loose sand below, thereby creating shallow erosional depressions on the landscape. Heavy trampling in wet interbeds of sand and mud homogenizes the previously distinct layers into a thicker, more massive unit, typically without any obvious tracks preserved. Although we have identified individual prints of hippo and antelope—and a four-print trackway of *Homo erectus*—exact taxonomic assignments are not yet easily made.

LARSON, ROGER L., Lamont-Doherty Geol. Observatory, Palisades, N.Y.

Late Mesozoic Plate Tectonics

Most of this world's oil was generated in the late Mesozoic, and most of these deposits consist of middle Cretaceous oil. A study of Deep Sea Drilling Project results combined with marine geophysical data has yielded a large-scale, plate-tectonic history for this period. The most significant events in this history are (1) the opening of the north-central Atlantic between North America and Africa about 180 m.y. ago; and (2) the fragmentation of Gondwanaland 130 m.y. ago, a worldwide phenomenon when Africa separated from South America, Australia-Antarctica separated from greater India, and spreading patterns in the Pacific were greatly altered in response to the large-scale continental breakup. The middle Cretaceous is not characterized by continental breakup, but has unusual, and probably highly significant, characteristics. An apparent increase in worldwide spreading rates occurred from 110 to 80 m.y.B.P., coincident with a period that lacked magnetic-field reversals. Subduction rates increased, sea levels rose, and batholiths formed behind subduction zones as results of these spreading-rate increases. Mid-plate volcanism created most of the seamounts and guyots present today in the western Pacific, as well as voluminous sills that are chemically similar to midocean ridge tholeiite. These events probably controlled the generation and subsequent preservation of late Mesozoic oil deposits in a yet unknown way.

LARSON, WILLIAM C., U.S. Bur. Mines, Twin Cities, Minn.

Uranium In-Situ Leach Mining—A Third Alternative

Uranium in-situ leach mining, when used as a single commercial mining method, represents a technologic breakthrough with which many people are not familiar. In the last 5 years, plant-installed capacities for uranium in-situ leach mining have increased approximately 12-fold. There are now at least seven western states which have activities of some type regarding uranium in-situ leaching.

LARUE, DAVID K., Northwestern Univ., Evanston, Ill.

Chocolay Group—Early Proterozoic Cratonic Sequence

The Chocolay Group of the southern Lake Superior region (upper Michigan, Wisconsin, and Minnesota), a stable-shelf assemblage bounded by unconformities, resembles Phanerozoic cratonic sequences. The Chocolay Group consists of a lenticular basal conglomerate overlain successively by quartzite (0 to 700 m), dolomite (30 to 800 m), and locally slate; it is capped by a regional unconformity. This sequence, although generally thicker, is similar to cratonic sequences (e.g., Sauk) in that both become finer upward, contain texturally mature sediments, are areally extensive, and are contained by unconformities.

New data on the Chocolay Group show interesting divergences from a quiescent stable-shelf model. Paleocurrents from cross-beds in quartzites show strong unimodality (s = 20 to 60°) atypical of stable platforms. Current directions from ripple marks and cross-beds crudely parallel later Precambrian troughs. Locally there are apparent reversals in the fining-upward trend of the Chocolay Group. Granite and basalt pebbles and abundant feldspars are present locally in dolomitic formations, but are absent in the underlying quartzites. The presence of irregular topography and the occurrence of uplifting locally are suggested by data which include thinning of quartzite members, variations in modal percent of detrital feldspar, and intraformational unconformities in the dolomites.

Based on large stratigraphic thickness, variations in sedimentary texture and mineralogy, and unimodality of paleocurrents, analogy to a simplistic stable craton interior is rejected. Rather, the influence of pericratonic tectonic conditions, including fault-bounded troughs, is suggested.

LEATHERMAN, STEPHEN P., Univ. Massachusetts, Amherst, Mass.

Interaction Between Overwash and Eolian Processes on Migrating Barrier Islands

Landward barrier-island migration is accomplished by three processes: (1) inlet dynamics, (2) overwash, and (3) eolian transport. Although these processes are well understood conceptually, few studies have been designed to define their relative roles and thus determine the actual mechanics of barrier-island migration in recent times.

From field surveys of sites on Nauset Spit, Cape Cod, Massachusetts, and Assateague Island, Maryland, an interaction between the two subaerial sediment transport processes can be recognized. Overwash surges during storm conditions deliver fairly large quantities of sand each year (often exceeding 10 cu m of overwash deposition per meter of dune breach). A large part of this material is then redistributed by the wind, eolian transport being largely governed by the winter northwest (offshore) winds.

The net result at Assateague Island is the transport of most of the sand back to the beach face. A small part (less than 10%) of the overwash sand is deposited on the backside of the primary barrier dunes. Although this amount of accretion may seem quantitatively insignificant, this sand may serve as the major source of material to the dunes for their landward translocation concurrent with the migration of the island. This same general model can be applied to the Cape Cod barrier beaches except that drift-line deposits can initiate dune development on the washover fans. These studies can be applied to barrier-island management as well as im-