nannofossils, and radiolarians) as old as Cretaceous, mixed planktonic and shallow benthic forams, a few shallow-shelf limestone clasts, and preservation of carbonate materials deposited approximately 1 km below the Miocene calcite compensation depth.

The Great Abaco Member at Site 391 is 500 m thick. Intermittent coring, recovering 21% of the interval, indicates the following sequence, from top to bottom: (1) structureless white calcareous silt (57 m) with reworked fossils, including Eocene ones; (2) intraclastic marly chalk (123 m) with gray mud clasts of variable abundance and size, up to 2 cm long, attributed to debris-flow deposition; (3) dark, structureless radiolarian mudstone (28 m); probably background hemipelagic sediment, but contains a few reworked fossils; (4) intraclastic chalk (171 m) with a few intervals of dark mudstone and of shallow-water limestone lithoclasts showing lamination, scoured surfaces, and vague grading; debris-flow deposits; (5) heterogeneous interval (124 m) of intraclastic chalk and dark mudstone with several graded beds of claystone intraclasts which show partial Bouma sequences, suggesting turbidity-current, as well as debris-flow and contour-current deposition.

The variety in types of clasts and in age and depth of reworked fossils, as well as the sheer volume of the unit, indicate several source areas including the continental rise and slope (hemipelagic clasts), the Blake Plateau (pelagic carbonate material) and the Great Bahama Banks (shallow-water limestones and benthic fossils).

Seismic profiling shows that the Great Abaco Member is about 500 m thick throughout the Blake-Bahama basin, an area of about 50,000 sq km, but pinches out abruptly at the basin margins, probably against hemipelagic muds. Several internal reflectors and a profound regional unconformity at the base (horizon A^u, Late Cretaceous to Miocene hiatus) provide good seismic mappability of the Great Abaco Member and several subunits. The internal acoustic character is a series of smooth, closely spaced reflectors, consistent with intermittent gravity-flow deposition, but local current sculpture is indicated by channels and long-wavelength bedforms.

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Petroleum Potential of Scotian Shelf—Case Study

Application of modern concepts of petroleum genesis, migration, and accumulation permits an evaluation of the petroleum potential for the Scotian Shelf area of the Atlantic outer continental shelf. Conclusions are that shows of gas and oil are to be expected, but commercial scale production is unlikely in the area studied. The paucity of accumulated petroleum derives from two primary factors: (1) unfavorable conditions of deposition resulting in a low conversion of organic matter; and (2) losses, probably to the surface, of a large proportion of the petroleum generated. A third factor of secondary importance is low concentrations of source material in some formations. The results of this study can be used to evaluate other parts of the basin where conditions may be more favorable for the formation of economic accumulations of petroleum.

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Dolomitization Models from Early Precambrian Sequence in South Africa

A 1,500-m-thick chemical sedimentary unit within the approximately 2,300-m.y.-old Transvaal Supergroup contains more than 75% dolomite. A paleogeographic reconstruction for this stratigraphic interval has delineated a passive southeastern basin margin which was a low-relief, stromatolitic tidal flat; this is distinguished from an active northwestern basin margin along which banded iron formations precipitated in lagoons behind clastic-textured carbonate barriers. Large stromatolitic mounds occupied the intervening shallow, subtidal environment.

Two generations of dolomitization are recognizable in the tidal-flat facies; these are considered to reflect schizohaline conditions. Palisade pseudomorphs, probably after gypsum, indicate hypersalinity which is considered to have resulted in the penecontemporaneous development of micritic dolomites. Later, coarse-grained, limpid dolomites with associated secondary cherts are interpreted as a response to a freshwater, low-pH meteoric overprint. The barrier facies comprises limestones and replacement dolomites which contain up to 10% FeO and 4% MnO in the carbonate lattice. The degree of dolomitization decreases away from the banded iron formations, suggesting the lagoon as a potential source of a refluxing magnesium-iron-manganese brine. The widespread occurrence of both iron and manganese in their divalent states lends support to previous contentions of a reducing atmosphere during the early Precambrian. The stromatolitic mounds, which have an average stratigraphic thickness of 200 m and a basinal extent of hundreds of kilometers, consist of uniformly pure and fine-grained dolomites which are characteristically devoid of chert. These dolomites may be primary or, conversely, could have formed through reaction with the ambient waters of an intracratonic epeiric sea which had high concentrations of magnesium and sodium.

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Malossa Field, Deep Discovery in Po Valley, Italy

The discovery of the Malossa gas and condensate field 15 mi (24 km) east of Milan is one of the more recent results of the exploration activities carried out by AGIP in the Po Valley since the 1950s.

The structure was recognized by a seismic reflection survey. Since 1967-68, with the introduction of digital techniques in geophysical prospecting, the reflection seismic method has allowed better information at a greater depth with a vast improvement in quality of the reflecting horizons. The Malossa field structure is a faulted, southward-overthrust block. The top of the hydrocarbon-bearing formation is at about 5,400 m. Hydrocarbons are present in the Dolomia Principale Formation of Noric (Mesozoic) age. Even though the formation has low porosity values it is the main reservoir.

The caprocks are a marly limestone of Cretaceous

age and Oligocene marlstones. The source rock is considered to be the Rhaetic black shale, which was deposited in an euxinic environment.

Drilling activities have to overcome unusual difficulties owing to high pressure gradient. New methods to forecast and study overpressured zones have been developed. The hydrocarbons in the reservoir are in a gas phase. Reservoir pressure is 15,000 psi (103,425 kPa), temperature is 300°F (149°C), a minimum amount of carbon dioxide is present, and serious problems of corrosion have to be faced in the completion operations. Estimated original reserves are 50×10^9 cu m of gas and 40×10^6 tons of crude oil.

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Determination of Depth to Hydrocarbon Maturation Temperature from Magnetic Data, Bligh Water, Fiji

The depth to the temperature at which rocks lose their magnetization (Curie point depth) can be calculated by estimating the average depth to the bottom of the magnetized bodies which make up the crust. Using the method of spectral analysis on magnetic data, as suggested by Bhattacharyya and Leu, we have calculated the depth to the Curie point temperature in Bligh Water, Fiji.

Measurements of the magnetic susceptibility of rocks versus temperature at field strengths approaching that of the earth's main field suggest that the effective Curie point temperature of the magnetic crust is about 500°C. Using this temperature with the calculated Curie point depth and reasonable ocean-bottom temperatures, we have prepared a crustal-thermal-gradient map of the Bligh Water basin. The thermal gradients thus calculated are in reasonable agreement with gradients determined from conventional oceanographic heat-flow measurements in surrounding deep-water regions. The results for Bligh Water, Fiji, suggest that hydrocarbon maturation temperatures are probably reached in the relatively shallow lower to middle Miocene reefs.

We are presently analyzing marine magnetic data over the Fiji Plateau west of Fiji, where an active back-arc spreading center is postulated. The results of this investigation will provide a direct comparison between thermal gradients calculated from Curie point data and marine heat-flow measurements, as well as provide insight into the regional geophysics of the area.

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Petrology and Diagenesis of Arc-Derived Lithic Sandstones—Wagwater Trough, East-Central Jamaica

The Wagwater trough is a fault-bounded block of lower Tertiary sedimentary and volcanic rocks that cuts across east-central Jamaica in a southeast direction. Detrital sandstone and conglomeratic sequences within this block include the early Eocene and Paleocene(?) Wagwater and Richmond Formations. The Wagwater Formation is a red-bed sequence of breccias, conglomerates, sandstones, and mudstones with minor amounts of limestone and gypsum deposited as a subaerial fan-delta complex. Sedimentary rocks of the Wagwater Formation are laterally equivalent to sandstones, conglomerates, shales, and limestones of the Richmond Formation, which were deposited in submarine-slope and fan environments.

Lithic arenites are the dominant sandstone type within the trough. Principal framework constituents include volcanic and carbonate lithic fragments, plagioclase, quartz, and fossil fragments with minor amounts of plutonic lithic fragments and opaque heavy minerals. Authigenic minerals are abundant in some sandstones and include phyllosilicates (chlorite and clay minerals), calcite, and iron oxide.

The progressive sequence of diagenetic features from earliest to latest in marine sandstones of the Richmond Formation is: (1) development of clay coats around framework grains, (2) precipitation of calcite pore-fill cement, (3) development of a second clay coat on calcite cement in incompletely filled pores, (4) crystallization of radiating pore-fill chlorite after development of clay coats in either stage 1 or stage 3, and (5) late-stage calcite replacement.

Despite minor differences in diagenetic features, the Richmond sandstones are similar to other arc-derived sandstones from five other basins. These separate occurrences suggest that sands deposited in arc basins have the same compositional range, and that postdeposition processes produce a common diagenetic sequence.

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Active Faults in Houston, Texas, Area as Observed on LANDSAT Imagery

Digitally processed LANDSAT imagery offers geologists a new perspective for detecting and assessing active faults in the Texas Gulf coastal plain. Many known active faults in and around Houston, such as those that periodically break the Katy Freeway and the runway at Ellington Air Force Base, appear on LANDSAT imagery as discrete linear features. Many other linear features correlate with surface projection of down-to-basin growth faults mapped in the subsurface. Several linear features observed do not appear to correlate with any known or mapped features. Investigation of these features using surface and subsurface data may reveal incipient or potentially active faults that may constitute geologic hazards as urban growth and development continue.

Many lineaments are marked by geomorphic features. Some lineaments seem to be marked by small-scale disruption of terrain and cultural patterns, especially in the urban area. Still others appear as changes in tone across sharp linear boundaries that may reflect differences in soil moisture on either side of a fracture system.

Each linear feature detected on space or aircraft imagery must be carefully investigated before it is designated a fault because its recognition can both guide future development and adversely affect current property values.