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Geological Abstracts

AMORUSO, J. J., Independent Geologist, Houston, Tex.

SMACKOVER STRATIGRAPHIC TRAPS—NEW PRODUCTION IN OLD AREAS

Stratigraphy has been recognized progressively as an important factor in the entrapment of Smackover hydrocarbons in the mature Arkansas and Louisiana producing fairway. Although most of the older fields generally were considered to be essentially in structural features, the importance of stratigraphic factors in entrapment has been dramatically focused by the discovery of Walker Creek field, Lafayette and Columbia Counties, Arkansas.

The accumulation in this field is caused by stratigraphic entrapment by the updip termination of porous Smackover beds across a gentle structural nose. Discovery of Walker Creek signals the beginning of the second phase of Smackover exploration—the search for combination structural/stratigraphic and wholly stratigraphic traps—and the rebirth of exploration for large reserves in a mature segment of the trend.

The regionally regressive depositional character of the Smackover in this area afforded an excellent setting for the formation of many stratigraphic traps. Porous carbonate zones, successively higher within the Smackover section, were deposited southward across the shelf. The updip terminus of each zone abuts an impermeable seal to form an ideal stratigraphic trap. The sinuous nature of the updip terminus, in many places in conjunction with low relief structural noses or closures, entraps the hydrocarbon accumulation laterally. In addition, many variations in the regional situation, due to the local depositional patterns of individual zones, tend to complicate the simple stratigraphic trap.

Lithologically, the most characteristis reservoir rock is an oolitic-pelletal limestone with intergranular porosity. Porosity up to 30% is not unusual, but average porosity ranges from 10 to 20%. Various degrees of porosity destruction have resulted from the infilling of the primary porosity with sparry calcite cement. Where wave action was not sufficient to winnow out carbonate muds, no primary porosity was developed.

The diverse nature of the stratigraphic traps opens up unlimited exploration opportunity on acreage once considered worthless because it was not located on closed structures. The stratigraphic phase of exploration now promises to be as profitable as was the structural phase in this "old" producing area.

BLOOMER, R. R., Consulting Geologist, Abilene, Tex.

FLUVIAL, DELTAIC, AND SLOPE RESERVOIR SANDSTONE IN WEST-CENTRAL TEXAS

More than 300 Lower Permian sandstone oil and gas fields are present in an area of about 7,000 sq mi on the Eastern shelf and slope of the Midland basin. All these fields appear to be in stratigraphic traps in fluvial, deltaic, and slope depositional environments. Two Lower Permian Cook fluvial sandstone systems extend in a downdip direction across the Eastern shelf to the shelf edge, where progradational Cook sandstone facies form two high-constructive deltas. These are the proximal parts of a thick terrigenous clastic wedge of sediments covering the eastern slope.

Outcrops of Cook channel-fill deposits grade upward from conglomerate and quartz sandstone, to gray shale. Downdip from outcrop to the shelf edge, Cook sandstone is present in one meander belt system 82 mi long. The upper 30 mi is about five mi wide and bounded by shale and two thin lenticular limestone beds. The belt narrows to about one mi where adjacent limestone beds are thicker and were more resistant to lateral channel erosion. About 58 mi downdip from outcrop, the meander belt divides into two belts. Each belt is about one mi wide and bounded by shale and thick limestone beds to the shelf edge.

Point bars (with characteristic electric-log SP curves), crevasse splays, and/or natural levees are discernible in the meander belts. Many stratigraphic traps are present in point bars, in sandstone belts perpendicular to regional dip, and in belts of sandstone that overlie buried reefs, hills, structures, and other channel sandstones. Paleocreekology is applicable in locating topographic features on the paleoshelf.

Both Cook sandstone deltas, nearly joining, are in an area of 295 sq mi. Delta-plain facies consist of interbedded dark gray shale, fine-grained, lenticular sandstones, and thin coal lenses underlain by thick, medium-grained sandstone facies in distributary channels. Electric-log SP curves of the channel sandstones are characteristic. Delta front distributary mouth bar and sheet-sandstone facies overlie thick prodelta shale and thin, lenticular sandstone. The Group 4000 "Cisco" sandstone field is the only oil field of any significance in the two deltas. It produces from delta-plain sandstone facies.

West of the shelf edge, the Cook wedge of shale and sandstone lenses reaches a maximum thickness of about 1,300 ft at midslope and thins basinward. The base is a maximum gradient of about 3° at midslope. The Northeast Bloodworth "Canyon" sandstone field produces from Cook sandstone, probably a turbidite and slump deposit, evidently deposited in a submarine channel. The Jameson "Strawn" sandstone field, about 35 sq mi in area, produced from Cook lower slope sandstone lenses, probably part of a submarine fan.

BUIS, O. J., and K. HALL, Shenandoah Oil Corp., Quito, Ecuador

GEOLOGY OF ORIENTE REGION OF COLOMBIA, ECUADOR, AND PERU

No abstract available.

DALRYMPLE, D. W., Phillips Petroleum Co., Bartlesville, Okla.

EKOFISK FIELD, ITS GEOLOGY AND PETROGRAPHY

The Ekofisk field is a landmark in the history of petroleum exploration. With recoverable reserves estimated at 1 billion bbl, it is the first major oil discovery in the now-burgeoning North Sea oil patch. Ekofisk is on a salt structure, and produces from approximately 700 ft of highly porous Danian limestone. Scanning electron micrographs show that this limestone is a typical chalk, formed almost entirely of coccoliths and planktonic foraminifers. Extensive fracture systems have been noted in cores. The original intergranular porosity of the rock is reduced in places by the precipitation of secondary calcite cement, possibly associated with stylolite formation

DICKEY, P. A., and L. MASROUA, Univ. Tulsa, Tulsa, Okla.

APPLICATION OF RESERVOIR-PRESSURE DATA IN PROSPECTING

The search for stratigraphic traps is basically the search for barriers to the movement of fluids. Such barriers can be identified more surely by pressure information than by stratigraphic correlation. We think of normal reservoir pressure as "that necessary to sustain a column of water to the surface." However, when oil or gas is in lenticular sands, the initial reservoir pressures may be much less or much more than "normal." Examples of low pressures are found in the Cretaceous of New Mexico and Alberta, and the Morrow of western Oklahoma. Abnormally high pressures are found in many areas of the world, especially in Tertiary sediments, but also in the Pennsylvanian Morrow sandstones of central Oklahoma. In Blaine County there are about 10 separate Morrow reservoirs. All the wells in each reservoir have similar initial pressures and subsequent pressure-decline histories, which differ markedly from one reservoir to another. It should be possible from well performance, or even good drillstem-test data, to tell which reservoir a wildcat well has penetrated, or whether it has found an entirely new reservoir. Thus the regional extent of each reservoir can be ascertained very early during exploration.

ELAM, J. G., Consulting Geologist, Midland, Tex.

TECTONIC EVOLUTION OF VAL VERDE-DELAWARE BASIN, TEXAS

The Val Verde-Delaware basin is a marginal foreland basin genetically related to the Ouachita overthrust belt and its associated subduction zone. Proximal structures to the overthrust belt evidence compressional folding and faulting indicative of a horizontal maximum principal stress, but the dominant principal stress of the more distal and productive structures is vertical. A similar tectonic style is evidenced for the Permian basin as a whole.

Isopachs indicate that structural growth began early and continued intermittently throughout the Paleozoic. Maximum