beneficial to any organization involved in frontier exploration for uranium or base metals.

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Internal Structures of Shallow-Marine Tidal Sand Waves

Asymmetric sand waves (average height 0.86 m, and average wavelength 46.6 m) with superimposed megaripples 0.05 to 0.2 m high, occur commonly in medium to coarse sand on tidal sandbars in the Bay of Fundy. Their internal structures are complex, but three main types can be distinguished: (1) *inclined sets* of descending and ascending cross-bedding (0.1 to 0.3 m thick) that have set boundaries dipping at an average angle of 9° in the dominant transport direction; (2) *large-scale foresets* having set thicknesses comparable to the sand wave lee-face height and average inclinations of only 20°; and (3) *complex cosets* up to 0.5 m thick of thin (0.05 to 0.15 m thick) cross-bedded sets with abundant herringbone cross-stratification. Types 1 and 2 are formed during sand wave lee-face migration, whereas type 3, which overlies the lee-face structures, is produced by the superimposed megaripples during vertical growth of the sand waves following degradation by storms or winter ice.

Inclined sets are the most common lee-face deposit in the Bay of Fundy. Their formation is favored by the high current speeds, low to intermediate sediment transport, and the migration of large megaripples (relative to the sand waves) which characterize this area. Large foresets are relatively rare, and extensive development of large-scale, angle-of-repose cross-bedding has never been observed. Large-scale foresets may be more abundant in other areas where there are larger sand waves, lower current speeds, and higher sediment transport, but they should contain numerous reactivation surfaces, and be overlain by vertically accreted complex cosets. The internal structures of tidal sand waves should differ significantly from those in aeolian dunes.

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Shallow Oil Shale Deposits of Southern Uinta Basin, Utah

In the southern part of the Uinta basin of northeastern Utah, the Mahogany zone of the Green River Formation occurs at or near the ground surface. This shallow Mahogany zone represents a resource of oil shale at depths of up to 200 ft (61 m), developable by horizontal in-situ methods such as demonstrated by Geokinetics Inc., which is operating in the study area. The geologic sections potentially attractive for near-surface oil production are described. The Mahogany zone is divided into seven correlatable units. Three cross sections constructed from oil-yield histograms detail the correlations. Thickness, average oil yield, and oil resource in place are used to create contour maps defining the resource.

Production of shale oil from near-surface horizontal retorts involves creating permeability by blasting. This method lifts the surface, providing subsurface void space. Horizontal in-situ production of shale oil uses this void space to permit passage of air and product gasses. To this date, successful experimental horizontal retorts have been created to depths of about 60 ft (18 m) and further experimentation is expected to increase that depth limit.

To determine and define the resource characteristics of this potentially developable section of the Green River Formation, the Laramie Energy Technology Center has drilled 12 core holes in the southern Uinta basin during the past 3 years. Data for 10 of these core holes are included. Information from 12 other cores taken by private companies is incorporated and 18 other test holes provided some data used in construction of structural contour and overburden maps.

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Dineh-Bi-Keyah Field, Apache County, Arizona

The Dineh-Bi-Keyah oil field is located on the Navaho Indian Reservation in northeastern Apache County, Arizona, and is situated on the northwest end of the Toadlena anticline, a surface feature on the northeast flank of the Defiance uplift. The field is producing from a syenite sill which intruded Lower Pennsylvanian rocks. The discovery well was completed in January 1967 and as of October 1, 1979, the field has produced a total of 15,386,725 bbl of oil.

The sill is of Tertiary age and contains both intercrystalline and fracture porosity. Primary minerals are sanidine, biotite, diopsidic augite, glass, and minor magnetite. Glass is the primary cementing material. The porosity, permeability, and oil-saturation values measured in the igneous rock are similar to the reservoir parameters of many oil-producing carbonate rocks.

The sill is comparable in general appearance and mineral composition with plugs, dikes, and sills that crop out in the area. However, the igneous rocks exposed at the surface in the area are very fine grained and dense and have little, if any, porosity. Samples from the two igneous plugs which crop out at Roof Butte, 1 mi (1.6 km) southeast of the discovery well, are difficult to distinguish from core chips from the dense parts of the producing formation.

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Graphic Representation of Subsurface Data by Computer

A subsurface stratigraphic study of terrigenous Miocene sediments along the south Texas Gulf coast was undertaken to determine the possible existence of a major, uranium-bearing, fluvial system that may be related to a paleo-Nueces River. The Nueces River in south Texas flows in a southeasterly direction toward the Texas Gulf coast. In southeastern LaSalle County, the Nueces River makes an abrupt 90° turn and flows northeast for 56 mi (90 km). The Neuces River joins with the Frio and Atascosa Rivers to flow southeasterly,