BROWN, GLEN A., Marshall Young Oil Co., Oklahoma City, OK and RUSSELL E. CLEMONS*, New Mexico State Univ., Las Cruces, NM

Florida Mountains, Southwest New Mexico: Part of Cordilleran Overthrust Belt or Foreland Block Uplift?

Several workers have proposed during the past 12 years that the Florida Mountains, about 15 mi (24 km) southeast of Deming, New Mexico, were involved in regional Cordilleran overthrusting. Consequently much oil and gas exploration is now based on the premise that the south Florida Mountains fault is a thrust fault that marks the northeastern edge of the "overthrust belt of southwestern New Mexico."

The overthrust model requires large-scale horizontal movements, versus dominantly vertical movements of the block uplift model. Stratigraphic separations in the southern Florida Mountains indicate a minimum of 4,000 ft (1,219 m) vertical displacement. There is no evidence for more than about 1,000 ft (304 m) of horizontal displacement on the south Florida Mountains fault, and perhaps 2,000 ft (610 m) of horizontal displacement on some of the small thrust faults in the 1-mi-wide area along the northeast side of the south Florida Mountains fault. The south Florida Mountains fault steepens at depth whereas overthrusting requires that the fault flatten at depth. Overthrusting generally involves thick, 25,000 to 50,000 ft (7,620 to 15,240 m) geosynclinal sequences. In contrast, basement-cored uplifts involve crystalline basement rocks and typically, a thin sedimentary sequence. Precambrian plutonic rocks are against, and locally over, about 4,000 ft (1,219 m) of Paleozoic carbonate rocks along the south Florida Mountains fault. Regional surveys indicate that the Florida Mountains area has been relative high since Pennsylvanian time. Foreland block uplift areas typically have shown a long history of structurally positive tendencies evidenced by thinning of units and the presence of unconformities over positive areas. Thrust faults formed during overthrusting due to extensive horizontal compression should, if curved, be concave upward. Faults produced by vertical basement uplift should be concave downward. The south Florida Mountains reverse fault is steeper at depth and concave downward. The imbricate thrust faults to the northeast are either concave downward or nearly horizontal. Regional overthrusting should produce telescoping of facies and stratigraphic anomalies yet to be observed or reported in publications on southwest New Mexico geology.

Our current study demonstrates that Laramide deformation in the Florida Mountains is probably not a continuation of the Cordilleran overthrust belt. Evidence suggests that the deformation resembles the basement-cored block uplifts of the Rocky Mountain foreland.

BRUCE, CLEMONT H., Mobil Research & Development Corp., Dallas, TX

Relation of Illite/Smectite Diagenesis and Development of Structure in the Northern Gulf of Mexico Basin

Water expelled from smectite into the pore system of the host shale during the process of diagenesis may migrate out of the shale early or may be totally or partly trapped and released slowly through time. In areas such as the northern Gulf of Mexico basin, where much of the water is partly trapped, clay diagenesis data indicate a close relation between high fluid pressure buildup and the smectite-illite transformation process.

Abnormal pressures affect, in part, the type and quantity of hydrocarbons accumulated since pressure controls the direction of fluid flow and partly controls the geometry of structures formed in basins where shale tectonism is the primary mechanism for structural development. In basins of these types, contemporaneous faults and related anticlines are the most common types of productive structures found. The depth to which faults can penetrate and the angle of dip that faults assume at depth is dependent largely upon fluid pressure in the sedimentary section at the time of faulting. Some faults formed in the overpressured Tertiary section of Texas have been observed to flatten and become bedding plane types at depths near of above the temperature level required for thermal generation of hydrocarbons. This observation suggests faults of these types play a minor role in draining hydrocarbons from deep shales within basins where thick overpressured sedimentary sections are present at shallow depths and where shale tectonism is the primary mechanism for structural development.

Microfracturing resulting from increased fluid pressure is indicated to be a primary mechanism for flushing fluids from deep basins where thick abnormally pressured sedimentary sections are present. This flushing process would be enhanced by clay diagenesis since water supplied from smectite would cause the process to continue for longer periods of time and to extend to greater depths than could be attained if only remnants of the original pore water were present in the section. Large volumes of diagenetic water present within the microfracturing interval could also act as a vehicle for primary hydrocarbon migration provided hydrocarbons are present in a form and in sufficient quantities to be transported.

BRUMBAUGH, EUGENE R., Geophysical Consultant, New Orleans, LA

A Coordinated Geological-Geophysical Approach to Finding Stratigraphic Traps

Many stratigraphic traps have been found on the gently dipping flanks of the stable sedimentary basins in the United States. Many more remain to be found. The sedimentary environment is becoming well known in most of these basins. This information combined with detailed studies of the already discovered and developed stratigraphic traps allows one to anticipate the type of trap and the tools needed to detect these traps in most areas being explored.

Studies of clastic, erosional, and carbonate stratigraphic traps indicate that most have a detectable anomaly associated with them. Some have a minor structural anomaly that is near the level of seismic structural resolution. These and others commonly have interval thinning in the sediments overlying the trap that is detectable using well data isopach and/or seismic isochron techniques. Most have a high impedance contrast reservoir unit that is thick enough to be detected using seismic waveform and reflection amplitude techniques. A coordinated use of these geological and geophysical tools is discussed briefly in this paper.

BUCHHEIM, H. PAUL, Loma Linda Univ., Riverside, CA

Carbonate Facies Patterns and Oil Shale Genesis in Eocene Green River Formation, Fossil Basin, Wyoming

Facies patterns and associated vertical sequences of kerogenous carbonates (oil shales) of the Green River Formation in Fossil basin, Wyoming, provide new insights into the deposition of oil shale. Unique to Fossil basin is a facies pattern consisting of kerogen-rich calcimicrite at the basin's depocenter succeeded laterally by laminated calcimicrite, bioturbated calcimicrite, and