trending belt of high density Tertiary igneous rocks and low density tuffs or pyroclastic volcanic and sedimentary rocks along the southern margin of the basin.

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Distribution and Depositional History of Neogene Phosphorites Along Pacific Coast of North America

Pelletal and nodular phosphorites occur commonly to abundantly in neritic (shelf) and bathyal (slope) deposits of uppermost Oligocene (25 Ma) to upper Miocene (10 to 7 Ma) age from 23°N on the peninsula of Baja California, Mexico, to 39°N near Point Arena, northern California, encompassing a belt of deposition about 1,430 mi (2,300 km) in length. In addition, pelletal phosphorite sands are commonly present within adjacent middle and lower bathyal deposits of similar age range representing redeposited material in conduits, feeding basins, and submarine fans. In some areas, pelletal phosphorites reach 200 ft (60 m) in thickness. Mining of Miocene phosphorites is now well under way in Baja California. The age of peak formation and accumulation of Pacific Coast phosphorites appears to become younger from south to north implying variations in patterns of upwelling and/or eustatic, climatic, and tectonic control of shelf character and flux of terrigenous clastics to the margin. Later reworking of the Miocene deposits has allowed reconcentration of the phosphorites in adjacent Pliocene, Pleistocene, and Holocene neritic units.

Paleontologic, isotopic, and sedimentologic evidence indicate that the widespread Neogene phosphorites formed under a special set of climatic, oceanographic, eustatic, and tectonic conditions associated or coincident with a major climatic threshold occurring in mid-Miocene (15 Ma) time and commencement of a glacial climatic state. Three key factors were apparently responsible for allowing the unusually prolific formation of Miocene phosphorites as well as simultaneous widespread deposition of diatomaceous sediments in this region including (1) vigorous upwelling of nutrient-rich water and accelerated productivity as a function of deteriorating Neogene climate, (2) associated development of intense oxygen minima impinging against the various slope and shelf areas creating appropriate biogeochemical conditions for phosphorite precipitation, and (3) the absence or severe reduction in delivery of terrigenous clastics to sites of phosphorite precipitation as a function of Neogene eustatic, climatic, and tectonic events.

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Diagenetic Relationships Between Inorganic Matrix and Kerogen in Wilcox Group, Southwest Texas

Eighteen core samples of shale from the Eocene Wilcox formation in the Gulf Coast of Texas were extracted in organic solvents and digested in hydrofluoric acid in order to examine the bitumen and kerogen fractions. The kerogen was found to be largely terrigenous in origin with stable carbon isotope values ranging between -26 and -29 ppt (PDB). Smectite dehydration in the area begins at less than 1 km depth (60°C). At the depths of initial petroleum generation (1.5 km and 85°C), expandable layers comprise only 30% of the illite-smectite clays. It therefore does not seem likely that water expelled during smectite dehydration can mobilize significant amounts of hydrocarbons.

Geopressuring of pore fluids occurs toward the end of the main stage of petroleum generation, below 3 km. In the gas zone, hydrocarbon concentrations increase between 3.6 and 4.6 km from a low of 7 mg/gC to 15 mg/gC. Two samples in this region showed anomalously high concentrations of hydrocarbons (100 mg/gC). These observations may indicate subsurface migration of hydrocarbons, perhaps in a methane and carbon dioxide-rich fluid phase. In addition to facilitating hydrocarbon migration, carbon dioxide generated from kerogen may also be involved in the precipitation of ankerite cement in sandstones below 2.5 km.

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Exploring for Subtle Sandstone Channels By Use of Electrical Geophysics

Electrical methods can be used directly as a resistivity tool which not only defines structure but also provides information, such as rock type, fluid content, and porosity, necessary to resolve lithologic and stratigraphic problems.

To help meet the challenge of today's petroleum exploration problems, a multi-methodology electrical resistivity system has been developed. This system uses various source-receiver arrays and multiple source and receiver types.

Seismic roll-along cables and an eight-channel digital recording system are used to achieve rapid field coverage. Measurements are made in profile every 220 ft (67 m).

Five decades of frequency can be covered to produce soundings from the surface to a maximum of 30,000 ft (9,100 m) in depth. A powerful transmitter is used to obtain near-zone (late time) and far-zone (early time) electromagnetic soundings as well as DC soundings. Magnetotelluric measurements are used to reach depths below 20,000 ft (6,100 m) if necessary.

The data are displayed as profiles of closely spaced pseudo E-logs and induction logs that are correlatable to existing well logs.

Two case histories of exploration for subtle sand traps include one located in the D J basin of Colorado. The other describes the detection of a 30 ft (9 m) sand sequence at a depth of 2,500 ft (760 m) on the eastern shelf of the Permian basin in west Texas. The approaches used in these case histories have direct application to many problems of the central valleys of California.

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Lithostratigraphy and Diagenesis of Monterey Formation near Ojai, California

Lithostratigraphy and diagenesis of the middle Miocene Monterey Formation were studied at seven localities parallel with the axial trend of the Miocene Santa Barbara basin between Goleta and the North Sulphur Mountain area of the Ojai oil field in Santa Barbara and Ventura Counties, California. The lithologic sequence of the Monterey Formation does not change markedly within the area except for the addition of discrete sand layers, as much as 1.6 ft (0.5 m) thick, in the east near the Ojai oil field. The most complete, accessible, and representative section studied is 1.2 mi (2 km) south of Oakview, where the formation can be divided into five units, which correlate well to C. M. Isaacs' five informal members along the Santa Barbara coast. At the base of the Monterey, distinctive,