



United States Department of the Interior

GEOLOGICAL SURVEY
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I-3 290 TO: Ken Hooks

IN REPLY REFER TO:

March 10, 1991

WBS: 1.2.9.2
QA: N/A

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Carl P. Gertz, Project Manager
Yucca Mountain Project Office
U.S. Department of Energy
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SUBJECT: U.S. Geological Survey Yucca Mountain Project Monthly Summary for February 1991.

REC'D IN YMP

3/14/91

Dear Carl:

In compliance with the revised Yucca Mountain Project monthly reporting procedures, following is the YMP USGS input for the month of February, 1991. If you have any questions, please contact Raye Ritchey at FTS 776-0517.

WBS 1.2.3 - SITE INVESTIGATIONS

Study Plan 8.3.1.2.1.3, Regional Groundwater Flow System, was transmitted from OCRWM to the NRC.

Study Plans 8.3.1.2.2.1, Unsaturated Zone Infiltration, and 8.3.1.2.3.1, Site Saturated Zone Groundwater Flow System, were approved by DOE.

Study Plan 8.3.1.2.1.1, Meteorology for Regional Hydrology, was transmitted to DOE/YMPO.

In support of surface fracture network studies, field work continued on fracture outcrop studies at Fran Ridge. Four field localities were completed - three are located in the caprock unit of the Topopah Spring Member and one is located in the upper lithophysal unit of the Tiva Canyon Member. As many as five individual fracture sets were identified at each locality and cooling joint sets were recognized and characterized at each locality. Criteria is being developed to distinguish cooling joints from tectonic sets in each unit studied.

In support of geologic mapping of zonal features in the Paintbrush Tuff, reconnaissance fieldwork was conducted at the north end of the Yucca Mountain study area. Miocene age rhyolitic lava flows between Fortymile Canyon and Yucca Wash (dubbed the Fortymile Canyon rhyolites) were studied. Particular attention was paid to basal vitrophyres that are situated above early pyroclastic deposits (surge flow and fallout) and below thick devitrified zones. The vitrophyres should allow the original compositions of the rhyolite flows to be established

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and estimates of the degree of post-emplacement to be determined. Petrographic and geochemical data, compiled by LANL, of the Fortymile Canyon rhyolites were studied. The data provide detailed descriptions of Fortymile Canyon rhyolites but will have limited usefulness for correlating rhyolites for the Yucca Mountain Project because few analyses were made of the basal vitrophyres.

The determination of site effects from ground motion recordings project reports that a draft was completed of report "Data Report 8 Depth - Resistivity Sections for the 1986 Magnetotelluric Experiment in the Region of Yucca Mountain, Southwestern Nevada". This report presents the data from 35 magnetotelluric soundings that were placed on traverse from Stovepipe Wells in Death Valley to the eastern part of Jackass Flats.

The report "Distinguishing colloidal and dissolved silica: Analytical separation using colorimetry and ICP/ES", by Anne Lewis-Russ, James Ranville and A. Thomas Kashuba, received USGS approval for publication in Analytical Chimica Acta Journal.

A major Pacific winter storm hit the southern California coast on February 27, reaching southern Nevada later the same day and continuing into February 28. The average areal precipitation amounted to 0.65 inch.

The precipitation and meteorological monitoring project reports that the satellite ground station was put into operation and data are now being downlinked from polar orbiting satellites. The data are being archived for the preparation of case studies on significant precipitation events at Yucca Mountain. The lightning display system was also put into permanent operation in preparation for the upcoming lightning season. This system is linked with a main-frame at the Weather Service Nuclear Support Office who operates a network of lightning detectors on the Nevada Test Site.

In support of regional saturated zone synthesis and modeling studies, J. Czarnecki developed conceptual models related to increased recharge under wetter climatic conditions and localized increase in hydraulic conductivity in the vicinity of the large hydraulic gradient north and west of the design repository area. He also tested various approaches for automatic time stepping control, using a non-linear finite-element groundwater flow model which uses vertical leakage functions to accommodate evapotranspiration. Criteria for time-step control is based on maximum head change within each time step.

Several USGS staff attended a meeting of the Nuclear Waste Technical Review Board (NWTREB) intended to allow Principal Investigators and Project staff an opportunity to state problems regarding the workability of the Quality Assurance Program. J. Czarnecki discussed the following: 1) the situation existing since 1986 of being able to construct piezometers and not measure water levels; 2) the problem of qualifying old data and the absurdity of spending large amounts of time and effort on qualifying fairly certain data such as potentiometric levels (which are used in models of groundwater flow) when the largest uncertainties will be with "educated guesses" for boundary conditions, such as specified recharge; 3) the problems associated with repeated modifications to simple, well established procedures and what is likely to happen when complex, poorly established procedures are written, used and audited; and 4) the way in which the

QMP regarding software quality assurance has gone full circle since the writing of SOP 03-02 and requires the user to interpret the requirements of NUREG-0856. Comments from all PIs were well received and recorded for transmission to DOE/YMPO.

In support of characterization of hydrologic properties of surficial materials, work continued on defining the subsurface distribution of some of the tuff units on Yucca Mountain. This information will help to determine the appropriate way to account for the deep alluvium/tuff interaction.

In support of air permeability studies, meetings were held to design a system for installation of pressure transducers in the unsaturated zone geochemistry prototype packer systems presently being tested at the Apache Leap Test Site. The pressure transducers will monitor the decreased pressures created during gas sampling, and combined with the pumping rates, will give permeability estimates.

Percolation testing staff are studying the effects of different chemicals that will be used in the infiltrating water during percolation testing of the large welded tuff block. The chemicals will be added to inhibit bacterial growth in and around the block. Water diffusion rates through the materials that will be used to surround the sample are also being studied. A system is being designed to periodically de-aerate the porous polymer plate that will be used to control the lower boundary condition. Processing of the air permeability data collected from the large welded tuff block was begun. This data was collected during December 1990 to estimate permeability and connectivity of fractures in this block before testing with water is begun.

The matrix hydrologic properties testing project reports that simulations of imbibition of water into rock core using the TOUGH code are being conducted to evaluate the appropriate formulations of moisture retention characteristic and relative permeability functions and to determine sensitivities to various physical parameters. This will also aid in the identification of the appropriateness of different methods of measurement for the same parameter.

The unsaturated zone gaseous phase hydrochemistry project completed a UZ-1 gas sampling trip at the Nevada Test Site, processed 16 C-14 samples for C-14 analysis, processed 33 whole gas samples for carbon and oxygen isotope analysis (15 aluminum cylinders, 15 Tedlar bags and 3 glass 500cc bubblers - the analysis results for each of these methods will be compared to aid in determining the best method), and analyzed several core-gas samples squeezed from Apache Leap cores on the gas chromatograph (to date all samples contain less than 0.01 ppm SF₆).

In support of unsaturated zone fracture rock hydrology studies, numerical analysis with TOUGH code continued to refine the model of an imbibition study utilizing a fracture, welded tuff core which suggests that permeability of the welded tuff matrix is strongly anisotropic, with matrix permeability parallel to the fracture two orders of magnitude greater than matrix permeability transverse to the fracture. Additional matrix imbibition experiments utilizing unfractured cores taken perpendicular and parallel to the original core will attempt to verify this hypothesis.

The prototype pore water extraction project compressed six partially welded cores

from Apache Leap. Core moisture content ranged from 4.49-6.12%. Average yields were 5.28 ml water and 22.94 ml gas. Nitrogen injection was needed on five of the six core samples in order to express out the pore water.

Geologic Division and Water Resource Division scientists met to discuss fracture mapping in the Crater Flat tuffs. The fracture mapping will serve as input to the fracture-flow model being developed by LBL at the UE25 c-hole complex. Discussed in the meeting were Geologic Division fracture data needs and cooperative efforts for fracture mapping.

The site potentiometric levels monitoring project reports that the altitude of reference point of all wells in the monitoring network will have to be surveyed. The project is currently using values generated by the USGS National Mapping Division in 1986. Investigation indicates that these levels were probably third-order accuracy and not the first-order accuracy that was assumed. National Mapping Division is preparing cost estimates to include these wells in the first-level line being run at Yucca Mountain. The actual work probably cannot begin until fall.

Agreement has been reached on a joint project between USGS, LBL, LANL, and AECL (Atomic Energy of Canada, Ltd.) to test methods and equipment to be used at the c-hole complex and at the URL in Canada. The study calls for an analog site to be set up within the United States that resembles the hydrologic and geologic conditions at Yucca Mountain. This site will then be tested using the strategy planned for the c-hole testing.

In support of past discharge studies, a field trip was conducted to the test site and the surrounding area to collect water quality and ostracode data from springs as well as outcrop samples from spring mounds and carbonate filled fractures. Water samples were collected from three pumping wells at NTS Area 25 and Crater Flat. Eight bailed water samples were collected from WT and H wells near Yucca Mountain. The water samples were collected for strontium isotope ratios and uranium analysis.

In support of calcite silica studies, a field trip was conducted to the test site to collect chrysophyte and water quality data from springs and outcrop samples from spring deposits and fractures filled by opal and/or carbonate.

Sincerely,

Roy E. Ritchey

for
Larry R. Hayes
Technical Project Officer
Yucca Mountain Project
U.S. Geological Survey

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