steam field, California, hot water fields in California, Nevada, Utah, and Idaho, and the LASL hot dry rock project in the Valles Caldera of New Mexico.

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Global Occurrence of Abnormal Formation Pressures

In the worldwide exploration for hydrocarbon resources both onshore and offshore, abnormal formation pressures have been encountered in all continents. Such abnormal formation pressures are defined as any departure from the normal hydrostatic pressure at any given depth.

Abnormal subsurface pressure environments occur as shallow as only a few hundred feet below the surface or at depths exceeding 25,000 ft (7,620 m). These abnormal pressures can be present in clastic sequences or massive evaporite and carbonate sections on a regional or very limited, localized basis. Sediments of Pleistocene age to as old as Cambrian age contain abnormal pressures.

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Modification of Linear Sand Ridges by Bed-Form Migration—Bering Sea and United States Atlantic Shelf

Linear sand ridges are a dominant topographic feature of the United States mid-Atlantic shelf and the northeastern Bering Sea, as well as other coastal plain shelves of the world. Similarities in geometry, lithology, and stratigraphy of ridges in these two areas of markedly different oceanographic environments reflect a similarity in the processes that modify and shape these ridges.

The best development of ridge topography occurs on the Atlantic shelf off Maryland where all stages of formation and modification can be identified. Progressive changes in ridge shape and relief and in bed-forms occur from onshore to offshore. Side slopes of ridges demonstrate characteristic trends related to water depth, and textural properties are 90° out of phase with topography. Historical documentation, seismic reflection and vibracore data, and sonographs of migrating sand waves all indicate southward migration of ridges, the dominant direction of storm-directed bottom flow.

Ridges in the Bering Sea are exposed to a strong unidirectional and continuous flow of water northward into the Bering Strait. Repeated surveys of these features show that families of large north-facing sandwaves undergo migration infrequently. These periods of transport occur only when the strong oceanic flow is reinforced by northward storm-driven currents.

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Diapir-Like Ridges and Possible Hydrocarbon Occurrence, Northern California Continental Margin

The Eel River basin of northern California contains a relatively thick (>4 km) section of Miocene, Pliocene, and Quaternary fine-grained sedimentary rocks that extends more than 200 km northward from Eureka along the shelf and adjacent Klamath plateau. The east margin of the basin is a fault contact with the coastal belt Franciscan assemblage; the west margin is defined by a zone of uplift along the outer plateau-upper slope. This uplifted zone is characterized by a series of north-south trending ridges that rise as much as 200 m above the adjacent seafloor and against which Quaternary sediments thin.

Seismic reflection profiling and coring studies of these ridges have shown them to be diapiric. Quaternary sediments thin against the eastern flanks and are generally absent on the upper flanks and crests of the ridges. Many of the ridges are bounded by one or more faults showing large vertical separation. Seismic reflection records show internal structure of ridges to be homogenous and acoustically opaque, or to consist of faulted and deformed strata. Ridge crests are irregular in surface topography and are presumed to be highly deformed. Shallow cores from ridge crests contain stiff clayey silts of Pliocene age.

A 2-m core from ponded sediments on the crest of one of the diapir-like ridges contained significant amounts of gasoline-range hydrocarbons as well as anomalously high quantities of gas in the methane to butane range. We infer that these hydrocarbons are derived from sediments deeper in the Neogene sedimentary section and are being released through fractures in the ridges. Deformation of young surface sediments in ridge areas indicates that uplift is presently occurring along the 200-km long lineament defined by the ridges. These diapir-like ridges may prove useful targets for evaluating the hydrocarbon potential of the offshore Eel River basin.

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Structure and Hydrocarbon Potential of Kodiak Shelf, Alaska

The Albatross basin underlies the southwest one-third of the Kodiak shelf, Alaska, and contains about 5 km of gently to moderately deformed rocks that are as old as late Miocene or Pliocene. The seaward limit of the basin is a large, northeast-trending anticline that underlies the shelf break.

The Dangerous Cape high, northeast of Albatross basin, is distinguished from the basin by shallow depth (1 to 2 km) to the base of reflective strata, by decreased relief of structures that underlie the shelf break, and by the central-shelf uplift. This uplift lies midway between Kodiak Island and the shelf break and is made up of several anticlines cut by numerous, northeast-trending reverse faults. Based on seismic evidence, deformed, nonreflective Paleogene rocks are inferred to unconformably underlie the less deformed upper Miocene or Pliocene reflective rocks.

Stevenson basin, northeast of the Dangerous Cape high, includes two subbasins that are separated by the northwest-trending Portlock anticline. The southwest subbasin contains as much as 4 km of rocks, and the northeast subbasin contains as much as 5 to 7 km.