23	55.82
29	Hidden Warm Spring	VA-27	29	44	376	18.8	1.90	720	141	10.8	1400	69.1	1195	2.71	--	10.6	3990	56.81	58.24
29	Hidden Warm Spring	VA-90	32	--	--	--	--	--	--	--	1370	48.3	1240	3.31	4.11	--	--	--	--
29	Hidden Warm Spring	VA-110	32.3	43	226	15.3	1.34	817	130	10.5	1324	53	1294	3.21	3.27	13.4	3930	52.93	59.48
29	Hidden Warm Spring	VA-141	32.2	43	305	20.0	2.55	780	125	11.1	1425	49	1240	3.04	3.8	10.6	4020	55.61	59.52
30	Main Jemez Spring	VA-10	55	93	152	5.40	0.56	656	74.2	10.1	711	40.9	904	5.19	--	7.9	2660	39.93	38.28
30	Main Jemez Spring	VA-18	35.5	85	115	4.52	0.60	690	74.0	9.00	699	45.4	968	5.19	--	8.0	2700	39.32	39.98

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
30	Main Jemez Spring	VA-93	46.3	--	--	--	--	--	--	--	720	45.5	926	5.18	2.86	--	--	--	--
30	Main Jemez Spring	VA-122	74.9	91	126	4.57	0.57	583	62	6.8	698	39	909	6.4	2.2	7.11	2540	34.60	38.23
30	Main Jemez Spring	VA-143	74.7	91	130	4.55	1.18	610	58	8.4	746	42	932	4.64	2.7	6.4	2640	36.10	39.64
30	Main Jemez Spring	VA-147	--	90	--	--	--	--	--	--	--	706	922	2.4	3.9	5.18	--	--	--
30	Jemez Springs Geothermal Well	VA-121	73.3	89	121	4.55	0.67	583	62	6.8	698	39	909	6.4	2.2	7.11	2530	34.35	38.23
30	Jemez Springs Geothermal Well	VA-144	72.2	94	126	4.23	1.22	630	61	8.5	714	41	941	5.38	2.6	6.5	3005	36.83	39.38
30	Jemez Well/24 m	VA-19	68	70	122	5.76	0.54	546	61.6	6.96	642	45.0	705	4.42	--	6.1	2220	32.90	31.58
30	Jemez Well/24 m	VA-25	73.3	79	180	4.60	0.86	610	68.0	8.4	705	53.0	836	3.52	--	6.8	2560	38.85	36.43
30	Jemez Well/152 m	VA-15	60.5	24	120	9.31	0.40	185	29.9	2.27	479	38.0	243	3.30	--	2.2	1140	15.90	15.67
30	Jemez Well/152 m	VA-21	61	36	122	9.25	0.40	193	35.4	3.60	492	49.9	281	3.50	--	2.5	1200	16.68	17.21
30	Travertine Mound Spring	VA-7	70	93	182	4.56	0.60	614	75.2	8.20	723	36.1	829	5.21	--	7.8	7580	39.28	36.26
30	Travertine Mound Spring	VA-17	72	83	114	4.48	0.54	612	70.3	8.46	714	43.2	936	5.05	--	7.9	2600	35.71	39.27
30	Travertine Mound Spring	VA-66	72	92	122	5.4	0.59	558	62	9.0	436	42.4	910	4.0	2.6	7.0	1700	33.70	33.91
30	Travertine Mound Spring	VA-71	72	92	135	4.75	0.337	540	73	8.7	712	41	894	4.4	2.8	7.19	2520	33.75	37.97
30	Travertine Mound Spring	VA-91	72.3	--	--	--	--	--	--	--	715	39.8	869	5.13	3.01	--	--	--	--
30	Travertine Mound Spring	VA-123	72.6	90	129	4.49	0.57	596	62	6.1	697	38	906	6.3	2.3	7.02	2550	35.21	38.10
30	Travertine Mound Spring	VA-142	72.9	92	132	4.3	1.22	610	58	8.6	757	40	917	4.31	2.7	6.7	2630	36.21	39.33
30	Buddhist Spring	VA-8	49	81	154	9.57	0.56	458	53.0	7.56	697	37.6	653	3.86	--	5.7	2160	30.85	30.83
30	Buddhist Spring	VA-16	50	72	128	7.50	0.52	494	57.8	6.06	708	40.6	653	3.76	--	5.7	2550	30.85	31.07
30	Buddhist Spring	VA-92	43.2	--	--	--	--	--	--	--	660	35.1	617	3.66	1.85	--	--	--	--

TABLE B-II (cont)

Map No.	Name	Field No.	Temp (°C)	SiO_2	Ca	Mg	Sr	Na	K	Li	HCO_3	SO_4	Cl	F	Br	B	TDS	Σcat	Σan
30	Unnamed Spring	VA-12	49	100	129	7.82	0.64	609	70.0	8.18	738	41.8	903	4.56	--	7.5	2620	36.55	38.68
San Ysidro - Jemez Pueblo Area																			
36	Ponderosa Spring	VA-39	11	16	49	10.3	0.95	447	34	2.2	848	193	267	7.2	--	3.16	1880	23.93	25.83
36	Ponderosa Spring	VA-135	15	14.5	51	9.3	0.89	480	39	2.2	862	202	263	7.52	0.83	3.01	1940	25.51	26.15
37	Cañon Spring	VA-40	18	47	36	5.2	0.49	161	7.6	0.5	367	127	71	9.3	--	0.41	833	9.50	11.15
55	San Ysidro Warm Spring	VA-33	27	14	375	128	7.70	1710	75.3	5.30	1860	1165	1820	3.95	--	8.32	7170	106.37	106.29
55	San Ysidro Warm Spring	VA-130	22	16.3	305	71.3	4.62	1720	77	8.1	1740	1183	1671	3.32	5.0	9.77	6810	99.08	100.46
55	San Ysidro Warm Spring	VA-148	--	20	--	--	--	--	--	--	1961	1181	1862	4.52	4.3	--	--	--	--
56	Zia Hot Well	VA-34	56	30	302	90	9.00	2650	66.7	6.7	1440	3740	3000	2.40	--	6.52	12200	140.46	186.22
56	Zia Hot Well	VA-53	54	33	321	61	4.75	3440	77	6.0	1068	3430	3210	4.51	4.20	7.41	11700	173.54	179.70
56	Zia Hot Well	VA-67	53	35	320	71.5	9.55	3180	64	6.3	1400	3280	2930	3.8	4.2	6.60	11300	162.76	174.08
56	Zia Hot Well	VA-74	53	34	354	21.8	6.87	3700	54	5.52	1400	4100	3210	2.67	1.1	6.9	12800	182.60	198.99
56	Zia Hot Well	VA-125	53.0	33	364	62.8	8.7	3080	63.4	5.2	1398	3338	2984	2.47	3.4	7.8	11400	159.71	176.71
56	Zia Hot Well	VA-149	--	34	--	--	--	--	--	--	1429	3350	3020	2.89	3.5	--	--	--	--
57	Unnamed Well	VA-35	21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
58	Salt Spring	VA-36	15.5	1	89	26.4	4.82	1950	94	7.4	1870	702	2380	10.8	--	9.2	7150	94.93	112.97
59	Log Spring	VA-37	28.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60	Owl Spring	VA-38	16	22	73	10.4	0.43	34	2.1	0.176	311	33.8	27.8	1.4	--	0.12	516	6.06	6.66

[a] Contaminated with drilling mud.

[b] Baca well samples are not corrected for steam loss; see Table B-I for steam fractions and separation pressures.

TABLE B-III

TRACE ELEMENT ANALYSES FOR WATERS IN THE JEMEZ MOUNTAINS REGION, NEW MEXICO (VALUES IN mg/ℓ)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
Surface and Near-Surface Meteoric Waters																				
1	Gallery Spring	LA-1	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
2	T-3 Well	LA-2	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	0.53	0.11	<0.10	--	<0.05	--	<0.14	--	--	0.01
3	T-2 Well	LA-3	<0.03	--	--	<0.12	0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	0.18
4	Sacred Spring	LA-4	0.06	--	--	<0.12	0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	0.02
5	Basalt Spring	LA-5	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.1
6	L-6 Well	LA-6	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
7	L-1B Well	LA-7	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
8	L-5 Well	LA-8	<0.05	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
9	L-4 Well	LA-9	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
10	PM-2 Well	LA-10	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
11	PM-1 Well	LA-11	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
12	G-6 Well	LA-12	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
13	G-5 Well	LA-13	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
14	G-4 Well	LA-14	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
15	G-3 Well	LA-15	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
16	G-2 Well	LA-16	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
17	G-1A Well	LA-17	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
18	G-1 Well	LA-18	0.06	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
19	Spring, White Rock Canyon	LA-19	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
20	PM-3 Well	LA-20	0.06	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	0.02
32	Pajarito Spring	VA-29	<0.03	--	--	0.010	<0.03	<0.06	0.018	<0.04	0.044	0.002	<0.10	--	<0.05	--	<0.14	--	--	0.001
33	Springs, White Rock Canyon	VA-30	<0.03	--	--	0.14	<0.03	<0.06	0.006	0.004	0.140	0.009	<0.10	--	0.004	--	<0.14	--	--	0.003

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
52	Unnamed Cold Spring	VA-58	<0.03	--	--	0.016	<0.001	<0.001	<0.001	<0.001	0.15	0.002	<0.002	--	<0.002	<0.2	<0.004	<0.2	--	0.024
53	Unnamed Cold Spring	VA-59	<0.03	--	--	0.022	<0.001	<0.001	0.004	<0.001	1.19	0.135	<0.002	--	<0.002	0.7	<0.004	<0.2	--	0.008
27	San Antonio Creek	VA-104	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.10	--	<0.1	--	--
28	San Antonio Creek	VA-24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
28	San Antonio Creek	VA-95	<0.01	--	--	0.07	<0.01	<0.01	0.05	0.01	0.70	0.04	<0.01	--	<0.01	0.69	<0.02	<0.02	--	0.01
28	San Antonio Creek	VA-127	--	--	--	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	0.02
29	Jemez River at Soda Dam	VA-52	<0.03	--	--	0.021	<0.001	<0.001	0.001	0.016	--	--	<0.002	--	<0.004	<0.1	--	<0.2	--	0.036
29	Jemez River at Soda Dam	VA-88	--	--	--	--	--	--	--	--	--	--	--	--	--	0.32	--	<0.02	--	--
29	Jemez River at Soda Dam	VA-111	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	Jemez River at Soda Dam	VA-131	--	0.4	--	0.04	0.001	--	--	--	0.3	0.02	--	--	--	--	--	--	--	--
31	Panorama Spring	VA-28	0.002	0.0013	--	0.176	<0.03	<0.06	0.018	0.002	0.016	0.003	<0.10	--	0.002	--	0.002	--	--	<0.01
31	Panorama Spring	VA-86	--	--	--	--	--	--	--	--	--	--	--	--	--	0.51	--	<0.02	--	--
31	Panorama Spring	VA-136	--	--	--	0.15	--	--	--	--	--	--	--	--	--	0.58	--	--	--	--
35	Sino Spring	VA-32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
35	Sino Spring	VA-63	<0.001	0.001	--	0.017	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	--	<0.001	<0.4	<0.004	<0.4	--	0.007
35	Sino Spring	VA-69	--	0.001	--	--	--	--	--	--	<0.01	0.01	--	--	--	1.2	--	<0.1	--	--
35	Sino Spring	VA-85	--	--	--	--	--	--	--	--	--	--	--	--	--	1.06	--	<0.02	--	--
35	Sino Spring	VA-102	--	--	--	--	--	--	--	--	--	--	--	--	--	0.14	--	<0.1	--	--
38	Indian Valley Well	VA-41	<0.03	--	--	0.053	<0.03	0.001	0.002	<0.04	0.42	0.024	0.002	--	<0.05	--	<0.14	--	--	0.002
40	Unnamed Cold Spring	VA-43	<0.03	--	--	0.031	<0.001	<0.001	<0.001	0.020	0.014	0.006	<0.002	--	<0.002	<0.2	<0.004	<0.2	--	0.060

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
40	Unnamed Cold Spring	VA-139	--	0.2	--	0.02	0.002	--	--	--	0.2	--	--	--	0.002	--	<0.14	--	--	--
41	Unnamed Cold Spring	VA-44	<0.03	--	--	0.129	<0.03	<0.06	0.001	<0.04	0.025	0.002	<0.10	--	<0.05	--	--	--	--	--
43	Unnamed Cold Spring	VA-46	<0.03	--	--	0.047	<0.03	<0.06	0.001	<0.04	0.004	<0.001	0.001	--	<0.05	--	<0.14	--	--	0.008
44	Seven Springs Spring	VA-47	<0.03	--	--	0.036	<0.03	<0.06	0.001	<0.04	0.036	0.001	0.001	--	<0.05	--	<0.14	--	--	<0.01
44	Seven Springs Spring	VA-138	--	0.2	--	0.02	0.003	--	--	--	0.2	--	--	--	--	--	--	--	--	--
44	Cold Spring west of caldera	VA-134	--	0.2	--	0.02	0.003	--	--	--	0.2	--	--	--	--	0.19	--	--	--	--
45	Unnamed Cold Spring	VA-48	<0.03	--	--	0.068	<0.001	<0.001	0.001	0.007	0.036	<0.001	<0.002	--	<0.002	2.6	<0.004	<0.5	--	0.300
46	Eddy's Well	VA-49	<0.03	--	--	0.113	<0.001	<0.001	<0.001	0.021	0.029	<0.001	0.117	--	<0.002	<0.2	<0.004	<0.2	--	0.040
46	Henson's Well	VA-61	<0.001	--	--	0.134	<0.001	<0.002	<0.001	0.088	<0.02	0.003	0.015	--	<0.001	9.1	<0.004	<0.4	--	0.015
48	Unnamed Cold Spring	VA-54	<0.03	--	--	0.065	<0.001	<0.001	0.002	<0.001	0.360	0.009	<0.002	--	<0.002	1.1	<0.004	<0.5	--	0.007
49	Unnamed Cold Spring	VA-55	<0.03	--	--	0.074	<0.001	<0.001	0.005	<0.001	1.18	0.012	<0.002	--	<0.002	0.9	<0.004	<0.5	--	0.015
50	Unnamed Cold Spring	VA-56	<0.03	--	--	0.018	<0.001	<0.001	0.002	<0.001	0.60	0.007	<0.002	--	<0.002	<0.2	<0.004	<0.5	--	0.018
51	Apache Spring	VA-57	<0.03	--	--	0.066	<0.001	<0.001	0.002	<0.001	0.42	0.003	<0.002	--	<0.002	1.4	<0.004	<0.2	--	0.020
54	Turkey Spring	VA-60	<0.03	--	--	0.056	<0.001	<0.001	<0.001	<0.001	0.012	0.001	<0.002	--	<0.002	1.3	<0.004	<0.2	--	0.080
54	Turkey Spring	VA-137	--	--	--	0.02	0.002	--	--	--	--	--	--	--	--	1.57	--	--	--	--
68	Las Conchas Spring	VA-124	--	0.05	--	0.01	--	--	--	--	0.02	--	--	--	--	--	--	--	--	--

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
	Sulphur Springs Area																			
21	Mudpot, Men's Bathhouse	VA-13	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	0.63	13	0.01	<0.10	--	<0.05	--	<0.14	--	--	0.16
21	Mudpot, Men's Bathhouse	S-7-80	<0.03	--	--	0.083	<0.001	0.059	--	0.030	37	0.64	0.010	--	--	--	--	--	--	--
21	Mudpot, Men's Bathhouse	VA-75	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Steam, Men's Bathhouse	VA-81	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
21	Women's Bathhouse	S-6-80	<0.03	--	--	0.053	0.001	0.245	--	--	490	8.10	0.10	--	--	--	--	--	--	--
21	Women's Bathhouse	VA-76	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Footbath Springs	S-4-80	<0.03	--	--	0.030	0.004	0.460	--	--	468	4.65	0.005	--	--	--	--	--	--	--
21	Footbath Springs	VA-77	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Footbath Springs	VA-79	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Unnamed Spring	S-3-80	<0.03	--	--	0.010	<0.001	0.024	0.052	<0.002	16.2	2.84	<0.002	--	0.039	--	0.032	--	--	--
21	Unnamed Hot Spring	S-9-80	<0.03	--	--	0.037	<0.001	0.017	0.063	--	38	3.20	<0.002	--	0.042	--	0.120	--	--	--
21	Unnamed Hot Spring	VA-14	<0.03	3.17	--	0.012	0.03	0.07	0.06	<0.04	18.1	11.7	<0.10	--	<0.05	--	<0.14	--	--	0.08
21	Electric Spring	S-5-80	<0.03	--	--	0.035	<0.001	0.100	0.360	0.080	127	2.40	0.004	--	0.220	--	0.080	--	--	0.640
21	Lemonade Spring	S-10-80	<0.03	--	--	0.055	<0.001	0.010	0.056	<0.001	38	3.76	<0.002	--	0.016	--	0.004	--	--	--
21	Sulphur Creek	VA-78	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	Steam, Main Fumarole	VA-80	--	--	--	--	--	--	--	--	--	--	--	2.57	--	<0.02	--	<0.02	--	--
22	Spring, Alamo Canyon	S-1-80	<0.03	--	--	0.050	<0.001	<0.001	0.019	0.001	16.3	0.44	<0.002	--	0.008	--	0.004	--	--	0.880
22	Creek, Alamo Canyon	S-2-80	<0.03	--	--	0.42	<0.001	0.002	0.005	0.008	1.1	0.35	<0.002	--	0.003	--	0.004	--	--	0.560
22	Bubbling Seep	VA-23	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	0.28	0.96	<0.10	--	<0.05	--	<0.14	--	--	<0.01

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
23	Bubbling Pool	VA-22	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	1.37	0.30	<0.10	--	<0.05	--	<0.14	--	--	<0.01
24	Spring, Short Canyon	S-8-80	<0.03	--	--	0.109	<0.001	0.005	0.010	0.007	5.5	0.54	<0.002	--	0.001	--	<0.004	--	--	0.160
63	GRI Mudpit at WC #23-4	VA-107	--	0.52	0.3	0.05	0.004	--	0.003	0.030	0.25	0.02	--	--	0.013	--	--	--	--	0.12
63	GRI Well at 4800 ft	VA-113	--	0.79	4.1	1.35	--	0.015	0.01	--	3.15	1.35	--	--	0.025	--	0.016	--	--	0.04
63	GRI Well at 4800 ft	VA-114	--	--	4.42	1.61	--	--	--	0.912	12.5	2.99	0.114	--	0.035	--	1.32	--	7.8	4.29
63	GRI Well at 6300 ft	VA-116	--	0.54	7.8	1.17	--	0.019	0.01	--	0.26	1.08	--	--	0.017	--	0.05	--	--	3.42
Valles Caldera - Ring Fracture Zone																				
25	Spence Hot Spring	VA-1	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	0.02
25	Spence Hot Spring	VA-68	<0.03	0.065	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.01	<0.01	<0.10	--	<0.05	<0.1	<0.14	<0.1	--	<0.01
25	Spence Hot Spring	VA-72	--	0.030	--	--	--	--	--	--	<0.01	<0.01	--	0.03	--	<0.02	--	<0.02	--	--
25	Spence Hot Spring	VA-83	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
25	Spence Hot Spring	VA-105	--	--	--	--	--	--	--	--	--	--	--	--	--	0.13	--	<0.1	--	--
25	Spence Hot Spring	VA-120	--	0.11	--	--	--	--	--	--	--	--	--	--	--	0.2	--	--	--	--
25	Little Spence Hot Spring	VA-2	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	0.10	--	<0.05	--	<0.14	--	--	0.02
26	McCauley Spring	VA-3	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	<0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
26	McCauley Spring	VA-87	--	--	--	--	--	--	--	--	--	--	--	--	--	1.67	--	<0.02	--	--
26	McCauley Spring	VA-119	--	0.08	--	--	--	--	--	--	--	--	--	--	--	1.30	--	--	--	--
27	San Antonio Hot Spring	VA-4	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.04	0.02	<0.10	--	<0.05	--	<0.14	--	--	<0.01
27	San Antonio Hot Spring	VA-96	<0.01	--	--	<0.01	<0.01	<0.01	0.06	0.01	0.02	<0.01	<0.01	--	<0.01	1.77	<0.02	<0.02	--	<0.01
27	San Antonio Hot Spring	VA-128	--	--	--	0.01	--	--	--	--	--	--	--	--	--	2.2	--	--	--	0.02
28	Bathhouse Spring	VA-20	<0.03	0.041	--	<0.12	<0.03	<0.06	<0.03	<0.04	<0.08	<0.04	<0.10	--	<0.05	--	<0.14	--	--	<0.01

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
28	Bathhouse Spring	VA-94	<0.01	--	--	0.02	<0.01	<0.01	0.05	0.01	0.01	<0.01	<0.01	--	<0.01	1.36	<0.02	<0.02	--	0.03
28	Bathhouse Spring	VA-126	--	--	--	0.01	--	--	--	--	0.1	--	--	--	0.02	0.3	--	--	--	0.02
34	Battleship Seep	VA-31	0.005	0.096	--	0.062	0.002	<0.06	<0.03	<0.04	0.005	<0.001	0.002	--	<0.05	--	<0.14	--	--	<0.01
34	Battleship Seep	VA-50	<0.03	--	--	0.022	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.002	--	<0.002	<0.1	0.016	<0.2	--	<0.002
34	Battleship Seep	VA-133	--	--	--	0.04	--	--	--	--	--	--	0.05	--	--	--	--	--	--	--
34	East Fork, Jemez River	VA-84	--	--	--	--	--	--	--	--	--	--	--	--	--	0.34	--	<0.02	--	--
34	East Fork, Jemez	VA-106	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.10	--	<0.1	--	--
39	Valle Grande Spring	VA-42	<0.03	--	--	0.010	<0.001	<0.001	0.002	<0.002	0.006	<0.001	<0.002	--	<0.002	1.9	<0.004	<0.2	--	--
39	Valle Grande Spring	VA-82	--	--	--	--	--	--	--	--	--	--	--	--	--	1.06	--	<0.02	--	--
39	Valle Grande Spring	VA-117	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
42	Horseshoe Spring	VA-45	<0.03	--	--	0.119	<0.03	0.001	0.008	<0.04	<0.004	<0.001	0.001	--	<0.05	--	<0.14	--	--	<0.01
42	Horseshoe Spring	VA-118	--	0.53	--	0.11	--	--	0.008	--	0.02	--	--	--	0.002	0.27	--	--	--	<0.02
61	PC1 at 225 ft	PC1-7	--	--	--	0.12	--	--	--	--	--	--	--	0.68	--	--	--	--	0.005	--
61	PC1 at 365-391 ft	PC1-8	--	--	--	0.07	--	--	0.003	--	--	--	--	--	--	1.31	--	--	0.006	0.03
61	PC1 at 685-691 ft	PC1-9	--	--	--	0.18	--	--	--	--	--	--	--	--	--	1.42	--	--	--	--
61	PC1 at 943 ft	PC1-10	--	--	--	0.14	--	--	--	--	0.07	0.03	--	--	0.005	1.13	--	--	--	--
61	PC1 at 1100 ft	PC1-11	--	--	--	0.79	--	--	--	--	0.14	0.05	--	--	--	0.28	--	--	0.004	--
61	PC1 at 1712 ft	PC1-1	--	--	--	0.12	--	--	0.001	--	0.16	0.28	--	--	0.050	--	--	--	0.018	--
61	PC1 at 1937 ft	PC1-2	--	8.6	--	0.04	--	--	0.050	--	0.30	0.02	--	--	0.24	--	--	--	0.012	--
61	PC1 at 1987 ft	PC1-3	--	--	--	0.15	--	--	0.015	0.004	0.10	0.02	--	--	0.30	--	--	--	0.008	--
61	PC1 at 1953 ft	PC1-4	--	--	--	0.06	--	--	0.002	0.020	0.08	0.15	--	--	--	--	--	--	0.005	--
61	PC1 at 2036 ft	PC1-5	--	--	--	0.06	--	--	0.095	--	0.06	0.02	--	--	--	--	--	--	--	--

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu
71	PC2 at 587-600 ft	PC2-1	<0.01	0.1	<0.1	0.06	0.005	<0.001	0.003	<0.001
71	PC2 at 630-635 ft	PC2-2	<0.01	0.5	<0.1	0.05	<0.001	<0.001	0.001	<0.001
71	PC2 at 1086 ft	PC2-3	<0.01	8.6	0.5	0.06	<0.001	0.001	0.028	0.006
71	PC2 at 1350 ft	PC2-4	<0.01	0.1	0.6	0.47	<0.001	<0.001	0.003	0.002
71	PC2 at 1360 ft	PC2-5	<0.01	<0.1	0.5	0.65	<0.001	0.003	0.005	<0.001
71	PC2 at 1335 ft	PC2-6	<0.01	0.1	1.0	<0.01	<0.001	<0.001	0.002	<0.001
71	PC2 at 1490 ft	PC2-7	<0.01	<0.1	0.5	0.34	<0.001	<0.001	0.001	<0.001
	Valles Caldera - Baca Geothermal Field									
62	Redondo Creek at Union Gate	VA-129	--	2.1	--	0.04	0.001	--	--	--
64	Baca Well #4	BA-2	<0.01	0.36	3.1	0.02	<0.01	0.03	0.05	0.03
64	Baca Well #4	BA-5	<0.01	0.41	2.8	0.02	<0.01	0.03	0.04	0.04
65	Baca Well #13	BA-1	<0.01	0.40	3.3	0.02	<0.01	0.02	0.04	0.02
65	Baca Well #13	BA-4	<0.01	0.34	3.0	0.02	0.01	0.03	0.05	0.03
66	Baca Well #15	BA-7	<0.01	0.51	3.4	0.03	<0.01	0.06	0.06	0.05
66	Baca Well #15	BA-8	<0.01	0.17	3.6	0.02	<0.01	0.01	0.01	0.02
66	Baca Well #19	BA-9	<0.01	0.37	4.1	0.02	<0.01	<0.01	0.03	0.04
67	Baca Well #24	BA-3	<0.01	0.46	4.1	0.014	0.01	0.03	0.04	0.03
67	Baca Well #24	BA-6	<0.01	0.72	3.5	0.013	<0.01	0.05	0.07	0.05
	Valles Caldera - Soda Dam and Jemez Springs Area									
29	Soda Dam Spring	VA-6	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04
29	Soda Dam Spring	VA-9	<0.03	0.036	--	<0.12	0.06	<0.06	<0.03	<0.04
29	Soda Dam Spring	VA-26	0.002	0.025	--	0.396	0.002	<0.06	0.062	0.004
29	Soda Dam Spring	VA-51	<0.03	--	--	0.206	<0.001	<0.001	<0.001	<0.001
29	Soda Dam Spring	VA-64	<0.001	--	--	0.430	<0.001	<0.002	<0.001	<0.001
29	Soda Dam Spring	VA-70	<0.03	0.020	--	<0.12	0.03	<0.06	<0.03	<0.04

Map No.	Name	Field No.	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
71	PC2 at 587-600 ft	PC2-1	0.06	<0.01	<0.2	0.06	<0.001	0.03	<0.002	<0.01	<0.001	<0.01
71	PC2 at 630-635 ft	PC2-2	0.19	<0.01	<0.2	0.13	<0.001	0.39	<0.002	<0.01	<0.001	<0.01
71	PC2 at 1086 ft	PC2-3	0.34	<0.01	0.1	--	0.010	12.0	<0.002	<0.1	<0.001	0.12
71	PC2 at 1350 ft	PC2-4	<0.01	0.02	<0.1	0.73	0.009	<0.1	<0.002	<0.1	<0.001	<0.01
71	PC2 at 1360 ft	PC2-5	<0.01	0.10	0.1	0.71	0.009	<0.1	<0.002	<0.1	<0.001	<0.01
71	PC2 at 1335 ft	PC2-6	<0.01	0.04	0.1	1.19	0.009	<1	<0.002	<0.2	0.012	<0.01
71	PC2 at 1490 ft	PC2-7	<0.01	0.21	<0.1	0.61	0.005	<0.5	<0.002	<0.1	0.008	<0.01
	Valles Caldera - Baca Geothermal Field											
62	Redondo Creek at Union Gate	VA-129	0.9	0.01	--	--	--	--	--	--	--	--
64	Baca Well #4	BA-2	0.03	<0.01	0.07	0.54	0.04	<0.1	0.02	<1	4.1	<0.01
64	Baca Well #4	BA-5	0.02	<0.01	0.05	0.17	0.05	<0.1	0.08	<1	2.5	<0.01
65	Baca Well #13	BA-1	0.02	0.01	0.03	0.41	0.03	<0.1	0.05	<1	4.1	<0.01
65	Baca Well #13	BA-4	0.02	<0.01	0.04	0.21	0.04	<0.1	<0.01	<1	3.0	0.02
66	Baca Well #15	BA-7	0.02	<0.01	0.24	0.87	0.07	<0.1	0.03	<1	4.5	<0.01
66	Baca Well #15	BA-8	0.01	<0.01	0.09	0.24	0.02	<0.1	0.05	<1	5.4	<0.01
66	Baca Well #19	BA-9	0.02	0.02	0.08	0.24	0.02	<0.1	0.09	<1	5.0	<0.01
67	Baca Well #24	BA-3	0.01	<0.01	0.35	0.33	0.02	<0.1	0.06	<1	2.9	<0.01
67	Baca Well #24	BA-6	0.02	<0.01	0.26	0.85	0.06	<0.1	<0.01	<1	2.8	<0.01
	Valles Caldera - Soda Dam and Jemez Springs Area											
29	Soda Dam Spring	VA-6	0.11	0.55	<0.10	--	<0.05	--	<0.14	--	--	0.02
29	Soda Dam Spring	VA-9	0.14	0.47	<0.10	--	0.05	--	<0.14	--	--	0.04
29	Soda Dam Spring	VA-26	0.08	0.54	<0.10	--	<0.05	--	0.014	--	--	<0.01
29	Soda Dam Spring	VA-51	--	--	<0.002	--	0.02	<0.1	0.044	<0.2	--	<0.002
29	Soda Dam Spring	VA-64	0.07	0.43	<0.002	--	<0.006	<0.4	<0.004	<0.4	--	<0.002
29	Soda Dam Spring	VA-70	0.05	0.53	<0.10	--	0.10	<0.1	<0.14	<0.1	--	0.03

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
29	Soda Dam Spring	VA-73	--	0.014	1.5	0.442	--	--	--	--	0.08	0.68	--	0.55	--	<0.02	--	<0.02	--	--
29	Soda Dam Spring	VA-89	--	--	1.6	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
29	Soda Dam Spring	VA-99	--	--	1.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	Soda Dam Spring	VA-109	--	0.11	1.8	0.46	--	--	--	--	0.07	0.56	--	--	0.003	--	--	--	--	0.01
29	Soda Dam Spring	VA-132	--	--	1.5	0.41	--	--	--	--	0.1	0.51	--	--	--	--	--	--	--	--
29	Soda Dam Spring	VA-140	--	0.3	1.5	0.45	0.008	--	0.001	--	0.09	0.97	--	--	--	--	--	--	3.25	0.01
29	Soda Dam Spring	VA-146	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	Grotto Spring	VA-5	<0.03	--	--	<0.12	<0.03	0.09	<0.03	<0.04	0.11	0.50	<0.10	--	<0.05	--	<0.14	--	--	0.01
29	Outfall of Soda Dam Spring	VA-65	<0.001	--	--	0.360	<0.001	<0.002	<0.001	<0.001	0.03	0.03	<0.002	--	<0.001	<0.4	<0.004	<0.4	--	<0.002
29	Hidden Warm Spring	VA-27	0.002	0.007	--	0.206	0.002	0.002	0.098	0.006	0.50	0.56	<0.10	--	<0.05	--	0.006	--	--	<0.001
29	Hidden Warm Spring	VA-90	--	--	1.2	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
29	Hidden Warm Spring	VA-110	--	0.13	0.1	0.39	--	--	0.001	--	0.51	0.50	--	--	0.002	--	--	--	--	0.02
29	Hidden Warm Spring	VA-141	--	--	1.2	0.37	--	--	0.005	--	0.45	0.90	--	--	--	--	--	--	2.85	0.01
30	Main Jemez Spring	VA-10	<0.03	0.015	--	<0.12	0.03	<0.06	<0.03	<0.04	0.20	0.17	<0.10	--	0.10	--	<0.14	--	--	0.03
30	Main Jemez Spring	VA-18	<0.03	0.014	--	0.24	<0.03	<0.06	<0.03	<0.04	0.02	0.10	<0.10	--	<0.05	--	<0.14	--	--	<0.01
30	Main Jemez Spring	VA-93	--	--	1.2	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
30	Main Jemez Spring	VA-122	--	0.08	0.8	0.28	--	--	--	--	0.21	0.21	--	--	0.001	--	--	--	--	--
30	Main Jemez Spring	VA-143	--	0.1	0.6	0.24	--	--	0.02	--	0.24	0.39	--	--	--	--	--	--	1.15	0.03
30	Main Jemez Spring	VA-147	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30	Jemez Springs Geothermal Well	VA-121	--	0.04	0.8	0.27	--	--	--	--	0.13	0.19	--	--	0.001	--	--	--	--	--
30	Jemez Springs Geothermal Well	VA-144	--	--	0.07	0.25	--	--	--	--	0.17	0.36	--	0.33	--	--	--	--	1.20	--
30	Jemez Well/24 m	VA-19	<0.03	0.013	--	<0.12	<0.03	<0.06	<0.03	<0.04	0.39	0.11	<0.10	--	<0.05	--	<0.14	--	--	<0.01

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
30	Jemez Well/24 m	VA-25	0.002	0.030	--	0.202	<0.03	0.002	0.002	0.002	0.21	0.22	<0.10	--	<0.05	--	0.006	--	--	<0.01
30	Jemez Well/152 m	VA-15	<0.03	0.018	--	<0.12	<0.03	0.10	<0.03	<0.04	0.39	0.02	<0.10	--	0.10	--	<0.14	--	--	<0.02
30	Jemez Well/152 m	VA-21	<0.03	--	--	<0.12	<0.03	<0.06	<0.03	<0.04	1.72	0.07	<0.10	--	<0.05	--	<0.14	--	--	<0.01
30	Travertine Mound Spring	VA-7	<0.03	--	--	<0.12	0.03	<0.06	<0.03	<0.04	0.15	0.18	<0.10	--	<0.05	--	<0.14	--	--	0.03
30	Travertine Mound Spring	VA-17	<0.03	0.016	--	0.20	<0.03	0.06	<0.03	<0.04	0.15	0.11	<0.10	--	0.10	--	<0.14	--	--	0.02
30	Travertine Mound Spring	VA-66	<0.001	--	--	0.232	<0.001	<0.002	0.001	<0.001	0.05	0.23	<0.002	--	0.002	<0.4	<0.004	<0.4	--	<0.002
30	Travertine Mound Spring	VA-71	--	0.009	0.7	0.111	--	--	--	--	0.13	0.19	--	--	--	<0.1	--	<0.1	--	--
30	Travertine Mound Spring	VA-91	--	--	1.1	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
30	Travertine Mound Spring	VA-123	--	0.09	0.8	0.27	--	--	--	--	0.16	0.21	--	--	--	--	--	--	--	--
30	Travertine Mound Spring	VA-142	--	--	0.6	0.25	--	--	0.001	--	0.19	0.40	--	--	--	--	--	--	1.15	--
30	Buddhist Spring	VA-8	<0.03	--	--	0.60	0.03	<0.06	<0.03	<0.04	0.18	0.24	<0.10	--	0.10	--	<0.14	--	--	0.02
30	Buddhist Spring	VA-16	<0.03	0.013	--	<0.12	<0.03	<0.06	<0.03	<0.04	0.16	0.19	<0.10	--	0.10	--	<0.14	--	--	0.02
30	Buddhist Spring	VA-92	--	--	0.8	--	--	--	--	--	--	--	--	--	--	<0.02	--	<0.02	--	--
30	Unnamed Spring	VA-12	<0.03	--	--	0.35	0.06	0.12	<0.03	<0.04	0.99	0.49	<0.10	--	0.10	--	<0.14	--	--	0.02
San Ysidro - Jemez Pueblo Area																				
36	Ponderosa Spring	VA-39	<0.001	0.021	--	0.044	<0.001	<0.002	<0.001	<0.001	0.272	0.144	0.014	--	<0.001	<0.2	<0.004	<0.2	--	<0.002
36	Ponderosa Spring	VA-135	--	--	--	0.05	--	--	--	--	1.2	0.18	--	--	--	--	--	--	--	--
37	Cañon Spring	VA-40	<0.001	0.006	--	0.082	<0.001	<0.002	<0.05	<0.05	0.81	0.148	0.048	--	<0.03	1.1	<0.004	<0.2	--	0.016
55	San Ysidro Mineral Spring	VA-33	0.006	0.014	--	0.044	0.006	0.016	0.008	0.009	3.40	1.80	<0.10	--	0.002	--	<0.14	--	--	0.001
55	San Ysidro Warm Spring	VA-130	--	0.2	0.5	0.02	--	0.015	0.007	0.003	11.4	1.9	--	--	0.016	--	--	--	--	0.013

TABLE B-III (cont)

Map No.	Name	Field No.	Ag	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Mo	NH_4	Ni	NO_3	Pb	PO_4	Rb	Zn
55	San Ysidro Warm Spring	VA-148	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
56	Zia Hot Well	VA-34	0.015	0.052	--	0.120	0.013	0.063	0.026	0.027	1.40	0.10	<0.10	--	0.009	--	0.002	--	--	<0.01
56	Zia Hot Well	VA-53	0.006	--	--	0.028	<0.001	0.004	0.004	0.020	0.240	0.022	<0.002	--	<0.002	<0.1	0.360	<0.2	--	0.007
56	Zia Hot Well	VA-67	<0.001	0.022	--	0.028	<0.001	0.006	0.020	<0.001	1.46	0.040	<0.002	--	<0.001	<0.5	0.012	<0.5	--	<0.002
56	Zia Hot Well	VA-74	--	0.018	--	--	--	--	--	--	1.66	0.02	--	--	--	--	--	--	--	--
56	Zia Hot Well	VA-125	--	0.18	0.7	0.02	--	0.065	0.002	0.070	1.57	0.05	--	--	0.050	--	--	--	--	0.01
56	Zia Hot Well	VA-149	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
57	Unnamed Well	VA-35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
58	Salt Spring	VA-36	<0.001	0.005	--	0.032	<0.001	<0.002	0.004	0.016	0.030	0.024	<0.002	--	<0.001	<0.5	0.008	<0.5	--	<0.002
59	Log Spring	VA-37	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60	Owl Spring	VA-38	<0.001	0.001	--	0.106	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	0.003	--	<0.001	0.35	<0.004	<0.2	--	0.007

TABLE B-IV

OXYGEN AND HYDROGEN ISOTOPE ANALYSES OF WATERS IN THE JEMEZ MOUNTAINS REGION, NEW MEXICO

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD °/°°	$\delta^{18}O$ °/°°	Tritium (T.U.)
Surface and Near-Surface Meteoric Waters								
1	Gallery Spring	LA-1	8/78	2439	11	-84.3	-12.20	--
2	T-3 Well	LA-2	8/78	2018	13	-73.8	-10.65	--
3	T-2 Well	LA-3	8/78	2024	11	-73.5	-10.60	--
4	Sacred Spring	LA-4	8/78	1719	14	-81.8	-11.80	--
5	Basalt Spring	LA-5	8/78	1835	15	-76.5	-10.85	--
6	L-6 Well	LA-6	9/78	1762	27	-94.7	-13.45	--
7	L-1B Well	LA-7	9/78	1716	30	-103.0	-14.30	--
8	L-5 Well	LA-8	9/78	1785	26.5	--	--	--
9	L-4 Well	LA-9	9/78	1847	28	--	--	--
10	PM-2 Well	LA-10	9/78	2048	23.5	-77.5	-11.40	--
11	PM-1 Well	LA-11	9/78	1981	28	-74.1	-10.95	--
12	G-6 Well	LA-12	9/78	1963	30.5	-76.0	-11.25	--
13	G-5 Well	LA-13	9/78	1926	26.5	--	--	--
14	G-4 Well	LA-14	9/78	1902	26	-76.3	-11.10	--
15	G-3 Well	LA-15	9/78	1872	29	--	--	--
16	G-2 Well	LA-16	9/78	1847	30	-83.1	-11.95	--
17	G-1A Well	LA-17	9/78	1835	28	-82.5	-11.80	--
18	G-1 Well	LA-18	9/78	1823	29	-81.0	-11.65	--
19	Spring, White Rock Canyon	LA-19	9/78	1646	19	-76.8	-11.00	--
20	PM-3 Well	LA-20	9/78	2024	27.5	--	--	--
32	Pajarito Spring	VA-29	7/79	1680	20	-74.5	-10.90	--

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
33	Spring, White Rock Canyon	VA-30	7/79	1640	18	--	--	--
52	Unnamed Cold Spring	VA-58	7/80	2020	15	-80.5	-11.55	--
53	Unnamed Cold Spring	VA-59	7/80	2050	17	-80.1	-11.60	--
27	San Antonio Creek	VA-104	9/82	2570	22.4	--	--	6.4
28	San Antonio Creek	VA-24	5/79	2570	2	-92.9	-12.85	--
28	San Antonio Creek	VA-95	3/82	2570	3.0	-90.5	-12.85	6.3
28	San Antonio Creek	VA-127	3/83	2570	0.5	--	--	15.5
29	Jemez River at Soda Dam	VA-52	4/80	1930	5	-94.4	-13.20	--
29	Jemez River at Soda Dam	VA-88	3/82	1930	1.9	-89.5	-12.50	13
29	Jemez River at Soda Dam	VA-111	1/83	1930	0.7	--	--	11.8
29	Jemez River at Soda Dam	VA-131	5/83	1930	9	-85.4	-12.00	32.6
31	Panorama Spring	VA-28	5/79	2070	13	-86.9	-11.80	--
31	Panorama Spring	VA-86	3/82	2070	7.2	-87.4	-11.90	4.3
31	Panorama Spring	VA-136	5/83	2070	9	--	--	1.56
35	Sino Spring	VA-32	8/79	2300	21	-88.0	-12.30	--
35	Sino Spring	VA-63	12/80	2300	18	--	--	--
35	Sino Spring	VA-69	6/81	2300	22	--	--	--
35	Sino Spring	VA-85	3/82	2300	16.9	-87.2	-11.90	1.1
35	Sino Spring	VA-102	9/82	2300	21.3	--	--	0.27

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
38	Indian Valley[a] Well	VA-41	8/79	2460	--	-87.1	-12.30	--
			10/79		17.5	-91.1	-12.75	--
40	Unnamed Spring	VA-43	8/79	2770	14.8	-78.2	-11.40	--
40	Unnamed Spring	VA-139	5/83	2770	3	-79.3	-11.65	44.3
41	Unnamed Spring	VA-44	8/79	2490	9.8	-98.2	-13.75	--
43	Unnamed Spring	VA-46	8/79	2330	13.3	-96.5	-13.60	--
44	Seven Springs Spring	VA-47	8/79	2480	12	-99.1	-14.25	--
44	Seven Springs Spring	VA-138	5/83	2480	12	-96.2	-13.50	20.6
44	Cold Spring west of caldera	VA-134	5/83	2480	--	--	--	--
45	Unnamed Cold Spring	VA-48	6/80	2500	9	--	--	--
46	Eddy's Well	VA-49	6/80	2390	15	--	--	--
46	Henson's Well	VA-61	12/80	2390	19	-81.2	-11.30	--
48	Unnamed Cold Spring	VA-54	6/80	2500	11	-88.6	-12.60	--
49	Unnamed Cold Spring	VA-55	6/80	2650	8.5	-90.5	-12.75	--
50	Unnamed Cold Spring	VA-56	6/80	2560	6.5	-87.6	-12.55	--
51	Apache Spring	VA-57	7/80	2530	9	-85.1	-12.25	--
54	Turkey Spring	VA-60	7/80	2130	18	-76.0	-11.00	--
54	Turkey Spring	VA-137	5/83	2130	18	-75.7	-10.90	1.65

[a] Well water collected twice during same year.

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/°°	$\delta^{18}O$°/°°	Tritium (T.U.)
68	Las Conchas Spring	VA-124	1/83	2554	14	--	--	--
Valles Caldera - Sulphur Springs Area								
21	Mudpot, Men's Bathhouse	VA-13	1/79	2500	78	-50.2	-3.25	--
21	Mudpot, Men's Bathhouse	S-7-80	9/80	2500	82	--	--	--
21	Mudpot, Men's Bathhouse	VA-75	1/82	2500	72	--	--	2.1
21	Steam, Men's Bathhouse	VA-81	3/82	2500	13.6	-85.1	-12.50	2.3
21	Women's Bathhouse	S-6-80	9/80	2500	90	--	--	--
21	Women's Bathhouse	VA-76	1/82	2500	89	--	--	19
21	Footbath Springs	S-4-80	9/80	2500	33	--	--	--
21	Footbath Springs	VA-77	1/82	2500	18	-107.0	-23.15	13
21	Footbath Springs	VA-79	3/82	2500	14.6	--	--	--
21	Unnamed Spring	S-3-80	9/80	2500	11	--	--	--
21	Unnamed Hot Spring	S-9-80	9/80	2500	--	--	--	--
21	Unnamed Hot Spring	VA-14	1/79	2500	63	-60.7	-8.80	--
21	Electric Spring	S-5-80	9/80	2500	36	--	--	--
21	Lemonade Spring	S-10-80	9/80	2500	58	--	--	--
21	Sulphur Creek	VA-78	1/82	2500	0.5	--	--	39
21	Steam, Main Fumarole	VA-80	3/82	2500	88	--	--	--
22	Spring, Alamo Canyon	S-1-80	9/80	2610	11	--	--	--

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
22	Creek, Alamo Canyon	S-2-80	9/80	2610	11	--	--	--
22	Bubbling Seep	VA-23	3/79	2610	7	--	--	--
23	Bubbling Pool	VA-22	3/79	2610	0.5	-97.3	-13.45	--
24	Spring, Short Canyon	S-8-80	9/80	2610	8	--	--	--
63	GRI Mudpit-WC #23-4	VA-107	12/82	2627	1.5	--	--	--
63	GRI Well at 4800 ft WC #23-4	VA-113	1/83	2627	214	--	--	--
63	GRI Well at 4800 ft WC #23-4	VA-114	1/83	2627	--	-80.4	-7.80	56.1
63	GRI Wellhead	VA-115	1/83	2627	--	--	--	--
63	GRI Well at 6300 ft WC #23-4	VA-116	1/83	2627	232.6	-71.5	-5.05	--
Valles Caldera - Ring Fracture Zone								
25	Spence Hot Spring	VA-1	7/78	2240	45	-86.4	-12.35	--
25	Spence Hot Spring	VA-68	6/81	2240	42	--	--	--
25	Spence Hot Spring	VA-72	10/81	2240	42	--	--	--
25	Spence Hot Spring	VA-83	3/82	2240	41.6	-36.5	-12.25	1.9
25	Spence Hot Spring	VA-105	9/82	2240	42.5	--	--	--
25	Spence Hot Spring	VA-120	1/83	2240	42.3	--	--	0.20
25	Little Spence Hot Spring	VA-2	7/78	2240	34	--	--	--
26	McCauley Spring	VA-3	7/78	2240	31	-88.4	-12.60	--
26	McCauley Spring	VA-87	3/82	2240	31.5	-89.1	-12.45	2.3
26	McCauley Spring	VA-119	1/83	2240	31.9	--	--	0.27

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
27	San Antonio Hot Spring	VA-4	7/78	2550	42	-92.0	-12.65	--
27	San Antonio Hot Spring	VA-96	3/82	2550	40.8	-91.6	-12.70	5.1
27	San Antonio Hot Spring	VA-128	3/83	2550	41.3	--	--	0.35
28	Bathhouse Spring	VA-20	2/79	2570	38	-86.4	-12.40	--
28	Bathhouse Spring	VA-94	3/82	2570	37.4	-85.0	-11.80	8.3
28	Bathhouse Spring	VA-126	3/83	2570	38.1	--	--	0.44
34	Battleship Seep	VA-31	8/79	2070	19	-92.9	-12.50	--
34	Battleship Seep	VA-50	4/80	2070	11	-92.7	-12.80	--
34	Battleship Seep	VA-133	5/83	2070	12	--	--	3.40
34	East Fork Jemez River	VA-84	3/82	2070	4.4	-88.0	-12.40	13
34	East Fork Jemez River	VA-106	9/82	2070	--	-88.0	-12.40	--
39	Valle Grande Spring	VA-42	8/79	2630	15	-85.0	-12.40	--
39	Valle Grande Spring	VA-82	3/82	2630	13.6	-85.1	-12.50	2.3
39	Valle Grande Spring	VA-117	1/83	2630	13.8	--	--	1.93
42	Horseshoe Spring	VA-45	8/79	2420	14	-90.2	-12.65	--
42	Horseshoe Spring	VA-118	1/83	2420	11.3	-88.9	-12.20	2.32
61	PC1 at 225 ft	PC1-7	10/83	2487	--	--	--	--
61	PC1 at 365-391 ft	PC1-8	10/83	2487	--	--	--	--
61	PC1 at 685-691 ft	PC1-9	10/83	2487	--	--	--	--

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	$\delta D°/_{\circ\circ}$	$\delta^{18}O°/_{\circ\circ}$	Tritium (T.U.)
61	PC1 at 943 ft	PC1-10	10/83	2487	--	--	--	--
61	PC1 at 1100 ft	PC1-11	10/83	2487	--	--	--	--
61	PC1 at 1712 ft	PC1-1	4/84	2487	--	--	--	--
61	PC1 at 1937 ft	PC1-2	4/84	2487	--	--	--	--
61	PC1 at 1987 ft	PC1-3	4/84	2487	--	--	--	--
61	PC1 at 1953 ft	PC1-4	4/84	2487	--	--	--	--
61	PC1 at 2036 ft	PC1-5	5/84	2487	--	--	--	--
71	PC2 at 587-600 ft	PC2-1	8/84	2627	30	--	--	--
71	PC2 at 630-635 ft	PC2-2	8/84	2627	30	--	--	--
71	PC2 at 1086 ft	PC2-3	9/84	2627	--	--	--	--
71	PC2 at 1350 ft	PC2-4	9/84	2627	35	--	--	--
71	PC2 at 1360 ft	PC2-5	9/84	2627	38	--	--	--
71	PC2 at 1335 ft	PC2-6	9/84	2627	40	--	--	--
71	PC2 at 1490 ft	PC2-7	10/84	2627	41	--	--	--
Valles Caldera - Baca Geothermal Field								
62	Redondo Creek at Union Gate	VA-129	5/83	2390	4	-88.7	-12.50	34.1
64	Baca Well #4	BA-2	6/11/82	2835	294	-86.5	-9.20	--
64	Baca Well #4	BA-5	7/2/82	2835	297	-86.0	-9.25	0.49
65	Baca Well #13	BA-1	6/4/82	2841	278	-97.0	-9.30	--
65	Baca Well #13	BA-4	7/1/82	2841	279	-85.0	-9.20	0.61
66	Baca Well #15	BA-7	7/23/82	2774	267	-82.5	-8.00	0.25
66	Baca Well #15	BA-8	9/7/82	2774	326	-85.0	-8.20	0.18
66	Baca Well #19	BA-9	10/15/82	2774	223	-80.0	-7.60	0.47
67	Baca Well #24	BA-3	6/18/82	2661	260	-83.5	-8.00	1.10
67	Baca Well #24	BA-6	7/16-82	2661	261	-83.5	-8.15	0.71

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
Valles Caldera - Soda Dam and Jemez Springs Area								
29	Soda Dam Spring	VA-6	7/78	1930	47	-84.9	-10.60	--
29	Soda Dam Spring	VA-9	1/79	1930	48	--	--	--
29	Soda Dam Spring	VA-26	5/79	1930	47	--	--	--
29	Soda Dam Spring	VA-51	4/80	1930	47	-85.4	-10.70	--
29	Soda Dam Spring	VA-64	12/80	1930	47	-85.2	-10.60	--
29	Soda Dam Spring	VA-70	6/81	1930	72	--	--	--
29	Soda Dam Spring	VA-73	10/81	1930	53	--	--	--
29	Soda Dam Spring	VA-89	3/82	1930	47	--	--	2.9
29	Soda Dam Spring	VA-99	9/82	1930	47.5	--	--	1.33
29	Soda Dam Spring	VA-109	1/83	1930	46.8	-84.0	-10.35	1.48
29	Soda Dam Spring	VA-132	5/83	1930	47	--	--	1.62
29	Soda Dam Spring	VA-140	2/84	1930	46.8	--	--	--
29	Soda Dam Spring	VA-146	4/84	1930	--	--	--	--
29	Grotto Spring	VA-5	7/78	1930	38	-84.6	-10.65	--
29	Outfall of Soda Dam Spring	VA-65	12/80	1930	17	--	--	--
29	Hidden Warm Spring	VA-27	5/79	1930	29	-84.9	-10.95	--
29	Hidden Warm Spring	VA-90	3/82	1930	32	-85.1	-10.65	5.7
29	Hidden Warm Spring	VA-110	1/83	1930	32.3	--	--	3.63
29	Hidden Warm Spring	VA-141	2/84	1930	32.2	--	--	--
30	Main Jemez Spring	VA-10	1/79	1890	55	-82.3	-10.6	--
30	Main Jemez Spring	VA-18	1/79	1890	36	-81.4	-10.4	--

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
30	Main Jemez Spring	VA-93	3/82	1890	46.3	-82.1	-10.40	1.2
30	Main Jemez Spring	VA-122	1/83	1890	74.9	--	--	--
30	Main Jemez Spring	VA-143	2/84	1890	74.7	--	--	--
30	Main Jemez Spring	VA-147	4/84	1890	--	--	--	--
30	Jemez Springs Geothermal Well	VA-121	1/83	1890	74.9	--	--	--
30	Jemez Springs Geothermal Well	VA-144	2/84	1890	72.2	--	--	--
30	Jemez Well/24 m	VA-19	1/79	1890	68	-84.0	-11.3	--
30	Jemez Well/24 m	VA-25	5/79	1890	73.3	--	--	--
30	Jemez Well/152 m	VA-15	1/79	1890	60.5	-85.9	-11.8	--
30	Jemez Well/152 m	VA-21	2/79	1890	61	--	--	--
30	Travertine Mound Spring	VA-7	1/79	1890	70	-83.6	-11.30	--
30	Travertine Mound Spring	VA-17	1/79	1890	72	--	--	--
30	Travertine Mound Spring	VA-66	12/80	1890	72	-83.1	-11.35	--
30	Travertine Mound Spring	VA-71	6/81	1890	72	--	--	--
30	Travertine Mound Spring	VA-91	3/82	1890	72.3	--	--	6.7
30	Travertine Mound Spring	VA-123	1/83	1890	72.6	--	--	2.92
30	Travertine Mound Spring	VA-142	2/84	1890	72.9	--	--	--
30	Buddhist Spring	VA-8	1/79	1890	49	--	--	--
30	Buddhist Spring	VA-16	1/79	1890	50	--	--	--
30	Buddhist Spring	VA-92	3/82	1890	43.2	-83.6	-11.05	10

TABLE B-IV (cont)

Map No.	Name	Field No.	Date Collected	Elev (m)	Temp (°C)	δD°/..	$\delta^{18}O$°/..	Tritium (T.U.)
30	Unnamed Spring	VA-12	1/79	1890	73.3	--	--	--
San Ysidro - Jemez Pueblo Area								
36	Ponderosa Spring	VA-39	8/79	1740	16.8	-84.6	-12.35	--
36	Ponderosa Spring	VA-135	5/83	1740	16.8	--	--	2.07
37	Cañon Spring	VA-40	8/79	1830	20.2	-86.6	-12.35	--
55	San Ysidro Mineral Spring	VA-33	8/79	1680	27	-86.6	-10.40	--
55	San Ysidro Warm Spring	VA-130	5/83	1680	22	--	--	0.40
55	San Ysidro Warm Spring	VA-148	4/84	1680	--	--	--	--
56	Zia Hot Well	VA-34	8/79	1840	56	-89.8	-11.25	--
56	Zia Hot Well	VA-53	4/80	1840	54	-89.0	-12.55	--
56	Zia Hot Well	VA-67	3/81	1840	53	--	--	--
56	Zia Hot Well	VA-74	10/81	1840	53	--	--	--
56	Zia Hot Well	VA-125	2/83	1840	53.0	--	--	0.05
56	Zia Hot Well	VA-149	4/84	1840	--	--	--	--
57	Unnamed Well	VA-35	8/79	1920	21	-101.4	-13.65	--
58	Salt Spring	VA-36	8/79	1690	29.2	-84.9	-10.20	--
59	Log Spring	VA-37	8/79	2190	28.5	-87.7	-12.25	--
60	Owl Spring	VA-38	8/79	1760	17.6	-86.2	-12.15	--

TABLE B-V

GAS ANALYSES FROM VALLES CALDERA REGION IN VOLUME PERCENTAGES

Sulphur Springs Area

	Men's Bathhouse Spring	Men's Bathhouse Spring	Fumarole by Men's Bathhouse	Women's Bathhouse Spring	Women's Bathhouse Spring	Footbath Spring	Footbath Spring	Spring Alamo Canyon	Alamo Canyon Gas Seep	Skin Spring	Lemonade Spring
Sample	S-7-81	VA-154	S-12-81[a]	VA-97	VA-155	S-4-80	VA-98	S-1-80	S-1-81	S-5-80	S-6-80[a]
Date	8/81	6/84	8/81	5/82	6/84	9/80	5/82	9/80	8/81	9/80	9/80
CO_2	97.0	96.79	60.1	96.93	96.90	71.9	99.28	94.5	96.2	92.3	79.4
H_2S	0.5	2.10	0.3	1.25	1.89	0.31	0.60	0.53	0.5	0.38	0.67
NH_3	--	--	--	--	--	--	--	--	--	--	--
H_2	--	0.303	--	0.180	0.376	--	0.300	--	--	--	--
He	--	0.076	--	<0.005	--	--	<0.005	--	--	--	--
N_2	1.8	1.15	31.9	1.41	0.168	23.2	0.14	4.2	2.5	6.0	16.1
O_2	0.7	--	7.7	0.16	--	4.6	<0.01	0.8	0.8	1.4	3.8
Ar	--	--	--	0.02	--	--	<0.01	--	--	--	--
CH_4	--	--	--	0.020	--	--	0.030	--	--	--	--
C_2H_6	--	--	--	<0.01	--	--	<0.01	--	--	--	--
Total	100.00	100.42	100.00	99.99	99.334	100.01	100.38	100.03	100.00	100.08	99.97
Empirical Gas Geothermometers											
CO_2-H_2S-CH_4-H_2[b]	--	--	--	215	--	--	215	--	--	--	--
CO_2-CH_4[c]	--	--	--	287	--	--	273	--	--	--	--

TABLE B-V (cont)

Sulphur Springs Area (cont)

	Short Canyon	Short Canyon	Fumarole Spring	Electric Spring	Sulphur Creek	GRI Mudpit	GRI Well	GRI Well at 4800 ft	GRI Well	GRI Well at Wellhead	Mudpot, Men's Bathhouse	
Sample Date	S-8-80 9/80	S-8-81 8/81	S-10-80 9/80	S-5-81 8/81	S-11-81 8/81	VA-107 12/82	VA-108 12/82	VA-113 1/83	VA-114 1/83	VA-115 1/83	VA-75a[a] 1/82	VA-75 1/82
CO_2	95.7	94.0	95.7	97.0	96.6	98.0	98.78	90.36	99.0	82.68	26.34	88.24
H_2S	0.61	0.5	0.61	0.3	0.3	--	<0.02	0.071	0.17	<0.01	0.22	0.78
NH_3	--	--	--	--	--	--	--	0.062	0.03	--	--	--
H_2	--	--	--	--	--	0.46	0.89	--	0.02	0.95	0.05	0.195
He	--	--	--	--	--	--	0.005	--	0.001	<0.005	<0.005	0.005
N_2	3.7	4.4	3.7	2.1	2.5	1.34	0.01	7.38	0.62	12.28	57.66	8.45
O_2	--	1.1	--	0.6	0.6	0.20	<0.01	1.72	0.10	3.17	15.3	2.05
Ar	--	--	--	--	--	--	0.45	--	0	0.14	0.70	0.10
CH_4	--	--	--	--	--	--	<0.01	--	0	<0.002	0.005	0.020
C_2H_6	--	--	--	--	--	--	<0.01	--	0	<0.001	<0.01	<0.01
Total	100.01	100.00	100.01	100.00	100.00	100.00	100.18	99.60	99.94	99.24	100.29	99.85
Empirical Gas Geothermometers												
CO_2-H_2S-CH_4-H_2[b]	--	--	--	--	--	--	209	--	--	221	288	214
CO_2-CH_4[c]	--	--	--	--	--	--	313	--	--	365	290	284

TABLE B-V (cont)

Baca Geothermal Field

Sample	Baca 4			Baca 13			Baca 13			Baca 15	Baca 15	Baca 19			Baca 24			Baca 24		
	Grav. Anal.	Titra-tion	Average	Grav. Anal.	Titra-tion	Average	Grav. Anal.	Titra-tion	Average	Titration	Titration	Grav. Anal.	Titra-tion	Average	Grav. Anal.	Titra-tion	Average	Grav. Anal.	Titra-tion	Average
DATE		7/2/82			6/4/82			7/1/82		7/23/82	9/8/82		11/12/82			6/18/82			7/16/82	
CO_2	98.44	98.70	98.57	99.28	99.36	99.32	99.15	99.31	99.23	99.34	95.49	98.38	97.95	98.165	98.48	98.75	98.615	98.4	98.82	98.61
H_2S	0.995	0.792	0.894	0.482	0.408	0.445	0.534	0.382	0.458	0.295	0	0.806	1.28	1.043	0.672	0.394	0.533	0.778	0.371	0.575
NH_3	0.027	0.024	0.026	0.017	0.017	0.017	0.017	0.017	0.017	0.015	0.847	0.049	0.047	0.048	0.042	0.042	0.042	0.096	0.094	0.095
H_2	0.07	0.063	0.067	0.004	0.039	0.04	0.052	0.05	0.051	0.034	0.223	0.107	0.101	0.104	0.054	0.054	0.054	0.032	0.032	0.032
HE	0.007	0.007	0.007	0.004	0.004	0.004	0.006	0.005	0.006	0.005	0.004	0.006	0.006	0.006	0.002	0.002	0.002	0.002	0.002	0.002
N_2	0.381	0.345	0.363	0.142	0.138	0.140	0.189	0.183	0.186	0.273	0.290	0.581	0.550	0.566	0.721	0.721	0.721	0.679	0.668	0.674
O_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AR	0.01	0.009	0.01	0.005	0.004	0.005	0.007	0.006	0.007	0.007	0.078	0.017	0.016	0.017	0.018	0.018	0.018	0.013	0.013	0.013
CH_4	0.042	0.038	0.04	0.021	0.020	0.021	0.026	0.025	0.026	0.006	0.015	0.064	0.061	0.063	0.018	0.015	0.018	0.009	0.008	0.009
C_2H_6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	99.97	99.98	99.977	99.95	99.99	99.99	99.98	99.98	99.981	99.98	96.95	100.01	100.01	100.012	100.01	100.00	100.005	100.01	100.01	100.01
STEAM/GAS			120.5			67.63			63.72	55.75	122.8			193.3			154.7			185.8
Empirical Gas Geothermometers																				
CO_2-H_2S-CH_4-H_2[b]			182	--	--	169	--	--	142	170	--	--	--	191	--	--	178	--	--	173
CO_2-CH_4[c]			263	--	--	288	--	--	279	332	297	--	--	246	--	--	292	--	--	317

TABLE B-V (cont)

	Fenton Hill			San Ysidro Area		Soda Dam and Jemez Springs Area		
Sample	V-39,EE-3	V-40,EE-3	V-42,EE-3	San Ysidro Warm Spring VA-148	Zia Hot Well VA-149	Main Jemez Spring VA-147	Soda Dam Spring VA-146	Battleship Gas Seep VA-175
Date	4/7/83	4/7/83	4/7/83	4/5/84	4/5/84	4/84	4/84	8/84
CO_2	98.72	99.99	94.36	95.296	86.147	93.053	97.474	96.07
H_2S	<0.01	<0.01	<0.01	--	--	--	159 ppm	0.43
NH_3	--	--	--	--	--	--	--	--
H_2	0.015	0.005	0.005	--	--	0.280	--	<0.005
He	0.22	0.060	0.075	0.750	0.965	0.747	--	<0.005
N_2	1.41	0.17	4.74	4.417	11.042	4.853	2.433	2.61
O_2	<0.01	<0.01	1.15	0.091	0.023	0.220	0.072	0.66
Ar	0.02	<0.01	0.05	--	0.54	--	--	0.02
CH_4	<0.002	<0.002	<0.002	--	--	1.466	--	0.054
C_2H_6	<0.01	<0.01	<0.01	--	--	--	--	<0.01
Total	100.42	100.27	100.40	100.55	98.72	100.62	99.98	99.86
Empirical Gas Geothermometers								
CO_2-H_2S-CH_4-H_2[b]	129	111	112	--	--	--	--	--
CO_2-CH_4[c]	371	372	370	--	--	131	--	251

[a] Large air contamination.

[b] D'Amore and Panichi (1980).

[c] Norman and Bernhardt (1981).

TABLE B-VI

GEOTHERMOMETERS IN °C

Field No.	Name	Measured Temp	SiO_2 Qtz[a]	SiO_2 Chalcedony	Na-K	Na-K-Ca β=4/3	Na-K-Ca β=1/3	Na-K-Ca Mg Corr	Na-Li[b]
Valles Caldera - Baca Geothermal Field									
BA-2	Baca Well #4	294	288	290	274	--	290	290	301
BA-5	Baca Well #4	297	294	297	273	--	288	288	298
BA-1	Baca Well #13	278	276	275	264	--	282	282	330
BA-4	Baca Well #13	279	282	282	264	--	279	279	303
BA-7	Baca Well #15	267	282	282	267	--	272	272	287
BA-8	Baca Well #15	326	--	--	275	--	277	277	297
BA-9	Baca Well #19	223	264	259	262	--	269	269	303
BA-3	Baca Well #24	260	273	271	235	--	244	244	293
BA-6	Baca Well #24	261	270	267	238	--	247	247	295
AVERAGE		277	279	278	261	--	272	272	301
Sulphur Springs Area - GRI Well									
VA-113	GRI Well at 4800 ft	214	232	220	266	--	258	257	265
VA-116	GRI Well at 6300 ft	232.6	243	234	269	--	287	287	283

TABLE B-VI (cont)

Field No.	Name	Measured Temp	SiO_2 Qtz[a]	SiO_2 Chalcedony	Na-K	Na-K-Ca β=4/3	Na-K-Ca β=1/3	Na-K-Ca Mg Corr	Na-Li[b]
Soda Dam and Jemez Springs Area									
	Soda Dam Spring (Avg. of 10)	47	98	68	274	175	222	167	317
	Hidden Warm Spr. (Avg. of 2)	32.2	95	65	261	166	213	165	306
VA-5	Grotto Spring	38	87	59	270	178	221	157	302
	Main Jemez Spr. (Avg. of 4)	74.8	131	104	221	153	191	175	305
	Travertine Mound (Avg. of 6)	72	132	104	228	150	193	178	309
	Buddhist Spring (Avg. of 2)	50	123	95	231	138	190	156	314
VA-12	Unnamed Spring	49	137	111	229	155	195	161	304
	80-ft Aquifer at Jemez Spring (Avg. of 2)	70.7	121	93	227	146	191	175	303
	500-ft Aquifer at Jemez Spring (Avg. of 2)	61	79	48	269	107	196	143	324
	Jemez Spr. Well	72	133	105	219	150	189	175	288
	Battleship Seep (Avg. of 3)	14	58	25	174	200	178	178	185
	Ponderosa Spr. (Avg. of 2)	13	54	21	198	149	178	92	185
	Average of PC1 Well data	--	144[c]	119[c]	176[c]	183[d]	183[d]	152[c]	84[d]
PC1-6	PC1 Well; with highest Cl content	--	87	56	<80	452	484	484	459[e]

TABLE B-VI (cont)

Field No.	Name	Measured Temp	SiO_2 Qtz[a]	SiO_2 Chalcedony	Na-K	Na-K-Ca β=4/3	Na-K-Ca β=1/3	Na-K-Ca Mg Corr	Na-Li[b]
Ring Fracture Zone									
	Spence Hot Spr. (Avg. of 5)	42.8	116	83	129	54	112	54	304
	McCauley Spr. (Avg. of 2)	31.5	106	77	160	29	118	29	290
	San Antonio Hot Spr. (Avg. of 3)	41.4	123	95	200	69	152	69	137
	Bathhouse Spr. (Avg. of 3)	38.9	138	111	256	82	181	82	144
San Ysidro - Jemez Pueblo Area									
VA-130	San Ysidro Warm Spring	25	56	23	157	148	156	66	184
	Zia Hot Well (Avg. of 4)	54	83	52	115	150	132	50	117
VA-36	Salt Spring	15.5	--	--	162	205	172	72	165

[a]Assuming no steam loss.

[b]Equation for Cl ≤ 7000 mg/ℓ (Fouillac and Michard 1981).

[c]Average of 5 values.

[d]Average of 4 values.

[e]Equation for Cl > 7000 mg/ℓ (Fouillac and Michard 1981).

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