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DOE-CFE Geothermal Agreement

GEOPHYSICAL STUDIES
CEBORUCO GEOTHERMAL RECONNAISSANCE AREA

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PROGRESS REPORT for 1994

Introduction

This project was suggested by CFE scientists at the second technical meeting, January 1994. The Ceboruco area, within the western Neovolcanic Belt, was identified as a promising geothermal area for additional geophysical studies during the 1989-1994 agreement. CFE completed extensive gravity, aeromagnetic, electrical resistivity and magnetotelluric (MT) studies in the greater Ceboruco reconnaissance area (approximately 1200 sq km) but UURI was unable to participate due to lack of project funding. Initial drilling results, including the 2800 m deep CB-1 were disappointing. Since the drill hole was sited in part on geophysical (MT, gravity) results, CFE requested a review of contractor geophsical data and interpretations. UURI has had a continuing interest in the geothermal exploration strategy and proposed a general review of the geophysical exploration effort.

Planned Scope of Project for 1994

The scope of the project for 1994 was to:

1. Review the Ceboruco exploration strategy.
2. Review supporting geologic and geophysical data.
3. Review and critique MT data and interpretation.
4. Complete new MT modeling and interpretation, as needed.

Results to Date

CFE scientists transmitted an extensive geologic and geophysical database to UURI. The geologic studies provided necessary background for the understanding and interpretation of the geophysical data, and for an understanding of the exploration strategy. UURI scientists reviewed the various reports and data.

Dr. Wannamaker completed a detailed review of the MT reports and data completed by GeoEvaluaciones. He found the treatment and evaluation of the data to be competent, and the interpretation generally valid. The occurrence of conductive volcanic horizons has been noted at Long Valley, California, and in the Cascades in the Pacific northwest, and these occurrences have presented severe interpretation and exploration problems in these areas also. Dr. Wannamaker has identified some additional concerns with MT data interpretations in these environments. The

MT contractor computed appropriate two-dimensional (2-D) models, and new numerical modeling was not deemed necessary. UURI was unable to obtain the necessary software in time to use the GEOTOOLS formated MT data submitted by CFE.

A second interpretation of the MT data was completed by CFE geophysicists. This interpretation called attention to several MT stations SW of Ceboruco volcano which suggested a larger conductivity-thickness body at depth. These stations had not been identified by GeoEvaluaciones as a promising target area because they did not exhibit a response typical of conductive bodies going to depth, and were believed to be part of the region-wide conductive horizon. Decreases in apparent resistivity observed for periods longer than 1 to 10 seconds are due to the regional, mid-crustal state, with some short scale data variations caused by minor static shifts, or data noise.

Dr. Ross reviewed the aeromagnetic and gravity data, and noted that extensive state-of-the-art processing had been applied to the aeromagnetic data. A final, geometric interpretion of magnetic bodies and geologic structures was not noted, however.

The gravity survey is described as a reconnaissance level survey which probably was restricted to existing roads and trails. The locations of gravity stations were determined by vehicle odometer (+/- 100 m), and station elevations were estimated from contour maps (estimated to be +/-10 m). It does not appear that terrain corrections were applied to the data, and these could be quite significant (1-3 mGal, 10-30 g.u.) near Ceboruco volcano. Elevation errors could result in errors of as much as 2.2 mGals (22 g.u.). Another limitation of the Bouguer gravity map, especially in the area near CB-1, is the relatively low data density. Although the automated contour interpolation routine may provide the best estimate of gravity contours, it could lead to considerable error in areas of low data density, especially when using data which may be in error due to elevation errors and without terrain corrections. Thus the gravity map may be useful in projecting regional geologic features, but may be inappropriate for use in drill site selection.

Plans for 1995

1. Additional detailed MT interpretation could be undertaken if specific interpretation problems are identified by CFE geophysicists, such as evaluating proposed drill targets.

2. UURI suggests a detailed evaluation of the accuracy of the Bouguer gravity map for an area of approximately 100 sq km, including the large gravity low which extends southwest from Ceboruco volcano. Gravity data should be obtained at 25 to 50 stations, well distributed between the existing stations. Positions and elevations should be accurately determined for these and nearby existing stations (GPS control?) and full terrain corrections should be applied.