sand at the top.

Oil saturation varies from 0 to 14 wt. % (average 8.5 wt. %), and is zero within: (1) calcite cemented beds, (2) a basal water zone varying from 4.5 to 11.5 ft thick, and (3) a thin water zone at the top of the reservoir.

Log porosity of saturated sand ranges up to 36%; permeability reaches 25 md and several darcys after extraction. The reservoir contains seven thin (0.5 to 1.5 ft), tightly calcite cemented beds that form permeability barriers. Permeability is highly directional and correlative with grain fabric. Oil saturation is controlled by grain size, fines, sorting, roundness and authigenic clay.

Current pilot experiments have been inconclusive. Difficulties have occurred with injection into oil-saturated sand and confinement therein. Laboratory simulation experiments have resulted in marked chemical and physical reservoir changes.

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Variation in Turbidite Sand Facies and Application to Petroleum Geology

Turbidite sand in canyon, slope base, fan valley, and depositional lobe deposits interbedded with hemipelagic mud provides an ideal environment for petroleum accumulation. The geometry of sand facies, composition of source mud, and petroleum potential vary with basin size and setting.

In the smallest restricted basins (i.e., carbonate platform troughs <10 km diameter) with multiple sources of extremely coarse-grained material, channelized turbidite facies do not develop. Thick, coarse-grained sediment gravity flows accumulate in slope valleys and base-of-slope settings associated with potentially organic-rich slope mud. At greater distances from the slope base, turbidite sand beds become fewer, thinner, and more widely dispersed in basin mud.

Restricted basin fans of intermediate size (i.e., California borderland basins <100 km) fed by canyons intercepting littoral drift cells have excellent petroleum reservoir potential. Low-matrix turbidite sand is channeled to mid-fan lobes and may be interbedded with organic-rich hemipelagic mud. Sandstone continuity extends laterally from inner fan channels to suprafan lobes and vertically within lobe sequences. Tectonic overprint in restricted basin settings commonly permits preservation of turbidite reservoir beds and enhances thermal maturation of organic-rich mud.

Turbidite sand of large, open basin fans fed from major river sources is: (1) finer grained and contains more matrix and (2) channeled to more distal depositional sites than those of restricted basin fans. The organic content of interbedded pelagic or hemipelagic mud is low because of oxidation and infaunal activity. Continuity is poor laterally between lower fan depositional lobes and upper to middle fan channel sand or vertically within mud-rich depositional lobe sand beds. Subduction of deep-sea floor fan complexes may destroy turbidite sand bodies as reservoir sites, just as it may tectonize linear turbidite sand bodies of trench fill and deep-sea channel systems. Similar sand bodies of submarine canyons however may have good petroleum potential where they are enclosed by organic-rich slope mud.

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Red Wing Creek Field—Cosmic Impact Structure

Red Wing Creek field is located near the center of the Williston basin in McKenzie County, North Dakota. The discovery well was drilled by True Oil Co. in August 1972. The primary trapping mechanism is structural. Seismic and subsurface data indicate that Triassic, Permian, and Pennsylvanian formations are missing over the center of the structure. Replacing these are rocks of Mississippian age which have undergone intensive deformation in an uplifted structural cone approximately 3,000 ft (914 m) high and 3 mi (4.8 km) in diameter at its base. Formations above and below the structure show very little tectonic disturbance.

Mission Canyon Limestone of Mississippian age is the primary producing horizon. The discovery well has over 1,600 ft (438 m) of net pay which is the best well in the field. Porosities range as high as 25% but most of the reservoir has porosities in the range of 6 to 10%. Oil-water contact is placed at a subsea depth of 7,600 ft (2,316 m). Reservoir studies indicate approximately 100, 000,000 bbl of oil in place.

To date the field has 11 wells capable of production. There are eight dry holes. Two wells have been drilled to the Red River Formation of Ordovician age. At present there has been no commercial production above or below the Mississippian.

Present data have indicated that the field is producing from the central peak of an astrobleme, or meteorite impact structure of Jurassic age. Proof of this origin is based on geometry and shock deformation features, which include monolithologic breccia, shatter cones, and shock deformed quartz. The feature has been modified by subsequent salt collapse and differential compaction.

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**AAPG SEALS FOR HYDROCARBONS RESEARCH CONFERENCE, SEPTEMBER 14-17, 1980 KEYSTONE LODGE KEYSTONE, COLORADO**

The Seals for Hydrocarbons Research Conference is being convened by T. T. SCHOWALTER and M. W. DOWNEY to focus attention on a fundamental, but relatively neglected area of petroleum geology. Recent advances in organic geochemistry and the study of migration have added to the understanding of the significance of hydrocarbon seals. The program is divided into discussions of the "micro" view (seal capacity, permeability, hydrodynamics, and prediction from core data), and the "mega" view (worldwide review of types, controls in faulted structures, trap leakage detected by acoustical devices, evaporites as seals, etc) and a general session on the direction of future research. Besides the two conveners, speakers will be R. R. BERG, Texas A&M; D. S. STONE, Independent; B. ROBERTS, Gulf R&D; H. GRUNAU, Petroconsultants; R. J.