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Frontier Exploration Basin Modeling Technology Tested in the Mature Arkoma Basin, Oklahoma, USA: Abstract

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ABSTRACT

Integrated Basin Chemical Modeling (IBCM) was developed as a predictive tool for frontier exploration and to date has been used in numerous basins worldwide. Amoco has utilized data from the mature Arkoma basin of eastern Oklahoma to verify the accuracy of this proprietary technique. The Arkoma basin was chosen as a test case due its complex tectonic history and the amount of subsurface data available.

Several dip and strike depth-converted seismic lines were used to model timing of critical events: Spiro deposition, thrusting, maximum paleotemperature, generation and expulsion of hydrocarbons, genesis of pressure compartments and evolution of pressure seals within the basin.

Preliminary IBCM simulations of basin thermal history indicate that the time of maximum temperature occurred at 280 mya, post-dating thrusting of the Ouachitas. Therefore, it is not necessary to palinspastically restore the traps within the thrusted terrain prior to identifying migration pathways. At the time of thrusting, 301 mya, the modeled pressures in the Atokan shales reached 7500 psi (500 atm) above normal hydrostatic pressures, creating effective pressure seals for the Pennsylvanian Spiro and Wapanucka reservoirs. Complex hydrologic flow thus became concentrated within these reservoir sections. The model also indicates that critical flow directions reversed several times during basin evolution.

Additional work is underway to confirm paleo-geothermal gradients estimated from apatite fission track analysis and to define potential subtle traps using the diagenetic module of IBCM.

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