marks, mud cracks, salt-pseudomorphs, and groove marks accompanied by vertebrate footprints on the same slab.

The set of trace fossils and associated sedimentary structures indicates an origin at the fringes of aquatic areas and at the borders of vegetation zones. These large areas were used by the ruling reptiles as pathways between the water and the vegetation where they found resting, breeding, and feeding places. The smaller vertebrates were living in habitats near the vegetation or at the borders of small channels. The invertebrate traces point out the proximity of water and the fluctuation of water level. The primary sedimentary structures suggest variable water levels and the salt-pseudomorphs suggest marine water. The assemblage of traces suggests very large sandy areas between the sea or lagoons and zones of dense vegetation which favored proliferation of the mobile Archosaurs.

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How Geologic Objectives Should Determine Seismic Field Design

The geologist needs to take an active part in seismic field design so that the results of the seismic survey will answer his questions as clearly as possible. Geologic objectives should provide the basis for field design. A systematic procedure is outlined where the field parameters are defined by (1) the depth of objectives, (2) the expected dip, (3) the required resolution, and (4) signal-to-noise considerations.

Optimizing seismic data quality requires proper design of field acquisition parameters as well as proper execution of the field work. Field parameters are usually chosen as "those that were used last time," even though these may not have been optimum or may have been constrained by hardware considerations that no longer apply. Furthermore, the geologic objectives may have changed.

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Uranium in Tertiary Sediments in Alaska

The early search for uranium in the continental Tertiary sediments in Alaska raised the question of whether the necessary processes to produce epigenetic uranium deposits ever occurred under the paleoenvironmental conditions that existed this far north. Recent discoveries, however, have demonstrated that epigenetic uranium enrichment occurred in these Tertiary sediments.

At present, the most intensely explored and best known uranium occurrences in Tertiary sediments are found in the Healy Creek basin. The richest occurrence found in this area is in discontinuous beds of sideritic nodules near the base of the Oligocene and Miocene Healy Creek Formation where it overlies the Mississippian(?) Totatlanika Schist. The Healy Creek Formation consists of a clay-rich, gray to light-reddish-brown conglomeratic sandstone containing carbonized plant debris. The nodules are 2-5 cm in diameter. They have a reddish-brown, outer goethitic rind, a yellowish-brown, inner sideritic core, and scattered gray areas containing uraninite and manganite. A composite sample of the sideritic nodules contained 717 ppm uranium and 2,000 ppm manganese. A low-grade roll-front deposit has also been reported from this area. The roll front is in the Miocene Suntrana Formation, which consists of coal-bearing pebbly quartz sandstone.

Slight uranium enrichment (12 ppm) had been reported from a thin carbonaceous sideritic bed in a conglomeratic part of the Tertiary Kenai Formation near Camp Creek in the Susitna Lowlands. Additional collections yielded a sample containing 72 ppm.

A uranium occurrence has been reported from the Tertiary Kootznahoo Formation on Kuiu Island in southeastern Alaska. The Kootznahoo consists of arkosic dolomitic sandstone containing carbonized wood fragments. As much as 0.23% gamma eU (0.13% beta eU) was found in the carbonized wood fragments. Some of the samples also contained apatite and siderite.

Siderite and carbonized plant material are common to all the known uranium deposits in Tertiary sediment in Alaska. The siderite suggests alkaline conditions and the carbonaceous material indicates reducing conditions. Tertiary ash beds and other volcanic sediments were the apparent sources of uranium for the Healy Creek and the Kuiu Island deposits. Cretaceous and Tertiary granite and quartz monzonite were the apparent sources of uranium in the Susitna Lowlands occurrence.

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Paleogene Depositional Systems, Western Transverse Ranges, Southern California

Paleogene strata of the western Transverse Ranges include varied clastic facies that prograded southwestward from arkosic sediment sources in granitic and metamorphic terranes of the Salinian and Mojave blocks. Deposition occurred within a complex fore-arc basin whose bathymetry was modified by pronounced uplift of a structural high along the trench slope break, and by internal deformation associated with oblique subduction during shallow plate descent beneath the Laramide cordillera. Integrated depositional systems produced intertonguing deep-marine, shallow-marine, marginal-marine, and nonmarine deposits. Exposed transitions between basinal turbidite successions, deltaic strandline complexes, and alluvial-plain sequences are common at several horizons. Mappable formations and local members are distinguished chiefly by their shaly, sandy and conglomeratic, or mixed lithologic character. Each such stratigraphic unit typically includes several facies associations. Shale-rich facies were deposited on terrestrial flood plains, prodelta and basin-flank slopes, overbank surfaces of subsea fans, and distal basin plains. Sand-rich intervals include thickening-upward cycles of sheet-flow depositional lobes on subsea fans, thinning-upward cycles of turbidite channels on subsea fans, coarsening-upward cycles of prograding shelf breaks, fining-upward cycles of migratory shelf and shoal-water bars, coarsening-upward cycles of distributary-mouth bars, and fining-upward cycles of fluviodeltaic channels. Conglomeratic strata occur both as piedmont-fan deposits and within proximal turbidite channel complexes. Sparse nonclastic facies include local algal carbonate platforms built on isolated submarine banks formed by tectonic uplift, and minor lagoonal beds of algal carbonate rocks and gypsiferous evaporites associated with delta platforms.

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Paleoecology in Basin Analysis—Humboldt Basin of California as Example

Paleoecologic techniques make important contributions to basin analysis. The Neogene Humboldt basin of northern California is an excellent example of a basin whose history of development is being increasingly understood owing to paleoecologic study. Before the geologic history of a basin can be well understood, correlation of stratigraphic units must be established. This has been a problem in the Humboldt basin, but improved zonation based on planktonic foraminfera, diatoms, paleomagnetics, and dated ash beds offers promise of improved correlation. Several paleoecological techniques have been used to determine depositional environments: (1) taxonomic uniformitarianism; (2) biogeochemistry (especially oxygen isotopic analysis); (3) skeletal structure; (4) functional morphology; (5) trace fossils; (6) population dynamics; (7) community analysis; and (8) biogeography. These techniques are especially valuable as supplements to sedimentologic and stratigraphic study.

The Humboldt basin formed in late Miocene time and deepened rapidly. Most of the basin fill is a thick regressive sequence of deep basin, slope, shelf, and finally continental deposits. At least the landward part of the basin was strongly deformed in mid-Pleistocene time. The basin was probably considerably more extensive both in the landward and seaward directions than suggested by the present outcrop pattern. The offshore part of the basin may still be an active site of deposition with nonmarine sedimentation still occurring in the lower Eel River valley, lagoonal sedimentation in Humboldt Bay, and shelf and deeper sedimentation continuing offshore into the Pacific Ocean basin.

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Evaluation of Volume of Entrained Methane in Deep, Tertiary Sandstone Reservoirs Along Onshore Texas Gulf Coast

Volume of methane dissolved in formation waters in Tertiary sandstone reservoirs is directly related to sandstone volume and porosity, formation temperature and pressure, and salinity of formation fluids. Volume of potential reservoirs, located on regional cross sections below 8,000 ft (2,438 m; approximate base of oil production), was determined from isopach and net-sandstone maps of each formation. Plots show variation of formation pressure, temperature, and salinity with depth in all wells on cross sections. Porosity was determined by whole-core analyses, supplemented by sonic and resistivity logs.

The Texas Gulf Coast was divided into 24 subdivisions for detailed reservoir mapping and calculation of methane resource. Subdivision boundaries were defined by structural provinces and by major fault zones. Subdivision 2, an area of 5,300 sq mi (13,727 sq km) along the lower Texas coast, illustrates methods for evaluating the amount of methane dissolved in formation waters. In the lower Frio Formation, an in-place resource estimate of 61 quads (1 quad = 1 Tcf) was calculated by averaging parameters in 1,000-ft (305 m) intervals, a method similar to that used by the U.S. Geological Survey. A comparable estimate, 56 quads, was calculated by using parameters averaged for the entire lower Frio Formation. Total in-place methane of 144 quads for all formations in Subdivision 2 was determined using the latter method. Similar evaluation of all subdivisions will define the entrained methane resource of the onshore Texas Gulf Coast.

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SEG Delegation Visit to People's Republic of China

A delegation of 11 members of the Society of Exploration Geophysicists visited the People's Republic of China (PRC), September 5-27, 1979. Facilities visited were the Geophysical Research Institute and an instrument factory in Peking, computer center in Zhou Xien (60 km south of Peking), Shengli oil field on the Yellow River delta, marine branch of the Geological Exploration Corp. in Shanghai, southwest branch of the China Petroleum Corp. in Chengtu, and south seas branch of the China National Oil and Gas Exploration and Development Corp. in Canton.

Delegation members presented previously prepared papers at each facility visited except at the instrument factory in Peking. A seismic-field party operating near Chungking also was visited.

Group discussions followed presentations of papers by delegation members. Generally, these consisted of a description by PRC geophysicists of current seismic exploration efforts and associated problems peculiar to the areas being explored. Delegation members then endeavored to answer specific questions and offer potential solutions to problems encountered. A wide range of topics were involved, covering seismic data acquisition, processing, and interpretation. Of special interest were (1) determination of lithology, (2) reef exploration, (3) operations in areas of rugged topography, (4) deconvolution, (5) modeling and migration, and (6) static time corrections. PRC geophysicists appeared extremely anxious to acquire necessary modern skills in petroleum exploration. A present lack of sufficient modern field equipment and data processing systems is being corrected by purchases from the United States and France as rapidly as possible. This activity, coupled with the training of personnel by U.S. petroleum and geophysical service companies, should bring petroleum exploration in the PRC to a more advanced stage in a few years.