GL00580

PRELIMINARY DRAFT

Appendix M

TRANSPORT OF PLATINUM GROUP ELEMENTS, GOLD, AND SULFUR IN THE SALTON SEA GEOTHERMAL BRINES

(University of California Riverside)

Progress Report
August 9, 1988

TRANSPORT OF PLATINUM GROUP ELEMENTS, GOLD AND SULFUR IN THE SALTON SEA GEOTHERMAL BRINES

Dr. Michael A. McKibben
and
Dr. Alan E. Williams

Geothermal Resources Program
Institute of Geophysics and Planetary Physics
University of California
Riverside, CA 92521
(714) 787–3444 or –4501

Research supported by National Science Foundation grants EAR–8617430 and EAR–8805426, and by University of California Universitywide Energy Research Grant UCB/UERG–034188.

We collected fluid and solid samples during the June 10 and 15 1988 flow–tests of the Salton Sea Scientific Drilling Project well California State 2–14 (S2–14). Samples of flashed brine and steam condensate were collected from the brine and steam flow–lines exiting the separator. Following the flow–tests, silica and hydroxide scales were collected from the valve between the wellhead and separator, and from an orifice plate valve on the brine flow–line after the separator. These fluid and solid samples are currently being analyzed for their contents of Pt, Pd, Rh, Au, H_2S, SO_4, I, Tl, Sc, As, Sb, Rb, Ga and In. Techniques being used are isotope dilution and fire assay inductively–coupled plasma mass spectrometry and graphite furnace atomic absorption spectrometry. Additionally, the sulfur isotopic composition ($\delta^{34}S$) of H_2S and SO_4 are currently being analyzed by conventional gas source mass spectrometry.

Preliminary results on Pt group elements and Au indicate that significant levels of these elements are <u>not</u> being transported by the Salton Sea geothermal brines. These results conflict with the results of other researchers, who have used analytical techniques that may be prone to serious matrix interferences caused by the high salinity, Fe and Mn contents of the SSGS brines.

Our preliminary results have significant implications for the formation of Pt group element ore deposits. It is often proposed that transport of Pt by saline hydrothermal fluids is geologically important during the late stages of crystallization in magma–hydrothermal systems. Our results imply that this may not be the case for fluids having salinities, oxidation states and pH values similar to the SSGS brines.

Results from the sulfur isotopic analyses are not yet available. However, results from previous flow–tests of the S2–14 well indicate that fluid H_2S and SO_4 are in sulfur isotopic equilibrium, and that H_2S is generated by hydrothermal reduction of SO_4 derived from evaporitic anhydrite in the reservoir rocks. This places constraints on the nature of sulfur transport in the SSGS, and on the scaling and corrosion behavior of the brines during geothermal power production.

Our preliminary results should be available in time for presentation at the annual Geothermal Resources Council meeting, to be held in San Diego in October of 1988.

PROGRESS REPORT
August 25, 1988

ISOTOPIC AND CHEMICAL CONSTRAINTS ON FLUID DISTRIBUTION AND WATER-ROCK INTERACTION IN THE SALTON SEA GEOTHERMAL SYSTEM

Dr. Alan E. Williams
Geothermal Resources Program
Institute of Geophysics and Planetary Physics
University of California
Riverside, California 92521
(714)-787-4611

Research Support by the National Science Foundation Grant Number EAR-8805426 and University of California Universitywide Energy Research Grant UCB/UERG-034188.

Samples from the Salton Sea Scientific Drilling Project well number State 2-14 were collected from separated brine and steam flow lines and from the weir box on both June 10, 1988 and June 15, 1988.

Raw brine and steam condensate samples are presently undergoing analysis for stable isotope ratios of D/H and $^{18}O/^{16}O$. Brine samples were also collected, stabilized, and are being analyzed by a variety of techniques measuring major, minor and trace element abundances. We expect information on at least 25 solute species which are typically above analytical background. Gas/steam ratios (which roughly give the content of carbon dioxide in the production fluid) were measured giving values on the order of 2500 ppm (somewhat higher than similar measurements made for previous tests of the State 2-14 well). Hydrogen sulfide was also collected from the separated steam phase for gravimetric analysis. Yields from our H_2S precipitation analysis are somewhat suspect but confirm the low sulfide content (on the order of 10 ppm) observed in other wells and previous flow tests of State 2-14.

Analyses of major brine constituents will be utilized to compute a reservoir fluid density for comparison with similar computations (Fournier, 1988; Williams, 1988) of fluid from other Salton Sea area wells and previous State 2-14 flow tests. Unfortunately, the producing interval for this long term flow test is not well constrained so a vertical density distribution in the State 2-14 well cannot easily be produced. Well controlled samples from the long term flow test will be compared with previously acquired data from other Salton Sea geothermal system wells. This will permit us to evaluate less well controlled sample analyses, both chemical and isotopic, and will allow us to make refinements on our model of fluid distribution and water-rock reactions in this well studied active geothermal system.

We hope that data from the State 2-14 will be available for presentation during the Geothermal Resources Council meeting (October 1988, San Diego, California) and at the Geological Society of America Convention (October-November 1988, Denver, Colorado).