MASTER

EXPLORATION OF VOLCANIC GEOTHERMAL ENERGY RESOURCES BASED ON RHEOLOGICAL TECHNIQUES

First Technical Status Report

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Brief Restatement of Objectives

Elementary considerations indicate that rheological methods may be useful in the detection and delineation of volcanic geothermal resources, in particular, those connected with subsurface molten or quasi-molten plutons such as may possibly be the case in the Oregon-Washington Cascades. The processes of main interest are the deformations or flows caused by (1) seasonal snow-ice load, (2) tidal strain and (3) seismic surface waves from moderate to high energy earthquakes. We propose to carry out an initial physical-analytic and field study of the general applicability of the rheidity sensing techniques in the Oregon-Washington Cascade region.

PROGRESS REPORT FOR THE PERIOD APRIL 1 TO JUNE 30 1978

Personnel

Gunnar Bodvarsson, Oregon State University, and Ansel Johnson, Portland State University, have each devoted 3 months at 1/6 time to the project.

Progress Summary

We itemize our efforts during the report period as follows.

(1) Acquisition of equipment (Ansel Johnson). Components for 3 earth strain meters are being purchased and assembled. The equipment will probably be operational by mid August. Two tilt meters and two water level meters have been ordered and will be delivered in the fall of 1978.

(2) Planning of field work (Gunnar Bodvarsson and Ansel Johnson). Suitable sites for strain and tilt metering in the Oregon Cascades and vicinity have been selected. The first testing of the instrumentation will be carried out at the eastern master fault of the Klamath Basin (graben) near Klamath Falls, Oregon.

(3) Elastomechanical signal theory and estimation (Gunnar Bodvarsson). The following types of signals have received attention.

(a) Seasonal snow-ice load deformation in the high Oregon Cascades. Investigation of various computational models and possibly anelastic effects.

(b) Strain and fluid pressure oscillations of solid earth tidal origin at various depths in fault and fracture zones. We are particularly interested in the possibilities for a local enhancement of the signal amplitudes. A suitable mathematical (perturbation) technique has been

worked out to estimate the depth dependence of the strain/pressure amplitude.

(c) Hydroelastic pressure oscillation resonances in open fractures as sources of low-frequency seismic noise.

(d) Design of new simplified and more robust instrumentation for the long-term monitoring of time-dependent strain signals based on the fluid-cavity technique.

Plan for the period July 1 to September 30 1978

Following the initial testing of the strain and tilt meters in the Klamath Falls and Newberry caldera areas (Oregon), we intend to move our field efforts to the high Cascades mainly in the vicinity of Mount Hood, Oregon. The theoretical efforts under item (3) above will be continued.