

versity, matures through increase in interdependence, and wanes to extinction under changing environment. Different styles of diversity are used to distinguish degree of provincial maturity.

In Pennsylvanian and Lower Permian rocks, several terrestrial biomes, based on insect-faunal and on floral ranges, are present across North America and Europe. One boundary is correlated with paleolatitude, another boundary is meridional. These biotically leaky boundaries are not associated with physiographic barriers.

Zonation of terrestrial biomes shows promise for fine-correlation of coal areas remote from standard and type stratigraphic sections.

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#### TINTINNIDS IN SHELF SEDIMENTS FROM ALASKA, OREGON, AND CALIFORNIA

The distribution of neritic, agglutinated tintinnids on the sea floor has been examined using approximately 530 samples from the Arctic Ocean between 115°E and 165°W long., the northern Bering Sea, and the eastern North Pacific between 37°N and 46°N lat. *Tintinopsis fimbriata* dominates the observed fauna in the Arctic Ocean and Bering Sea, whereas *Stenosemella ventricosa* is dominant in the sublittoral region off northern California and Oregon. Species <63 $\mu$  in diameter and without firmly agglutinated loricas are not likely to have been recovered with sample processing techniques used in this study.

*Tintinopsis fimbriata* occurs in low frequencies in nearly all samples from the Arctic Ocean and Bering Sea. It is most common, however, in samples from off the mouths of the largest rivers, particularly the Lena River. It may be a diagnostic brackish-water species. An unidentified *Tintinopsis* appears to have a similar relation to the Columbia River and the Yaquina River of the Oregon-Washington area. Other distributional patterns appear to be the result of dispersal by either surface currents or bottom currents. This pattern is particularly noticeable in the southeastern Chukchi Sea and off the coast of Oregon and Washington.

A sharp decrease in the number of tintinnid loricas with depth in a core from the southeastern Chukchi Sea suggests that they are less likely to be preserved in the fossil record than are the remains of other common marine microorganisms.

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#### MARINE GEOLOGY OF CARIBBEAN SEA COMPARED WITH MEDITERRANEAN SEA

The Caribbean basins, surrounded by lands and islands marked by a history of tectonic and volcanic activity, have remained remarkably stable throughout the Cenozoic. Sedimentation has been characterized by pelagic biogenic material and volcanic ash typical of a deep marine environment. Acoustic basement, reached at 5 sites by the Deep Sea Drilling Project, is composed of Late Cretaceous dolerites and basalts considerably younger than the surrounding lands.

The Mediterranean Sea may be divided into eastern and western basins. The eastern basin is dominated by the Hellenic arc, an island-arc structure, and the Mediterranean Ridge, a low ridge characterized by thick folded and faulted sediments. The western basin has more features in common with the Gulf of Mexico,

such as thick terrigenous sediments and salt diapirs. Drilling has revealed buried evaporites in association with shallow water sediment and fossil indicators that led the scientific team to the conclusion that the Mediterranean desiccated during the late Miocene.

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#### RADIOGRAPHIC AND SEDIMENTOLOGIC EXAMINATION OF HOLOCENE SALT MARSH, GEORGIA

Seven subenvironments of a coastal Georgia Holocene salt marsh vary conspicuously in grass types and topography. However, preliminary examination has revealed few basic differences in sedimentary structures and grain-size distribution of the sediments, from these various parts of the marsh. Samples from these subenvironments are classed as either clays or silty clays, and any primary sedimentary structures in these habitats have been reworked biogenically by burrowing organisms and/or disturbed by plant activity. Noticeable variations do occur in subenvironments in which silt and sand predominate over clay-size materials. Tidal creek banks show laminations, crossbedding, slump structures, and filled-in burrows. Levees bordering major drainage tributaries and barrens adjacent to the Pleistocene barrier island show no distinct structures but have a distinctive grain-size distribution in the silty sand to fine-grained sand range. Minerals present include quartz, feldspar, montmorillonite, kaolinite, chlorite, and illite at all sampled stations, with only slight variation in relative proportions.

The widespread uniformity of the normal marsh and the grain-size variation on and adjacent to tidal levees suggest that the topography and grass types delimiting subenvironments are controlled chiefly by the tidal and freshwater hydrography of the marsh.

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#### MAGNETIC SUSCEPTIBILITY STUDIES OF SHALES FROM NORTHERN ANTHRACITE FIELD OF PENNSYLVANIA

Magnetic susceptibility measurements, using the Gouy method, were carried out on 70 pulverized shale samples from the Wyoming-Lackawanna Valley in northeastern Pennsylvania. The samples also were chemically analyzed for the elements Fe, Mn, Cr, Ni, and Co. The study showed that variations in the susceptibility values follow very closely variations in the concentration of the trace elements Cr, Ni, and Co. The susceptibility values varied from 1.682186  $\times 10^{-6}$  to 29.938439  $\times 10^{-6}$  per gram using a magnetic field of 2.25 Kilogauss. These values correspond to concentrations of Cr = 11 to 420, Ni = 30 to 160, and Co = 2 to 7.5 ppm respectively. The magnetic susceptibility was found to be field-dependent particularly in samples with high trace-element concentrations. The susceptibility also was measured using the Faraday method and similar results were obtained.

By both methods the variations in Fe concentration did not correlate with the susceptibility values measured, although Mn showed a minor degree of correlation. The contribution to the susceptibility values by free pyrite present in some samples was very small.

Trace-element concentrations were found to be low in the north and to increase southward. Black shales showed higher concentrations than greenish or grayish shales. Samples containing appreciable amounts of coal gave very low or negative susceptibility. Pure