From: Kurt W. Larson
To: malord, pvaughn, msychu
Date: 1/24/96 8:24AM
Subject: Fracture model ideas

A couple of ideas as the frac. model parameters are determined. I will be away next week, so Palmer you will have to see that the memo for Project office to consider gets written.

From brine-outflow meeting 1/23/96:

Wolfgang Wawersik thinks each interbed has a zone about 10cm thick which dilates. Each zone dilates identically. This means a different set of fracture parameters would be applied to each interbed. He and Norm Warpinski think the LEFM model is appropriate analogue. LEFM predicts about 1 cm dilation max with tremendous permeability change for pressures somewhat above lithostatic.

For MB 138 and 139, 1 cm dilation - 1% porosity change over entire thickness
For anh.A+B, 1 cm dilation - 3-5% porosity change over entire thickness (someone who knows modeled thickness can figure out more accurately)

dilation/fracturing begins is a continuous process, so initiation pressure should be low.

Additionally, Norm thinks pressures above 17-18 MPa are not realistic, and indicate too constrictive fracture model conditions. Thus, fracture model must be able to open up better than recent implementations (FEPs) which allowed pressures up to 23 MPa.

This leads me to the following recommendation:

Initiation pressure
about 0.2 MPa above initial pressure of cell
I
Final Pressure, Final Porosity, Final Permeability
I suggest using these as fitting parameters so that the following condition is attained

At about 2.5 MPa above initial pressure in cell, fracture porosity and permeability begin steep rise (commensurate with onset of real fracturing ) - below this pressure shallower rises indicate interconnection/dilation of existing fractures

a. At about 3 MPa above initial pressure in cell, fracture porosity reaches 1% for MB 139, MB 138; 3-5% for Anha+b.

b. At about 3 MPa above initial pressure in cell, fracture permeabiltiy reaches 87 OM greater than initial.

a+b above make a fracture that is relatively long due to high permeability and narrow due to moderate increase in porosity. condition of a+b is ideal max pressure for model, and commensurate with LEFM model.

Above about 3 MPa increase, fracture porosity and permeabity continue steep rise so that increased pressures have a mechanism for blowing off steam rapidly.

If the modal is set so that there is no increased porosity or permeability above about + 3 MPa, then I think some vectors will result in pressures significantly in excess of 20 MPa.

I look forward to hearing what the final values chosen are

Kurt