available owing to economic, environmental, or political reasons. Also it is a useful technique for a realistic assessment of hydrocarbon potential in a drilled area for two reasons. First, the proposed method is applicable to the evaluation of hydrocarbon potential in an off-structure area where most of the hydrocarbon generation occurred but where the conventional geochemical methods are useless because of lack of samples. Second, the technique incorporates subtle lateral changes in geothermal gradients—hence maturation level—due to variation in thickness and lithology of sediments.

The proposed method involves three major steps. (1) The thermal conductivity of a formation in a basin is determined from the seismic interval velocity. Then the subsurface temperature is calculated from heat flow (measured or estimated) and the thermal conductivity. (2) The calculated temperature is combined with geologic age derived from seismic stratigraphic or related data to calculate maturation level in terms of vitrinite reflectance (R_O) using our modified Lopatin's method. (3) The calculated R_O value is incorporated with burial history curve to reconstruct organic maturation history diagram. This diagram forms the basis for determining the timing of oil generation and depth interval of the oil window.

We have tested the modeling technique in several sedimentary basins using measured vitrinite reflectance value, DST temperature, and fluid inclusion as checks.

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Pyrolysis-Gas Chromatography as an Exploration Tool for Geochemical Evaluation of Source-Rock Potential

A pyrolysis system was developed to identify the possible production type (oil, condensate, and gas) and the presence of contamination (by migrated oil or drilling additives) in rock samples. This is accomplished by incorporating gas chromatography (GC) in the pyrolysis system so that a direct analysis can be made of the hydrocarbons in the pyrolysis products from sediments samples. This analytical capability of making a positive identification of pyrolysis products is one of the important advantages of this system. Because of this additional feature, this pyrolysis system can overcome problems related to the interpretation of indirect production type indicators such as the oxygen and hydrogen indices used by the commercially available ROCK-EVAL system.

The productive type is recognized either qualitatively by GC fingerprint traces or quantitatively by hydrocarbon composition (C_1-C_4, C_5-C_{14}, and $C_{15}+$) from the kerogen (Peak II) pyrolysate. Oil-prone sediments are recognized by GC traces with a full spectrum of C_1 to C_{28} hydrocarbons, or by high amounts of $C_{15}+$ hydrocarbons. In contrast, gas-prone sediments are characterized by the predominance of light hydrocarbons from C_1 to C_7 in the GC trace, or by low amounts of C_5-C_{14} and $C_{15}+$ hydrocarbons. Condensate or mixed type production is intermediate in character between the two.

Migrated oil or liquid contaminants are detected by a stepwise heating of the rock samples and GC analysis or Peak I (solvent extractables) and Peak II (kerogen decomposition) products.

The application of this pyrolysis system over the past four years as a rapid method for evaluation of organic richness, maturation, and production type using well or outcrop samples along with the limitations of the techniques will also be discussed.

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Surficial Sediments, Chesapeake Bay, Virginia

Surficial sediments, Chesapeake Bay, Virginia, are significantly sandier than previously reported. Sixty-five percent of the area as determined from 2,000 grab samples are sands when plotted on the ternary sand:silt:clay diagram. The mean graphic-mean is 3.17ϕ. Distribution of sediments is, in large part, a function of geomorphology with an apparently good correlation between depth and sediment type. Finer grained sediments are usually confined to the deeper channels. The exceptions to the depth-size relationship are the presence of fines in the shallow, marginal embayments such as Mobjack Bay and the absence of fines in the deep channel in the southeastern section of the bay. The occurrence of sands here is a function of infilling with sands from the area of the bay mouth and, perhaps, of scour into older (Pliocene?) materials. Sediment distribution also reflects the local source with the shallow-water marginal sands derived from erosion of the banks and relict features.

Several large geomorphic features are distinguishable on the maps of sediment characteristics. These features include the deep channels, a large sand shield near Tangier Island, relict spits, the zone of influence of the bay mouth, and the possible existence of an ancient channel extending from Mobjack Bay. The number of samples in this study is an order of magnitude greater (2,000 versus 200) than previous studies, allowing a significantly better delineation of sediment types.

900 samples, biased away from the coarser sands, were analyzed for total carbon, organic carbon, and sulfur contents. There are strong correlations between these characteristics and sediment type, especially weight percent clay. Additionally, there is a good relationship between the organic carbon and sulfur content. Total carbon content reached 10% in some samples, however, the average was 1.5%. Average organic carbon and sulfur contents were 1.0 and 0.34%, respectively.

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Three-Dimensional Study of a Modern Flood-Tidal Delta in South Carolina

A three-dimensional study of a modern flood-tidal delta in South Carolina was conducted using historical charts and photographs, geomorphic and sedimentologic process measurements, and shallow seismic profiling. Results suggest that the flood-tidal delta developed in response to shoreline erosion of the Santee River delta since the river was dammed and diverted in the first half of this century. The Santee flood-tidal delta complex consists of a transgressive sequence topped with tidal delta deposits 1 to 1.5 m thick. The clean, coarse to medium-grained sand of the flood-tidal delta is underlain by tidal flat, tidal channel fill, and bay-fill sediments. Beneath that lies estuarine-lower delta plain deposits.

The relationship of peak ebb and flood currents to the depth of flow and the degree of shielding by topographic highs exerts control over bed-form orientation and distribution. Ebb-oriented bed forms dominate the tidal delta surface, but preferential preservation favors flood-oriented bed forms owing to higher hydraulic energy on the ebb shield and flood ramp, and by protection from ebb currents provided in the lee of the ebb shield. Textural and mineralogic evidence indicates that littoral-derived sediments are being deposited in the North Santee channel. Seismic and stratigraphic data indicate the maximum volume of clean sand in the flood-tidal delta is between 387,000 and 500,000 m^3.

Surface mapping suggests that the North Santee flood-tidal delta will continue to transgress the adjacent tidal flat, weld onto nearby Cane Island, and be capped by salt marsh if undisturbed by rediversion of the Santee. The flood-tidal delta would apper in