nesium carbonate or a transitory alkali-bearing carbonate.

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Mid-Cretaceous Calcareous Nannoplankton Paleobiogeography and Paleo-oceanography of Atlantic Ocean

The abrupt lithologic change from Neocomian pelagic carbonate rocks to widespread organic-rich shales of middle Cretaceous age and the return to mostly oxidized sediments in the Cenomanian suggest significant changes in paleocirculation and productivity patterns. A quantitative study of calcareous nannofossils from DSDP and IPOD cores and selected land samples allowed delineation of paleo-oceanographic and paleoecologic patterns. Major factors controlling the distribution of calcareous nannoplankton are: (1) surface-water temperature and polar or equatorial temperature gradients, (2) aggressiveness of bottom water and associated position of the calcite compensation depth (CCD), and (3) diagenesis. Paleobiogeographic patterns of calcareous nannofossils change significantly during the middle Cretaceous.

In the Barremian to early Aptian, both Atlantic basins showed sluggish surface circulation resulting in a broad tropical assemblage and a weakly developed austral assemblage. During the late Aptian through middle Albian carbonate dissolution was most pronounced. Neither austral nor boreal nannoplankton assemblages could be distinguished. During late Albian to Cenomanian time boreal and austral assemblages are well developed and tropical assemblages are compressed with respect to latitude. Gyre-margin assemblages become more common and there are indications of more widespread upwelling in the eastern North Atlantic and over the Walvis-Rio Grande Ridge system.

This would indicate that stronger polar-equatorial temperature gradients developed in the latest Albian to early Cenomanian. More vigorous deep- and surface-water circulation would result in better ventilation of the deep ocean and the deposition of more oxidized sediments. Oxygen isotope determinations support the underlying assumption for this hypothesis. Nannofossil paleobiogeographic studies thus allowed us to document a comprehensive picture of middle Cretaceous paleo-oceanography in the Atlantic.


Changing Perspectives in Paleoecologic Use of Trace Fossils

Historically, trace fossils have been described as "tricks of the devil, plant or fucoid remains, or the specific tracks of organisms," and more recently, as "the behavioral responses of organisms to a particular substrate." Moreover, there are now many attempts to use trace fossils to model community structure, to interpret depth zonations, diversity, nutrient levels, etc. However, it stretches the point to treat traces as pseudo-organisms. They can be excellent paleoindicators when accepted as the complex structures they are—especially surface traces. Surface traces represent the preservation of an ephemeral animal, combination of sediment, and fluid that can provide us with information about the size, weight, style, and locomotory types of animals present; they can set limits for values of the engineering or geotechnical properties of the substrate (such as bearing capacity, water content, and shear strength); and they can indicate the fluid regime (current velocities and directions) associated with the site area. This information can be gleaned from fossil traces by treating them as structures created by organisms (nothing more), that to be preserved must respond to local, transitory conditions at the seabed.

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Intisar "D" Oil Field, Libya

The Intisar "D" reef oil field was discovered by Occidental in October 1967; the discovery well tested 75,000 BOPD. The prospect was based on reflection seismic data, which indicated the presence of an isolated reef. Three such prospects had been drilled previously with varying degrees of success.

The Paleocene of the Sirte basin is characterized by carbonate rocks and shales deposited in an epeiric sea. The Intisar reefs grew in a late Paleocene embayment bounded on three sides by carbonate banks. Three distinct stages of organic development are recognized. The Intisar "D" reef is roughly circular in plan and approximately 5 km in diameter. Its maximum thickness is 1,262 ft (385 m). The reef is coral and algal with grain- and mud-supported biomicrites. Porosity averages 22% and is mostly solution and intergranular. Measured permeability is as high as 500 md and averages 87 md. The main reservoir is remarkably homogeneous without noticeable layering typical of other reefs in the area.

The reef was full to spill point with a maximum oil column of 955 ft (291 m). The 40° API gravity oil has a paraffinic base and is low in sulfur. The original solution GOR was 509 cu ft/bbl. Original stock tank oil in place is estimated at 1.8 billion bbl. The field currently produces 200,000 BOPD oil from 13 wells; 11 water injection and 7 gas injection wells are used. Cumulative oil production as of September 30, 1978, totaled 777 million bbl. Ultimate recovery efficiency is expected to approach 75%.

No pressure support was expected. Supplemental recovery operations were begun early and included pressure maintenance by both water and gas injection. The reservoir pressure is now maintained at the 4,000-psi level, high enough for miscible gas displacement.

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Seismic Sequence Analysis; New Approach for Exploration in Offshore Brazilian Coastal Basins

Twelve Late Cretaceous to Holocene depositional se-
sequences, grouped in four supersequences, have been recognized in the Pelotas, Santos, Campos, Espirito Santo, Cumuruxatiba, Sergipe-Alagoas, Potiguar, Barreirinhas, and Foz do Amazonas basins along the Brazilian continental margin.

In general, the sequences are bound by sharp breaks on seismic sections separating distinct seismic-stratigraphic patterns. The most common breaks include: the top of Albian-Cenomanian post-rift carbonate rocks; the top of lower Eocene or Paleocene, coincident with a change in the subsidence regime of the margin; the boundary between lower and upper Oligocene; the base of lower Miocene that marks the beginning of a well-developed progradational episode: the base of middle Miocene, and an upper Miocene top, both indicating major transgressions along the continental margin.

The sequences were analyzed and correlated along the basins by their main seismic and geologic parameters, being recognized by different depositional styles.

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Process for Primary Migration of Petroleum in Sedimentary Basins

No abstract available.

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Exploration Geophysics in People's Republic of China

Details of exploration geophysics instruments and techniques in the People's Republic of China are relatively unknown to those outside the country. The People's Republic, a country the size of the United States, with relatively large mineral and petroleum resources, since its founding in 1949, has conducted more or less continuous geophysical exploration by vast teams of geologic and geophysical personnel.

In 1974 and 1977, the writer visited exploration geophysical personnel in the People's Republic of China; the latter visit was at the invitation and expense of the State Bureau of Geology. During each 3-week visit, various laboratories, institutions, geophysical instrument factories, computer centers, and other technical installations were visited. Included in these facilities were the large Ta Ching oil field in Manchuria; the geophysical instrument factories in Peking, Shanghai, and Changchun; the Geological College in Changchun; and various State Bureau of Geology personnel in other cities. During these visits the writer compared the state of exploration geophysics with present geophysical practice in the United States and other Western countries.


Role of Bioerosion in Mass-Wasting of Pleistocene Outcrops on Georgia Coast

Outcrops of semiconsolidated Pleistocene sands, exposed by meandering tidal rivers and creeks in the Georgia estuaries, are undergoing rapid disaggregation by a variety of plants and animals. Bioeroders include large and small mammals, wasps, crabs, isopods, and pelecypods. In this area, bioerosion is responsible for retreat of bluffs as high as 15 m and contributes significantly to mass-wasting and subsequent erosion by currents and waves.

Blocks initially break away from the bluffs along fractures created by plant roots. As the blocks move downslope they serve as substrates for numerous supralittoral, littoral, and sublittoral invertebrate organisms which burrow, bore, and scrape the blocks as well as the bluff itself. Different organisms are restricted to distinct vertical zones and the degree of bioerosion increases to a maximum at the low-water line where boulders are riddled with borings, mainly by the isopod Sphaeroma destructor. Multiple isopod borings are in turn further eroded to form large burrows and galleries occupied by crabs. Rates of excavation and colonization of exposed surfaces are rapid, and obvious changes occur in periods of less than 2 weeks.

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Three-Dimensional Seismic Interpretation Methods

A 3-D seismic survey provides a volume of closely spaced accurate three-dimensionally migrated data. From this data volume, the seismic interpreter has a wide variety of display options available: two-dimensional slices, both vertical and horizontal, and three-dimensional displays of the data volume itself. Thus the interpreter can study a subsurface feature on a two-dimensional section of chosen orientation or in three dimensions. He has, however, a very large quantity of data to examine before arriving at a final interpretation of the prospect.

Interpretation of Seiscrop (trademark of Geophysical Service, Inc.) horizontal sections provides a fast, convenient, and effective way of interpreting the data volume. Seiscrop sections displayed every 2 or 4 msec and made into a motion picture are used in conjunction with the Seiscrop Interpretation Table to build horizon contour maps directly. Seiscrop sections are an easy and successful means of delineating flat spots or small structures. In “flat” spots which are not quite flat because of lateral velocity gradients, composite Seiscrop sections from more than one record time are used. Seiscrop sections are also used for stratigraphic interpretation.

Seismodel (trademark) Display Unit is a means of viewing many vertical slices through the data volume simultaneously. This permits the interpreter to see structural and stratigraphic features in three dimensions. Each vertical section is on a separate demountable transparent plate. The interpreter removes and marks each plate in turn to develop his interpretation in three dimensions.

Reflection holography is also used to display a 3-D data volume. Many vertical seismic sections are stored on a single holographic plate. The data are then recon-