State of Nevada-Funded Research

Parametric Analyses of Alternative Flow Models at Yucca Mountain, Nevada Calibrations and Controls

Presentation to the NWTRB

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OUTLINE

INTRODUCTION

CONCEPTUAL MODEL

CALIBRATION TARGETS

GRIDDING AND BOUNDARY CONDITIONS

DISCUSSION OF RESULTS

CONCLUSIONS

CONCERNS

DOE IS PROCEEDING WITH SITE-RECOMMENDATION WITHOUT:

- DEMONSTRATING AN UNDERSTANDING OF THE SATURATED ZONE
- CONDUCTING UNCERTAINTY AND SENSITIVITY ANALYSES ON REASONABLE ALTERNATIVE MODELS OF FRACTURE FLOW
- UTILIZING ALL AVAILABLE AND RELEVANT DATA IN ANALYSES LEADING TO SITE RECOMMENDATION
- DEMONSTRATING THAT THEIR FLOW MODEL CAN MATCH DETAILED HYDRAULIC POTENTIOMETRIC SURFACE OR TEMPERATURE DISTRIBUTION
- UTILIZING COUPLED HEAT AND FLOW MODELS TO DETERMINE POTENTIAL FLOW PATHS

WORK IN PROGRESS

RESULTS ARE OF PARAMETRIC ANALYSES COMPLETED TO DATE

CONCLUSIONS ARE DRAWN FROM THIS PRELIMINARY WORK.

CALIBRATION TARGETS

POTENTIOMETRIC SURFACE - USGS DATA SET

TEMPERATURE

- TEMPERATURE MEASUREMENTS OF SASS (1988)
- HEAT FLUX AT WATER TABLE - SASS (1988)

CONCEPTUAL MODEL

- 3 DIMENSIONAL
- FULLY COUPLED HEAT AND FLOW MODEL
- FRACTURE FLOW MODEL
- FAULT ZONES PLAY A KEY ROLE IN FLOW FIELD
- TRANSIENT FLOW FIELD
  Though Model Results Are Steady State

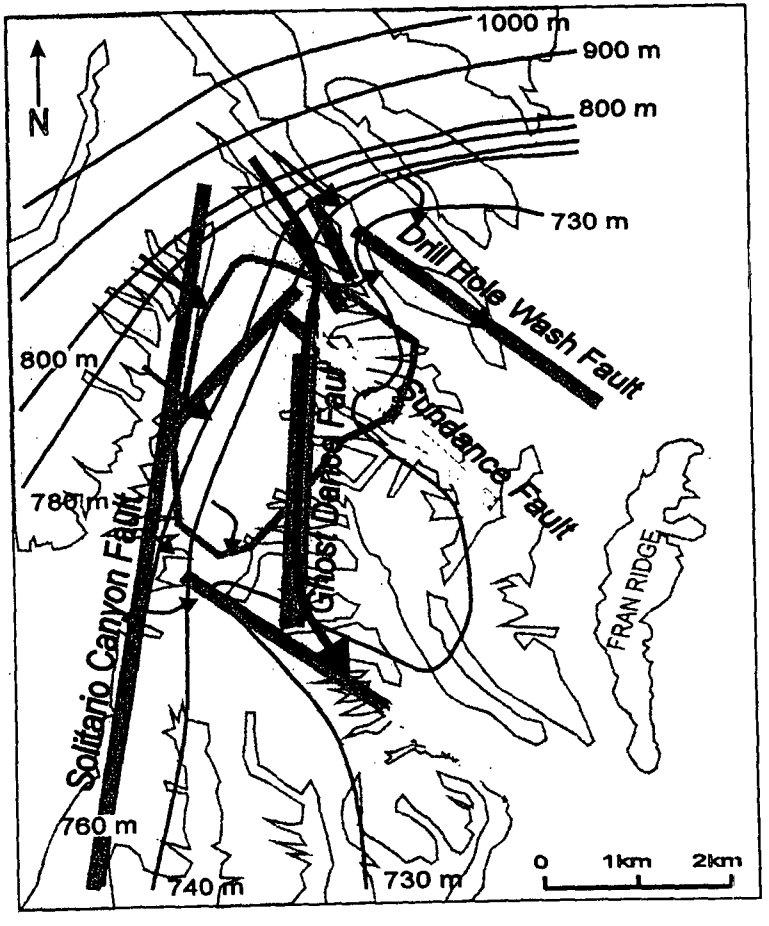


Figure 4. Alternative potentiometric surface with fault locartions and resulting flow pathways.

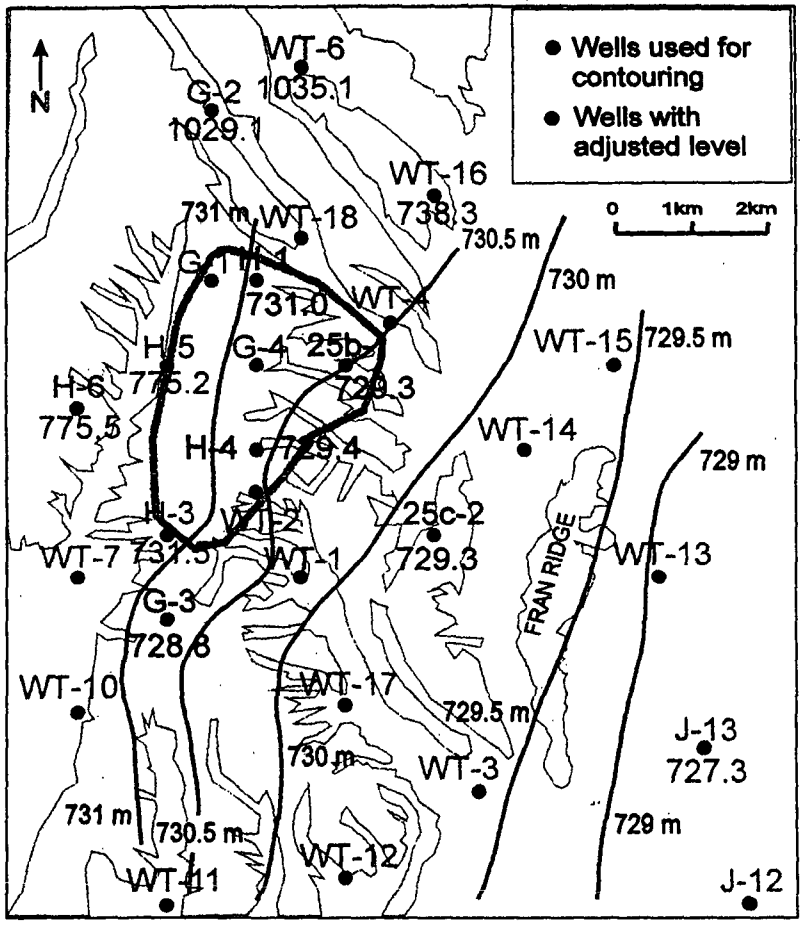
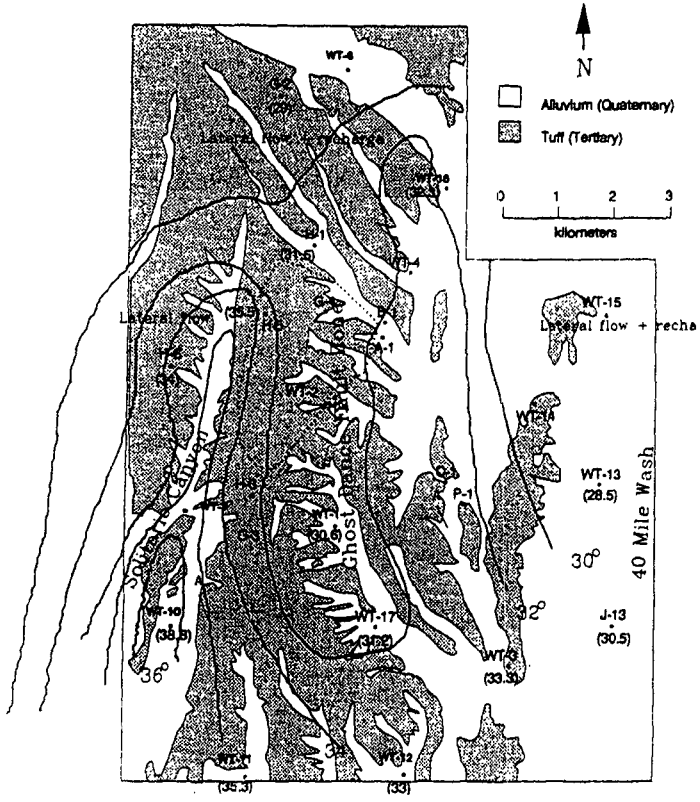
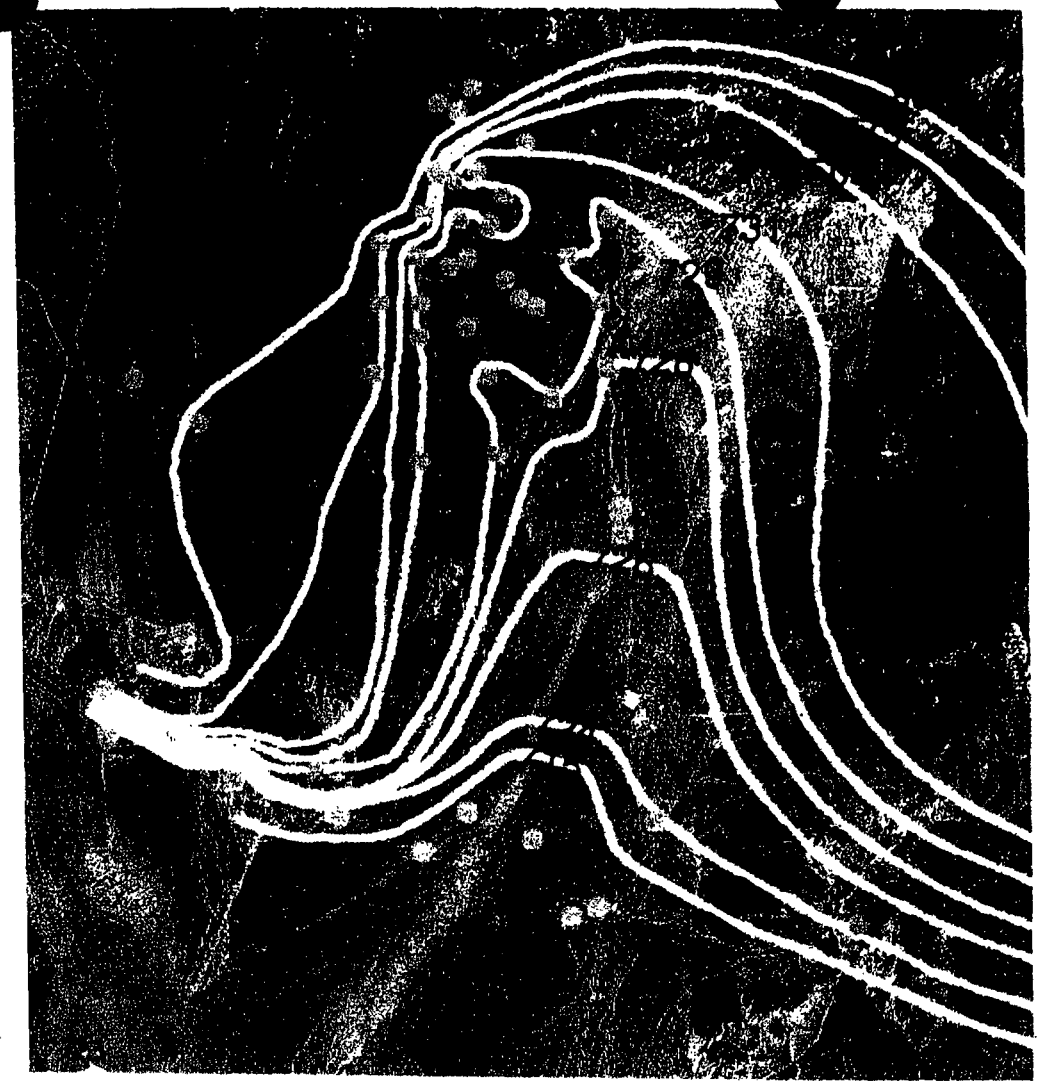


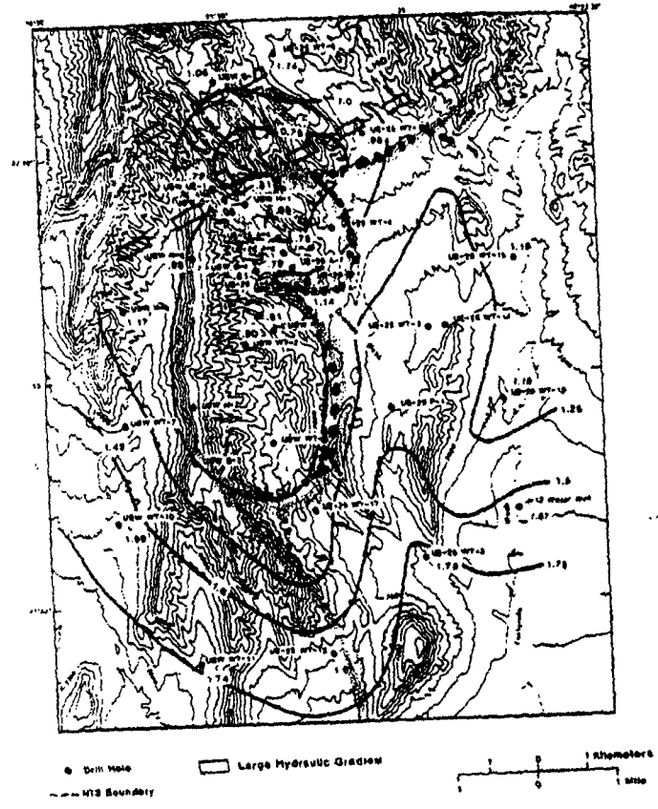
Figure 3. USGS Revised saturated zone potentiometric surface (Ervin, Luckey and Burkhardt, 1994). Red labels indicate adjusted data inconsistant with surface.

Saturated Zone Isotherms





GRIDDING AND BOUNDARY CONDITIONS

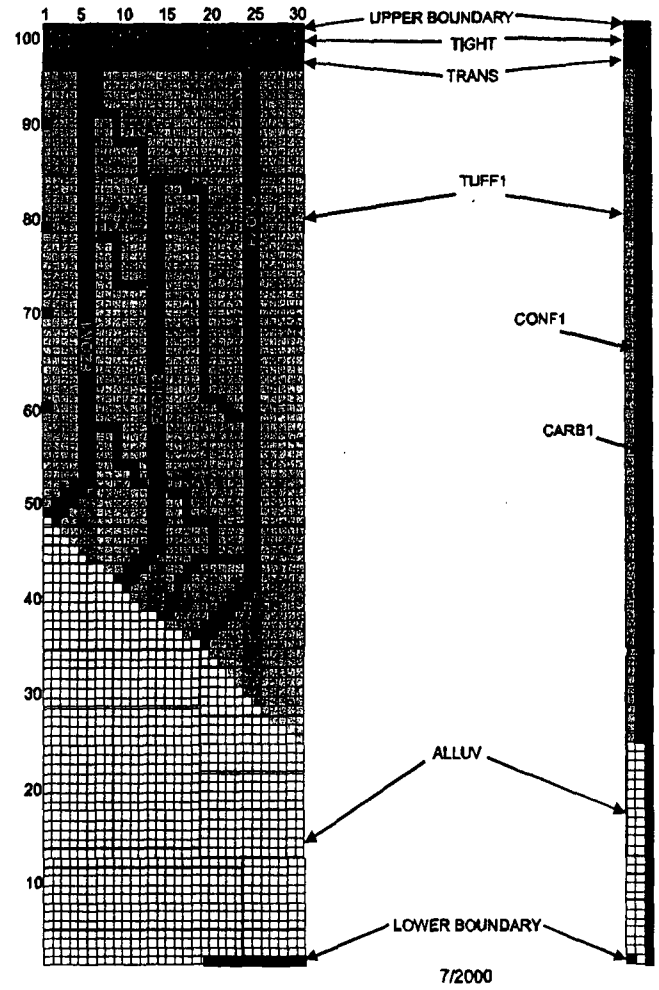


approximate 730 m contour of potentiometric surface mg

Fig. 7. Map showing lines of equal heat flow in heat-flow units (1 HFU = 10^{-6} cal cm^{-2} s^{-1}) measured in the unsaturated zone under Yucca Mountain, modified from Sass et al. (1988).

Lehman & Brown (1994)

CONTROLS OF POTENTIOMETRIC SURFACE



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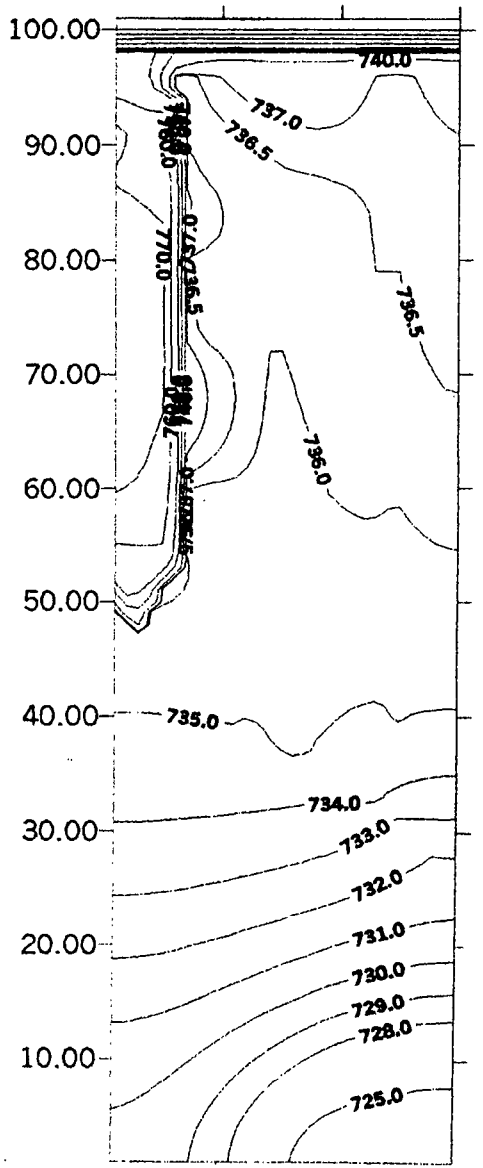

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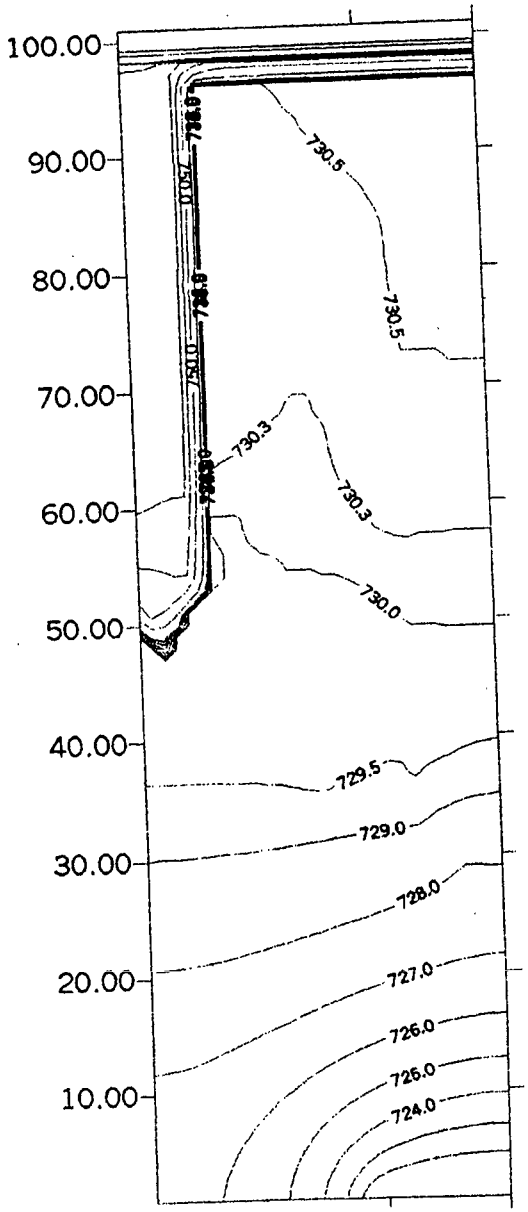

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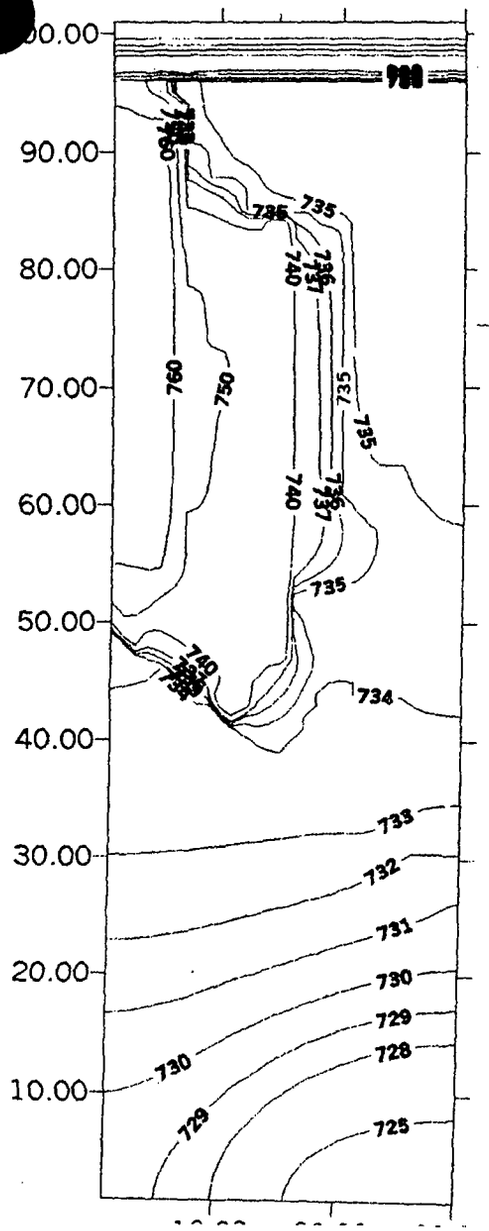

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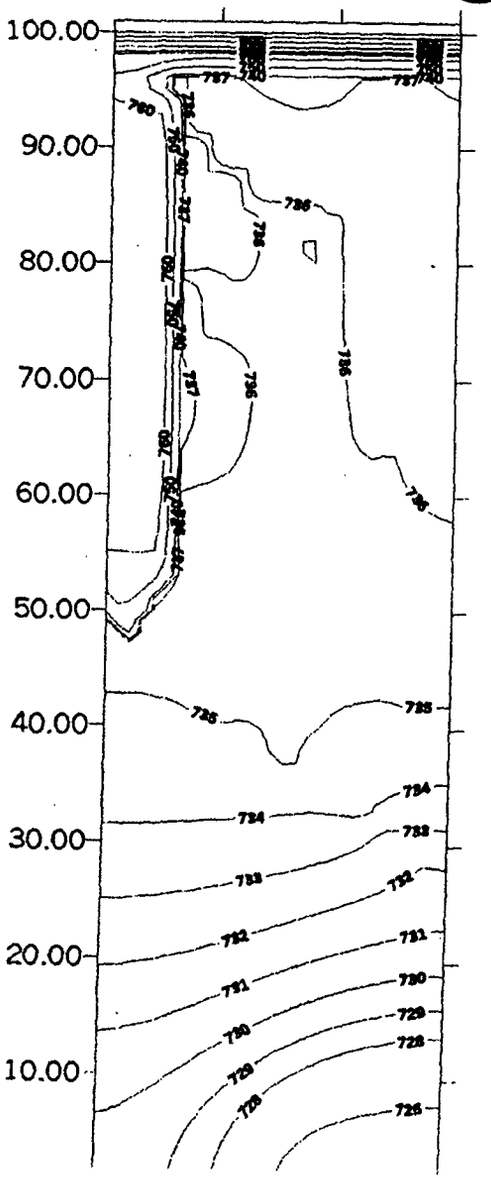

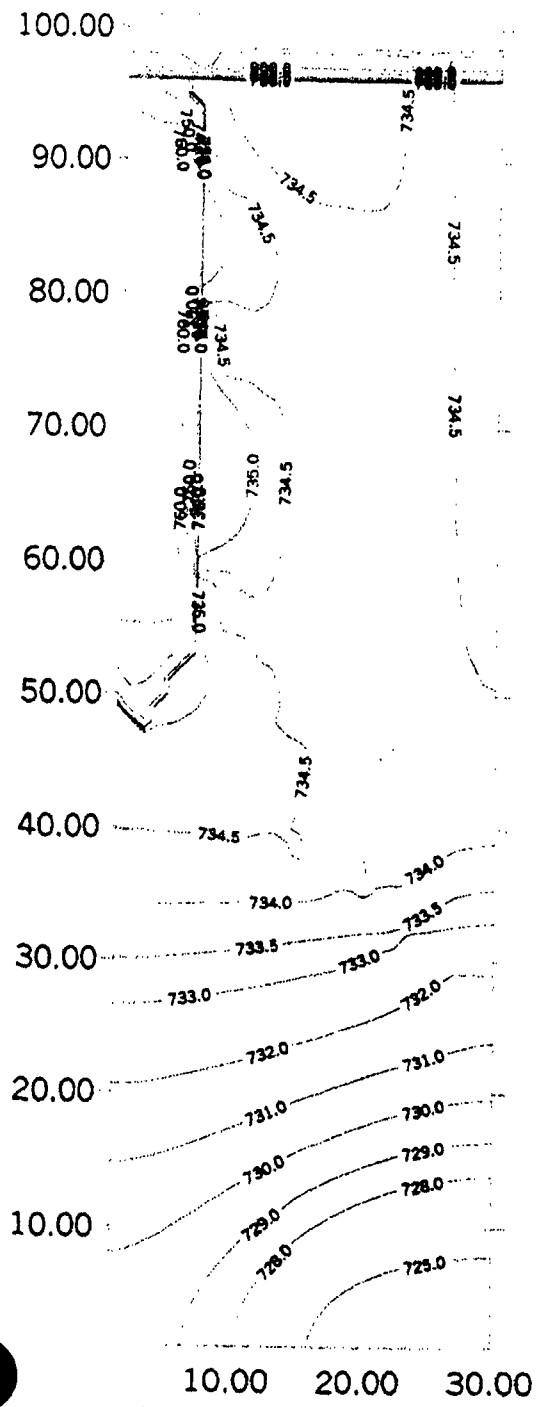
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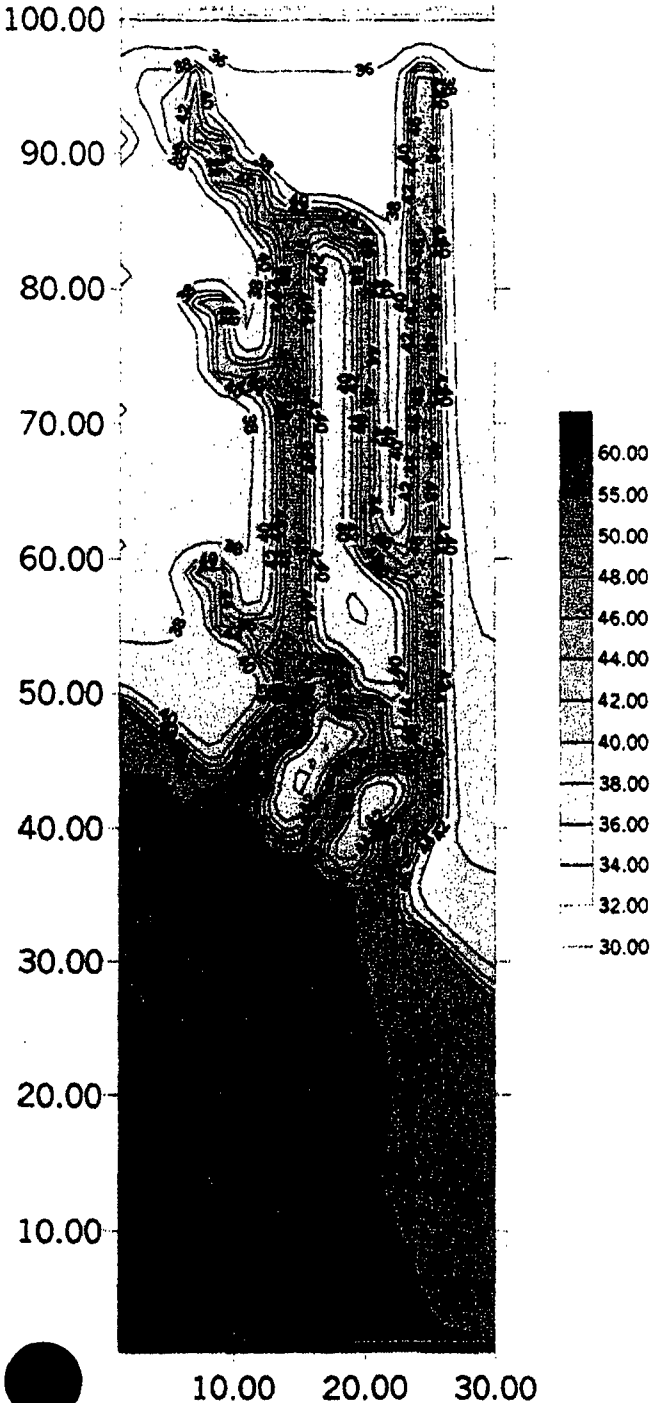
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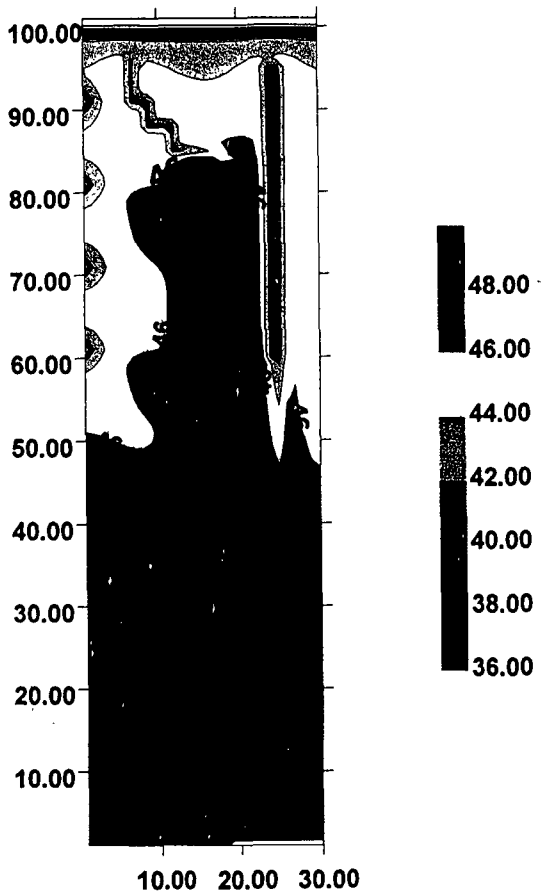
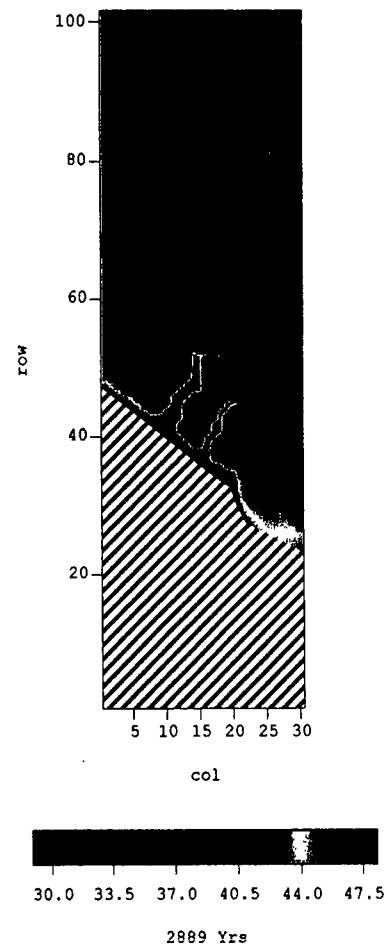


SEVERAL WAYS TO COOL FAULTS

1. ADD WATER FROM THE NORTH
2. ADD WATER FROM INFILTRATION
3. NO VERTICAL COMMUNICATION WITH CARBONATES
4. LOWER BOUNDARY CONDITION FOR CARBONATES IS NOT AS ASSUMED UNDER YUCCA MOUNTAIN
5. ADJUST THERMAL CONDUCTIVITIES

CONTROLS OF POTENTIOMETRIC SURFACE

- 1. NW trending shear zones of high permeability - embayments
- 2. N-S high K_{xy} in a north-south flow field



New Run: Initials set at
Carb=50
Layer 2 = 40
Layer 3 = 29

Layer 1 Deck03

FUTURE WORK

MATCH ALLUVIUM PROPERTIES FROM NYE COUNTY DATA

ADD HWY 95 FAULT EXPLICITLY

UTILIZE THERMAL CONDUCTIVITY CONTRASTS

EXAMINE BOUNDARY CONDITIONS

UTILIZE ITOUGH FOR CALIBRATIONS

CONTROLS ON TEMPERATURE FIELD

(BALANCING ACT)

.1. HEAD DISTRIBUTION

2. HEAT COMES UP FRACTURES WITH MINOR K_v CHANGE

(HIGHER THAN CONFINING UNIT - UNDER THESE BOUNDARY CONDITIONS)

3. HEAT BALANCED BY RECHARGE OR INFILTRATION