

the ebb-tidal delta did not develop solely through progradation, but was also formed through erosion of the surrounding Gulf bottom. Accordingly, the shoal is termed "ebb-tidal delta retreat body."

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Interpretive Mineralogy: Examples from Miocene Coastal Plain Sediments

Gulf Coast Miocene sediments are among the most lithologically complex in the entire nation. This varied lithology stems in part from multiple source areas that were active during this interval; but also it reflects major tectonic events that influenced depositional patterns throughout the Gulf Coast during the Miocene. Because fossils are scarce or lacking in many of the units, important questions relating to a number of geologic problems have been addressed by analysis of sediment mineralogy. Examples are discussed illustrating how such analyses can be used to: (1) clarify stratigraphic relationships between units in contact, (2) define environmental conditions in the depositional basin, (3) reconstruct paleoclimate conditions, and (4) identify provenance areas. A major anomaly in the mineralogy of central Gulf Coast Miocene sediments is explained by postulating a major "ancestral Tennessee River" originating in the southern Appalachians and flowing southwestward across Alabama and Mississippi to a terminus in the ancient Gulf of Mexico.

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Textures of Chert and Novaculite: An Exploration Guide

Textures of chert and novaculite observable in scanning electron micrographs (SEMs) are useful as a practical, geologic thermometer for estimating the maximum temperature of those rocks since deposition. Such information may be further applied during exploration for hydrocarbons (maturation or degradation), and for metallic and nonmetallic minerals, in those and associated rocks.

Scanning electron micrographs taken of cherts and novaculites that crop out in the Ouachita Mountain foldbelt of Arkansas and Oklahoma, and in areas adjacent to exposed and buried intrusives, show a sequential range in textures from cryptocrystalline, anhedral quartz in the nonmetamorphosed chert and novaculite to coarse euhedral, polygonal, triple-point quartz 60 μm in diameter. A similar range of textures occurs in chert of a contact metamorphic aureole on the Isle of Skye, Scotland, where classic metamorphic mineral suites from talc through tremolite, diopside, and forsterite grades are represented. Hence, some chert and novaculite of the Ouachita Mountain foldbelt shows textures morphologically correlative with classic representatives of varied metamorphic conditions.

Measurements were made of grain sizes of the quartz along transects across the SEMs of chert and novaculite from the Ouachita foldbelt. From them an isopleth map was made showing mean grain sizes of the polygonal triple-point texture developed. The map defines a linear 25 to 65 km (15 to 40 mi) wide belt that extends from Little Rock, Arkansas, about 250 km (155 mi) west to Broken Bow, Oklahoma. The texture increases from the margins to the core of the Ouachita Mountain foldbelt and contains two coarse-grain anomalies, one near Little Rock (35 μm diameter) and another near Broken Bow (15 μm diameter). This textural belt, with anomalies, conforms to the most intense, predominant late Paleozoic, structural deformation in the Ouachita Mountains. Previous interpretations have considered the rocks in the core of the foldbelt to have attained a maximum metamorphic grade in the zeolite to lower greenschist facies.

Cherts and novaculites adjacent to Magnet Cove, a Cretaceous age pluton in the eastern Ouachita Mountains of Arkansas, illustrate a superposed overprinting of polygonal triple-point texture. It ranges from a background of about 2 μm (talc grade) in chert 1,370 m (4,500 ft) from the pluton to about 45 μm (forsterite grade) from near the contact. Private drilling operations indicate that the pluton contact dips about 45° beneath much of the sedimentary rock that exhibits locally anomalous crystallinity. Homogenization temperatures of vein quartz, determined by H. Jackson in 1973, show a gradient along this profile of slightly more than 200°C (390°F) in quartz 1,370 m (4,500 ft) from the pluton, to about 440°C (825°F) near the contact. Novaculite xenoliths in the adjoining

Potash Sulphur Springs intrusive are coarser in texture, 60 μm or larger, and represent the higher temperature periclase metamorphic grade, approximately 760°C, 1,400°F, at Crestmore, California, according to Carpenter.

The triple-point texture and coarseness of chert and novaculite are related to the degree of thermal maturation resulting from various heating events. The crystal morphology is equivalent in the two processes described (regional and contact metamorphism), but the changes due to individual agents, temperature, physical deformation, time, depth of burial, and mineralizers have not yet been resolved separately.

Very small quantities of chert and novaculite, by using SEM techniques, can serve as a guide to areas that have undergone elevated rock temperatures resulting from deep burial, mechanical stresses, intrusions, exhalations, and other thermal events. These investigations are relevant in determining temperature levels that may mature or degrade hydrocarbons, and offer clues in exploration for thermally related metallic and nonmetallic minerals. SEM studies of cherts and novaculite now provide another method of ascertaining the thermal maturation of rocks.

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Diagenetic Changes to Microfossils: Experimental Study

An understanding of taphonomic processes including diagenesis would enhance the usefulness of fossils such as the Foraminifera. In this study, shells of five modern species of calcareous Foraminifera were subjected to temperatures and pressures (T-P) that simulated burial. One kilometer (0.6 mi) increments were used with a maximum simulated depth of 10 km (6 mi) in wet sediment.

An increased alteration of shells occurred at each higher T-P in each sediment type (quartz, illite, or calcite). Shells in quartz were more altered than those treated in either illite or calcite. Compared to untreated shells, pores in quartz at 5 km (3 mi) were enlarged by 15%, and tiny hillocks were visible at high magnification (2,000 X). At 6 km (3.7 mi), high sharp pinnacles were formed and pores were enlarged 30 to 50%. At 7 km (4.3 mi), long narrow solution channels developed while pores were increased by 40 to 60% in diameter. The next T-P increment (8 km, 5 mi) caused even greater pore solution, whereas at 9 km (5.6 mi) sutures were obliterated and the previously formed pinnacles were removed. At the highest T-P (10 km, 6 mi), chambers and shell outlines were highly altered and newly formed crystals appeared. There were platelets oriented perpendicular to the shell surface; often they were arranged as rosettes.

Under experimental conditions, alteration features of Foraminifera shells appear diagnostic of certain T-P levels. If such features develop on shells in natural sediments they may be useful to reconstruct some conditions of diagenesis.

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Characteristics of Peat Deposits in Mississippi River Delta Plain

Variations in organic-rich sediment (peat) from the Mississippi River delta plain can be explained by differences in three interrelated parameters: (a) depositional setting, (b) balance between subsidence and detrital influx, and (c) marine inundation. Variations are observed in geometry of the overall deposits, organic matter content, and the mineralogy of peats and related ashes.

Using a vibrator, samples were collected from two brackish areas (Avery Island/Sale-Cypremort and Barataria basin) and one freshwater area (Gueydan). Geometries of the deposits are different for the two brackish settings; intertributary peats of Barataria basin tend to be discontinuous and somewhat thicker than blanket peats of Avery Island/Sale-Cypremort. The freshwater peat is an elongate body in a Pleistocene channel cut.

Peats in all areas average 90% moisture content. Dried peat averages 81.3% organic matter with a bulk density of 0.12 g/cm³. Holocene differential compaction has been minimal (< 4%).

Conventional ash values indicate different distributions of organic material for the two brackish areas. For the area containing intertributary peats, approximately 5% of the subsurface contains more than 70%