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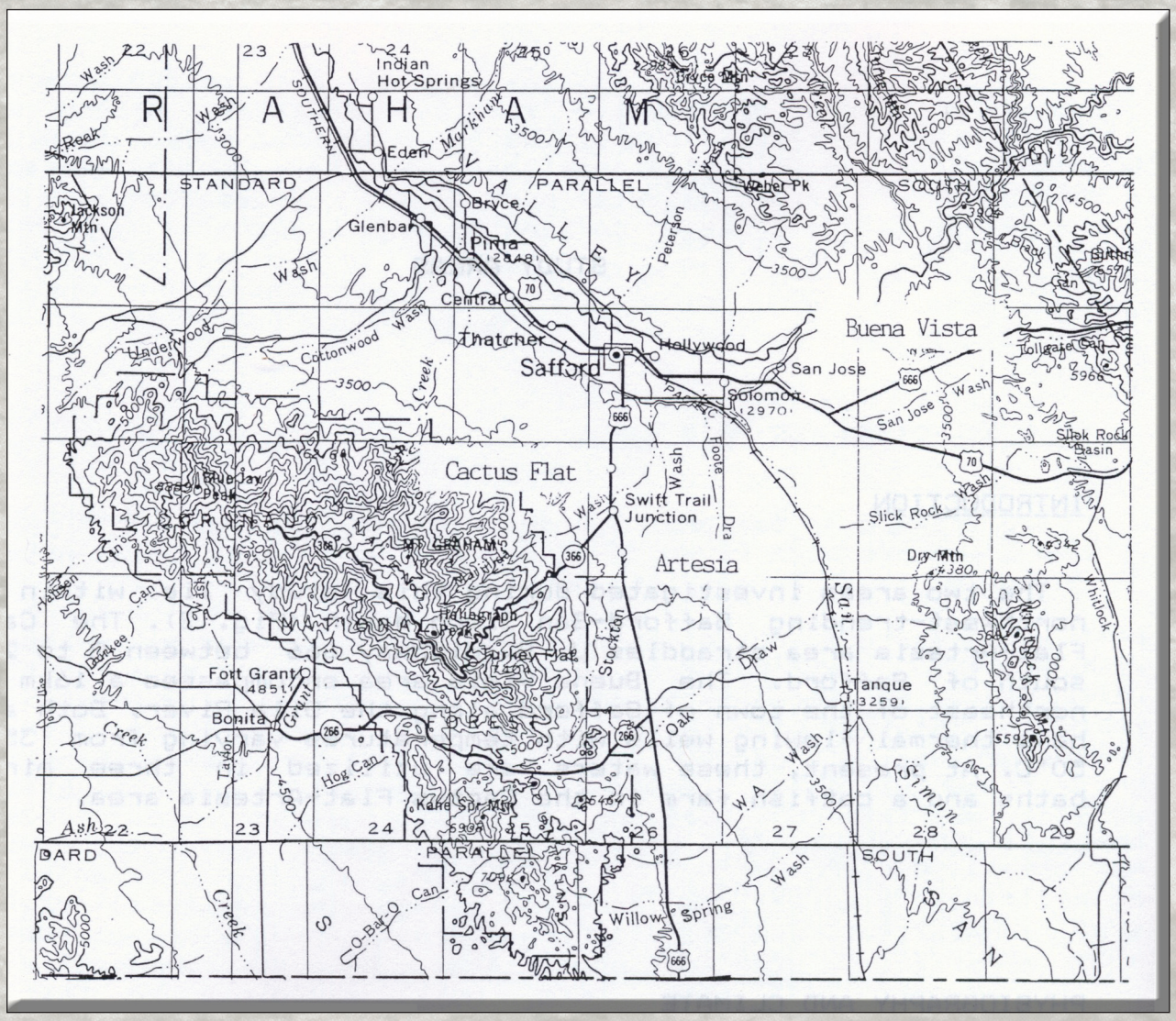

A CO_2-Silica Geothermometer for Low Temperature Geothermal Resource Assessment, with Application to Resources in the Safford Basin, Arizona

May, 2005

JAMES C. WITCHER AND CLAUDIA STONE

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A CO_2-SILICA GEOTHERMOMETER FOR LOW TEMPERATURE GEOTHERMAL RESOURCE ASSESSMENT, WITH APPLICATION TO RESOURCES IN THE SAFFORD BASIN, ARIZONA

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INTRODUCTION

GEOTHERMAL STUDIES

Geothermics is the study of the earth's heat energy, it's affect on subsurface temperature distribution, it's physical and chemical sources, and it's role in dynamic geologic processes. The term, geothermometry, is applied to the determination of equilibrium temperatures of natural chemical systems, including rock, mineral, and liquid phases. An assemblage of minerals or a chemical system whose phase composition is a function of temperature and pressure can be used as a geothermometer. Thus a geothermometer is useful to determine the formation temperature of rock or the last equilibrium temperature of a flowing aqueous solution such as ground water and hydrothermal fluids.

GEOTHERMOMETERS

Several types of geothermometers exist to determine temperature using analyses aqueous solutions from near-surface (upper crust) environments. They include isotope geothermometers, which are based upon temperature dependent fractionation (Craig, 1953; Lloyd, 1968; Mizutani and Rafter, 1967; McKenzie and Truesdell, 1977; and Ellis and Mahon, 1977) and chemical geothermometers. Commonly used chemical geothermometers fall into one of two categories: (1) cation geothermometers (White, 1963; Ellis and Mahon, 1967; Fournier and Truesdell, 1973; Paces, 1975; Fournier, 1979; Fournier and Potter, 1979; and Benjamin and others, 1983), and (2) silica geothermometers (Bodvarrson, 1960; Fournier and Rowe, 1966; Mahon, 1966; Truesdell, 1976; Fournier, 1973; Fournier, 1977; Fournier, 1981; Fournier and Potter, 1982; and Arnorsson and others, 1983). The subject of this research is silica geothermometers.

SILICA GEOTHERMOMETERS

Silica geothermometers exist for several geothermometry models, which have different characteristics, limits, and uses. In an ideal sense, silica geothermometers are based upon temperature dependent water solubility of various polymorphs of silica. Common low pressure polymorphs include alpha-quartz, alpha-cristobalite, and tridymite (Frondel, 1962; and Deer, Howie, and Zussman, 1966). Alpha-quartz (hexagonal) is a relatively pure, stable form of silica and it is one of the most ubiquitious minerals of the upper crust. Several varieties of alpha-quartz exist, which are indentified by color and crystalline state. The latter varieties are of importance in geothermometry due to their solubility differences in water. Crystalline forms of alpha-quartz are quartz, while "non-crystalline" forms fall into a group called chalcedony. Chalcedony is actually cryptocrystalline quartz having a fibrous microscopic texture. Agate, chert, petrified wood and flint are all chalcedony. Chalcedony is more soluble than quartz.

Alpha-cristobalite (tetragonal) is a metastable, high-temperature polymorph of silica. It may be a common constituent in volcanic rocks. Opal, normally regarded as amorphous silica, is actually a hydrous sub-microcrystalline aggregate of cristobalite. Tridymite (orthorombic) is another metastable, high-temperature polymorph of silica. In some siliceous volcanic rocks it may be the dominant silica polymorph. Both cristobalite and tridymite contain greater impurities than alpha-quartz and they have solubilities greater than quartz and chalcedony. Opal is the most soluble silica species.

Silica geothermometry was proposed by Bodvarsson (1960), who published a rough empirical relationship describing silica concentration versus temperature from Icelandic geothermal sources. Fournier and Rowe (1966), using experimental solubility studies of quartz at the vapor pressure of solution, which were published by Kennedy (1950) and Morey and others (1962), developed a quantitative silica geothermometer assuming quartz is the equilibrium silica phase. Mahon (1966) showed that silica concentrations in New Zealand geothermal wells (>150 °C) were controlled by quartz equilibrium.

While quartz is the most stable silica polymorph, other varieties of silica, such as metastable chalcedony, cristobalite and opal may also control silica concentrations in water.

Fournier (1981) reviewed evidence for non-quartz control of dissolved silica. This evidence includes (1) anomalously high silica concentrations in natural waters; (2) paragenetic sequences of silica minerals in drill core from geothermal areas; and (3) experimental silica solubility studies that determined of two different silica varieties contact a solution, the more soluble one controls silica concentration. Arnorsson (1975) demonstrated that chalcedony control silica concentrations in Icelandic geothermal systems in basaltic rocks below 110°C and to 180 °C in some cases. To summarize,control of silica concentration in natural waters rests largely upon the silica phase present and upon reaction kinetics (discussed in a later section), in addition to temperature.

In order to successfully apply silica geothermometers to geothermal exploration and reservoir engineering, several models have been developed for their use. These models describe circumstances commonly found in nature. Each model has its own set of requirements, which must hold true if results of geothermometry are to be accurate and reliable. These models are:

(1) The conductive model

If a solution cools conductively (heat loss to country rock) after it leaves a reservoir where it has equilibrated with some polymorphs of silica, it does not lose or gain dissolved silica; it is not mixed with cool near-surface water, or it has not lost steam, a conductive silica geothermometer applies. Conductive silica geothermometers exist for quartz, chalcedony, cristobalite, and opal (Fournier, 1973; Fournier and others, 1974; Fournier, 1977; and Arnorsson, 1983).

(2) The adiabatic model

If a geothermal water has lost steam, the residual silica in solution increases proportional to steam loss. Therefore, the proportion of adiabatic steam loss to conductive cooling is used to correct the silica geothermometer. Adiabatic geothermometers exist for quartz and chalcedony (Fournier and others, 1977; Fournier, 1977; and Arnorsson, 1983). These goethermometers apply to near-surface boiling systems where minimal or no conductive heat loss occurs and no loss of dissolved silica occurs.

(3) Mixing models

Several mixing models exist, which may include the effect of surface boiling (single stage steam loss at a specified enthalpy). The simplest mixing model is hot

water mixed with cold water where the gross compositions of each differ, no steam loss occurs, no silica precipitates before or after mixing and no conductive heat loss occurs. Mixing model geothermometry techniques may include the use of heat, silica and chloride-balance equations, which are solved simultaneously, enthalpy-silica diagrams, and enthalpy-chloride diagrams. The latter technique may calculate enthalpy with silica geothermometers or cation geothermometers and the combined effects of mixing, boiling and conductive heat loss may be observed provided several discharges from the same reservoir are used (Fournier and Truesdell, 1974; Truesdell and Fournier, 1977; Mahon, 1975; and Fournier 1979). Before mixing models are applied the occurrrence of mixing must be established. Truesdell and Fournier (1976) Fournier (1979, 1981) reviewed factors that may indicate mixing: (1) chloride concentration variations too great to be explained by steam loss in boiling (which causes increased chloride concentration); (2) systematic variation of ratios of highly soluble and conservativeconstituents such as Cl/B, B/Li, and Cl/Li; (3) variations in oxygen and hydrogen isotopes; (4) Cool springs with high flow rates but high geothermometer values (either silica conductive or cation geothermometers); (5) systematic variations of spring compositions and measured temperatures. Successful application of mixing models may require knowledge of chemistry and temperature of the cold mixing waters.

We propose that another model, which we call a steady-state model, has use as a geothermometer on low-temperature waters (<150°C). At these temperatures silica-reaction kinetics are slow and may have similar or lower rates than aluminosilicate-water reactions. Our study addressed the affect of CO_2 concentration on silica geothermometry and devised a method to correct CO_2 affects in order to obtain an accurate silica geothermometer for use on waters less than 100°C.

Impetus to study and develop this geothermometry model was two-fold. First, systems with reservoir temperatures less than 150 °C frequently do not realistically fit models previously developed, which were outlined in the preceeding discussion. This makes geothermometers unreliable and ambiguous to interpret. One major reason is that the silica in these waters is not from quartz or other silica polymorph forms. The dissolved silica contributions are from non-equilibrium reactions whose rates may exceed polymorph equilibrium. Second, the problem is important because the greatest number of geothermal resources have reservoir temperatures less than 150 °C. Successful demonstration and use of a steady-state geothermometry model will

aid exploration and developement of the low- to moderate-temperature resources.

PREVIOUS STUDIES

Feth and others (1964) and Garrels and McKenzie (1967) showed that the reactions of dissolved carbon dioxide with primary rock minerals such as feldspars explain the chemical compositions of springs in the Sierra Nevada of California and Nevada. Dissolved silica in these low-temperature waters may be due entirely to acid attack by dissolved carbon dioxide on aluminosilicate minerals, which also releases cations to solution. Busenberg and Clemency (1976) have experimentally determined in long-term tests at standard conditions and constant pCO_2 (1 atmosphere) that silica is initially released rapidly during feldspar-water reactions. However, after several days the silica release rate was very slow and nearly constant. Studies by Rimstidt and Barnes (1980) showed that equilibration rates of silica polymorphs are extremely slow at lower temperatures. Paces (1978) has suggested that aqueous concentrations associated with acid (pCO_2) attack of aluminosilicate minerals are controlled by "hydrodynamic or chemical steady-state mechanisms or through chemical equilibrium with a reversible metastable (aluminum silicate solid." The foregoing studies make it abundantly clear that silica geothermometry at low temperatures (less than 80 C) is fraught with difficulty due to reactions which introduce dissolved silica to solution from non-polymorph sources.

This study investigates silica-water reactions in low-temperature geothermal water in areas near Safford, southeastern Arizona, and derives a pCO_2 correction for conductive silica geothermometers. Use and limitations of the technique are also discussed. Data collection , interpretation approach, and basic geochemistry, as it applies to this study, are outlined. In addition, the geology, thermal regime, geohydrology, and gross geochemistry of the Safford area are reviewed. Finally, geothermal potential, as indicated by this study and previous studies is discussed.

DATA COLLECTION AND INTERPRETATION

DATA SOURCES

Data collected for this study include ground water chemical analyses, drillers' logs of water wells, geohydrologic and geologic information. Published chemical analyses were compiled from Witcher, 1981; Swanberg and others, 1977; Muller and others, 1973; Dutt and McCreary, 1970; and Hem, 1950. Additional analyses from an area near Buena Vista were obtained from a University of Arizona Master's thesis on a sub-economic mineral deposit (Yarter, 1981). Knechtel (1938) published several analyses from the area in a U.S. Geological Survey Water Supply Paper. Knechtel's data were not included in our data base because they were relatively incomplete. Unpublished chemical analyses were obtained from files of the city of Safford's engineers' office and from files of the U. S. Geological Survey, Water Resources Division, Tucson. Because available published and unpublished chemical analyses usually had no aluminum, boron, or lithium analyses and because reliability of pH and alkalinity data were generally unknown, field collection of an additional 42 chemical analyses of ground water was performed.

Drillers' logs and geohydrologic information were obtained from Knechtel, 1938; Witcher, 1982; and from files of the Arizona Department of Water Resources, Phoenix and the U. S. Geological Survey, Water Resources Division, Tucson.

FIELD WATER SAMPLING

Samples were selectively taken from flowing artesian wells except for one pumped well at Buena Vista and one surface runoff sample. Temperature, pH, and total alkalinity were carefully measured in the field in order to obtain the most accurate

values. The pH and alkalinity are critical measurements to determine pCO_2 pressure.

The pH was measured with a Corning Model 610A Expand Portable Meter equipped with a Corning 476115, KCl-AgCl Combination Glass Electrode. Calibration was done by standardizing the electrode in pH7 buffer standard. The buffer standard was temperature equilibrated to the sample temperature. This temperature was set on the pH meter temperature compensator during the calibration. The electrode was rinsed in deionized water after calibration and placed in an unfiltered volume of sample. The pH readings were taken at intervals of time until the pH meter stabilized. The stabilized pH value was recorded. Temperatures were taken with a 0.1 C graduated mercury thermometer.

After measuring temperature and pH, an electrometric titration was performed on an unfiltered 50ml pipette volume of sample. A 0.02297N standardized solution of H_2SO_4 was used for titration. Acid was added in small increments (0.1 to 0.05ml) near the CO_3 and HCO_3 end points (approximately pH 8.3 to pH 4.5, respectively). End points were determined by noting the highest ratios of pH/ ml acid. The volume of acid required to reach these end points was used to calculate alkalinity.

Two samples were prepared in the field to preserve chemistry for laboratory analysis. Both samples were filtered through a 0.45 micron Nalgene filter, using an on-line vacuum filtration system. A hand pump was used to create the vacuum. The first sample consisted of approximately 500ml of pure filtered sample. The second sample consisted of approximately 500ml of filtered sample with 5ml of 1N HCl added to preserve cations and aluminum. Both samples were placed in clean, rinsed plastic bottles. Because very high silica concentrations (> 100 ppm) were not expected, sample dilution with deionized water was not performed to prevent silica polymerization.

CHEMICAL ANALYSES

Samples were shipped in wooden boxes lined with styrofoam by bus to B. C. Laboratories in Bakersfield, California. Blue ice packages kept the box interiors cool during shipment. Analyses were performed according to APHA-AWWA-WPCF-EPA standards (American Public Health Association, 1979; Environmental Protection Agency, 1979).

Milliequivalent charge balances of lab analyses were all less

than 2 percent. Ion charge balance after speciation calculations, using field pH and alkalinity, were within three percent, except for four samples. Charge balance differences between five and seven percent occurred in three samples; 16W83 was off by 15 percent. Samples 21W83 and 40W83 are from the same well but were collected on different days. Agreement between analyses is better than 96 percent. Thus, the combined effects of sampling error, lab error and changes in discharge chemistry with time are minimal in these two samples.

DRILLERS' LOGS OF WELL LITHOLOGY

Available drillers' logs were compiled to obtain subsurface stratigraphic and structural information. Drillers' logs are difficult to interpret and they may be ambiguous because drillers they usually do not follow geologic convention or vernacular. However, in areas where distinctive lithologic units occur, drillers' logs can be interpreted with a fair degree of confidence. In many cases they provide the only available subsurface information.

Table 1 shows the systematics of drillers'-log interpretation. This method of interpretation is not perfect; but it allows consistent evaluation of the logs. It has been used successfully in the San Simon and Willcox basins (Witcher, 1981; 1982). Units with distinctive color, texture and grain size are generally noted consistently by drillers. In this area, the blue-green clay and sand and gravel descriptions fall into this recognizable category. The blue or green clay is a real unit, which is found in outcrop. Harbour (1966) and White and Smith (1965) indicated that the unit is of lacustrine origin. Witcher (1981; 1982) showed that it occurs as a lens shaped marker bed in the Safford-San Simon basins and the Willcox basin. The blue or green clay thickens toward depositional basin centers; but the blue-green clay elevation tops usually vary only slightly. Perhaps the most difficult stratigraphy to distinguish in drillers' logs is the evaporite sequences within the basins of southeastern Arizona. Geophysical logs and resistivity data are used to supplement drillers' logs when they are available. These methods are sensitive to clay and evaporite sequences (and to ground water with high TDS that is associated with these units). Drillers'-log interpretations are only guides and are not absolutely reliable by themselves. However, their usefulness should not be underestimated; that is why we used them when other information was unavailable.

DATA PROCESSING

Standard laboratory chemical analyses were used to determine the gross chemistry of ground water. These analyses are reported in terms of total analytical concentration of sodium, potassium, calcium, silica and so forth. Concentrations of individual ions and ion pairs are not reported. For instance, reported calcium concentrations are actually the sum of several ionic calcium species and uncharged complexes (ion pairs) present in the ground water:

Equation 1

$$Ca(analyzed) = Ca^{++} + CaCO_3^{\circ} + CaSO_4^{\circ} + ...etc.$$

In detailed studies of equilibrium and reaction kinetics the thermodynamic state or saturation level of a sample water is required. In order to know the thermodynamic state of ground water, ionic speciation requires calculation. Because of electrostatic interaction of ions in a soluition, the Gibbs free energy change may be different in a real solution than in an ideal solution. Hence, it is necessary to determine effective concentration (activity) of ions in solution. Species activity is related to species concentration by an activity coefficient:

Equation 2

$$a_i = y_i \, m_i$$

a_i is activity concentration of species i

m_i is concentration of species i

y_i is activity coefficient of species i

In dilute solutions activity is near unity. As concentratrion

increases the coefficient deviates more and more from unity.

Calculation of speciation is accomplished by setting up a geochemical model involving mass balance equations similar to Equation 1. Mass action equations are then derived to describe all of the components in the mass balance equations. Using a simplified example from Equation 1, the mass action equations are:

Equation 3

$$K1 = aCaCO3^{\circ} / aCa^{++}\ aCO3^{--}$$

Equation 4

$$K2 = aCaSO4^{\circ} / aCa^{++}\ aSO4^{--}$$

from these equations:

Equation 5

$$mCaCO3o = K1\ aCO3^{--}\ mCa^{++}\ yCa^{++} / yCaCO3^{\circ}$$

Equation 6

$$mCaSO4o = K2\ aSO4^{--}\ mCa^{++}\ yCa^{++} / yCaSO4^{\circ}$$

combining equations 5, 6, and 1:

Equation 7

$$mCa^{++} = mCa^{++}(analyzed) / 1 + yCa^{++}\ (K1\ aCO3^{--} /$$

$yCaCO_3^{\circ}) + (K_2 aSO_4^{--} / yCaSO_4^{\circ})$

A set of equations similar to Equation 7 is solved simultaneously by iterative methods until a mass-charge balance is obtained.

When activities have been calculated it is possible to determine aqueous saturation with solid mineral phases. Several geochemical models and computer programs have been developed to determine speciation, activities, and mineral saturation of ground waters. Our study has employed the WATSPEC program (Wigley, 1977), which is a shortened FORTRAN IV program based upon the longer and more detailed WATEQ (Truesdell and Jones, 1974) and WATEQF (Plummer and others, 1976) programs. WATSPEC was chosen because it uses only major constituents normally analyzed in ground water. It is well documented, and it uses little computer time. Because our data did not include eH data and our study did not require trace element speciation, this program was basically tailored to our research.

WATSPEC uses an extended Debye-Huckel equation to calculate activity coefficients (Stumm and Morgan, 1970). Thermodynamic data used in WATSPEC has the same values as those used in WATEQ. Temperature adjustment of equilibrium constants is done with the Van't Hoff relationship except where analytical expressions were employed.

A DEC PDP 11 computer was used to process data through the WATSPEC program. The WATSPEC program was modified to eliminate calculation of iron and sulfur speciation. Equilibrium constants smaller than 10E-37 for certain sulfur and iron species in a data statement caused an overflow problem. Since iron and sulfur were not critical to our study, these calculations were overridden. In addition, our data base was incomplete with respect to iron and sulfur. The program was also modified to calculate saturation indices of silica phases, using the latest analytical expressions of the temperature dependence of their respective equilibrium constants. Silica saturation indices using original equilibrium constants are still calculated and presented in output along with the new values. WATSPEC was further modified to give additional output information in a different format than the published version.

Because WATSPEC accepts chemical data in millimoles per liter, a small FORTRAN IV program, MOLAL, was written to convert parts per million concentration into millimoles per liter and make a data base with a suitable format for WATSPEC to accept.

BACKGROUND

GENERAL THERMODYNAMIC BASIS OF CHEMICAL GEOTHERMOMETRY

Chemical geothermometry is based upon two important concepts describing a chemical reaction. These concepts, chemical equilibrium and reaction kinetics, are best described in terms of energy changes that occur during a chemical reaction. As a reaction proceeds, a point is eventually reached where no net change in energy takes place. At this point a chemical system is in chemical equilibrium. The rate at which a reaction approaches equilibrium is described by reaction kinetics. When a chemical system reaches an equilibrium condition, no net change in energy occurs unless new forces are introduced. Like physical systems in a non-equilibrium condition, chemical systems undergo a spontaneous change until the energy of the system has been minimized. This minimized-energy condition or equilibrium energy is called Gibbs free energy.

Gibbs free energy is a thermodynamic parameter that is used to relate the concentrations of chemical species involved in a reaction. The driving force in a non-equilibrium or initial state that causes a system to change to a final or equilibrium state is called the Gibbs free energy change (G). This parameter commonly employs units of Kcal/mole and is expressed as:

Equation 8

$$G = \Delta G(\text{final}) - \Delta G(\text{initial})$$

In terms of a chemical reaction the Gibbs free energy change may also be written as:

Equation 9

$\Delta G = \Sigma G(\text{products}) - \Sigma G(\text{reactants})$

The Gibbs free energy of an individual species is dependent upon temperature, pressure, and concentration. These physical conditions define a state. At standard state conditions (25 C, 1 atmosphere and 1.0 molar pure concentration or unit activity) Gibbs free energy is designated as standard free energy of formation (Gf).

Because the concentrations of the species involved in reactions in natural systems are generally different from those specified for the standard state, it is necessary to relate standard free energy of formation to Gibbs free energy change. Chemical thermodynamics predicts the following relationship:

Equation 10

$$Gx = Gf + RT\ln ax$$

R is universal gas constant or 1.987 cal/mol K

T is absolute temperature in degrees Kelvin (K)

ax is activity concentration of chemical species x

This relationship can be extended to include all species in a reaction in order to determine the Gibbs free energy change in a reaction. First, a general chemical reaction may be written as:

Equation 11

$$aA + bB = cC + dD$$

a,b,c,d are stoichiometric coefficients

A,B,C,D, are of species involved in the reaction

Second, by combining equations 9 and 11 an expression for the Gibbs free energy change for this reaction is obtained:

Equation 12

$$\Delta Gr = c\Delta G(C) + d\Delta G(D) - a\Delta G(A) - b\Delta G(B)$$

Inorder to relate Gibbs free energy change of the reaction to standard free energy of formation, equations 10 and 12 are combined and terms rearranged to give:

Equation 13

$$\Delta Gr = \Delta Gf + RT\ln(aC)^{c}(aD)^{d}/(aA)^{a}(aB)^{b}$$

or stated another way:

$$\Delta Gr = \Delta Gf + RT\ln Q$$

Q is a reaction quotient $Q = (aC)^{c}(aD)^{d}/(aA)^{a}(aB)^{b}$

Because a system at equilibrium shows no net energy change, a system at equilibrium at standard state is described as follows:

Equation 14

$$\Delta Gr = 0 = \Delta Gf + RT\ln Q$$

or

$$\Delta Gf = -RT\ln K$$

K is an equilibrium constant

At equilibrium the reaction quotient (Q) equals the equilibrium constant (K). Because geothermometry by definition assumes equilibrium at some specified state, the log ratio Q/K is an important factor to predict how far a reaction has proceeded toward equilibrium and assess the geothermometer reliability in a natural system. This ratio is often referred to as I, an indices of saturation:

Equation 15

$$\log I = \log Q/K$$

I is related to Gibbs free energy change by:

Equation 16

$\Delta Gr = 2.303\ RT \log I$

In order to use chemical geothermometry , it is necessary to relate the thermodynamic equlibrium constant (K) to temperatures and pressures other than standard state. The influence of pressure at shallow depths is minimal and will not be discussed.

Another definition of Gibbs free energy change provides a useful starting point to discuss the effects of temperature on equilibrium. Gibbs free energy change for a given chemical reaction at constant temperature is dependent upon the enthalpy change (H), the entropy change (S), and temperature as follows:

Equation 17

$\Delta Gr = \Delta Hr - T\Delta Sr$

ΔHr is commonly in units kcal/mole

ΔSr is commonly in units cal/deg mole

T is absolute temperature degrees Kelvin

The magnitude and direction of a reaction is dependent upon temperature and the respective signs of enthalpy and entropy. Because enthalpy change (ΔHr) is a quantity of heat liberated or absorbed in a chemical reaction , enthalpy change is useful to relate the equilibriuim constant (K) to temperatures other than a standard state. This is done using the Van't Hoff relationship:

Equation 18

$\ln Kt/\ln Ks = (-\Delta Hf/R\ )(Tt - Ts/TsTt)$

The quantity ofΔHf is the standard enthalpy change and it is assumed to remain constant over the temperature range Tt to Ts.

Discussion up to this point relates the equilibrium constant (K) to temperatures and concentrations other than standard state conditions. It should be pointed out that this discussion of

concentration is in terms of activity concentration. The relationship between activity concentration, speciation, and measured laboratory concentration is discussed in a later section.

Clearly there are several reactions that have a theoretical potential as geothermometers. However, more is required than temperature dependence of species concentration in a reaction. For a specified reaction to have use, species in the reaction can not be involved in other reactions at faster rates. Just as important, in order that geothermometers have any meaning beyond measured surface conditions, the reaction kinetics must be slow at low temperatures. This slow reaction rate preserves the chemical species concentration after the aqueous solution at equilibrium leaves a reservoir and cools, thus allowing calculation of a reservoir temperature.

Kinetics is described by a general reaction of the form:

Equation 19

$$A + B \underset{kr}{\overset{kf}{\rightleftharpoons}} C + D$$

kf and kr are rate constants

The forward reaction rate (Rf) is described by:

Equation 20

$$Rf = kf[A][B]$$

Brackets denote activity concentration of species A and B.

This relationship is interpreted to show that as a reaction proceeds, the activity concentrations of A and B decrease; likewise Rf , which is initially large, decreases also. The reverse rate (Rr) is described by:

Equation 21

$$Rr = kr[C][D]$$

As the reaction in Equation 19 proceeds the activities of C and D increase, and Rr increases. When Rf = Rr, equilibrium is reached. This condition is described by:

Equation 22

$$Kt = kf/kr = [C][D]/[A][B]$$

Kt is an equilibrium constant for the reaction at temperature t

In summary, the preceeding geochemical discussion provides a general basis for understanding chemical geothermometers. Two main conclusions from this discussion are relevent to chemical geothermometry in natural aqueous systems:

(1) A reaction must have sufficient standard enthalpy change to allow an easily observed temperature dependent variation of species concentration. (2) The reaction kinetics must be faster at higher temperatures and much slower at lower temperatures for a reaction to have use as a geothermometer.

However, the main factor required for successful geothermometry is that a particular reaction must reach temperature-dependent equilibrium in a natural system. For that to happen the chemical species required for the reaction must be present, and the specified reaction must occur, not another reaction that uses the same species.

THE GEOCHEMICAL SYSTEM WITHIN BASINS IN THE SOUTHWESTERN U. S.

In order for silica and cation geothermometry to predict valid subsurface temperatures, the reactions upon which they are based must occur. At higher temperatures (greater than 100 to 150°C) alteration and mineral assemblages found in active and fossil geothermal systems are compatible with the geothermometers. Reliability of geothermometers at lower temperatures (less than 150 to 100°C) is less certain. Part of the problem deals with slower reaction kinetics at lower temperatures, and part involves the occurrence of the specified reactions necessary for valid geothermometry results. In order to address this latter problem,

the geochemical systems found in basins in the southwestern U. S. must first be characterized.

The processes of sediment diagenesis provided general information on basin geochemistry. Diagenesis has been defined by Pettijohn and others (1973) as . . . "all those processes, chemical and physical, which affect the sediment after deposition and up to the lowest grade of metamorphism, the greenschist facies." The overall trend during diagenesis is towards equilibrium, however, equilibrium is usually not reached between all minerals and contained fluids. In an ideal sense, herein lies the main difference between diagenesis and metamorphism. Generally, diagenetic mineral and alteration assemblages only approach equilibrium; whereas metamorphic and hydrothermal assemblages are sometimes interpretable in terms of the assemblage equilibrium at a specified temperature and pressure (Pettijohn and others, 1973). Factors responsible to varying degrees for this difference in overall state of chemical equilibrium are reaction kinetics, time, and fluid-flow rate.

As with hydrothermal and metamorphic processes, diagenetic processes also dramatically change the chemical composition of rocks by chemical mass transport in aqueous solutions. These chemical processes involve both dissolution and precipitation of minerals and cements. Dissolution may be congruent or incongruent. Congruent dissolution removes all components in a solid species into solution. Incongruent dissolution selectively removes a few components to change the composition of a solid. Alteration of feldspars to clay minerals is an example of incongruent dissolution. Precipitation requires that the system is open to fluid flow in order to replenish supersatured solutions. However, with time precipitation of cements and authigenic minerals decreases permeability by filling pore spaces.

Diagenesis of basin-fill sediments in the southwest United States and northern Mexico have been discussed in detail by Walker and others (1978) and Turner (1980). Walker and others (1978) showed that four post-depositional processes affect basin-fill sediments: (1) mechanical infiltration of detrital clay into the interstitial pore spaces; (2) dissolution of primary detrital framework silicate (tectosilicate) minerals; (3) replacement of primary detrital framework silicate minerals by clay; and (4) precipitation of a wide variety of stable and metastable authigenic cementing minerals. These authors noted that these processes are "not equally important everywhere, but almost everywhere one or more of these processes significantly altered the original texture and mineral composition of the sediments." Three stages of diagenesis through time were indentified by Walker and others (1978) (Fig. 1). Stage 1 is infiltration of detrital clay; stage 2 is significant alteration of pyroxene, amphibole and calcium plagiocalse; stage 3 is

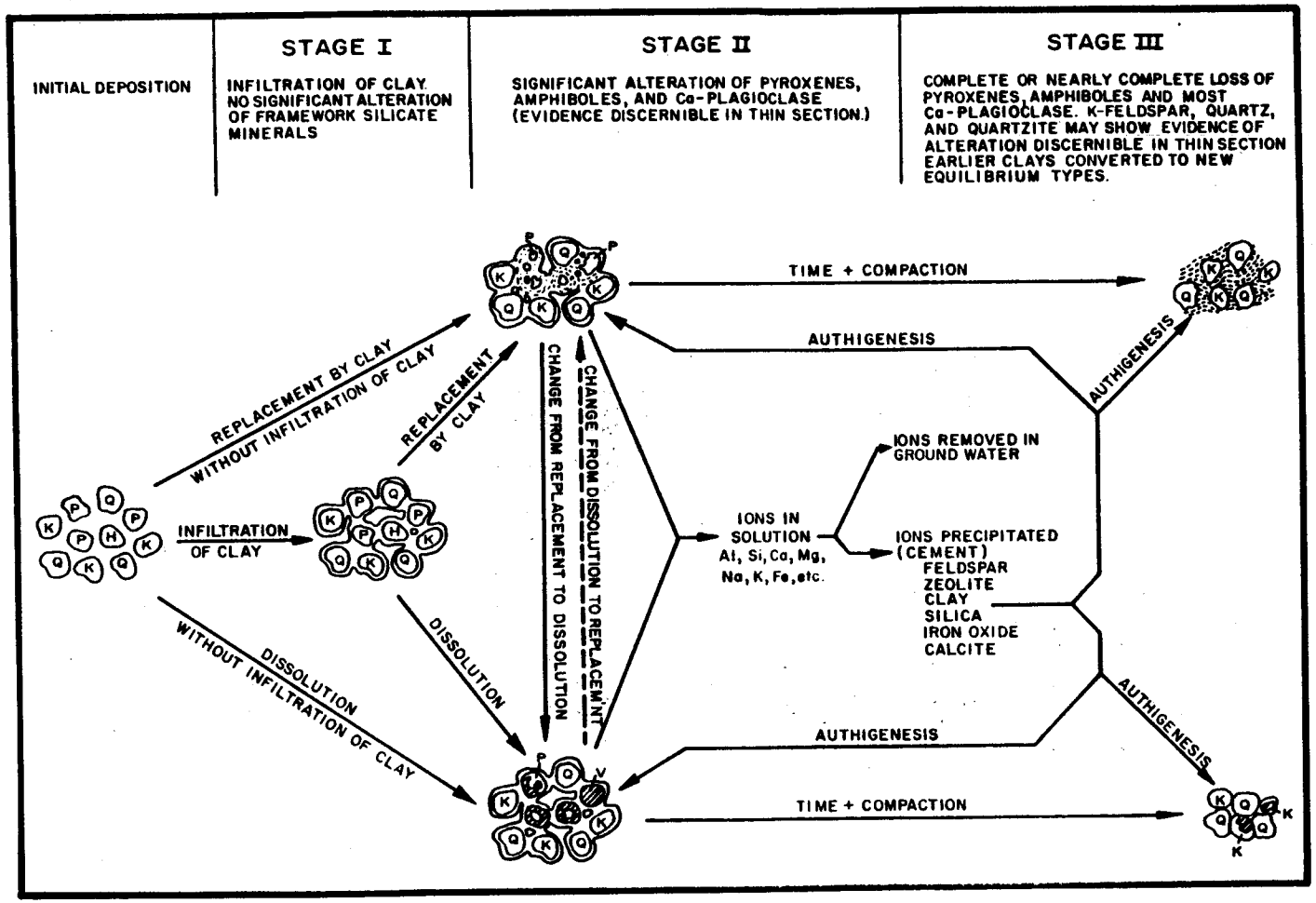


Figure 1 Stages of basin-fill diagenesis

After Walker and others (1978)

complete or nearly complete loss of pyroxene, amphibole and most calcium plagioclase, while potassium feldspar and quartz may show evidence of alteration.

Alteration of primary framework silicate minerals is greatest in minerals low in the Goldich stability series (Goldich, 1938; Loughnan, 1969; Walker and others, 1978; and Turner, 1980). These minerals include plagioclase, augite and hornblende. Dissolution and replacement by clay is the common alteration mechanism.

Walker and others (1978) found that replacement of silicate minerals by clay commonly exceeds 15 percent of the sediment volume and that in most instances this clay is nearly pure montmorillonite.

Most authigenic minerals in the basin-fill sediments are extremely fine grained and normally they are very difficult to recognize without the aid of a scanning electron microscope (Walker and others,1978). Potassiuum feldspar is one of the most common authigenic minerals. Detrital grains of primary potassium feldspar and plagioclase serve as hosts for overgrowths of secondary potassium feldspar. In many locations potassium feldspar crystals are important components of interstitial matrix along with infiltrated clay and authigenic montmorillonite (Walker and others, 1978).

Clinoptilolite, a high-silica zeolite, forms a common cementing material where volcaniclastic detritus occurs. Authigenic potassium feldspar and quartz are commonly associated with this zeolite (Walker and others, 1978). Sheppard and Gude (1973) described the occurrence of zeolite minerals in the Big Sandy formation in western Arizona. Authigenic zeolites are most abundant in altered vitric tuffs and tuffaceous sediments, and may show laterally or vertically zoned zeolite assemblages. Commercial zeolite deposits exist in the Safford-San Simon basin northeast of Bowie, Arizona (Eyde, 1978).

Authigenic montmorillonite is frequently observed in interstitial cavities as small crystals in addition to being a common replacement of alteration minerals (Walker and others, (1978).

Walker and others (1978) found that silica is precipitated as quartz, exhibiting two crystal forms. They stated, "We have not observed the two crystal forms occurring together, and therefore we conclude that one is not the precursor of the other. We also conclude that the two forms reflect either different concentrations of SIO2 in the groundwaters or other differences in the interstitial chemical conditions but we do not know the nature of the differences. Both quartz forms commonly are associated with authigenic potassium feldspar." They further noted that dissoluition of detrital silicate minerals precedes

precipitation of authigenic quartz.

Authigenic calcite most commonly causes induration of basin-fill sediments. Calcite is usually coarse grained and it fills interstitial voids and voids formed by dissolution of detrital minerals. Hematite is an additional authigenic mineral common to basin-fill sediments.Chlorite was not discussed by Walker and others (1978); however, Turner (1980) pointed out that it is one of the common minerals in ancient red-bed deposits.

IDENTIFICATION OF FACTORS AFFECTING THE USE OF GEOTHERMOMETERS

Studies of diagenesis in basin-fill sediments reveal that silicate minerals and aqueous solutions interact extensively. Primary detrital minerals such as amphiboles, pyroxenes, biotite, and calcium plagioclase are altered or dissolved to the greatest extent. Authigenic minerals and cements include various clay minerals, various zeolites, potassium feldspar, quartz and calcite. Thus silica dissolved in water is lost to solution by precipitation of aluminosilicates and quartz. No mention was found of other solid silica phases such as chalcedony or cristobalite having been identified as authigenic precipitates in basin-fill sediments. (Chalcedony, cristobalite, and opal have been found as primary detrital minerals where detritus from volcanic terranes comprises the basin-fill sediments.)

Chemical reactions occur and mineral phases exist in basin sediments and their fluids which are compatible with cation and silica geothermometers. But, the primary detrital minerals are not an equilibrium assemblage as shown by their dissolution and extensive alteration. As they dissolve or alter their contributions of silica and cations to solution cause supersaturation of components that are necessary to precipitate authigenic (equilibrium) minerals such as quartz and potassium feldspar, zeolites, chlorite, clays, and calcite. If the kinetics of the dissolution reactions exceed the kinetics of precipitation reactions, silica geothermometry will predict high and unrealistic reservoir temperatures. In the case of the quartz geothermometer, the rate at which dissolved silica from alteration of primary detrital framework silicate minerals is added to solution may exceed the rates of quartz and authigenic aluminosilicate precipitation to give excess dissolved aqueous silica and erroneously high reservoir temperatures.

In order to maintain dissolution, authigenic mineral precipitation, and excess dissolved silica in ground water, a

constant supply of reactive fluid is required. Ground water containing significant quantities of dissolved carbon dioxide is highly reactive with aluminosilicate minerals. The atmosphere and decay of organic material provide the sources for a constant supply of CO_2 in areas of recharging groundwater.

SITE SELECTION FOR THIS STUDY

Two areas near Safford, Arizona were selected for this study. The principal area is south of Safford at Cactus Flat-Artesia. The other is at Buena Vista northeast of Safford.

Major factors for selecting these sites included a knowledge of subsurface temperatures and an understanding of local ground-water geochemistry and the geohydrologic flow system. At Cactus Flat-Artesia these factors have been well characterized. The geochemical, geohydrologic and thermal regimes at Buena Vista are less well known. Another major factor in selecting these sites was that they meet the criteria necessary to adequately study geothermometry. These criteria include:

> (1) distinct, and confined groundwater aquifers. (2) relatively unmixed discharges from the aquifers. (3) relatively wide and predictable subsurface temperature ranges. (4) long term well discharge so that temperature and chemistry best refect aquifer conditions. (5) adequate knowledge of subsurface geology to detail geochemistry and geohydrology.

The Cactus Flat-Artesia area, characterized by numerous thermal and non-thermal flowing artesian wells, meets these criteria very well. While the Buena Vista area has flowing wells, its geologic and geohydrologic conditions are less well known. It was studied primarily to gain more information about the geothermal potential there. Results and conclusions obtained in studies in the Cactus Flat area, therefore, have been applied to assess geothermal resources at Buena Vista.

STUDY AREAS

INTRODUCTION

The two areas investigated during this study lie within the northwest-trending Safford-San Simon basin (Fig. 2). The Cactus Flat-Artesia area straddles U. S. Highway 666 between 8 to 24 km south of Safford. The Buena Vista area encompasses a 16km area northeast of the town of Safford along the Gila River. Both areas have thermal flowing wells with temperatures varying from 35 to 50°C. At present, these waters are utilized in three mineral baths and a catfish farm in the Cactus Flat-Artesia area.

PHYSIOGRAPHY AND CLIMATE

The Cactus Flat-Artesia area is at the base of the Pinaleno Mountains (Fig. 2). Stockton, Marijilda and Graveyard washes, which discharge surface water from deep canyons in the Pinaleno Mountains, have dissected the area into a succession of mesas, fans, and arroyos. Flow occurs during winter and early spring due to snow melt at high elevations. All drainage flows north and east toward the Gila Valley.

The impressive Pinaleno Mountains rise abruptly to form a range over 3,300m in elevation, where more than 76cm/yr of precipitation falls. The Cactus Flat area lies at 900 to 1,100m elevation and receives only 20 to 25cm of precipitation annually. Because of high mean annual temperature (17 °C) and thick stands of tamarisk trees, evapotranspiration is high in this area.

The Buena Vista area is in the Gila River flood plain at an elevation of 910 to 920m. West of Buena Vista, the flood plain widens and curves northwestward south of Safford to form a

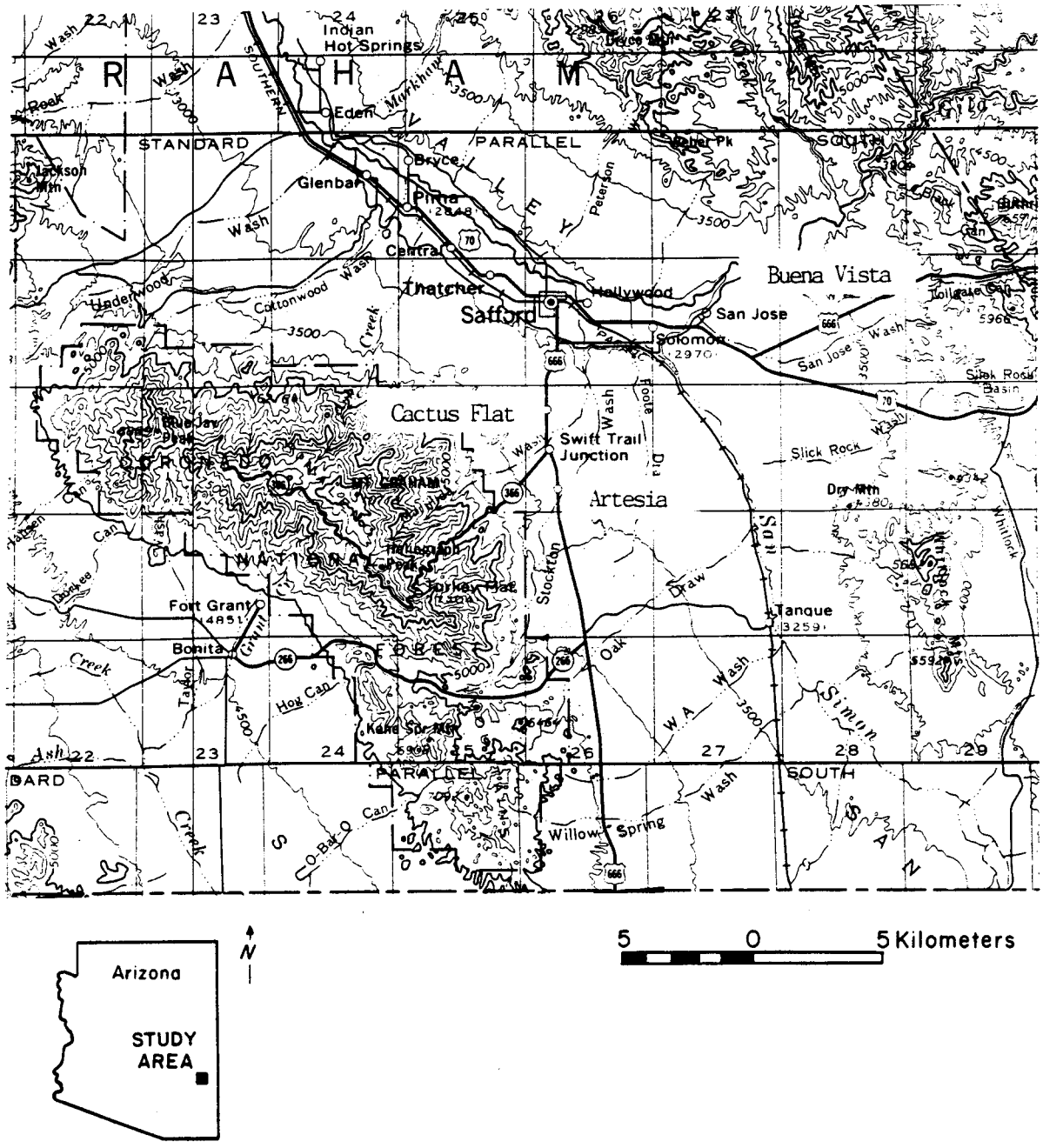


Figure 2 Location of study areas

flat-bottomed valley 5 to 8km across (Fig. 2). Eastward, the flood plain narrows into the northeast-trending Gila Box, a canyon formed by the Gila River between the Gila Mountains and the Peloncillo Mountains. Paired terraces 20 to 30m high bound the flood plain. Above the terraces 5 to 20km-wide piedmonts slope gently upward toward the Gila and Peloncillo Mountains except north of Buena Vista where at least two more older ancestral Gila River terraces are found. Mean annual temperature is 17°C and precipitation is less than 25cm/yr. The Gila River is a perennial stream at this location.

HISTORICAL GEOLOGY

The crust of this region is highly anisotropic and is dominated by a west-northwest structural grain, which is superimposed on a older northeast grain (Swan, 1982; Silver, 1978). This anisotropicity originated during the Precambrian. During the Mesozoic, tectonism reactivated structures to create a highland that crosses the Safford region (Coney, 1978; Turner, 1962; Elston, 1958). Major erosion, resulting from uplift, removed Paleozoic and pre-Late Cretaceous rocks to expose Precambrian basement. Late Cretaceous shales and sandstones were deposited over the Precambrian terrane (Elston, 1958). Later, Paleocene (Laramide) volcanism and plutonism was active in the area. Laramide andesitic flows and silicic stocks crop out in the Gila Mountains and are associated with economic copper mineralization (Dunn, 1978). The Eocene was an interval of erosion and local sedimentation, probably accompanying major tectonism and a break in volcanism. During this time copper mineralization was unroofed in the Gila Mountains, and Late Cretaceous shales were partially removed. Late Oligocene and early Miocene volcanism buried the area in basaltic and andesitic flows and volcanoclastic sediment up to 1km thick (Strangway and others, 1976; Richter and others, 1981). Limited silicic volcanism occurred as rhyolitic-dacitic domes and associated pyroclastic deposits in the vents and on margins of large stratovolcanoes and along major structural lineaments. No major silicic cauldrons, such as those found in southwestern New Mexico and in the Chiricahua Mountains, Arizona, have been observed in the Safford area. However, silicic mid-Tertiary plutons were emplaced in the Pinaleno Mountains (Thorman, 1981). During Miocene, crustal extension began to form the proto Basin and Range. This normal faulting was characterized in places by listric style rotation of upper crustal fault blocks, overlying low angle decollements at depth. Local sedimentation accompanied this tectonism. Low angle faults are sometimes closely related spacially and

genetically to metamorphic complexes in Arizona (Davis and Coney, 1979). The Pinaleno Mountains have been described by Davis and Coney (1979) as a metamorphic core complex. During mid to late Miocene high angle normal faulting began to create the gross structure and topography of the contemporary Basin and Range Province (Scarborough and Peirce, 1978). By the time this last stage of tectonism was well underway, volcanism had ceased. The yougest volcanic rocks in the Safford area are 16 m.y. old alkali-rich basalts in the Whitlock Mountains (Richter and others, 1981). Pliocene to Quaternary basalts are found northwest of the area on the San Carlos Indian Reservation. Major late Miocene and Pliocene sedimentation occurred in the Safford basin. A large Pliocene lake existed in the basin and through-flowing drainage of the Gila system probably did not exist prior to latest Pliocene or earliest Pleistocene (Harbour, 1966).

STRUCTURE

Figures 3 and 4 provide one interpretation of the gross structural relationships of the Safford basin. Figure 4 is a structural cross section through the Cactus Flat-Artesia area and the Buena Vista area. Structural relationships are based upon published geology, deep well drill core, drillers' logs of water wells, Bouguer gravity, and electrical resistivity information.

The Safford basin is an assymetrical graben complex bound by a major fault zone at the base of the Pinaleno Mountains on the southwest and south. The basin is probably underlain by a series of faulted stair-step blocks, which rise upward to form the Gila Mountains on the northeast and north. Bouguer gravity profile modeling by Oppenheimer and Sumner (1981) suggests that bedrock in the basin center is buried by a least 3,050m of clastic sediments. The existance of stratigraphic unit Tso shown in Figure 4 has been inferred by us from sonic logs and three cores from the Safford A-1 wildcat exploration hole (D-9-26-16ab) drilled by Phillips Petroleum in 1982. The core and log are on file at the Arizona Oil and Gas Commission in Phoenix. All three cores are at the bottom or in the lower 610m of the hole and consist of an indurated reddish brown granite conglomerate. No volcanic clasts or metamorphic clasts were observed in the cores; therefore, we believe this unit is an Eocene to early Oligocene fanglomerate (or older) and it should properly be classified as a pre-Basin and Range sediment.

Pleistocene fault scarps occur at the base of the Pinaleno Mountains (Menges and others 1982). Another Pleistocene(?) scarp occurs southeast of Buena Vista (Figure 3)(Menges and

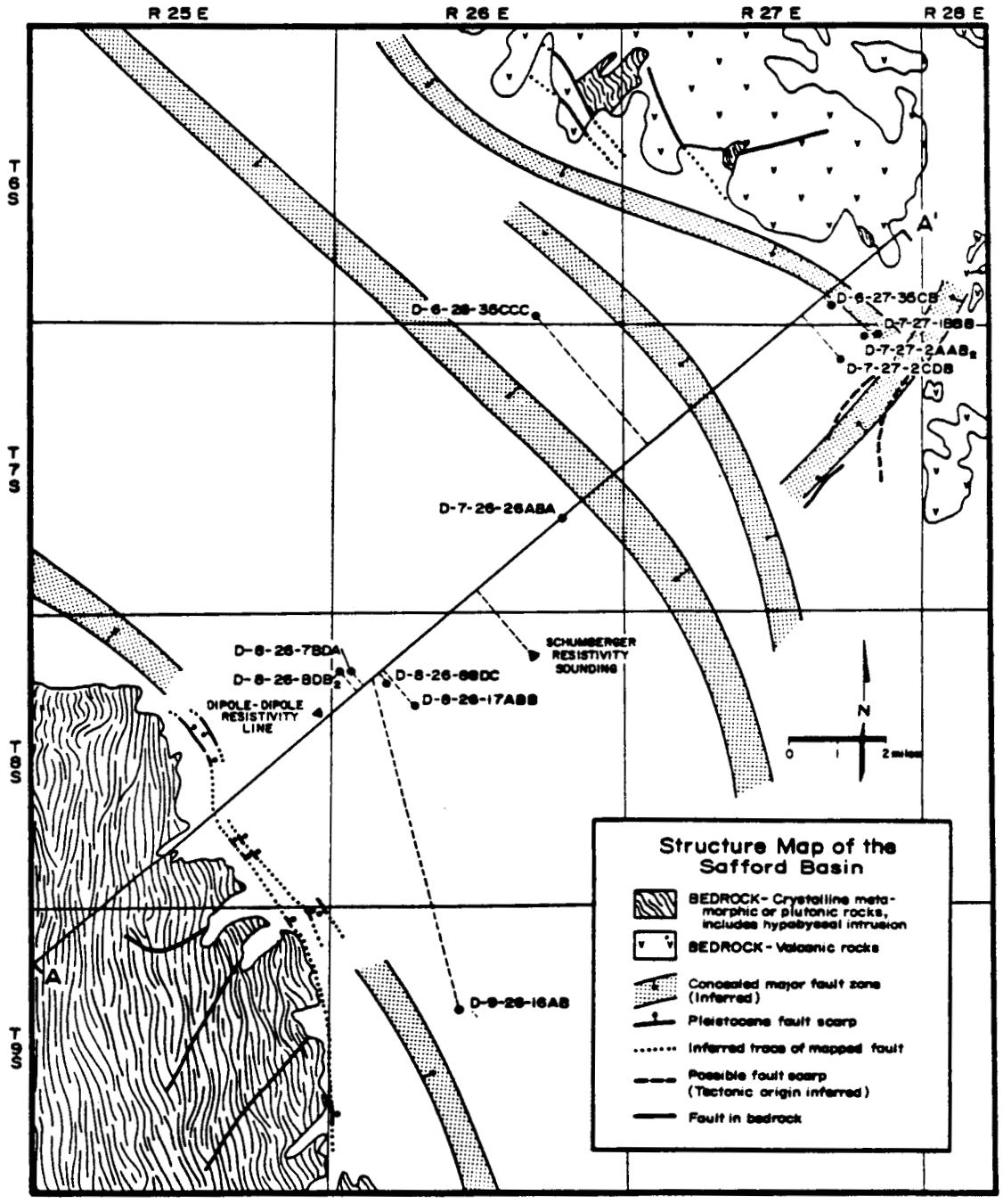


Figure 3 Map of major structures in the Safford Basin

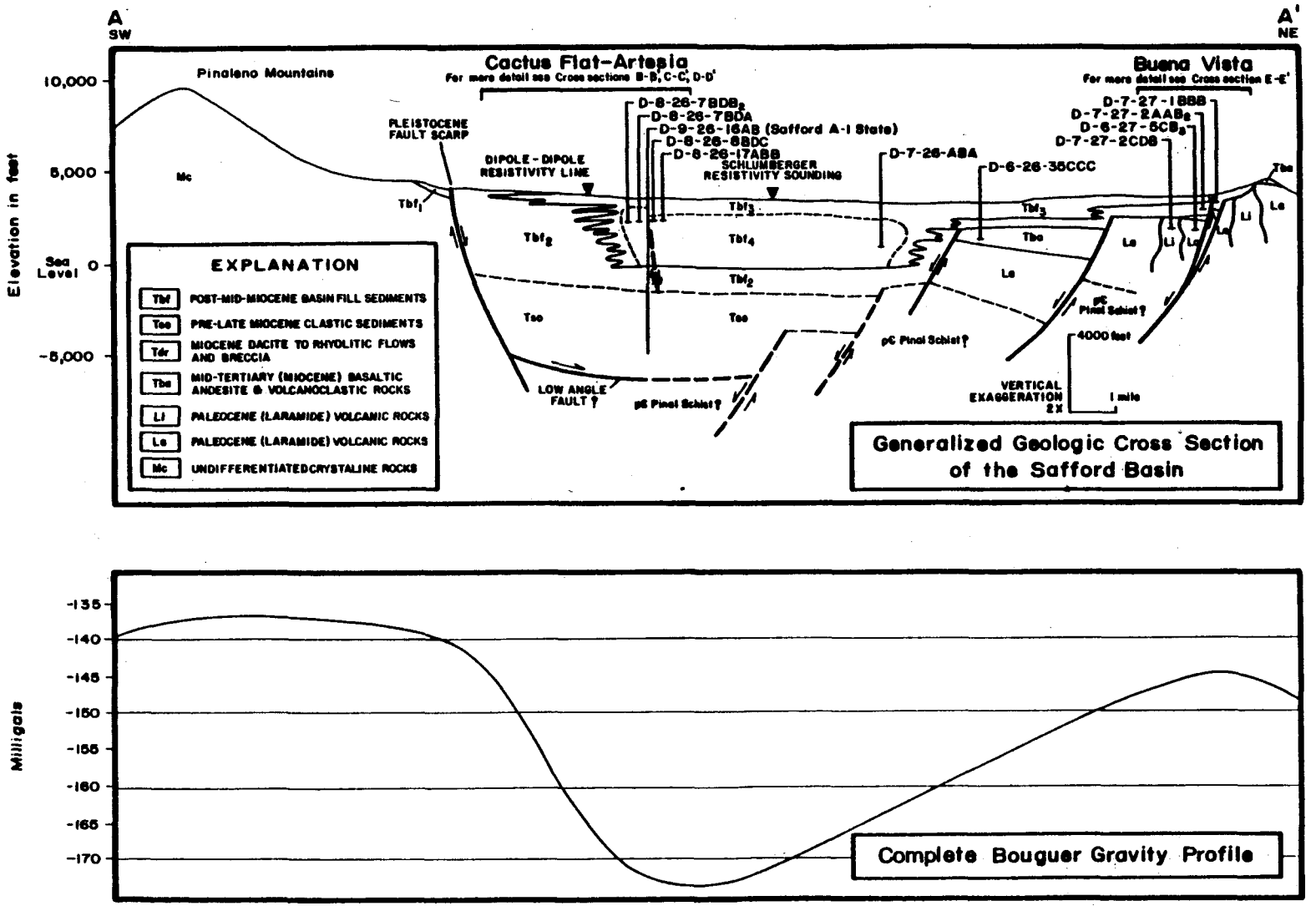


Figure 4 Geologic cross section of the Safford Basin

others,1982).

Bedrock (noncontinental clastic rocks) includes mostly schist, gneiss, granite, quartzitic mylonite, andesitic to basaltic volcanic rocks and minor rhyolitic to dacitic volcanic rocks. Mineralogy of these units includes common aluminosilicate minerals, hornblende, augite, biotite, chlorite and feldspars. Volcanic minerals probably comprise olivine, chalcedony, cristobalite, zeolites and calcite. Quartz is common to all units. Rocks associated with Laramide copper mineralization also contain kaolinite, sericite, epidote, chlorite, gypsum and anhydrite.

Sediments filling the contemporary Safford basin are over 1,220m thick and they indicate several distinct depositional environments. In general, but not always, the fine_grained and evaporite sediments are found toward the basin center and away from the margins. Basin-filling units are probably most important in this study because nearly all water sampled during this study has been confined to these formations. Water in the Buena Vista area is a possible exception; it may have flowed upward from underlying bedrock.

BASIN-FILLING SEDIMENTS

Harbour (1966) divided the basin-fill into two major units, upper and lower basin fill. These units are separated by a time-stratigraphic horizon that shows a change in sedimentation processes(fluvial-lacustrine-playa to fluvial-alluvial) and by a Pliocene to Quaternary faunal transition. Harbour (1966) also divided the basin-fill sediments into facies. Because drillers' logs were used in our subsurface interpretations, we have generalized Harbour's units in to three major groups. Table 1 shows the correlation of our stratigraphic units with those of Harbour and gives the systematics of drillers'-logs interpretation within our stratigraphic divisions. We used the following stratigraphic subdivisions: (1) a sand-conglomerate facies, (2) a silt-clay facies, and (3) an evaporite facies. We have divided the silt-clay facies into two sub-units: (1) a blue or green clay unit, and (2) a brown-yellow silt and clay. All of the facies intertongue.

The silt-clay facies is lacustrine (blue-green clay) and fluvial over-bank (blue-green clay, in part, and the yellow-brown silt and clay unit). The evaporite facies consists of gypsiferous clay, gypsum, anhydrite, and halite and it was

TABLE 1 - Systematics of drillers' log interpretation

Unit	Drillers' Descriptive Term	Correlation with Harbour's basin-fill units
Sand/conglomerate facies	Sand, gravel, conglomerate, honeycomb formation, caliche, sandy loam, silt gravel, cement	Basal conglomerate facies, piedmont facies, orange silt and conglomerate facies
Silt/clay facies blue clay	Blue clay, blue shale, black clay, gray clay, green clay, sticky clay, white and blue clay	Green clay facies
Silt/clay facies brown clay	Brown clay, yellow clay, mudstone, red clay, tuff, sandy clay, siltstone, gravel clay, silt and clay, sandy clay, gravel silt	Green clay facies, delta facies, red facies
Evaporite facies	Gypsum, anhydrite, evaporites, salt halite, hardlayers, hardpan	Evaporite facies

deposited in a playa environment. In a few areas the top of the silt-clay facies consists of a zone of gypsiferous, limonitic and calcareous clay. These deposits may indicate desiccation of the Pliocene lake. Air-fall ash deposits are common in the upper silt-clay facies and they are commonly zeolitized, diatomaceous, or argillic and calcareous. Harbour (1966) suggested the most common basin-fill clay mineral is montmorillonite.

Upper basin-fill consists of mostly gruslike sand with gravel lenses, except north of Buena Vista, where fine grained tuffaceous sediments are interbedded in sandy and silty sediments adjacent to the Gila Mountains.

A thin generally less than 20m-thick cobble to boulder conglomerate caps the basin-fill deposits to form Pleistocene to Recent geomorphic surfaces. These sediments are pediment caps, ancestral Gila River terrace deposits, and alluvial fan deposits. Ancestral Gila River gravels are usually well rounded dark volcanic clasts with a few well rounded red granite clasts (Morenci Granite?).

Calcite is the most common cement in upper basin fill and in degradational deposits. Harbour (1966) stated that coarse upper basin-fill units frequently show "replacement" of hornblende and plagioclase by sparry calcite. Other minerals such as quartz and orthoclase may show "corrosion" by calcite. Harbour also described two unusual forms of interstitial calcite: spherolitic cementation, and sand-calcite crystals.

CACTUS FLAT-ARTESIA SUBSURFACE GEOLOGY

We have inferred subsurface geology has been inferredfrom drillers' logs. Figure 5 shows the locations of cross sections in Figures 6, 7, and 8. Cross section B-B' from Swift Trail to Cactus Flat shows the blue clay unit pinching out to the south and fine grained units becoming dominate at Cactus Flat. Cross section C-C' is from Swift Trail to Artesia. The blue clay pinches out to the west and silt-clay is dominant towards Artesia. Cross section D-D' is from west to east across the Cactus Flat area. Drillers' logs were used to infer structure also, which is somewhat speculative. However, the high total dissolved solids in wells in this area could result from contact with the gypsiferous sediments (evaporites) that we have interpreted to be faulted upward in a narrow horst block in this area (also see Figure 9). This structural interpretation is based upon blue clay elevation tops and the top of the evaporite

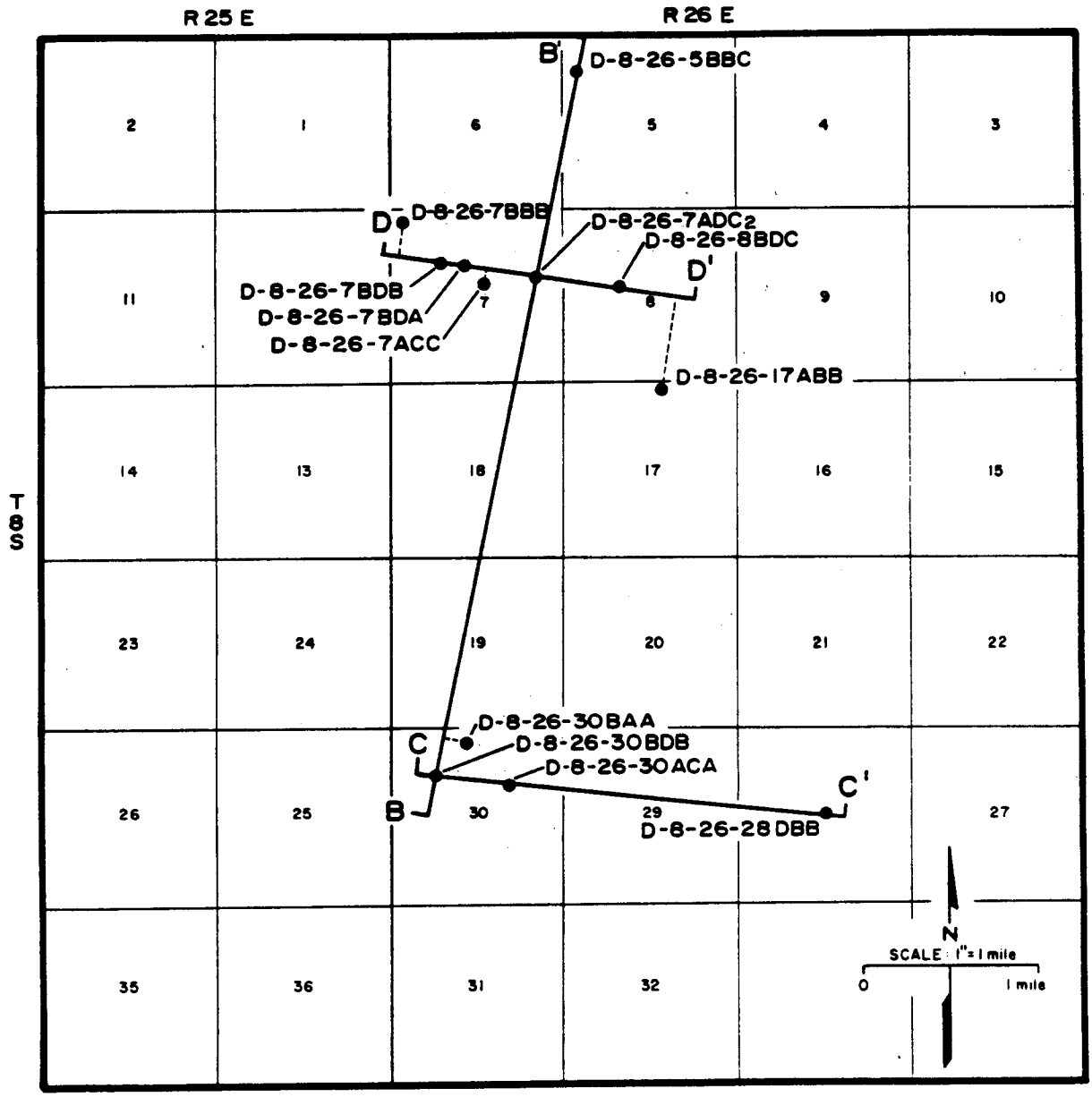
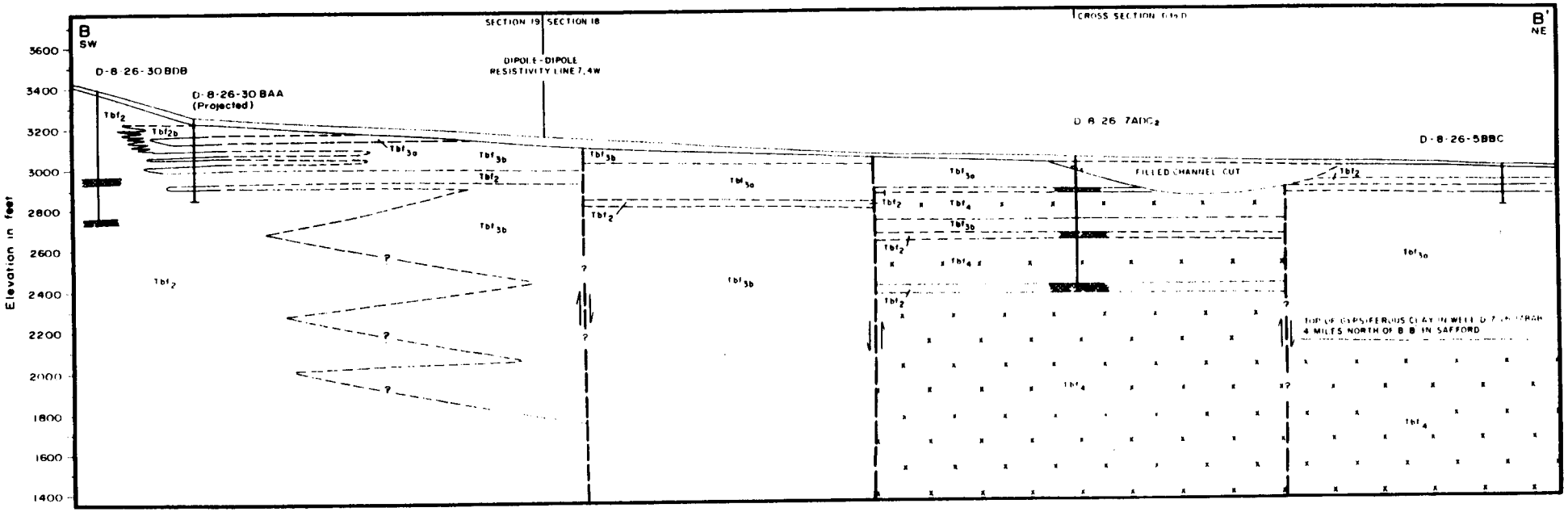


Figure 5 Location of geologic cross sections at Cactus Flat-Artesia



EXPLANATION

- Tbf_2 Sand/conglomerate facies
- Tbf_{3a} Silt/blue clay facies
- Tbf_{3b} Silt/brown clay facies
- Tbf_4 Evaporative facies
- WATER

Figure 6 Geologic cross section B to B' from Swift Trail to Cactus Flat

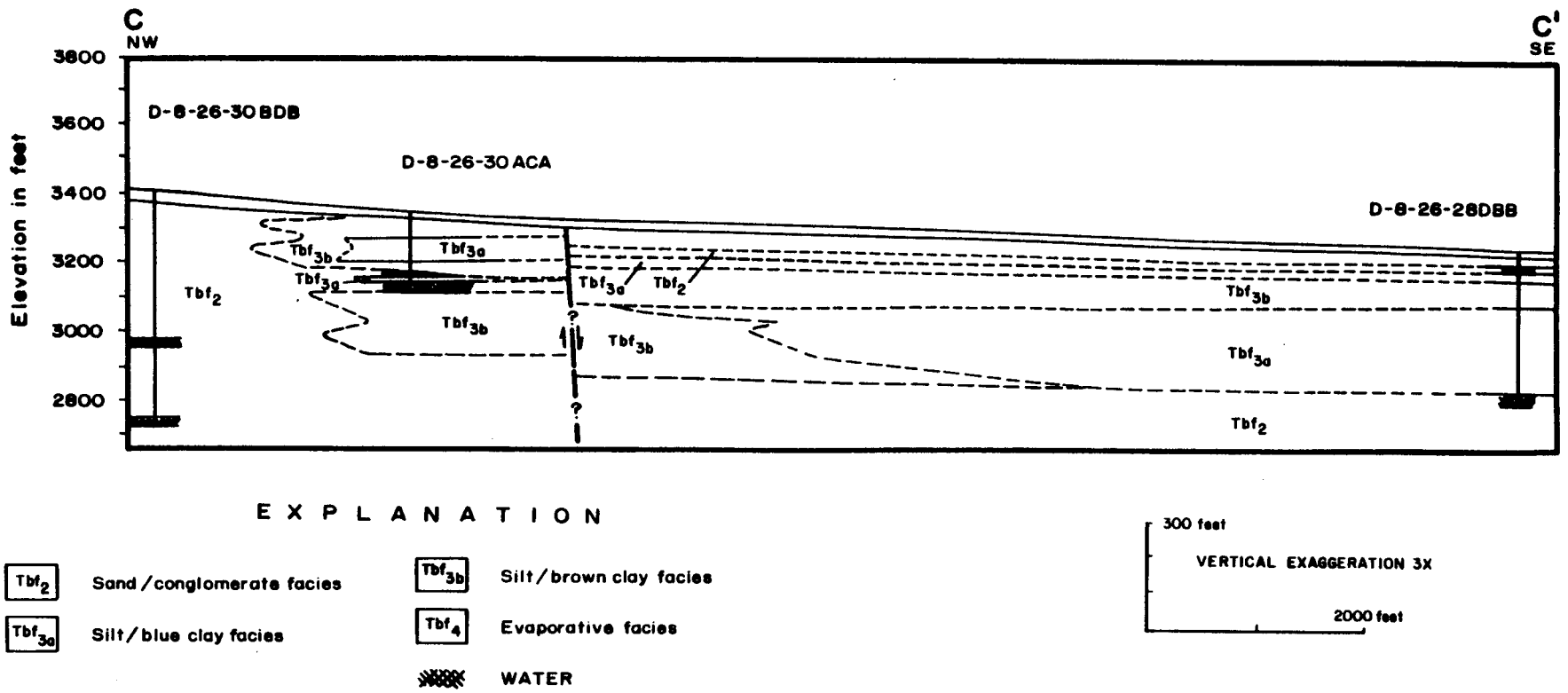


Figure 7 Geologic cross section C to C' from Swift Trail to Artesia

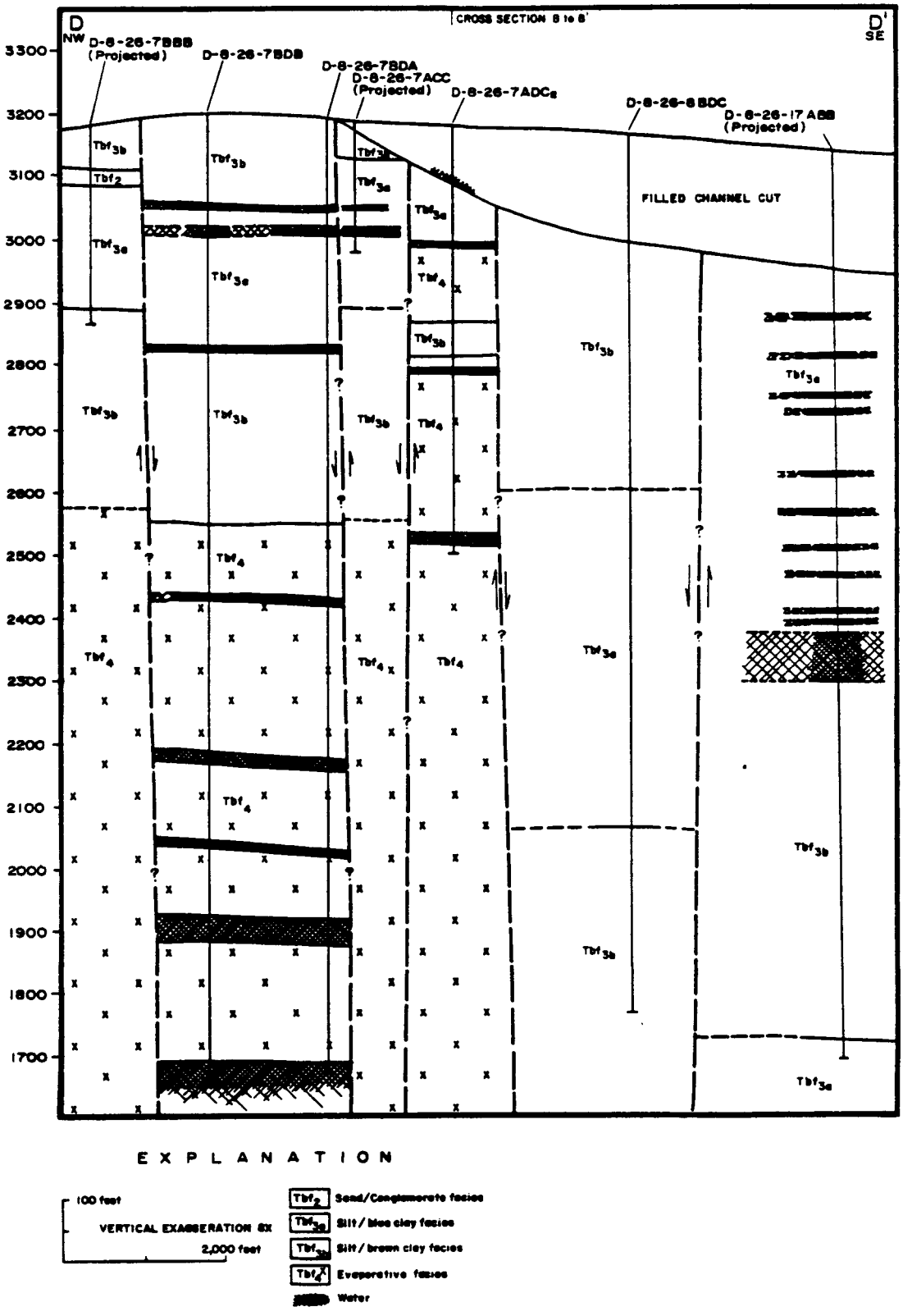


Figure 8 Geologic cross section D to D' at Cactus Flat

sequence as interpreted from drillers' logs, using Table 2. Figure 9 shows the blue clay elevation tops and a structural interpretation. Probably the most noteworthy feature of these cross sections is the persistent layers or lenses of sand and gravel that produce water. These zones have been interpreted as tongues of the sand-gravel facies that predominate to the south and west in the subsurface nearest the Pinaleno Mountains.

BUENA VISTA SUBSURFACE GEOLOGY

Buena Vista overlies a structural bench bound by fault zones (see Fig 3). Clastic basin-fill sediments overlie the bench, which is composed mainly of Larimide volcanic and intrusive rocks. Silt-clay and sandy clay with gravel lenses overlie sand and gravel and clay lenses (Witcher, 1981). The fine grained section is probably equivalent to the silt-clay facies, while the coarse units represent the sand-conglomerate facies. At Buena Vista the base of the silt-clay facies is 105m below the surface. This unit thins and pinches out to the northeast near the Gila River. Recent flood plain gravels less than 30m thick overlie the silt-clay facies. Well D-6-27-35cbb penetrated pre-basin-fill formations at 210m depth. Mid-Tertiary volcanic rocks and associated interbedded clastic sediments occur between 210m and 275m. At 275m an epidotized andesite containing oxidized copper mineralization has been observed, which we believe represents the Laramide volcanic sequence. Well D-7-27-2cdb encountered "red granite" at 213m. This rock may be a Laramide iron-stained and altered silicic tuff or felsic intrusive rock. Deep core drilling at the Sol copper prospect 5km southeast of Buena Vista encountered Laramide rocks between 300 and 600m of basin-fill sediments (Yarter,1981). In the adjacent Gila Mountains, the Laramide sequence is altered and highly fractured and sheared, especially near intrusive mineralized stocks (Robinson and Cook, 1966; Dunn, 1978). Northeast-striking dike swarms, faults and fractures are common.

GEOHYDROLOGY CACTUS FLAT-ARTESIA

Figure 10 is a water-table map constructed from shallow heat-flow hole data (less than 60m) (Witcher, 1982) and from water well

TABLE 2 - Formation tops of blue clay unit at Cactus Flat-Artesia

No.	Well Location	Elevation	Top Blue Clay (Depth)	Top Blue Clay (Elevation)
1	(D-8-26) 5bbc	3,100'	148'	2,952'
2	(D-8-26) 6ccb	3,200'	115'	3,085'
3	(D-8-26) 7acc	3,170'	48'	3,122'
4	(D-8-26) 7adc$_2$	3,160'	81'	3,079'
5	(D-8-26) 7bbb	3,180'	80'	3,100'
6	(D-8-26) 7bcc$_2$	3,190'	40'	3,115'
7	(D-8-26) 7bda	3,180'	269'	2,911'
8	(D-8-26) 7bdb$_2$	3,200'	269'	2,931'
9	(D-8-26) 8bdc	3,160'	557'	2,603'
10	(D-8-26) 17abb	3,130'	190'	2,940'
11	(D-8-26) 17bbc	3,180'	565'	2,615'
12	(D-8-26) 21cdc	3,210'	101'	3,109'
13	(D-8-26) 28dbb	3,230'	81'	3,149'
14	(D-8-26) 30aca	3,342'	60'	3,282'
15	(D-8-26) 30baa	3,350'	80'	3,270'

data (less than 100m) (U. S. Geological Survey, WRD, Tucson). Shallow unconfined ground water flows generally toward the north and north-northeast as does surface drainage. The water table gradient is about 100 feet per mile. A small ground-water depression exists at Artesia, which may result from drawdown due to heavy pumping.

Artesian wells occur in a 3-km-wide arc, which mimics the Pinaleno Mountain front. This arc is between 3 and 4km from the mountain front (Fig. 11). We believe the arcuate distribution of the artesian wells is a result of sand-conglomerate tongues in the silt-clay and evaporite facies, rather than fault-induced geohydrologic processes. The convergence of topography and hydraulic head in sand and gravel aquifers is of primary importance in allowing flow from these wells. Flow rates from the artesian wells increase systematically with depth (Fig. 12). This fact suggests that several distinct and confined aquifers exist and that hydraulic pressure also increases with depth.

Several flowing wells and pumped artesian wells discharge thermal water (>35 °C) at Buena Vista. Pumped flow rates exceed 1,000 gpm (U. S. Geological Survey, WRD, Tucson). This water is produced from sand-conglomerate facies that are confined below

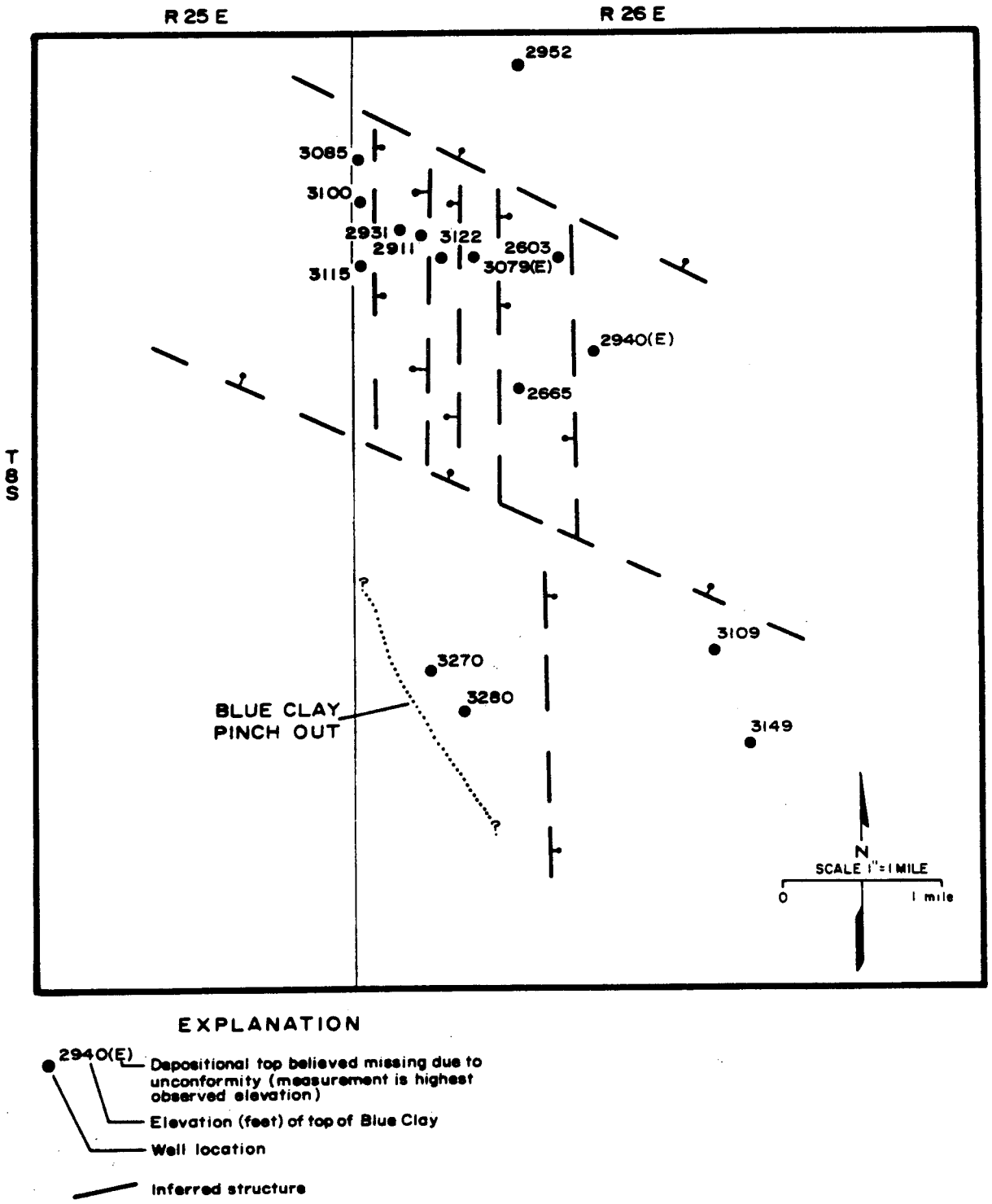


Figure 9 Map showing elevation tops of the blue clay and inferred structure

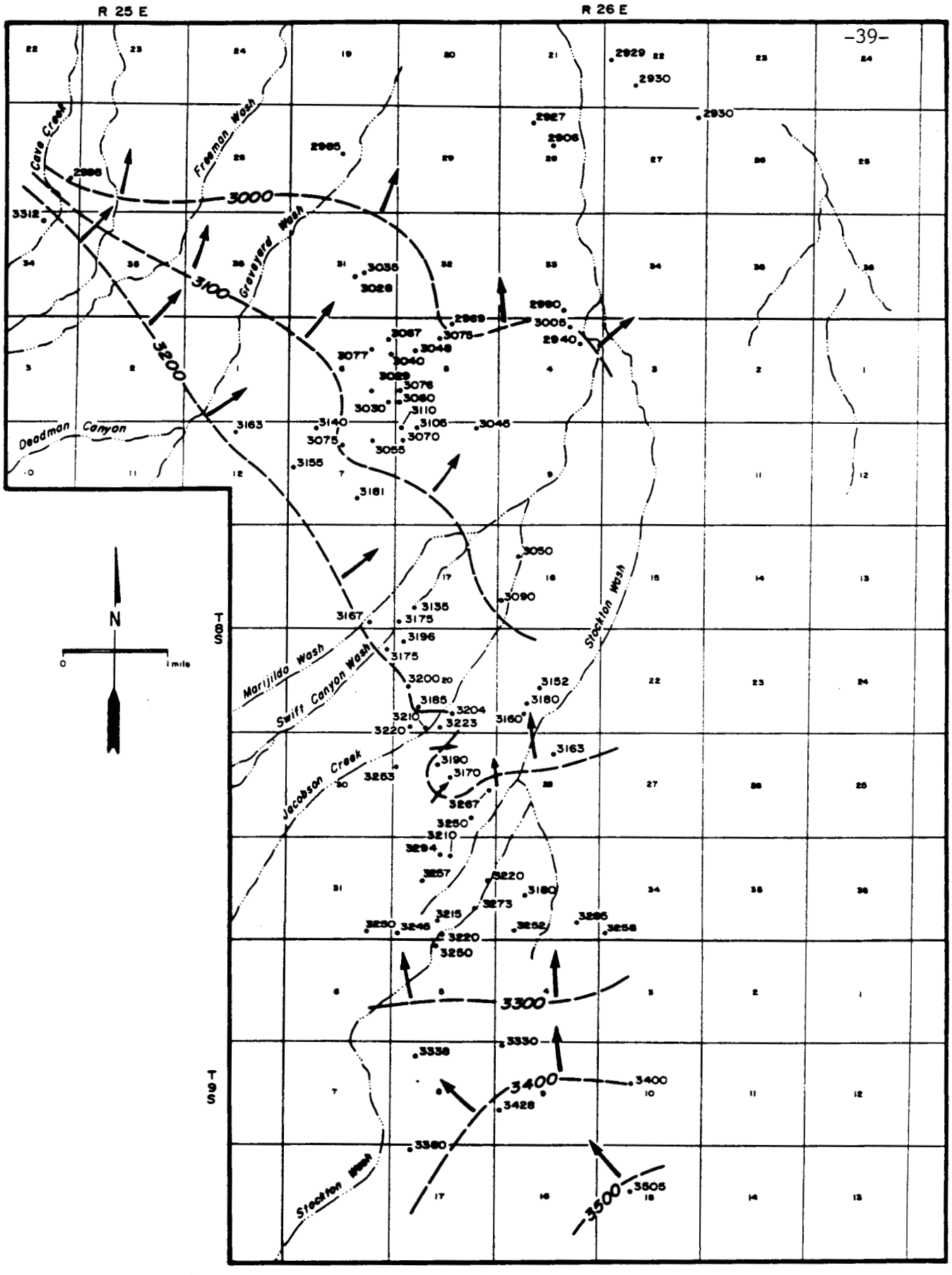


Figure 10 Ground water elevation map at the Cactus Flat- Artesia area

(Water table elevation for wells less than 160 feet in depth)

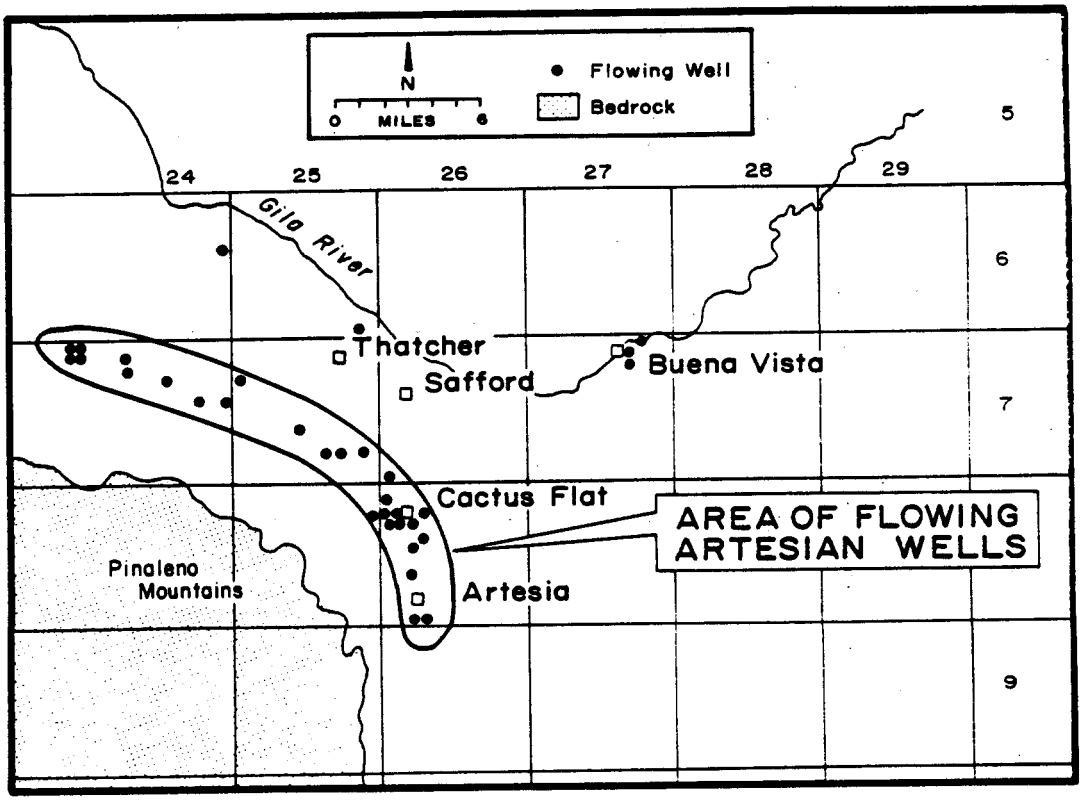


Figure 11 Distribution of artesian wells in Cactus Flat-Artesia

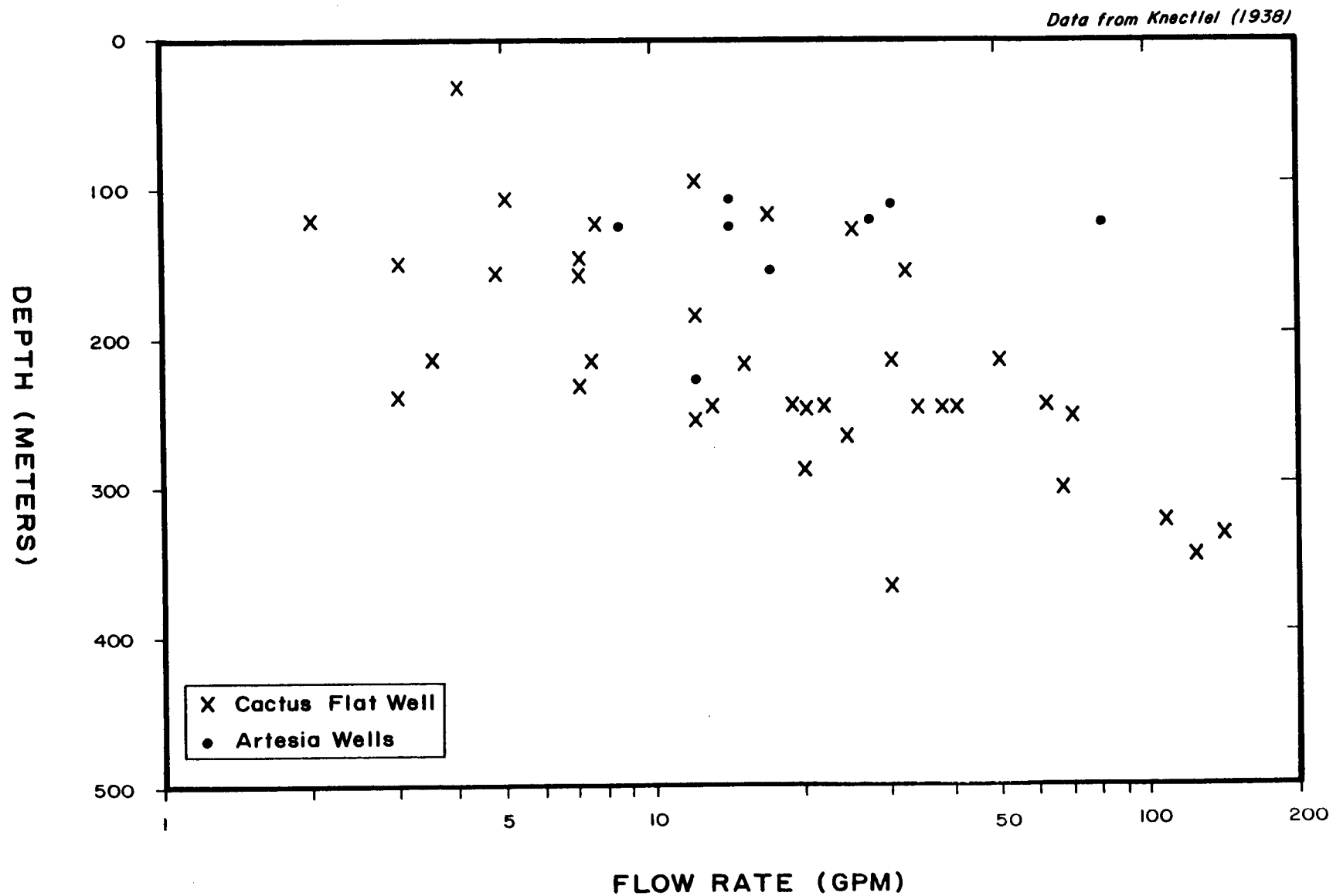


Figure 12 Flow rate versus depth of artesian wells

the silt-clay facies, but temperatures suggest a deeper origin. Mining company wells northwest of the area, along the piedmont of the Gila Mountains, produce thermal water (>35 °C) that has chemistry and temperatures similar to Buena Vista wells (see Well D-6-26-35ccc in Table 6). A deep well in the basin near Safford, which was completed in the sand-conglomerate facies below the silt-clay and evaporite facies, produces brackish water with a much higher total dissolved solids than the Buena Vista waters.

THERMAL REGIME

Background heat flow for the Safford area is about 80mWm-2, which is the approximate average value obtained from several deep (>300m) holes in the Gila Mountains (Reiter and Shearer, 1979). Surface discharge temperatures of artesian waters at Cactus Flat, excluding wells at Artesia, show a linear increase in temperature with the depth (4.5 °C per 100m) (Witcher,1979). Two artesian wells were temperature logged and showed less than 1 °C temperature change from surface to bottom (Witcher, 1979). Heat flow studies (Witcher,1982) indicate that basin-fill sediments in this area have thermal conductivities less than 1.88W/mK. Thus a 45 °C/km temperature gradient is normal for a conductive heat flow of 80mWm-2.

Unusually warm wells near Artesia have estimated gradients exceeding 100 °C/km. A soil mercury survey and heat flow study have delineated a hidden convection system south of Artesia (Witcher, 1982). No wells penetrate this system. We have estimated that the heat flow over the top of this system exceeds 200mWm-2.

Wells at Buena Vista are anomalously warm for their depths. Reiter and Shearer (1979) measured heat flow in a mineral exploration hole 5km east of Buena Vista. A value of 209mWm-2 was reported for the 300 to 500m depth interval; 50mWm-2 was reported for the 950 to 1,050m interval. A temperature log of this hole shows a temperature inversion below 500m, which accounts for the reported heat flow. Apparently this hole encountered a horizontal flow of thermal water (approximately 70 °C) at about 600m depth. Interpretation of temperature information from this hole indicates the existence of a nearby low to moderate geothermal convection system and suggests that the thermal anomaly at Buena Vista is more extensive and hotter than is apparent from temperatures measured in thermal irrigation wells.

GEOCHEMICAL MODEL AT CACTUS FLAT-ARTESIA

Cold (<30°C) ground water in the Cactus Flat area has generally sodium sulfate-bicarbonate chemistry with TDS less than 1,000 ppm. Thermal water (>30°C) has sodium chloride-sulfate chemistry with TDS between 1,000 and 9,000 ppm. Witcher(1981) showed that the milliequivalent chloride-sulfate versus bicarbonate ratio has a logarithmic relation to the milliequivalent lithium concentration. This correlation suggests that thermal and nonthermal water chemistry evolves from contact with differing rocks through equlilibria and (or) ion exchange processes. The silt-clay and evaporite facies provide a source for sulfate, chloride, and lithium.

Silica concentrations are frequently highest in nonthermal, sodium bicarbonate waters. Also, unusually warm waters near Artesia do not deviate from these observations and their gross chemistry trends are indistinct from other waters in the Cactus Flat-Artesia area. The following geochemical model applies in the Cactus Flat area. Meteoric water recharging aquifers near the Pinaleno Mountain front has high dissolved carbon dioxide content, which attacks aluminosilicate minerals to form sodium-bicarbonate water. As ground water flows deeper into and laterally through sand and gravel zones confined by silt-clay and evaporite sequences, gypsum, halite, and carbonate minerals dissolve. Solution of evaporites and ion exchange with clay minerals occurs to transform the sodium bicarbonate water into sulfate-chloride water.

GEOCHEMISTRY

INTRODUCTION

The geochemical discussion presented in the following section focuses on mineral-water thermodynamic processes and how they relate to silica concentration and dissolved carbon dioxide. In a previous section the rates of chemical processes were discussed in terms of reaction kinetics from a thermodynamic standpoint. Hydrodynamic factors are equally important in overall kinetics of natural systems. Hydrodynamic factors involve the flow paths, contact time, and nature of the interface between minerals and solutions. In-depth discussion of these factors are found in Berner (1978, 1980), Freeze and Cherry (1979), Dominico (1977), and Paces (1976). In this report these factors are not discussed except where they grossly influence thermodynamic processes.

SILICA GEOCHEMISTRY

Dissolved silica solutions that become supersaturated with respect to opal are unique compared to most other inorganic solutions because silica tends to polymerize and stay in solution as colloidal particles and gels (Iler, 1979). However, at concentrations usually encountered in low temperature waters, silica occurs as a monomeric species rather than in a multimeric form. Studies by Alexander and others (1954) have shown that the colored complex, formed by silico-molybdate colorimetric measurements of aqueous silica, results from monomeric silicic acid ($H_4SiO_4^\circ$). Solid silica polymorphs dissolve in water to produce this species.

$$SiO_2(qtz) + 2H_2O = H_4SiO_4^\circ$$

The solubility constant (K_{qtz}) for this reaction is:

Equation 23

$$K\ qtz = aH_4SiO_4^{\circ} / aH_2O$$

A dilute solution of aH_2O is about 1.

$$K\ qtz = aH_4SiO_4^{\circ}$$

Dissolved silicic acid dissociates at pH greater than 8 to form ionic species of dissolved silica (Stumm and Morgan, 1970; Seward, 1974). The following mass action equations describe these processes:

Equation 24

$$H_4SiO_4^{\circ} = H_3SiO_4^- + H^+$$

Equation 25

$$K1 = aH_3SiO_4^-\ aH^+ / aH_4SiO_4^{\circ}$$

Equation 26

$$H_3SiO_4^- = H_2SiO_4^{--} + H^+$$

Equation 27

$$K2 = aH_2SiO_4^{--} + aH^+ / aH_3SiO_4^-$$

Seward (1974) suggested that the $NaH_3SiO_4^{o}$ complex may be an important silica species in high pH (ph>8) solutions where sodium exceeds 0.1 molar concentration. This species was not calculated in this study although some of the ground water we sampled fits Seward's criteria for its presence. Total measured silica concentrations in natural water are described by the following mass balance equation:

Equation 28

$$SiO_2(measured) = mH_4SiO_4^{\circ} + mH_3SiO_4^- + mH_2SiO_4^{--}$$

Only the $H_4SiO_4^{\circ}$ species is used in silica geothermometry. Therefore, when reservoir pH exceeds 8.0 it may be necessary to make a pH correction to measured silica values in order to correct for dissociation. Speciation and activity calculations in the WATSPEC program automatically perform this correction. Truesdell and Jones (1974) presented an equation that is used to calculate silica speciation, but it may also be used as a pH correction for silica geothermometry. This equation was derived by combining equations 25, 27, and 28 and re-evaluating and rearranging the terms.

Equation 29

$$mH_4SiO_4^{\circ} = SiO_2(\text{measured as molality})/[1 + yH_4SiO_4^{\circ}(K_1 10^{pH}/yH_3SiO_4^{-} + K_1K_2 10^{2pH}/yH_2SiO_4^{--})]$$

where:

Yi = activity coefficient of species i
mi = molal concentration of species i

Analytical expressions that may be used to calculate K and K at any temperature are:

Equation 30

K1 = -2549/T - 15.36 X 10E-6 TE2 (Arnorsson and others, 1982)

Equation 31

K2 = 5.37 - 3320/T - 20 X 10E-3 T (Arnorsson and others, 1982)

where:

T = absolute temperature in degrees Kelvin

Constants K1 and K2 used in the WATSPEC program are determined using analytical expressions given by Truesdell and Jones (1974). Quartz solubilities have been measured experimentally over a wide range of temperatures and pressures in both pure water and in salt solutions. Fournier and Potter (1982) and Fournier (1983) have reviewed these experiments and provided additional experimental solubility information. Table 3 lists several analytical expressions from recent literature relating quartz solubilities to temperature.

Experimental solubilities of other polymorphic forms of silica are found in Kennedy (1950), Alexander and others (1954), Siever (1962), Krauskopf (1956), Fournier (1973), Fournier and Rowe (1977), Rimstidt and Barnes (1981), and Fournier and Marshall (1983). The empirical solubility of chalcedony based on geothermal wells in Iceland was given by Arnorsson and others (1983). Table 3 lists analytical expressions relating various silica polymorph phase solubilities to temperature.

The kinetics of silica-water reactions were reported in terms of interfacial area and water mass by Rimstidt and Barnes (1981). They reported that reverse rate (precipitation) constants of all silica phases are the same at a specified temperature. However,

TABLE 3 - Analytical expressions relating silica polymorph solubility to temperature

I. Quartz

(A) $\text{Log } K_{qtz} = 0.41 - 1309/T$ Fournier (1977)
Arnorsson and others (1982)

(B) $\text{Log } K_{qtz} = 1.881 - 2.028 \times 10^{-3} (T) - 1560/T$
Rimstidt and Barnes (1980)

(C) $\text{Log } K_{qtz} = A + B (\text{Log } V) + C (\text{Log } V)^2$
Fournier and Potter (1982)

V = specific volume (inverse of density)
$A = 4.66206 + 0.0034063T + 2179.7/T - 1.1292 \times 10^6/T^2 + 1.3543 \times 10^8/T^3$
$B = -0.0014180T - 806.97/T$
$C = 3.9465 \times 10^{-4}(T)$
$T = {}^{o}K$

II. Chalcedony

(A) $\text{Log } K_{chal} = 0.11 - 1101/T$
Arnorsson and others (1982)

III. Alpha-Cristobalite

(A) $\text{Log } K_{crist} = -0.0321 - 988.2/T$
Rimstidt and Barnes (1980)

IV. Amorphous Silica (opal)

(A) $\text{Log } K_{amorph} = 0.3380 - 7.889 \times 10^{-4}(T) - 840.1/T$
Rimstidt and Barnes (1980)

the forward rate (dissolution) constants vary depending upon the polymorphic phase present at a particular temperature. Reaction rates are faster at higher temperatures and slower at lower temperatures. One practical aspect of the Rimstidt and Barnes (1981) work is,

> "Upon cooling a silica-saturated solution below the equilibrium temperature, the decreasing solubility causes increasing supersaturation, which tends to raise the precipitation rate, but the rate constants rapidly decrease, which tends to lower the precipitation rate. These competing effects cause a maximum rate of precipitation 25-50 °C below the saturation temperature. At temperatures below that of the maximum rate, silica is often quenched into solution by very slow reaction rates. Consequently, the quartz geothermometer will give the most accurate results if samples are taken from the hottest, highest flow rate, thermal springs which occur above highly fracture areas."

A parallel conclusion drawn by these authors is that due to fast reaction rates above 150 °C, quartz geothermometers work best on systems whose reservoir temperatures are below 200 °C. In systems near or above 200 °C, significant precipitation of quartz is highly probable, as the waters cool and flow through the 150 to 200 °C temperature zones on the margins of high temperature systems.

In conclusion, the congruent dissolution (and precipitation) reaction rates of silica polymorphs are very slow at low temperatures. Where very fine grained particles or crystals of the polymorphs exist, reaction rates are faster and solubilities are apparently higher.

SILICATE-WATER REACTIONS

So far discussion has shown that silica polymorphs in contact with water are sources of dissolved monomeric silicic acid. Another large group of water-mineral reactions also releases $H_4SiO_4^{\circ}$ to solution. Studies by Feth and others (1964) were among the first to dramatically detail these sources of H_4SiO_4 in low temperature water. Feth and others (1964) in studies of low temperature and thermal springs in the Sierra Nevada of

California and Nevada, demonstrated thermodynamically that reactions between silicate minerals in granitic rocks and water rich in dissolved carbon dioxide may account for the chemistry of and silica contained in Sierra Nevada springs. Follow-up studies by Garrels (1967) and Garrells and MacKenzie (1967), using a mass balance approach, showed that Sierra Nevada spring chemistry is controlled almost entirely by reactions of dissolved carbon dioxide-rich water with aluminosilicate minerals. Their studies indicate that virtually all silica dissolved in these waters was obtained form dissolution of aluminosilicate minerals. They further concluded that plagioclase reactions with carbon dioxide-rich water accounted for more than three quarters of the dissolved constituents found in spring waters that have had contact with silicic rocks in near surface environments.

A typical raction of an aluminosilicate mineral with water is:

Equation 32

$$NaAlSi_3O_8 \text{ (albite)} + CO_2 + 5.5H_2O = Na^+ + HCO_3^- + 2H_4SiO_4^\circ + 0.5Al_2Si_2O_5(OH)_4 \text{ (kaolinite)}$$

In this reaction Na^+ , HCO_3^-, and $H_4SiO_4^o$ are released into solution. A solid residue of kaolinite remains to conserve aluminum in a solid phase and retains a portion of silica originally contained in albite. Reactions of this kind are incongruent because not all components of albite go into solution. The equilibrium composition of water as a function of pCO_2 can be calculated because the charge balance, the stoichiometric relationship of Na and HCO_3^- to $H_4SiO_4^o$,is known and the equilibrium constant (Keq) for the albite-kaolinite reaction can be estimated.

Equation 33

$$mNa^+ = mHCO_3^- \quad \text{(charge balance)}$$

$$mNa^+ = m\ \tfrac{1}{2}\ H_4SiO_4^\circ \quad \text{(stoichiometric relationship)}$$

$$\log Keq \sim 4\log aH_4SiO_4^\circ - \log pCO_2$$

$$\log Keq = -8.18$$

The equilibrium constant Keq was estimated using standard free energy of formation values given in Drever (1983). Standard free energy values for kaolinite and albite are those of Robie and others (1978), which were tabulated by Drever (1982). Using Equation 33, the solubility of albite expressed as activity $H_4SiO_4^\circ$, is shown as a function of pCO_2 in Figure 13. Figure 13 shows that albite is more soluble with higher pCO_2. Stumm and Morgan (1970) showed that other common aluminosilicate minerals behave similarly. Instead of expressing solubilities as H_4SiO_4-

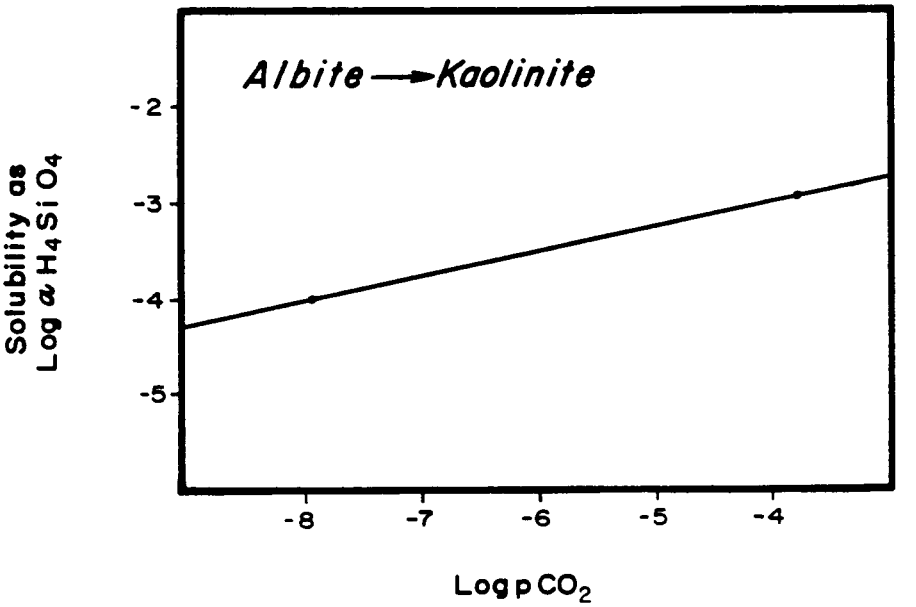


Figure 13 Solubility of albite expressed as a function of Log $A_{H_4SiO_4}$ versus Log pCO_2 concentration

they used HCO_3^- in a manner identical to our example with albite.

Another way to study solubility of silicate minerals is with activity-activity diagrams, which define an equilibrium system. These diagrams are useful to model incongruent dissolution of aluminosilicate minerals. Figure 14 is a stability diagram for the system H_2O-NaO-Al_2O_3-SiO_2 at 25°C and 1 atmosphere pressure. This diagram will be used to show what happens to the composition of water as albite reacts with water and the solution reaches equilibrium or becomes stable with respect to various alteration phases. Successive small amounts of albite are hypothetically added and allowed to reach equilibrium. Helgeson (1969) discussed models of this type in detail. The first batch of albite will dissolve completely.

Equation 34

$$NaAlSi_3O_8 + 8H_2O = Na^+ + Al(OH)_4 + 3H_4SiO_4^\circ$$

At point A the solution becomes saturated with gibbsite and the albite then alters to gibbsite.

Equation 35

$$NaAlSi_3O_8 + 8H_2O = Al(OH)_3 + Na^+ + OH^- + 3H_4SiO_4^\circ$$

Path A to B is followed as more albite alters to gibbsite and Na^+, OH^-, and $H_4SiO_4^\circ$ enter solution. This reaction is also accompanied by a pH rise due to loss of H^+ to gibbsite. At B the solution is in equilibrium with kaolinite. However, the solution will not leave the gibbsite stability field as long as gibbsite remains in the system. Addition of more albite to the reaction causes the gibbsite to alter to kaolinite .

Equation 36

$$2NaAlSi_3O_8 + 4Al(OH)_3 + H_2O = 3Al_2Si_2O_5(OH)_4 + 2Na^+ + 2(OH^-)$$

Note that no silica is released to solution. Any release of $H_4SiO_4^\circ$ is quickly consumed in the gibbsite to kaolinite conversion. Further addition of albite causes all gibbsite to be converted into kaolinite at C. Between C and D albite is converted into kaolinite and again $H_4SiO_4^\circ$ is released to solution.

Equation 37

$$2NaAlSi_3O_8 + 11H_2O = Al_2Si_2O_5(OH)_4 + 2Na^+ + 2(OH^-) + 4H_4SiO_4^\circ$$

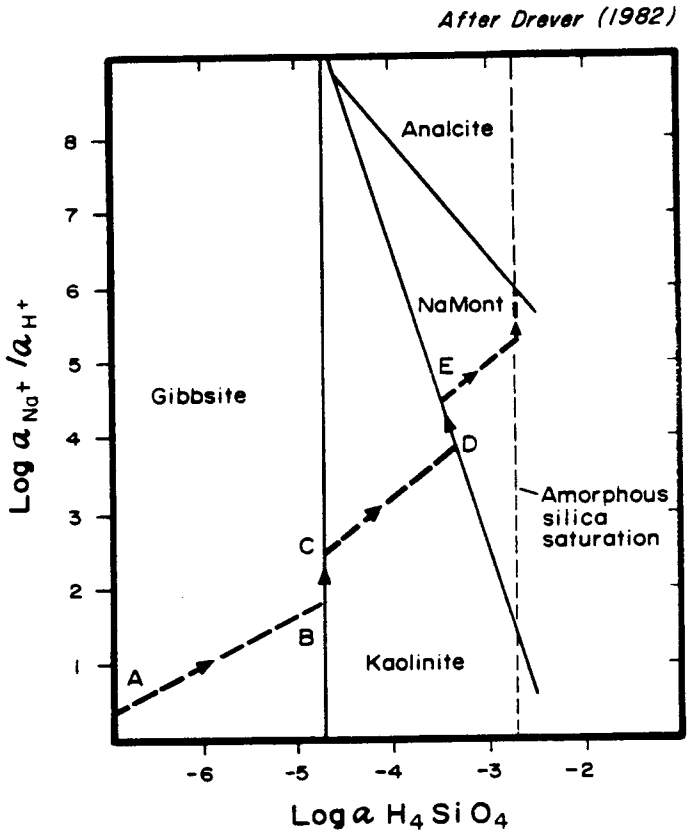


Figure 14 Theoretical activity diagram for the system $NaO-Al_2O_3-SiO_2-H_2O$ at 25°C and 1 atmosphere. Diagram shows predicted path or evolution of solution as albite reacts with water (after Drever, 1982).

Note that this reaction is the same as the one given in Equation 32, except CO_2 was added, OH^- was replaced by HCO_3^-, and stoichiometry was reduced by one half for all components. At D the solution is in equlibrium with Na-montmorillonite. In this case the solution evolves along D-E, as more albite is reacted, until all kaolinite in the system is converted to Na-montmorillonite. Along this path, Na^+ is released but $H_4SiO_4^\circ$ is taken from solution in the kaolinite to montmorillonite conversion. Garrels (1967) has shown that the kaolinite-montmorillonite boundary forms the compositional limit of most low temperature waters.

It is clear that not only does pCO_2 concentration effect $H_4SiO_4^\circ$ concentration of water in contact with silicate minerals, but the degree to which silicate-water reactions have taken place and the relationship of water chemistry to stability boundaries have important effects upon $H_4SiO_4^\circ$ concentrations.

Kinetics of incongruent dissolution of silicate minerals at low temperature has been studied by numerous investigators (Garrels and Howard, 1957; Wollast, 1967; Helgeson, 1971; Luce and others, 1972; Paces, 1973; Busenberg and Clemency, 1976; Holdren and Berner, 1979; Berner and Holdren, 1977; Petrovic and others, 1976; Correns, 1963; Bailey, 1976; and Wildman and others, 1968). Most of these experimenters have studied feldspar reactions.

Studies by Wollast (1967), Helgeson (1971), Paces (1973, 1978), and Busenberg and Clemency (1976) suggest that kinetics of feldspar dissolution are controlled by the formation of a surface alteration product layer. This layer apparently controls diffusion rates to the feldspar surface and (or) reversible silica and aluminum exchange with solution. The layer model explains cation and silica release to solution versus time in feldspar-dissolution experiments. Busenberg and Clemency (1976) showed four stages of alteration processes in their experiments, each with different reaction rates: (1) initial rapid release of cations and silica lasting about 1 minute; (2) a 1.5 to 100 hour release of significant amounts of cations and silica that does not correspond to any simple rate equation model; (3) release of silica and cations for up to 19 days, following a parabolic rate law; and (4) slow linear rate law release of silica and cations over a very long time span.

In other studies, Petrovic and others (1976), Berner and Holdren (1977, 1979), and Holdren and Berner (1977) argue that SEM does not conclusively show the existence of a surface layer. They also attribute the commonly observed parabolic rate law kinetics to very fine feldspar particles and crystal structure dislocations. Because surface energies of small particles and crystal dislocations are relatively high compared to ideal surfaces, greater solubility is predictable until surface energies are minimized. Drever (1982) stated:

> "...although Berner and Holdren explained well the rate of dissolution of silicates, their mechanism does not directly explain the stoichiometry. In experiments of Busenberg and Clemency (1976), and in those of Luce and others (1972), cations appeared in solution at a more rapid rate than silica, implying that a silica-rich residue must exist somewhere."

Models presented by Paces (1978, 1973) may best explain the low silica release rate, compared to cations, and solid conservation of aluminum, during linear rate law release. Paces (1978, 1973) proposed that an amorphous metastable reversible aluminum silicate whose composition varies with pH controls silica concentration rather than a strictly irreversible and incongruent dissolution model, such as was previously discussed in this study using a stability diagram and albite reactions. Whether or not Paces' hypothesized metastable aluminumsilicate forms a diffusive surface layer, which controls early cation release, is apparently highly uncertain.

Other interesting results of feldspar reaction experiments are also pertinent to this study. Bailey (1976) showed that higher temperatures increase the linear rate kinetics of incongruent silicate dissolution. Results of Busenberg and Clemency (1976) indicate that the different feldspar phases have linear rate kinetics at a particular temperature and pCO_2, which are within an order of magnitude of one another. Finally, Paces (1973) and Wildman and others (1968) showed that incongruent solubility of silicate minerals is also a function of pCO_2 in natural systems.

Regardless of the exact nature of aluminum silicate dissolution, the following conclusions are evident from the literature:

> (1) Both temperature and pCO_2 have a significant effect on silicate mineral solubility. (2) pH of waters in terranes comprised of silicic rocks is buffered by dissolution of primary silicate minerals. (3) $H_4SiO_4^{\circ}$ in low temperature water in contact with silicic rocks is largely due to incongruent disslolution and possibly steady-state equilibrium with various stable and metastable alteration products such as magnesium silicates, zeolites, clay minerals, and aluminum silicates. The effect of silica polymorph control on $H_4SiO_4^{\circ}$ concentration may increase with higher temperature and (or) lower pCO_2.

CARBON DIOXIDE

The sources of dissolved carbon dioxide may be very important to our study. One source of carbon dioxide is the earth's atmosphere.

Equation 38

$$CO_2(gas) + H_2O \rightleftharpoons H_2CO_3$$

atmospheric carbon dioxide — dissolved carbon dioxide

Henry's law states that the partial pressure (in bars) of a gas phase (pCO_2) in contact with a dilute water solution will be inverse.y related toe molality of the dissolved gas (H_2CO_3o) in equilibrium with the solution by a proportionality constant (KCO_2).

Equation 39

$$KCO_2 = aH_2CO_3/pCO_2$$
$$\log KCO_2(25\ C) = -1.47$$
$$\log KCO_2(40\ C) = -1.64$$

Drever (1982)

KCO_2 varies only with temperature. pCO_2 is used in our discussions in terms of a hypothetical gas phase, since no gas phase is actually present in subsurface aquifers, and it is related to aH_2CO_3o by Equation 39. Note that H_2CO_3o is carbonic acid. Average atmospheric pCO_2 is about $10^{-3.5}$ atmosphere partial pressure. Another source of carbon dioxide is decomposition of organic matter:

Equation 40

$$2CH_2O \longrightarrow CH_4 + CO_2$$

organic matter (highly simplified) — methane

Very large amounts of CO_2 are produced in this manner in near-surface soil environments. The same processes can occur in the subsurface where similar reactions decompose organic material such as coal. In this study we have assumed that the subsurface chemical system is closed to the direct addition of atmospheric and organic pCO_2 except for recharge water, which passes from the atmosphere through a near-surface soil zone to an aquifer in the

subsurface. Calcite and dolomite precipitation are additional subsurface sources of pCO_2. This process is not a net gain in carbonate to the system.

Equation 41

$$Ca^{++} + 2HCO_3^- = CaCO_3 + CO_2 + H_2O$$

Details of carbonate chemistry are discussed in Garrels and Christ (1965) along with common ion effects of gypsum dissolution on carbonate equilibria.

INTERPRETATION OF FIELD STUDIES

INTERPRETATION

Geochemical theories and laboratory experiments reported in the literature concerning the relations between aluminosilicate minerals and carbon dioxide rich waters were tested and applied to the chemistry of ground water collected from the Safford area.

Examination of mineral saturation indices caculated by the WATSPEC program reveals that calcite ($CaCO_3$), talc ($Mg_3Si_4O_{10}(OH)_2$), and quartz (SiO_2)are routinely saturated or supersaturated. Dolomite ($CaMg(CO_3)_2$, chalcedony (SiO_2), chlorite ($Mg_3Al_2Si_3O_{10}(OH)_8$), and aragonite ($CaCO_3$) are sometimes supersaturated, but they are usually slightly undersaturated to saturated. Adularia ($KAlSi_3O_8$), albite ($NaAlSi_3O_8$), Ca-montmorillonite ($Ca_{0.167}Al_{2.33}Si_{3.67}O_{10}(OH)_2$), and kaolinite ($Al_2Si_2O_5(OH)_4$) are generally slightly saturated to undersaturated. Mineral equilibrium was indicated if the indices were within -+ 5 percent of the mineral equilibrium constant, taken from Truesdell and Jones (1974). Minerals in equilibrium with Safford area ground water are consistent with the mineralogy of basin-fill sediments. Where aluminum concentration was below the unit of reliable quantitative analyses, indices for aluminosilicate minerals were not calcualted by WATSPEC.

Since montmorillonite is a ubiquitous mineral in basin-fill sediments, ground-water chemistry was plotted on an activity-activity diagram showing the stability fields for Mg-montmorillonite, Ca-montmorillonite, and kaolinite (Fig.15). This diagram allows interpretation of various components of the ground-water chemistry with respect to mineral phases. Calcite and dolomite saturation surfaces at a particualr pCO_2 were plotted as a function of aCa^{++}/a^2H^+ (Drever, 1982). The saturation surfaces of talc and sepiolite were plotted as a function of aMg^{++}/a^2H^+. Solubility constants for these magnesium silicates were calculated from thermodynamic data tabulated in Drever (1982).

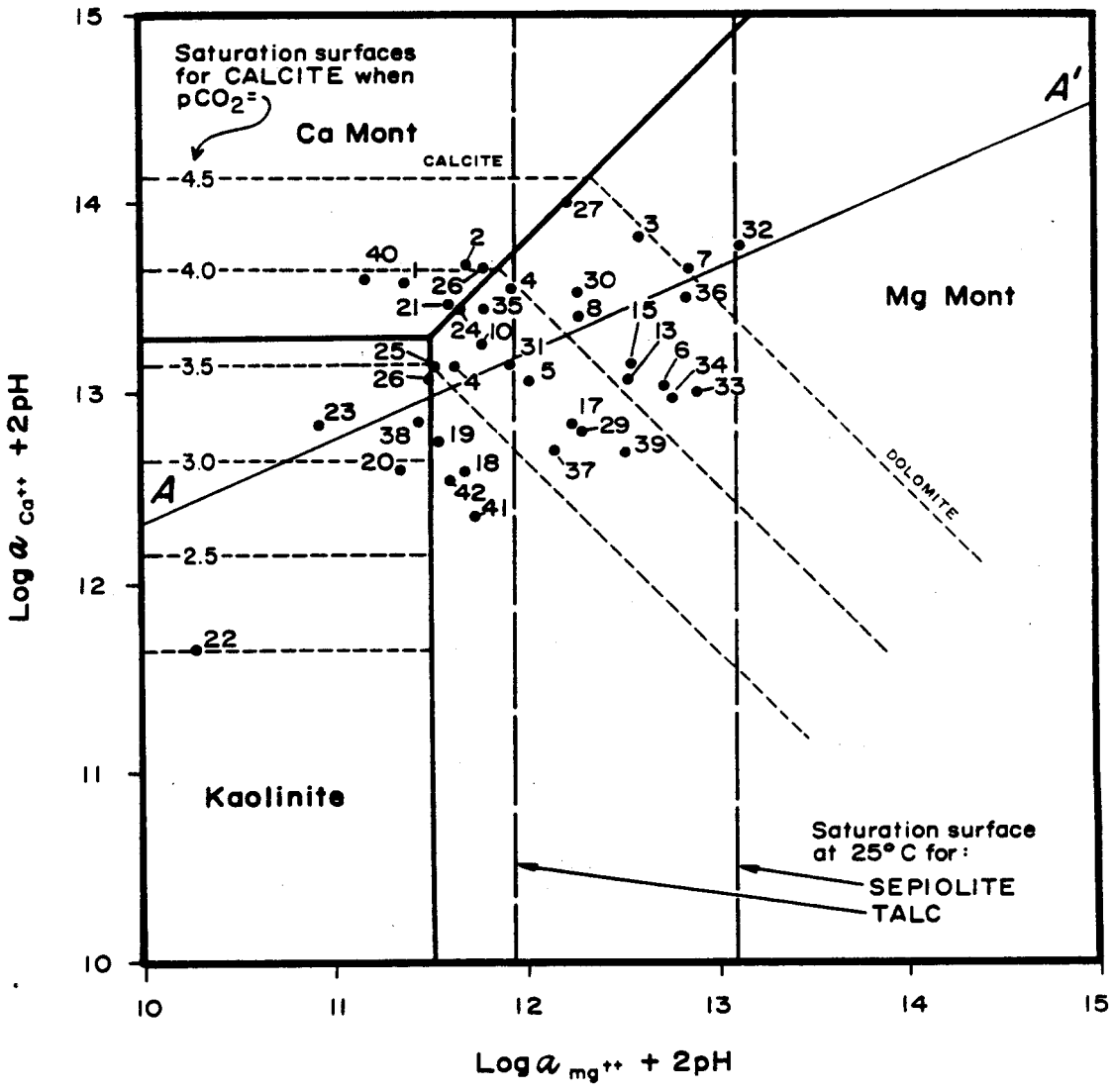


Figure 15 Theoretical activity diagram for the system $CaO-MgO-Al_2O_3-SiO_2-CO_2-H_2O$ at 40°C, 1 atmosphere and at Log $A_{H_4SiO_4^o}$ = -3.54 (diagram modified from Cole, 1983)

Most sampled ground water falls into the Mg-montmorillonite stability field. Four samples plot in the kaolinite field; the remaining samples plot in the Ca-montmorillonite field. Sample 22, which plots in the middle-left portion of the kaolinite field, is surface snow-melt flow from Marijilda Wash. This sample is representative of recharge water before it reacts with soil and near surface sediments and enters the ground-water system. As recharge water reacts with subsurface rocks it loses pCO2 and increases in pH through loss of H+ to silicate alteration minerals. Since talc and sepiolite are apparently saturated, they may control magnesium (and silica) concentration at pH greater than 8.5 and at lower pCO2 (-Log pCO2>3.8). At lower pH and higher pCO2 concentrations, dolomite is the more stable mineral phase.

Comparison of the calcite saturation indices with total calcium concentration dramatically shows that calcite equilibrium controls total calcium concentration (Fig. 16). Nearly all samples plot within the bounds of calcite saturation. Figure 17 is a plot of dolomite saturation indices versus total magnesium concentration in parts per million. Generally, concentrations above 0.6 ppm are controlled by dolomite equilibrium. The small number of samples in apparent supersaturation with calcite are in eqilibrium with dolomite. Samples that plot in the Ca-montmorillonite stability field and in the Mg-montmorillonite field above a line drawn between samples 12 and 7, are undersaturated with dolomite. Due to the low magnesium concentration in these waters, another magnesium mineral(s) is suspected to control magnesium concentration in the dolomite-undersaturated water.

Talc saturation indices were plotted against total magnesium concentration in Figure 18. Samples that were undersaturated with dolomite approach gross equilibrium with talc. Waters with magnesium concentration greater than 1.0 ppm are either in equilibrium or supersaturated with talc. Samples with magnesium concentration less than 0.6 ppm fall into two general groupings. One group approaches gross equilibrium; the other group is in a field approaching supersaturation. The latter group may actually have attained equilibrium with sepiolite. These relationships suggest that magnesium silicates control very low (<0.6 ppm) magnesium concentrations. Magnesium silicate solubility control of dissolved magnesium and silica at high pH has been suggested by the field and laboratory studies of Klein (1974) in the San Luis basin, Colorado and by the laboratory experiments of Siffert (1962). For completeness, it should be noted that if a sepiolite equilibria phase exists, it is metastable because talc and dolomite are more stable.

Figure 19 is a plot of pCO2 versus chalcedony saturation indices. It is generally believed by most workers that chalcedony controls silica concentration in waters below 100 C.

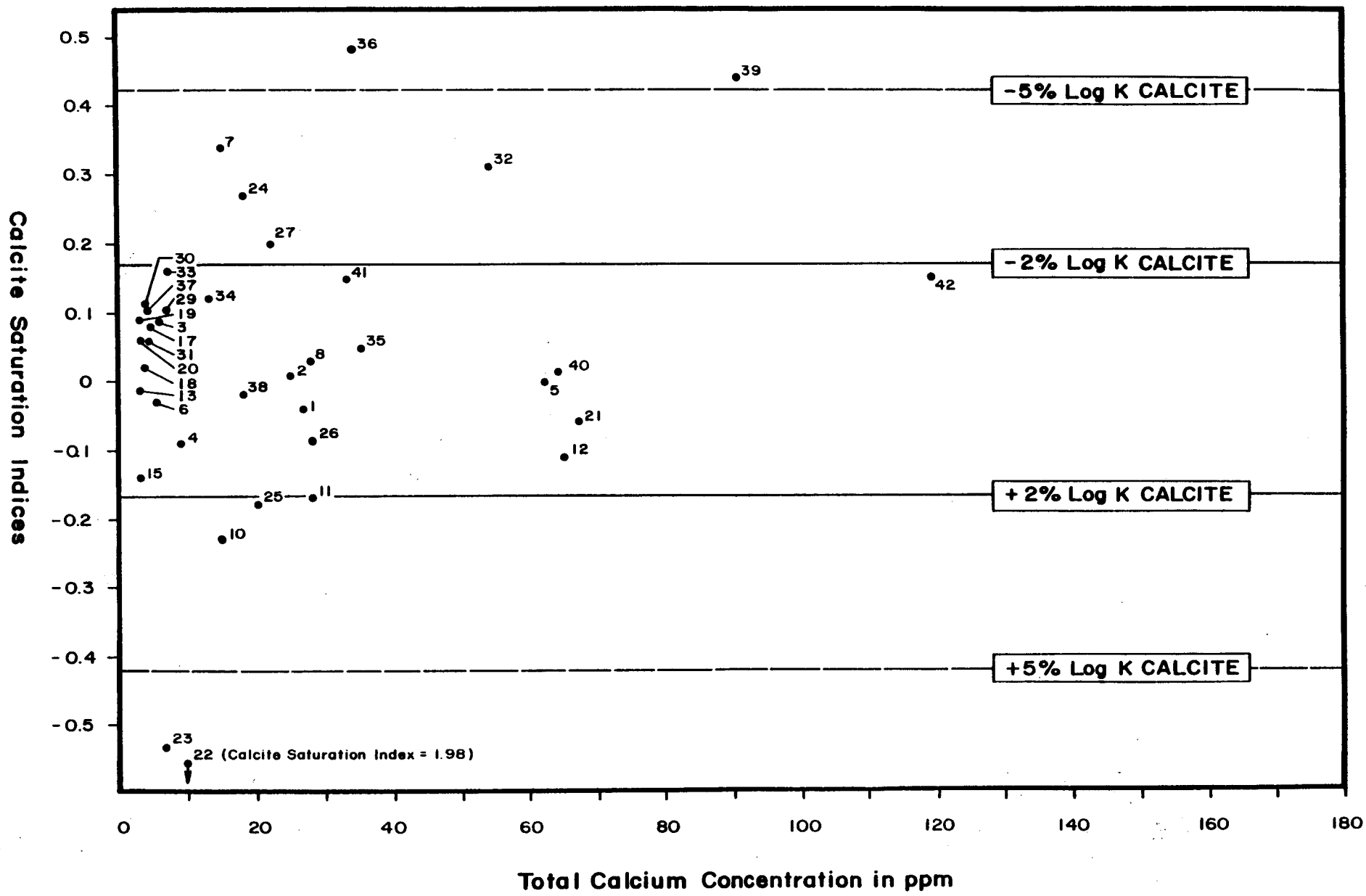


Figure 16 Calcite saturation indices versus total calcium concentration

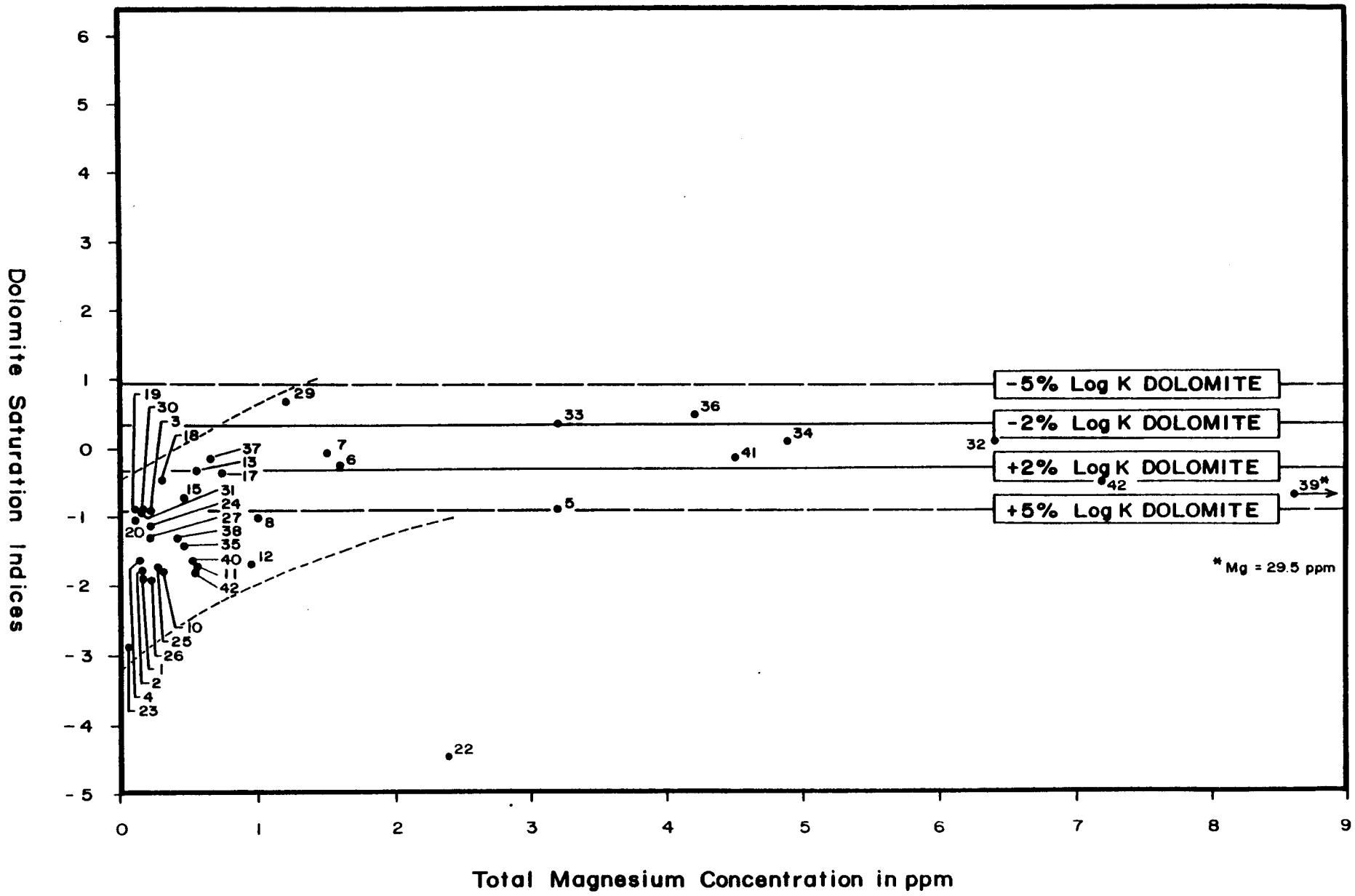


Figure 17 Dolomite saturation indices versus total magnesium concentration

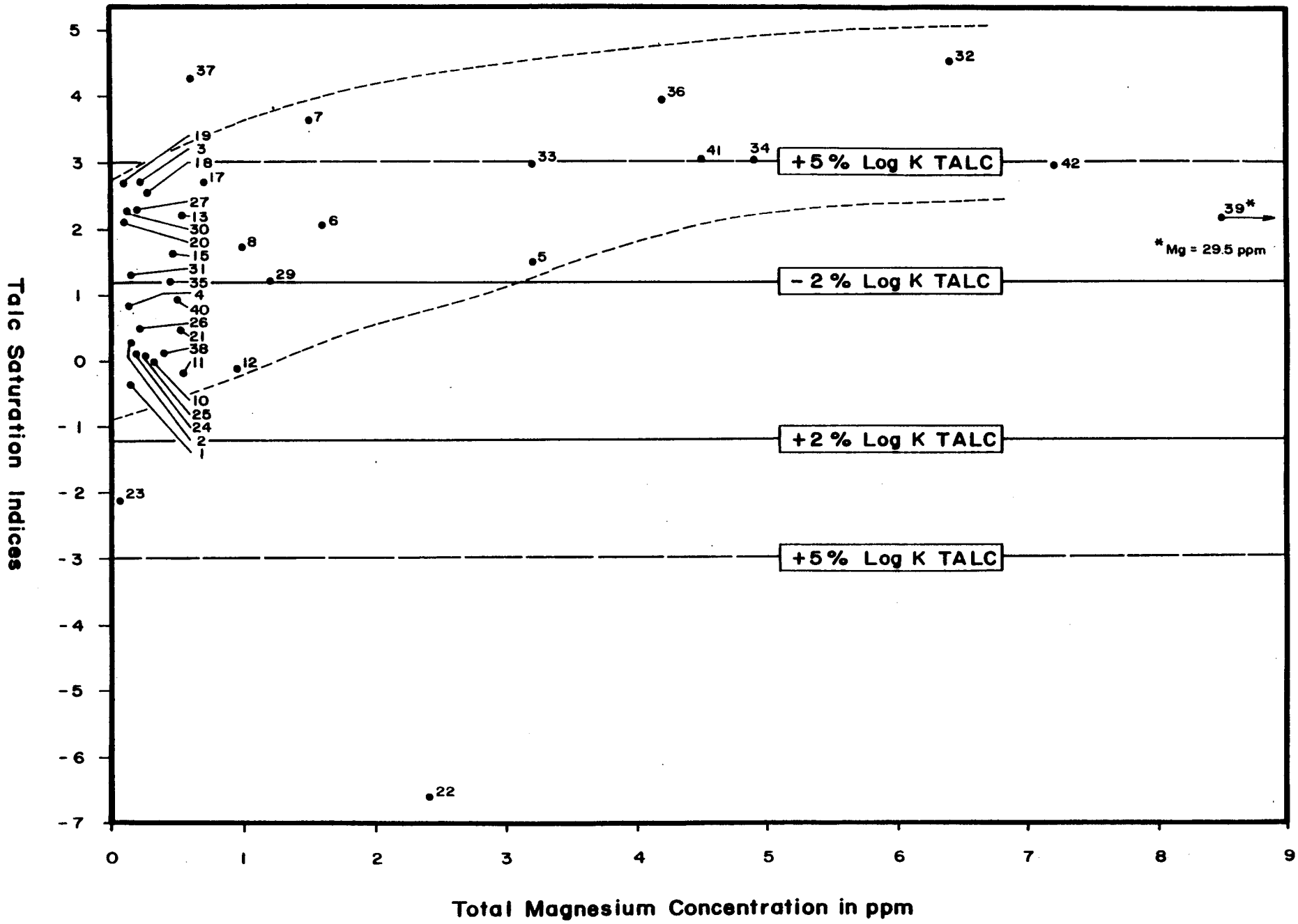


Figure 18 Talc saturation indices versus total magnesium concentration

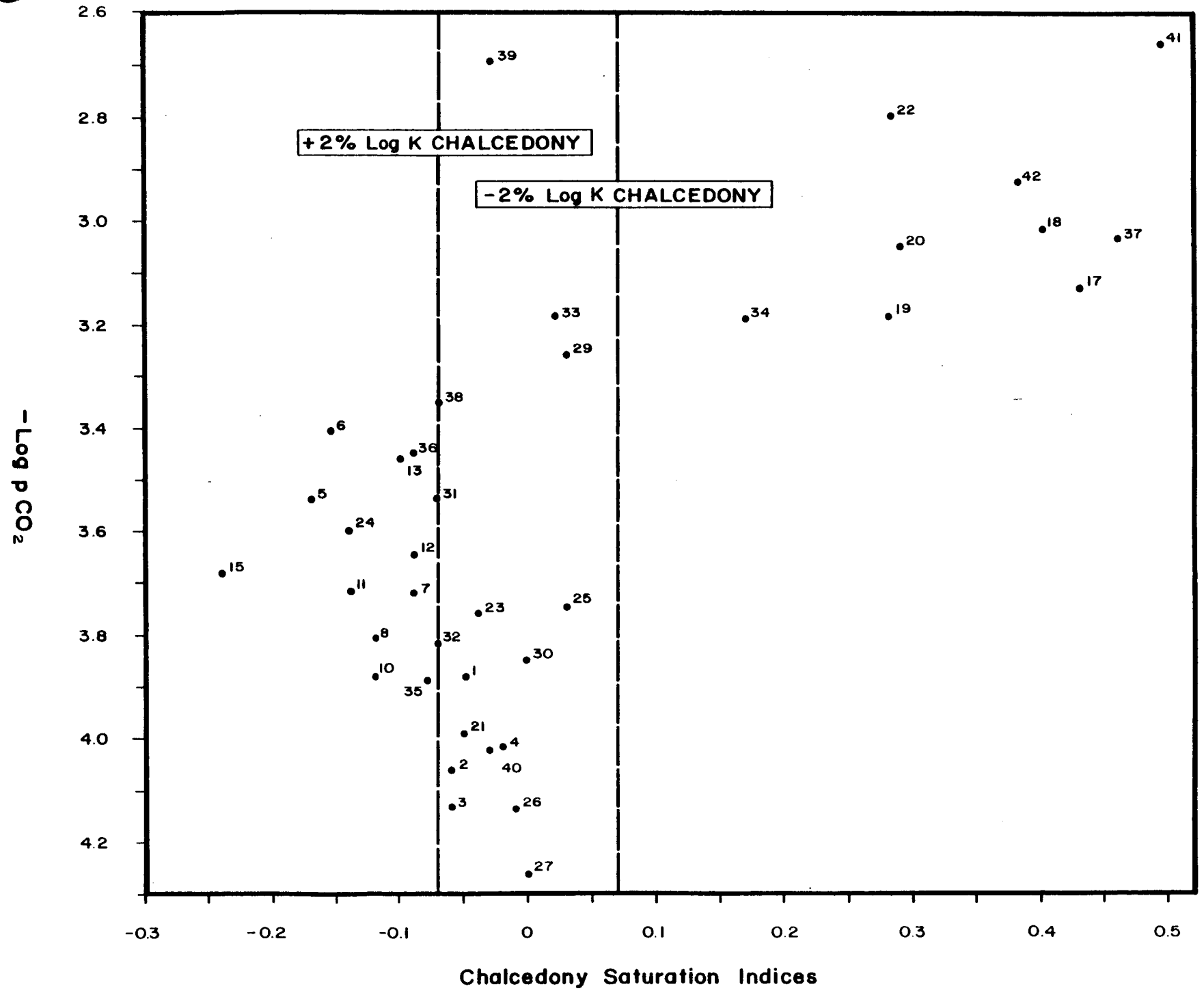


Figure 19 Chalcedony saturation indices versus $-\text{Log } pCO_2$ concentration

However, most waters sampled in this study plot outside the chalcedony saturation boundaries. Two trends are striking. Indices increase systematically above Log pCO2 -3.5 and they decrease systematically below Log pCO2 -3.5. Sample 39 does not plot in either field. This water is highly anomalous and its dissolved silica concentration is probably in equilibrium with chalcedony. This water has high TDS (7797 ppm), mostly sodium and chloride, and contains 10 ppm boron! The flow rate of this well is less than 0.5 gpm, about an order of magnitude lower than all other wells sampled for this study. Interestingly, the fluoride concentration in Sample 39 is the lowest analyzed in the area. Due to a low flow rate and rotten surface casing it appears that major changes in carbonate and silica chemistry have occurred due to mixing, precipitation, and shallow water-rock interactions after this water left the aquifer. The ground surface above and below this well was moist and had a salt crust.

Figure 20 is a plot of quartz saturation indices compared to pCO2. It shows the same relationships as Figure 19. The upper surface limit of silica indices versus pCO2 above Log pCO2 -3.5 is better defined with the quartz indices than with the chalcedony indices. Nearly all waters plotting below Log pCO2 -3.5 have very low magnesium concentration, are undersaturated with dolomite, and are saturated with talc. The trend in these later waters suggests precipitation of magnesium silicate after an initial dissolved-silica equilibrium with chalcedony or silica input from zeolite reactions. Water showing a systematic increase in saturation indices above Log pCO2 -3.5 suggests a dissolved carbon dioxide reaction with aluminosilicate minerals. A steady-state equilibrium exists in these waters.

Assumptions made in these interpretations are: (1) no mixing has taken place; (2) chemistry is representative of aquifer conditions; (3) well discharge temperatures are very close to aquifer temperatures; and (4) no carbonate or pH change has occurred.

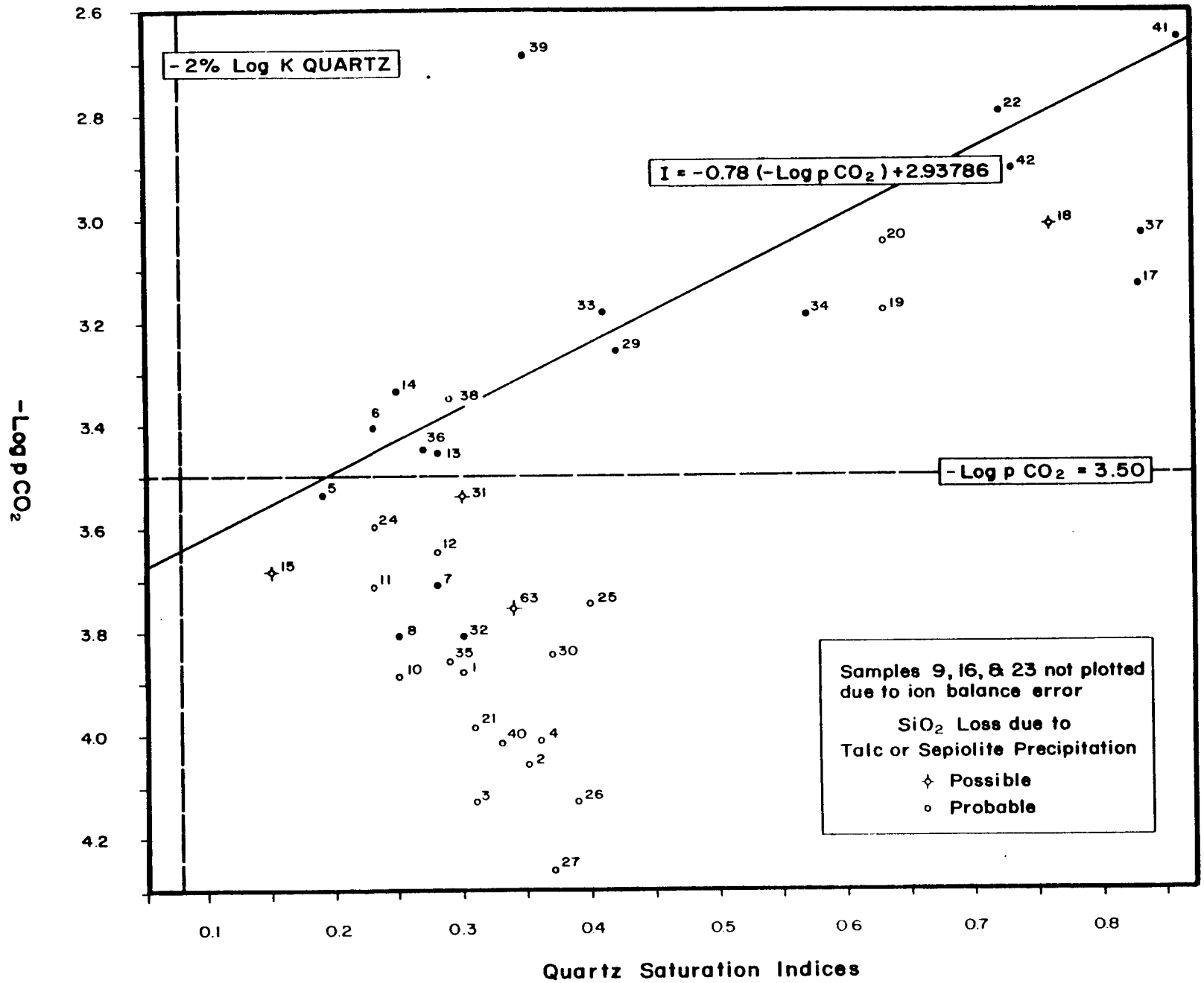


Figure 20 Quartz saturation indices versus -Log pCO_2 concentration

A CO2-CORRECTED QUARTZ GEOTHERMOMETER

Silica geothermometers are based upon experimental solubility of solid silica polymorphs at different temperatures. They were derived with plots of log silica concentration (log K) versus the inverse of absolute temperature (T). The equation is a variation of the familiar linear relationship describing a line:

Equation 42

$$1000/T = (m \log K) + b$$

where m and b are constants

We propose a correction to the silica geothermometer for ground water less than 100 C. This correction involves the use of a disequilibrium indices (I) that is determined from the relationship between quartz saturation indices and log pCO2 concentration. This factor I is subracted from log K in the pCO2 corrected geothermometer.

Equation 43

$$1000/T = (m \log K - I) + b$$

We use an upper limit of quartz saturation indices versus log pCO2 greater than -3.50 of samples from Cactus Flat to describe I (see Figure 20). Samples which are undersaturated with dolomite and saturated with talc (open symbols) are not used to describe this limit because they may have lost dissolved silica due to precipitation of magnesium silicate minerals. Also, samples 17, 37, and 39 are not used. Samples 17 and 34 are form Buena Vista. Sample 39 is unrepresentative of aquifer conditions (see section on interpretation of field studies). The equation describing this upper limit is:

Equation 44

$$I = -0.78(-\log pCO_2) + 2.93786$$

This correction is limited to ground water with log pCO_2 greater than -3.50. At lower pCO_2 concentrations traditional chalcedony and quartz geothermometers apply. The quartz geothermometer presented by Fournier (1977, 1981) is modified to obtain a pCO_2 corrected silica temperature as follows:

Equation 45

$$T°C = (1309/5.19 - \log SiO_2 + I) - 273.15$$

where log SiO_2 is in ppm silica concentration and I is determined from Equation 44

In order to successfully apply this technique, accurate field pH measurement is required. Laboratory alkalinity measurement will give accurate carbonate information if analyses are done within a few days (or a couple of weeks if the sample is kept cool). However, if calcite actively precipitates at a spring or well, field measurement of alkalinity should be performed. Scaling and travertine deposits will indicate calcite precipitation. Total alkalinity and pH are used to calculate pCO_2 concentration. These calculations are well documented in standard references (Garrels and Christ, 1967; Stumm and Morgan, 1970; and Drever, 1982).

APPLICATION OF THE NEW CO_2 CORRECTION TO THE QUARTZ GEOTHERMOMETERS AT CACTUS FLAT-ARTESIA AND BUENA VISTA

APPLICATION

A CO_2 correction to the quartz geothermometer was applied to waters having log pCO_2 greater than -3.50. This correction subtracts the non-silica polymorph dissolved fraction to allow realistic application of silica geothermometers to low temperature ground water. In other waters, with log pCO_2 less than -3.50, dissolved silica is in apparent equilibrium with chalcedony (Figure 19). Comparison of the CO_2 corrected geothermometer temperatures and the chalcedony temperatures with measured temperatures for the Cactus Flat-Artesia area shows that these geothermometers agree well with measured temperatures. This is expected because the Cactus Flat-Artesia samples are from confined aquifers.

We compared the results of a conventional resource assessment using Na-K-Ca and SiO_2 geothermometer temperatures calculated from published data with our CO_2-corrected silica geothermometer temperatures and chalcedony geothermometer temperatures calculated from water chemistry collected during this study. First, we reviewed the published water chemistry from Cactus-Artesia and Buena Vista and applied the conventional geothermometers to estimate reservoir temperatures (Table 4). Figures 21, 22, and 23 show that these geothermometers suggest a 80 to 100°C reservoir at Buena Vista and 80 to 90°C reservoir at Cactus Flat-Artesia. Second, we tabulated the silica geothermometer temperatures for water samples we collected (Table 5) and applied the CO_2 correction to those samples having log pCO_2 greater than -3.5. The correction was applicable to seven samples at Cactus Flat and five at Buena Vista.

These new values and the revised silica geothermometer maps (Figs. 24 and 25) suggest lower reservoir temperatures. A more realistic resource temperature at Buena Vista appears to be in the 50 to 70°C range, about 30 °C lower than predicted on the basis of an uncorrected silica geothermometer alone. A temperature-depth profile of a deep well 5km east of Buena Vista shows a temperature inversion at 500m (Reiter and Shearer,1979). This profile indicates the existance of a 65 to 70°C convective geothermal system in the Buena Vista area. The CO_2-corrected

silica geothermometer temperatures for the area range between 52 and 68°C.

CONCLUSIONS

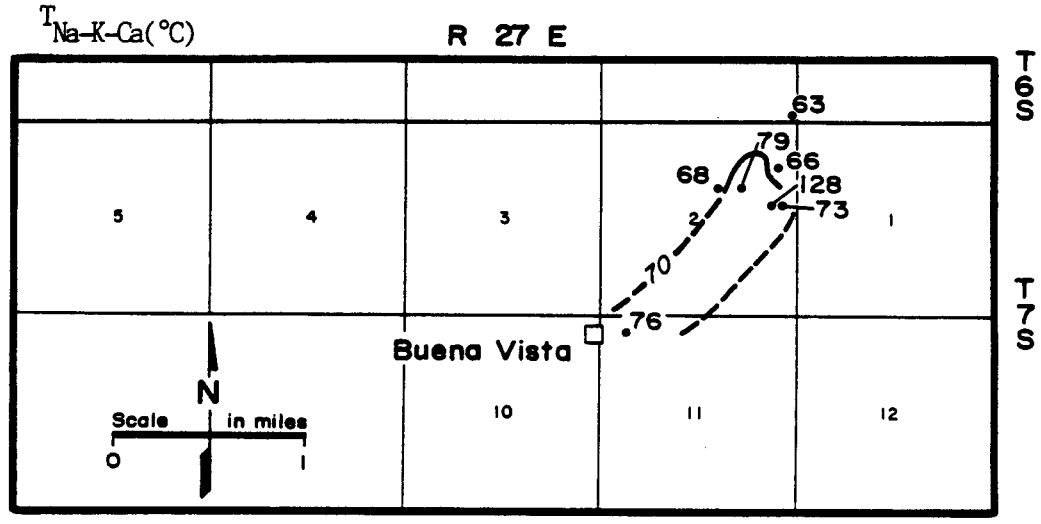
Dissolved silica concentrations in the low temperature waters are not restricted to silica polymorph solubility. Steady state processes occur that involve introduction of silica by reaction of water with aluminosilicate minerals and precipitation of magnesium silicates, clay and aluminum silicates. Zeolite-water reactions may contribute silica; however, thermodynamic data for zeolites are uncertain and their influence was not evaluated.

Non-silica polymorph contributions of dissolved silica may cause traditional silica geothermometers to give unrealistic and unreliable results. Application of a CO_2 correction to quartz geothermometers appears to give accurate reservoir temperatures of low temperature geothermal resources.

TABLE 4 - Measured and Geothermometer Temperatures, Published Data, Cactus Flat-Artesia and Buena Vista

Location		Temp(°C)	TChal(°C)	TQtz(°C)	TNa-K-Ca(°C)
(D-8-25)	1ddd	36	31.4	63.4	81.0
	12aaa	39	26.5	58.7	94.3
	12aaa	39	45.0	76.6	75.7
	12aaa	39	31.4	63.4	95.6
(D-8-26)	6cbb	31	25.2	57.4	61.7 *
	7ab	45	31.4	63.4	83.6
	7ac	37	50.5	81.7	67.8
	7adc	32	20.5	53.0	85.5 *
	7ba	34.5	45.0	76.6	87.4
	7bb	33.5	45.6	78.0	68.0
	7bbb	34	27.3	59.5	93.3
	7da	41.5	45.0	76.6	86.7
	7dd	42	38.6	70.4	84.8
	7dda	39	28.3	60.5	87.5
	7dda	39	35.1	67.0	74.5
	7ddb	35	35.1	67.0	74.8
	7ddb	38	36.9	68.7	73.3
	8bdcc	39	18.3	50.8	92.2 *
	8ca	39.4	35.1	67.0	92.5
	9bc	29.4	48.1	79.4	51.9 *
	9bc	38.9	31.4	63.4	60.4 *
	19cdda	27	68.8	98.9	57.3
	19cddb	27	56.2	87.1	61.0
	19cddbc	29	53.5	84.6	66.9
	19dccb	27	71.9	101.8	52.6
	20cd	44	42.0	73.6	93.9
	20dbcc	45	28.1	60.3	105.2
	20dc	39.4	45.1	76.6	64.2
	32dcc	28	45.1	76.6	82.4
	33cccc	31	52.2	83.4	50.5
	33ccd	34	42.0	73.6	69.4
(D-9-26)	5ab	33	45.1	76.6	66.9
	5acb	33	46.6	78.0	64.3
(D-6-27)	35dddd	27	73.9	103.6	63.2 *
(D-7-27)	2aadc	36	45.1	76.6	66.2
	2aca	37.5	87.2	116.0	78.6 *
	2acb	38	82.1	111.3	67.9 *
	2adbb	40	43.5	75.1	29.2
	2add	41	85.5	114.5	73.3 *
	2addcb	39	83.9	113.0	127.6 *
	11bbb	43.5	87.2	116.0	75.8 *

* Mg correction applied



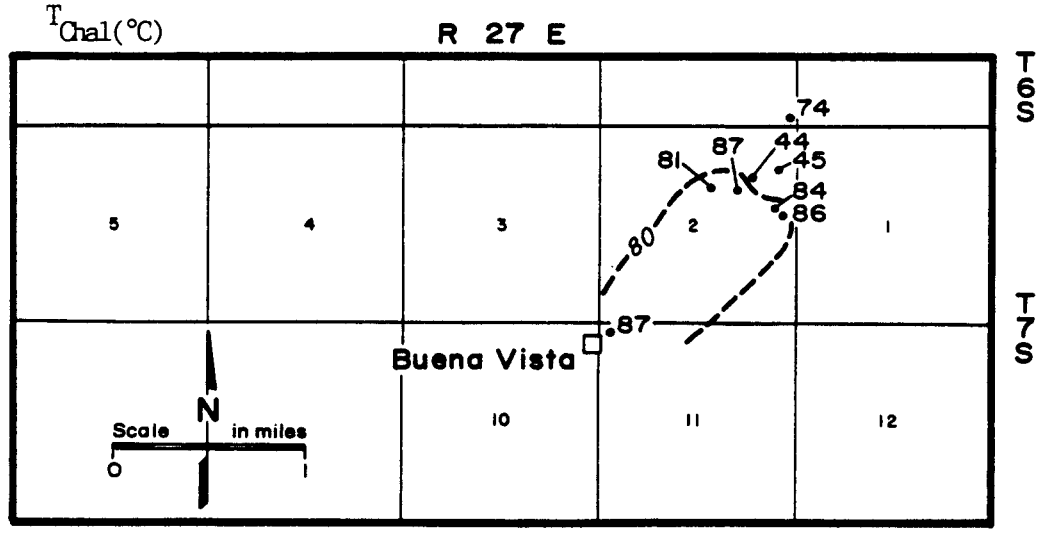


Figure 21 Maps showing Na-K-Ca (upper) and SiO_2 (lower) geothermometer temperatures calculated from published data for Buena Vista

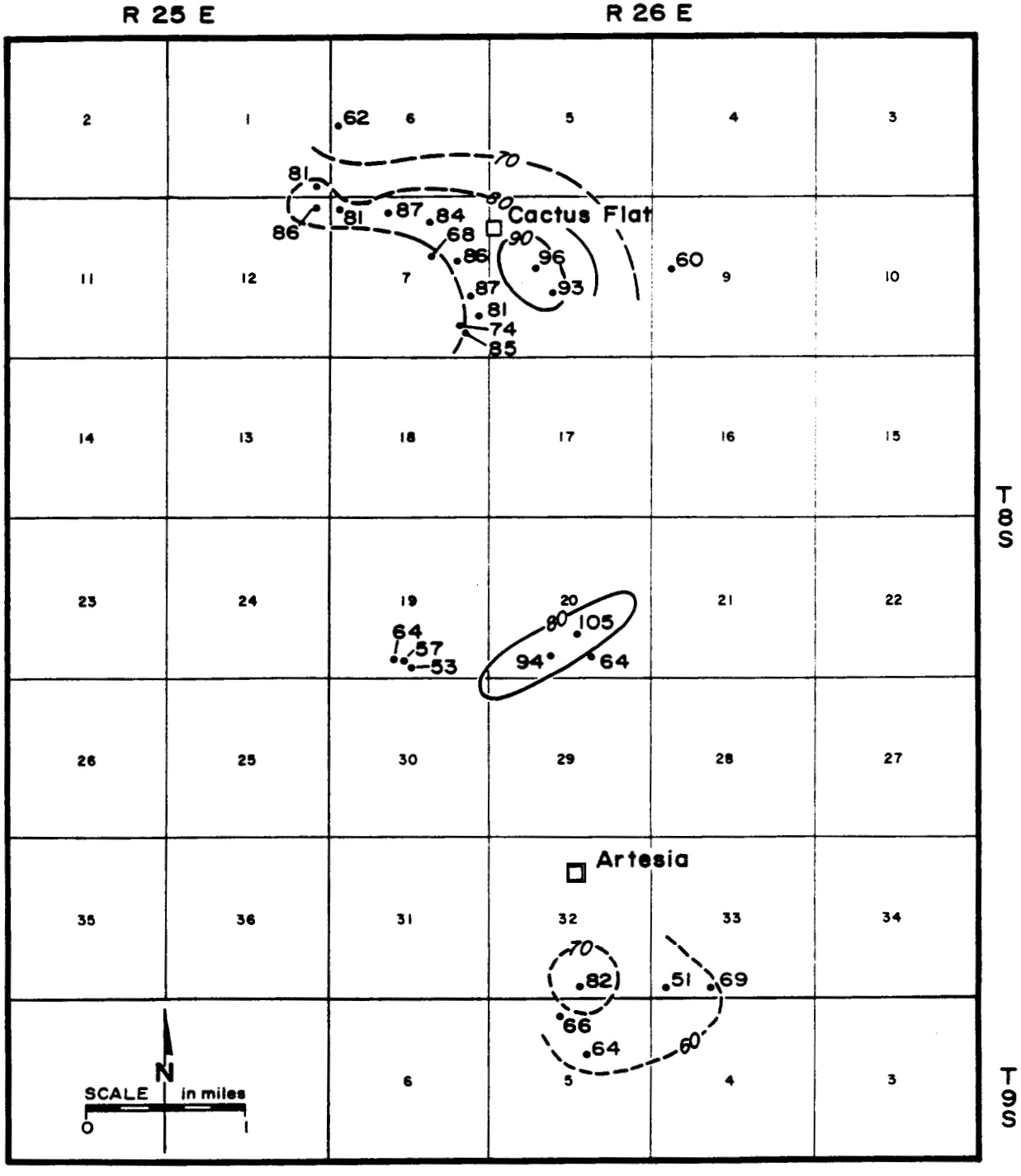


Figure 22 Map showing Na-K-Ca geothermometer temperatures calculated from published data at Cactus Flat-Artesia

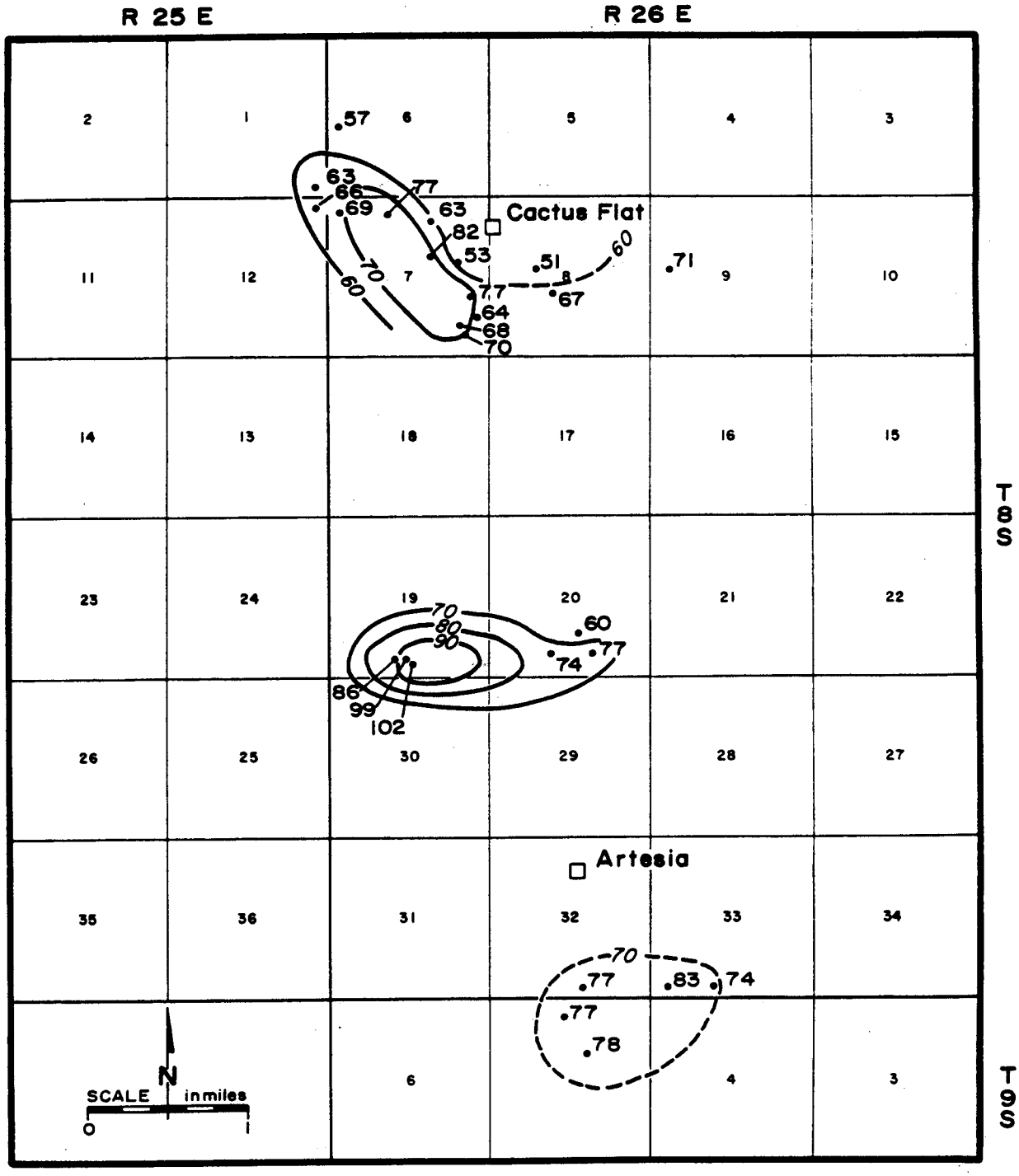


Figure 23 Map showing SiO_2 geothermometer temperatures calculated from published data at Cactus Flat-Artesia

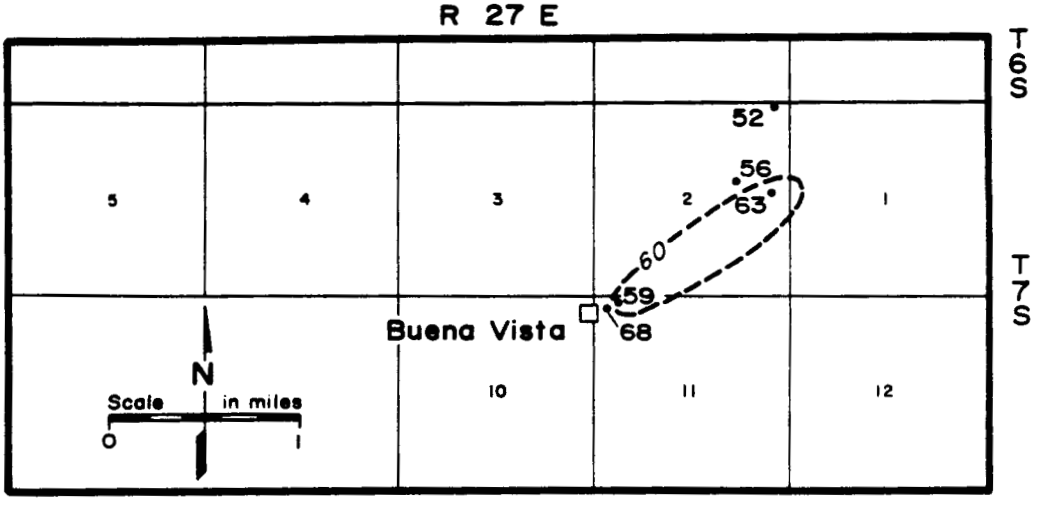


Figure 24 Map showing CO_2-corrected quartz geothermometer temperatures, this study, Buena Vists

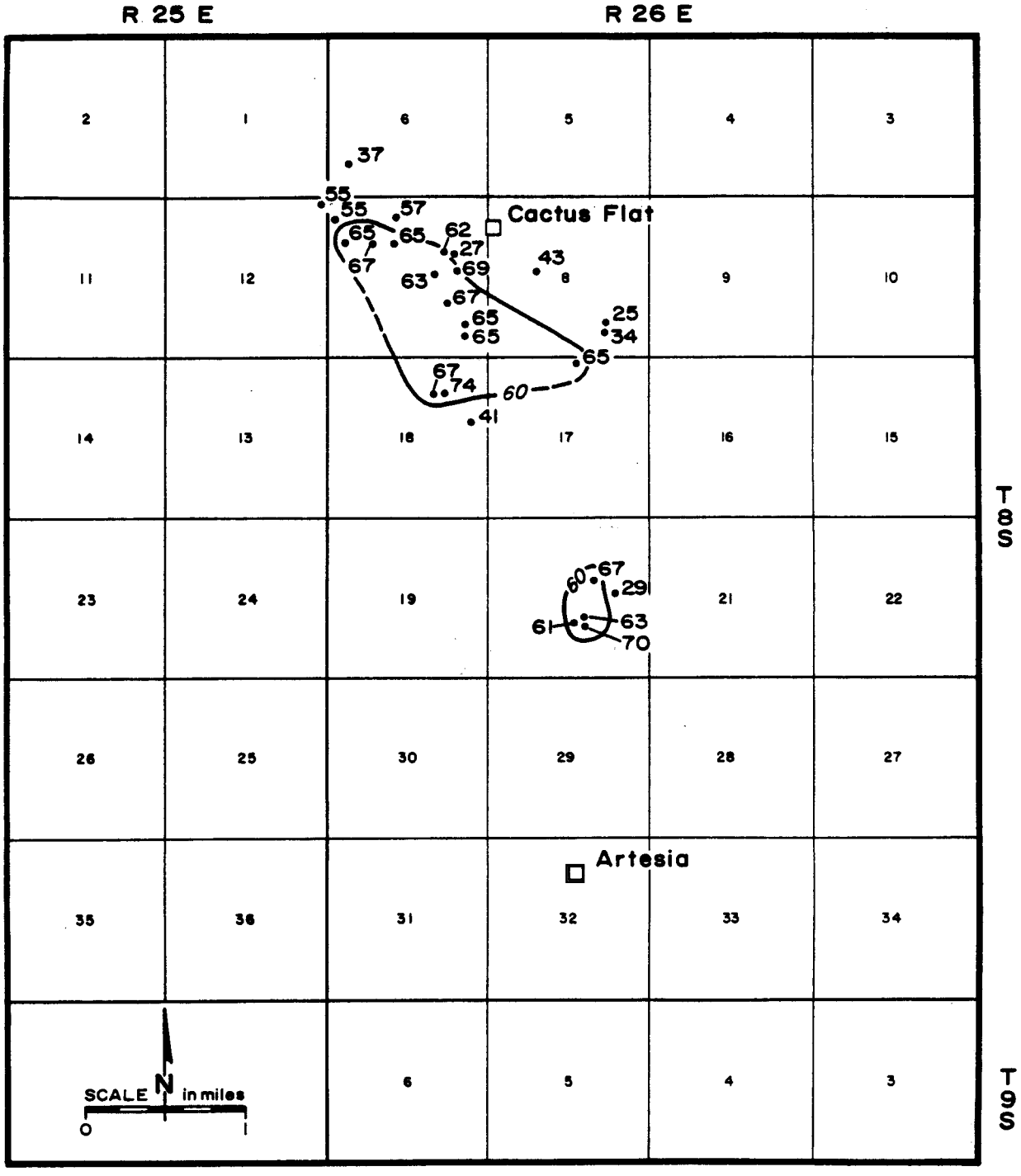


Figure 25 Map showing CO_2-corrected quartz geothermometer temperatures, this study, Cactus Flat-Artesia

TABLE 5 - Measured, SiO_2, and pCO_2-Corrected Geothermometer Temperatures, This Report, Cactus Flat-Artesia and Buena Vista

Location	Well No.	Temp(°C)	T_{Chal}(°C)	T_{Qtz}(°C)	T_{Qcorr}(°C)
(D-8-26) 7ddba	1W83	38.6	33.3	65.3	
7ddbc	2W83	34.6	33.3	65.3	
7bdab	3W33	34.3	33.3	65.3	
7bbcd	4W83	33.1	33.3	65.3	
7baac	5W83	41.4	25.2	57.4	
7adbc	6W83	29.2	15.4	48.0	30.8
7acad	7W83	35.3	29.4	61.5	
7acad	8W83	37.8	27.3	59.5	
7adcd	9W83	33.7	31.4	63.4	
7bbbc	10W83	33.8	22.9	55.3	
12aaaa	11W83	36.0	22.9	55.3	
12aaaa	12W83	38.5	29.4	61.5	
6ccba	13W83	30.4	22.9	55.3	40.5
7adcc	15W83	31.6	12.7	45.3	
(D-7-27) 2aaab	17W83	26.3	67.8	98.0	54.7
2acda	18W83	39.4	83.0	112.1	57.8
11bbbb	19W83	48.4	85.5	114.5	71.3
11bbbb	20W83	49.2	85.5	114.5	61.7
(D-8-26) 7bdbb	21W83	39.9	35.1	67.1	
(D-8-25) 27caaa	22W83	6.5	25.2	57.4	5.2
(D-8-26) 20dbbd	23W83	35.1	31.4	63.4	
20dbcb	24W83	38.7	27.3	59.5	
20dbca	25W83	36.5	38.7	70.4	
20acdb	26W83	33.7	35.1	67.1	
20acdb	27W83	38.0	42.0	73.6	
20adcc	29W83	26.5	27.3	59.5	31.9
18abdd	30W83	37.2	42.0	73.6	
18abdc	31W83	38.9	35.1	67.1	
17abbb	32W83	39.0	33.3	65.3	
8dcaa	33W83	26.6	27.3	59.5	27.2
8dcad	34W83	25.1	38.7	70.4	36.7
7dbda	35W83	41.3	35.1	67.1	
8bdcc	36W83	39.1	31.4	63.4	47.3
(D-7-27) 2addc	37W83	40.4	93.5	121.7	65.6
(D-8-26) 18addb	38W83	41.4	35.1	67.1	43.9
7bdbb	40W83	39.9	36.9	68.8	
(D-6-25) 23bbad	41W83	39.6	91.9	120.3	39.5
36cbbb	42W83	46.1	85.5	114.5	52.6

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APPENDIX A

Drillers' Logs

	Depth Interval (feet)
(D-6-25) 7acab	
dirt rock, top soil	0-20
silt	20-35
silt w/rock	73-79
red clay	79-165
(D-6-25) 34bbb	
sandy loam	1-28
gravel	28-33
clay	33-98
gravel	98-103
clay	103-250
gravel	250-252
clay	252-400
(D-6-25) 36cbb	
silty clay	40-179
soft clay	179-209
hard clay	209-235
sticky clay	235-292
clay	292-440
sticky clay	440-507
hard clay	507-522
sticky clay	522-570
clay	570-715
clay w/streaks of shale	715-754
soft sandy clay	754-770
hard clay	770-881
shale	881-897
clay	897-911
clay w/streaks of sand	911-1012
sandy shale	1012-1044
shale w/streaks of gravel	1044-1106
hard cemented sand	1106-1111
sandy shale	1111-1198
sandy shale w/streaks of cemented sand	1198-1389
cemented sand w/streaks of gravel	1389-1510
hard clay & shale	1510-1561
sand & gravel w/streaks of clay	1561-1654
coarse gravel w/streaks of clay	1654-1761
hard sandy shale w/streaks of sand	1761-1812
hard sandy shale	1812-1835
cemented sand	1835-1918
soft break	1918-1922
hard sandy shale	1922-1927
soft break	1927-1935
hard sandy shale	1935-1938
soft break "lost some mud"	1938-1945
hard sandy shale	1945-1961
sandy shale	1961-1985
loose sand & gravel "lost some mud"	1985-1996
hard sand	1996-2001
fine sand w/streaks of shale	2001-2025
hard sand plus shale	2025-2037
fine sand w/streaks of shale	2037-2042
hard sand & shale	2042-2048
loose gravel "lost some mud"	2048-2052
hard sand	2052-2060
med. soft sand w/some shale	2060-2119
med. soft sand	2119-2149
hard sand & shale	2149-2161
U.S.G.S. analysis:	
mudstone	235-850
gypsum 70-90%	850-1650
volcanic sand	1650-2160
(D-6-26) 7cac	
gravel, sand, pebbles, boulders	0-10
unconsolidated	10-90
consolidated sand, pebbles, boulders of Cretaceous & Tertiary origin	90-710
Tertiary volcanics, red porphry docite	710-730
Tuffaceous cg (frogs of andes enclosed in rhy matrix)	730-1060
Porphry docite? light yel-brn, soft	1060-1100
Pink, soft, non-porphyretic	1100-1110
(D-6-26) 8abb	
gravel	0-450
Tertiary volcanic (tuff agglomerate)	450-525
andesite porphyry	525-540
dacite porphyry	540-618
rhyolite tuff	620-630
cg	630-690
andesite	690-745
rhyolite Tuff cg	745-820
rhyolite	820-840
cg - rhyolite tuff	840-925
andesite	925-960
cg - rhyolite tuff	960-965
alt. tuff & andesite	965-1075
gray andesite	1075-1100
(D-6-26) 8ccd	
gravel	0-580
(D-6-26) 8bbb	
gravel	0-700
Tertiary volcanic (dacite? prop.)	700-730
perlitic tuff	730-800
tuffaceous cg; rhy matrix	800-965
(D-6-27) 02abd	
soil	0-10
malapais (cavern at 400 ft.)	10-505
On outcrop of younger vols.	
(D-6-27) 13cc	
basalt	0-200
(D-6-27) 30b	
top fill & boulders	0-90
red & blue clay	90-305
black mud "in cavity"	305-345
(D-6-27) 35cbb	
Logged 1958 by Davidson. Only core 560 to 1,000 ft. located.	
dense, well cemented cg w/lenses of ss & tuff beds. Red granite is present. Bedding is up to 30° from perpend. to core. ∴ pre Plio-Pleistocene basin fill. May be equiv. to Bonita Creek cg.	560-689
May be equiv. to intermediate series andes & basalts - early Cenozoic.	689-893
epidotized andesite Cretaceous, prob. equiv. to Silverbell cg of Tucson	893-TD
- - - - - - - - - -	
cg	560-566
white tuff	566-568
mudstone 30°	568-581
sandstone	581-588
siltstone	588-601.7
red granite 4" cobble	601.8
cg grit	601.8-616
siltstone & mudstone	616-625
sandstone (red gr)	625-658
cg	658-689
siltstone to ss	689-692
cg	692-754
mudstone	754-756
flow breccis or cg	756-761
andesite	761-893
andesite & basalt	893-1000
(D-6-26) 35aaa	
gravel	0-119
clay	119-896
gravel	896-1112
gravel	1112-1167
bedrock 1167	
(D-6-27) 36ccc	
gravel	0-15
gravel & caliche, alternating in beds 3' apart	15-250
(D-6-27) dbdz dbdc	
surface soil	1-8
water bearing sand & gravel	8-69
conglomerate	69-85
"nothing for deepen to 250' " deepened to 250' in 1951 "no water"	
(D-6-28) 03 ccd	
conglomerate	0-2015
"just reached basalt" "N40°W trending fault just NE of hole - down drop to SW"	

	Depth Interval (feet)
(D-6-28) 31dba	
top soil	1-4
clay, gravel	4-36
boulders	36-45
clay & gravel	45-116
cg	116-280
sandy clay	280-294
rocks & clay	294-400
(D-7-25) 07ccc	
sandy loam	0-25
red blue clay	25-250
blue, gray clay	250-975
fine, sandy, honeycomb clay	975-980
clay	980-1100
(D-7-25) 22ddd	
silt, sand-calcareous	0-18
sand w/some siltstone	18-60
siltstone, grey to brown & calcareous	60-500
siltstone (described by driller as "sticky clay) grey to brown	500-730
silty clay, calcareous	730-800
siltstone, limey brown (driller reports it sticky)	800-981
siltstone - brown to grey calcareous. Some thin hard layers from 1270-1360 ft.	981-1465
Siltstone w.some hard layers. Mostly grey in color	1465-1705
Greyish siltstone	1705-1780
Siltstone w/minor qty. (gyp?) fragments	1780-1828
"Hard rock" probably gypsum bed in silts	1828-1935
Siltstone, brownish calcareous w/some interbedded gypsum. Temp. up to 100°F	1835-1988
Siltstone-brown calcareous; light grey fragments	1988-2160
Siltstone - brown, light grey fragments. Temp. 2181 92° 2220 98° 2260 99°	2160-2282
Siltstone - brown w/lighter fragments. Calcareous Temp. 2320 96° 2380 98° 2420 100°	2282-2422
Hard layer - considerable gypsum in grey siltstone calcareous	2422-2483
Brown & grey siltstone. calcareous	2483-2515
Probably bedrock potash granite	2515-2535
(D-7-25) 26 cbc$_2$	
Sand, few gravels, some gypsum (blue-grey)	0-45
Sand, few gravels, no gypsum (blue-grey)	45-119
Fine to coarse sand	119-397
Sand, few gravel	397-668
Grey sand, rare gravel	668-1499

	Depth Interval (feet)
(D-7-25) 27 dad$_3$	
?	0-130
Grey vol. sand, gravel, few pebbles	130-230
Sticky brown clay, vol. sand & gravel; few granite fragments	230-310
Very fine to coarse sand w/gypsum fragments	310-446
Gypsum	446-1206
Very fine to coarse volcanic sand	1206-1396
(D-7-25) 27 dcc	
Sand or sandy gravels interbedded w/silt or V.F. sand	0-10
Sand w/interbedded silt. Enters tuff bed near 20 ft.	10-20
Tuff	20-30
Silts & silty tuffs w/interbedded or disseminated sands	30-40
Bedded sands	40-50
Silts & silty tuffs	50-60
Sand w/diseminated clay or clay seams	60-70
Silts & micaceous tuffs w/stringers of sand & pebbles	70-80
Clayed sands & silts	80-90
Clayey silt	90-110
Fine silty sand	110-120
Silty & clayey sand	120-140
Sandy mudstone or clayey sand	140-150
Clayey sand or silt	150-170
Silty sand w/some clay	170-180
Clayey siltstone	180-185
Silty sand	185-190
V.F. sand w/disseminated silt or silt layers	190-200
Clayey silt	200-210
Silty clay	210-230
Interbedded silty sands & clays	230-240
Clayey siltstone	240-320
Calcareous siltstone	320-330
(D-7-26) 4 cad	
Boulders & sand	1-70
Blue clay	70-250
(D-7-26) 07 cbd	
Clay & gravel	0-57
Water	52-60
Clay & gravel	57-90
"Full amt. of water"	80
"Dry clay"	90-303
(D-7-26) 17 baa	
Soil	0-8
Gravel & boulders	8-90
Blue & yellow clay; streaks of gypsum & strata of hard rock (800 to 895 ft.)	90-895
Blue clay	90-190
Yellow clay	190-260

	Depth Interval (feet)
Blue clay	260-300
Yellow stratified clay	300-700
Yellow clay w/ streaks of clay	700-800
Yellow clay w/ strata of hard rock	800-895
(D-7-26) 19aa	
Yellow brown sand	0-60
Gravel predom w/ some sand	60-80
Brown sand, some gypsum; much siltstone, some gravel	80-260
Pinkish brown sand; little gravel, much siltstone	260-400
(D-7-26) 26aba	
Grey & brown clay & silt	0-1910
Siltstone & mdstn.	1910-2262
(D-7-26) 31cda	
Top soil	0-1
Sand & rock	1-7
Fractured rock	7-23
Tan clay	23-52
Clay w/mixed grvl.	52-70
Gravel & water	70-82
Clay	82-98
Gravel & water	98-105
Hard red clay	105-115
Wash gravel & water	115-120
Clay	120-153
Gravel & water	153-170
Clay	170-180
Blue clay	180-190
- - - - - - - - - - - -	
Perforations	130-180
Gravel	110-190
Grouted	20-110
(D-7-27) 1bbg	
Gravel	0-15
Gravel & caliche in alternating 3' layers	15-250
(D-7-27) 02aaa$_2$	
Pediment cap	0-18
Green clay	18-212
Basal cg	212-400
- - - - - - - - - - - -	
Artesian-water rose to 18' depth	
(D-7-27) 02aab$_2$	
Brown sand & dirt	0-16
Boulders	16-24
Yellow clay	24-125
Gravel	125-180
Clay	180-190
Gravel, cg	190-330
Yellow clay	330-350
Cg	350-500

	Depth Interval (feet)
(D-7-27) 02aca2	
Top soil	0-10
Boulders	10-25
(D-7-27) 2cbb	
Top soil	0-8
Sand, dry & gravel	8-16
Gravel, water	16-46
Rock & clay	46-66
Boulders	66-70
Clay	70-117
Sand	117-124
Clay	124-131
Sand	131-138
Clay	138-144
Gravel	144-149
Clay	149-158
Sand	158-167
Clay	167-175
Sand	175-179
Clay	179-186
Gravel	186-191
Clay	191-238
Gravel	238-247
Clay	247-278
Gravel	278-287
Clay	287-291
Clay - sandy	291-297
Sand	297-304
Clay	304-323
Gravel	323-331
Clay	331-338
Gravel	338-341
Clay	341-349
Gravel	349-360
Clay	360-374
Gravel & clay	374-387
Gravel	387-435
(D-7-27) 02acd	
Top soil	0-8
Gravel	8-15
Green clay	15-262
Basal cg	262-400
(D-7-27) 2cdb	
Surface soil	0-16
Boulders	16-48
Yellow clay	48-130
Gravel	130-142
Yellow clay	142-158
Gravel	158-172
Yellow gravel	172-197
Gravel	197-215
Yellow clay	215-222
Gravel	222-237
Clay	237-248
Gravel	248-255
Clay	255-260
Cg	260-301
Yellow clay	301-307
Water/gravel	307-415
Yellow clay	415-418
Water/gravel	418-502
Yellow gravel	502-508
Water/gravel	508-535
Yellow clay	535-538
Sand & boulders	538-560
Yellow clay	560-566
Water/gravel & sand	566-700
Bedrock - red granite	700-702

	Depth Interval (feet)
(D-7-27) 2dbb	
Water - loam	0-14
Gravelrock	14-35
Rock & clay	35-45
Clay	45-55
Clay & gravel	55-75
Water/gravel	75-76
(water came up to within 6' of top)	
Clay	76-130
Gravel	105-112
Clay	112-142
Gravel	142-148
Clay	148-155
Gravel	155-160
Clay	160-166
Gravel	166-169
Clay	169-180
Gravel	180-187
Clay	187-193
Gravel	193-198
Clay	198-210
Gravel	210-232
Clay	232-238
Gravel	238-257
Clay	257-268
Gravel	268-276
Clay	276-282
Gravel	282-287
Clay	287-291
Gravel	291-297
Clay	297-308
Gravel	308-315
Clay	315-322
Gravel	322-327
Clay	327-334
Gravel	334-342
Clay	342-348
Gravel (flowing water)	348-356
Clay	356-364
Gravel	364-373
Clay	373-381
Gravel	381-433
(D-7-27) 2dbc	
Native top soil	0-15
Sand & gravel & water-bearing sand	15-75
Rock & gravel	75-125
Rock & gravel	125-250
(D-7-27) 11bbb	
Boulders	0-18
Clay	18-42
Sand & water	42-46
Alternate beds of sand & clay	46-110
Gravel	110-112
Alt. sand & clay	112-129
Sandy clay	129-145
Alt. sand & clay	145-302
Sandy clay	302-339
Clay	339-344
Water/gravel	344-356
Clay	356-361
Sand & gravel	361-398
Alt. sand & clay	398-420
Coarse sand	420-435

	Depth Interval (feet)
(D-8-26) 01aab	
Sandstone	0-2
Red clay	2-10
Sand & SS hard	10-53
Sand & water	53-60
Clay	60-68
Sand & water	68-72
Red clay	72-80
Sand & water	80-93
Sand & sm gravel	93-105
River rock & water	105-115
Sand & water	115-135
Blue clay	135-145
- - - - - - - - - - - -	
Perforations	105-145
Gravel	100-145
Grouted	1-100
(D-8-26) 5bbc	
Top soil	0-26
Brown clay & SS	26-29
Clay & sand	29-37
Brown clay	37-87
Clay & sand	87-91
Brown clay	91-103
Gravel	103-119
Brown clay	119-130
Gravel	130-145
Brown clay	145-148
Blue clay	148-204
(D-8-26) 5ccd	
Fill	0-30
Brown clay	30-47
Water/sand	47-48
Red clay	48-65
Brown clay	65-70
Dark brown clay	70-82
Light brown clay	82-88
Red clay	88-95
Water/gravel	95-106
(D-8-26) 6abc	
Sandy loam	0-36
Sand	36-39
Sandy clay alt. w/ water/gravel in about 5' beds	39-206
Clay	206-210
Sand	210-214
Sandy clay	214-220
Clay	220-224
Sandy clay	224-234
Hard sand	234-235
Water sand & gravel	235-237
(D-8-26) 6cbc	
Flowing 10 gpm	3-60
Flowing	7-60
Flowing - very small amount	11-60
Water @ 95'; 256'; 403'; 455'; 500'; 525'; 624' & 642'	
- - - - - - - - - - - -	
Sandy silt	0-10
Silty sand w/interbedded thin siltstone	10-19
Interbedded siltstone & sands	19-29

	Depth Interval (feet)
(D-8-26) 6cbc - continued	
Siltstone w/interb. silty sands	29-42
Siltstone w/interb. silty sands	42-52
Interbed siltstone w/ sand. Siltstone predominate	52-85
Interbed sand & siltstn.	85-96
Limey sand	96-107
Limey silty sand	107-117
Limey sandy silt	117-128
Limey siltstone	128-139
Limey siltstone, somewhat sandy	139-172
Limey siltstone w/ interbed gypsum	172-218
Limey siltstone, some dissem. sand	218-229
Interbed siltstone & sand. Limey	229-239
Interbed sands & limey siltstone	239-250
Limey fine sand occas. grading to silt	250-261
Limey silt & fine sand	261-271
Limey siltstone (gypsiferous?)	271-282
Limey siltstone	282-349
Sand w/interbed siltstone	349-383
Sand	383-414
Siltstone w/interbed sands	414-447
Siltstone	447-458
Sand w/interbed siltstone	458-469
Sand	469-491
Siltstone w/interbed sands	491-523
Sand w/interbed siltstone	523-545
Siltstone w/interbed sand	545-589
Interbed sand & silt	589-651

(D-8-26) 6ccb

Sandstone & clay	0-115
Blue white clay & siltstone, red clay & siltstone	115-256
started flowing	624-655

(D-8-26) 7acc

Top sandy soil	0-20
Sand-water (sealed off)	20-28
Brown clay	28-42
Blue sand - blue clay	42-48
Blue clay - all water sealed off to this depth	48-85
Blue clay	85-145
Blue sand - gravel water	145-148
Blue clay	148-160
Blue sand	160-162
Blue clay	162-197
Blue sand	197-198
Brown clay	198-200

(D-8-26) 7adc

Siltstone-clay streaks	0-82
Clay	82-217
Water at all depth measurements	217-314
Vary between 6" to 4'	314-337
Water in honeycomb formation	485-530
U.S.G.S. well depth	545'

(D-8-26) $7adc_2$

Sandstone, clay	0-80
Water	80-82
Blue s.s. clay	82-187
Water	187-190
Hardpan, clay	190-314
Water	314-316
Clay	316-385
Hardpan	385-389
Water	389-394
Brown clay, hardpan	394-647
Water	647-660
Brown clay	660-668

(D-8-26) 7bbb

Clay	0-20
Clay & sand	20-60
Clay, sand & gravel	60-80
Blue clay	80-270
Clay, sand	270-310

(D-8-26) 7bcc

Sandstone, clay	135
Water at all depths	228-271
Measurements vary from 8" to 12'	290-430

(D-8-26) $7bcc_2$

Fill	0-16
Sand & water	16-40
Blue clay	40-47
Red clay	47-81
Sand water seep	81-92
Blue clay	92-109
Sand water seep	109-110
Blue clay	110-127
Sand water	127-128½
Blue clay	128½-132

(D-8-26) 7bda

SS & clay	0-130
Water	130-132
Clay, SS streaks	132-265
Water	265-269
Blue clay	269-356
Water	356-357
Clay	357-642
Clay, hard pans	642-760
Water	760-764
Clay, hard pans	764-1010
Water btwn hard pans	1010-1032
Hard pans, clay	1032-1150
Water	1150-1160
Clay	1160-1265
Water Honeycomb fm	1265-1310

(D-8-26) $7bdb_2$

SS Clay	0-130
Water	130-132
Clay SS	132-265
Water	265-269
Blue clay	269-356
Water	356-357
Clay	357-642
Clay Hard Pans	642-760
Water	760-764
Clay Hard Pans	764-1010
Water Hard Pans	1010-1032
Hard Pans Clay	1032-1150
Water	1150-1160
Clay	1160-1265
Water	1265-1310
Clay Hard Pans	1310-1500
Water	1500-1518

(D-8-26) 7ccc

Rocks, gravel, blue & red clay	478-508

NOTE: This is artesian water but high land. Water stands within 40' of surface. Honey comb formation.

(D-8-26) 7dda

Mostly clay & silt. Swamp & lake deposits except first 3 samples (19-59'). Grayish - blue green clay & silt or mud dominate samples. Some have fair amount of sand & small gravel. Samples 13, 14, 15 (208-253') have red coloring which indicated a drying out period. The red is due to oxidation. Organic material present from samples 17-32 (269-544'). At 1276' change in material. Lighter color. Caliche. Coarse sand grains may be deformed gravel.

(D-8-26) $7ddb_2$

Water at all depth measurements	123-137
Formation SS & clay	174-180

(D-8-26) $8adc_1$

Samples to Bur. of Mines

(D-8-26) $8adc_2$

Samples to Bur. of Mines

(D-8-26) 8bdc

Sand & sml gravel	19-166
Some fine sand, silt, clay (mud)	166-392
Silt gravel	392-557
Silt & clay (mud) grey-green	557-1098
Mostly silt & clay	1098-1399

	Depth Interval (feet)

(D-8-26) 8cdd

Sandstone, clay, rocks	0-301
Water	301-303
SS (clay streaks)	303-365
Water (honeycomb)	365-415
Clay	415-418

(D-8-26) 16bca

Surface soil	0-60
Sandstone	60-70
Clay	70-250
Clay & sandstone	250-300
Sand & sandstone	300-340
Water	340'
Clay & sandstone	340-460

(D-8-26) 16ccd

Sand, rock & clay	75-85
Clay & sandstone	110-112
Honeycomb	280-295
Honeycomb flowing	400-410
Sand & clay	525-535
Clay	549-551
Clay	551-564

(D-8-26) 17abb

Red SS	0-33

"Water stood @ 9' at 33'"

Red SS	33-190
Blue shale	190-790

"Water at 262'; 323'; 390'; 410'; 520'; 574'; 631'; 675'; 734'; 747';"

Some water	756-788
Water good	790'
Honeycomb, lots water	790-842
Layer sand 675'; 734'; 747'	
Choc. sandy clay	842-1412
Blue shale	1412-1449

"Water @ 1449' honeycomb (salt wtr.)"
"Water at 1064'; 1140'; 1164'; 1216'; 1260'; & 1337'"

(D-8-26) 17bbc

Sand & clay	0-25
Gravel - 1st water	-27
Clay	27-260
Alt. sand & clay	260-460
Clay, sand & gravel	460-475
Sand & gravel	475-490
Hard sand & gravel	490-520
CG, hard	520-565
Grey clay	565-575
Sand & gravel	575-580
Clay	580-610

(D-8-26) 18add

Sandstone & clay	1250-1525

(D-8-26) 19dcc$_2$

Boulders	0-16
Brown sandy shale	16-90
Brown sandy clay	90-122
Brown sandy shale	122-130
Sand, trace of water	130-134
Brown sandy clay	134-203
Brown sand, source of water	203-210
Brown clay	210-233
Sand & gravel	233-238
Brown shale & sand	238-250

(D-8-26) 21cdc

Fill or overburden	0-51
Red clay	51-97
Dry sand	97-101
Grey clay	101-137
Red clay	137-154
Grey-green clay	154-173
Water sand (very little water)	173'
Red clay	173-189
Water gravel	189-192
Red brown clay	192-209
Water gravel	209-213
Brown clay	213-241
Water gravel	241-244
Red clay	244-250

(D-8-26) 28bdd

Soil & rocks to 50'	
Clay to 365'. Water in honeycomb formation	365-390

(D-8-26) 28dbb

Decomposed granite fill	0-4
Fill & boulders	4-12
Granite boulder & clay	12-18
Sandstone	18-22
Yellow clay	22-27
Brown squeezing clay	27-35
Red clay	35-51
Grey sandstone some water 5 gpm	51-64
Benonite clay	64-72
Red clay	72-76
River salt	76-81
Blue clay	81-84
Green benonite clay	84-95
Brown clay	95-99
Red clay	99-101
Brown clay	101-113
Joint clay	113-118
Brown clay	118-124
Grey sandstone	124-131
Brown clay	131-145
Benonite clay green	145-152
Brown sandy clay	152-157
Brown benonite clay	157-161
Sandstone	161-165
Brown clay	165-169
Sticky olive green clay w/small gravel & rock	169-187
Grey sticky clay	187-201
Benonite clay green	201-205
Grey sticky clay	205-260
Green benonite	260-268
Grey sticky clay	268-315
Grey clay w/very fine sand	315-335
Grey sticky clay	335-350
Grey clay w/very fine sand	350-361
Grey clay	361-430
Blue SS	430-435
Blue sand, very fine Water	435-441

Water raised to 100' of surface.

(D-8-26) 29bbd

Sandy soil	0-95
Sand & water	95-96
Sandy clay	96-140
Sand & water	140-141
Sandy clay	141-182
Sand & water	182-184
Sandy clay	184-236
Sand & water	236-238
Sandy clay	238-284
Water & sand	284-288

(D-8-28) 29dbd

Soil & clay	0-8
Sand & clay	8-17
Gravel & clay	17-31
Brown clay	31-60
Blue clay	60-71
Brown clay	71-92
Blue clay	92-99
Brown clay	99-107
Brown & blue clay mixed layers	107-275
Sandstone	275-276
Sand & brown clay	276-302
Sandstone water level 213'	302-303
Sand & clay	303-314
Sandstone water level 128'	314-315
Sand & clay	315-331
Sandstone water level 75'	331-332
Sand & clay	332-338
Gravel water level 38'	338-341
Sand & clay	341-369
Gravel water level 18'	369-370
Sand & clay	370-386
Sand & gravel water level 9'	386-389
Sand & clay	389-395
Sand & gravel water level 5'	395-397
Brown clay	397-407
Red clay & gravel	407-600

(D-8-26) 30 aca

Sand & rock	0-23
Sandy clay	23-56
Brown clay	56-60
Blue sandy clay	60-104
Green sandy clay	104-120
Brown sandy clay	120-140
Brown clay	140-151
Brown sandy clay	151-162
Brown clay	162-164
Sand & water	164-166
Blue clay	166-173
Sandstone	173-220
Coarse sand & water	220-223
Brown clay	223-225
Brown sandy clay	225-230
Fine sand & water	230-243
Brown clay	243-248

(D-8-26) 30baa

Big boulders	0-11
Sandy clay (few bldrs)	11-20
Boulders	20-22
Sand & clay	22-30
Gravel	30-32
Big boulders	32-34
Sand, grvl & clay	34-45
Sandy clay	45-60
Clay w/sand & grvl	60-77
Sand, grvl & clay	77-80

	Depth Interval (feet)
(D-8-26) 30baa - continued	
Sandy clay & blue clay	80-85
Brown or grey clay & blue clay	85-95
Blue clay & sandy clay	95-111
Sandy clay & small streaks of sand	111-126
Brown sandy clay	126-162
Sand, brown clay w/ sand & gravel	162-164
Sand, gravel & clay	164-168
Sandy clay	168-170
Sand, gravel & clay streaks	170-172
Sand & clay broken	172-186
Sand & clay broken; some gravel	186-211
Sand, gravel & clay	211-228
Sandy clay & sand streaks	228-238
Sandy clay	238-246
Sandy clay streaks	246-248
Sandy clay	248-256
Big gravel, sand & clay streaks	256-259
Sandy clay	259-263
Sandy clay w/sand & small gravel	263-278
Sand & gravel	278-280
Small streaks sand & gravel	280-293
Sand gravel w/few sm. clay streaks	293-300
Sandy clay w/sand streaks	300-306
Sand streaks w/clay & few gravel streaks	306-321
Sand & clay broken	321-339
Clay	339-340
Sand & gravel	340-357
Sand & clay	357-362
Sand & gravel	362-387
Sandy clay & sand	387-397

(D-8-26) 30bdb

Granite boulders	0-30
Sand w/water	425-450
Most of water supply	650-670

"From start to finish very little to no clay. Granite sandstone the entire way."

(D-8-26) 30bdd

Granite fill & "boulders"	0-20
Granite fill	20-172
Sandstone - water	172-202
Red sandstone - water	202-245
Granite fill	245-300

(D-8-26) 30ddd

Sandy soil	0-95
Sand & water	95-96
Sandy clay	96-140
Sand & water	140-141
Sandy clay	141-182
Water & sand	182-184
Sandy clay	184-236
Sand & water	236-238
Sandy clay	238-284
Water & sand	284-288

(D-8-26) 31abd

Top soil	0-35
Sand & clay strips	35-90
Small amt. water 90'	
Sand & clay strips	90-140
Red clay	140-250
Sand w/water	250-257
Clay	257-290
Sand w/water	290-293
Clay	293-404
Sand w/water	404-450

(D-8-26) 31ddc

Sand	0-17
Sandstone	17-26
Sandy clay	26-29
Sandstone	29-36
Sandy clay	36-66
Water sand	66-68
Sandy clay	68-84
Red clay	84-108
Water gravel	108-110
Clay	110-115
Sandy clay	115-123
Sand & clay alternating beds in 1'sand;8'clay	123-161
Sandy clay	161-175
Clay	175-209
Water sand	209-211
Clay	211-241
Hard sandy clay	241-250

(D-9-26) 5acd

Fill	0-25
Brown clay	25-90
Seep	90
Brown clay	90-185
Water gravel	185-186
Red clay	186-232
Water gravel	232-234
Brown clay	234-250

(D-9-26) 6bda

Sand & clay	0-50
Sand & gravel (1st water)	50-51
Sand, clay	51-108
Gravel, water	108-110
Sand, gravel clay	110-120
Sand, gravel, rock (caving)	120-127
Conglomerate	127-140
Sand	140-143
Conglomerate	143-166
Sandy clay	166-175
Sand, gravel	175-180
Sandy clay	180-200

(D-9-27) 36bc

Hardpan	0-32
Gravel	32-38
Yellow clay	38-90
Sand & gravel	90-124
Yellow clay	124-132
Gravel	132-144
Blue clay	144-240
Blue clay & sand	240-254
Gravel & sand	254-260
Blue clay	260-284
Sand	284-288
Yellow clay	288-322
Blue clay	326-396
Sandstone	396-400
Blue clay	400-592
Gypsum & clay	592-735
Gypsum	735-765

(D-9-27) 36cdb

Greyish brown sand; some gravel, mudstone	280-450
Greenish gray sand; some gravel, some calcite, ankyd & gypsum	460-950
Grey sand; some gravel; some halite, ankyd & calcite	960-1630
White sand; some gravel, ankyd & calcite	1640-1790
Grey sand; some gravel, ankyd, calcite	1800-3390
Brown sand; some gravel, ankydrite, calcite	3400-3480

APPENDIX B

Water Chemistry

CHEMISTRY REPORTED IN PARTS PER MILLION (PPM) EXCEPT FOR ALKALINITY. ALKALINITY IN MILLEQUIVALLENTS.

SAMPLE	NA	K	CA	MG	CL	SO4	HCO3	CO3	SIO2	B	LI	AL	F	ALKALINITY
001W83	475.00	3.60	26.80	0.15	490.00	346.00	35.56	4.65	21.00	0.80	1.30	0.01	15.00	0.66
002W83	437.00	3.10	25.00	0.16	405.00	370.00	32.76	6.55	21.00	0.75	1.40	0.00	14.40	0.65
003W83	427.00	3.50	6.00	0.21	407.00	270.00	78.13	11.20	21.00	0.80	1.00	0.01	14.40	1.47
004W83	325.00	2.50	8.50	0.13	285.00	205.00	53.08	6.55	21.00	0.56	0.75	0.01	15.20	0.98
005W83	1000.00	9.50	62.00	3.20	1140.00	625.00	38.19	4.65	17.00	1.40	2.20	0.01	9.30	0.70
006W83	660.00	5.90	5.40	1.60	640.00	360.00	189.72	10.68	13.00	1.60	0.80	0.01	9.50	3.20
007W83	780.00	5.50	15.00	1.50	740.00	570.00	115.44	12.23	19.00	1.70	1.50	0.01	11.60	2.10
008W83	600.00	5.20	27.80	1.00	609.00	430.00	44.32	4.65	18.00	1.00	1.50	0.02	14.40	0.80
009W83	443.00	3.40	5.00	0.18	400.00	310.00	20.32	9.30	20.00	0.80	1.00	0.10	14.60	0.49
010W83	435.00	3.90	15.00	0.31	430.00	310.00	40.12	4.65	16.00	0.80	1.30	0.01	14.20	0.74
011W83	605.00	5.10	28.00	0.55	640.00	410.00	39.07	3.79	16.00	0.95	1.50	0.01	13.00	0.70
012W83	850.00	7.40	65.00	0.96	980.00	540.00	28.91	4.31	19.00	1.10	2.00	0.01	10.00	0.55
013W83	620.00	3.90	2.60	0.55	520.00	380.00	263.65	17.23	16.00	2.30	0.70	0.00	11.60	4.61
014W83	490.00	5.70	17.00	0.59	505.00	275.00	99.85	2.58	23.00	0.60	1.20	0.02	15.20	1.68
015W83	500.00	4.00	3.10	0.48	455.00	300.00	142.60	15.16	12.00	1.20	0.90	0.01	11.00	2.59
016W83	305.00	3.30	3.40	0.28	225.00	100.00	86.54	12.23	45.00	0.20	0.25	0.00	7.00	1.62
017W83	290.00	4.20	5.00	0.72	224.00	95.00	258.92	9.30	46.00	0.25	0.25	0.00	7.40	4.40
018W83	375.00	4.90	3.90	0.28	225.00	240.00	254.02	10.16	62.00	0.50	0.32	0.00	10.80	4.33
019W83	365.00	5.00	2.90	0.10	204.00	275.00	234.75	14.82	65.00	0.50	0.33	0.00	11.40	4.09
020W83	365.00	5.40	3.20	0.10	217.00	270.00	241.58	9.30	65.00	0.45	0.35	0.00	11.80	4.11
021W83	822.00	8.80	67.00	0.52	956.00	525.00	22.07	2.76	22.00	0.95	1.70	0.02	9.20	0.41
022W83	8.30	1.90	10.00	2.40	1.80	21.00	30.13	0.00	17.00	0.02	0.01	0.04	1.90	0.49
023W83	340.00	2.10	6.90	0.05	268.00	235.00	44.50	3.79	20.00	0.56	0.90	0.00	16.20	0.79
024W83	410.00	2.90	19.80	0.19	443.00	250.00	79.01	5.51	18.00	0.45	0.90	0.00	11.60	1.39
025W83	370.00	6.40	19.00	0.26	368.00	270.00	40.99	3.62	24.00	0.55	1.00	0.01	11.40	0.73
026W83	425.00	5.30	28.00	0.23	474.00	290.00	26.98	3.79	22.00	0.50	1.20	0.01	8.80	0.51
027W83	445.00	5.00	22.00	0.20	425.00	350.00	39.07	5.51	26.00	0.75	1.30	0.01	13.40	0.73
028W83	260.00	5.00	6.60	1.50	182.00	100.00	172.03	5.51	17.00	0.65	0.27	0.02	8.50	2.91
029W83	255.00	5.20	6.80	1.20	177.00	167.00	158.02	1.00	18.00	0.44	0.26	0.00	8.80	2.59
030W83	275.00	3.30	3.80	0.12	225.00	140.00	119.47	7.41	26.00	0.50	0.50	0.02	19.60	2.08
031W83	303.00	3.90	4.10	0.14	262.00	130.00	133.00	13.78	22.00	0.60	0.60	0.02	19.20	2.42
032W83	965.00	10.20	54.00	6.40	1016.00	775.00	52.73	3.79	21.00	1.60	0.31	0.01	12.80	0.93
033W83	341.00	7.00	6.80	3.20	227.00	223.00	246.66	9.30	18.00	1.10	0.43	0.00	4.90	4.20
034W83	200.00	5.70	13.00	4.90	128.00	160.00	157.66	4.65	24.00	0.50	0.23	0.00	6.60	2.66
035W83	765.00	8.20	35.00	0.46	864.00	425.00	38.37	2.76	22.00	1.00	1.50	0.01	10.20	0.68
036W83	1015.00	10.70	32.00	4.20	1076.00	675.00	121.40	8.44	20.00	2.00	1.60	0.01	11.20	2.13
037W83	327.00	7.10	3.80	0.64	196.00	165.00	265.93	17.57	75.00	0.50	0.00	0.00	12.40	4.65
038W83	591.00	7.20	18.00	0.40	648.00	280.00	77.08	3.79	22.00	0.90	1.10	0.02	13.20	1.33
039W83	2650.00	20.00	90.00	29.50	3080.00	1650.00	248.23	0.00	17.00	10.00	2.60	0.00	1.70	4.07
040W83	780.00	4.90	64.00	0.53	938.00	500.00	22.77	3.79	23.00	0.95	1.70	0.01	9.40	0.44
041W83	1060.00	18.80	33.00	4.50	1218.00	550.00	185.87	1.89	73.00	1.30	1.30	0.00	7.30	3.08
042W83	2600.00	19.20	119.00	7.20	3611.00	750.00	77.61	1.00	65.00	1.60	1.70	0.00	6.20	1.27

CHEMISTRY REPORTED IN PARTS PER MILLION (PPM) EXCEPT FOR ALKALINITY. ALKALINITY IN MILLEQUIVALLENTS.

SAMPLE	NA	K	CA	MG	CL	SO4	HCO3	CO3	SIO2	B	LI	AL	F	ALKALINITY
CF1	605.00	3.10	19.00	0.60	655.00	392.00	42.00	0.00	20.00	0.60	1.70	0.00	11.00	0.69
CF2	881.00	7.70	50.00	0.90	941.00	535.00	32.00	0.00	17.60	0.00	0.00	0.00	0.00	0.52
CF3	783.00	5.50	65.00	1.10	1024.00	497.00	31.00	3.60	28.00	1.18	2.40	0.00	0.00	0.56
CF4	810.00	5.30	26.00	0.80	965.00	542.00	31.00	0.00	20.00	0.30	2.10	0.00	7.80	0.50
CF5	644.00	2.70	1.00	0.50	538.00	330.00	223.00	0.00	17.00	2.50	0.80	0.00	8.60	3.70
CF6	1054.00	6.60	69.00	2.60	447.00	605.00	48.00	0.00	20.00	1.30	0.00	0.00	9.00	0.79
CF7	384.00	2.30	18.00	0.20	418.00	294.00	40.00	13.00	31.70	0.80	0.00	0.00	11.70	0.89
CF8	474.00	2.60	2.00	0.50	483.00	309.00	129.00	0.00	15.00	0.60	1.00	0.00	8.30	2.10
CF9	379.00	2.30	7.20	0.20	399.00	247.00	65.00	17.00	28.00	0.94	0.00	0.00	14.00	1.30
CF10	306.00	1.60	9.20	0.10	294.00	195.00	49.00	11.00	29.00	0.60	0.00	0.00	14.60	0.98
CF11	444.00	3.00	9.00	0.40	457.00	313.00	42.00	0.00	18.00	0.70	1.30	0.00	10.20	0.69
CF12	678.00	3.90	22.00	0.50	818.00	369.00	40.00	2.40	28.00	1.04	0.00	0.00	9.60	0.70
CF13	524.00	3.90	21.00	0.40	204.00	282.00	83.00	0.00	24.00	0.90	0.00	0.00	13.60	1.36
CF14	470.00	3.50	15.00	0.20	503.00	335.00	33.00	0.00	18.50	0.00	0.00	0.00	0.00	0.54
CF15	449.00	2.40	15.00	0.20	505.00	300.00	38.00	0.00	22.00	0.10	1.30	0.00	12.50	0.62
CF16	448.00	2.20	13.00	0.20	424.00	325.00	40.00	0.00	22.00	0.10	1.50	0.00	12.00	0.65
CF17	539.00	2.80	22.00	0.20	580.00	377.00	38.00	0.00	23.00	0.30	1.60	0.00	11.50	0.62
CF18	1152.00	10.60	31.00	4.30	1066.00	607.00	90.00	0.00	14.10	0.00	0.00	0.00	0.00	1.50
CF19	1025.00	6.20	42.10	5.70	1125.00	585.00	117.00	0.00	22.00	1.78	2.32	0.00	9.45	1.90
CF20	3283.00	14.10	67.90	20.70	4097.00	1688.00	165.00	0.00	30.00	8.40	5.16	0.00	1.20	2.70
CF21	443.00	6.20	37.70	11.40	365.00	410.00	172.00	0.00	20.00	2.06	0.93	0.00	5.40	2.80
CF22	23.00	2.20	7.00	4.10	19.00	6.00	116.00	0.00	47.00	0.20	0.10	0.00	1.20	1.90
CF23	48.00	3.10	14.00	2.70	108.00	58.00	104.00	0.00	36.00	0.50	0.30	0.00	1.00	1.70
CF24	60.00	2.80	10.00	2.00	201.00	95.00	96.00	0.00	34.00	0.00	0.50	0.00	1.00	1.60
CF25	50.00	0.00	30.00	7.00	30.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00
CF26	21.00	2.10	8.00	3.90	16.00	5.00	132.00	0.00	50.00	0.40	0.10	0.00	1.10	2.20
CF27	498.00	4.30	16.00	0.70	197.00	267.00	99.00	0.00	26.00	0.55	1.38	0.00	14.20	1.60
CF28	579.00	5.80	17.00	0.60	510.00	290.00	79.00	0.00	18.40	0.00	0.00	0.00	11.07	1.30
CF29	304.00	1.20	7.20	0.10	260.00	203.00	86.00	9.00	28.00	0.84	0.00	0.00	14.50	1.60
CF30	328.00	0.00	4.00	1.00	196.00	240.00	212.00	0.00	0.00	0.00	0.00	0.00	10.00	3.50
CF31	168.00	0.00	48.00	2.50	144.00	203.00	156.00	0.00	0.00	0.00	0.00	0.00	6.20	2.60
CF32	127.00	0.00	23.00	6.00	132.00	100.00	144.00	0.00	0.00	0.00	0.00	0.00	4.80	2.40
CF33	0.00	0.00	9.50	3.90	101.00	88.00	164.00	0.00	0.00	0.00	0.00	0.00	10.00	2.70
CF34	161.00	1.60	3.40	0.60	111.00	265.00	113.00	0.00	28.00	5.10	0.30	0.00	9.80	1.90
CF35	171.00	4.30	75.00	2.80	82.00	345.00	110.00	0.00	33.00	4.80	0.30	0.00	5.20	1.80
CF36	61.00	3.60	13.00	1.80	156.00	120.00	118.00	0.00	26.00	0.70	0.30	0.00	0.50	1.90
CF37	162.00	1.20	4.60	0.10	109.00	106.00	137.00	10.00	28.00	0.28	0.00	0.00	10.40	2.40
CF38	249.00	2.30	17.20	1.00	151.00	172.00	218.00	0.00	29.00	0.30	0.00	0.00	14.60	3.60

CHEMISTRY REPORTED IN PARTS PER MILLION (PPM) EXCEPT FOR ALKALINITY. ALKALINITY IN MILLEQUIVALLENTS.

SAMPLE	NA	K	CA	MG	CL	SO4	HCO3	CO3	SIO2	B	LI	AL	F	ALKALINITY
BV1	327.00	0.00	118.00	37.20	410.00	200.00	415.00	0.00	0.00	0.00	0.00	0.00	2.45	6.80
BV2	237.00	0.00	3.60	0.50	228.00	120.00	200.00	12.00	0.00	0.00	0.00	0.00	7.00	3.50
BV3	284.00	2.90	1.00	0.40	232.00	120.00	202.00	0.00	52.00	0.30	0.30	0.00	6.90	3.30
BV4	320.00	0.00	5.60	0.50	246.00	105.00	254.00	0.00	0.00	0.00	0.00	0.00	3.00	4.20
BV5	290.00	0.00	4.40	1.00	244.00	110.00	210.00	0.00	0.00	0.00	0.00	0.00	4.70	3.40
BV6	193.00	0.00	100.00	21.00	372.00	80.00	210.00	0.00	0.00	0.00	0.00	0.00	1.30	3.40
BV7	167.00	0.00	70.00	18.00	252.00	70.00	237.00	0.00	0.00	0.00	0.00	0.00	1.30	3.90
BV8	359.00	0.00	6.20	1.30	250.00	250.00	256.00	9.60	0.00	0.00	0.00	0.00	7.30	4.40
BV9	260.00	0.00	4.00	0.40	232.00	80.00	234.00	9.60	0.00	0.00	0.00	0.00	2.90	4.00
BV10	285.00	0.00	1.40	1.50	195.00	120.00	244.00	12.00	0.00	0.00	0.00	0.00	4.90	4.20
BV11	264.00	0.00	4.00	0.20	216.00	75.00	200.00	14.40	0.00	0.00	0.00	0.00	2.90	3.50
BV12	283.00	0.00	5.20	0.50	200.00	90.00	2.20	14.40	0.00	0.00	0.00	0.00	4.30	0.28
BV13	241.00	0.00	6.20	0.70	194.00	120.00	239.00	8.40	0.00	0.00	0.00	0.00	7.00	4.00
BV14	52.00	4.50	19.60	2.60	189.00	24.00	122.00	0.00	28.00	0.00	0.20	0.00	4.80	2.00
BV15	358.00	3.90	6.20	1.00	168.00	227.00	250.00	8.40	67.00	0.46	0.00	0.00	10.20	4.20
BV16	256.00	0.00	80.00	16.40	342.00	130.00	264.00	0.00	0.00	0.00	0.00	0.00	2.10	4.30
BV17	360.00	3.50	1.00	0.40	249.00	265.00	195.00	0.00	61.00	0.00	0.40	0.00	8.60	3.20
BV18	61.00	0.80	12.40	0.40	210.00	111.00	134.00	0.00	27.00	0.00	0.00	0.00	7.00	2.20
BV19	360.00	4.30	4.30	0.90	240.00	250.00	255.00	0.00	65.00	0.50	0.00	0.00	14.00	4.20
BV20	321.00	3.80	0.60	0.20	195.00	180.00	186.00	0.00	63.00	0.00	0.40	0.00	13.00	3.00
BV21	369.00	0.00	9.50	6.60	230.00	275.00	259.00	0.00	0.00	0.00	0.00	0.00	11.00	4.20
BV22	217.00	0.00	101.00	22.90	246.00	120.00	337.00	0.00	0.00	0.00	0.00	0.00	1.80	5.50
BV23	209.00	0.00	103.00	22.40	248.00	110.00	303.00	0.00	0.00	0.00	0.00	0.00	1.60	5.00
BV24	368.00	4.70	7.00	2.00	256.00	270.00	239.00	0.00	65.00	0.46	0.20	0.00	9.00	3.90
BV25	205.00	0.00	109.00	28.50	344.00	190.00	366.00	0.00	0.00	0.00	0.00	0.00	2.10	6.00
BV26	280.00	0.00	124.00	29.20	370.00	200.00	366.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
BV27	235.00	0.00	114.00	27.40	332.00	160.00	356.00	0.00	0.00	0.00	0.00	0.00	0.00	5.80
BV28	163.00	0.00	69.00	15.00	218.00	70.00	244.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
BV29	365.00	0.00	16.80	3.70	256.00	230.00	215.00	7.20	0.00	0.00	0.00	0.00	0.00	3.60
BV30	331.00	4.30	7.40	1.30	203.00	296.00	233.00	13.20	67.00	0.43	0.36	0.00	0.00	4.00
BV31	365.00	0.00	4.40	0.97	220.00	150.00	223.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70
BV32	60.00	1.00	4.50	0.10	201.00	190.00	124.00	0.00	31.00	0.00	0.10	0.00	4.10	2.00
BV33	333.00	3.90	1.00	0.10	212.00	272.00	205.00	0.00	62.00	0.00	0.40	0.00	16.20	3.40
BV34	215.00	0.00	92.00	23.00	350.00	240.00	427.00	0.00	0.00	0.00	0.00	0.00	2.80	7.00
BV35	192.00	0.00	129.00	29.00	236.00	170.00	386.00	0.00	0.00	0.00	0.00	0.00	1.80	6.30
BV36	283.00	0.00	120.00	25.30	246.00	170.00	395.00	0.00	0.00	0.00	0.00	0.00	2.00	6.50
BV37	315.00	0.00	68.80	16.50	320.00	250.00	390.00	0.00	0.00	0.00	0.00	0.00	3.40	6.40
BV38	2900.00	12.00	120.00	8.70	4100.00	0.00	78.00	0.00	53.00	1.50	0.00	0.00	6.80	1.30
BV39	410.00	3.00	6.80	0.34	300.00	110.00	251.00	0.00	55.00	0.00	0.00	0.00	11.00	4.10

APPENDIX C

Geochemistry of Water Samples

TITLE 00[illegible]3 LOCATION 0-08-26-070DBA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6687E-03	MGTOT	0.6200E-05	NATOT	0.2066E-01	KTOT	0.9210E-04	CLTOT	0.1382E-01	ALK	0.6600E-03
SO4TOT	0.3602E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1873E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3494E-03	BTOT	0.7400E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.46 PE = 99.99 TEMP = 38.60DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.88 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02538 TOTAL DISS SOLIDS = 1.41GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5880E-03
ION BALANCE ERROR = 1.41PERCENT CATION EXCESS = 0.6070E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9993

INDIVIDUAL SPECIES MOLALITIES

OH-	0.9095E-05	CO3--	0.1472E-04	HCO3-	0.5519E-03	SO4--	0.3277E-02	CL-	0.1384E-01	CA++	0.5420E-03
CAOH+	0.7314E-07	CACO3O	0.4951E-05	CAHCO3	0.2576E-05	CASO4O	0.1200E-03	MG++	0.5184E-05	MGOH++	0.4953E-08
MGCO3O	0.2738E-07	MGHCO3	0.2055E-07	MGSO4O	0.9723E-06	NA+	0.2047E-01	NACO3-	0.5895E-05	NAHCO3	0.4662E-05
NASO4-	0.2064E-03	NACLO	0.5137E-05	K+	0.9080E-04	KSO4-	0.1409E-05	KCLO	0.2353E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1861E-03	LIOHO	0.2798E-08	LISO4-	0.1455E-05
H4SIO4	0.3253E-03	H3SIO4	0.2459E-04	H2SIO4	0.9732E-07	AL+++	0.6581E-19	ALOH++	0.3304E-15	ALOH2+	0.2433E-11
ALOH4-	0.3720E-06	ALSO4+	0.7954E-19	ALSO42	0.1191E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3949E-08	H2SO4O	0.4444E-20	HSO4-	0.1030E-08
HCLO	0.1271E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.5896E-04
H2BO3-	0.1514E-04	H2CO3*	0.3260E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.11	CO3--	5.09	HCO3-	3.32	SO4--	2.75	CL-	1.93	CA++	3.53	CAOH+	7.20
CACO3O	5.30	CAHCO3	5.65	CASO4O	3.92	MG++	5.54	MGOH+	8.37	MGCO3O	7.56	MGHCO3	7.76
MGSO4O	6.01	NA+	1.76	NACO3-	5.29	NAHCO3	5.33	NASO4-	3.75	NACLO	5.29	K+	4.11
KSO4-	5.92	KCLO	7.63	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.79
LIOHO	8.55	LISO4-	5.90	H4SIO4	3.49	H3SIO4	4.68	H2SIO4	7.27	AL+++	19.69	ALOH++	15.74
ALOH2+	11.68	ALOH4-	6.50	ALSO4+	19.17	ALSO42	19.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.46	H2SO4O	20.35	HSO4-	9.05	HCLO	15.89	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.23	H2BO3-	4.90	H2CO3	5.48	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.48	ALBITE	-1.53	ANHYDRIT	-1.61	ANORTHIT	-4.72	ARAGONIT	-0.31	BARITE	-99.99	BOEHMITE	-2.00
BRUCITE	-4.38	CALCITE	-0.04	CA-MONT	-2.31	CELESTIT	-99.99	CHALCEDN	-0.11	CHLORITE	-3.17	DOLOMITE	-1.96
GIBBSITE	-2.72	GEOTHITE	-99.99	GKIEGITE	-99.99	GYPSUM	-1.65	HALITE	-5.30	HALLOYST	-5.49	HEMATITE	-99.99
HUNTITE	-9.17	HYDTOMAG	-9.02	ILLITE	-2.58	KAOLINIT	-1.54	K-MICA	-4.05	MACKINAW	-99.99	MAGNESIT	-2.19
MAGNETIT	-99.99	MIRABILT	-5.76	NESQUEHO	-5.27	PHLOGOPT	-4.82	PYRITE	-99.99	PYROPHYL	-1.42	QUARTZ	0.32
SIDERITE	-99.99	STRONTNT	-99.99	TALC	-0.37	THENARDT	-6.06	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.49	QUARTZ	0.30	CHALCEDONY	-0.06	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.37

TITLE 00[illegible] LOCATION 0-08-26-07DDBC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6237E-03	MGTOT	0.6600E-05	NATOT	0.1901E-01	KTOT	0.7930E-04	CLTOT	0.1143E-01	ALK	0.6500E-03
SO4TOT	0.3852E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2018E-03
NO3TOT	0.0000E+00	SIO2TOT	0.1494E-03	BTOT	0.6938E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.61 PE = 99.99 TEMP = 34.60DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.07 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02377 TOTAL DISS SOLIDS = 1.30GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5675E-03
ION BALANCE ERROR = 1.96PERCENT CATION EXCESS = 0.7738E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.9656E-05	CO3--	0.1853E-04	HCO3-	0.5295E-03	SO4--	0.3529E-02	CL-	0.1144E-01	CA++	0.4975E-03
CAOH+	0.7094E-07	CACO3O	0.5262E-05	CAHCO3	0.2046E-05	CASO4O	0.1197E-03	MG++	0.5436E-05	MGOH++	0.5364E-08
MGCO3O	0.3531E-07	MGHCO3	0.2044E-07	MGSO4O	0.1112E-05	NA+	0.1882E-01	NACO3-	0.5768E-05	NAHCO3	0.4154E-05
NASO4-	0.2038E-03	NACLO	0.3946E-05	K+	0.7814E-04	KSO4-	0.1250E-05	KCLO	0.1693E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2003E-03	LIOHO	0.2920E-08	LISO4-	0.1721E-05
H4SIO4	0.3213E-03	H3SIO4	0.2859E-04	H2SIO4	0.1054E-06	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2785E-08	H2SO4O	0.1985E-20	HSO4-	0.7102E-09
HCLO	0.5062E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.5201E-04
H2BO3-	0.1746E-04	H2CO3*	0.2282E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.08	CO3--	4.98	HCO3-	3.34	SO4--	2.71	CL-	2.01	CA++	3.55	CAOH+	7.21
CACO3O	5.28	CAHCO3	5.75	CASO4O	3.92	MG++	5.51	MGOH+	8.33	MGCO3O	7.45	MGHCO3	7.76
MGSO4O	5.95	NA+	1.79	NACO3-	5.30	NAHCO3	5.38	NASO4-	3.75	NACLO	5.40	K+	4.17
KSO4-	5.97	KCLO	7.77	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.76
LIOHO	8.53	LISO4-	5.83	H4SIO4	3.49	H3SIO4	4.61	H2SIO4	7.23	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.61	H2SO4O	20.70	HSO4-	9.21	HCLO	16.29	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.28	H2BO3-	4.84	H2CO3	5.64	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-1.63	ANORTHIT	-99.99	ARAGONIT	-0.26	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.29	CALCITE	0.01	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.07	CHLORITE	-99.99	DOLOMITE	-1.82
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.65	HALITE	-5.40	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-8.92	HYDTOMAG	-8.75	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-2.11
MAGNETIT	-99.99	MIRABILT	-5.61	MESQUEHO	-5.18	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.37
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.27	THENARDT	-6.10	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.49	QUARTZ	0.35	CHALCEDONY	-0.02	A-CRISTOBALITE	-0.28	AMORPHOUS	-1.34

SAMPLE NUMBER 3

TITLE 83 LOCATION 0-08-26-078DAB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1497E-03	MGTOT	0.8600E-05	NATOT	0.1857E-01	KTOT	0.8950E-04	CLTOT	0.1148E-01	ALK	0.1470E-02				
SO4TOT	0.2811E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1441E-03				
NO3TOT	0.0000E+00	SIO2TOT	0.3494E-03	BTOT	0.7400E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00				

PH = 8.99 PE = 99.99 TEMP = 34.30DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.13 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02147 TOTAL DISS SOLIDS = 1.23GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1231E-02
ION BALANCE ERROR = 1.49PERCENT CATION EXCESS = 0.5536E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2252E-04	CO3--	0.8994E-04	HCO3-	0.1095E-02	SO4--	0.2636E-02	CL-	0.1149E-01	CA++	0.1199E-03
CAOH+	0.4077E-07	CACO3O	0.6392E-05	CAHCO3	0.1035E-05	CASO4O	0.2253E-04	MG++	0.7158E-05	MGOH++	0.1681E-07
MGCO3O	0.2351E-06	MGHCO3	0.5676E-07	MGSO4O	0.1143E-05	NA+	0.1840E-01	NACO3-	0.2764E-04	NAHCO3	0.8511E-05
NASO4-	0.1523E-03	NACLO	0.3930E-05	K+	0.8851E-04	KSO4-	0.1079E-05	KCLO	0.1954E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1433E-03	LIOHO	0.4898E-08	LISO4-	0.9416E-06
H4SIO4	0.2893E-03	H3SIO4	0.6050E-04	H2SIO4	0.5101E-06	AL+++	0.1267E-20	ALOH++	0.1574E-16	ALOH2+	0.3138E-12
ALOH4-	0.3720E-06	ALSO4+	0.1302E-20	ALSO42	0.1611E-21	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1156E-08	H2SO4O	0.2599E-21	HSO4-	0.2232E-09
HCLO	0.2073E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4131E-04
H2BO3-	0.3278E-04	H2CO3*	0.1985E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.71	CO3--	4.29	HCO3-	3.02	SO4--	2.82	CL-	2.00	CA++	4.16	CAOH+	7.45
CACO3O	5.19	CAHCO3	6.04	CASO4O	4.65	MG++	5.38	MGOH+	7.83	MGCO3O	6.63	MGHCO3	7.31
MGSO4O	5.94	NA+	1.80	NACO3-	4.62	NAHCO3	5.07	NASO4-	3.88	NACLO	5.40	K+	4.12
KSO4-	6.03	KCLO	7.71	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.90
LIOHO	8.31	LISO4-	6.09	H4SIO4	3.54	H3SIO4	4.28	H2SIO4	6.53	AL+++	21.37	ALOH++	17.04
ALOH2+	12.56	ALOH4-	6.49	ALSO4+	20.95	ALSO42	21.86	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.99	H2SO4O	21.58	HSO4-	9.71	HCLO	16.68	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.38	H2BO3-	4.56	H2CO3	5.70	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.33	ALBITE	-1.47	ANHYDRIT	-2.36	ANORTHIT	-5.28	ARAGONIT	-0.17	BARITE	-99.99	BOEHMITE	-2.36
BRUCITE	-3.41	CALCITE	0.09	CA-MONT	-3.08	CELESTIT	-99.99	CHALCEDN	-0.12	CHLORITE	1.20	DOLOMITE	-0.91
GIBBSITE	-3.06	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.37	HALITE	-5.40	HALLOYST	-6.21	HEMATITE	-99.99
HUNTITE	-6.37	HYDTOMAG	-5.43	ILLITE	-2.81	KAOLINIT	-2.21	K-MICA	-4.59	MACKINAW	-99.99	MAGNESIT	-1.29
MAGNETIT	-99.99	MIRABILT	-5.73	NESQUEHO	-4.36	PHLOGOPT	-2.10	PYRITE	-99.99	PYROPHYL	-2.68	QUARTZ	0.33
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.73	THENARDT	-6.23	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.54	QUARTZ	0.31	CHALCEDONY	-0.07	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.38

SAMPLE NUMBER 4

TITLE [illegible]3 LOCATION D-08-26-07BBCD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.2121E-03	MGTOT	0.5300E-05	NATOT	0.1414E-01	KTOT	0.6390E-04	CLTOT	0.8040E-02	ALK	0.9800E-03
SO4TOT	0.2134E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1081E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3494E-03	BTOT	0.5180E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.75 PE = 99.99 TEMP = 33.30DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.02 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01608 TOTAL DISS SOLIDS = 0.91GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.8697E-03
ION BALANCE ERROR = 5.27PERCENT CATION EXCESS = 0.1459E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1186E-04	CO3--	0.3604E-04	HCO3-	0.8120E-03	SO4--	0.2011E-02	CL-	0.8045E-02	CA++	0.1781E-03
CAOH+	0.3381E-07	CACO3O	0.4189E-05	CAHCO3	0.1176E-05	CASO4O	0.2877E-04	MG++	0.4576E-05	MGOH++	0.5950E-08
MGCO3O	0.6702E-07	MGHCO3	0.2829E-07	MGSO4O	0.6273E-06	NA+	0.1404E-01	NACO3-	0.8578E-05	NAHCO3	0.4974E-05
NASO4-	0.9405E-04	NACLO	0.2174E-05	K+	0.6333E-04	KSO4-	0.6190E-06	KCLO	0.1015E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1076E-03	LIOHO	0.1952E-08	LISO4-	0.5746E-06
H4SIO4	0.3142E-03	H3SIO4	0.3547E-04	H2SIO4	0.1482E-06	AL+++	0.1332E-19	ALOH++	0.9197E-16	ALOH2+	0.1040E-11
ALOH4-	0.3718E-06	ALSO4+	0.1206E-19	ALSO42	0.1209E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1985E-08	H2SO4O	0.6061E-21	HSO4-	0.3016E-09
HCLO	0.2327E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3607E-04
H2BO3-	0.1578E-04	H2CO3*	0.2620E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.98	CO3--	4.66	HCO3-	3.14	SO4--	2.91	CL-	2.15	CA++	3.96	CAOH+	7.52
CACO3O	5.38	CAHCO3	5.98	CASO4O	4.54	MG++	5.55	MGOH+	8.28	MGCO3O	7.17	MGHCO3	7.60
MGSO4O	6.20	NA+	1.91	NACO3-	5.12	NAHCO3	5.30	NASO4-	4.08	NACLO	5.66	K+	4.26
KSO4-	6.26	KCLO	7.99	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.02
LIOHO	8.71	LISO4-	6.29	H4SIO4	3.50	H3SIO4	4.51	H2SIO4	7.04	AL+++	20.30	ALOH++	16.25
ALOH2+	12.04	ALOH4-	6.48	ALSO4+	19.97	ALSO42	20.97	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.75	H2SO4O	21.22	HSO4-	9.58	HCLO	16.63	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.44	H2BO3-	4.87	H2CO3	5.58	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.28	ALBITE	-1.41	ANHYDRIT	-2.26	ANORTHIT	-4.95	ARAGONIT	-0.35	BARITE	-99.99	BOEHMITE	-2.08
BRUCITE	-4.12	CALCITE	-0.09	CA-MONT	-2.29	CELESTIT	-99.99	CHALCEDN	-0.07	CHLORITE	-1.56	DOLOMITE	-1.64
GIBBSITE	-2.77	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.26	HALITE	-5.66	HALLOYST	-5.54	HEMATITE	-99.99
HUNTITE	-8.22	HYDTOMAG	-7.81	ILLITE	-2.38	KAOLINIT	-1.54	K-MICA	-3.97	MACKINAW	-99.99	MAGNESIT	-1.84
MAGNETIT	-99.99	MIRABILT	-6.00	NESQUEHO	-4.91	PHLOGOPT	-4.26	PYRITE	-99.99	PYROPHYL	-2.04	QUARTZ	0.38
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.84	THENARDT	-6.54	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.50	QUARTZ	0.36	CHALCEDONY	-0.02	A-CRISTOBALITE	-0.28	AMORPHOUS	-1.34

SAMPLE NUMBER 5

TITLE [illegible]83 LOCATION D-08-26-078AAC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1547E-02	MGTOT	0.1316E-03	NATOT	0.4350E-01	KTOT	0.2429E-03	CLTOT	0.3216E-01	ALK	0.7060E-03
SO4TOT	0.6506E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3170E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2829E-03	BTOT	0.1295E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.16 PE = 99.99 TEMP = 41.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.54 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.05232 TOTAL DISS SOLIDS = 2.90GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.6491E-03
ION BALANCE ERROR = 1.71PERCENT CATION EXCESS = 0.1551E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9986

INDIVIDUAL SPECIES MOLALITIES

OH-	0.5841E-05	CO3--	0.9654E-05	HCO3-	0.6036E-03	SO4--	0.5563E-02	CL-	0.3223E-01	CA++	0.1222E-02
CAOH+	0.8838E-07	CACO3O	0.5481E-05	CAHCO3	0.5732E-05	CASO4O	0.3176E-03	MG++	0.1074E-03	MGOH++	0.5640E-07
MGCO3O	0.2683E-06	MGHCO3	0.4024E-06	MGSO4O	0.2383E-04	NA+	0.4298E-01	NACO3-	0.7618E-05	NAHCO3	0.9658E-05
NASO4-	0.6114E-03	NACLO	0.2246E-04	K+	0.2382E-03	KSO4-	0.5328E-05	KCLO	0.1277E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3145E-03	LIOHO	0.2922E-08	LISO4-	0.3438E-05
H4SIO4	0.2714E-03	H3SIO4	0.1230E-04	H2SIO4	0.3652E-07	AL+++	0.7213E-18	ALOH++	0.2001E-14	ALOH2+	0.7538E-11
ALOH4-	0.3726E-06	ALSO4+	0.9671E-18	ALSO42	0.2039E-18	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.8157E-08	H2SO4O	0.2825E-19	HSO4-	0.3267E-08
HCLO	0.7256E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1131E-03
H2BO3-	0.1674E-04	H2CO3*	0.6661E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.33	CO3--	5.36	HCO3-	3.30	SO4--	2.61	CL-	1.59	CA++	3.25	CAOH+	7.14
CACO3O	5.26	CAHCO3	5.32	CASO4O	3.49	MG++	4.30	MGOH+	7.33	MGCO3O	6.57	MGHCO3	6.49
MGSO4O	4.62	NA+	1.46	NACO3-	5.20	NAHCO3	5.01	NASO4-	3.30	NACLO	4.64	K+	3.72
KSO4-	5.36	KCLO	6.89	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.59
LIOHO	8.53	LISO4-	5.55	H4SIO4	3.56	H3SIO4	5.00	H2SIO4	7.78	AL+++	18.79	ALOH++	15.04
ALOH2+	11.21	ALOH4-	6.52	ALSO4+	18.10	ALSO42	18.78	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.16	H2SO4O	19.54	HSO4-	8.58	HCLO	15.13	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.94	H2BO3-	4.90	H2CO3	5.17	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.52	ALBITE	-1.64	ANHYDRIT	-1.17	ANORTHIT	-4.75	ARAGONIT	-0.28	BARITE	-99.99	BOEHMITE	-1.82
BRUCITE	-3.58	CALCITE	-0.00	CA-MONT	-2.35	CELESTIT	-99.99	CHALCEDN	-0.21	CHLORITE	0.68	DOLOMITE	-0.93
GIBBSITE	-2.55	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.22	HALITE	-4.66	HALLOYST	-5.36	HEMATITE	-99.99
HUNTITE	-6.08	HYDTOMAG	-5.13	ILLITE	-2.33	KAOLINIT	-1.44	K-MICA	-3.77	MACKINAW	-99.99	MAGNESIT	-1.18
MAGNETIT	-99.99	MIRABILT	-5.14	NESQUEHO	-4.27	PHLOGOPT	-2.25	PYRITE	-99.99	PYROPHYL	-1.16	QUARTZ	0.21
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.46	THENARDT	-5.32	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.56	QUARTZ	0.19	CHALCEDONY	-0.17	A-CRISTOBALITE	-0.42	AMORPHOUS	-1.48

SAMPLE NUMBER 6

TITLE 83 LOCATION D-08-26-07ADBC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1347E-03	MGTOT	0.6580E-04	NATOT	0.2871E-01	KTOT	0.1509E-03	CLTOT	0.1805E-01	ALK	0.3200E-02		
SO4TOT	0.3748E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1153E-03		
NO3TOT	0.0000E+00	SIO2TOT	0.2163E-03	BTOT	0.1480E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00		

PH = 8.63 PE = 99.99 TEMP = 29.20DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.41 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.03240 TOTAL DISS SOLIDS = 1.88GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3018E-02
ION BALANCE ERROR = 1.10PERCENT CATION EXCESS = 0.6299E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9991

INDIVIDUAL SPECIES MOLALITIES

OH-	0.6984E-05	CO3--	0.9952E-04	HCO3-	0.2832E-02	SO4--	0.3450E-02	CL-	0.1808E-01	CA++	0.1074E-03
CAOH+	0.9975E-08	CACO3O	0.4595E-05	CAHCO3	0.1873E-05	CASO4O	0.2105E-04	MG++	0.5424E-04	MGOH++	0.3396E-07
MGCO3O	0.1527E-05	MGHCO3	0.9900E-06	MGSO4O	0.9134E-05	NA+	0.2842E-01	NACO3-	0.3371E-04	NAHCO3	0.3236E-04
NASO4-	0.2714E-03	NACLO	0.9059E-05	K+	0.1492E-03	KSO4-	0.1981E-05	KCLO	0.4902E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1146E-03	LIOHO	0.1010E-08	LISO4-	0.8985E-06
H4SIO4	0.2018E-03	H3SIO4	0.1493E-04	H2SIO4	0.3387E-07	AL+++	0.1341E-18	ALOH++	0.4474E-15	ALOH2+	0.2659E-11
ALOH4-	0.3722E-06	ALSO4+	0.1356E-18	ALSO42	0.1956E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2694E-08	H2SO4O	0.1230E-20	HSO4-	0.5398E-09
HCLO	0.4340E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1115E-03
H2BO3-	0.3675E-04	H2CO3*	0.1199E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.23	CO3--	4.28	HCO3-	2.62	SO4--	2.75	CL-	1.82	CA++	4.25	CAOH+	8.07
CACO3O	5.33	CAHCO3	5.80	CASO4O	4.67	MG++	4.54	MGOH+	7.54	MGCO3O	5.81	MGHCO3	6.08
MGSO4O	5.04	NA+	1.62	NACO3-	4.54	NAHCO3	4.49	NASO4-	3.64	NACLO	5.04	K+	3.90
KSO4-	5.77	KCLO	7.31	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.01
LIOHO	8.99	LISO4-	6.12	H4SIO4	3.69	H3SIO4	4.90	H2SIO4	7.75	AL+++	19.42	ALOH++	15.63
ALOH2+	11.65	ALOH4-	6.50	ALSO4+	18.94	ALSO42	19.78	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.63	H2SO4O	20.91	HSO4-	9.34	HCLO	16.36	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.95	H2BO3-	4.53	H2CO3	4.92	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.22	ALBITE	-1.46	ANHYDRIT	-2.41	ANORTHIT	-5.48	ARAGONIT	-0.29	BARITE	-99.99	BOEHMITE	-1.82
BRUCITE	-3.60	CALCITE	-0.03	CA-MONT	-2.27	CELESTIT	-99.99	CHALCEDN	-0.22	CHLORITE	1.43	DOLOMITE	-0.25
GIBBSITE	-2.49	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.39	HALITE	-5.03	HALLOYST	-5.28	HEMATITE	-99.99
HUNTITE	-4.22	HYDTOMAG	-3.39	ILLITE	-1.95	KAOLINIT	-1.24	K-MICA	-3.34	MACKINAW	-99.99	MAGNESIT	-0.52
MAGNETIT	-99.99	MIRABILT	-5.07	NESQUEHO	-3.56	PHLOGOPT	-2.96	PYRITE	-99.99	PYROPHYL	-2.60	QUARTZ	0.25
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.06	THENARDT	-5.80	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.69	QUARTZ	0.23	CHALCEDONY	-0.16	A-CRISTOBALITE	-0.42	AMORPHOUS	-1.49

SAMPLE NUMBER 7

TITLE 83 LOCATION D-08-26-07ACAD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.3742E-03	MGTOT	0.6170E-04	NATOT	0.3393E-01	KTOT	0.1406E-03	CLTOT	0.2088E-01	ALK	0.2100E-02
SO4TOT	0.5934E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2162E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3162E-03	BTOT	0.1573E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.75 PE = 99.99 TEMP = 35.30DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.72 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.04009 TOTAL DISS SOLIDS = 2.26GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1856E-02
ION BALANCE ERROR = 0.46PERCENT CATION EXCESS = 0.3176E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9989

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1454E-04	CO3--	0.9016E-04	HCO3-	0.1677E-02	SO4--	0.5368E-02	CL-	0.2091E-01	CA++	0.2810E-03
CAOH+	0.5299E-07	CACO3O	0.1140E-04	CAHCO3	0.3290E-05	CASO4O	0.7932E-04	MG++	0.4837E-04	MGOH++	0.6375E-07
MGCO3O	0.1202E-05	MGHCO3	0.5161E-06	MGSO4O	0.1169E-04	NA+	0.3344E-01	NACO3-	0.4530E-04	NAHCO3	0.2182E-04
NASO4-	0.4830E-03	NACLO	0.1190E-04	K+	0.1379E-03	KSO4-	0.2950E-05	KCLO	0.5048E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2142E-03	LIOHO	0.4455E-08	LISO4-	0.2454E-05
H4SIO4	0.2800E-03	H3SIO4	0.3694E-04	H2SIO4	0.2215E-06	AL+++	0.1136E-19	ALOH++	0.7940E-16	ALOH2+	0.8634E-12
ALOH4-	0.3723E-06	ALSO4+	0.1658E-19	ALSO42	0.3582E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2067E-08	H2SO4O	0.1432E-20	HSO4-	0.7227E-09
HCLO	0.6894E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1053E-03
H2BO3-	0.5239E-04	H2CO3*	0.5026E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.92	CO3--	4.35	HCO3-	2.85	SO4--	2.58	CL-	1.76	CA++	3.86	CAOH+	7.35
CACO3O	4.94	CAHCO3	5.56	CASO4O	4.10	MG++	4.61	MGOH+	7.27	MGCO3O	5.92	MGHCO3	6.37
MGSO4O	4.93	NA+	1.55	NACO3-	4.42	NAHCO3	4.66	NASO4-	3.39	NACLO	4.92	K+	3.94
KSO4-	5.61	KCLO	7.29	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.74
LIOHO	8.35	LISO4-	5.69	H4SIO4	3.55	H3SIO4	4.51	H2SIO4	6.96	AL+++	20.53	ALOH++	16.41
ALOH2+	12.14	ALOH4-	6.51	ALSO4+	19.86	ALSO42	20.53	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.75	H2SO4O	20.84	HSO4-	9.22	HCLO	16.16	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.97	H2BO3-	4.38	H2CO3	5.29	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.28	ALBITE	-1.34	ANHYDRIT	-1.80	ANORTHIT	-5.07	ARAGONIT	0.08	BARITE	-99.99	BOEHMITE	-2.18
BRUCITE	-3.07	CALCITE	0.34	CA-MONT	-2.77	CELESTIT	-99.99	CHALCEDN	-0.14	CHLORITE	3.17	DOLOMITE	0.05
GIBBSITE	-2.88	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.82	HALITE	-4.92	HALLOYST	-5.89	HEMATITE	-99.99
HUNTITE	-3.96	HYDTOMAG	-2.91	ILLITE	-2.44	KAOLINIT	-1.91	K-MICA	-4.18	MACKINAW	-99.99	MAGNESIT	-0.57
MAGNETIT	-99.99	MIRABILT	-5.05	NESQUEHO	-3.64	PHLOGOPT	-0.93	PYRITE	-99.99	PYROPHYL	-2.28	QUARTZ	0.30
SIDERITE	-99.99	STRONTNT	-99.99	TALC	3.63	THENARDT	-5.50	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.55	QUARTZ	0.28	CHALCEDONY	-0.09	A-CRISTOBALITE	-0.35	AMORPHOUS	-1.41

SAMPLE NUMBER 8

TITLE [illegible]33 LOCATION D-08-26-07ACAD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6936E-03	MGTOT	0.4110E-04	NATOT	0.2610E-01	KTOT	0.1330E-03	CLTOT	0.1718E-01	ALK	0.8000E-03
SO4TOT	0.4476E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2162E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2995E-03	BTOT	0.9250E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.47 PE = 99.99 TEMP = 37.80DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.81 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.03148 TOTAL DISS SOLIDS = 1.74GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.7191E-03
ION BALANCE ERROR = 1.84PERCENT CATION EXCESS = 0.9901E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9992

INDIVIDUAL SPECIES MOLALITIES

OH-	0.8937E-05	CO3--	0.1883E-04	HCO3-	0.6717E-03	SO4--	0.4036E-02	CL-	0.1720E-01	CA++	0.5515E-03
CAOH+	0.6900E-07	CACO3O	0.5672E-05	CAHCO3	0.2958E-05	CASO4O	0.1346E-03	MG++	0.3377E-04	MGOH++	0.2985E-07
MGCO3O	0.2041E-06	MGHCO3	0.1547E-06	MGSO4O	0.7010E-05	NA+	0.2582E-01	NACO3-	0.8707E-05	NAHCO3	0.6964E-05
NASO4-	0.3025E-03	NACLO	0.7821E-05	K+	0.1309E-03	KSO4-	0.2336E-05	KCLO	0.4087E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2146E-03	LIOHO	0.3020E-08	LISO4-	0.1962E-05
H4SIO4	0.2789E-03	H3SIO4	0.2116E-04	H2SIO4	0.8217E-07	AL+++	0.1550E-18	ALOH++	0.7217E-15	ALOH2+	0.4994E-11
ALOH4-	0.7443E-06	ALSO4+	0.2018E-18	ALSO42	0.3518E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3896E-08	H2SO4O	0.4749E-20	HSO4-	0.1164E-08
HCLO	0.1406E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7324E-04
H2BO3-	0.1942E-04	H2CO3*	0.3840E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.13	CO3--	5.01	HCO3-	3.24	SO4--	2.68	CL-	1.84	CA++	3.54	CAOH+	7.23
CACO3O	5.24	CAHCO3	5.60	CASO4O	3.87	MG++	4.75	MGOH+	7.59	MGCO3O	6.69	MGHCO3	6.89
MGSO4O	5.15	NA+	1.66	NACO3-	5.13	NAHCO3	5.15	NASO4-	3.59	NACLO	5.10	K+	3.96
KSO4-	5.70	KCLO	7.39	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.74
LIOHO	8.52	LISO4-	5.78	H4SIO4	3.55	H3SIO4	4.75	H2SIO4	7.37	AL+++	19.36	ALOH++	15.42
ALOH2+	11.37	ALOH4-	6.20	ALSO4+	18.77	ALSO42	19.53	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.47	H2SO4O	20.32	HSO4-	9.01	HCLO	15.85	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.13	H2BO3-	4.80	H2CO3	5.41	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.17	ALBITE	-1.30	ANHYDRIT	-1.56	ANORTHIT	-4.24	ARAGONIT	-0.24	BARITE	-99.99	BOEHMITE	-1.68
BRUCITE	-3.61	CALCITE	0.03	CA-MONT	-1.78	CELESTIT	-99.99	CHALCEDN	-0.17	CHLORITE	1.17	DOLOMITE	-1.03
GIBBSITE	-2.40	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.60	HALITE	-5.11	HALLOYST	-4.97	HEMATITE	-99.99
HUNTITE	-6.52	HYDTOMAG	-5.66	ILLITE	-1.76	KAOLINIT	-1.02	K-MICA	-3.11	MACKINAW	-99.99	MAGNESIT	-1.33
MAGNETIT	-99.99	MIRABILT	-5.47	NESQUEHO	-4.40	PHLOGOPT	-2.27	PYRITE	-99.99	PYROPHYL	-1.11	QUARTZ	0.27
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.74	THENARDT	-5.81	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.55	QUARTZ	0.25	CHALCEDONY	-0.12	A-CRISTOBALITE	-0.37	AMORPHOUS	-1.43

SAMPLE NUMBER 9

TITLE 83 LOCATION D-08-26-07ADCD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1247E-03	MGTOT	0.7400E-05	NATOT	0.1927E-01	KTOT	0.8690E-04	CLTOT	0.1128E-01	ALK	0.4900E-03
SO4TOT	0.3227E-02	ALTOT	0.3715E-05	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1441E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3328E-03	BTOT	0.7400E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.92 PE = 99.99 TEMP = 33.70DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.61 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02193 TOTAL DISS SOLIDS = 1.21GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3484E-03
ION BALANCE ERROR = 4.13PERCENT CATION EXCESS = 0.1551E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1839E-04	CO3--	0.2187E-04	HCO3-	0.3150E-03	SO4--	0.3026E-02	CL-	0.1129E-01	CA++	0.1016E-03
CAOH+	0.2800E-07	CACO3O	0.1285E-05	CAHCO3	0.2466E-06	CASO4O	0.2164E-04	MG++	0.6210E-05	MGOH++	0.1177E-07
MGCO3O	0.4875E-07	MGHCO3	0.1405E-07	MGSO4O	0.1125E-05	NA+	0.1910E-01	NACO3-	0.6751E-05	NAHCO3	0.2534E-05
NASO4-	0.1800E-03	NACLO	0.3999E-05	K+	0.8580E-04	KSO4-	0.1183E-05	KCLO	0.1857E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1432E-03	LIOHO	0.3926E-08	LISO4-	0.1075E-05
H4SIO4	0.2840E-03	H3SIO4	0.4924E-04	H2SIO4	0.3329E-06	AL+++	0.2796E-19	ALOH++	0.2807E-15	ALOH2+	0.4579E-11
ALOH4-	0.3720E-05	ALSO4+	0.3241E-19	ALSO42	0.4573E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1359E-08	H2SO4O	0.3971E-21	HSO4-	0.2949E-09
HCLO	0.2252E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4438E-04
H2BO3-	0.2971E-04	H2CO3*	0.6728E-06	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.80	CO3--	4.90	HCO3-	3.56	SO4--	2.77	CL-	2.01	CA++	4.24	CAOH+	7.61
CACO3O	5.89	CAHCO3	6.67	CASO4O	4.66	MG++	5.44	MGOH+	7.99	MGCO3O	7.31	MGHCO3	7.92
MGSO4O	5.95	NA+	1.78	NACO3-	5.23	NAHCO3	5.59	NASO4-	3.81	NACLO	5.40	K+	4.13
KSO4-	5.99	KCLO	7.73	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.90
LIOHO	8.40	LISO4-	6.03	H4SIO4	3.54	H3SIO4	4.37	H2SIO4	6.72	AL+++	20.03	ALOH++	15.79
ALOH2+	11.40	ALOH4-	5.49	ALSO4+	19.55	ALSO42	20.40	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.92	H2SO4O	21.40	HSO4-	9.59	HCLO	16.65	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.35	H2BO3-	4.60	H2CO3	6.17	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.33	ALBITE	-0.44	ANHYDRIT	-2.38	ANORTHIT	-3.34	ARAGONIT	-0.86	BARITE	-99.99	BOEHMITE	-1.27
BRUCITE	-3.65	CALCITE	-0.60	CA-MONT	-0.58	CELESTIT	-99.99	CHALCEDN	-0.12	CHLORITE	2.23	DOLOMITE	-2.29
GIBBSITE	-1.97	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.39	HALITE	-5.39	HALLOYST	-4.02	HEMATITE	-99.99
HUNTITE	-9.14	HYDTOMAG	-7.74	ILLITE	-0.41	KAOLINIT	-0.02	K-MICA	-1.40	MACKINAW	-99.99	MAGNESIT	-1.98
MAGNETIT	-99.99	MIRABILT	-5.61	NESQUEHO	-5.04	PHLOGOPT	-1.86	PYRITE	-99.99	PYROPHYL	-0.57	QUARTZ	0.33
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.04	THENARDT	-6.14	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.54	QUARTZ	0.31	CHALCEDONY	-0.07	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.39

SAMPLE NUMBER 10

TITLE O[illegible] LOCATION D-08-26-07BBBC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.3742E-03	MGTOT	0.1280E-04	NATOT	0.1892E-01	KTOT	0.9970E-04	CLTOT	0.1213E-01	ALK	0.7400E-03
SO4TOT	0.3227E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1873E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2662E-03	BTOT	0.7400E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.50 PE = 99.99 TEMP = 33.80DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.88 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02267 TOTAL DISS SOLIDS = 1.26GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.6791E-03
ION BALANCE ERROR = 1.71PERCENT CATION EXCESS = 0.6609E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.7007E-05	CO3--	0.1708E-04	HCO3-	0.6436E-03	SO4--	0.2990E-02	CL-	0.1214E-01	CA++	0.3066E-03
CAOH+	0.3193E-07	CACO3O	0.2982E-05	CAHCO3	0.1509E-05	CASO4O	0.6352E-04	MG++	0.1079E-04	MGOH++	0.7736E-08
MGCO3O	0.6521E-07	MGHCO3	0.4954E-07	MGSO4O	0.1902E-05	NA+	0.1876E-01	NACO3-	0.5140E-05	NAHCO3	0.5065E-05
NASO4-	0.1733E-03	NACLO	0.4204E-05	K+	0.9847E-04	KSO4-	0.1331E-05	KCLO	0.2281E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1862E-03	LIOHO	0.1937E-08	LISO4-	0.1371E-05
H4SIO4	0.2500E-03	H3SIO4	0.1652E-04	H2SIO4	0.4269E-07	AL+++	0.1353E-18	ALOH++	0.5136E-15	ALOH2+	0.3168E-11
ALOH4-	0.3720E-06	ALSO4+	0.1521E-18	ALSO42	0.2104E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3580E-08	H2SO4O	0.2693E-20	HSO4-	0.7621E-09
HCLO	0.6354E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.5902E-04
H2BO3-	0.1507E-04	H2CO3*	0.3608E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.22	CO3--	5.01	HCO3-	3.25	SO4--	2.78	CL-	1.98	CA++	3.76	CAOH+	7.56
CACO3O	5.52	CAHCO3	5.88	CASO4O	4.19	MG++	5.21	MGOH+	8.17	MGCO3O	7.18	MGHCO3	7.37
MGSO4O	5.72	NA+	1.79	NACO3-	5.35	NAHCO3	5.29	NASO4-	3.82	NACLO	5.37	K+	4.07
KSO4-	5.94	KCLO	7.64	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.79
LIOHO	8.71	LISO4-	5.93	H4SIO4	3.60	H3SIO4	4.85	H2SIO4	7.62	AL+++	19.35	ALOH++	15.54
ALOH2+	11.56	ALOH4-	6.49	ALSO4+	18.88	ALSO42	19.74	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.50	H2SO4O	20.57	HSO4-	9.18	HCLO	16.19	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.23	H2BO3-	4.90	H2CO3	5.44	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.43	ALBITE	-1.62	ANHYDRIT	-1.91	ANORTHIT	-4.98	ARAGONIT	-0.50	BARITE	-99.99	BOEHMITE	-1.85
BRUCITE	-4.26	CALCITE	-0.23	CA-MONT	-2.19	CELESTIT	-99.99	CHALCEDN	-0.17	CHLORITE	-2.12	DOLOMITE	-1.80
GIBBSITE	-2.55	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.92	HALITE	-5.37	HALLOYST	-5.29	HEMATITE	-99.99
HUNTITE	-8.39	HYDTOMAG	-7.96	ILLITE	-2.30	KAOLINIT	-1.30	K-MICA	-3.67	MACKINAW	-99.99	MAGNESIT	-1.85
MAGNETIT	-99.99	MIRABILT	-5.64	NESQUEHO	-4.92	PHLOGOPT	-4.78	PYRITE	-99.99	PYROPHYL	-1.95	QUARTZ	0.28
SIDERITE	-99.99	STRUNTNT	-99.99	TALC	0.01	THENARDT	-6.16	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.60	QUARTZ	0.25	CHALCEDONY	-0.12	A-CRISTOBALITE	-0.38	AMORPHOUS	-1.44

SAMPLE NUMBER 11

TITLE [illegible]3 LOCATION D-08-26-12AAAA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6986E-03	MGTOT	0.2260E-04	NATOT	0.2632E-01	KTOT	0.1304E-03	CLTOT	0.1805E-01	ALK	0.7000E-03
SO4TOT	0.4268E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2162E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2662E-03	BTOT	0.8788E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.33 PE = 99.99 TEMP = 36.00DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.72 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.03160 TOTAL DISS SOLIDS = 1.75GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.6511E-03
ION BALANCE ERROR = 1.51PERCENT CATION EXCESS = 0.8185E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9991

INDIVIDUAL SPECIES MOLALITIES

OH-	0.5708E-05	CO3--	0.1217E-04	HCO3-	0.6160E-03	SO4--	0.3850E-02	CL-	0.1808E-01	CA++	0.5638E-03
CAOH+	0.4460E-07	CACO3O	0.3555E-05	CAHCO3	0.2628E-05	CASO4O	0.1298E-03	MG++	0.1879E-04	MGOH++	0.1040E-07
MGCO3O	0.7158E-07	MGHCO3	0.7803E-07	MGSO4O	0.3686E-05	NA+	0.2606E-01	NACO3-	0.5228E-05	NAHCO3	0.6449E-05
NASO4-	0.2886E-03	NACLO	0.8299E-05	K+	0.1285E-03	KSO4-	0.2128E-05	KCLO	0.4219E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2147E-03	LIOHO	0.1845E-08	LISO4-	0.1875E-05
H4SIO4	0.2538E-03	H3SIO4	0.1289E-04	H2SIO4	0.3024E-07	AL+++	0.4253E-18	ALOH++	0.1243E-14	ALOH2+	0.5604E-11
ALOH4-	0.3721E-06	ALSO4+	0.5185E-18	ALSO42	0.8573E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.5377E-08	H2SO4O	0.7864E-20	HSO4-	0.1457E-08
HCLO	0.1712E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7422E-04
H2BO3-	0.1382E-04	H2CO3*	0.4915E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.32	CO3--	5.20	HCO3-	3.28	SO4--	2.70	CL-	1.82	CA++	3.53	CAOH+	7.42
CACO3O	5.45	CAHCO3	5.65	CASO4O	3.88	MG++	5.00	MGOH+	8.05	MGCO3O	7.14	MGHCO3	7.18
MGSO4O	5.43	NA+	1.66	NACO3-	5.35	NAHCO3	5.19	NASO4-	3.61	NACLO	5.08	K+	3.97
KSO4-	5.74	KCLO	7.37	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.74
LIOHO	8.73	LISO4-	5.80	H4SIO4	3.59	H3SIO4	4.96	H2SIO4	7.80	AL+++	18.92	ALOH++	15.19
ALOH2+	11.32	ALOH4-	6.50	ALSO4+	18.36	ALSO42	19.14	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.33	H2SO4O	20.10	HSO4-	8.91	HCLO	15.76	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.13	H2BO3-	4.95	H2CO3	5.31	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.48	ALBITE	-1.61	ANHYDRIT	-1.59	ANORTHIT	-4.84	ARAGONIT	-0.43	BARITE	-99.99	BOEHMITE	-1.78
BRUCITE	-4.25	CALCITE	-0.17	CA-MONT	-2.11	CELESTIT	-99.99	CHALCEDN	-0.19	CHLORITE	-2.16	DOLOMITE	-1.68
GIBBSITE	-2.48	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.61	HALITE	-5.08	HALLOYST	-5.19	HEMATITE	-99.99
HUNTITE	-8.13	HYDTOMAG	-7.74	ILLITE	-2.27	KAOLINIT	-1.22	K-MICA	-3.59	MACKINAW	-99.99	MAGNESIT	-1.79
MAGNETIT	-99.99	MIRABILT	-5.40	NESQUEHO	-4.87	PHLOGOPT	-4.63	PYRITE	-99.99	PYROPHYL	-1.60	QUARTZ	0.25
SIDERITE	-99.99	STRONTNT	-99.99	TALC	-0.17	THENARDT	-5.82	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.59	QUARTZ	0.23	CHALCEDONY	-0.14	A-CRISTOBALITE	-0.40	AMORPHOUS	-1.46

SAMPLE NUMBER 12

TITLE 0[illegible]3 LOCATION D-OR-25-12AAAA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1622E-02	MGTOT	0.3950E-04	NATOT	0.3698E-01	KTOT	0.1892E-03	CLTOT	0.2765E-01	ALK	0.5500E-03
SO4TOT	0.5621E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2882E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3162E-03	BTOT	0.1018E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.15 PE = 99.99 TEMP = 38.50DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.65 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.04523 TOTAL DISS SOLIDS = 2.50GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5113E-03
ION BALANCE ERROR = 1.72PERCENT CATION EXCESS = 0.1341E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9988

INDIVIDUAL SPECIES MOLALITIES

OH-	0.4618E-05	CO3--	0.6966E-05	HCO3-	0.4789E-03	SO4--	0.4840E-02	CL-	0.2770E-01	CA++	0.1302E-02
CAOH+	0.7655E-07	CACO3O	0.4185E-05	CAHCO3	0.4629E-05	CASO4O	0.3153E-03	MG++	0.3267E-04	MGOH++	0.1369E-07
MGCO3O	0.6136E-07	MGHCO3	0.9866E-07	MGSO4O	0.6759E-05	NA+	0.3657E-01	NACO3-	0.4283E-05	NAHCO3	0.6680E-05
NASO4-	0.4668E-03	NACLO	0.1687E-04	K+	0.1860E-03	KSO4-	0.3630E-05	KCLO	0.8813E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2861E-03	LIOHO	0.2006E-08	LISO4-	0.2847E-05
H4SIO4	0.3052E-03	H3SIO4	0.1178E-04	H2SIO4	0.2508E-07	AL+++	0.1435E-17	ALOH++	0.3181E-14	ALOH2+	0.1023E-10
ALOH4-	0.3724E-06	ALSO4+	0.1798E-17	ALSO42	0.3414E-18	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.8282E-08	H2SO4O	0.2327E-19	HSO4-	0.2767E-08
HCLO	0.4908E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.8995E-04
H2BO3-	0.1210E-04	H2CO3*	0.5547E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.42	CO3--	5.48	HCO3-	3.40	SO4--	2.65	CL-	1.65	CA++	3.21	CAOH+	7.19
CACO3O	5.37	CAHCO3	5.41	CASO4O	3.50	MG++	4.80	MGOH+	7.94	MGCO3O	7.21	MGHCO3	7.09
MGSO4O	5.17	NA+	1.52	NACO3-	5.45	NAHCO3	5.17	NASO4-	3.41	NACLO	4.77	K+	3.82
KSO4-	5.52	KCLO	7.05	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.62
LIOHO	8.69	LISO4-	5.63	H4SIO4	3.51	H3SIO4	5.02	H2SIO4	7.92	AL+++	18.46	ALOH++	14.82
ALOH2+	11.07	ALOH4-	6.51	ALSO4+	17.83	ALSO42	18.55	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.15	H2SO4O	19.63	HSO4-	8.64	HCLO	15.30	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.04	H2BO3-	5.03	H2CO3	5.25	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.27	ALBITE	-1.38	ANHYDRIT	-1.19	ANORTHIT	-4.48	ARAGONIT	-0.38	BARITE	-99.99	BOEHMITE	-1.70
BRUCITE	-4.26	CALCITE	-0.11	CA-MONT	-1.75	CELESTIT	-99.99	CHALCEDN	-0.13	CHLORITE	-2.07	DOLOMITE	-1.68
GIBBSITE	-2.42	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.23	HALITE	-4.78	HALLOYST	-4.94	HEMATITE	-99.99
HUNTITE	-8.19	HYDTOMAG	-7.85	ILLITE	-1.96	KAOLINIT	-1.00	K-MICA	-3.25	MACKINAW	-99.99	MAGNESIT	-1.84
MAGNETIT	-99.99	MIRABILT	-5.18	NESQUEHO	-4.92	PHLOGOPT	-4.27	PYRITE	-99.99	PYROPHYL	-0.93	QUARTZ	0.30
SIDERITE	-99.99	STRONTNT	-99.99	TALC	-0.12	THENARDT	-5.49	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.51	QUARTZ	0.28	CHALCEDONY	-0.09	A-CRISTOBALITE	-0.34	AMORPHOUS	-1.40

SAMPLE NUMBER 13[illegible]

TITLE [illegible]83 LOCATION D-08-26-06CCBA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6490E-04	MGTOT	0.2260E-04	NATOT	0.2697E-01	KTOT	0.9970E-04	CLTOT	0.1467E-01	ALK.	0.4610E-02		
SO4TOT	0.3956E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1009E-03		
NO3TOT	0.0000E+00	SIO2TOT	0.2662E-03	BTOT	0.2128E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00		

PH = 8.83 PE = 99.99 TEMP = 30.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.46 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.03083 TOTAL DISS SOLIDS = 1.83GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4215E-02
ION BALANCE ERROR = 0.29PERCENT CATION EXCESS = 0.1551E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9991

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1205E-04	CO3--	0.2181E-03	HCO3-	0.3863E-02	SO4--	0.3671E-02	CL-	0.1469E-01	CA++	0.4855E-04
CAOH+	0.7925E-08	CACO3O	0.4798E-05	CAHCO3	0.1211E-05	CASO4O	0.1045E-04	MG++	0.1775E-04	MGOH++	0.1966E-07
MGCO3O	0.1140E-05	MGHCO3	0.4498E-06	MGSO4O	0.3278E-05	NA+	0.2662E-01	NACO3-	0.7418E-04	NAHCO3	0.4160E-04
NASO4-	0.2757E-03	NACLO	0.6939E-05	K+	0.9842E-04	KSO4-	0.1436E-05	KCLO	0.2646E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1002E-03	LIOHO	0.1583E-08	LISO4-	0.8455E-06
H4SIO4	0.2373E-03	H3SIO4	0.2936E-04	H2SIO4	0.1196E-06	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1696E-08	H2SO4O	0.5628E-21	HSO4-	0.3780E-09
HCLO	0.2524E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1393E-03
H2BO3-	0.7392E-04	H2CO3*	0.1023E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.99	CO3--	3.94	HCO3-	2.48	SO4--	2.72	CL-	1.91	CA++	4.59	CAOH+	8.17
CACO3O	5.32	CAHCO3	5.98	CASO4O	4.98	MG++	5.02	MGOH+	7.77	MGCO3O	5.94	MGHCO3	6.42
MGSO4O	5.48	NA+	1.65	NACO3-	4.20	NAHCO3	4.38	NASO4-	3.63	NACLO	5.16	K+	4.08
KSO4-	5.91	KCLO	7.57	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.07
LIOHO	8.80	LISO4-	6.14	H4SIO4	3.62	H3SIO4	4.61	H2SIO4	7.20	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.83	H2SO4O	21.25	HSO4-	9.49	HCLO	16.59	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.85	H2BO3-	4.22	H2CO3	4.99	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.71	ANORTHIT	-99.99	ARAGONIT	-0.27	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.61	CALCITE	-0.01	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.16	CHLORITE	-99.99	DOLOMITE	-0.35
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.70	HALITE	-5.15	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-4.55	HYDTOMAG	-3.72	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.64
MAGNETIT	-99.99	MIRABILT	-5.15	NESQUEHO	-3.69	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.30
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.20	THENARDT	-5.82	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.62	QUARTZ	0.28	CHALCEDONY	-0.10	A-CRISTOBALITE	-0.37	AMORPHOUS	-1.43

SAMPLE NUMBER 14

TITLE [illegible]33 LOCATION D-08-26-20DBCC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.4241E-03	MGTOT	0.2430E-04	NATOT	0.2132E-01	KTOT	0.1457E-03	CLTOT	0.1425E-01	ALK	0.1680E-02
SO4TOT	0.2863E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1729E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3827E-03	BTOT	0.5550E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.40 PE = 99.99 TEMP = 44.50DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.35 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02477 TOTAL DISS SOLIDS = 1.42GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1569E-02
ION BALANCE ERROR = 2.03PERCENT CATION EXCESS = 0.8825E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9993

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1182E-04	CO3--	0.3695E-04	HCO3-	0.1474E-02	SO4--	0.2621E-02	CL-	0.1426E-01	CA++	0.3458E-03
CAOH+	0.6278E-07	CACO3O	0.9650E-05	CAHCO3	0.5253E-05	CASO4O	0.6393E-04	MG++	0.2058E-04	MGOH++	0.2737E-07
MGCO3O	0.2981E-06	MGHCO3	0.2280E-06	MGSO4O	0.3200E-05	NA+	0.2113E-01	NACO3-	0.1993E-04	NAHCO3	0.1285E-04
NASO4-	0.1760E-03	NACLO	0.5463E-05	K+	0.1439E-03	KSO4-	0.1957E-05	KCLO	0.3842E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1721E-03	LIOHO	0.3885E-08	LISO4-	0.1075E-05
H4SIO4	0.3535E-03	H3SIO4	0.2974E-04	H2SIO4	0.1786E-06	AL+++	0.6122E-19	ALOH++	0.4231E-15	ALOH2+	0.3812E-11
ALOH4-	0.7441E-06	ALSO4+	0.6314E-19	ALSO42	0.7736E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4536E-08	H2SO4O	0.6318E-20	HSO4-	0.1123E-08
HCLO	0.2630E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4456E-04
H2BO3-	0.1102E-04	H2CO3*	0.9785E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.00	CO3--	4.69	HCO3-	2.90	SO4--	2.85	CL-	1.92	CA++	3.72	CAOH+	7.27
CACO3O	5.01	CAHCO3	5.34	CASO4O	4.19	MG++	4.94	MGOH+	7.62	MGCO3O	6.52	MGHCO3	6.71
MGSO4O	5.49	NA+	1.74	NACO3-	4.77	NAHCO3	4.89	NASO4-	3.82	NACLO	5.26	K+	3.91
KSO4-	5.77	KCLO	7.41	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.83
LIOHO	8.41	LISO4-	6.03	H4SIO4	3.45	H3SIO4	4.60	H2SIO4	7.01	AL+++	19.72	ALOH++	15.63
ALOH2+	11.48	ALOH4-	6.20	ALSO4+	19.27	ALSO42	20.18	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.40	H2SO4O	20.20	HSO4-	9.02	HCLO	15.58	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.35	H2BO3-	5.04	H2CO3	5.01	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.27	ALBITE	-1.45	ANHYDRIT	-1.85	ANORTHIT	-4.47	ARAGONIT	-0.07	BARITE	-99.99	BOEHMITE	-1.84
BRUCITE	-3.56	CALCITE	0.23	CA-MONT	-2.15	CELESTIT	-99.99	CHALCEDN	-0.13	CHLORITE	0.72	DOLOMITE	-0.65
GIBBSITE	-2.60	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.92	HALITE	-5.28	HALLOYST	-5.28	HEMATITE	-99.99
HUNTITE	-5.64	HYDTOMAG	-4.87	ILLITE	-2.13	KAOLINIT	-1.39	K-MICA	-3.61	MACKINAW	-99.99	MAGNESIT	-1.12
MAGNETIT	-99.99	MIRABILT	-6.08	NESQUEHO	-4.22	PHLOGOPT	-1.73	PYRITE	-99.99	PYROPHYL	-0.55	QUARTZ	0.28
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.66	THENARDT	-6.13	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.45	QUARTZ	0.26	CHALCEDONY	-0.09	A-CRISTOBALITE	-0.34	AMORPHOUS	-1.39

SAMPLE NUMBER 15

TITLE [illegible]33 LOCATION D-08-26-07ADCC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.7730E-04	MGTOT	0.1970E-04	NATOT	0.2175E-01	KTOT	0.1023E-03	CLTOT	0.1284E-01	ALK	0.2590E-02
SO4TOT	0.3123E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1297E-03
NO3TOT	0.0000E+00	SIO2TOT	0.1997E-03	BTOT	0.1110E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.81 PE = 99.99 TEMP = 31.60DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.68 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02478 TOTAL DISS SOLIDS = 1.43GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.2371E-02
ION BALANCE ERROR = 1.17PERCENT CATION EXCESS = 0.5063E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9993

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1237E-04	CO3--	0.1160E-03	HCO3-	0.2188E-02	SO4--	0.2922E-02	CL-	0.1285E-01	CA++	0.6107E-04
CAOH+	0.1087E-07	CACO3O	0.3669E-05	CAHCO3	0.9409E-06	CASO4O	0.1172E-04	MG++	0.1619E-04	MGOH++	0.1963E-07
MGCO3O	0.6212E-06	MGHCO3	0.2450E-06	MGSO4O	0.2653E-05	NA+	0.2153E-01	NACO3-	0.3559E-04	NAHCO3	0.1958E-04
NASO4-	0.1885E-03	NACLO	0.5054E-05	K+	0.1012E-03	KSO4-	0.1266E-05	KCLO	0.2452E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1290E-03	LIOHO	0.2220E-08	LISO4-	0.9115E-06
H4SIO4	0.1781E-03	H3SIO4	0.2192E-04	H2SIO4	0.9374E-07	AL+++	0.1315E-19	ALOH++	0.8462E-16	ALOH2+	0.9248E-12
ALOH4-	0.3720E-06	ALSO4+	0.1347E-19	ALSO42	0.1772E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1759E-08	H2SO4O	0.5533E-21	HSO4-	0.3389E-09
HCLO	0.2653E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7380E-04
H2BO3-	0.3736E-04	H2CO3*	0.6084E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.98	CO3--	4.19	HCO3-	2.72	SO4--	2.79	CL-	1.96	CA++	4.47	CAOH+	8.03
CACO3O	5.43	CAHCO3	6.09	CASO4O	4.93	MG++	5.04	MGOH+	7.77	MGCO3O	6.20	MGHCO3	6.68
MGSO4O	5.57	NA+	1.73	NACO3-	4.51	NAHCO3	4.71	NASO4-	3.79	NACLO	5.29	K+	4.06
KSO4-	5.96	KCLO	7.61	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.95
LIOHO	8.65	LISO4-	6.10	H4SIO4	3.75	H3SIO4	4.73	H2SIO4	7.28	AL+++	20.38	ALOH++	16.33
ALOH2+	12.10	ALOH4-	6.50	ALSO4+	19.94	ALSO42	20.82	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.81	H2SO4O	21.25	HSO4-	9.54	HCLO	16.57	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.13	H2BO3-	4.51	H2CO3	5.21	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.72	ALBITE	-1.88	ANHYDRIT	-2.65	ANORTHIT	-5.90	ARAGONIT	-0.40	BARITE	-99.99	BOEHMITE	-2.09
BRUCITE	-3.60	CALCITE	-0.14	CA-MONT	-3.19	CELESTIT	-99.99	CHALCEDN	-0.30	CHLORITE	0.51	DOLOMITE	-0.73
GIBBSITE	-2.77	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.65	HALITE	-5.29	HALLOYST	-5.99	HEMATITE	-99.99
HUNTITE	-5.42	HYDTOMAG	-4.45	ILLITE	-2.88	KAOLINIT	-1.97	K-MICA	-4.39	MACKINAW	-99.99	MAGNESIT	-0.89
MAGNETIT	-99.99	MIRABILT	-5.45	NESQUEHO	-3.95	PHLOGOPT	-3.24	PYRITE	-99.99	PYROPHYL	-3.16	QUARTZ	0.16
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.62	THENARDT	-6.07	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.75	QUARTZ	0.14	CHALCEDONY	-0.24	A-CRISTOBALITE	-0.50	AMORPHOUS	-1.57

SAMPLE NUMBER 16

TITLE 0[illegible]3 LOCATION D-06-27-35DDDD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.8480E-04	MGTOT	0.1150E-04	NATOT	0.1327E-01	KTOT	0.8440E-04	CLTOT	0.6347E-02	ALK	0.1620E-02
SO4TOT	0.1041E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3603E-04
NO3TOT	0.0000E+00	SIO2TOT	0.7488E-03	BTOT	0.1850E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.58 PE = 99.99 TEMP = 23.80DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.65 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01286 TOTAL DISS SOLIDS = 0.78GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1545E-02
ION BALANCE ERROR = 15.04PERCENT CATION EXCESS = 0.3534E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3920E-05	CO3--	0.3590E-04	HCO3-	0.1484E-02	SO4--	0.9910E-03	CL-	0.6350E-02	CA++	0.7634E-04
CAOH+	0.4746E-08	CACO3O	0.1560E-05	CAHCO3	0.7252E-06	CASO4O	0.6233E-05	MG++	0.1051E-04	MGOH++	0.4250E-08
MGCO3O	0.1465E-06	MGHCO3	0.1171E-06	MGSO4O	0.7353E-06	NA+	0.1322E-01	NACO3-	0.5304E-05	NAHCO3	0.8793E-05
NASO4-	0.4343E-04	NACLO	0.1662E-05	K+	0.8409E-04	KSO4-	0.3636E-06	KCLO	0.1095E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3596E-04	LIOHO	0.1719E-09	LISO4-	0.9961E-07
H4SIO4	0.7155E-03	H3SIO4	0.3393E-04	H2SIO4	0.3179E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2905E-08	H2SO4O	0.4075E-21	HSO4-	0.1750E-09
HCLO	0.1036E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1488E-04
H2BO3-	0.3639E-05	H2CO3*	0.7944E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.46	CO3--	4.64	HCO3-	2.88	SO4--	3.20	CL-	2.25	CA++	4.31	CAOH+	8.37
CACO3O	5.81	CAHCO3	6.19	CASO4O	5.20	MG++	5.17	MGOH+	8.42	MGCO3O	6.83	MGHCO3	6.98
MGSO4O	6.13	NA+	1.93	NACO3-	5.32	NAHCO3	5.05	NASO4-	4.41	NACLO	5.78	K+	4.13
KSO4-	6.49	KCLO	7.96	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.49
LIOHO	9.76	LISO4-	7.05	H4SIO4	3.14	H3SIO4	4.52	H2SIO4	7.69	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.58	H2SO4O	21.39	HSO4-	9.81	HCLO	16.98	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.83	H2BO3-	5.50	H2CO3	5.10	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.97	ANORTHIT	-99.99	ARAGONIT	-0.74	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.67	CALCITE	-0.48	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.39	CHLORITE	-99.99	DOLOMITE	-1.76
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.91	HALITE	-5.76	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-7.93	HYDTOMAG	-7.75	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-1.58
MAGNETIT	-99.99	MIRABILT	-5.89	NESQUEHO	-4.61	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.88
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.60	THENARDT	-6.88	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.14	QUARTZ	0.85	CHALCEDONY	0.45	A-CRISTOBALITE	0.18	AMORPHOUS	-0.89

SAMPLE NUMBER 17

TITLE 83 LOCATION D-07-27-02AAA8

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1247E-03	MGTOT	0.2960E-04	NATOT	0.1261E-01	KTOT	0.1074E-03	CLTOT	0.6319E-02	ALK	0.4400E-02
SO4TOT	0.9889E-03	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3603E-04
NO3TOT	0.0000E+00	SIO2TOT	0.7654E-03	BTOT	0.2313E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.52 PE = 99.99 TEMP = 26.20DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.13 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01394 TOTAL DISS SOLIDS = 0.93GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4273E-02
ION BALANCE ERROR = 1.45PERCENT CATION EXCESS = 0.3706E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.4113E-05	CO3--	0.9207E-04	HCO3-	0.4108E-02	SO4--	0.9403E-03	CL-	0.6323E-02	CA++	0.1078E-03
CAOH+	0.7020E-08	CACO3O	0.5764E-05	CAHCO3	0.2999E-05	CASO4O	0.8232E-05	MG++	0.2616E-04	MGOH++	0.1123E-07
MGCO3O	0.9387E-06	MGHCO3	0.8061E-06	MGSO4O	0.1708E-05	NA+	0.1255E-01	NACO3-	0.1433E-04	NAHCO3	0.2290E-04
NASO4-	0.3901E-04	NACLO	0.1556E-05	K+	0.1070E-03	KSO4-	0.4497E-06	KCLO	0.1375E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3597E-04	LIOHO	0.1909E-09	LISO4-	0.9293E-07
H4SIO4	0.7318E-03	H3SIO4	0.3429E-04	H2SIO4	0.3758E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3347E-08	H2SO4O	0.5736E-21	HSO4-	0.2011E-09
HCLO	0.1518E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1891E-04
H2BO3-	0.4238E-05	H2CO3*	0.2438E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.44	CO3--	4.24	HCO3-	2.44	SO4--	3.23	CL-	2.25	CA++	4.17	CAOH+	8.20
CACO3O	5.24	CAHCO3	5.57	CASO4O	5.08	MG++	4.78	MGOH+	8.00	MGCO3O	6.03	MGHCO3	6.15
MGSO4O	5.77	NA+	1.95	NACO3-	4.89	NAHCO3	4.64	NASO4-	4.46	NACLO	5.81	K+	4.02
KSO4-	6.40	KCLO	7.86	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.49
LIOHO	9.72	LISO4-	7.08	H4SIO4	3.13	H3SIO4	4.52	H2SIO4	7.62	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.52	H2SO4O	21.24	HSO4-	9.75	HCLO	16.82	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.72	H2BO3-	5.43	H2CO3	4.61	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.84	ANORTHIT	-99.99	ARAGONIT	-0.18	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.25	CALCITE	0.08	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.38	CHLORITE	-99.99	DOLOMITE	-0.37
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.79	HALITE	-5.79	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-4.86	HYDTOMAG	-4.80	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.76
MAGNETIT	-99.99	MIRABILT	-6.08	NESQUEHO	-3.79	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.85
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.65	THENARDT	-6.95	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.13	QUARTZ	0.83	CHALCEDONY	0.43	A-CRISTOBALITE	0.17	AMORPHOUS	-0.90

SAMPLE NUMBER 18

TITLE [illegible]3 LOCATION D-07-27-02ACDA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.9730E-04	MGTOT	0.1150E-04	NATOT	0.1631E-01	KTOT	0.1253E-03	CLTOT	0.6347E-02	ALK	0.4330E-02
SO4TOT	0.2498E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.4612E-04
NO3TOT	0.0000E+00	SIO2TOT	0.1032E-02	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.47 PE = 99.99 TEMP = 39.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.02 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01851 TOTAL DISS SOLIDS = 1.18GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4118E-02
ION BALANCE ERROR = 3.22PERCENT CATION EXCESS = 0.1029E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.9640E-05	CO3--	0.1027E-03	HCO3-	0.3920E-02	SO4--	0.2358E-02	CL-	0.6353E-02	CA++	0.7509E-04
CAOH+	0.1160E-07	CACO3O	0.5647E-05	CAHCO3	0.2785E-05	CASO4O	0.1388E-04	MG++	0.9360E-05	MGOH++	0.1026E-07
MGCO3O	0.4004E-06	MGHCO3	0.2826E-06	MGSO4O	0.1460E-05	NA+	0.1614E-01	NACO3-	0.3609E-04	NAHCO3	0.2710E-04
NASO4-	0.1266E-03	NACLO	0.1935E-05	K+	0.1239E-03	KSO4-	0.1510E-05	KCLO	0.1537E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.4590E-04	LIOHO	0.7752E-09	LISO4-	0.2772E-06
H4SIO4	0.9581E-03	H3SIO4	0.7510E-04	H2SIO4	0.3128E-06	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3808E-08	H2SO4O	0.3426E-20	HSO4-	0.7819E-09
HCLO	0.6294E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3679E-04
H2BO3-	0.9518E-05	H2CO3*	0.2297E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.08	CO3--	4.22	HCO3-	2.46	SO4--	2.86	CL-	2.26	CA++	4.35	CAOH+	7.99
CACO3O	5.25	CAHCO3	5.61	CASO4O	4.86	MG++	5.25	MGOH+	8.04	MGCO3O	6.40	MGHCO3	6.61
MGSO4O	5.83	NA+	1.85	NACO3-	4.50	NAHCO3	4.57	NASO4-	3.96	NACLO	5.71	K+	3.97
KSO4-	5.88	KCLO	7.81	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.39
LIOHO	9.11	LISO4-	6.62	H4SIO4	3.02	H3SIO4	4.18	H2SIO4	6.73	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.47	H2SO4O	20.46	HSO4-	9.17	HCLO	16.20	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.43	H2BO3-	5.09	H2CO3	4.64	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.54	ANORTHIT	-99.99	ARAGONIT	-0.26	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.03	CALCITE	0.02	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.35	CHLORITE	-99.99	DOLOMITE	-0.74
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.58	HALITE	-5.72	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-5.61	HYDTOMAG	-5.14	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-1.02
MAGNETIT	-99.99	MIRABILT	-6.09	NESQUEHO	-4.11	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.78
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.48	THENARDT	-6.37	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.02	QUARTZ	0.76	CHALCEDONY	0.40	A-CRISTOBALITE	0.15	AMORPHOUS	-0.91

SAMPLE NUMBER 19

TITLE [illegible]83 LOCATION D-07-27-11BBBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.7240E-04	MGTOT	0.4100E-05	NATOT	0.1588E-01	KTOT	0.1278E-03	CLTOT	0.5755E-02	ALK	0.4090E-02
SO4TOT	0.2863E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.4756E-04
NO3TOT	0.0000E+00	SIO2TOT	0.1082E-02	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.63 PE = 99.99 TEMP = 48.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.18 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01853 TOTAL DISS SOLIDS = 1.17GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3687E-02
ION BALANCE ERROR = 2.04PERCENT CATION EXCESS = 0.6364E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2549E-04	CO3--	0.1451E-03	HCO3-	0.3422E-02	SO4--	0.2705E-02	CL-	0.5760E-02	CA++	0.5147E-04
CAOH+	0.2197E-07	CACO3O	0.7354E-05	CAHCO3	0.2174E-05	CASO4O	0.1146E-04	MG++	0.3194E-05	MGOH++	0.1020E-07
MGCO3O	0.2174E-06	MGHCO3	0.8970E-07	MGSO4O	0.5938E-06	NA+	0.1565E-01	NACO3-	0.7314E-04	NAHCO3	0.2283E-04
NASO4-	0.1465E-03	NACLO	0.1693E-05	K+	0.1259E-03	KSO4-	0.2003E-05	KCLO	0.1409E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.4729E-04	LIOHO	0.2613E-08	LISO4-	0.3246E-06
H4SIO4	0.9311E-03	H3SIO4	0.1521E-03	H2SIO4	0.2089E-05	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2640E-08	H2SO4O	0.2924E-20	HSO4-	0.8034E-09
HCLO	0.9118E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3223E-04
H2BO3-	0.1407E-04	H2CO3+	0.1353E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.66	CO3--	4.07	HCO3-	2.52	SO4--	2.81	CL-	2.30	CA++	4.52	CAOH+	7.72
CACO3O	5.13	CAHCO3	5.72	CASO4O	4.94	MG++	5.72	MGOH+	8.05	MGCO3O	6.66	MGHCO3	7.11
MGSO4O	6.22	NA+	1.87	NACO3-	4.19	NAHCO3	4.64	NASO4-	3.89	NACLO	5.77	K+	3.96
KSO4-	5.76	KCLO	7.85	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.38
LIOHO	8.58	LISO4-	6.55	H4SIO4	3.03	H3SIO4	3.88	H2SIO4	5.91	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.63	H2SO4O	20.53	HSO4-	9.16	HCLO	16.04	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.49	H2BO3-	4.92	H2CO3	4.87	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.58	ANORTHIT	-99.99	ARAGONIT	-0.22	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.67	CALCITE	0.09	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.25	CHLORITE	-99.99	DOLOMITE	-0.93
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.66	HALITE	-5.80	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-6.10	HYDTOMAG	-5.25	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-1.23
MAGNETIT	-99.99	MIRABILT	-6.44	NESQUEHO	-4.34	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.64
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.66	THENARDT	-6.33	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.03	QUARTZ	0.63	CHALCEDONY	0.28	A-CRISTOBALITE	0.04	AMORPHOUS	-1.01

SAMPLE NUMBER 20

TITLE 0[illegible]3 LOCATION D-07-27-118BBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.7980E-04	MGTOT	0.4100E-05	NATOT	0.1588E-01	KTOT	0.1381E-03	CLTOT	0.6122E-02	ALK	0.4110E-02
SO4TOT	0.2811E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.5044E-04
NO3TOT	0.0000E+00	SIO2TOT	0.1082E-02	BTOT	0.4163E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.53 PE = 99.99 TEMP = 49.20DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.05 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01862 TOTAL DISS SOLIDS = 1.18GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3779E-02
ION BALANCE ERROR = 1.21PERCENT CATION EXCESS = 0.3813E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2134E-04	CO3--	0.1205E-03	HCO3-	0.3545E-02	SO4--	0.2654E-02	CL-	0.6127E-02	CA++	0.5765E-04
CAOH+	0.2065E-07	CACO3O	0.7022E-05	CAHCO3	0.2580E-05	CASO4O	0.1262E-04	MG++	0.3228E-05	MGOH++	0.8692E-08
MGCO3O	0.1840E-06	MGHCO3	0.9439E-07	MGSO4O	0.5895E-06	NA+	0.1566E-01	NACO3-	0.6279E-04	NAHCO3	0.2364E-04
NASO4-	0.1442E-03	NACLO	0.1800E-05	K+	0.1361E-03	KSO4-	0.2145E-05	KCLO	0.1618E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.5016E-04	LIOHO	0.2362E-08	LISO4-	0.3371E-06
H4SIO4	0.9554E-03	H3SIO4	0.1279E-03	H2SIO4	0.1495E-05	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3325E-08	H2SO4O	0.4718E-20	HSO4-	0.1015E-08
HCLO	0.1312E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3083E-04
H2BO3-	0.1085E-04	H2CO3*	0.1763E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.73	CO3--	4.15	HCO3-	2.51	SO4--	2.81	CL-	2.28	CA++	4.47	CAOH+	7.74
CACO3O	5.15	CAHCO3	5.65	CASO4O	4.90	MG++	5.72	MGOH+	8.12	MGCO3O	6.73	MGHCO3	7.09
MGSO4O	6.23	NA+	1.87	NACO3-	4.26	NAHCO3	4.62	NASO4-	3.90	NACLO	5.74	K+	3.93
KSO4-	5.73	KCLO	7.79	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.36
LIOHO	8.62	LISO4-	6.53	H4SIO4	3.02	H3SIO4	3.95	H2SIO4	6.06	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.53	H2SO4O	20.32	HSO4-	9.05	HCLO	15.88	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.51	H2BO3-	5.04	H2CO3	4.75	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.53	ANORTHIT	-99.99	ARAGONIT	-0.25	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.83	CALCITE	0.06	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.25	CHLORITE	-99.99	DOLOMITE	-1.03
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.61	HALITE	-5.77	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-6.32	HYDTOMAG	-5.59	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-1.29
MAGNETIT	-99.99	MIRABILT	-6.48	NESQUEHO	-4.41	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.65
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.17	THENARDT	-6.34	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.02	QUARTZ	0.63	CHALCEDONY	0.29	A-CRISTOBALITE	0.05	AMORPHOUS	-1.00

SAMPLE NUMBER 21

TITLE [illegible]33 LOCATION D-08-26-078089

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1672E-02	MGTOT	0.2140E-04	NATOT	0.3576E-01	KTOT	0.2250E-03	CLTOT	0.2697E-01	ALK	0.4100E-03
SO4TOT	0.5465E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2450E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3661E-03	BTOT	0.8788E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.33 PE = 99.99 TEMP = 39.90DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.99 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.04398 TOTAL DISS SOLIDS = 2.43GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3494E-03
ION BALANCE ERROR = 1.73PERCENT CATION EXCESS = 0.1309E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9988

INDIVIDUAL SPECIES MOLALITIES

OH-	0.7684E-05	CO3--	0.7209E-05	HCO3-	0.3226E-03	SO4--	0.4700E-02	CL-	0.2702E-01	CA++	0.1344E-02
CAOH+	0.1334E-06	CACO3O	0.4733E-05	CAHCO3	0.3379E-05	CASO4O	0.3233E-03	MG++	0.1773E-04	MGOH++	0.1264E-07
MGCO3O	0.3560E-07	MGHCO3	0.3663E-07	MGSO4O	0.3636E-05	NA+	0.3537E-01	NACO3-	0.4598E-05	NAHCO3	0.4366E-05
NASO4-	0.4446E-03	NACLO	0.1597E-04	K+	0.2211E-03	KSO4-	0.4313E-05	KCLO	0.1026E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2432E-03	LIOHO	0.2948E-08	LISO4-	0.2364E-05
H4SIO4	0.3456E-03	H3SIO4	0.2139E-04	H2SIO4	0.7866E-07	AL+++	0.3949E-18	ALOH++	0.1485E-14	ALOH2+	0.7875E-11
ALOH4-	0.7448E-06	ALSO4+	0.4949E-18	ALSO42	0.9235E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.5467E-08	H2SO4O	0.1067E-19	HSO4-	0.1857E-08
HCLO	0.3626E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7293E-04
H2BO3-	0.1516E-04	H2CO3*	0.2456E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.20	CO3--	5.46	HCO3-	3.57	SO4--	2.66	CL-	1.66	CA++	3.19	CAOH+	6.95
CACO3O	5.32	CAHCO3	5.55	CASO4O	3.49	MG++	5.06	MGOH+	7.97	MGCO3O	7.44	MGHCO3	7.52
MGSO4O	5.43	NA+	1.53	NACO3-	5.42	NAHCO3	5.36	NASO4-	3.43	NACLO	4.79	K+	3.74
KSO4-	5.45	KCLO	6.98	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.69
LIOHO	8.53	LISO4-	5.71	H4SIO4	3.46	H3SIO4	4.76	H2SIO4	7.42	AL+++	19.01	ALOH++	15.15
ALOH2+	11.18	ALOH4-	6.21	ALSO4+	18.39	ALSO42	19.12	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.33	H2SO4O	19.97	HSO4-	8.82	HCLO	15.44	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.13	H2BO3-	4.93	H2CO3	5.61	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.83	ALBITE	-1.02	ANHYDRIT	-1.17	ANORTHIT	-3.81	ARAGONIT	-0.33	BARITE	-99.99	BOEHMITE	-1.63
BRUCITE	-4.09	CALCITE	-0.06	CA-MONT	-1.39	CELESTIT	-99.99	CHALCEDN	-0.09	CHLORITE	-1.02	DOLOMITE	-1.87
GIBBSITE	-2.36	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.22	HALITE	-4.80	HALLOYST	-4.73	HEMATITE	-99.99
HUNTITE	-8.81	HYDTOMAG	-8.33	ILLITE	-1.49	KAOLINIT	-0.80	K-MICA	-2.68	MACKINAW	-99.99	MAGNESIT	-2.07
MAGNETIT	-99.99	MIRABILT	-5.28	NESQUEHO	-5.15	PHLOGOPT	-3.19	PYRITE	-99.99	PYROPHYL	-0.48	QUARTZ	0.33
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.49	THENARDT	-5.53	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.46	QUARTZ	0.31	CHALCEDONY	-0.05	A-CRISTOBALITE	-0.30	AMORPHOUS	-1.36

SAMPLE NUMBER 22

TITLE [illegible]83 LOCATION D-08-25-27CAAA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.2495E-03	MGTOT	0.9870E-04	NATOT	0.3611E-03	KTOT	0.4860E-04	CLTOT	0.5080E-04	ALK	0.4900E-03
SO4TOT	0.2186E-03	ALTOT	0.1486E-05	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1441E-05
NO3TOT	0.0000E+00	SIO2TOT	0.2829E-03	BTOT	0.1850E-05	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 7.18 PE = 99.99 TEMP = 6.50DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 2.80 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.00157 TOTAL DISS SOLIDS = 0.09GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5804E-03
ION BALANCE ERROR = 6.55PERCENT CATION EXCESS = 0.1340E-03(CHARGE*MOLES) H2O ACTIVITY = 1.0000

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3578E-07	CO3--	0.2425E-06	HCO3-	0.4824E-03	SO4--	0.2099E-03	CL-	0.5080E-04	CA++	0.2426E-03
CAOH+	0.1611E-09	CACO3O	0.4460E-07	CAHCO3	0.5812E-06	CASO4O	0.6254E-05	MG++	0.9612E-04	MGOH++	0.3814E-09
MGCO3O	0.1196E-07	MGHCO3	0.4151E-06	MGSO4O	0.2161E-05	NA+	0.3607E-03	NACO3-	0.5064E-09	NAHCO3	0.8988E-07
NASO4-	0.2965E-06	NACLO	0.4205E-09	K+	0.4856E-04	KSO4-	0.4281E-07	KCLO	0.5884E-10	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1440E-05	LIOHO	0.4371E-13	LISO4-	0.1114E-08
H4SIO4	0.2827E-03	H3SIO4	0.1853E-06	H2SIO4	0.5567E-12	AL+++	0.5707E-10	ALOH++	0.1283E-08	ALOH2+	0.8349E-07
ALOH4-	0.1401E-05	ALSO4+	0.9004E-11	ALSO42	0.1161E-12	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.6879E-07	H2SO4O	0.2531E-19	HSO4-	0.7213E-09
HCLO	0.3189E-18	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1838E-05
H2BO3-	0.1174E-07	H2CO3*	0.9659E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	7.47	CO3--	6.69	HCO3-	3.33	SO4--	3.75	CL-	4.31	CA++	3.69	CAOH+	9.81
CACO3O	7.35	CAHCO3	6.25	CASO4O	5.20	MG++	4.09	MGOH+	9.44	MGCO3O	7.92	MGHCO3	6.40
MGSO4O	5.67	NA+	3.46	NACO3-	9.31	NAHCO3	7.05	NASO4-	6.55	NACLO	9.38	K+	4.33
KSO4-	7.39	KCLO	10.23	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	5.86
LIOHO	13.36	LISO4-	8.97	H4SIO4	3.55	H3SIO4	6.75	H2SIO4	12.33	AL+++	10.40	ALOH++	8.97
ALOH2+	7.10	ALOH4-	5.87	ALSO4+	11.06	ALSO42	12.95	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	7.18	H2SO4O	19.60	HSO4-	9.16	HCLO	18.50	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	5.74	H2BO3-	7.95	H2CO3	4.01	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	1.21	ALBITE	-0.72	ANHYDRIT	-3.07	ANORTHIT	-2.35	ARAGONIT	-2.31	BARITE	-99.99	BOEHMITE	1.19
BRUCITE	-7.57	CALCITE	-1.98	CA-MONT	6.14	CELESTIT	-99.99	CHALCEDN	0.20	CHLORITE	-9.29	DOLOMITE	-4.54
GIBBSITE	0.67	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.81	HALITE	-9.31	HALLOYST	1.79	HEMATITE	-99.99
HUNTITE	-13.45	HYDTOMAG	-14.77	ILLITE	4.80	KAOLINIT	6.09	K-MICA	5.43	MACKINAW	-99.99	MAGNESIT	-2.84
MAGNETIT	-99.99	MIRABILT	-8.64	MESQUEHO	-5.79	PHLOGOPT	-14.38	PYRITE	-99.99	PYROPHYL	2.13	QUARTZ	0.76
SIDERITE	-99.99	STRONTNT	-99.99	TALC	-6.78	THENARDT	-10.52	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.55	QUARTZ	0.72	CHALCEDONY	0.28	A-CRISTOBALITE	-0.01	AMORPHOUS	-1.10

SAMPLE NUMBER 23

TITLE [illegible]33 LOCATION D-08-26-20DBBD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1722E-03	MGTOT	0.2100E-05	NATOT	0.1479E-01	KTOT	0.5370E-04	CLTOT	0.7560E-02	ALK	0.7900E-03
SO4TOT	0.2446E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1297E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3328E-03	BTOT	0.5180E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.44 PE = 99.99 TEMP = 35.10DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.76 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01658 TOTAL DISS SOLIDS = 0.92GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.7385E-03
ION BALANCE ERROR = 7.37PERCENT CATION EXCESS = 0.2081E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.6616E-05	CO3--	0.1591E-04	HCO3-	0.7068E-03	SO4--	0.2307E-02	CL-	0.7565E-02	CA++	0.1434E-03
CAOH+	0.1523E-07	CACO3O	0.1544E-05	CAHCO3	0.8640E-06	CASO4O	0.2653E-04	MG++	0.1798E-05	MGOH++	0.1321E-08
MGCO3O	0.1176E-07	MGHCO3	0.9723E-08	MGSO4O	0.2816E-06	NA+	0.1468E-01	NACO3-	0.4277E-05	NAHCO3	0.4508E-05
NASO4-	0.1131E-03	NACLO	0.2128E-05	K+	0.5313E-04	KSO4-	0.6085E-06	KCLO	0.7971E-08	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1290E-03	LIOHO	0.1362E-08	LISO4-	0.7840E-06
H4SIO4	0.3142E-03	H3SIO4	0.1889E-04	H2SIO4	0.4690E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4059E-08	H2SO4O	0.3164E-20	HSO4-	0.7393E-09
HCLO	0.5329E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4244E-04
H2BO3-	0.9412E-05	H2CO3*	0.4584E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.24	CO3--	5.02	HCO3-	3.21	SO4--	2.86	CL-	2.18	CA++	4.06	CAOH+	7.87
CACO3O	5.81	CAHCO3	6.12	CASO4O	4.57	MG++	5.96	MGOH+	8.93	MGCO3O	7.93	MGHCO3	8.07
MGSO4O	6.55	NA+	1.89	NACO3-	5.42	NAHCO3	5.34	NASO4-	4.00	NACLO	5.67	K+	4.33
KSO4-	6.27	KCLO	8.10	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.94
LIOHO	8.86	LISO4-	6.16	H4SIO4	3.50	H3SIO4	4.78	H2SIO4	7.55	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.44	H2SO4O	20.50	HSO4-	9.19	HCLO	16.27	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.37	H2BO3-	5.09	H2CO3	5.34	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.28	ANORTHIT	-99.99	ARAGONIT	-0.79	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-5.04	CALCITE	-0.53	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.09	CHLORITE	-99.99	DOLOMITE	-2.83
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.30	HALITE	-5.67	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-10.87	HYDTOMAG	-10.93	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-2.59
MAGNETIT	-99.99	MIRABILT	-5.98	NESQUEHO	-5.66	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.35
SIDERITE	-99.99	STRONTNT	-99.99	TALC	-2.10	THENARDT	-6.44	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.50	QUARTZ	0.34	CHALCEDONY	-0.04	A-CRISTOBALITE	-0.30	AMORPHOUS	-1.36

SAMPLE NUMBER 24

TITLE 0[illegible]3 LOCATION 0-08-26-20D8CB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.4940E-03	MGTOT	0.7800E-05	NATOT	0.1783E-01	KTOT	0.7420E-04	CLTOT	0.1250E-01	ALK	0.1390E-02
SO4TOT	0.2602E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1297E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2995E-03	BTOT	0.4163E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.53 PE = 99.99 TEMP = 38.70DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.60 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02161 TOTAL DISS SOLIDS = 1.23GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1292E-02
ION BALANCE ERROR = -0.13PERCENT CATION EXCESS =-0.4956E-04(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1065E-04	CO3--	0.3702E-04	HCO3-	0.1212E-02	SO4--	0.2396E-02	CL-	0.1251E-01	CA++	0.4086E-03
CAOH+	0.6709E-07	CACO3O	0.1013E-04	CAHCO3	0.4437E-05	CASO4O	0.7138E-04	MG++	0.6663E-05	MGOH++	0.7740E-08
MGCO3O	0.9523E-07	MGHCO3	0.6003E-07	MGSO4O	0.9841E-06	NA+	0.1769E-01	NACO3-	0.1336E-04	NAHCO3	0.9027E-05
NASO4-	0.1357E-03	NACLO	0.4099E-05	K+	0.7341E-04	KSO4-	0.8676E-06	KCLO	0.1758E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1291E-03	LIOHO	0.2324E-08	LISO4-	0.7662E-06
H4SIO4	0.2756E-03	H3SIO4	0.2430E-04	H2SIO4	0.1112E-06	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3338E-08	H2SO4O	0.2460E-20	HSO4-	0.6612E-09
HCLO	0.9990E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3212E-04
H2BO3-	0.9559E-05	H2CO3*	0.6153E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.04	CO3--	4.68	HCO3-	2.98	SO4--	2.87	CL-	1.97	CA++	3.63	CAOH+	7.23
CACO3O	4.99	CAHCO3	5.41	CASO4O	4.14	MG++	5.41	MGOH+	8.17	MGCO3O	7.02	MGHCO3	7.29
MGSO4O	6.00	NA+	1.81	NACO3-	4.94	NAHCO3	5.04	NASO4-	3.93	NACLO	5.39	K+	4.20
KSO4-	6.12	KCLO	7.75	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.95
LIOHO	8.63	LISO4-	6.18	H4SIO4	3.56	H3SIO4	4.68	H2SIO4	7.20	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.53	H2SO4O	20.61	HSO4-	9.24	HCLO	16.00	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.49	H2BO3-	5.10	H2CO3	5.21	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-1.83	ANORTHIT	-99.99	ARAGONIT	0.00	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.11	CALCITE	0.27	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.18	CHLORITE	-99.99	DOLOMITE	-1.11
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.87	HALITE	-5.39	HALLUYST	-99.99	HEMATITE	-99.99
HUNTITE	-7.24	HYDTOMAG	-7.12	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-1.65
MAGNETIT	-99.99	MIRABILT	-6.00	NESQUEHO	-4.73	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.25
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.14	THENARDT	-6.30	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.56	QUARTZ	0.23	CHALCEDONY	-0.14	A-CRISTOBALITE	-0.39	AMORPHOUS	-1.45

SAMPLE NUMBER 25

TITLE [illegible]83 LOCATION D-08-26-20DBCA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.4740E-03	MGTOT	0.1070E-04	NATOT	0.1609E-01	KTOT	0.1636E-03	CLTOT	0.1036E-01	ALK	0.7300E-03
SO4TOT	0.2811E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1441E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3994E-03	BTOT	0.5088E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.39 PE = 99.99 TEMP = 36.50DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.75 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01977 TOTAL DISS SOLIDS = 1.10GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.6755E-03
ION BALANCE ERROR = 1.91PERCENT CATION EXCESS = 0.6412E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.6578E-05	CO3--	0.1356E-04	HCO3-	0.6432E-03	SO4--	0.2599E-02	CL-	0.1039E-01	CA++	0.3924E-03
CAOH+	0.4017E-07	CACO3D	0.3478E-05	CAHCO3	0.2161E-05	CASO4D	0.7642E-04	MG++	0.9111E-05	MGOH++	0.6513E-08
MGCO3D	0.4814E-07	MGHCO3	0.4372E-07	MGSO4D	0.1503E-05	NA+	0.1597E-01	NACO3-	0.4075E-05	NAHCO3	0.4372E-05
NASO4-	0.1342E-03	NACLO	0.3110E-05	K+	0.1617E-03	KSO4-	0.2048E-05	KCLO	0.3258E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1433E-03	LIOHO	0.1526E-08	LISO4-	0.9432E-06
H4SIO4	0.3780E-03	H3SIO4	0.2181E-04	H2SIO4	0.5719E-07	AL+++	0.1863E-18	ALOH++	0.7028E-15	ALOH2+	0.4064E-11
ALOH4-	0.3719E-06	ALSO4+	0.2016E-18	ALSO42	0.2522E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4588E-08	H2SO4O	0.4639E-20	HSO4-	0.9445E-09
HCLO	0.9313E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4225E-04
H2BO3-	0.8690E-05	H2CO3*	0.4590E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.24	CO3--	5.10	HCO3-	3.25	SO4--	2.82	CL-	2.05	CA++	3.64	CAOH+	7.45
CACO3O	5.46	CAHCO3	5.72	CASO4O	4.11	MG++	5.27	MGOH+	8.24	MGCO3O	7.32	MGHCO3	7.42
MGSO4O	5.82	NA+	1.86	NACO3-	5.45	NAHCO3	5.36	NASO4-	3.93	NACLO	5.51	K+	3.85
KSO4-	5.75	KCLO	7.49	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.90
LIOHO	8.81	LISO4-	6.08	H4SIO4	3.42	H3SIO4	4.72	H2SIO4	7.48	AL+++	19.19	ALOH++	15.39
ALOH2+	11.45	ALOH4-	6.49	ALSO4+	18.76	ALSO42	19.66	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.39	H2SO4O	20.33	HSO4-	9.09	HCLO	16.03	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.37	H2BO3-	5.13	H2CO3	5.34	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.87	ALBITE	-1.31	ANHYDRIT	-1.81	ANORTHIT	-4.61	ARAGONIT	-0.45	BARITE	-99.99	BOEHMITE	-1.84
BRUCITE	-4.37	CALCITE	-0.18	CA-MONT	-1.66	CELESTIT	-99.99	CHALCEDN	-0.02	CHLORITE	-2.43	DOLOMITE	-1.87
GIBBSITE	-2.55	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.84	HALITE	-5.51	HALLOYST	-5.00	HEMATITE	-99.99
HUNTITE	-8.65	HYDTOMAG	-8.36	ILLITE	-1.77	KAOLINIT	-1.03	K-MICA	-3.12	MACKINAW	-99.99	MAGNESIT	-1.96
MAGNETIT	-99.99	MIRABILT	-5.94	NESQUEHO	-5.04	PHLOGOPT	-4.35	PYRITE	-99.99	PYROPHYL	-1.01	QUARTZ	0.42
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.10	THENARDT	-6.34	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.42	QUARTZ	0.40	CHALCEDONY	0.03	A-CRISTOBALITE	-0.23	AMORPHOUS	-1.29

SAMPLE NUMBER 26

TITLE 02[illegible] LOCATION D-08-26-20ACDB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.6986E-03	MGTOT	0.9500E-05	NATOT	0.1849E-01	KTOT	0.1355E-03	CLTOT	0.1337E-01	ALK	0.5100E-03
SO4TOT	0.3019E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1729E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3661E-03	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.56 PE = 99.99 TEMP = 33.70DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.13 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02304 TOTAL DISS SOLIDS = 1.28GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4458E-03
ION BALANCE ERROR = 0.75PERCENT CATION EXCESS = 0.2943E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.8054E-05	CO3--	0.1277E-04	HCO3-	0.4179E-03	SO4--	0.2753E-02	CL-	0.1338E-01	CA++	0.5830E-03
CAOH+	0.6952E-07	CACO3O	0.4207E-05	CAHCO3	0.1856E-05	CASO4O	0.1104E-03	MG++	0.8134E-05	MGOH++	0.6678E-08
MGCO3O	0.3649E-07	MGHCO3	0.2417E-07	MGSO4O	0.1311E-05	NA+	0.1834E-01	NACO3-	0.3744E-05	NAHCO3	0.3210E-05
NASO4-	0.1555E-03	NACLO	0.4523E-05	K+	0.1340E-03	KSO4-	0.1661E-05	KCLO	0.3413E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1720E-03	LIOHO	0.2052E-08	LISO4-	0.1162E-05
H4SIO4	0.3407E-03	H3SIO4	0.2587E-04	H2SIO4	0.7697E-07	AL+++	0.7829E-19	ALOH++	0.3403E-15	ALOH2+	0.2403E-11
ALOH4-	0.3720E-06	ALSO4+	0.8030E-19	ALSO42	0.1019E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3120E-08	H2SO4O	0.1874E-20	HSO4-	0.6094E-09
HCLO	0.6094E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3580E-04
H2BO3-	0.1051E-04	H2CO3*	0.2039E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.16	CO3--	5.14	HCO3-	3.44	SO4--	2.81	CL-	1.94	CA++	3.48	CAOH+	7.22
CACO3O	5.37	CAHCO3	5.79	CASO4O	3.95	MG++	5.33	MGOH+	8.23	MGCO3O	7.44	MGHCO3	7.68
MGSO4O	5.88	NA+	1.80	NACO3-	5.49	NAHCO3	5.49	NASO4-	3.87	NACLO	5.34	K+	3.94
KSO4-	5.84	KCLO	7.46	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.83
LIOHO	8.69	LISO4-	6.00	H4SIO4	3.47	H3SIO4	4.65	H2SIO4	7.36	AL+++	19.59	ALOH++	15.72
ALOH2+	11.68	ALOH4-	6.49	ALSO4+	19.16	ALSO42	20.06	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.56	H2SO4O	20.72	HSO4-	9.28	HCLO	16.21	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.44	H2BO3-	5.06	H2CO3	5.69	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.90	ALBITE	-1.23	ANHYDRIT	-1.67	ANORTHIT	-4.43	ARAGONIT	-0.35	BARITE	-99.99	BOEHMITE	-1.91
BRUCITE	-4.26	CALCITE	-0.09	CA-MONT	-1.77	CELESTIT	-99.99	CHALCEDN	-0.04	CHLORITE	-1.86	DOLOMITE	-1.90
GIBBSITE	-2.61	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.68	HALITE	-5.34	HALLOYST	-5.14	HEMATITE	-99.99
HUNTITE	-9.00	HYDTOMAG	-8.72	ILLITE	-1.86	KAOLINIT	-1.15	K-MICA	-3.25	MACKINAW	-99.99	MAGNESIT	-2.11
MAGNETIT	-99.99	MIRABILT	-5.70	MESQUEHO	-5.17	PHLOGOPT	-4.26	PYRITE	-99.99	PYROPHYL	-1.54	QUARTZ	0.41
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.53	THENARDT	-6.22	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.47	QUARTZ	0.39	CHALCEDONY	0.01	A-CRISTOBALITE	-0.24	AMORPHOUS	-1.31

SAMPLE NUMBER 27

TITLE [illegible]3 LOCATION D-08-26-20ACD8

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.5489E-03	MGTOT	0.8200E-05	NATOT	0.1936E-01	KTOT	0.1278E-03	CLTOT	0.1199E-01	ALK	0.7300E-03
SO4TOT	0.3644E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1873E-03
NO3TOT	0.0000E+00	SIO2TOT	0.4326E-03	BTOT	0.6938E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.82 PE = 99.99 TEMP = 38.00DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.27 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02379 TOTAL DISS SOLIDS = 1.32GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5713E-03
ION BALANCE ERROR = 1.96PERCENT CATION EXCESS = 0.7827E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9994

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1990E-04	CO3--	0.3074E-04	HCO3-	0.5133E-03	SO4--	0.3342E-02	CL-	0.1200E-01	CA++	0.4376E-03
CAOH+	0.1308E-06	CACO3O	0.8449E-05	CAHCO3	0.1928E-05	CASO4O	0.1016E-03	MG++	0.6765E-05	MGOH++	0.1426E-07
MGCO3O	0.7624E-07	MGHCO3	0.2519E-07	MGSO4O	0.1330E-05	NA+	0.1916E-01	NACO3-	0.1139E-04	NAHCO3	0.4093E-05
NASO4-	0.1997E-03	NACLO	0.4208E-05	K+	0.1259E-03	KSO4-	0.2007E-05	KCLO	0.2857E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1860E-03	LIOHO	0.6080E-08	LISO4-	0.1508E-05
H4SIO4	0.3709E-03	H3SIO4	0.6228E-04	H2SIO4	0.5265E-06	AL+++	0.2679E-20	ALOH++	0.2971E-16	ALOH2+	0.4895E-12
ALOH4-	0.3720E-06	ALSO4+	0.3408E-20	ALSO42	0.5280E-21	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1719E-08	H2SO4O	0.8512E-21	HSO4-	0.4561E-09
HCLO	0.4564E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4401E-04
H2BO3-	0.2546E-04	H2CO3*	0.1333E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.77	CO3--	4.77	HCO3-	3.35	SO4--	2.73	CL-	1.99	CA++	3.61	CAOH+	6.95
CACO3O	5.07	CAHCO3	5.78	CASO4O	3.99	MG++	5.42	MGOH+	7.91	MGCO3O	7.12	MGHCO3	7.67
MGSO4O	5.87	NA+	1.78	NACO3-	5.01	NAHCO3	5.39	NASO4-	3.76	NACLO	5.37	K+	3.97
KSO4-	5.76	KCLO	7.54	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.79
LIOHO	8.21	LISO4-	5.89	H4SIO4	3.43	H3SIO4	4.27	H2SIO4	6.53	AL+++	21.07	ALOH++	16.78
ALOH2+	12.37	ALOH4-	6.50	ALSO4+	20.53	ALSO42	21.34	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.82	H2SO4O	21.07	HSO4-	9.41	HCLO	16.34	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.35	H2BO3-	4.67	H2CO3	5.87	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.12	ALBITE	-1.35	ANHYDRIT	-1.68	ANORTHIT	-4.66	ARAGONIT	-0.07	BARITE	-99.99	BOEHMITE	-2.33
BRUCITE	-3.57	CALCITE	0.20	CA-MONT	-2.75	CELESTIT	-99.99	CHALCEDN	-0.05	CHLORITE	0.42	DOLOMITE	-1.28
GIBBSITE	-3.05	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.72	HALITE	-5.38	HALLOYST	-6.03	HEMATITE	-99.99
HUNTITE	-7.62	HYDTOMAG	-6.90	ILLITE	-2.62	KAOLINIT	-2.08	K-MICA	-4.36	MACKINAW	-99.99	MAGNESIT	-1.75
MAGNETIT	-99.99	MIRABILT	-5.77	NESQUEHO	-4.93	PHLOGOPT	-2.08	PYRITE	-99.99	PYROPHYL	-1.91	QUARTZ	0.39
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.33	THENARDT	-6.10	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.43	QUARTZ	0.37	CHALCEDONY	0.00	A-CRISTOBALITE	-0.25	AMORPHOUS	-1.31

SAMPLE NUMBER 28

TITLE [illegible]83 LOCATION D-08-26-20ADBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1647E-03	MGTOT	0.6170E-04	NATOT	0.1131E-01	KTOT	0.1278E-03	CLTOT	0.5134E-02	ALK	0.2910E-02
SO4TOT	0.1041E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3891E-04
NO3TOT	0.0000E+00	SIO2TOT	0.2829E-03	BTOT	0.6012E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.45 PE = 99.99 TEMP = 24.80DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.24 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01217 TOTAL DISS SOLIDS = 0.75GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.2844E-02
ION BALANCE ERROR = 8.27PERCENT CATION EXCESS = 0.1807E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3127E-05	CO3--	0.4990E-04	HCO3-	0.2745E-02	SO4--	0.9875E-03	CL-	0.5137E-02	CA++	0.1457E-03
CAOH+	0.7343E-08	CACO3O	0.4309E-05	CAHCO3	0.2663E-05	CASO4O	0.1218E-04	MG++	0.5548E-04	MGOH++	0.1829E-07
MGCO3O	0.1113E-05	MGHCO3	0.1161E-05	MGSO4O	0.3972E-05	NA+	0.1126E-01	NACO3-	0.6669E-05	NAHCO3	0.1392E-04
NASO4-	0.3745E-04	NACLO	0.1151E-05	K+	0.1273E-03	KSO4-	0.5638E-06	KCLO	0.1349E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3883E-04	LIOHO	0.1530E-09	LISO4-	0.1082E-06
H4SIO4	0.2730E-03	H3SIO4	0.1007E-04	H2SIO4	0.7825E-08	AL+++	0.3025E-17	ALOH++	0.5366E-14	ALOH2+	0.1870E-10
ALOH4-	0.7435E-06	ALSO4+	0.1413E-17	ALSO42	0.7137E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3912E-08	H2SO4O	0.7899E-21	HSO4-	0.2435E-09
HCLO	0.1261E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.5081E-04
H2BO3-	0.9353E-05	H2CO3*	0.1961E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.55	CO3--	4.49	HCO3-	2.61	SO4--	3.20	CL-	2.34	CA++	4.02	CAOH+	8.18
CACO3O	5.36	CAHCO3	5.62	CASO4O	4.91	MG++	4.44	MGOH+	7.78	MGCO3O	5.95	MGHCO3	5.98
MGSO4O	5.40	NA+	2.00	NACO3-	5.22	NAHCO3	4.86	NASO4-	4.47	NACLO	5.94	K+	3.94
KSO4-	6.30	KCLO	7.87	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.46
LIOHO	9.81	LISO4-	7.01	H4SIO4	3.56	H3SIO4	5.05	H2SIO4	8.29	AL+++	17.90	ALOH++	14.46
ALOH2+	10.78	ALOH4-	6.18	ALSO4+	17.90	ALSO42	19.19	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.45	H2SO4O	21.10	HSO4-	9.66	HCLO	16.90	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.29	H2BO3-	5.09	H2CO3	4.71	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.22	ALBITE	-0.85	ANHYDRIT	-2.68	ANORTHIT	-4.16	ARAGONIT	-0.30	BARITE	-99.99	BOEHMITE	-1.15
BRUCITE	-4.14	CALCITE	-0.04	CA-MONT	-0.02	CELESTIT	-99.99	CHALCEDN	-0.04	CHLORITE	0.95	DOLOMITE	-0.43
GIBBSITE	-1.79	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.62	HALITE	-5.92	HALLOYST	-3.54	HEMATITE	-99.99
HUNTITE	-4.81	HYDTOMAG	-4.54	ILLITE	0.05	KAOLINIT	0.56	K-MICA	-0.94	MACKINAW	-99.99	MAGNESIT	-0.69
MAGNETIT	-99.99	MIRABILT	-6.07	MESQUEHO	-3.72	PHLOGOPT	-3.93	PYRITE	-99.99	PYROPHYL	-1.07	QUARTZ	0.45
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.41	THENARDT	-7.01	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.56	QUARTZ	0.42	CHALCEDONY	0.02	A-CRISTOBALITE	-0.25	AMORPHOUS	-1.32

SAMPLE NUMBER 29

TITLE 0[illegible]3 LOCATION D-08-26-20ADCC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1697E-03	MGTOT	0.4940E-04	NATOT	0.1109E-01	KTOT	0.1330E-03	CLTOT	0.4993E-02	ALK	0.2590E-02
SO4TOT	0.1738E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3747E-04
NO3TOT	0.0000E+00	SIO2TOT	0.2995E-03	BTOT	0.4070E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.43 PE = 99.99 TEMP = 26.50DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.26 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01313 TOTAL DISS SOLIDS = 0.79GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.2534E-02
ION BALANCE ERROR = 2.85PERCENT CATION EXCESS = 0.6415E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3408E-05	CO3--	0.4444E-04	HCO3-	0.2445E-02	SO4--	0.1653E-02	CL-	0.4996E-02	CA++	0.1438E-03
CAOH+	0.7865E-08	CACO3O	0.3821E-05	CAHCO3	0.2429E-05	CASO4O	0.1979E-04	MG++	0.4283E-04	MGOH++	0.1546E-07
MGCO3O	0.7616E-06	MGHCO3	0.7951E-06	MGSO4O	0.5037E-05	NA+	0.1102E-01	NACO3-	0.6234E-05	NAHCO3	0.1204E-04
NASO4-	0.6103E-04	NACLO	0.1087E-05	K+	0.1321E-03	KSO4-	0.9922E-06	KCLO	0.1349E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3733E-04	LIOHO	0.1665E-09	LISO4-	0.1714E-06
H4SIO4	0.2886E-03	H3SIO4	0.1112E-04	H2SIO4	0.1017E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4109E-08	H2SO4O	0.1570E-20	HSO4-	0.4423E-09
HCLO	0.1528E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3445E-04
H2BO3-	0.6282E-05	H2CO3*	0.1784E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.52	CO3--	4.55	HCO3-	2.66	SO4--	2.98	CL-	2.35	CA++	4.04	CAOH+	8.15
CACO3O	5.42	CAHCO3	5.66	CASO4O	4.70	MG++	4.56	MGOH+	7.86	MGCO3O	6.12	MGHCO3	6.15
MGSO4O	5.30	NA+	2.01	NACO3-	5.25	NAHCO3	4.92	NASO4-	4.26	NACLO	5.96	K+	3.93
KSO4-	6.05	KCLO	7.87	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.48
LIOHO	9.78	LISO4-	6.82	H4SIO4	3.54	H3SIO4	5.00	H2SIO4	8.19	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.43	H2SO4O	20.80	HSO4-	9.40	HCLO	16.81	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.46	H2BO3-	5.26	H2CO3	4.75	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.45	ANORTHIT	-99.99	ARAGONIT	-0.36	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-4.19	CALCITE	-0.10	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.03	CHLORITE	-99.99	DOLOMITE	-0.64
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.41	HALITE	-5.95	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-5.30	HYDTOMAG	-5.00	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.84
MAGNETIT	-99.99	MIRABILT	-5.95	NESQUEHO	-3.88	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.44
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.18	THENARDT	-6.81	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.54	QUARTZ	0.42	CHALCEDONY	0.03	A-CRISTOBALITE	-0.24	AMORPHOUS	-1.31

SAMPLE NUMBER 30

TITLE 0[illegible]3 LOCATION D-08-26-18ABDD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.9480E-04	MGTOT	0.4900E-05	NATOT	0.1196E-01	KTOT	0.8440E-04	CLTOT	0.6347E-02	ALK	0.2080E-02
SO4TOT	0.1457E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.7205E-04
NO3TOT	0.0000E+00	SIO2TOT	0.4326E-03	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.92 PE = 99.99 TEMP = 37.20DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.85 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01329 TOTAL DISS SOLIDS = 0.80GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1820E-02
ION BALANCE ERROR = 4.18PERCENT CATION EXCESS = 0.9794E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2288E-04	CO3--	0.1128E-03	HCO3-	0.1658E-02	SO4--	0.1389E-02	CL-	0.6351E-02	CA++	0.7726E-04
CAOH+	0.3004E-07	CACO3O	0.6834E-05	CAHCO3	0.1215E-05	CASO4O	0.9532E-05	MG++	0.4184E-05	MGOH++	0.1137E-07
MGCO3O	0.2176E-06	MGHCO3	0.5605E-07	MGSO4O	0.4353E-06	NA+	0.1188E-01	NACO3-	0.2823E-04	NAHCO3	0.8748E-05
NASO4-	0.5824E-04	NACLO	0.1479E-05	K+	0.8383E-04	KSO4-	0.6254E-06	KCLO	0.1082E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.7183E-04	LIOHO	0.2829E-08	LISO4-	0.2742E-06
H4SIO4	0.3617E-03	H3SIO4	0.7121E-04	H2SIO4	0.6406E-06	AL+++	0.2129E-20	ALOH++	0.3064E-16	ALOH2+	0.6648E-12
ALOH4-	0.7436E-06	ALSO4+	0.1523E-20	ALSO42	0.1110E-21	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1333E-08	H2SO4O	0.2438E-21	HSO4-	0.1617E-09
HCLO	0.1843E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.2749E-04
H2BO3-	0.1879E-04	H2CO3*	0.3553E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.69	CO3--	4.15	HCO3-	2.83	SO4--	3.06	CL-	2.25	CA++	4.31	CAOH+	7.57
CACO3O	5.16	CAHCO3	5.96	CASO4O	5.02	MG++	5.57	MGOH+	7.99	MGCO3O	6.66	MGHCO3	7.30
MGSO4O	5.36	NA+	1.98	NACO3-	4.60	NAHCO3	5.06	NASO4-	4.28	NACLO	5.83	K+	4.13
KSO4-	6.25	KCLO	7.96	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.19
LIOHO	8.55	LISO4-	6.61	H4SIO4	3.44	H3SIO4	4.20	H2SIO4	6.39	AL+++	21.07	ALOH++	16.71
ALOH2+	12.23	ALOH4-	6.18	ALSO4+	20.87	ALSO42	22.01	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.92	H2SO4O	21.61	HSO4-	9.84	HCLO	16.73	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.56	H2BO3-	4.79	H2CO3	5.45	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.95	ALBITE	-1.22	ANHYDRIT	-2.72	ANORTHIT	-4.73	ARAGONIT	-0.16	BARITE	-99.99	BOEHMITE	-2.09
BRUCITE	-3.58	CALCITE	0.11	CA-MONT	-2.28	CELESTIT	-99.99	CHALCEDN	-0.05	CHLORITE	0.93	DOLOMITE	-0.92
GIBBSITE	-2.80	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.75	HALITE	-5.84	HALLOYST	-5.55	HEMATITE	-99.99
HUNTITE	-6.37	HYDTOMAG	-5.57	ILLITE	-2.09	KAOLINIT	-1.59	K-MICA	-3.69	MACKINAW	-99.99	MAGNESIT	-1.30
MAGNETIT	-99.99	MIRABILT	-6.45	NESQUEHO	-4.38	PHLOGOPT	-1.98	PYRITE	-99.99	PYROPHYL	-1.53	QUARTZ	0.39
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.35	THENARDT	-6.82	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.44	QUARTZ	0.37	CHALCEDONY	-0.00	A-CRISTOBALITE	-0.26	AMORPHOUS	-1.32

SAMPLE NUMBER 31

TITLE [illegible]83 LOCATION D-08-26-18ABDC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1023E-03	MGTOT	0.5800E-05	NATOT	0.1318E-01	KTOT	0.9970E-04	CLTOT	0.7391E-02	ALK	0.2420E-02
SO4TOT	0.1353E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.8647E-04
NO3TOT	0.0000E+00	SIO2TOT	0.3661E-03	BTOT	0.5550E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.71 PE = 99.99 TEMP = 38.90DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.54 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01439 TOTAL DISS SOLIDS = 0.87GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.2227E-02
ION BALANCE ERROR = 4.13PERCENT CATION EXCESS = 0.1068E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9996

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1595E-04	CO3--	0.9057E-04	HCO3-	0.2082E-02	SO4--	0.1285E-02	CL-	0.7396E-02	CA++	0.8498E-04
CAOH+	0.2287E-07	CACO3O	0.6157E-05	CAHCO3	0.1737E-05	CASO4O	0.9489E-05	MG++	0.5030E-05	MGOH++	0.9557E-08
MGCO3O	0.2056E-06	MGHCO3	0.8433E-07	MGSO4O	0.4729E-06	NA+	0.1309E-01	NACO3-	0.2659E-04	NAHCO3	0.1200E-04
NASO4-	0.5890E-04	NACLO	0.1882E-05	K+	0.9908E-04	KSO4-	0.6898E-06	KCLO	0.1475E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.8624E-04	LIOHO	0.2448E-08	LISO4-	0.2992E-06
H4SIO4	0.3239E-03	H3SIO4	0.4253E-04	H2SIO4	0.2824E-06	AL+++	0.1025E-19	ALOH++	0.1027E-15	ALOH2+	0.1500E-11
ALOH4-	0.7436E-06	ALSO4+	0.6620E-20	ALSO42	0.4414E-21	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.2169E-08	H2SO4O	0.6363E-21	HSO4-	0.2515E-09
HCLO	0.4082E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3866E-04
H2BO3-	0.1689E-04	H2CO3*	0.7137E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	4.85	CO3--	4.25	HCO3-	2.73	SO4--	3.10	CL-	2.19	CA++	4.28	CAOH+	7.69
CACO3O	5.21	CAHCO3	5.81	CASO4O	5.02	MG++	5.50	MGOH+	8.07	MGCO3O	6.68	MGHCO3	7.13
MGSO4O	6.32	NA+	1.94	NACO3-	4.63	NAHCO3	4.92	NASO4-	4.28	NACLO	5.72	K+	4.06
KSO4-	6.21	KCLO	7.83	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.11
LIOHO	8.61	LISO4-	6.58	H4SIO4	3.49	H3SIO4	4.43	H2SIO4	6.76	AL+++	20.41	ALOH++	16.20
ALOH2+	11.88	ALOH4-	6.18	ALSO4+	20.23	ALSO42	21.41	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.71	H2SO4O	21.19	HSO4-	9.65	HCLO	16.39	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.41	H2BO3-	4.84	H2CO3	5.15	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.14	ALBITE	-1.43	ANHYDRIT	-2.71	ANORTHIT	-4.86	ARAGONIT	-0.22	BARITE	-99.99	BOEHMITE	-1.94
BRUCITE	-3.82	CALCITE	0.06	CA-MONT	-2.26	CELESTIT	-99.99	CHALCEDN	-0.12	CHLORITE	-0.33	DOLOMITE	-0.99
GIBBSITE	-2.67	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.75	HALITE	-5.73	HALLUYST	-5.40	HEMATITE	-99.99
HUNTITE	-6.43	HYDTOMAG	-5.81	ILLITE	-2.16	KAOLINIT	-1.45	K-MICA	-3.61	MACKINAW	-99.99	MAGNESIT	-1.31
MAGNETIT	-99.99	MIRABILT	-6.48	NESQUEHO	-4.39	PHLOGOPT	-2.79	PYRITE	-99.99	PYROPHYL	-1.30	QUARTZ	0.31
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.25	THENARDT	-6.78	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.49	QUARTZ	0.30	CHALCEDONY	-0.07	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.38

SAMPLE NUMBER 32

TITLE [illegible]3 LOCATION D-08-26-17ABBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1347E-02	MGTOT	0.2632E-03	NATOT	0.4198E-01	KTOT	0.2608E-03	CLTOT	0.2866E-01	ALK	0.9300E-03
SO4TOT	0.8068E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.4467E-04
NO3TOT	0.0000E+00	SIO2TOT	0.3494E-03	BTOT	0.1480E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.51 PE = 99.99 TEMP = 39.00DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.82 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.05238 TOTAL DISS SOLIDS = 2.91GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.8037E-03
ION BALANCE ERROR = -0.25PERCENT CATION EXCESS =-0.2224E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9986

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1101E-04	CO3--	0.2516E-04	HCO3-	0.7282E-03	SO4--	0.6973E-02	CL-	0.2873E-01	CA++	0.1010E-02
CAOH+	0.1360E-06	CACO3O	0.1094E-04	CAHCO3	0.5310E-05	CASO4O	0.3249E-03	MG++	0.2051E-03	MGOH++	0.1978E-06
MGCO3O	0.1293E-05	MGHCO3	0.9119E-06	MGSO4O	0.5648E-04	NA+	0.4132E-01	NACO3-	0.1709E-04	NAHCO3	0.1122E-04
NASO4-	0.7291E-03	NACLO	0.1929E-04	K+	0.2546E-03	KSO4-	0.6885E-05	KCLO	0.1219E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.4419E-04	LIOHO	0.7288E-09	LISO4-	0.6075E-06
H4SIO4	0.3211E-03	H3SIO4	0.2928E-04	H2SIO4	0.1529E-06	AL+++	0.5023E-19	ALOH++	0.2570E-15	ALOH2+	0.1879E-11
ALOH4-	0.3726E-06	ALSO4+	0.8269E-19	ALSO42	0.2171E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3641E-08	H2SO4O	0.6237E-20	HSO4-	0.1705E-08
HCLO	0.2277E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1127E-03
H2BO3-	0.3573E-04	H2CO3*	0.3631E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.05	CO3--	4.94	HCO3-	3.22	SO4--	2.51	CL-	1.64	CA++	3.33	CAOH+	6.95
CACO3O	4.96	CAHCO3	5.36	CASO4O	3.48	MG++	4.02	MGOH+	6.78	MGCO3O	5.88	MGHCO3	6.13
MGSO4O	4.24	NA+	1.47	NACO3-	4.85	NAHCO3	4.94	NASO4-	3.22	NACLO	4.71	K+	3.69
KSO4-	5.25	KCLO	6.91	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.44
LIOHO	9.13	LISO4-	6.30	H4SIO4	3.49	H3SIO4	4.63	H2SIO4	7.16	AL+++	19.94	ALOH++	15.93
ALOH2+	11.81	ALOH4-	6.52	ALSO4+	19.17	ALSO42	19.75	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.51	H2SO4O	20.20	HSO4-	8.86	HCLO	15.64	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.94	H2BO3-	4.57	H2CO3	5.43	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.10	ALBITE	-1.29	ANHYDRIT	-1.17	ANORTHIT	-4.58	ARAGONIT	0.04	BARITE	-99.99	BOEHMITE	-2.08
BRUCITE	-2.74	CALCITE	0.31	CA-MONT	-2.47	CELESTIT	-99.99	CHALCEDN	-0.11	CHLORITE	4.82	DOLOMITE	0.06
GIBBSITE	-2.80	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.21	HALITE	-4.72	HALLOYST	-5.67	HEMATITE	-99.99
HUNTITE	-3.79	HYDTOMAG	-2.34	ILLITE	-2.10	KAOLINIT	-1.72	K-MICA	-3.85	MACKINAW	-99.99	MAGNESIT	-0.51
MAGNETIT	-99.99	MIRABILT	-4.96	NESQUEHO	-3.60	PHLOGOPT	0.50	PYRITE	-99.99	PYROPHYL	-1.57	QUARTZ	0.32
SIDERITE	-99.99	STRONTNT	-99.99	TALC	4.51	THENAROT	-5.25	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.49	QUARTZ	0.30	CHALCEDONY	-0.07	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.38

SAMPLE NUMBER 33

TITLE 83 LOCATION D-08-26-08DCAA

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1697E-03	MGTOT	0.1316E-03	NATOT	0.1483E-01	KTOT	0.1790E-03	CLTOT	0.6404E-02	ALK	0.4200E-02
SO4TOT	0.2321E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.6197E-04
NO3TOT	0.0000E+00	SIO2TOT	0.2995E-03	BTOT	0.1018E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.54 PE = 99.99 TEMP = 26.60DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.18 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01776 TOTAL DISS SOLIDS = 1.08GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4064E-02
ION BALANCE ERROR = 1.42PERCENT CATION EXCESS = 0.4310E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.4499E-05	CO3--	0.9535E-04	HCO3-	0.3889E-02	SO4--	0.2183E-02	CL-	0.6409E-02	CA++	0.1373E-03
CAOH+	0.9325E-08	CACO3O	0.6965E-05	CAHCO3	0.3486E-05	CASO4O	0.2213E-04	MG++	0.1097E-03	MGOH++	0.4931E-07
MGCO3O	0.3731E-05	MGHCO3	0.3068E-05	MGSO4O	0.1515E-04	NA+	0.1470E-01	NACO3-	0.1689E-04	NAHCO3	0.2476E-04
NASO4-	0.1012E-03	NACLO	0.1799E-05	K+	0.1775E-03	KSO4-	0.1657E-05	KCLO	0.2247E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.6168E-04	LIOHO	0.3527E-09	LISO4-	0.3524E-06
H4SIO4	0.2853E-03	H3SIO4	0.1449E-04	H2SIO4	0.1803E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3227E-08	H2SO4O	0.1181E-20	HSO4-	0.4346E-09
HCLO	0.1510E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.8213E-04
H2BO3-	0.1978E-04	H2CO3*	0.2165E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.41	CO3--	4.24	HCO3-	2.47	SO4--	2.89	CL-	2.25	CA++	4.08	CAOH+	8.08
CACO3O	5.16	CAHCO3	5.51	CASO4O	4.65	MG++	4.18	MGOH+	7.36	MGCO3O	5.43	MGHCO3	5.57
MGSO4O	4.82	NA+	1.89	NACO3-	4.83	NAHCO3	4.60	NASO4-	4.05	NACLO	5.74	K+	3.81
KSO4-	5.84	KCLO	7.65	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.26
LIOHO	9.45	LISO4-	6.51	H4SIO4	3.54	H3SIO4	4.90	H2SIO4	7.96	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.54	H2SO4O	20.93	HSO4-	9.42	HCLO	16.82	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.08	H2BO3-	4.77	H2CO3	4.66	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.41	ANORTHIT	-99.99	ARAGONIT	-0.10	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.58	CALCITE	0.16	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.04	CHLORITE	-99.99	DOLOMITE	0.31
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.36	HALITE	-5.73	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-2.96	HYDTOMAG	-2.32	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.15
MAGNETIT	-99.99	MIRABILT	-5.63	NESQUEHO	-3.19	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.44
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.98	THENARDT	-6.48	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.54	QUARTZ	0.41	CHALCEDONY	0.02	A-CRISTOBALITE	-0.25	AMORPHOUS	-1.31

SAMPLE NUMBER 34

TITLE 0[illegible]3 LOCATION D-08-26-08DCA0

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.3243E-03	MGTOT	0.2015E-03	NATOT	0.8700E-02	KTOT	0.1457E-03	CLTOT	0.3611E-02	ALK	0.2660E-02
SO4TOT	0.1666E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3315E-04
NO3TOT	0.0000E+00	SIO2TOT	0.3994E-03	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.36 PE = 99.99 TEMP = 25.10DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.19 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01162 TOTAL DISS SOLIDS = 0.70GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.2613E-02
ION BALANCE ERROR = 1.72PERCENT CATION EXCESS = 0.3286E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9997

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2594E-05	CO3--	0.3729E-04	HCO3-	0.2523E-02	SO4--	0.1562E-02	CL-	0.3613E-02	CA++	0.2763E-03
CAOH+	0.1168E-07	CACO3O	0.6250E-05	CAHCO3	0.4724E-05	CASO4O	0.3725E-04	MG++	0.1753E-03	MGOH++	0.4850E-07
MGCO3O	0.2681E-05	MGHCO3	0.3403E-05	MGSO4O	0.2022E-04	NA+	0.8646E-02	NACO3-	0.3916E-05	NAHCO3	0.9866E-05
NASO4-	0.4596E-04	NACLO	0.6244E-06	K+	0.1448E-03	KSO4-	0.1028E-05	KCLO	0.1084E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3303E-04	LIOHO	0.1093E-09	LISO4-	0.1468E-06
H4SIO4	0.3879E-03	H3SIO4	0.1178E-04	H2SIO4	0.7663E-08	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4805E-08	H2SO4O	0.1940E-20	HSO4-	0.4809E-09
HCLO	0.1129E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.4025E-04
H2BO3-	0.6037E-05	H2CO3*	0.2214E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.63	CO3--	4.61	HCO3-	2.64	SO4--	2.99	CL-	2.49	CA++	3.74	CAOH+	7.98
CACO3O	5.20	CAHCO3	5.37	CASO4O	4.43	MG++	3.94	MGOH+	7.36	MGCO3O	5.57	MGHCO3	5.52
MGSO4O	4.69	NA+	2.11	NACO3-	5.45	NAHCO3	5.00	NASO4-	4.38	NACLO	6.20	K+	3.89
KSO4-	6.03	KCLO	7.96	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	4.53
LIOHO	9.96	LISO4-	6.88	H4SIO4	3.41	H3SIO4	4.98	H2SIO4	8.30	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.36	H2SO4O	20.71	HSO4-	9.37	HCLO	16.95	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.39	H2BO3-	5.27	H2CO3	4.65	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.19	ANORTHIT	-99.99	ARAGONIT	-0.14	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.80	CALCITE	0.12	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.11	CHLORITE	-99.99	DOLOMITE	0.11
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.13	HALITE	-6.18	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-3.49	HYDTOMAG	-3.03	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.31
MAGNETIT	-99.99	MIRABILT	-6.11	NESQUEHO	-3.34	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.59
SIDERITE	-99.99	STRONTNT	-99.99	TALC	3.02	THENARDT	-7.04	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.41	QUARTZ	0.57	CHALCEDONY	0.17	A-CRISTOBALITE	-0.10	AMORPHOUS	-1.17

SAMPLE NUMBER 35

TITLE 0[illegible] LOCATION D-08-26-07080A

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.8733E-03	MGTOT	0.1890E-04	NATOT	0.3328E-01	KTOT	0.2097E-03	CLTOT	0.2437E-01	ALK	0.6800E-03
SO4TOT	0.4424E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2162E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3661E-03	BTOT	0.9250E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.45 PE = 99.99 TEMP = 41.30DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.87 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.03870 TOTAL DISS SOLIDS = 2.16GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.5900E-03
ION BALANCE ERROR = 2.34PERCENT CATION EXCESS = 0.1591E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9989

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1104E-04	CO3--	0.1594E-04	HCO3-	0.5440E-03	SO4--	0.3912E-02	CL-	0.2441E-01	CA++	0.7117E-03
CAOH+	0.1059E-06	CACO3O	0.6189E-05	CAHCO3	0.3252E-05	CASO4O	0.1539E-03	MG++	0.1587E-04	MGOH++	0.1706E-07
MGCO3O	0.7663E-07	MGHCO3	0.5749E-07	MGSO4O	0.2916E-05	NA+	0.3296E-01	NACO3-	0.1043E-04	NAHCO3	0.6981E-05
NASO4-	0.3596E-03	NACLO	0.1370E-04	K+	0.2065E-03	KSO4-	0.3551E-05	KCLO	0.8837E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2149E-03	LIOHO	0.3945E-08	LISO4-	0.1797E-05
H4SIO4	0.3380E-03	H3SIO4	0.2894E-04	H2SIO4	0.1567E-06	AL+++	0.4568E-19	ALOH++	0.2577E-15	ALOH2+	0.2002E-11
ALOH4-	0.3723E-06	ALSO4+	0.5228E-19	ALSO42	0.8444E-20	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4123E-08	H2SO4O	0.5685E-20	HSO4-	0.1252E-08
HCLO	0.2870E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7264E-04
H2BO3-	0.2006E-04	H2CO3*	0.3153E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.04	CO3--	5.10	HCO3-	3.34	SO4--	2.72	CL-	1.70	CA++	3.45	CAOH+	7.05
CACO3O	5.20	CAHCO3	5.56	CASO4O	3.81	MG++	5.10	MGOH+	7.84	MGCO3O	7.11	MGHCO3	7.32
MGSO4O	5.53	NA+	1.56	NACO3-	5.06	NAHCO3	5.15	NASO4-	3.52	NACLO	4.86	K+	3.77
KSO4-	5.53	KCLO	7.05	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.74
LIOHO	8.40	LISO4-	5.82	H4SIO4	3.47	H3SIO4	4.62	H2SIO4	7.11	AL+++	19.93	ALOH++	15.90
ALOH2+	11.79	ALOH4-	6.51	ALSO4+	19.36	ALSO42	20.15	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.45	H2SO4O	20.24	HSO4-	8.98	HCLO	15.54	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.13	H2BO3-	4.80	H2CO3	5.50	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.28	ALBITE	-1.45	ANHYDRIT	-1.48	ANORTHIT	-4.74	ARAGONIT	-0.23	BARITE	-99.99	BOEHMITE	-2.09
BRUCITE	-3.80	CALCITE	0.05	CA-MONT	-2.59	CELESTIT	-99.99	CHALCEDN	-0.12	CHLORITE	-0.70	DOLOMITE	-1.42
GIBBSITE	-2.83	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.54	HALITE	-4.87	HALLOYST	-5.73	HEMATITE	-99.99
HUNTITE	-7.67	HYDTOMAG	-6.99	ILLITE	-2.54	KAOLINIT	-1.81	K-MICA	-4.08	MACKINAW	-99.99	MAGNESIT	-1.73
MAGNETIT	-99.99	MIRABILT	-5.46	NESQUEHO	-4.82	PHLOGOPT	-2.68	PYRITE	-99.99	PYROPHYL	-1.35	QUARTZ	0.30
SIDERITE	-99.99	STRONTNT	-99.99	TALC	1.18	THENARDT	-5.64	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.47	QUARTZ	0.29	CHALCEDONY	-0.08	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.38

SAMPLE NUMBER 36

TITLE 0[illegible]3 LOCATION 0-08-26-08BDCC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.7984E-03	MGTOT	0.1727E-03	NATOT	0.4415E-01	KTOT	0.2736E-03	CLTOT	0.3035E-01	ALK	0.2130E-02
SO4TOT	0.7027E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2306E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3328E-03	BTOT	0.1850E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.52 PE = 99.99 TEMP = 39.10DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.45 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.05243 TOTAL DISS SOLIDS = 2.97GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1931E-02
ION BALANCE ERROR = 0.07PERCENT CATION EXCESS = 0.6280E-04(CHARGE*MOLES) H2O ACTIVITY = 0.9986

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1143E-04	CO3--	0.6239E-04	HCO3-	0.1759E-02	SO4--	0.6155E-02	CL-	0.3042E-01	CA++	0.6048E-03
CAOH+	0.8459E-07	CACO3O	0.1634E-04	CAHCO3	0.7726E-05	CASO4O	0.1718E-03	MG++	0.1363E-03	MGOH++	0.1366E-06
MGCO3O	0.2136E-05	MGHCO3	0.1466E-05	MGSO4O	0.3315E-04	NA+	0.4351E-01	NACO3-	0.4500E-04	NAHCO3	0.2854E-04
NASO4-	0.6781E-03	NACLO	0.2150E-04	K+	0.2679E-03	KSO4-	0.6413E-05	KCLO	0.1358E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2285E-03	LIOHO	0.3929E-08	LISO4-	0.2771E-05
H4SIO4	0.3051E-03	H3SIO4	0.2871E-04	H2SIO4	0.1565E-06	AL+++	0.4382E-19	ALOH++	0.2330E-15	ALOH2+	0.1763E-11
ALOH4-	0.3726E-06	ALSO4+	0.6374E-19	ALSO42	0.1477E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3559E-08	H2SO4O	0.5309E-20	HSO4-	0.1479E-08
HCLO	0.2402E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1400E-03
H2BO3-	0.4557E-04	H2CO3*	0.8564E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.04	CO3--	4.55	HCO3-	2.84	SO4--	2.56	CL-	1.61	CA++	3.56	CAOH+	7.16
CACO3O	4.78	CAHCO3	5.19	CASO4O	3.76	MG++	4.19	MGOH+	6.94	MGCO3O	5.67	MGHCO3	5.93
MGSO4O	4.47	NA+	1.45	NACO3-	4.43	NAHCO3	4.54	NASO4-	3.25	NACLO	4.66	K+	3.67
KSO4-	5.28	KCLO	6.86	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.72
LIOHO	8.40	LISO4-	5.64	H4SIO4	3.51	H3SIO4	4.63	H2SIO4	7.15	AL+++	20.00	ALOH++	15.97
ALOH2+	11.84	ALOH4-	6.52	ALSO4+	19.29	ALSO42	19.92	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.52	H2SO4O	20.27	HSO4-	8.92	HCLO	15.61	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.85	H2BO3-	4.46	H2CO3	5.06	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.16	ALBITE	-1.35	ANHYDRIT	-1.45	ANORTHIT	-4.86	ARAGONIT	0.21	BARITE	-99.99	BOEHMITE	-2.09
BRUCITE	-2.89	CALCITE	0.48	CA-MONT	-2.64	CELESTIT	-99.99	CHALCEDN	-0.14	CHLORITE	3.97	DOLOMITE	0.45
GIBBSITE	-2.82	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.49	HALITE	-4.67	HALLOYST	-5.75	HEMATITE	-99.99
HUNTITE	-2.96	HYDTOMAG	-1.82	ILLITE	-2.24	KAOLINIT	-1.81	K-MICA	-3.94	MACKINAW	-99.99	MAGNESIT	-0.29
MAGNETIT	-99.99	MIRABILT	-4.98	NESQUEHO	-3.38	PHLOGOPT	0.02	PYRITE	-99.99	PYROPHYL	-1.68	QUARTZ	0.29
SIDERITE	-99.99	STRONTNT	-99.99	TALC	3.96	THENARDT	-5.26	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.51	QUARTZ	0.27	CHALCEDONY	-0.09	A-CRISTOBALITE	-0.35	AMORPHOUS	-1.40

SAMPLE NUMBER 37

TITLE [illegible]83 LOCATION D-07-07-02ADDC

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.9480E-04	MGTOT	0.2630E-04	NATOT	0.1422E-01	KTOT	0.1815E-03	CLTOT	0.5529E-02	ALK	0.4650E-02
SO4TOT	0.1718E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.0000E+00
NO3TOT	0.0000E+00	SIO2TOT	0.1248E-02	BTOT	0.4625E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.51 PE = 99.99 TEMP = 40.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.03 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.01579 TOTAL DISS SOLIDS = 1.06GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.4387E-02
ION BALANCE ERROR = 3.71PERCENT CATION EXCESS = 0.1035E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9995

INDIVIDUAL SPECIES MOLALITIES

OH-	0.1122E-04	CO3--	0.1185E-03	HCO3-	0.4169E-02	SO4--	0.1626E-02	CL-	0.5534E-02	CA++	0.7443E-04
CAOH+	0.1392E-07	CACO3O	0.7117E-05	CAHCO3	0.3126E-05	CASO4O	0.1021E-04	MG++	0.2188E-04	MGOH++	0.2916E-07
MGCO3O	0.1168E-05	MGHCO3	0.7291E-06	MGSO4O	0.2526E-05	NA+	0.1409E-01	NACO3-	0.3932E-04	NAHCO3	0.2560E-04
NASO4-	0.7926E-04	NACLO	0.1499E-05	K+	0.1801E-03	KSO4-	0.1591E-05	KCLO	0.1982E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.0000E+00	LIOHO	0.0000E+00	LISO4-	0.0000E+00
H4SIO4	0.1147E-02	H3SIO4	0.1019E-03	H2SIO4	0.5006E-06	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.3452E-08	H2SO4O	0.2140E-20	HSO4-	0.5190E-09
HCLO	0.5556E-16	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.3603E-04
H2BO3-	0.1027E-04	H2CO3*	0.2237E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.01	CO3--	4.14	HCO3-	2.43	SO4--	3.01	CL-	2.31	CA++	4.34	CAOH+	7.91
CACO3O	5.15	CAHCO3	5.56	CASO4O	4.99	MG++	4.87	MGOH+	7.59	MGCO3O	5.93	MGHCO3	6.19
MGSO4O	5.60	NA+	1.91	NACO3-	4.46	NAHCO3	4.59	NASO4-	4.15	NACLO	5.82	K+	3.80
KSO4-	5.85	KCLO	7.70	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	-99.99
LIOHO	-99.99	LISO4-	-99.99	H4SIO4	2.94	H3SIO4	4.05	H2SIO4	6.52	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.51	H2SO4O	20.67	HSO4-	9.34	HCLO	16.25	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.44	H2BO3-	5.05	H2CO3	4.65	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-2.67	ANORTHIT	-99.99	ARAGONIT	-0.16	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.51	CALCITE	0.11	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.42	CHLORITE	-99.99	DOLOMITE	-0.18
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-2.72	HALITE	-5.84	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-4.09	HYDTOMAG	-3.19	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.55
MAGNETIT	-99.99	MIRABILT	-6.39	NESQUEHO	-3.64	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.84
SIDERITE	-99.99	STRONTNT	-99.99	TALC	4.25	THENARDT	-6.62	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	2.94	QUARTZ	0.83	CHALCEDONY	0.46	A-CRISTOBALITE	0.21	AMORPHOUS	-0.84

SAMPLE NUMBER 38

TITLE 0[illegible]3 LOCATION D-08-26-18ADDB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.4491E-03	MGTOT	0.1650E-04	NATOT	0.2571E-01	KTOT	0.1841E-03	CLTOT	0.1828E-01	ALK	0.1330E-02
SO4TOT	0.2915E-02	ALTOT	0.7430E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1585E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3661E-03	BTOT	0.8325E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.28 PE = 99.99 TEMP = 41.40DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 3.35 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.02893 TOTAL DISS SOLIDS = 1.65GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1260E-02
ION BALANCE ERROR = 2.99PERCENT CATION EXCESS = 0.1547E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9992

INDIVIDUAL SPECIES MOLALITIES

OH-	0.7352E-05	CO3--	0.2239E-04	HCO3-	0.1192E-02	SO4--	0.2647E-02	CL-	0.1830E-01	CA++	0.3763E-03
CAOH+	0.4028E-07	CACO3O	0.5346E-05	CAHCO3	0.4067E-05	CASO4O	0.6408E-04	MG++	0.1423E-04	MGOH++	0.1098E-07
MGCO3O	0.1116E-06	MGHCO3	0.1207E-06	MGSO4O	0.2050E-05	NA+	0.2551E-01	NACO3-	0.1227E-04	NAHCO3	0.1233E-04
NASO4-	0.2036E-03	NACLO	0.8303E-05	K+	0.1820E-03	KSO4-	0.2297E-05	KCLO	0.6112E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1578E-03	LIOHO	0.2017E-08	LISO4-	0.9623E-06
H4SIO4	0.3470E-03	H3SIO4	0.1971E-04	H2SIO4	0.6913E-07	AL+++	0.3858E-18	ALOH++	0.1556E-14	ALOH2+	0.8686E-11
ALOH4-	0.7442E-06	ALSO4+	0.3573E-18	ALSO42	0.4218E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.6017E-08	H2SO4O	0.9152E-20	HSO4-	0.1330E-08
HCLO	0.3291E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7063E-04
H2BO3-	0.1276E-04	H2CO3*	0.1043E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.21	CO3--	4.92	HCO3-	2.99	SO4--	2.86	CL-	1.81	CA++	3.70	CAOH+	7.46
CACO3O	5.27	CAHCO3	5.46	CASO4O	4.19	MG++	5.11	MGOH+	8.03	MGCO3O	6.95	MGHCO3	6.99
MGSO4O	5.69	NA+	1.66	NACO3-	4.98	NAHCO3	4.91	NASO4-	3.76	NACLO	5.08	K+	3.81
KSO4-	5.71	KCLO	7.21	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.87
LIOHO	8.69	LISO4-	6.09	H4SIO4	3.46	H3SIO4	4.78	H2SIO4	7.43	AL+++	18.95	ALOH++	15.08
ALOH2+	11.13	ALOH4-	6.20	ALSO4+	18.52	ALSO42	19.45	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.28	H2SO4O	20.04	HSO4-	8.95	HCLO	15.48	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.15	H2BO3-	4.98	H2CO3	4.98	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-0.99	ALBITE	-1.22	ANHYDRIT	-1.86	ANORTHIT	-4.35	ARAGONIT	-0.30	BARITE	-99.99	BOEHMITE	-1.62
BRUCITE	-4.15	CALCITE	-0.02	CA-MONT	-1.55	CELESTIT	-99.99	CHALCEDN	-0.11	CHLORITE	-1.49	DOLOMITE	-1.33
GIBBSITE	-2.36	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.92	HALITE	-5.09	HALLOYST	-4.76	HEMATITE	-99.99
HUNTITE	-7.24	HYDTOMAG	-6.85	ILLITE	-1.64	KAOLINIT	-0.84	K-MICA	-2.84	MACKINAW	-99.99	MAGNESIT	-1.56
MAGNETIT	-99.99	MIRABILT	-5.80	NESQUEHO	-4.65	PHLOGOPT	-3.44	PYRITE	-99.99	PYROPHYL	-0.35	QUARTZ	0.31
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.15	THENARDT	-5.99	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.46	QUARTZ	0.29	CHALCEDONY	-0.07	A-CRISTOBALITE	-0.32	AMORPHOUS	-1.37

SAMPLE NUMBER 39

TITLE [illegible]33 LOCATION D-08-26-08ACCD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.2245E-02	MGTOT	0.1213E-02	NATOT	0.1153E+00	KTOT	0.5114E-03	CLTOT	0.8689E-01	ALK	0.4070E-02
SO4TOT	0.1718E-01	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.3747E-03
NO3TOT	0.0000E+00	SIO2TOT	0.2829E-03	BTOT	0.9250E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 7.99 PE = 99.99 TEMP = 31.10DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 2.69 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.13664 TOTAL DISS SOLIDS = 7.80GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3967E-02
ION BALANCE ERROR = -0.93PERCENT CATION EXCESS =-0.2249E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9961

INDIVIDUAL SPECIES MOLALITIES

OH-	0.2090E-05	CO3--	0.4129E-04	HCO3-	0.3635E-02	SO4--	0.1368E-01	CL-	0.8743E-01	CA++	0.1667E-02
CAOH+	0.3053E-07	CACO3O	0.1354E-04	CAHCO3	0.2648E-04	CASO4O	0.5558E-03	MG++	0.9279E-03	MGOH++	0.1190E-06
MGCO3O	0.5022E-05	MGHCO3	0.1565E-04	MGSO4O	0.2742E-03	NA+	0.1131E+00	NACO3-	0.4031E-04	NAHCO3	0.1311E-03
NASO4-	0.2776E-02	NACLO	0.1349E-03	K+	0.4979E-03	KSO4-	0.1696E-04	KCLO	0.5984E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.3702E-03	LIOHO	0.7981E-09	LISO4-	0.7474E-05
H4SIO4	0.2791E-03	H3SIO4	0.5997E-05	H2SIO4	0.5137E-08	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1262E-07	H2SO4O	0.6458E-19	HSO4-	0.7100E-08
HCLO	0.9555E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.8473E-03
H2BO3-	0.8495E-04	H2CO3*	0.5803E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.81	CO3--	4.84	HCO3-	2.55	SO4--	2.34	CL-	1.19	CA++	3.23	CAOH+	7.63
CACO3O	4.85	CAHCO3	4.69	CASO4O	3.24	MG++	3.46	MGOH+	7.03	MGCO3O	5.29	MGHCO3	4.93
MGSO4O	3.55	NA+	1.06	NACO3-	4.51	NAHCO3	3.87	NASO4-	2.67	NACLO	3.86	K+	3.43
KSO4-	4.89	KCLO	6.21	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.54
LIOHO	9.08	LISO4-	5.24	H4SIO4	3.54	H3SIO4	5.35	H2SIO4	8.75	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	7.99	H2SO4O	19.18	HSO4-	8.27	HCLO	15.01	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.06	H2BO3-	4.26	H2CO3	4.22	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-0.97	ANORTHIT	-99.99	ARAGONIT	0.19	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.69	CALCITE	0.44	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	-0.08	CHLORITE	-99.99	DOLOMITE	0.76
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-0.97	HALITE	-3.85	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-2.10	HYDTOMAG	-1.82	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	0.02
MAGNETIT	-99.99	MIRABILT	-3.65	NESQUEHO	-3.03	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.38
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.22	THENARDT	-4.28	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.54	QUARTZ	0.35	CHALCEDONY	-0.03	A-CRISTOBALITE	-0.29	AMORPHOUS	-1.36

SAMPLE NUMBER 40

TITLE 04 LOCATION D-08-26-078DBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.1597E-02	MGTOT	0.2180E-04	NATOT	0.3393E-01	KTOT	0.1253E-03	CLTOT	0.2646E-01	ALK	0.4400E-03
SO4TOT	0.5205E-02	ALTOT	0.3715E-06	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2450E-03
NO3TOT	0.0000E+00	SIO2TOT	0.3827E-03	BTOT	0.8788E-04	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 8.39 PF = 99.99 TEMP = 39.90DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 4.02 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.04226 TOTAL DISS SOLIDS = 2.34GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3708E-03
ION BALANCE ERROR = 0.31PERCENT CATION EXCESS = 0.2281E-03(CHARGE*MOLES) H2O ACTIVITY = 0.9988

INDIVIDUAL SPECIES MOLALITIES

OH-	0.8794E-05	CO3--	0.8680E-05	HCO3-	0.3410E-03	SO4--	0.4497E-02	CL-	0.2651E-01	CA++	0.1288E-02
CAOH+	0.1480E-06	CACO3O	0.5580E-05	CAHCO3	0.3460E-05	CASO4O	0.3031E-03	MG++	0.1812E-04	MGOH++	0.1494E-07
MGCO3O	0.4473E-07	MGHCO3	0.3994E-07	MGSO4O	0.3633E-05	NA+	0.3358E-01	NACO3-	0.5312E-05	NAHCO3	0.4406E-05
NASO4-	0.4084E-03	NACLO	0.1497E-04	K+	0.1232E-03	KSO4-	0.2327E-05	KCLO	0.5648E-07	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2433E-03	LIOHO	0.3396E-08	LISO4-	0.2288E-05
H4SIO4	0.3582E-03	H3SIO4	0.2537E-04	H2SIO4	0.1063E-06	AL+++	0.1120E-18	ALOH++	0.4866E-15	ALOH2+	0.2987E-11
ALOH4-	0.3724E-06	ALSO4+	0.1378E-18	ALSO42	0.2487E-19	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.4752E-08	H2SO4O	0.7836E-20	HSO4-	0.1560E-08
HCLO	0.3109E-15	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.7119E-04
H2BO3-	0.1690E-04	H2CO3*	0.2268E-05	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.14	CO3--	5.38	HCO3-	3.55	SO4--	2.67	CL-	1.66	CA++	3.20	CAOH+	6.91
CACO3O	5.25	CAHCO3	5.54	CASO4O	3.51	MG++	5.05	MGOH+	7.90	MGCO3O	7.35	MGHCO3	7.48
MGSO4O	5.44	NA+	1.56	NACO3-	5.35	NAHCO3	5.35	NASO4-	3.47	NACLO	4.82	K+	4.00
KSO4-	5.71	KCLO	7.24	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.69
LIOHO	8.46	LISO4-	5.72	H4SIO4	3.44	H3SIO4	4.68	H2SIO4	7.29	AL+++	19.55	ALOH++	15.63
ALOH2+	11.60	ALOH4-	6.51	ALSO4+	18.94	ALSO42	19.69	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	8.39	H2SO4O	20.10	HSO4-	8.89	HCLO	15.50	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	4.14	H2BO3-	4.88	H2CO3	5.64	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-1.33	ALBITE	-1.29	ANHYDRIT	-1.20	ANORTHIT	-4.39	ARAGONIT	-0.26	BARITE	-99.99	BOEHMITE	-1.99
BRUCITE	-3.95	CALCITE	0.01	CA-MONT	-2.16	CELESTIT	-99.99	CHALCEDN	-0.08	CHLORITE	-1.02	DOLOMITE	-1.70
GIBBSITE	-2.72	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.24	HALITE	-4.83	HALLOYST	-5.42	HEMATITE	-99.99
HUNTITE	-8.45	HYDTOMAG	-7.90	ILLITE	-2.34	KAOLINIT	-1.49	K-MICA	-3.91	MACKINAW	-99.99	MAGNESIT	-1.97
MAGNETIT	-99.99	MIRABILT	-5.34	NESQUEHO	-5.06	PHLOGOPT	-3.30	PYRITE	-99.99	PYROPHYL	-1.13	QUARTZ	0.35
SIDERITE	-99.99	STRONTNT	-99.99	TALC	0.95	THENARDT	-5.58	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	3.44	QUARTZ	0.33	CHALCEDONY	-0.03	A-CRISTOBALITE	-0.28	AMORPHOUS	-1.34

SAMPLE NUMBER 41

TITLE [illegible]183 LOCATION D-06-25-23BBAD

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.8234E-03	MGTOT	0.1851E-03	NATOT	0.4611E-01	KTOT	0.4807E-03	CLTOT	0.3436E-01	ALK	0.3080E-02
SO4TOT	0.5726E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.1873E-03
NO3TOT	0.0000E+00	SIO2TOT	0.1215E-02	BTOT	0.1202E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 7.94 PE = 99.99 TEMP = 39.60DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 2.66 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.05375 TOTAL DISS SOLIDS = 3.15GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.3043E-02
ION BALANCE ERROR = -0.10PERCENT CATION EXCESS =-0.9610E-04(CHARGE*MOLES) H2O ACTIVITY = 0.9984

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3117E-05	CO3--	0.2710E-04	HCO3-	0.2868E-02	SO4--	0.4982E-02	CL-	0.3444E-01	CA++	0.6556E-03
CAOH+	0.2489E-07	CACO3O	0.7698E-05	CAHCO3	0.1376E-04	CASO4O	0.1489E-03	MG++	0.1523E-03	MGOH++	0.4159E-07
MGCO3O	0.1029E-05	MGHCO3	0.2663E-05	MGSO4O	0.2962E-04	NA+	0.4559E-01	NACO3-	0.2079E-04	NAHCO3	0.4856E-04
NASO4-	0.5720E-03	NACLO	0.2539E-04	K+	0.4728E-03	KSO4-	0.9156E-05	KCLO	0.2700E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.1861E-03	LIOHO	0.8799E-09	LISO4-	0.1812E-05
H4SIO4	0.1189E-02	H3SIO4	0.3013E-04	H2SIO4	0.4558E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1355E-07	H2SO4O	0.6320E-19	HSO4-	0.4589E-08
HCLO	0.1082E-14	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1110E-03
H2BO3-	0.9622E-05	H2CO3*	0.5285E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.60	CO3--	4.91	HCO3-	2.63	SO4--	2.66	CL-	1.56	CA++	3.53	CAOH+	7.69
CACO3O	5.11	CAHCO3	4.94	CASO4O	3.82	MG++	4.15	MGOH+	7.46	MGCO3O	5.98	MGHCO3	5.67
MGSO4O	4.52	NA+	1.43	NACO3-	4.77	NAHCO3	4.31	NASO4-	3.33	NACLO	4.59	K+	3.42
KSO4-	5.12	KCLO	6.56	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.81
LIOHO	9.05	LISO4-	5.83	H4SIO4	2.92	H3SIO4	4.61	H2SIO4	7.68	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	7.94	H2SO4O	19.19	HSO4-	8.43	HCLO	14.96	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.95	H2BO3-	5.14	H2CO3	4.27	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-1.51	ANORTHIT	-99.99	ARAGONIT	-0.12	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.97	CALCITE	0.15	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.45	CHLORITE	-99.99	DOLOMITE	-0.19
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.55	HALITE	-4.60	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-4.22	HYDTOMAG	-3.84	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.61
MAGNETIT	-99.99	MIRABILT	-5.06	NESQUEHO	-3.69	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.87
SIDERITE	-99.99	STRONTNT	-99.99	TALC	3.02	THENARDT	-5.32	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	2.92	QUARTZ	0.86	CHALCEDONY	0.49	A-CRISTOBALITE	0.24	AMORPHOUS	-0.82

SAMPLE NUMBER 42

TITLE [illegible]483 LOCATION D-06-25-36CBBB

INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIVALENTS PER LITER FOR ALKALINITY)

CATOT	0.2969E-02	MGTOT	0.2961E-03	NATOT	0.1131E+00	KTOT	0.4909E-03	CLTOT	0.1019E+00	ALK	0.1270E-02
SO4TOT	0.7807E-02	ALTOT	0.0000E+00	FETOT	0.0000E+00	SRTOT	0.0000E+00	BATOT	0.0000E+00	LITOT	0.2450E-03
NO3TOT	0.0000E+00	SIO2TOT	0.1082E-02	BTOT	0.1480E-03	BRTOT	0.0000E+00	H2STOT	0.0000E+00	NH4TOT	0.0000E+00

PH = 7.81 PE = 99.99 TEMP = 46.10DEG C DENSITY = 1.000GM/CC
-LOG(PCO2) = 2.92 -LOG(PO2) = 99.99 -LOG(PCH4) = 99.99
IONIC STRENGTH = 0.12681 TOTAL DISS SOLIDS = 7.25GM/LITER SOLN TOTAL INORG CARBON MOLALITY = 0.1221E-02
ION BALANCE ERROR = 0.69PERCENT CATION EXCESS = 0.1627E-02(CHARGE*MOLES) H2O ACTIVITY = 0.9961

INDIVIDUAL SPECIES MOLALITIES

OH-	0.3896E-05	CO3--	0.1020E-04	HCO3-	0.1098E-02	SO4--	0.6069E-02	CL-	0.1025E+00	CA++	0.2544E-02
CAOH+	0.9464E-07	CACO3O	0.8144E-05	CAHCO3	0.1917E-04	CASO4O	0.4192E-03	MG++	0.2592E-03	MGOH++	0.7342E-07
MGCO3O	0.4315E-06	MGHCO3	0.1464E-05	MGSO4O	0.3714E-04	NA+	0.1124E+00	NACO3-	0.1967E-04	NAHCO3	0.3928E-04
NASO4-	0.1328E-02	NACLO	0.1569E-03	K+	0.4845E-03	KSO4-	0.9278E-05	KCLO	0.6829E-06	BA++	0.0000E+00
BAOH+	0.0000E+00	SR++	0.0000E+00	SROH+	0.0000E+00	LI+	0.2446E-03	LIOHO	0.1432E-08	LISO4-	0.2184E-05
H4SIO4	0.1061E-02	H3SIO4	0.2871E-04	H2SIO4	0.7091E-07	AL+++	0.0000E+00	ALOH++	0.0000E+00	ALOH2+	0.0000E+00
ALOH4-	0.0000E+00	ALSO4+	0.0000E+00	ALSO42	0.0000E+00	FE+++	0.0000E+00	FEOH++	0.0000E+00	FEOH2+	0.0000E+00
FEOH3O	0.0000E+00	FEOH4-	0.0000E+00	FECL++	0.0000E+00	FECL2+	0.0000E+00	FECL3O	0.0000E+00	FESO4+	0.0000E+00
FE++	0.0000E+00	FEOH+	0.0000E+00	FEOH2O	0.0000E+00	FEOOH-	0.0000E+00	FESO4O	0.0000E+00	NH4+	0.0000E+00
NH3AQ	0.0000E+00	NH4SO4	0.0000E+00	NO3-	0.0000E+00	H+	0.1913E-07	H2SO4O	0.1427E-18	HSO4-	0.7352E-08
HCLO	0.7219E-14	H2SAQ	0.0000E+00	HS-	0.0000E+00	S--	0.0000E+00	BR-	0.0000E+00	H3BO3O	0.1374E-03
H2BO3-	0.1172E-04	H2CO3*	0.2459E-04	O2AQ	0.0000E+00						

INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)

OH	5.54	CO3--	5.45	HCO3-	3.07	SO4--	2.70	CL-	1.12	CA++	3.05	CAOH+	7.13
CACO3O	5.08	CAHCO3	4.83	CASO4O	3.36	MG++	4.02	MGOH+	7.24	MGCO3O	6.35	MGHCO3	5.96
MGSO4O	4.42	NA+	1.07	NACO3-	4.82	NAHCO3	4.39	NASO4-	2.99	NACLO	3.79	K+	3.45
KSO4-	5.15	KCLO	6.15	BA++	-99.99	BAOH+	-99.99	SR++	-99.99	SROH+	-99.99	LI+	3.72
LIOHO	8.83	LISO4-	5.78	H4SIO4	2.96	H3SIO4	4.67	H2SIO4	7.61	AL+++	-99.99	ALOH++	-99.99
ALOH2+	-99.99	ALOH4-	-99.99	ALSO4+	-99.99	ALSO42	-99.99	FE+++	-99.99	FEOH++	-99.99	FEOH2+	-99.99
FEOH3	-99.99	FEOH4-	-99.99	FECL++	-99.99	FECL2+	-99.99	FECL3O	-99.99	FESO4+	-99.99	FE++	-99.99
FEOH+	-99.99	FEOH2O	-99.99	FEOOH-	-99.99	FESO4O	-99.99	NH4+	-99.99	NH3AQ	-99.99	NH4SO4	-99.99
NO3-	-99.99	H+	7.81	H2SO4O	18.83	HSO4-	8.26	HCLO	14.13	H2SAQ	-99.99	HS-	-99.99
S--	-99.99	BR--	-99.99	H3BO3O	3.85	H2BO3-	5.12	H2CO3	4.60	O2AQ	-99.99		

MINERAL SATURATION INDICES

ADULARIA	-99.99	ALBITE	-99.99	ANHYDRIT	-1.02	ANORTHIT	-99.99	ARAGONIT	-0.14	BARITE	-99.99	BOEHMITE	-99.99
BRUCITE	-3.74	CALCITE	0.15	CA-MONT	-99.99	CELESTIT	-99.99	CHALCEDN	0.34	CHLORITE	-99.99	DOLOMITE	-0.55
GIBBSITE	-99.99	GEOTHITE	-99.99	GRIEGITE	-99.99	GYPSUM	-1.09	HALITE	-3.82	HALLOYST	-99.99	HEMATITE	-99.99
HUNTITE	-5.16	HYDTOMAG	-4.47	ILLITE	-99.99	KAOLINIT	-99.99	K-MICA	-99.99	MACKINAW	-99.99	MAGNESIT	-0.93
MAGNETIT	-99.99	MIRABILT	-4.66	NESQUEHO	-4.05	PHLOGOPT	-99.99	PYRITE	-99.99	PYROPHYL	-99.99	QUARTZ	0.75
SIDERITE	-99.99	STRONTNT	-99.99	TALC	2.96	THENARDT	-4.63	WITHERIT	-99.99				

SILICA SATURATION INDICES

-LOG H4SIO4O	2.96	QUARTZ	0.73	CHALCEDONY	0.38	A-CRISTOBALITE	0.13	AMORPHOUS	-0.92

APPENDIX D

WATSPEC Program

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C                                WATSPEC
C
C  REFERENCE : WIGLEY,T.M.L.,1977,WATSPEC-A COMPUTER PROGRAM FOR DETER-
C  MINING THE EQUILIBRIUM SPECIATION OF AQUEOUS SOLUTIONS:BRITISH
C  GEOMORPHOLOGICAL GROUP TECHNICAL BULLETIN 20, GEO ABSTRACTS LTD,
C  UNIVERSITY OF EAST ANGLIA,NORWICH NR4 7TJ,ENGLAND,40P.
C
C  WATSPEC IS AN AQUEOUS MODEL FOR DETERMINING EQUILIBRIUM CHEMICAL
C  SPECIATION IN NATURAL WATERS. IT ACCEPTS UP TO 18 TOTAL SPECIES
C  CONCENTRATIONS AS INPUT. EH INPUT CAN BE INCLUDED IN ANY OF 5
C  DIFFERENT WAYS, OR MAY BE OMITTED. WATSPEC ACCOUNTS FOR UP TO 70
C  AQUEOUS-PHASE SPECIES AND COMPUTES SATURATION INDICES FOR 40
C  MINERALS
C  INPUT DETAILS : EACH SAMPLE REQUIRES 2,3,4 OR 5 CARDS.
C  CARD 1 (2I1,F10.0)
C    FLAG1= 1 IF SAMPLE INCLUDES REDUCTION-OXIDATION DATA (CARD 3)
C    FLAG2= NUMBER OF MINOR SPECIES CARDS (CARDS 4 AND/OR 5)
C           (6 MINOR SPECIES PER CARD SO FLAG2= 0, 1 OR 2)
C    DENS= DENSITY (GM/CC OR KG/LITER) : IF DENS IS MISSING OR INPUT
C          AS LESS THAN 1.0, WATSPEC PUTS DENS = 1.0
C  CARD 2 (9F6.0) : TEMP (DEG C), PH AND MAJOR SPECIES.
C    Z(I),I=1,7 = MAJOR SPECIES TOTAL CONCENTRATIONS IN MILLIMOLES PER
C                 LITER OF SOLUTION (MILLIEQUIVALENTS FOR TITRATION
C                 ALKALINITY) : SPECIES ORDER, 1 = CALCIUM,
C                 2 = MAGNESIUM, 3 = SODIUM, 4 = POTASSIUM, 5 = CHLORIDE
C                 6 = TITRATION ALKALINITY, 7 = SULPHATE
C  CARD 3 (I1,2F10.0) : OXIDN-REDN DATA (OMIT IF FLAG1 NOT EQUAL TO 1).
C    THERE ARE 5 INPUT OPTIONS INDICATED BY FLAG3. ZZZ IS THE
C    APPROPRIATE DATA VALUE. EZ IS LEFT BLANK UNLESS FLAG3 = 3. EH
C    VALUES IN VOLTS.
C     FLAG3 VALUE       ZZZ
C        1          MEASURED EH, TEMPERATURE CORRECTED
C        2          MEASURED EH, NOT TEMPERATURE CORRECTED
C        3          MEASURED EH, NOT TEMPERATURE CORRECTED. EZ MUST BE
C                   SPECIFIED WITH THIS OPTION. EZ = EH OF STANDARD
C                   ZOBELLS SOLUTION
C        4          OXYGEN CONCENTRATION AS -LOG(MOLES OF O2 PER LITER
C                   OF SOLUTION)
C        5          TOTAL SULPHIDE AS -LOG(MOLES OF H2S PER LITER
C                   OF SOLUTION)
C  CARDS 4 AND 5 (6(I2,G10.4) : MINOR SPECIES. OMIT IF NO MINOR SPECIES
C    DATA. DATA INPUT IS IN PAIRS WITH SPECIES NUMBER FOLLOWED BY TOTAL
C    CONCENTRATION IN MILLIMOLES PER LITER OF SOLN : SPECIES NUMBERS
C    8 (ALUMINIUM), 9 (IRON), 10 (STRONTIUM), 11 (BARIUM), 12 (LITHIUM),
C    13 (NITRATE), 14 (SILICATE AS SIO2), 15 (BORATE AS B), 16 (BROMIDE)
C    17 (SULFIDE AS H2S), 18 (AMMONIA AS NH4+).
C    IF SULFIDE IS ENTERED ON CARD 4 OR 5 THIS VALUE WILL BE USED FOR
C    CALCULATION OF SPECIATION EVEN IF MEASURED EH DATA IS GIVEN ON
C    CARD 3. TO FIND SPECIATION WITH SULPHIDE DETERMINED BY MEASURED
C    EH DATA OMIT SULPHIDE FROM CARD 4.
C  END OF DATA: A CARD WITH 99 IN COLUMNS 1 AND 2 SHOULD ALWAYS BE
C  INCLUDED AFTER THE LAST DATA CARD TO DENOTE END OF DATA
C
C
C/////////////////////////////////////////////////////////////////////////
      DIMENSION R(72),B(72),IPAIR(21),IR1(21),IR2(21),GFW(18),NX(11)
     1,CHH(72),XLOC(4)                                                  A  2
      INTEGER CHG,CHH,FLAG1,FLAG2,FLAG3                                 A  3
      REAL K,KMIN                                                       A  4
      REAL*8 ATITLE                                                     A X4
      COMMUNA(75),F(72),X(72),Z(72),AA,BB,CHG(72),CTOT,DENS,FLAG3,GMH2O,  A  5
     1PPCH4,EZ,PE,PH,T,TEMP,TOS,U,ZZZ,K(77),KMIN(40),PK(77),PKMIN(40)   A  6
      DATA IPAIR/19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,35,58,59,  A  7
     160,61,68/,IR1/4*1,4*2,4*3,4,4,71,71,10,11,12,12,71/,IR2/72,34,6,7, A  8
     32,1,-1,0,0,-1,0,1,1,0,1,0,1,0,1,0,0,-1,0,-1,0,-1,0,-2,-1,0,-1,-2,  A 10
     43,2,1,1,-1,-1,3,2,0,2,1,-1,1,2,1,1,0,-1,0,1,1,0,-1,-1,-2,0,-1,5*0, A 11
     51,-1/,GFW/40.08,24.312,22.99,39.102,35.453,61.017,96.062,26.981,  A 12
     655.847,87.62,137.34,6.939,62.005,60.085,10.811,79.909,34.08,      A 13
     718.039/,R/5.,5.5,4.,2*3.5,5.4,5.,4.5,0.,5.,5.,6.,3.,0.,2.5,4.,0., A 14
     80.,6.,0.,6.,0.,6.5,0.,4.,0.,0.,5.4,0.,5.4,0.,5.4,0.,5.4,4.5,0.,4., A 15
     95.4,9.,2*5.4,2*4.5,0.,9.,5.,0.,5.,2*5.4,5.,6.,5.,5.,0.,5.,0.,5.,  A 16
     *5.,0.,5.,3.5,5.,0.,5.,5*0.,9.,3.5/,B/.165,.2,.075,2*.015,0.,-.04, A 17
     165*0./,ELIMIT/1.E-06/,NDATA/0/,TKEEP/1000./                       A 18
C
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```
C** OPEN FILES
C
      TYPE 901
901   FORMAT(' INPUT FILE? ',$)
      CALL ASSIGN(5,0,-1)
      TYPE 902
902   FORMAT(' OUTPUT FILE? ',$)
      CALL ASSIGN(6,0,-1)
C
C** DONE OPENING FILES
C
C
10    DO 20 I=1,72                                                      A 19
      CHG(I)=CHH(I)                                                     A 20
      Z(I)=0                                                            A 21
      X(I)=0                                                            A 22
      A(I)=0                                                            A 23
20    F(I)=1                                                            A 24
      NDATA=NDATA+1                                                     A 25
      READ(5,220,END=23)FLAG1,FLAG2,DENS,ATITLE,XLOC                    A 26
      IF((FLAG1.EQ.9).AND.(FLAG2.EQ.9))GO TO 130                        A 27
      READ(5,230) TEMP,PH,(Z(I),I=1,7)                                  A 28
      IF(FLAG1.EQ.1)READ(5,240)FLAG3,ZZZ,EZ                             A 29
      IF(FLAG2.GE.1)READ(5,250)((NX(I),Z(NX(I))),I=1,6)                 A 30
      IF(FLAG2.GE.2)READ(5,250)((NX(I),Z(NX(I))),I=1,6)                 A 31
      WRITE(6,170) NDATA                                                A 32
      WRITE(6,211) ATITLE,XLOC                                          AX32
      IF((DENS.GT.0).AND.(DENS.LT.1.))WRITE(6,210)DENS                  A 33
      IF((DENS.GE.0.).AND.(DENS.LT.1.))DENS=1.0                         A 34
      T=TEMP+273.15                                                     A 35
      IF(ABS(TEMP-TKEEP).GT.0.1)CALL EQUCON                             A 36
      TKEEP=TEMP                                                        A 37
      PPCH4=99.99                                                       A 38
      PE=99.99                                                          A 39
      CTOT=1000                                                         A 40
      TDS=0                                                             A 41
      GMSOLN=1000.*DENS                                                 A 42
      DO 30 I=1,18                                                      A 43
30    TDS=TDS+Z(I)*GFW(I)/1000.                                         A 44
      GMH2O=GMSOLN-TDS                                                  A 45
      DO 40 I=1,18                                                      A 46
      Z(I)=Z(I)/GMH2O                                                   A 47
40    X(I)=Z(I)                                                         A 48
      IF((Z(17).GT.0.).AND.(FLAG1.NE.1)) GO TO 120                      A 49
      A(71)=10.**(-PH)                                                  A 50
      X(71)=A(71)                                                       A 51
      X(72)=K(73)/A(71)                                                 A 52
      A(73)=1.                                                          A 53
C      FIRST ESTIMATE OF HCO3- ACTIVITY.
      X(6)=(Z(6)+X(71)-X(72))/(1.+Z(1)*K(21)+Z(2)*K(25)+Z(3)*K(29)+     A 54
     12.*(1.+Z(1)*K(20)+Z(2)*K(24)+Z(3)*K(28))/(K(6)*A(71)))            A 55
      IF(X(6).LT.0.0)GO TO 120                                          A 56
      ITER=0                                                            A 57
50    IF(ITER.GE.50) GO TO 120                                          A 58
C      CALCN OF IONIC STRENGTH AND ACTIVITY COEFFICIENTS
      DO 60 I=1,72                                                      A 60
60    U=U+.5*X(I)*CHG(I)*CHG(I)                                         A 61
      XTOT=0                                                            A 62
      DO 70 I=1,72                                                      A 63
      C=SQRT(U)*CHG(I)*CHG(I)*AA                                        A 64
      IF(CHG(I).EQ.0)F(I)=10.**(0.1*U)                                  A 65
      IF(CHG(I).NE.0)F(I)=10.**(-C/(1.+BB*SQRT(U)*R(I))+U*B(I))         A 66
      IF(I.NE.71) A(I)=F(I)*X(I)                                        A 67
70    XTOT=XTOT+X(I)                                                    A 68
      C=TEMP*TEMP                                                       A 69
      F(68)=10.**(U*(33.5-.109*TEMP+.0014*C-U*(1.5+.015*TEMP-.0004*C))  A 70
     1/T)                                                               A 71
C     ACTIVITIES OF H2O, OH-,AND CO3--.
      A(73)=1.-.017*XTOT                                                A 72
      A(72)=K(73)*A(73)/A(71)                                           A 73
      X(72)=A(72)/F(72)                                                 A 74
      A(34)=A(6)/(K(6)*A(71))                                           A 75
C      TEST FOR CONVERGENCE.
      TEST=CTOT                                                         A 76
      CTOT=X(6)+X(20)+X(21)+X(24)+X(25)+X(28)+X(29)+X(34)+X(68)         A 77
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```
      IF((ABS(TEST-CTOT)/CTOT).LT.ELIMIT)GO TO 110                      A 78
      ITER=ITER+1                                                       A 79
C       CALCULATION OF PE, O2, CH4 AND SULPHIDE SPECIES.
      IF(FLAG1.EQ.1)CALL PECALC                                         A 80
C      SILICATE SPECIES.
      A(14)=Z(14)/(1./F(14)+(K(37)/F(37)+K(38)/F(38))/A(71))            A 81
      A(37)=K(37)*A(14)/A(71)                                           A 82
      A(38)=K(38)*A(14)/(A(71)*A(71))                                   A 83
C      BORATE SPECIES.
      A(15)=Z(15)/(1./F(15)+K(44)/(F(44)*A(71)))                        A 84
      A(44)=K(44)*A(15)/A(71)                                           A 85
C      ALUMINIUM SPECIES.
      A(39)=Z(8)/(1./F(39)+A(72)*A(72)*(A(72)*A(72)*K(8)/F(8)+K(40)/    A 86
     1(F(40)*A(72))+K(41)/F(41))+A(7)*(K(42)/F(42)+K(43)*A(7)/F(43)))   A 87
      C=A(39)*A(72)                                                     A 88
      A(8)=K(8)*C*A(72)**3                                              A 89
      A(40)=K(40)*C                                                     A 90
      A(41)=K(41)*C*A(72)                                               A 91
      A(42)=K(42)*A(39)*A(7)                                            A 92
      A(43)=K(43)*A(39)*A(7)*A(7)                                       A 93
      IF((FLAG1.NE.1).AND.(Z(9).GT.0.)) PE=10.                          A 94
      IF((FLAG1.NE.1).AND.(Z(9).EQ.0.)) GO TO 80                        A 95
C      IRON SPECIES.
      E=10.**(-PE)                                                      A 96
      A(74)=E                                                           A 97
      C=A(71)/A(73)                                                     A 98
      G=C*C                                                             A 99
      A(52)=E*Z(9)/(E/F(52)+K(9)/(F(9)*C*G)+K(45)/F(45)+K(46)*A(5)/F(46) A100
     1+K(47)*A(5)**3/F(47)+K(48)/(F(48)*C)+K(49)/(F(49)*G)+K(50)/(F(50)* A101
     2G*G)+K(51)*A(7)/F(51)+K(53)*A(5)*A(5)/F(53)+K(54)*E/(F(54)*C)     A102
     3+K(55)*E/(F(55)*G)+K(56)*E/(F(56)*G*A(71))+K(57)*E*A(7)/F(57))    A103
      Y=A(52)/E                                                         A104
      A(9)=K(9)*Y/(C*G)                                                 A105
      A(45)=K(45)*Y                                                     A106
      A(46)=K(46)*Y*A(5)                                                A107
      A(47)=K(47)*Y*(A(5)**3)                                           A109
      A(48)=K(48)*Y/C                                                   A108
      A(49)=K(49)*Y/G                                                   A110
      A(50)=K(50)*Y/(G*G)                                               A111
      A(51)=K(51)*Y*A(7)                                                A112
      A(53)=K(53)*Y*A(5)*A(5)                                           A113
      A(54)=K(54)*A(52)/C                                               A114
      A(55)=K(55)*A(52)/G                                               A115
      A(56)=K(56)*A(52)/(G*A(71))                                       A116
80    A(57)=K(57)*A(52)*A(7)                                            A117
C      FOR THESE SPECIES.
      IF(Z(18).GT.0.) A(18)=Z(18)/(1./F(18)+K(64)/(F(64)*A(71))+K(65)   A118
     1/(F(65)*A(7)))                                                    A119
      IF(FLAG1.EQ.1)C=10.**(PK(76)+10.*PH+8.*PE+3.*ALOG10(A(73)))       A120
      IF((Z(13).GT.0.).AND.(FLAG1.EQ.1))X18=A(13)/(C*F(18))             A121
      IF((Z(18).GT.0.).AND.(FLAG1.EQ.1))X13=A(18)*C/F(13)               A122
      IF(A(18).GT.0.)A(64)=K(64)*A(18)/A(71)                            A123
      IF(A(18).GT.0.)A(65)=K(65)*A(18)/A(7)                             A124
C      ALL OTHER ION PAIRS
      DO 90 I=1,21                                                      A125
90    A(IPAIR(I))=K(IPAIR(I))*A(IR1(I))*A(IR2(I))                       A126
      A(36)=K(36)*A(71)*A(71)*A(7)                                      A127
      DO 100 I=1,65                                                     A128
100   X(I+7)=A(I+7)/F(I+7)                                              A129
C      KEY SPECIES
      IF(X(1).GT.0.)X(1)=Z(1)/(1.+(X(19)+X(20)+X(21)+X(22))/X(1))       A130
      IF(X(2).GT.0.)X(2)=Z(2)/(1.+(X(23)+X(24)+X(25)+X(26))/X(2))       A131
      IF(X(3).GT.0.)X(3)=Z(3)/(1.+(X(27)+X(28)+X(29)+X(30))/X(3))       A132
      IF(X(4).GT.0.)X(4)=Z(4)/(1.+(X(31)+X(32))/X(4))                   A133
      IF(X(5).GT.0.)X(5)=Z(5)/(1.+(X(27)+X(31)+X(33)+X(46)+3.*X(47)+2.* A134
     1X(53))/X(5))                                                      A135
      IF(X(7).GT.0.)X(7)=Z(7)/(1.+(X(22)+X(26)+X(30)+X(32)+X(35)+X(36)  A136
     1+X(42)+2.*X(43)+X(51)+X(57)+X(61)+X(65))/X(7))                    A137
      IF(X(10).GT.0.)X(10)=Z(10)/(1.+X(58)/X(10))                       A138
      IF(X(11).GT.0.)X(11)=Z(11)/(1.+X(59)/X(11))                       A139
      IF(X(12).GT.0.)X(12)=Z(12)/(1.+(X(60)+X(61))/X(12))               A140
      C=X(37)+2.*X(38)+X(44)+X(8)+X(62)+2.*X(63)+X(72)+X(60)-X(71)      A141
      C=X(37)+2.*X(38)+X(44)+X(40)+2.*X(41)+4.*X(8)+X(62)+2.*X(63)+X(64) A142
     1+X(72)+X(19)+X(23)+X(58)+X(59)+X(60)-X(71)-X(33)-X(35)-2.*X(36)   A143
      X(6)=(Z(6)-C)/(1.+(X(21)+X(25)+X(29)+2.*(X(20)+X(24)+X(28)+X(34))) A144
     1/X(6))                                                            A145
```

```
      GO TO 50                                                          A146
110   IF((FLAG1.EQ.1).AND.(Z(18).GT.0.)) WRITE(6,140) X13               A147
      IF((FLAG1.EQ.1).AND.(Z(13).GT.0.)) WRITE(6,150) X18               A148
      IF((FLAG1.NE.1).AND.(Z(9).GT.0.)) WRITE(6,160)                    A149
      CALL PRINT                                                        A150
      GO TO 10                                                          A151
120   IF(ITER.GT.50) WRITE(6,180)                                       A152
      IF(X(6).LT.0.) WRITE (6,190)                                      A153
      IF((Z17.GT.0.).AND.(FLAG1.NE.1)) WRITE (6,200)                    A154
      IF(ITER.GT.50) CALL PRINT                                         A155
      GO TO 10                                                          A156
130   CONTINUE                                                          A157
140   FORMAT(//,'  NH3 AND PE DATA GIVEN : NH3, PH AND PE IMPLY NO3- MOL  A158
     1ALITY =',E11.4)                                                   A159
150   FORMAT(//,'  NO3 AND PE DATA GIVEN : NO3, PH AND PE IMPLY NH4+ MOL  A160
     1ALITY =',E11.4)                                                   A161
160   FORMAT(//,'  FE TOTAL > ZERO BUT NO EH DATA CARD : PE ARBITRARILY  A162
     1ASSUMED EQUAL TO 10.0')                                           A163
170   FORMAT(1H1,'          SAMPLE NUMBER',I4)                          A164
211   FORMAT(/,2X,'TITLE',2X,A6,10X,'LOCATION',2X,3A4,A2)               AX164
180   FORMAT(//,'  NOT CONVERGED AFTER 50 ITERATIONS.  RESULTS AT THIS S  A165
     1AGE ARE        ')                                                 A166
190   FORMAT(1X,'    SAMPLE REJECTED : HCO3 < 0, POSSIBLE PH OR ALKALINIT  A167
     1Y ERROR')                                                         A168
200   FORMAT(1X,'    POSSIBLE DATA INPUT ERROR : TOTAL SULPHIDE SPECIFIED  A169
     1 BUT NO EH DATA CARD')                                            A170
210   FORMAT(1X,'    WARNING, DENSITY SPECIFIED AS',F6.3,'  :  VALUE CHAN  A171
     1GED TO 1.0')                                                      A172
220   FORMAT(2I1,F10.0,A6,3A4,A2)                                       A173
230   FORMAT(9F8.4)                                                     A174
240   FORMAT(I1,2F10.0)                                                 A175
250   FORMAT(6(I2,G10.4))                                               A176
C220    FORMAT(2I,F)
C230    FORMAT(9F)
C250    FORMAT(6(I,G))
23    STOP                                                              A177
      END                                                               A178
      SUBROUTINE EQUCON                                                 B  1
C      THIS SUBROUTINE CALCULATES ALL EQUILIBRIUM CONSTANTS AND
C      DEBYE-HUCKEL CONSTANTS
      DIMENSION I1(39),I2(15),PK25(78),DELH(78),A1(15),A2(15),A3(15)    B  2
      INTEGER CHG,FLAG1,FLAG2,FLAG3                                     B  3
      REAL K,KMIN                                                       B  4
      COMMONA(75),F(72),X(72),Z(72),AA,BB,CHG(72),CTOT,DENS,FLAG3,GMH20,  B  5
     1PPCH4,EZ,PE,PH,T,TEMP,TDS,U,ZZZ,K(77),KMIN(40),PK(77),PKMIN(40)   B  6
      DATA I1/8,9,19,22,26,27,28,29,30,31,33,36,40,41,42,43,45,46,47,48,  B  7
     149,50,51,53,54,55,56,57,58,59,60,61,63,65,66,73,74,75,76/,I2/6,20,  B  8
     221,23,24,25,32,35,37,38,44,62,64,68,77/                           B  9
      DATA PK25/-33.938, 26.571, -1.4  , -2.309, -2.238,  1.602, -1.268,  B 10
     1      .25 , -0.72 ,  1.585,  6.1  ,  1.   , -8.998,-18.235, -3.2  ,  B 11
     2   -5.1  , 13.013, 11.6  , 11.925, 15.473, 20.173, 34.894,  8.886,  B 12
     3   10.919,  9.319, 20.57 , 29.458, -2.2  , -0.82 , -0.64 , -0.2  ,  B 13
     4   -0.64 , 12.918, -1.11 , 21.495, 13.998,-40.644,-30.741,-119.077  B 14
     5 ,  8.215,  4.548,  8.24 , -1.582, 11.41 ,  5.974,  9.756, 13.32 ,  B 15
     6   10.55 ,   .179, 11.41 , 32.77 ,  3.523,  4.005, 17.02 ,  4.759,  B 16
     7    5.211,  1.113,  4.631, 30.51 , 41.2  , 33.41 ,-24.15 , 18.   ,  B 17
     8   63.53 , 20.57 , 49.09 , 19.33 , 62.29 , 36.91 , 32.82 , 90.61 ,  B 18
     9   42.43 , 37.82 ,-32.67 , 18.48 , 17.97 , 40.31 , 45.   /         B 19
      DATA DELH/ -9.32 ,   .0  ,  1.19 ,  1.5  ,  1.27 ,   .0  ,  8.911,  B 20
     1      .0  ,  1.1  ,   .0  , 18.63 , 10.   ,  1.99 ,   .0  ,  2.29 ,  B 21
     2     3.07 ,  9.7  , 18.152,   .0  , 20.115,   .0  ,   .0  , 15.92 ,  B 22
     3      .0  , 13.218, 28.565, 32.995,   .56 ,  1.15 ,  1.75 ,  4.832,  B 23
     4      .0  , 12.1  ,   .0  , 33.457, 13.345,-65.44 ,-57.435,-187.055  B 24
     5 , -2.959, -3.769, -6.169,   .918,  2.361, -1.054,  6.141,  6.95 ,  B 25
     6   -5.328, -0.572,   .85 , 14.47 ,  4.615,  6.22 , -8.29 ,   .261,  B 26
     7   -4.551, 18.987,   .0  ,-25.76 , 25.555, 11.905,-49.65 , 25.896,  B 27
     8      .0  , 30.82 , 67.86 , 17.53 , 45.065, 49.15 , 44.68 , 54.76 ,  B 28
     9      .0  ,-25.52 ,-68.86 , 11.3  ,   .0  , 54.684, 58.373/       B 29
      DATAA1/-6.498,-27.393,-2.95,.684,.991,2.319,3.106,-5.3505,6.368,39  B 30
     1.478,28.6059,11.17,.6322,-14.8435,-14.0184/,A2/.02379,.05617,.0133  B 31
     2,.0051295,.00667,-.011056,0.,.0183412,-.016346,-.065927,.012078,-.  B 32
     302386,-.001225,.032786,.015264/,A3/2902.39,4114.,0.,0.,0.,0.,-673.  B 33
     46,557.25,-3405.9,-12355.1,1573.21,-3279.,-2835.76,3404.71,2385.73/  B 34
      DO 10 I=1,39                                                      B 35
      PK(I1(I))=PK25(I)+DELH(I)*(25.-TEMP)/(T*1.3642378)                B 36
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```
      IF((I1(I).NE.76).AND.(-PK(I1(I)).GT.35.0)) PK(I1(I))=-35.0          BX39
10    IF(I1(I).NE.76) K(I1(I))=10.**(-PK(I1(I)))                          B 39
      DO 20 I=1,15                                                        B 38
      PK(I2(I))=-A1(I)-A2(I)*T-A3(I)/T                                    B 39
      IF(I.EQ.6)PK(I2(I))=PK(I2(I))-2.29812E-05*T*T                       B 40
      IF(I.EQ.11)PK(I2(I))=PK(I2(I))+13.2258*ALOG10(T)+PK(73)             B 41
20    K(I2(I))=10.**(-PK(I2(I)))                                          B 42
      DO 30 I=1,39                                                        B 43
30    PKMIN(I+1)=PK25(I+39)+DELH(I+39)*(25.-TEMP)/(T*1.3642378)           B 44
      PKMIN(1)=-13.543+.0401*T+3000./T                                    B 45
      PKMIN(17)=4.6535-TEMP*(.004545-.000101*TEMP)                        B 46
      AA=.48863+TEMP*7.48E-4+TEMP*TEMP*3.85E-6                            B 47
      BB=.32415+TEMP*1.65E-4+TEMP*TEMP*2.0E-7                             B 48
      RETURN                                                              B 49
      END                                                                 B 50
      SUBROUTINE PECALC                                                   C  1
C      THIS SUBROUTINE CALCULATES PE, O2, CH4 AND SULPHIDE SPECIES.
      INTEGER CHG,FLAG1,FLAG2,FLAG3                                       C  2
      REAL K,KMIN                                                         C  3
      COMMONA(75),F(72),X(72),Z(72),AA,BB,CHG(72),CTOT,DENS,FLAG3,GMH2O,  C  4
     1PPCH4,EZ,PE,PH,T,TEMP,TDS,U,ZZZ,K(77),KMIN(40),PK(77),PKMIN(40)     C  5
      C=ALOG10(A(73))                                                     C  6
      IF(FLAG3.EQ.1)EH=ZZZ                                                C  7
      IF(FLAG3.EQ.2)EH=ZZZ+.244+.00085*(25.-TEMP)                         C  8
      IF(FLAG3.LT.4) PE=EH/(1.98422E-04*T)                                C 10
      IF(FLAG3.NE.5) GO TO 10                                             C 11
      Z17=10.**(-ZZZ)/(GMH2O/1000.)                                       C 12
      A(17)=Z17/(1./F(17)+K(62)*(1./F(62)+K(63)/(F(63)*A(71))))/A(71))    C 13
      PE=(-ALOG10(A(17))-4.*C+ALOG10(A(7))-10.*PH-PK(74))                 C 14
10    IF(FLAG3.EQ.4) A(66)=10.**(-ZZZ)*F(66)/(GMH2O/1000.)                C 15
      IF(FLAG3.EQ.4)PE=PK(66)-.5*C-PH+.25*ALOG10(A(66))                   C 16
      IF(A(7).GT.0.)G=-PK(74)+ALOG10(A(7))-10.*PH-8.*PE-4.*C              C 17
      IF((A(7).GT.0.).AND.(G.GT.-35.))A(17)=10.**G                        C 18
      IF(Z(17).GT.0.)A(17)=Z(17)/(1./F(17)+K(62)*(1./F(62)+K(63)/(F(63)*  C 19
     1A(71)))/A(71))                                                      C 20
      A(62)=K(62)*A(17)/A(71)                                             C 21
      A(63)=K(63)*A(62)/A(71)                                             C 22
      G=4.*(PE-PK(66)+.5*C+PH)                                            C 23
      IF((FLAG3.NE.4).AND.(G.GT.-35.))A(66)=10.**G                        C 24
      PPCH4=9.*PE+3.*C+PK(75)+9.*PH-ALOG10(A(6))                          C 25
      RETURN                                                              C 26
      END                                                                 C 27
      SUBROUTINE PRINT                                                    D  1
C      THIS SUBROUTINE CALCULATES SATURATION INDICES AND OTHER OUTPUTS.
      DIMENSION IS1(38),IS2(38),IS3(38),IS4(38),N1(38),N2(38),N3(38),     D  2
     1N4(38),SI(40),IO1(69),IO2(40)                                       D  3
      INTEGER CHG,FLAG1,FLAG2,FLAG3                                       D  4
      REAL K,KMIN                                                         D  5
      COMMONA(75),F(72),X(72),Z(72),AA,BB,CHG(72),CTOT,DENS,FLAG3,GMH2O,  D  6
     1PPCH4,EZ,PE,PH,T,TEMP,TDS,U,ZZZ,K(77),KMIN(40),PK(77),PKMIN(40)     D  7
      DATA IS1/3*1,2,3,2*10,2*11,52,7,2,39,2*14,2*1,2,7,52,1,45,39,52,3,  D  8
     13*4,1,2,4*8,2,3*74/,N1/23*1,2,5*1,3,4*2,4,3*-2/,IS2/2*34,7,34,5,    D  9
     234,7,7,2*34,3,2*72,2*73,2,7,34,3,62,2,2*72,71,5*8,72,2*71,72,71,72  D 10
     3,3*71/,N2/10*1,2*2,3,2*-2,3*1,2,1,3*3,-6,3*1,3,2,6,2*2,8,2*2,-8,-2  D 11
     4,-4/,IS3/15*75,34,3*73,71,34,15*73,2*62/,N3/15*0,2*2,3,10,-1,4,     D 12
     52*-1,3,-8,-10,-8,-12,-8,-10,2*-7,-10,-12,3,4,2,4/,IS4/23*75,74,     D 13
     610*14,34,3*52/,N4/23*0,-2,4*3,2,4,2*2,3,4,3,3,1,3/                  D 14
      DATA IO1/72,34,6,7,5,1,19,20,21,22,2,23,24,25,26,3,28,29,30,27,4,3  D 15
     12,31,11,59,10,58,12,60,61,14,37,38,39,40,41,8,42,43,45,48,49,9,50,  D 16
     246,53,47,51,52,54,55,56,57,18,64,65,13,71,36,35,33,17,62,63,16,15,  D 17
     344,68,66/, IO2/27,25,3,29,2,8,23,12,1,40,7,14,33,16,13,22,38,17,5,  D 18
     432,24,21,35,39,31,28,20,4,36,19,18,26,37,34,15,10,6,30,11,9/        D 19
      A(75)=1.                                                            D 20
      PPO2=99.99                                                          D 21
      SUMCAT=0.                                                           D 22
      SUMAN=0                                                             D 23
      DO 10 I=1,40                                                        D 24
10    SI(I)=-99.99                                                        D 25
      DO 20 I=1,38                                                        D 26
20    IF((A(IS1(I)).GT.0.).AND.(A(IS2(I)).GT.0.).AND.(A(IS3(I)).GT.0.).   D 27
     1AND.(A(IS4(I)).GT.0.))SI(I)=N1(I)*ALOG10(A(IS1(I)))+N2(I)*ALOG10(A  D 28
     2(IS2(I)))+N3(I)*ALOG10(A(IS3(I)))+N4(I)*ALOG10(A(IS4(I)))+PKMIN(I)  D 29
      IF(SI(26).GT.-99.99)SI(26)=SI(26)+3.*ALOG10(A(2))+6.*ALOG10(A(72))  D 30
      IF(SI(28).GT.-99.99)SI(28)=SI(28)+2.*ALOG10(A(71))                  D 31
      IF(SI(33).GT.-99.99)SI(33)=SI(33)+5.*ALOG10(A(2))                   D 32
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      IF((A(2).GT.0.).AND.(A(4).GT.0.).AND.(A(8).GT.0.).AND.(A(14).GT.0.   D 33
     1))SI(39)=.25*ALOG10(A(2))+.6*ALOG10(A(4))+2.3*ALOG10(A(8))+3.5*      D 34
     2ALOG10(A(14))+1.2*ALOG10(A(71))-11.2*ALOG10(A(73))+PKMIN(39)         D 35
      IF((A(1).GT.0.).AND.(A(8).GT.0.).AND.(A(14).GT.0.))SI(40)=.17*ALOG   D 36
     110(A(1))+2.33*ALOG10(A(8))+3.67*ALOG10(A(14))+2.*ALOG10(A(71))-      D 37
     212.*ALOG10(A(73))+PKMIN(40)                                          D 38
      DO 30 I=1,72                                                         D 39
      IF(CHG(I).GT.0)SUMCAT=SUMCAT+CHG(I)*X(I)                             D 40
30    IF(CHG(I).LT.0)SUMAN=SUMAN-CHG(I)*X(I)                               D 41
      DO 40 I=1,18                                                         D 42
40    Z(I)=Z(I)*GMH2O/1000.                                                D 43
      WRITE(6,50) (Z(I),I=1,18)                                            D 44
      PKH02=2.860-2.8*(25.-TEMP)/(T*1.3642378)                             D 45
      IF(A(66).GT.0) PPO2=-ALOG10(A(66))-PKO2                              D 46
      CATXS=SUMCAT-SUMAN                                                   D 48
      ERROR=100.*CATXS/(SUMCAT+SUMAN)                                      D 49
      ACRST=(-0.0321-988.2)/T
      AAMOR=(0.3380-T*(-7.849/10000)-(840.1/T))
      ACHAL=0.11-1101/T
      AQTZ=0.41-1309/T
      DO 22 I=1,69
      IF(A(IO1(I)).EQ.0.)A(IO1(I))=-99.99
22    IF(A(IO1(I)).NE.-99.99)A(IO1(I))=-ALOG10(A(IO1(I)))
      BCRST=-A(IO1(31))-ACRST
      BAMOR=-A(IO1(31))-AAMOR
      BCHAL=-A(IO1(31))-ACHAL
      BQTZ=-A(IO1(31))-AQTZ
      IF(A(IO1(31)).EQ.-99.99)BCRST=-99.99
      IF(A(IO1(31)).EQ.-99.99)BAMOR=-99.99
      IF(A(IO1(31)).EQ.-99.99)BCHAL=-99.99
      IF(A(IO1(31)).EQ.-99.99)BQTZ=-99.99
      WRITE(6,60) PH,PE,TEMP,DENS,PPCO2,PPO2,PPCH4,U,TDS,CTOT,ERROR,
     1CATXS,A(73)                                                          D 51
      WRITE(6,70)(X(IO1(I)),I=1,69)                                        D 52
      WRITE(6,92)(A(IO1(I)),I=1,69)                                        DX53
      WRITE(6,80)(SI(IO2(I)),I=1,40)                                       D 53
      WRITE(6,95)A(IO1(31)),BQTZ,BCHAL,BCRST,BAMOR
50    FORMAT(//,'          INPUT DATA (MOLES PER LITER OF SOLUTION : EQUIV
     1ALENTS PER LITER FOR ALKALINITY)',/,                                 D 55
     2'  CATOT',E12.4,'  MGTOT',E13.4,'  NATOT',E11.4,'  KTOT',E12.4,      D 56
     3'  CLTOT',E12.4,'  ALK',E14.4,/,'  SO4TOT',E11.4,'  ALTOT',E13.4,    D 57
     4'  FETOT',E11.4,'  SRTOT',E11.4,'  BATOT',E12.4,'  LITOT',E12.4,/,   D 58
     5'  NO3TOT',E11.4,'  SIO2TOT',E11.4,'  BTOT',E12.4,'  BRTOT',         D 59
     6E11.4,'  H2STOT',E11.4,'  NH4TOT',E11.4)                             D 60
60    FORMAT(//,'  PH =',F6.2,'   PE =',F6.2,'   TEMP =',F6.2,'DEG C   D  D 61
     1ENSITY =',F6.3,'GM/CC',  /,'  -LOG(PCO2) =',F5.2,'   -LOG(PO2) =',  D 62
     2F6.2,'   -LOG(PCH4) =',F6.2,  /,'  IONIC STRENGTH =',F8.5,'   TOTA  D 63
     3L DISS SOLIDS =',F6.2,'GM/LITER SOLN   TOTAL INORG CARBON MOLALITY  D 64
     4 =',E11.4,  /,'  ION BALANCE ERROR =',F6.2,'PERCENT  CATION EXCESS  D 65
     5 =',E11.4,'(CHARGE*MOLES)   H2O ACTIVITY =',F7.4)                   D 66
70    FORMAT(//,'          INDIVIDUAL SPECIES MOLALITIES     ',//,2X ,'OH-  D 67
     1   ',E11.4,'  CO3-- ',E11.4,'  HCO3- ',E11.4,'  SO4-- ',E11.4,'  C  D 68
     2L-   ',E11.4,'  CA++  ',E11.4,/,'  CAOH+ ',E11.4,'  CACO3O',E11.4,  D 69
     3'  CAHCO3',E11.4,'  CASO4O',E11.4,'  MG++  ',E11.4,'  MGOH++'       D 70
     4 ,E11.4,/,'  MGCO3O',E11.4,'  MGHCO3',E11.4,'  MGSO4O',E11.4,       D 71
     5'  NA+   ',E11.4  ,'  NACO3-',E11.4,'  NAHCO3',E11.4,/,'  NASO4-',  D 72
     6E11.4,'  NACLO ',E11.4,'  K+    ',E11.4    ,'  KSO4- ',E11.4,       D 73
     7'  KCLO  ',E11.4,'  BA++  ',E11.4,/,'  BAOH+ ',E11.4,'  SR++  ',    D 74
     8E11.4,'  SROH+ ',E11.4,'  LI+   ',E11.4,'  LIOHO ',E11.4    ,        D 75
     9'  LISO4-',E11.4,/,'  H4SIO4',E11.4,'  H3SIO4',E11.4,'  H2SIO4'     D 76
     * ,E11.4,'  AL+++ ',E11.4,'  ALOH++',E11.4,'  ALOH2+',E11.4,/,'  AL  D 77
     1OH4-',E11.4,'  ALSO4+',E11.4,'  ALSO42',E11.4,'  FE+++ ',E11.4,     D 78
     2'  FEOH++',E11.4,'  FEOH2+',E11.4,/,'  FEOH3O',E11.4,'  FEOH4-',    D 79
     3E11.4,'  FECL++',E11.4    ,'  FECL2+',E11.4,'  FECL3O',E11.4,  '    D 80
     4FESO4+' ,E11.4,/,'  FE++  ',E11.4,'  FEOH+ ',E11.4,'  FEOH2O',E11.  D 81
     54,'  FEOOH-',E11.4,'  FESO4O',E11.4,'  NH4+  ',E11.4,/,'  NH3AQ ',  D 82
     6E11.4,  '  NH4SO4',E11.4,'  NO3-  ',E11.4,  '  H+    ',E11.4,  '   D 83
     7 H2SO4O',E11.4,' HSO4- ', E11.4,/,'  HCLO  ',E11.4,'  H2SAQ ',E11.  D 84
     84,'  HS-   ',E11.4,  '  S--   ',E11.4,  '  BR-   ',E11.4,'  H3BO3O  D 85
     9',E11.4,/,'  H2BO3-',E11.4  ,'  H2CO3*',E11.4,'  O2AQ  ',E11.4)    D 86
92    FORMAT(//,'          INDIVIDUAL SPECIES ACTIVITIES(-LOG ACTIVITY)  '
     1,//,'  OH      ',F6.2,'  CO3--   ',F6.2,'  HCO3-   ',F6.2,'  SO4--
     2   ',F6.2,'  CL-     ',F6.2,'  CA++    ',F6.2,'  CAOH+   ',F6.2,
     3/,'  CACO3O  ',F6.2,'  CAHCO3  ',F6.2,'  CASO4O  ',F6.2,'  MG++
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     4 ',F6.2,'  MGOH+   ',F6.2,'  MGCO3O  ',F6.2,'  MGHCO3  ',F6.2,/,
     5'  MGSO4O  ',F6.2,'  NA+     ',F6.2,'  NACO3-  ',F6.2,'  NAHCO3  '
     6,F6.2,'  NASO4-  ',F6.2,'  NACLO   ',F6.2,'  K+      ',F6.2,/,
     7'  KSO4-   ',F6.2,'  KCLO    ',F6.2,'  BA++    ',F6.2,'  BAOH+   '
     8,F6.2,'  SR++    ',F6.2,'  SROH+   ',F6.2,'  LI+     ',F6.2,/,
     *,F6.2,'  H2SIO4  ',F6.2,'  AL+++   ',F6.2,'  ALOH++  ',F6.2,/,
     1'  ALOH2+  ',F6.2,'  ALOH4-  ',F6.2,'  ALSO4+  ',F6.2,'  ALSO42  '
     2,F6.2,'  FE+++   ',F6.2,'  FEOH++  ',F6.2,'  FEOH2+  ',F6.2,/,
     3'  FEOH3   ',F6.2,'  FEOH4-  ',F6.2,'  FECL++  ',F6.2,'  FECL2+  '
     4,F6.2,'  FECL3O  ',F6.2,'  FESO4+  ',F6.2,'  FE++    ',F6.2,/,
     5'  FEOH+   ',F6.2,'  FEOH2O  ',F6.2,'  FEOOH-  ',F6.2,'  FESO4O  '
     6,F6.2,'  NH4+    ',F6.2,'  NH3AQ   ',F6.2,'  NH4SO4  ',F6.2,/,
     7'  NO3-    ',F6.2,'  H+      ',F6.2,'  H2SO4O  ',F6.2,'  HSO4-   '
     8,F6.2,'  HCLO    ',F6.2,'  H2SAQ   ',F6.2,'  HS-     ',F6.2,/,
     9'  S--     ',F6.2,'  BR--    ',F6.2,'  H3BO3O  ',F6.2,'  H2BO3-  '
     *,F6.2,'  H2CO3   ',F6.2,'  O2AQ    ',F6.2)
80   FORMAT(//,'        MINERAL SATURATION INDICES     ',//'  ADULARIA'  D 87
     1,F7.2,'  ALBITE   ',F7.2,'  ANHYDRIT',F7.2,'  ANORTHIT',F7.2,'  ARA  D 88
     2GONIT',F7.2,'  BARITE   ',F7.2,'  BOEHMITE',F7.2,/,'  BRUCITE ',F7.  D 89
     32,'  CALCITE ',F7.2,'  CA-MONT ',F7.2,'  CELESTIT',F7.2,'  CHALCED  D 90
     4N',F7.2,'  CHLORITE',F7.2,'  DOLOMITE',F7.2,/,'  GIBBSITE',F7.2,'  D 91
     5 GEOTHITE',F7.2,'  GRIEGITE',F7.2,'  GYPSUM  ',F7.2,'  HALITE  ',F  D 92
     67.2,'  HALLOYST',F7.2,'  HEMATITE',F7.2,/,'  HUNTITE ',F7.2,'  HYD  D 93
     7TOMAG',F7.2,'  ILLITE  ',F7.2,'  KAOLINIT',F7.2,'  K-MICA  ',F7.2,  D 94
     8'  MACKINAW',F7.2,'  MAGNESIT',F7.2,/,'  MAGNETIT',F7.2,'  MIRABIL  D 95
     9T',F7.2,'  NESQUEHO',F7.2,'  PHLOGOPT',F7.2,'  PYRITE  ',F7.2,'  P  D 96
     *YROPHYL',F7.2,'  QUARTZ  ',F7.2,/,'  SIDERITE',F7.2,'  STRONTNT',F  D 97
     17.2,'  TALC    ',F7.2,'  THENARDT',F7.2,'  WITHERIT',F7.2)          D 98
95   FORMAT(//,'          SILICA SATURATION INDICES       ',//,
     1'  -LOG H4SIO4O  ',F6.2,'  QUARTZ  ',F7.2,'  CHALCEDONY  ',F7.2,
     2'  A-CRISTOBALITE  ',F7.2,'  AMORPHOUS  ',F7.2)
      RETURN                                                              D 99
      END                                                                 D100
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      INTEGER FLAG1, FLAG2, FLAG3, FLAG4, FLAG5
      DIMENSION AN(18),XM(18),XLOC(4),AD(7),BN(18),YM(18),YLOC(4),BD(7)
      REAL*8 ATITLE,SOURCE,XTITLE
      DATA FLAG4,FLAG5,FLAG1,FLAG3/4*0/,FLAG2/2/
C
        TYPE 901
901     FORMAT(' INPUT FILE? ',$)
        CALL ASSIGN(1,0,-1)
        TYPE 902
902     FORMAT(' OUTPUT FILE? ',$)
        CALL ASSIGN(2,0,-1)
C      CALL ASSIGN(1,'CHEMA',0,'OLD')
C      CALL ASSIGN(2,'KB:',0,'NEW','NC')
1     READ(1,500,END=23) ATITLE, XLOC,TEMP, PH,ID,SOURCE
      READ(1,525)AD
      READ(1,550) AN
500   FORMAT(A5,3A4,A2,F6.2,F6.2,A1,4A4)
525   FORMAT(7F10.0)
550   FORMAT(9F8.2)
      IF(TEMP.EQ.-9.9 )GO TO 2
      GO TO 4
2     TEMP=24.99
4     IF(PH.EQ.-9.9 )GO TO 3
      GO TO 5
3     PH=6.99
5     CONTINUE
      DO 55 I=1,18
      IF(AN(I) .EQ. -9.99) AN(I) = 0.0
55    CONTINUE
      DO 175 I=1,18
      XM(I)=0
175   CONTINUE
      AN(17)=0.0
      XM(1)=AN(1)*0.04350
      XM(2)=AN(2)*0.02557
      XM(3)=AN(3)*0.02495
      XM(4)=AN(4)*0.04113
      XM(5)=AN(5)*0.02821
      XM(6)=AN(6)*0.01041
      XM(7)=AN(7)*0.01639
      XM(8)=AN(8)*0.01666
      XM(9)=AN(9)*0.01664
      XM(10)=AN(10)*0.09250
      XM(11)=AN(11)*0.14411
      XM(12)=AN(12)*0.03715
      XM(13)=AN(13)*0.01791
      XM(14)=AN(14)*0.01141
      XM(15)=AN(15)*0.00728
      XM(16)=AN(16)*0.01251
      XM(17)=AN(17)*0.01613
      XM(18)=AN(18)
      WRITE(2,700) FLAG1,FLAG2,DENS,ATITLE,XLOC
      WRITE(2,800) TEMP,PH,XM(3),XM(4),XM(1),XM(2),XM(5),XM(18),XM(6)
C      WRITE(2,900) FLAG3,ZZZ,FZ
      WRITE(2,600) XM(12),XM(13),XM(14),XM(15),XM(11),XM(17),XM(9),XM(10
     1),XM(16),XM(17),XM(17),XM(17)
      GO TO 1
700   FORMAT(2I1,F10.00,A6,3A4,A2)
800   FORMAT(9F8.4)
C900   FORMAT(I1,2F10.0)
600   FORMAT('09',E10.4,'09',E10.4,'10',E10.4,'11',E10.4,'12',E10.4,
     1'13',E10.4,/,'14',E10.4,'15',E10.4,'16',E10.4,'17',E10.4,'18',
     2E10.4,'13',E10.4)
23     STOP
```