ities of 0.5 to 83 md. Primary sedimentary structures, textures, mineralogy, and stratigraphic sequences from core analysis, log character, and paleontology suggest a delta to prodelta environment. Convolute structures within reservoirs and chaotic dipmeter patterns suggest complex subaqueous mass movement, similar to that within the modern Mississippi delta complex.

General Crude Oil has drilled 17 wells in the field with 15 containing hydrocarbon-bearing sands. The productive sandstones rarely correlate between wells, thus masking reservoir geometry and indicating a restricted aerial extent for most reservoir sandstones. Production in most wells has declined rapidly, and results of stimulation by fracturing, acidizing, and clay stabilization appear to substantiate the interpretation of multiple, small, discontinuous reservoirs.

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Lithology Data Systems—Rocks to Applications

As geologists we should take a close look at the development and use of Lithologic Data Systems as hydrocarbon finding tools. The technology and experience are now available for us to do this.

A Lithologic Data System must be capable of accepting descriptive data from sample cuttings, cores, outcrops, and that purchased from commercial concerns. The capture of the company data is very time consuming and expensive. Purchase of lithologic data from commercial firms is the fastest and least expensive method of obtaining a Lithologic Data System. Their data are more adaptable to a computer system because of the higher degree of standardization and are already prepared for computer storage. Commercial firms are currently generating more intervals of data per month than most companies. The three commercial firms currently in the data processing business have in their files approximately 15,000 lithologic digital logs. The files are increasing at the rate of approximately 100 wells per month. No longer are data systems the sole property of the larger companies. All three commercial lithologic data firms have retrieval programs that will process their data.

With the increase of computer usage, industry-wide standardization of logging methods, geologic terms, and data formats are essential. After storage, geologic models can be developed and retrievals created for output in any desirable form such as log strips, multiple types of maps, histograms, statistical data, etc. Of all data systems developed by the oil companies, the Lithologic Data System has the greatest potential for aiding in the search for future energy reserves.

TALWANI, MANIK, Lamont-Doherty Geol. Observ., Palisades, N.Y.

Deep-Sea Drilling and Global Tectonics

The start of the Deep Sea Drilling Project coincided with the development of the ideas of "global tectonics" or "plate tectonics," which had been mainly derived from geophysical data. The results of drilling have been able to confirm the ideas of plate tectonics and have been important in adding important information in many areas: the age of the oceanic crust, relative and absolute plate motions, composition of the oceanic crust, sources of magnetic anomalies, tectonics at subduction zones, and initiation of rifting.

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Characteristics of LANDSAT System for Geologic Applications

LANDSAT satellites were launched into orbit in 1972 and 1975. Additional LANDSAT satellites will be launched in 1978 and 1981. The satellites orbit the Earth every 18 days at an altitude of approximately 900 km. A sun-synchronous orbit is utilized to insure repeatable illumination conditions. Seasonal variations in solar illumination must be analyzed to select the best LANDSAT data for geologic applications. LANDSAT data may be viewed in stereo where there is sufficient sidelap and sufficient topographic relief. Repetitive satellite coverage allows optimal cover conditions for geologic applications to be identified. The present LANDSAT satellites detect only solar radiation that is reflected from the earth's surface in visible and near-visible wavelengths. The third LANDSAT satellite will detect emitted thermal radiation. The Multispectral Scanner (MSS) is the only sensing instrument operating on the first two satellites. The MSS on LANDSATS 1 and 2 detects radiation which is reflected from a 79 × 79-m area, and the data are formated as if the measurement were made from a 56 × 79-m area.

The MSS integrates spectral response from all cover types within the 79 × 79-m area. The integrated spectral signature often does not resemble the spectral signature from individual cover types, and the integrated signature is also modified by the atmosphere. LANDSAT 1 and 2 data are converted to 70-mm film and computer compatible tapes (CCT's) at Goddard Space Flight Center (GSFC) and are shipped to the EROS Data Center (EDC) for distribution to users. LANDSAT-C data will be converted to 241-mm wide film and CCT's at EDC. LANDSAT-D data will be relayed from the satellite collection platform directly to geosynchronous satellites and then to the United States from any location on Earth.

TARANIK, JAMES V., U.S. Geol. Survey, Sioux Falls, S.D.

Computer Processing of LANDSAT Data for Geologic Applications

The main objectives of computer processing of LANDSAT data for geologic applications are to improve display of image data to the analyst or to facilitate evaluation of the multispectral characteristics of the data. Image enhancements involve adjustments of brightness values for individual picture elements. Image classification involves determination of the brightness values of picture elements for a particular cover type. Histograms are used to display the range and frequency of occurrence of brightness values.

LANDSAT 1 and 2 data are preprocessed at Goddard Space Flight Center (GSFC) to adjust for the detector response of the Multispectral Scanner (MSS). Because illumination conditions and landscape characteristics vary considerably and detector response changes with time, the radiometric adjustments applied at GSFC are seldom perfect and detector striping remains in LANDSAT data. Therefore, adjustments are applied to minimize the effects of striping, and to adjust for bad data lines, line segments, and lost individual pixel data. Rotation of the earth under the satellite and movements of the satellite platform introduce geometric distortions in the data which must be compensated for if image data are to be correctly displayed to the data analyst. Adjustments to LANDSAT data are made to compensate for variable solar illumination and for atmospheric effects. Geometric registration of LANDSAT data involves determination of the spatial location of a pixel in the output image and determination of the new value of the pixel in the output image.

TEMPLES, TOMMY J., and BARUN K. SEN GUPTA, Univ. Georgia, Athens, Ga.

Late Quaternary Foraminiferal Record in Eastern Caribbean Cores—Paleo-Oceanographic Implications

Oxygen-isotope variations in planktonic Foraminifera (*Orbulina universa, Globorotalia menardii,* and *Globigerinoides sacculifer*) indicate that, in two Grenada Basin cores, paleontologic datum planes do not coincide with isotope boundaries. The time lag is greater when the boundaries are transitional from glacial to interglacial phases.

Recurrent-groups analysis of benthic foram assemblages led to the recognition of five groups. Only one of these, containing *Osangularia culter, Bulimina buchiana,* and *Chilostomella oolina,* appears to have any stratigraphic significance. The group shows its best development during interglacial times. In accordance with Weyl's paleo-oceanographic model, this group is associated with colder bottom waters and can be used to draw inferences about the influx of such waters. Periods of cold-water influx ranged from before 367,000 to 210,000 years B.P., from 139,000 to 81,000 years B.P., and from 22,000 to 8,600 years B.P. Cessation of influx 8,600 years B.P. is further substantiated by heat-flow calculations.

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Environmental Assessment of In-Situ Leaching of Uranium

Maintenance of water quality during and following in-situ leaching of uranium is the fundamental problem which must be considered in an environmental assessment of such operations. Prior to any leaching activity, a realistic baseline by which to judge the groundwater quality must be established for any given operation. Monitoring programs will be required to evaluate subsurface restoration efforts and to assess the containment of the lixiviant and the solubilized ions essentially within the mining area of the ore-bearing aquifer of the leaching operation. Disposal of leach-mining wastes may prove a greater threat to the environment than the mining.

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Oceans and Climate During Cenozoic

Ten years of deep-ocean drilling have helped to assemble an enormous body of new data about the evolution of the physiography and sedimentary processes of the Cenozoic ocean basins. The formation of the Southern Ocean isolated Antarctica and allowed the evolution of the circum-Antarctic oceanic current regime during mid-Tertiary time. The opening of the Norwegian-Greenland sea during the early Tertiary and the final subsidence of the Iceland-Faroe Ridge during the late Miocene connected the main North Atlantic with the Arctic basin. This seaway was the final step in the formation of an ocean basin connecting the cold, polar water bodies of both hemispheres. The construction of the middle American land bridge and the interruption of the Tethys into separated shallow and deep basins led to a segmentation of the old global, equatorial seaway into different current regimes in the Indian, Atlantic, and Pacific Oceans. This physiographic-tectonic evolution of the ocean basins and the deterioration of the earth's climate during the Cenozoic led to important changes of the depositional regime in the deep oceans because of the initiation of a vigorous polar bottom-water formation and because of the generation of steep zonal hydrographic gradients in the surface-water masses. The effects of these changes on pelagic sedimentation cannot be separated easily, but they have resulted in many deep ocean basins and in lithofacies distributions along their continental margins that are asymmetric along zonal profiles. The DSDP data from the North Atlantic are a prominent example of this Cenozoic evolution of the pelagic depositional environment.

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Middle Cretaceous Oxygen-Deficient Paleoenvironments in Mid-Pacific Mountains and on Hess Rise, Central North Pacific Ocean

Cores collected during Leg 62 of the Deep Sea Drilling Project recovered organic-rich rocks of early Aptian age in the Mid-Pacific Mountains and of late Albian age on the southern Hess Rise. Concentrations of organic carbon in these rocks range from a few tenths of 1% to more than 9%. The organic-rich strata in the Mid-Pacific Mountains are in a 45-m-thick sequence of carbonaceous and tuffaceous limestone that lies on inter-