the Viscaino Desert of Baja California, a distance of 400 miles, the eastern extent of the Upper Cretaceous Rosario Formation can be plotted with the edge of a ruler. At several points the exhumed coast line is well exposed. In some places marine strata buttress directly against precipitous bedrock slopes. In other localities they interfinger with deltas of conglomerate which built from narrow gorges incised in the bedrock coast.

Westward from this paleocoast the Rosario thickens considerably in a short distance. At times, relatively deep water must have extended almost to the shore. The steep and straight paleocoast appears to have coincided with a hinge line, suggesting fault control. This tectonic line has continued to be active throughout the Cenozoic. Faults of Pleistocene age parallel the modern coast in several places.

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J.O.I.D.E.S. Ocean Drilling on Continental Margin off Florida

Most of the Tertiary section was sampled in six core holes drilled along a transect across the continental shelf, slope, and Blake plateau east of Jacksonville, Florida. Water depths at the drill sites ranged from 25 to 1,032 meters and penetrations into the bottom from 120 to 320 meters. Continuous coring was attempted at most of the sites, using a wire-line core barrel. Core recovery averaged 36 per cent overall, with best recovery (46%) in the soft formations of silt and clay and poorest recovery (22%) in hard layers of chert and dolomite. A generalized stratigraphic cross section, drawn from the coring results, reveals that the continental margin is a wedge-shaped constructional feature which becomes thinner seaward.

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Seismic Investigation of Eel Submarine Canyon, Humboldt County, California

Prior to and during the early 1960s several "sparker" and conventional survey lines were run across the head of Eel Canyon, which lies 7 miles west of the mouth of the Eel River, Humboldt County, California, and on the adjacent shelf area. The data from the surveys were utilized to discover if a "buried" canyon exists below the shelf sediments.

Interpretation of the seismic records indicates that a buried canyon does extend shoreward from the present-day canyon. Furthermore, this buried canyon consists of two branches; one branch is oriented toward Arcata Bay in the north Humboldt Bay area and the other branch is oriented toward South Bay in the south Humboldt Bay area.

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Seasonal Distribution of Magnetite and Ilmenite in Beach Sand of Malaga Cove, California

In 1961, 1962, and 1963, surveys of part of the "black sand" beach at Malaga Cove, California, included profiles for measuring seasonal variations in beach erosion and accretion, and sampling for grain-size, mineral composition, and magnetite percentage.

Profiles show maximum beach erosion during August and maximum accretion during January, contrary to the cycle of summer accretion and winter erosion for most beaches.

Mean grain-sizes, determined from analyses of samples extracted on October 19, 1963, are largest for all depth intervals within a narrow strip midway between the cliff and the swash. Particle size gradually decreases both oceanward and shoreward and increases northward. The average percentage of magnetite decreases with an increase in grain-size.

Magnetite, ilmenite, epidote, zircon, and quartz are the most abundant of 27 minerals identified petrographically in the very fine size.

For all samplings, the magnetite content in the beach sand increases with depth and shoreward; maximum concentrations are at the "slope break" near the cliff. During beach buildup, high-energy waves temporarily erode the foreshore, carry the lighter, fine materials offshore, and concentrate the magnetite and other heavy minerals as laminations and layers at depth in the beach. The magnetite concentration high on the beach reflects the superiority of onshore wave energy over other types of wave energy.

The magnetite and ilmenite in the sand at Malaga Cove are believed to have been transported from the western San Gabriel Mountains to Santa Monica Bay when the Los Angeles River channel followed the present course of Ballona Creek. The minerals were carried southward along the coast by predominant littoral movement in this direction and concentrated by wave action on the beach at Malaga Cove.

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Sub-Bottom Investigation Techniques

(No abstract submitted.)

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Structural Evolution of Santa Lucia Range, California

The rocks of the Santa Lucia Range are divisible into a bedrock complex and a superjacent series, separated by a major unconformity which represents early Late Cretaceous deformation ("Santa Lucia orogeny"). *Décollement* tectonics, involving gravity sliding of the Franciscan rocks over carbonate rocks of the Gabilan mesa, played an important role in the deformation of the bedrock complex during Late Jurassic and middle Cretaceous times (Hsu, 1965). The superjacent rocks were deformed by wrench faulting, and by folding during several Cenozoic orogenic episodes. Thrust faults have been observed in wrench-fault zones. Local changes from wrench to thrust faulting are related to slight changes in the magnitude of the vertical and horizontal principal stresses. These thrusts should not be confused with the *décollement* tectonics which affected only the bedrock complex.

The Franciscan-Recent succession of the region is illustrated and discussed. The stratigraphy of the superjacent sediments is based on the work of previous investigators. The stratigraphy of the bedrock complex is based mainly on the writer's structural interpretations.

Although the Franciscan rocks were deformed during late Mesozoic and denuded during early Tertiary, they furnished very little debris to the Cretaceous and early Tertiary sedimentary formations of California,