

Summary of Volcanic Geothermal
Update FY 1981 Fugro, Inc., Contract

BY

James R. Park
Summer Intern
Division of Waste Management
Geotechnical Branch
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Volcanic/Geothermal Update
FY1981 Fugro, Inc., Contract

Review Comments for the Fugro, Inc. Report "Assessment of Volcanic and Geothermal Activity in the Pasco Basin and Vicinity" by Howard P. Ross (comments referenced to text)

Abstract

Occurrence of low temperature geothermal waters (20-90°C) in the Pasco Basin and vicinity is a geologic process with poorly understood controls.

General conclusions probably correct. Additional testing suggested for at least two areas to make geothermal assessment more certain.

Volcanic Assessment

Conclusion from comparison with flood basalts questioned. Comparison limited by much greater age of basalt provinces and uncertainty of age dates (0-5 m.y.) is on a scale of concern.

Agree with overall conclusion that a direct threat from volcanism to repository integrity is unlikely.

Geothermal Assessment

Fugro doesn't go much beyond conclusions of others and doesn't utilize all existing data in an exploration sense.

pg 3-2. Conclusion that Pasco Basin and vicinity has little geothermal potential for future exploration may not be valid.

pg 3-5. Paths and amounts of water migration in Hanford area should be well known from ongoing Rockwell studies.

Many resources could be present and undetected by shallow thermal gradient holes in the hydrologic regime likely to be present in Pasco Basin.

pg 3-5, 3-7. Deep wells with high bottom hole temperatures merely reflect

hole depth and near normal geothermal gradient.

pg. 3-7, Table 3-1. Gradient data base could have been increased with relatively small error using techniques to manipulate existing data. Would have a more complete data evaluation if anomalous gradients were mapped. Ross finds at least two areas with possible economic potential.

pg 3-12. Figure 3-2 indicates Pasco Basin may be regionally an area of low heat flow. Detailed data could show otherwise.

Only large offsets of major magnetization contrasts on a regional scale would be detected by Zeitz et al. High level aeromagnetic map (1971's) because flight lines are so high and widely spaced.

pg 3-16. In order to offer a solid geologic explanation for the magnetic linears, an interpretation of the detailed aeromagnetic data is needed, supported by numerical modeling. Without this work, the lineaments can't be correlated with a higher density of fractures.

Crust and basalt thicknesses from magnetotelluric (MT) data may be 10,000-20,000 feet due to 3-D geometry, noisy data, 1-D modelling, etc. MT "depths" should be used with care.

pg 3-19. Shallow (5km) swarmlike earthquake activity is considered a good indicator of geothermal activity by most major companies exploring for high temperature geothermal systems. This seems very similar to the seismicity which characterizes much of the Columbia Plateau.

pg 3-24. Valles Caldera in New Mexico is not a hot, dry rock system, but rather an economic quality high temperature, hot water dominated hydro-thermal system.

pg 3-27. Snake River Plain is a more generalized heat source with local geothermal fluid circulation paths.

pg 3-31. Temperature of the Raft River System is more a function of high temperature fluid circulation along basin border faults than the 2 km sedimentary cover.

pg 3-33. Economics of deep drilling depend upon the quality of the resources.

pg 3-33, 3-34. Shallow swarms of low magnitude earthquakes could be a good indicator of thermal stress and geothermal activity.

pg 3-34. The aeromagnetic data without a detailed geologic interpretation, is a poor basis for defining potential areas.

pg 3-35. There is some potential for low-intermediate temperature resources.

Data (from the report?) are incomplete, and present data are not adequately interpreted.

General Comments

There is some potential for intermediate resources at moderate depth.

Naturally elevated water temperatures arise from:

1. circulation close to a cooling igneous body
2. increased heat transfer due to an increase in thermal conductivity in the surrounding rock
3. convection of water heater at depth via vertical or vertical and/or horizontal fractures
4. Other, e.g. insolation

With an adequate data base of temperatures, thermal conductivities, and temperature gradients, its possible to calculate minimum depth to source of waters in order to get observed temperatures.

S.R. Straits' Review of H Ross' Comments

Ross' interpretation and presentation of gradient data is misleading. Important factor to recognize is the borehole completion and downhole conditions at time of temperature measurements. A flowing well or a cross-hole flow could result in abnormally low geothermal gradients. Also, more accurate results by using 11.7°C instead of 12.7°C for "approximate surface temperature."

Boreholes should be classified as in either confined or unconfined groundwater systems. Since unconfined aquifers have been significantly affected by Hanford Site activities for the past 35 years plus, geothermal gradient interpretation is necessary.

Ross' calculations of anomalous groundwater temperatures are based upon almost entirely unconfined aquifer measurements, and he used some boreholes located near cooling water disposal sites, which would certainly affect his results.

Suggested careful reexamination of borehole completion records, instrument accuracy/precision, and a historical understanding of the area penetrated by the borehole before saying anything about anomalous gradients. Ross' results and conclusions have numerous errors associated with them.