the sandy filling of the distributary channel. The distributary channels and their associated depositional lobes may serve as collectors and feeders of hydrocarbons to the main channel system.

Isolated depressions ranging from a few tens of meters to more than a kilometer across are seen on all fans that have been studied with the deep tow. On both Monterey and Navy submarine fans, large scour-shaped depressions are observed. In cross sections perpendicular to the fan gradient, these depressions resemble channels. Cores and reflection data show that these features are floored by sand and could be filled by sand or mud. Contrasting the interconnected nature of buried channel systems, the limited extent and continuity of sand-filled and buried depressions would suggest little potential as hydrocarbon reservoirs. Depositional lobes are also common on submarine fans and range in size from small (1 km wide) features associated with distributary channels to large fan lobes occupying tens of square kilometers.

HOBDAY, DAVID K., and ROBERT A. MORTON, Bur. Econ. Geology, Univ. Texas at Austin, Austin, TX

Lower Cretaceous Shelf Storm Deposits, North Texas

Many of the important features of shelf storm deposits are displayed in the Lower Cretaceous Washita Group in Grayson County, Texas. Proximal shelf sands are up to 2 m thick. They show channeled tops and abrupt lateral thickness variation and are stacked vertically or separated by thin, sparsely fossiliferous marine muds. Each sand unit has a scoured base and comprises a structureless lower interval that grades upward into hummocky cross-stratification. These features in turn are overlain by subhorizontal lamination, with an uppermost interval consisting of small-scale wave ripples containing abundant horizontal burrows and feeding trails. Distal shelf sands are thin (10 to 40 cm) compared to the intervening muds, and are comparable to modern storm deposits of the Texas shelf. A basal shelly lag, with a scoured base of upward-convex, disarticulated bivalves or current-aligned high-spired gastropods merges upward into subdued hummocky cross-stratification and subhorizontal lamination. Powerful bottom return currents, that in the modern Gulf of Mexico are generated by wind immediately prior to storm landfall, were probably the dominant mechanism of offshore sand transport. Storm waves operated contemporaneously and probably contributed toward sediment entrainment, as evidenced by hummocky cross-stratification. However, the disposition of fossils suggests that initially, at least, unidirectional currents were the dominant transport mechanism. Relatively shallow-water depths (50 m or less) are indicated by associated regressive deltaic sequences.

HOFFMAN, DAVID R., Amoco Production Co., Denver, CO

Williston Basin—Reawakening of Giant Petroleum Province

The Williston basin, covering parts of Montana, North Dakota, and South Dakota, is one of the largest and most active petroleum provinces in the Rocky Mountains. Since the discovery of gas on Cedar Creek anticline in 1913 and oil in 1950, the basin has been the scene of several periods of intense drilling activity, the most recent beginning in the mid-1970s and continuing to the present. Early exploration in the basin centered around structural features with surface expression, such as Cedar Creek anticline, and shallow objective zones. As deeper Paleozoic zones were proven productive on these structures, seismic techniques became essential for defining structural leads with no surface expression. More detailed seismic data and more sophisticated processing techniques were necessary to define deeper and more subtle structures in remote parts of the basin. Existing technology was rapidly adapted by the petroleum industry to explore for these deeper traps.

Although a mature basin by some standards, the Williston basin still contains vast areas that are virtually unexplored. Intense competition by the industry and escalating land acquisition costs indicate that these parts of the basin will be the center of exploration activity in the future. The reserve potential of these areas should be at least as large as the proven reserves in the basin to date. Of equal importance is the exploitation of the more mature parts of the basin, including new pay zones.

Future exploration in the Williston basin must incorporate new exploration techniques and new exploration philosophies in the evaluation of new pay zones and unexplored parts of the basin.

HOFFMAN, E., Boston Univ., Boston, MA

Intertidal Zonation of Recent Microbial Endoliths, Bermuda

Recent microbial endoliths have fine zonation within the intertidal and supratidal areas along the carbonate coast of Bermuda. This zonation correlates with a gradual change in the rock surface relief and color. The diversity and abundance of the endoliths were determined for seven sites with different degrees of slope and wave exposure around Bermuda. Within each site there is a gradual reduction in the number of species and a shift in the dominance of a species from subtidal to supratidal. By grouping of species, it is possible to identify community composition changes for each site and to establish the principal microbial endolith associations representative of the Bermuda Coast. A given assemblage of endolithic organisms occupies a certain relative position with respect to mean sea level and wave exposure, and is characterized by the microrelief of the biokarst. Preliminary work on the endoliths of Jamaica and Florida suggests that the endolith-community profile for Bermuda may be typical of the entire Caribbean area.

The microbial endolithic assemblages can be recognized on the basis of (SEM-studied) resin casts of their boreholes. Thus, by comparison with recent assemblages, fossil microborings can be interpreted.