

FRACTURE IMAGING IN GEOTHERMAL SYSTEMS

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ABSTRACT

A high temperature borehole televiewer tool has been developed in cooperation with Sandia National Labs and tested in a Unocal well in the Salton Sea geothermal field. Processed televiewer data provides detailed images of permeable fracture zones and wellbore breakouts. Fracture orientations in the log portion of the hole generally trend N12W and dip steeply to the SW. These macroscopic fractures are subparallel to the trend of the Brawley Fault which cuts the eastern edge of Unocal's development area. Changes in wellbore geometry occur both as wellbore breakouts and asymmetric elongations. Wellbore breakouts occur in a distinct population oriented N83E and provide a well resolved orientation of maximum horizontal principal stress at N07W. Asymmetric elongations trend N67W and appear to be controlled by steeply dipping fractures crossing the wellbore. Breakouts determined from HDT dipmeter data correlate very well with televiewer breakout data and suggest the same relation between fracturing and wellbore configuration in other parts of the well. The apparent relationship between steeply dipping fractures and breakouts suggests that with knowledge of the maximum horizontal stress significant changes in breakout shape and orientation may be used to identify fractured zones. The extreme detail provided by televiewer data is a highly effective way to interpret the details of wellbore geometry from conventional logs. Surveys with a high temperature oriented caliper log may allow similar interpretations in steam wells.