high formation-fluid pressures, (2) fracture-type reservoirs, and (3) water-free gas-condensate production. Abnormal pressures are believed to be caused by high generation rates, volume expansion during conversion of kerogen to a gas phase, and rock-framework collapse. Indigenous fracturing is caused by a favorable stress condition accompanied by critically high formation-fluid pressure. Water-free hydrocarbon production is the result of the nearly complete saturation of available reservoir space by relatively large volumes of generated and only partially expelled gas-condensate.

We believe that the simple pyrolysis technique and its interpretations are applicable to many basins. The method requires only a library of sample cuttings, a supply of test tubes, and a propane torch (or similar heat source) for implementation.

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Diagenetic Phenomena of Chipola Formation, Calhoun County, Florida

The Chipola Formation crops out along the Chipola River, Ten Mile Creek, and Farley Creek in Calhoun County, Florida. The formation, dated at 16.1 m.y.B.P., is predominantly an unconsolidated, bioclastic wackestone. These carbonate rocks have undergone very little diagenetic alteration, and as a result fossil preservation is excellent. Original mineralogy is essentially unchanged, and most shell material is aragonite or high-magnesian calcite. X-ray analysis of unlithified sediment indicates a composition of approximately 75% aragonite and 25% high-magnesian calcite. Disregarding the age of the formation, the unit is considered to be in a very early stage of lithification.

Cementation occurs locally in the unit by the formation of low-magnesian calcite as microspar. The lithified parts of the formation take on a nodular appearance as bioclastic debris is cemented. "Nodules" are usually less than 15 cm in diameter. Sparry calcite locally may be a void-filling cement, but this is usually confined to lithified burrows. Cementation within burrows is apparently controlled by the presence of organic mucus in the sediment. Early stages of pseudosparitization can also be observed in shell material. Alteration to pseudospar appears as a migrating or advancing "front" through the shell material.

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Depositional Environments and Diagenesis of Grand Rapids Formation, North-Central Alberta, Canada

The Lower Cretaceous Grand Rapids Formation of north-central Alberta consists of three massive sandstone members: upper A, middle B, and lower C. Maximum thickness of the formation is 90 m. In the subsurface, the A and B sands are bitumen impregnated and form the Wabasca oil sand deposit, with reserves estimated at 10.5×10^9 cu m (66×10^9 bbl).

The Grand Rapids Formation was deposited in a broadly regressive setting, interrupted by two transgressive pulses that resulted in shales forming between the three sandstone members. The C sand and the lower part of the B sand were deposited under offshore marine conditions which gradually shallowed to distributary channels, nearshore bars, and coastal swamps at the close of B sand deposition. The shales between the A and B sands were initially formed in brackish environments, which changed to an offshore marine environment as the result of transgression. The A sand consists of nearshore marine deposits overlain by distributary and tidal-channel sands. Coal seams that cap the A and B sands in the outcrop area indicate a coastal-swamp to interdistributary-bay setting.

The clay mineral assemblage in the sandstones consists of kaolinite, illite, montmorillonite, and minor chlorite. In general, the bitumen-saturated sandstones have lower clay content with a larger proportion of kaolinite and less montmorillonite than the nonsaturated, water-bearing sandstones. Examination of the sandstones in thin section and by scanning electron microscopy shows that most clays are either authigenic or have authigenic overgrowths giving the appearance of authigenic minerals.

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Megascale Variability of Sediments on United States Atlantic Continental Shelf and Slope—Multivariate Study

The Atlantic continental shelf of the United States provides an excellent laboratory for application of statistical techniques designed to augment the megascale distribution of spatially oriented geologic data.

Multivariate methods have been applied to data from over 2,000 surface-sediment grab samples in a baseline study conceived both to discern regional trends of textural and mineralogic parameters and to evaluate the relative usefulness of these statistical strategies. The data include textural information on mean grain size, sorting, skewness, and various mineralogic constituents, whereas the statistical techniques employed include cluster, ordination, and trend surface analysis.

Distinct sedimentary facies were first determined by Q-mode cluster analysis, based on the similarity among individual samples utilizing Sorenson's coefficient as the similarity index. To interpret the relations among sedimentary facies, the clusters were plotted in n-dimensional space by Q-mode ordination, employing a highest dissimilarity criterion. The method suggests, for example, that the sediments from the shelf south of Cape Hatteras can be classified on the basis of water depth and calcium carbonate. The sedimentary facies include: a low $CaCO_3$ inner-shelf facies, an outer-shelf facies with variable $CaCO_3$ content, a shelf-break facies, an biogenic upper-slope facies, and a lower-slope facies. Plotting the spatial distribution of these clusters shows the trend toward low $CaCO_3$ content in sediments on the shelf off Georgia, thereby emphasizing the inverse relation between clastic influx and $CaCO_3$ content.

As would be expected, trend surface analysis ignores local variations in sedimentary parameters in favor of extracting the regional gradient. The trend from fine sand nearshore to coarser sand on the shelf below wave