the rocks, and in at least one area, accumulated in older traps. Rich, oil-prone source beds and oil shales occur in rocks ranging from Devonian to Early Cretaceous in age. These rocks are typically mature or post-mature on surface thrust plates in the heart of the thrust belt, but become significantly less mature to the north along the leading edge thrusts.

In the fold belt, the primary objective is Lower Cretaceous sandstone. Surface and seismic mapping reveal numerous open folds, whose location is controlled by more deeply seated thrust fault geometry. Cretaceous shale units are typically gas-prone and organic-lean, but the Umiat field demonstrates that oil has migrated into shallow structures, perhaps from a significant distance. Also, residual oil shows are common in many wells throughout the fold belt. The relationship of the source of the Umiat oil to the fold and thrust belt and its implications for exploration potential are yet to be fully understood.

KNOWLES, STEPHEN C., and RICHARD A. DAVIS, JR., Univ. South Florida, Tampa, FL

Hurricane Influence on Holocene Sediment Accumulation in Sarasota Bay, Florida

Sarasota Bay is a shallow, somewhat ovoid-shaped coastal bay located landward of a Holocene barrier complex on the west-peninsular, microtidal coast of Florida. Sediments presently accumulating in the bay consist of: (1) fine to very fine quartz sand contributed by littoral drift and reworking of older deposits, (2) fine to coarse quartz and phosphatic sand contributed by Tertiary carbonates and Pleistocene terrace deposits, (3) biogenic carbonate debris which is produced within the bay and/or derived from the nearby Gulf of Mexico, and (4) clay minerals derived from weathering of nearby carbonates and shales. Vibracoring throughout the bay has enabled recognition of six subsurface facies: protected bay, open bay, tidal delta-overwash, storm, sand bar, and marsh. Bedrock beneath the bay ranges from 0 to 8 m (26 ft) below present sea level and is largely responsible for the present aerial configuration of Sarasota Bay.

Intense storms (hurricanes) played a prominent role in the Holocene history of the bay. At least three of these extreme events are recorded in the strata that lie beneath the present bay. The storm facies is characterized by fining-upward units of shelly quartz sand each of which ranges up to 1.6 m (5 ft) in thickness. Individual storm deposits may cover as much as 80% (38 km^2, 15 mi^2) of the bay. These deposits are stratigraphically bracketed by the protected bay and/or open bay facies, which are the other laterally extensive facies present. Washover phenomena and the opening and closing of inlets are also documented in Holocene history and can be related to specific storm units.

The typical stratigraphic sequence of storm and related facies shows the protected bay facies overlain by the storm facies and capped by a combination of the protected bay and open bay facies. Tidal inlet-related facies occur proximal to the barrier and are associated with the storm and protected bay facies, whereas the distal areas are dominated by open bay facies which is reworked, storm-deposited sediment.

KNUTSON, CARROLL F., GeoEnergy Corp., Las Vegas, NV, and GEORGE F. DANA, U.S. Dept. Energy, Laramie, WY

Oil Shale Perspectives

The worldwide oil shale resources are extremely large. As an example, the calculated recoverable oil from just the Green River Formation in the tri-state area of Colorado-Utah-Wyoming is as large as the estimated ultimate total conventional oil production from the entire world. In addition there are significant resources in other parts of the USA and in other countries.

Despite the great potential, the pace of western oil shale development took a general downturn in 1982 because of a combination of factors led by an uncertainty concerning short to intermediate term pricing for crude oil, a lesser demand for petroleum products, and increased projected costs for development. An example is Exxon's announcement that the Exxon/TOSCO multi-billion dollar project would be discontinued and most of its support equipment sold.

Other western developers that are progressing with their projects include Union Oil of California in the Piceance basin of Colorado and Geokinetics Inc. of the Uinta basin of Utah.

In the eastern part of the county, Paraho decided not to move its project to Kentucky unless additional financial support could be obtained.

On the international front, Brazil and Morocco are actively developing oil shales in their countries, and feasibility and background studies are being conducted in other areas of the world.

The industry, from a future commercial development standpoint, and the government, following its policy to promote high-risk, long-range, high-return energy projects, should accelerate their efforts in oil shale research and development. A lead time of 3 to 5 years is necessary from the planning stage to the first barrel of shale oil production. Using a 10,000 bbl/day plant as a minimum goal, modular development of several competing processes and technologies should be conducted in the near future. These plants should be modular in nature, so that the more favorable processes could be replicated to provide for future demand.

The U.S. Department of Energy current oil shale support efforts are pointed toward process technology research rather than monetary support of industry pilot projects.

Federal government support for commercial oil shale development is a function of the Synthetic Fuels Corporation which provides price support guarantees to companies who are willing to build plants which can produce a minimum of 10,000 bbl/day of shale oil.

KONOPKA, EDITH HOFFMAN, and ROBERT H. DOTT, JR., Univ. Wisconsin, Madison, WI

Sandstone-Carbonate Repetitive Alternations: Butterfield Peaks Formation (Middle Pennsylvanian), Oquirrh Group, Central Utah

The Butterfield Peaks Formation is an impressively thick (up to 2,000 m, 6,600 ft, or more) example of alternating siliciclastic and carbonate deposition. In the Provo area, it exhibits several prominent facies of sandstone and carbonate, as well as intermediate gradations. The sandstones are quartzose, generally very fine and fine-grained, and are best separated into facies on the basis of sedimentary structures. These include tabular cross sets interpreted as eolian in part, and a variety of other marginal to shallow-marine facies. Trace fossils of the *Cruziana* facies occur in some units of most of these sandstones except the subaerial ones. They are also common in the carbonate rocks.

The carbonate rocks can be separated into facies on the basis of composition and texture. The fossiliferous carbonate rocks, predominantly wackestone and packstone, contain diverse marine fauna dominated by brachiopods, bryozoans, and echinoderm ossicles. Rarer fossiliferous carbonate facies include spiculitic dark mudstone to wackestone, and fossil grainstone.

In sandy carbonate rocks, the content of siliciclastic grains ranges from support of the rock (grading into sandstone with interstitial carbonate), to a sprinkling of silt grains in micrite or