Origin for Uraniferous Organic Nodules, Hennessey Group (Permian), Oklahoma

Geologic field relations may be used to infer a coal- or petroleum-related origin for uraniferous organic nodules of the Hennessey Group (Permian), in Kiowa County, Oklahoma. The local presence of crude oil in the shallow subsurface and the local absence of commercial coal deposits suggest a petroleum-related origin for these nodules. This conclusion is compatible with the subsurface structure near the nodule site, which is dominated by several major near-vertical reverse faults, below the Permian unconformity. These faults may provide vertical conduits for petroleum sources below.

Geochemical analyses of the uraniferous nodules, including infrared spectra and elemental analyses, reveal characteristics of both coal and petroleum. However, carbon isotopic analyses favor a petroleum-related origin. A model can be proposed whereby petroleum, migrating from depth, is initially altered near the surface to a more viscous material. Concurrently migrating, uranium-rich ground water is then stripped of its uranium by the degraded petroleum. Subsequent radiation damage in the uranium-rich nodules has resulted in unusual chemical characteristics. Such a model suggests that associated petroleums may geochemically correlate to the organic matter of the nodules. This is confirmed by carbon isotope ratios, which are very similar for both the petroleum and the uraniferous nodules.

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A Study of Channel Patterns and Morphology of Amazon Deep-Sea Fan Using Long-Range Side-Scan Sonar (GLORIA)

The Amazon Cone is a large deep-sea fan off northeast Brazil. Previous studies utilizing 3.5-kHz echograms, seismic profiles, and piston cores show that the modern fan is characterized by a complex of leveed distributary channels which are bounded to the east and west by large slump/debris-flow deposits. Seismic data show that older channel-levee complexes extend beneath these debris flows.

We recently conducted a detailed study of the modern distributary-channel system of the fan using the Institute of Oceanographic Sciences (England) long-range side-scan sonar instrument (GLORIA). We were able to continuously insonify a 20 to 30-km wide swath of sea floor along each ship track; thus we were able to continuously map many of the distributary channels of the upper and middle fan for distances of a few tens to 150 km. These sonographs suggest that the central leveed channel on the uppermost fan arises within the floor of the lower Amazon Canyon near the 1,500 m isobath. This central channel leads into at least four leveed channels between 1,500 and 2,500 m.

On the middle fan between 2,500 and 4,300 m, these channels divide into additional distributaries. Differences in acoustic reflectivity between channels as well as discontinuity of some channels suggest that certain channels have become inactive and abandoned, and were subsequently partly buried by overbank deposits. This is confirmed by seismic and 3.5 kHz data. The apparent branching of some channels observed on the sonographs may thus be due in part to channel abandonment and avulsion. Most channels on the middle fan are characterized by continuous, highly developed meanders, much like those characteristic of late-maturity rivers on land. The number, tightness, and intricacy of the meanders generally increase from upper to middle fan. Meander migration scars, abandoned meanders, chutes, neck cutoffs, and breaching of channel levees to form additional distributaries are observed. Portions of the large slump/debris-flow deposits which flank the distributary-channel complex are also visible on the side-scan sonographs. At some locations these debris flows appear to have crossed distributary channels and buried, obliterated, or diverted them.

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Sabkha or Subaqueous Intrastratal Origin of Chickenwire Gypsum, DeQueen Formation (Cretaceous), Arkansas

The DeQueen Formation comprises two members. The lower consists of thick, chickenwire gypsum with calcareous mudstones; the upper consists of thin-bedded limestones and shales with hopper halite molds, gypsum, and a celestite bed. Possible interpretations involving sabkha models are questioned. Stromatolites and dolomite are rarely present and correlation with the Ferry Lake Formation would imply a sabkha plain at least 250 km wide; extensive intra-formational erosion surfaces are absent.

It has been suggested that the chickenwire beds were precipitated from standing water and that "nodular" structures resulted from secondary flowage of superjacent and subjacent muds into the gypsum as a result of compaction and shrinkage due to dehydration to anhydrite. A principal objection to this theory is the uniformity of texture of the mud screens even throughout thick gypsum beds and the lack of any structures directly attributable to flowage.

Many features of the formation indicate a highly restricted, lagoonal environment of deposition. These include ostracod faunas and evaporite minerals indicative of salinities fluctuating between brackish and hypersaline, and sedimentary structures suggestive of extremely shallow water and even of emergence. Some limestone beds in the upper member contain unequivocal evidence of intrastratal gypsum crystal growth, and the possibility is here advanced that the chickenwire gypsum beds are also intrastratal in origin but that they formed on the floor of a lagoon rather than in a supratidal setting. The same mechanism, it is implied, may also account for the Ferry Lake chickenwire anhydrite throughout the east Texas–central Louisiana backreef area of the Lower Cretaceous.

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Thermal Chromatography in Source-Rock Analysis

Thermal chromatography or pyrolysis-gas chromatography of mixtures of expanding three-layer clays and sedimentary organic matter or kerogen gives insight into the differences in composition of pyrolyzates of specific sediments and isolated kerogens. Argillaceous sediments containing less than about 2% kerogen-C yield pyrolyzates consisting primarily of low molecular weight hydrocarbons in the gas condensate range, whereas kerogens isolated from such sediments yield a broad range of hydrocarbons as in oil. Pyrolyzates of organic-rich sediments are similar in composition to pyrolyzates of isolated kerogens, being oil-like. The ratio of expanding three-layer (smectite) clays to organic matter in sediments apparently controls the degree of catalytic cracking, so that argillaceous