Abstracts

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Tertiary Kenai Group, Cook Inlet, Alaska, Tectonic and Depositional Model Applied to Barranca Formation (Upper Triassic), Central Sonora, Mexico

The Barranca Formation contains important deposits of coal and, where metamorphism was more intense, some of North America's most valuable graphite reserves. Information derived from petroleum exploration supports a Tertiary model for the Cook Inlet basin that applies to the Barranca. Since a fore-arc basin has existed near Cook Inlet through the present time, the modern Cook Inlet could also be an analog of the Barranca basin.

The Kenai Group in the Cook Inlet area consists of fluvial-deltaic, swamp, and estuarine sediments about 4,600 m thick that represent three sedimentation phases: (1) the Oligocene to Miocene West Foreland, Hemlock, and lower Tyonek formations contain conglomerate, graywacke, siltstone, tuff, basalt flows, and coal; (2) siltstone, shale, carbonate, and coal of the Miocene upper Tyonek and lower Beluga formations indicate lower energy deposition; and (3) the Pliocene upper Beluga and Sterling Formations are mostly coarse clastic rock.

The three members of the Barranca Formation, which is over 1,500 m thick, indicate gross changes from high to low to high-energy deposition. The upper and lower members contain sandstone, conglomerate, minor shale, and coal, and enclose a middle member that consists of coal, nonmarine to shallow marine shale and siltstone, and some conglomerate and impure sandstone. The rocks within each member, and mainly within the middle one, indicate that shallow marine incursions interrupted fluvial and swamp sedimentation.

Paleogeographic and tectonic similarities between the two areas suggest that detailed aspects of Cook Inlet sedimentary environments apply to the Barranca Formation.

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Gulf of Suez—A Rewarding Environment

High current levels of exploration activity in the Gulf of Suez continue to show that this geologically complex rift area remains the most prolific oil province in Egypt. Favorable conditions for generating and trapping oil are well-documented in the central and southern Gulf of Suez. More than 15 oil and gas discoveries have been made from both Miocene and pre-Miocene age reservoirs during the past five years.

Exploration results in the northern Gulf of Suez have thus far been disappointing, failing to find any new oil or gas accumulations. Influenced by the Mesozoic growth of the Ayun Musa high, the northern Gulf of Suez differs both tectonically and stratigraphically from the more prolific areas to the south.

South of the Gulf of Suez in the Red Sea, drilling activity has been minimal. Although efforts to date have not met with notable success, exploration of this relatively large rifted basin is continuing.

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Deep-Water Evaporites: Detrital, Authigenic, or Diagenetic?

The thought of "deep-water" evaporites commonly conjures images of hypersaline starved basins, chemical precipitation of evaporite minerals in the water column or at the sediment-water interface, and cyclically laminated salts. It is implicit in this model that the evaporite fabrics reflect stagnant, unstirred, abiotic conditions, but deep-water evaporites in the Messinian of the Sicilian basin include evaporite turbidites and resedimented clastic evaporites with wholly different petrographic characteristics and sedimentary structures. Detrital dolomites in the Onondaga Limestone and in the Cretaceous of the western United States reflect clastic depositional histories and yet may have strong diagenetic overprints that obscure the original depositional textures.

Diagenetically altered, sandy, anhydritic dolomites from the Bell Canyon Formation in Texas provide examples of deep-water detrital, evaporitic carbonates with a depositional history indicated principally by the included siliciclastics and a diagenetic history indicated first by "groundmass" versus pore-filling dolomite crystal fabrics and second by nodular versus pore-filling and replacement anhydrite. Comparisons between the Bell Canyon deep-water anhydritic dolomites and other deep-water evaporites is useful in making the distinction between clastic, penecontemporaneous authigenic, and later diagenetic origins.

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Geochemistry and Isotopic Composition of Hydrocarbon-Induced Diagenetic Aureole (HIDA), Southwestern Oklahoma

The Permian red beds at Cement and Chickasha oil fields in southwestern Oklahoma have undergone extensive and intensive alteration. This diagenetic mineralization is a direct expression of hydrocarbon migration along unconformity surfaces and fault zones. The oxidation of seeping hydrocarbons to carbon dioxide is the major source of carbon in diagenetic carbonates, which occur as cement and as replacement of gypsum and detrital grains. Calcite cement with δC^{13} values up to -39 ppt PDB reflect this hydrocarbon source. However, a few calcite samples analyzed show δC^{13} values of approximately -6 ppt PDB which indicates a freshwater origin. In addition, isotopically hybrid carbonate cement with a bimodal carbon source also is found throughout the stratigraphic section.

Bleaching of red beds and formation of pyrite are explained as reduction of iron oxides by hydrogen sulfide associated with hydrocarbons. Sulfur isotope ratios of pyrite are similar to those of crude oil. The δS^{34} values of pyrite samples collected from the surface and shallow subsurface tend to be slightly enriched in S^{32}. The enrichment of pyrite with the light isotope S^{32} may be due either to increases in biological activity or to increases of oxygen fugacity. Authigenic kaolinite and mixed-layered illite-smectite are formed as by-products of hydrocarbon migration, which has significant effect on formation-water chemistry. The relationship between hydrocarbon migration and diagenetic minerals may be used as a pathfinder for hydrocarbon accumulation at depth.

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Pennsylvanian Shelf Carbonates, Madera Formation, Taos Trough, Northern New Mexico

The sandy limestones of the Madera Formation differ significantly from shelf carbonates described in other southwestern late Paleozoic basins in that: (1) they were deposited adjacent to an active uplift that provided terrigenous clastics; and (2) no large scale phylloid algal mounds were developed. Prior to deposition of the Madera limestones, early to middle Desmoinesian deltaic deposits derived from the Uncompagre uplift prograded eastward into the basin. Carbonate deposition was locally initiated on abandoned deltaic platforms, where low relief blue-green algal mudbanks and bryozoan mounds developed.

Carbonate deposition became widespread during a middle Desmoinesian transgression. Hummocky to cross-bedded crinoid grainstone shoals formed on and seaward of the algal mudbanks. These initial crinoid shoals were small and laterally discontinuous. As the shoals prograded and evolved into wave resistant barriers, extensive lagoonal and channeled tidal-flat deposits developed behind them. These low-energy lagoonal facies are characterized by small, low relief phylloid algal bars separated by bioturbated sandy siltstones. Fusulinid packstones filled tidal channels which graded laterally into dasycladacean algal flats. Progradation of the shoals also caused steepening of the platform margin, which led to restricted circulation in the slope/basinal depression. Anoxic conditions developed, and thick black, calcareous shaly siltstones were deposited in the basin. Carbonate deposition on the shelf was then terminated by renewed fluvial activity.

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Evidence for Pervasive Bioerosion of Silica Substrates in a Freshwater Peat Environment

Siliceous particles (30 to 100 μm) collected from freshwater peat deposits in the Okefenokee swamp show extensive effects of bioerosion. When viewed with the SEM these effects include: (1) depressions (similar to those produced by diatoms); (2) perforations (holes 2 μm in diameter); and (3) borings (holes $>$2 μm in diameter). These features are most likely to be of biological origin because of their smooth surfaces and the consistency of the geometry of the cavities. The delicate nature of the eroded grains dictates that the biological agents responsible must have lived in the peat-forming environment. For example, monaxon sponge spicules have lost as much as half their original mass through hundreds of tubular microborings, rendering them far too fragile for transport. Heretofore, microborings have been observed to commonly occur on carbonate substrates, and in only two cases has bioerosion been reported in siliceous sediments in a marine environment. Our observations show that freshwater organisms are also capable of boring/dissolving silica, and that this form of degradation may play a major role in silicon mobility within peat-forming environments.

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Barra Nova Salt Domes Province, Espirito Santo Basin, Offshore Brazil

The Barra Nova salt domes province, in the Espirito Santo basin, offshore Brazil, bears some resemblance to the interior basins of the Gulf of Mexico. Two main hypotheses try to explain the origin of the Barra Nova salt domes. (1) Since Aptian salt was overlain by uniform Albian platform, salt movement began as a consequence of the general eastward tilting of the basin which caused gravity sliding and the formation of salt pillows. (2) Existence of an uneven sedimentary loading is represented by Upper Cretaceous volcanic flows extending over the area underlain by salt. These volcanics sank into the salt, forming exposed salt masses which were dissolved, causing salt withdrawal and gravity sliding. Continued sedimentation on the evacuated areas induces the formation of salt domes.

The initial salt pillows began forming during the Albian. Before the Maestrichtian, they reached the extrusion/collapsing phase which extended to the Holocene with the salt domes being dissolved on the present sea floor. One of the mapped domes represents an exception, as it seems to be already in the burying phase.

The gravity sliding, originated from halokinesis, was an important factor in the tectono-sedimentary evolution of the Espirito Santo basin from Late Cretaceous on.

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Analysis of Upper Cretaceous Trace-Fossil Assemblages, U.S. Western Interior

Diversity and abundance of trace fossils in strata of the Greenhorn and Niobrara cyclothems of west-central Kansas, southern Colorado, and south-central Utah have been used to quantify trace-fossil assemblages. Recognition of assemblages is based on use of quantitative, semi-quantitative, and binary (presence-absence) data in conjunction with cluster and factor analysis. Although the character of the original burrowing infauna was a primary factor in assemblage composition, the nature of burrowed sediments and diagenesis exerted strong influence on the preserved trace-fossil record. Thus, the present composition of originally similar assemblages may differ among the several lithotypes (sandstone, shale, chalk, limestone) because of variations in depositional and diagenetic processes that affected preservation of biogenic structures. It is suggested that some of the observed differences in these Upper Cretaceous trace-fossil assemblages are more apparent than real.

At present, taxonomic problems relating to trace fossils hinder quantification of the Upper Cretaceous assemblages. Direct application of standard taxonomic conventions could lead to conceptual confusion because the morphology of trace fossils is controlled as much by general behavior of organisms and their specific responses to sedimentologic parameters as by body form. For example, *Ophiomorpha* is known to grade into *Thalassinoides,* some of which developed *Teichichnus*-like form. Furthermore, some *Rhizocorallium* are connected to *Thalassinoides* burrow systems. The first three genera could be synonymized with *Rhizocorallium,* which has priority. A more constructive approach involves erection of suprageneric categories, such as *Rhizocorallium*-group, that would express