Two oil fields in the Williston basin and one potential gas field in Algeria are interpreted to be reservoirs in fractured strata beneath buried impact structures.

In addition to fractured domal structures, impact events in water-bearing, poorly consolidated materials can produce large bodies comparable to sand-flow volcanoes and clastic dikes. Such permeable features, after burial and lithification, may or may not be found in sedimentary environments, such as starved basins, deltas, or lagoonal areas, in which petroleum reservoirs normally occur.

Impact features with petroleum accumulations are most likely to be formed in relatively young, shallow-marine depositional environments (water depths less than 200 m) merely because these structures are most favorably located relative to the time and place of petroleum origin and its later migration. Terrestrial impact sites in well-lithified ancient strata, even crystalline rocks, however, may become reservoirs if a subsequent transgression results in deposition of a basal marine sequence of petroleum-generating sediments.

The best means of recognizing subsurface-impact features are detailed stratigraphic analyses, local structural-anomaly recognition, and high-recognition seismic data. Potential reservoirs of impact origin will be randomly distributed geographically and temporally throughout stratigraphic sequences; prediction of their location will therefore be difficult. Lack of trends, preferential location, or predictable distribution of impact sites precludes systematic search strategies during petroleum exploration. Commonly, magnetic and gravimetric signatures of buried impact features tend to be so subtle as to be ignored by geologists and geophysicists, although known large surface impact sites typically display gravity deficiencies. Only those isolated anomalies which show an obvious circularity can be readily distinguished as possible subsurface impact features. Constant alertness for subtle clues to the presence of subsurface impact structures during routine stratigraphic, structural, and seismic data analyses will be most effective in achieving their discovery.

MAXEY, MARILYN H., and ALAN H. COOGAN, Kent State Univ., Kent, Ohio

Oil- and Gas-Producing Configurations in Trenton Limestone, Northwestern Ohio

Five types of petroleum-producing configurations are present in the Middle Ordovician Trenton Limestone around the Lima-Indiana field in northwestern Ohio. The first, an anticlinal trap, is present along the Findlay arch. Closure is provided on top of the Trenton by regional carbonate bank buildup, folded with and capped by the Utica Shale. The second, a faulted anticline, is present along the Bowling Green fault in Wood, Hancock, and Lucas Counties. A high-angle reverse fault along the crest of the Findlay arch juxtaposes dolomitized Trenton rock with the overlying Utica Shale. This configuration has accounted for significant oil and gas production. The third trap type consists of an updip facies change from Trenton Limestone to Utica Shale, with draping of the thickened shale over the Trenton Limestone. The fourth type, in the Michigan basin, is the fracture systems and dolomitization in the Albion-Scipio trend. The fifth, and less well documented, is a porosity trap in dolomitized upper parts of the Trenton. Dolomitization may function in two ways, both as a prerequisite to formation of sufficiently porous reservoir rock with other trapping mechanisms. Other Trenton fields are not accounted for by these five configurations.

Stratigraphic and structural cross sections from the top of the Trenton to the Knox unconformity, as well as structural and isopach maps of the area, show a major carbonate buildup of the Trenton in a northeast-southwest trending arc in northwestern Ohio. A broad carbonate platform with wedge-top dolomitization in an island environment is postulated as an alternative to a regional erosional unconformity between the Trenton Limestone and Utica Shale.

MCHUGH, STUART L., PAUL E. SENSENY, DOUGLAS D. KEOUGH, and ALEXANDER L. FLORENCE, SRI International, Menlo Park, Calif.

Interaction of Proppants with Crack Formation and Propagation in Hydraulic Fracturing

In many wells, productivity can be increased by repeated hydraulic fracturing. Repeated flow cycling has also been shown to increase productivity, sometimes significantly above what can be obtained with a single cycle. The increased productivity from repeated flow cycling suggests that a predictive capability for treating specific wells could be developed if the controlling parameters and their interactions in the flow/cycle treatment process were better understood. Although the primary role of the proppant in hydraulic fracturing is to maintain fracture opening, the proppants may have other effects such as altering the pressure distribution along the fracture (e.g., by blocking the tip) and hence significantly affecting the fracture mechanics.

Although proppant transport by fluids has been studied intensively, the coupled interaction problem of fracture propagation, fluid flow, and proppant transport has not been previously investigated. In SRI International's program to analyze the coupled interactions of proppants and fracture mechanics, proppant distributions are being determined for the coupled problem of fluid-proppant-fracture interaction, and the effects of the proppant distributions on fracture production are being evaluated for the flow/cycle treatment.

Scaled experiments in several media (PMMA and rock simulant) will check the correlation of fluid penetration and fracture propagation rate with a calculational model for the fluid-fracture interactions. The scaled experiments will also constrain the relation between the proppant distributions and the fluid-fracture interactions. The computational model will be verified by comparing calculations of the proppant distributions in the scaled experiments, for which viscous or gravitational effects are dominant, with the scaled experiments.

MILLER, R. E., D. M. SCHULTZ, H. LERCH, D. LIGON, D. OWINGS, and C. GARY, U.S. Geol. Survey, Reston, Va.