A GEOPHYSICAL APPROACH TO RESERVOIR DELINEATION IN THE GEYSERS

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Recent syntheses of geophysical work at The Geysers (Chapman 1975, Isherwood 1975) have provided useful insights into regional structure in this complex and chaotic area. Regional studies of this type, however, are of limited value to reservoir investigations and it may be that the more detailed temperature gradient/heat flow studies (Frye 1976) can supply more useful information.

The survey discussed here was carried out on the Rorabaugh lease in the southwest sector of The Geysers geothermal field in an area of known production, good drilling records and closely spaced data points. Initial drilling on this lease was carried out by Geothermal Resources International and the area was subsequently developed for a 55 mW power plant by Pacific Energy Corporation and their successor, Thermogenics, Inc. The study included data from several producing wells, three deep suspended wells and four shallow (250'-500') temperature gradient holes.

The raw data were corrected for terrain (Jamieson 1976) and isotherms plotted from 25°C to 240°C (Fig. 1). Gradients in Big Sulphur Creek Valley were as high as 7.2°C/100 ft. and required terrain corrections of minus 20 per cent. Gradients on the ridge above the creek were as low as 1.88°C/100 ft. and required terrain correction of almost 100 per cent.

The 240°C isotherm plotted from these data lies just above steam shows in the producing area. This suggests that the terrain corrections were of the correct order of magnitude, that the thermal conductivity of the formation is reasonably uniform and that there is good conductive coupling between the reservoir and the surface (Urban, et al 1975).

The rapid down turn of the 240°C isotherm outside the producing area suggests a sharp field boundary, a postulate supported by the absence of steam in Rorabaugh A8. It further suggests a very high angle field boundary, which is in accord with the high angle fractures encountered during drilling and with the high angle structural features which appear in geological mapping. The nature of the boundary is undefined, and it may correspond to faulting, changes in fracture intensity, changes in metamorphic grade or changes in silica content. The position of the boundary, however, is fairly precisely defined, and this should be of considerable interest when interpreting well test data from this field.

The success of this survey in a comparatively simple situation suggests that it may be developed to handle more complex areas with shallow hot water zones, variable lithology and variable microclimates. If this can be done, it may provide a useful link between geothermal exploration and reservoir engineering.

References

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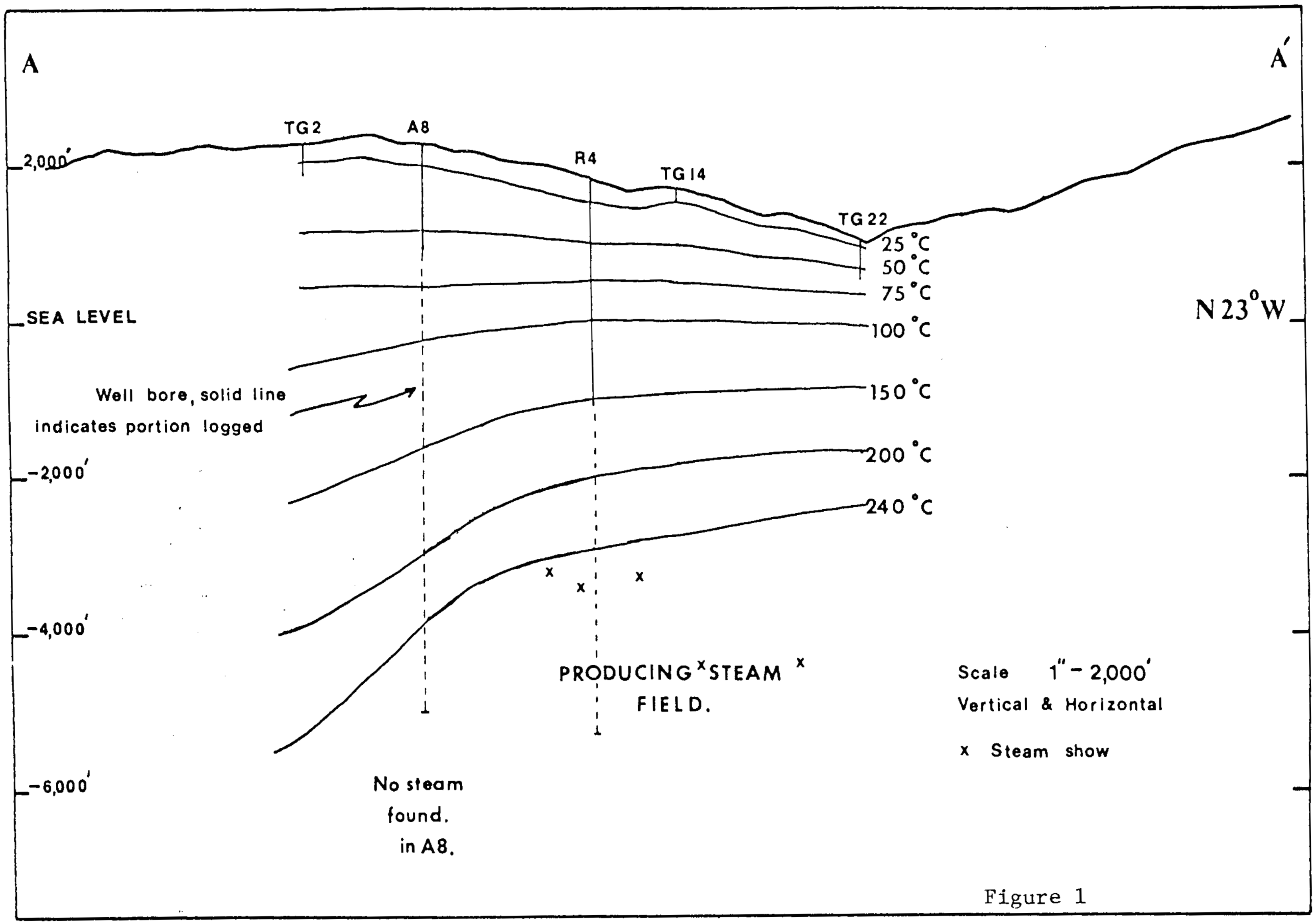

Fig. 1. Isotherms along the profile AA' showing temperature gradient holes, wells and steam shows. Portions of the well bores for which temperature data were obtained are shown as solid lines and portions for which no temperature data are available are shown as broken lines.