

# SOLUTION MINING RESEARCH INSTITUTE

812 MURIEL STREET  
WOODSTOCK, ILLINOIS 60098  
815-338-8579

MEETING  
PAPER



PANEL DISCUSSION ON HYDROFRACTURE TESTS  
Summary by R. L. Thoms

Special Session: Hydrofracture Tests of U.S. Salt  
Spring Meeting, April 20-22, 1986  
Baton Rouge, Louisiana

Applied Geomechanics, Inc.  
P.O. Box 80619  
Baton Rouge, Louisiana 70898

1986 SMRI SPRING MEETING  
April 21, Baton Rouge, Louisiana  
Panel Discussion, Special Session on Hydraulic Fracturing of Salt

PARTICIPANTS: D. Bush, Earth Technology Corporation;  
T. Doe, Lawrence Livermore National Laboratory;  
T. Lamb, Stone and Webster Engineering Corporation;  
R. Nelson, Woodward Clyde Consultants;  
R. Thoms, Applied Geomechanics, Incorporated (Moderator); and  
W. Wawersik, Sandia National Laboratories.

The panel convened after lunch following presentations by individuals in the morning portion of the Special Session. W. Wawersik presented some results of Finite Element (FE) modeling of a fluid-filled borehole and compared it briefly to results for an "open" hole. J. Head then asked T. Doe about use of Acoustic Emissions (AE) for "tracking" hydraulic fractures. T. Doe responded that some success had been achieved in the hot, dry rock program using multiple boreholes and AE, however similar efforts from a single borehole would be more restricted (for AE "source" location). Discussion followed on use of near-surface AE sensors (as compared to downhole sensors). The general consensus appeared to be that the degree of uncertainty in interpreting AE increased with the use of near-surface sensors (i.e., the closer to the source, the better - R. Unterburger. The work of R. Hardy at Penn State was noted during this discussion.)

L. Van der Horst stated that tiltmeters had been used to detect hydrofracturing from wells, however G. Petrick indicated that this technique apparently had not been successful in their field operations at St. Clair, Michigan. T. Doe observed that the Gas Research Association (GRA) had funded use of tiltmeters for this application, and that this technique had also been used with some success at the Oak Ridge National Laboratory to detect the location of injected wastes.

The discussion then turned to the topic of the use of impression packers to determine the orientation of fractures downhole. Most of the Panel participated in this discussion. Field results had ranged from useful data (T. Lamb and D. Bush) to limited (R. Nelson). W. Wawersik reported that impression packers apparently yielded no data for German workers in the Asse Mine, and that only by mining back over the test area were they able to collect data on fracture orientation. Nevertheless, the consensus appeared to be that impression packers could be used to obtain useful information on fracture character and orientation. Also, participants agreed that special packers for impression application should be used, rather than "wrapped" regular packers.

A member of the audience requested information on a blast "set-off" in the Winnfield salt dome and its effects on the surrounding salt. R. Thoms noted that a set of Lawrence Livermore Laboratory reports existed on this project ("Cowboy", circa early 60's), and that the blast area was blackened and exhibited some localized fracturing (to the best of his recollection). J. Head reported that

miners use the fractures from blast holes in salt as indicators of stress states. The fractures can be traced because they are blackened by soot. Extensive horizontal fractures indicate relatively large lateral stresses---thus, beware of possible roof falls.

The final portion of the Panel Discussion dealt mainly with determining stress states in salt with hydraulic fracturing tests. W. Wawersik, in response to questions from L. Eriksson and others, cautioned against use of "shut-in" pressures for stress analyses in salt because of "pinch-down" effects. Based on FE analyses, he also indicated a "window in time" existed after a hole was drilled in salt for performing hydraulic fracturing tests for studies of stress states. It was interesting to note the confluence of conclusions by Doe and Wawersik that the character of salt fracturing was affected by the anisotropy of confining stress states when the ratio ranged around 1.25. W. Wawersik indicated that more information on hydraulic fracturing tests at WIPP would be obtained in the next few months, and that these findings will be relevant to the topics discussed at this Special Session.

In summary, the Open Panel discussions with the audience generally appeared to be well received and of interest to those present.