

INTER-OFFICE MEMORANDUM

SUBJECT: Exploration and Evaluation Activities                      November 10, 1982  
          on the Topaz Project, Juab County, Utah.

TO:            Joyce Emerson, H. D. Pilkington ✓

FROM:         J. E. Deymonaz

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Introduction

During the period from November 1981 thru October 1982, AMAX Exploration, Inc. conducted extensive exploration activities on the Topaz geothermal project in Juab County, Utah. The exploration was conducted on and in the vicinity of Brush Wellman's state and federal geothermal leases. Activities included:

1. Drilling of ten shallow (less than 500 feet) temperature gradient holes.
2. Drilling of one 1,507 foot (459 meter) temperature observataion hole.
3. Conducting a dipole-dipole resistivity survey consisting of 24.5 line miles along four north-south lines.
4. Temperature gradient measurements in 51 existing mineral holes.
5. Collection and analysis of six water samples from mineral drill holes and water wells in the area.
6. Compilation of thermal maps contouring heatflow, and temperatures at 40 and 80 meters from temperature measurements made in 133 drill holes. All thermal data from Brush and AMAX has been put on the AMAX temperature/depth log format and will be entered into our computer system as soon as possible.

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7. Compilation of a hydrogeochemical base map and data sheets listing temperatures, chemistry and estimated temperatures using various geothermometers.
8. Compilation of a 1:24,000 scale geologic map of the area.

### Intermediate Depth Temperature Observation Hole

In February 1982, a 1,507 foot (459 meter) temperature observation hole (1198-128) was completed in the NE 1/4, SE 1/4 of Sec. 17, T13S, R12W. The hole bottomed in Paleozoic sedimentary rock in what appears to be a zone of primarily convective heat transfer dominated by pervasive fracture permeability. The overlying Tertiary volcanics with relatively low permeability act as a sealing cap. Gradients measured in the volcanics are primarily conductive in this and nearby holes.

### Dipole-Dipole Resistivity Survey

During November and December 1981, Mining Geophysical Surveys was contracted by AMAX to conduct a 24.5 line mile dipole-dipole resistivity survey. The survey was run along four north-south lines with one mile spacing between lines and a 2,000 foot spacing between stations. The resulting pseudo-sections were modeled by Exploration Geothermics to produce 2-0 geoelectric models. The report will be included in the data package.

### Temperature Gradient Measurements in Existing Mineral Exploration Drill Holes

Extensive drilling during recent years for minerals and water has resulted in hundreds of open drill holes in the area. Considerable effort was made to obtain accurate temperature gradients from these holes. In certain portions of the project many holes have been drilled in very small areas. In these locations a limited number of holes were selected based on their depth and locations.

Dry holes were prepared by installing 3/4 inch PVC pipe from the surface to TD, sealing the top of the annulus and filling the pipe with water. The holes had a minimum equilibration period of five days prior to

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logging. Temperature measurements were made with a thermistor probe accurate to within 0.01°C. Temperatures were recorded every 1-2 meters. In holes with water, no PVC pipe was installed and temperatures were recorded below the water level.

Collection and Analysis of Water Samples

Water analysis from USGS publications, Plateau Resources and Brush Wellman were augmented with five samples collected by AMAX from mineral holes and water wells and one sample collected while drilling a 1,500 foot temperature observation hole.

The results of all analysis have been tabulated in chart form listing collection temperature, chemistry, flow, estimated temperatures from various chemical geothermometers and electrical conductivity if obtained.

The chalcedony geothermometer appears to give the most realistic projection. The briny nature of the source water at the south end of the Salt Lake Desert and possible ion exchange problems in the sediments and volcanic rocks cast doubt on the reliability of the Na-K-Ca geothermometer. Applying the Mg correction to the alkali estimated temperatures brought most down to less than 50°C.

The two most interesting samples came from the 1,500 foot temperature observation hole (SE, SE, SE 17, T13S R12W) from a uranium exploration hole (NE, SE 11, T13S, R12W). These holes have estimated temperatures based on the chalcedony geothermometers of 116°C and 127°C respectively.

Temperature Gradient Data

Temperature gradient data incorporated on the various thermal maps has come from three sources:

1. AMAX Exploration, Inc.

The AMAX data consists of information from 10 temperature gradient holes drilled by AMAX and 51 mineral exploration holes. The holes range from 33-656 feet in depth and total approximately 15,000 feet.

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Completion and temperature logging methods are described in the Shallow Temperature Gradient Drilling section.

Numerous open mineral exploration holes are located in the area and fifty-one of these were utilized as temperature gradient holes. Preparation involved setting 3/4 inch PVC pipe in the hole, filling the pipe with water and sealing the annulus at the surface. Temperature measurements were made after a minimum equilibration period of five days. Measurements were made in the same manner as in the AMAX drilled gradient holes.

2. Brush Wellman, Inc.

The Brush data consists of temperature measurements made by Brush personnel in fifty-seven existing mineral exploration drill holes. The holes range in depth from 52-900 feet and total 15,900 feet. The majority of the measurements were made in air in open holes.

AMAX personnel located five of these holes and several others in the immediate vicinity of holes Brush had logged. Three quarter inch PVC pipe was installed and filled with water prior to making temperature measurements. The results in all but one hole agreed very well with the Brush data. The remaining Brush data was compared with surrounding AMAX measurements and most appear to be in good correlation.

3. O'Brien Resources

Information received from O'Brien consists of data from twenty-one mineral exploration drill holes including temperature gradients, bottom hole temperatures and hole depth. The measurements were made by O'Brien in open holes during geothermal exploration activities in the area. Four of these holes were located and logged by AMAX in the same manner as described above and were in good agreement with the O'Brien results. The remaining data was integrated by comparing it with nearby data.

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Geologic Map

A 1:24,000 scale geologic map was prepared incorporating information from the Geologic Map and Cross Sections of Tertiary Rocks in the Thomas Range and Northern Drum Mountains, Juab County, Utah (Lindsey, D.A., U.S.G.S. Miscellaneous Investigations Series Map I-1176, 1979), a fault map prepared by Brush Wellman and field work by AMAX personnel.

  
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J. E. Deymonaz

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