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GEOLOGICAL SURVEY
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"PRELIMINARY DRAFT"

January 31, 1995

Robert M. Nelson, Jr., Acting Project Manager
Yucca Mountain Site Characterization Project Office
Nevada Field Office
U.S. Department of Energy
P.O. Box 98608

WBS: 1.2.3.2.5.2.1

Attn: Peter M. Stephan, REECo, MS 523, Las Vegas, NV

SUBJECT: PUBLICATIONS--Transmittal of abstract entitled, "Depth to pre-Cenozoic basement in southwest Nevada", by V.E. Langenheim and D.A. Ponce

Interagency Agreement No. DE-AI08-92NV10874

Dear Bob:

One copy of the subject abstract is enclosed for review in your office and concurrence for presentation and publication.in the proceedings volume for the International High-Level Radioactive Waste Management Conference to be held May 1-5, 1995 in Las Vegas, Nevada

This report received technical review by Robert C.Jachens and Robert F. Sikora who were chosen because of their general knowledge of the work and techniques. A QA review was performed by Bob Scavuzzo, YMPB-QA Office, and a preliminary Policy review was performed by Bob Lewis, YMPB.

Technical data for this report have been submitted in accordance with YAP-SIII.3Q. The tracking number for the TDIF associated with these data is GS950100123252.001

This report was prepared under WBS number 1.2.3.2.5.2.1. There are no milestones associated with this report. Upon publication, this report will be submitted to OSTI in accordance with DOE order 1430.2, under distribution category UC-814.

Robert E. Lewis

Robert E. Lewis, Reports Improvement Officer
Yucca Mountain Project Branch
For: Larry R. Hayes, Chief YMPB

Enclosures

cc w/o enclosures:
- LRC File 3.304-9 (P)
- M.P. Chornack, USGS, YMPB, Denver, CO
- V.E. Langenheim, USGS, GD, Menlo Park, CA
- B.T. Brady, YMPB, Denver, CO
- R. Ritchey, YMPB, Denver, CO
- YMP WBS Manager: T. Sullivan, DOE, Las Vegas, NV

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# DEPTH TO PRE-CENOZOIC BASEMENT IN SOUTHWEST NEVADA

V.E. Langenheim and D.A. Ponce
U.S. Geological Survey
345 Middlefield Road, Menlo Park, CA 94025
(415) 329-5313

## I. Introduction

The composition of and depth to pre-Cenozoic basement are poorly known at Yucca Mountain and vicinity because of the thick sequence of tuff that was erupted between 15 and 7 Ma. Only one well (UE-25 p#1) of many deep wells drilled to characterize the Yucca Mountain site penetrated basement. Gravity data can be used to estimate the thickness of Cenozoic deposits because of the large density contrast between low-density volcanic and alluvial deposits and high-density pre-Cenozoic basement rock. We use an iterative procedure based on the gravity data, the surface geology, and an estimated density-depth function for the Cenozoic deposits to separate the gravity field into a "basement" gravity component and a "basin" gravity component[1]. We present a preliminary isopach map of Cenozoic deposits at Yucca Mountain and vicinity based on the "basin" gravity field.

cite Sawyer and others 1994 (GSA Bulletin, v.106, no.10, p.1304-1318).

## II. Method



The method[1] separates gravity observations into two sets, one consisting of observations on basement outcrops and the other consisting of observations taken on Cenozoic outcrops. The second set of observations is inverted for thickness of Cenozoic deposits based on an estimate of the density-depth curve (from Jachens and Moring[1]) between these deposits and pre-Cenozoic basement. This inversion is complicated by two factors: (1) basement gravity stations are influenced by the gravity anomaly caused by low-density deposits in nearby basins, and (2) the basement gravity field varies because of density variations within the basement. The inversion does not take into account lateral variations in the density distribution of the Cenozoic deposits.

To overcome these difficulties, a first approximation of the basement gravity field is determined by interpolating a smooth surface through all gravity values measured on basement outcrops (curve labeled "iteration 1" in lower panel of Fig. 1b). The basin gravity is then the difference between the observed gravity field on the original map and the first approximation of the basement gravity field and is used to calculate the first approximation of the thickness of Cenozoic deposits. The thickness is forced to zero where basement rock is exposed. This first approximation of the basement gravity field is too low near basins because of the proximity of low-density deposits to the basement gravity stations. The basement gravity station values are "corrected" for the effects of the low-density deposits (the effects are calculated directly from the first approximation of the thickness of the Cenozoic deposits) and a second approximation of the basement gravity field is made by interpolating a smooth surface through the corrected basement gravity observations. This leads to an improved estimate of the basin gravity field, an improved depth to basement and a new correction to the basement gravity values. This procedure is repeated until successive iterations produce no significant changes in the basement gravity field.

## III. Results

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Using an updated gravity data set and more detailed surface geology we have produced a preliminary isopach map of Cenozoic deposits at Yucca Mountain and vicinity (fig. 2). Cenozoic deposits reach thicknesses greater than 2.5 km in Crater Flat, consistent with previous modeling results[2,3,4]. The isopach map indicates thicker deposits in western and southern Crater Flat and under northern Yucca Mountain. These local lows within Crater Flat and Yucca Mountain may indicate grabens that formed before the advent of voluminous silicic volcanism about 17 Ma[5]. This model predicts about 600 m of Cenozoic deposits at drillhole UE-25 p#1, which penetrated basement at a depth of 1244 m. Cenozoic deposits in Amargosa Desert and Jackass Flats are generally less than 1.5 km thick, in agreement with interpretations of electrical resistivity data[6] and with limited drill-hole data.

## IV. Conclusions

Although the results of the iterative modeling procedure agree fairly well with other data, the preliminary isopach map has several inherent limitations arising from the procedure and data used to create the map. Better gravity coverage on basement outcrops would better constrain the known basement gravity field. However, uncertainties in the density-depth function, lateral variations in density within the volcanic sequence, and the presence of concealed basement sources (e.g., a hypothetical pluton underlying the Cenozoic sequence in Crater Flat) could all affect the predicted cover thicknesses. Nonetheless, the isopach map does provide target basement depths for deep drilling in Crater Flat and Yucca Mountain. Differences between the predicted thicknesses and thicknesses determined by other methods can be used to refine the model.

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6. M.R. Greenhaus and C.J. Zablocki, "A Schlumberger resistivity survey of the Amargosa Desert, southern Nevada", U.S. Geological Survey Open-File Report 82-897, 150 p. (1982).

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Fig. 1 Schematic representation of the gravity separation procedure. "n" represents final iteration of basin-fitting procedure.

Fig. 2 Preliminary isopach map of Cenozoic sedimentary and volcanic rocks. Contour interval 0.5 km. Dark areas indicate outcrops of pre-Cenozoic rock; lightly shaded areas, Tertiary volcanic rock; unshaded areas, Quaternary and Cenozoic alluvial deposits. YM, Yucca Mountain; AD, Amargosa Desert; CF, Crater Flat; JF, Jackass Flats. Triangle shows location of well UE-25 p#1.

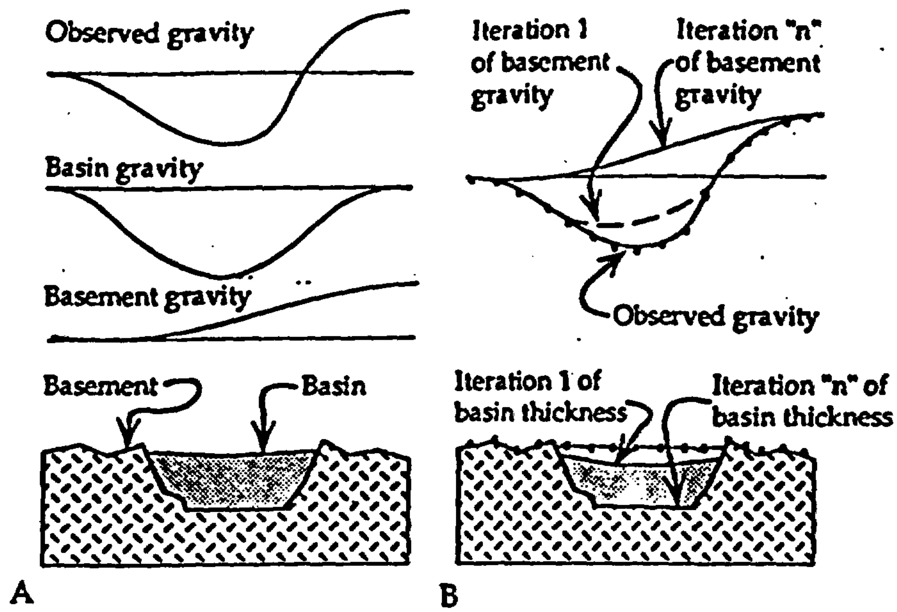
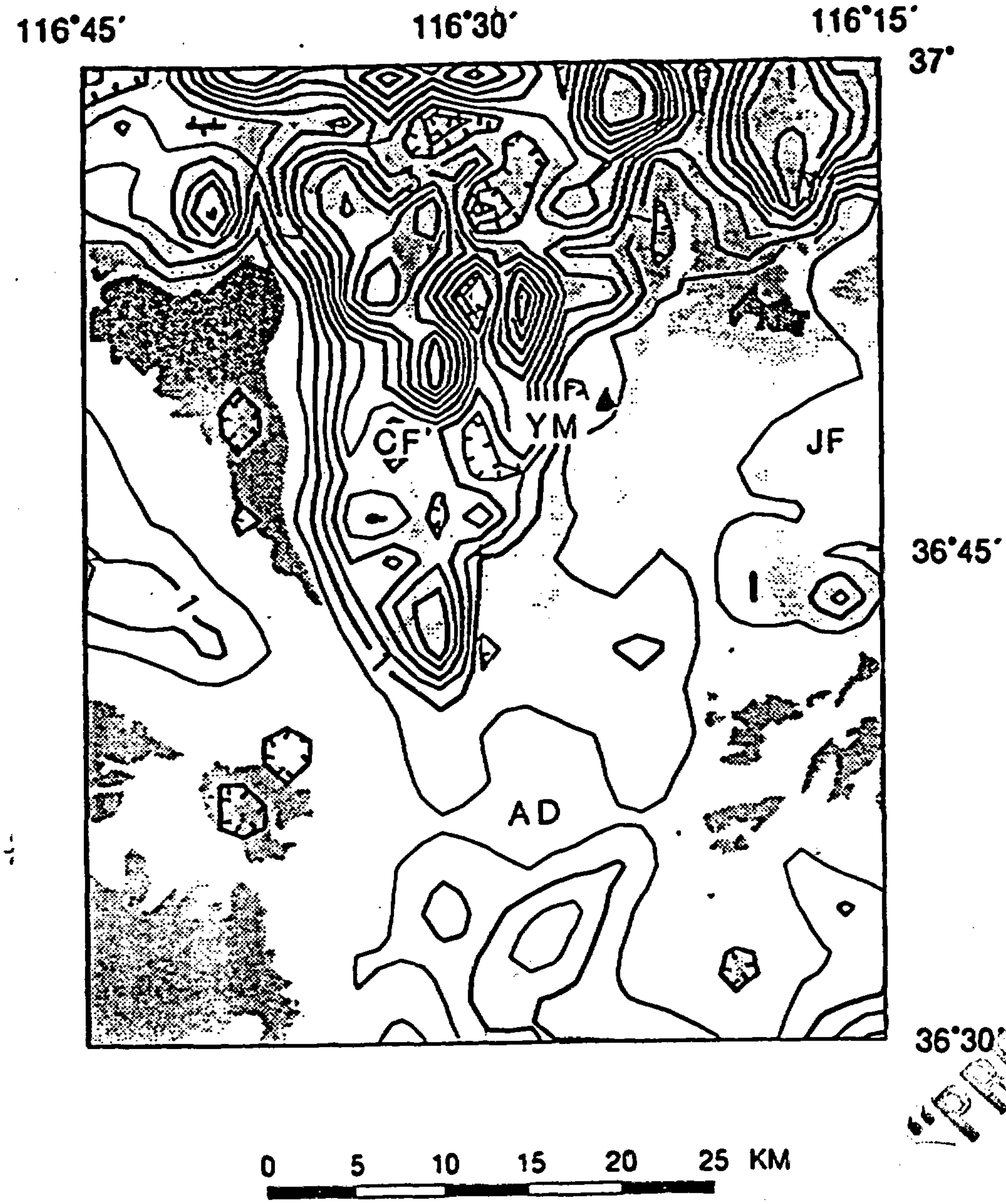



Figure 1. Schematic representation of the gravity separation procedure. "n" represents final iteration of basin-fitting procedure.






Preliminary isopach map of Cenozoic sedimentary and volcanic rocks. Contour interval 0.5 km. Dark areas indicate outcrops of pre-Cenozoic rock; lightly shaded areas, Tertiary volcanic rock; unshaded areas, Quaternary and Cenozoic alluvial deposits. YM, Yucca Mountain; AD, Amargosa Desert; CF, Crater Flat; JF, Jackass Flats. Triangle shows location of well UE25p#1.

UE-25