**Arizona
Solar
Energy
Commission**

DOE/RA/50076--T18

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ABOVE ALL... SOLAR ENERGY.

*Title: An Improved Silica Geothermometer for
Low Temperature Geothermal Resource Assessment*

MONTHLY REPORT #3

for

DE-FC03-80RA50076

DOE/RA/50076--T18

Amendment M007

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to

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from

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MASTER

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MONTHLY PROGRESS REPORT
DE FC03-80RA50076 (Amendment M007)
March - April, 1983

The following tasks were addressed during late March - early April, 1983 and reported to the Commission. They are presented to DOE as reported to ASEC.

1. Water chemistry data base: Existing water chemistry for all thermal and nonthermal wells in the Cactus Flat-Artesia and Buena Vista areas has been collected, compiled, and reviewed. In the Cactus Flat-Artesia area 39 complete analyses and 55 partial analyses were found. The partial analyses were obtained from the City of Safford, which conducted a well survey there in 1977. Water samples in this survey were analysed only for Cl, SO₄, F, TDS, and pH. However, they also obtained well depths and water temperatures, which are essential to compute thermal gradients, as well as static water levels and perforations in well casings. Some of the 39 complete chemical analyses are duplicates from the same well, so that only 30 wells are actually represented by published chemical analyses in the Cactus Flat-Artesia area.

In the Buena Vista area, water chemistry data are more limited, as was the case with available drillers' logs. Thirty seven complete analyses were found, six of which are duplicates. While these analyses are regarded as "complete", this is not quite an accurate statement. Earlier water sampling programs usually did not analyse for potassium or silica. Thus, 26 of the 37 analyses lack these constituents, so that geothermometers can be calculated for only 11 wells using published data.

Geothermometers calculated from published data indicate anomalies in the temperature range of 70 to 80°C in both areas. Actually Cactus Flat-Artesia shows three separate anomalies, but in fact what appear to be distinct targets are most probably artifacts of data distribution. Wells are concentrated around Cactus Flat, around Artesia, and at Swift Trail in between. Well discharge temperatures range from 27 to 49°C in Buena Vista and 18 to 45°C in Cactus Flat-Artesia.

2. Water sampling: All water samples have been collected. The initial 25 samples have been sent to B C Laboratories, Bakersfield, California for analysis. The remaining samples will be sent there late this week or next week. The analyses should be available in about three weeks. Following is a brief description of the sampling method we used in the field.

(1) The temperature of the discharging well is measured with a long mercury thermometer that has 0.1 degree Celsius gradations.

(2) Calibration of the pH meter is accomplished by placing the electrode in a pH 7 buffer standard that is the same temperature as the discharging well. The temperature on the pH-meter temperature compensator is adjusted to the temperature of the buffer standard.

(3) One liter of water sample is filtered through a 0.45 micron Nalgene filter. The filtering system consists of an on-line filter between a vacuum (collection) bottle and a large plastic pail containing water collected at the discharging well.

Air is pumped from the vacuum bottle with a hand pump to force the water to flow through the filtration system.

(4) During filtration, 500 ml of unfiltered sample in a plastic bottle is placed in a pan filled with well water to stabilize the temperature. pH is determined by placing the rinsed pH electrode in the unfiltered sample. pH readings are taken every five minutes until the readings stabilize. This operation typically takes 60 to 90 minutes. Temperature of the sample is recorded when the readings stabilize. pH is recorded to 0.01 of a pH.

(5) The filtered sample is divided between two 500 ml plastic bottles. One sample is left pure. The other sample is acidified with 5 ml of 1 N HCl to preserve dissolved constituents.

(6) Acid titration of 50 ml of sample is performed in the field to determine alkalinity. A weak solution of standardized H_2SO_4 is used for titration. After each addition of acid, the pH is recorded. Titration is continued until the pH is less than 4.00. At that point alkalinity is determined using ΔpH and Δ ml of H_2SO_4 , according to Stumm and Morgan (1970).

COMMENTS

There is still no conclusive data obtained to date by Stone and Witcher and reported to the Commission that supports their hypothesis of "non-temperature dependent" reactions occurring between the brine and aluminosilicates.

This report is just a record of the actions taken during sampling and do not represent any analysis of the data, however it is clear that:

- What must be shown first is the amount of aluminosilicate material that is dissolved into the "water" when it is at a temperature less than 100°C . This "water", of course, is geothermal brine of a particular chemical make-up having a given pH and carbonate chemistry. Clearly much of this work must have already been done by a geochemist.
- Apparently Stone and Witcher will determine how much silica is put into ground water due to the CO_2 -rich water action on feldspar and other aluminosilicate minerals. Which means, of course, what is the range of silica dissolution into the CO_2 -rich water?
- Even after they get to this point (and I'm sure all the data on such geochemistry is readily available) they will only have, in fact, a probability of having so much silica introduced into the geothermal water due to this mechanism*. They cannot absolutely determine just what silicon molecules got into the

*heretofore referred to as the "Stone-Witcher Mechanism".

solution due to this "Stone-Witcher Mechanism" and which ones got in there due to the temperature of the geotherm water. To say otherwise is obviously nonsensical.

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