

**AAPG Annual Convention  
Salt Lake City, Utah  
May 11-14, 2003**

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### **Geochemical Fingerprinting of Crude Oils, Shaybah Field, Saudi Arabia: Evidence Of Reservoir Charging History**

Production of 500,000 BOPD commenced in July 1998 from the supergiant Shaybah field in the Rub' Al-Khali basin of Saudi Arabia. Oil is trapped in platform limestones of the Lower Cretaceous Shu'aiba Formation along a SW-NE-trending anticlinal structure roughly 60 km long and 12 km wide. Permeabilities, generally between 10 and 50 mD, tend to be poorer in the south, which is dominated by lagoonal facies, and better in the north, which is dominated by rudist barrier facies. A number of E-W-trending strike-slip faults with relatively small displacement cut the top of the Shu'aiba but recent interference tests suggest that these are not sealing.

Geochemical fingerprinting studies involving 76 Shu'aiba wells have identified four discrete oil families that produce from different parts of the field. Principal components analysis shows that most of the fingerprint variations are controlled by just two underlying factors, interpreted to be thermal maturity and source rock depositional environment. Evidence for reservoir compartmentalization is lacking. Fluid pressure variations are adequately explained by permeability variations within a single compartment model and mapping shows no correspondence between the distribution of the oil families and reservoir facies or fault patterns.

The Shaybah oil families appear to reflect discrete pulses of oil that charged the reservoir from different directions at different times. Although detailed charge modeling has not been carried out, the inferred charging directions are consistent with regional structure and maturity maps on the relevant Lower Cretaceous and Upper Jurassic strata.