Drilling Project Leg 71 cores has been constructed for the Maurice Ewing Bank of the eastern Falkland Plateau, southwestern Atlantic Ocean. Specifically, the cores cover portions of the middle Eocene, upper Eocene, and lower Oligocene. Surface water isotopic temperatures postulated for the middle Eocene at Site 512 fluctuated within about four degrees but generally averaged about 9°C (48°F). Bottom isotopic temperatures at Site 512 (water depth = 1,846 m, 6,056 ft) were generally a degree lower than surface water temperatures.

Surface water isotopic temperatures at Site 511 initially averaged about 11°C (52°F) during the late Eocene, but dropped to an average of 7°C (44.5°F) in the early Oligocene. Bottom isotopic temperatures at Site 511 (water depth = 2,589 m, 8,494 ft) generally record temperatures between 12.5°C (54.5°F) and 8°C (46.5°F), similar to the range in the surface water temperatures. During the early Oligocene, bottom isotopic temperatures dropped sharply and averaged about 2°C (35.5°F), very close to present-day values. Surface water isotopic temperature values also decreased to an average of about 7°C (44.5°F), leading to a significant divergence between surface and bottom water isotopic temperatures during the early Oligocene. Comparisons among Southern Ocean DSDP Sites 511, 512, and 277, and between these and other DSDP sites from central and northern latitudes (Sites 44, 167, 171, 292, 357, 398, 119, and 401) show that much of the Eocene was characterized by relatively warm temperatures until sometime in either the middle Eocene, late Eocene, or early Oligocene. At each site, conspicuous ^{18}O enrichments occur in both the benthic and planktonic foraminifers over a relatively short period of time. Although a general trend toward a climatic deterioration is evident, the density of data points among the various studies is still too sparse to determine either a synchroneity or a time transgression between the major isotopic events.

A close correlation could be made between the Site 511 oxygen isotope temperature curve and paleoclimatic trends derived independently from radiolarian studies. The sharp temperature drop and the divergence between bottom and surface water temperatures during the early Oligocene apparently reflect a major expansion of the Antarctic water mass. The migration of the boundary between the sub-Antarctic and Antarctic water masses over the site at this time would account in part for the sharp temperature changes. Sharp changes of this nature would not necessarily be noted in other geographic areas, particularly those to the north which have different oceanographic regimes.

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Trace Fossils in Siluro-Devonian Tidal Flat to Distal Basin Slope Carbonates of Arctic Canada

Upper Silurian and Lower Devonian carbonates of Somerset, Griffith, Cornwallis, and Devon Islands (Arctic Canada) were deposited under conditions which ranged from tidal flat in the south to basin slope in the north. Trace fossils occur commonly in this succession. *Planolites, Palaeophycos, Chondrites*, and *Skolithos* are ubiquitous throughout the sequence. Seven commonly occurring ichnogenera exhibit restricted environmental conditions: *Polarichnus* is confined to tidal flat deposits, *Zoophycos* and *Pilichnia* are most common in deep subtidal shelf and upper basin slope deposits, and *Phycodes, Lockeia, Taenidium*, and *Cruziana* occur predominantly in basin slope deposits. Seven other ichnogenera, *Arenicolites, Arthraria, Cochlichnus*, cf. *Furculosus, Helicodromites, Teichichnus*, and cf. *Thalassinoides*, occur only very rarely.

Trace fossil assemblages of the tidal flat and subtidal shelf carbonates are broadly similar to the *Skolithos* and *Cruziana* ichnofacies reported from environmentally equivalent siliciclastic deposits. Similarly, the assemblage of the deep subtidal–upper basin slope carbonates resembles the environmentally equivalent *Zoophycos* ichnofacies. In contrast, the assemblage of the basin slope carbonates comprises abundant resting and feeding traces (*Cruziana* ichnofacies) whereas assemblages of siliciclastic slope deposits are dominated by complex grazing traces and graphoglyptids (*Nereites* ichnofacies). The relative scarcity of arthropod traces throughout this carbonate sequence probably reflects diagenetic alternation of bedding surfaces.

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Radiolarian Succession of Latest Carboniferous through Permian, Urals and West Texas

A succession of characteristic radiolarian assemblages has been recognized through the Late Carboniferous and stratotypic Permian of the Urals and west Texas. The majority of the component taxa are yet undescribed. The oldest well-preserved assemblage from the regions appears in the lower Gzhelian Stage of the Urals and consists of more than 30 species belonging to 12 genera. Typical are large *Albaillella*, curled *Haplodiacanthus*, abundant spongy, cross-axon forms with an open central area, and *Polyentactinia* of octahedral form. The top of the Gzhelian Stage contains 54 species assigned to 18 genera. A new genus of the Corythoecidae, species of a highly plastic, closed spongy, cross-axon form, an unsegmented *Albaillella* with massive basal spines, *Camptoalatus, Popofskyellum*, and various triradiate, cross-axon forms are characteristic.

The lower horizons of the Asselian Stage are distinguished by the appearance of *Latenofistula crucex*, a unique, large-pored *Entactinosphaera*, and spherical and elliptical forms with multiple concentric shells. Thus, radiolarian assemblages gradually change at the Carboniferous-Permian boundary. The Sarabil Suite of the Sakmarian Stage is distinguished by *Haplodiacanthus perforatus* (Kozur), *Albaillella permica* (Kozur), and large *Helioentactinia*. In the upper part of the Sakmarian Stage appears as assemblage of *Camptoalatus monopterygius* Nazarov and Rudenko, *Raphidociclicus hiulcus* Nazarov and Rudenko, and a new species of *Ruzhencevispongus*. The base of the Artinian Stage is characterized by the appearance of a new, multishelled, spongy polycystine genus possessing a three-rayed internal framework, *Tormentum? pavlovi* (Kozur), and a large, triradiate form with two strongly curving legs. The lower and middle parts of the Aktastinian Substage (Artinian Stage) are distinguished by an undescribed, small, discoidal, five-rayed radiolarian and by *Entactinosphaera* sp. The top of the Artinian Stage is typified by *Haplodiacanthus anfractus, Raphidociclicus gemellus*, and *Ruzhencevispongus uralicus* Kozur, and marks the first appearance of *Follicucullus* Ormiston and Babcock in the Urals. This is clearly an older horizon than that of the type species, *Follicucullus ventricosus*, known from the Guadalupian of west Texas. Direct comparison of radiolarian faunas indicates a correlation of the Bone Spring Limestone (Leonardian) of west Texas with the upper Sakmarian and/or Artinian Stages of the Urals.

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Carbonate Petrology of Arun Limestone, Arun Field, Sumatra, Indonesia

The Arun gas and gas distillate field (estimated 13.7 tcf hydrocarbon gas in place) is a large Miocene coral-algal reef complex located on an intrabasin high in the North Sumatra basin. It was discovered in 1971 by Pertamina/Mobil Oil Indonesia following definition of a reflection seismic anomaly. The field is a large, asymmetric stratigraphic trap 18.5 km (11 mi) long and 5 km (3 mi) wide. The Arun Limestone which forms the reservoir is overlain, underlain, and possibly surrounded by shale. The limestone ranges in thickness from zero west of the field to about 1,200 ft (365 m) in well A-10. Closure on the Arun Limestone is at least 1,200 ft (365 m).

The reservoir rock is made up of several carbonate rock types, including coral-algal boundstones, foraminiferal packstones and wackestones, mixed-skeletal wackestones and packstones, and dolomite. Interstitial fill of the reef consists of lime and reef detritus (i.e., skeletal wackestones and packstones); grainstone fabrics are notably absent in the Arun reef and related facies.

Diagenesis has had a strong effect on the original sediments; (1) the lower part of the reservoir is completely dolomitized; (2) patches of limestone throughout the Arun are recrystalized to sparry calcite; and (3) much, if not most, of the reservoir is strongly micritized. The most pronounced effect of diagenesis has been the formation of secondary moldic and vuggy porosity formed by the dissolution of aragonite fossils (mainly branching corals, mollusks, and foraminifera). Had there been no diagenesis of the original limestone, it is doubtful that a hydrocarbon reservoir would be present on the Arun structure.

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Estuarine and Fluvial Systems, Lower Mesaverde Group (Campanian), Northwestern Colorado

Stacked shoreline sandstones near the base of the Mesaverde Group are well exposed along the southern flank of Rangely dome, northwestern Colorado. Overlying these marine deposits is a thick sequence of carbonaceous siltstones that encase elongate lenticular sandstones. This sequence records the evolution from estuarine to fluvial channels formed along the western margin of the Cretaceous Western Interior seaway. Sections 180 to 250 m (590 to 820 ft) long, were measured along a trend perpendicular to paleoshoreline. Several individual sandstones were studied in detail to develop depositional models. Data from over 300 well logs provided information regarding regional distribution and stratigraphic relationships of the systems. Two major stratigraphic successions were recognized.

Thin (0.5 to 2 m, 20 in. to 6.6 ft) bioturbated and root-mottled fine sandstones, interbedded with pervasive siltstones occur immediately over the marine shoreline deposits in both sequences. The sandstones are interpreted as storm washover deposits. At Gillam Draw in the eastern portion of the outcrop study area, the washover sandstones are overlain by 50 to 60 m (165 to 195 ft) of bioturbated shales and siltstones. Ripple-stratified, upward-fining, fine to very fine sandstone lenses occur in this interval. These lenses are 4 to 8 m (13 to 26 ft) thick, have erosional bases, and have well-developed lateral-accretion bounding surfaces. *Ophiomorpha* and other trace fossils suggest an estuarine influence. The sandstone lenses are point bar deposits formed along meandering tidal creeks. Siltstones, coals, and 8 to 12 m (26 to 39 ft) thick lenticular sandstones overlie the tidally influenced interval. The sandstone lenses change significantly in geometry, bounding surface relationships, and textural trends within this succession.

Stratigraphically lower sandstones form broad (100 to 200 m, 330 to 660 ft wide) belts. Individual sandstone bodies within the lenses have erosional bases and prominent lateral-accretion surfaces. Trough cross-bedding near the base is overlain by ripple stratification. These broad, lenticular sandstones represent fluvial meander-belt deposits.

Sandstone lenses become narrower and lack accretionary surfaces higher in the section. These younger sandstones are multistoried, rather than multilateral, channel deposits and are flanked by extensive crevasse splay facies. They are interpreted as confined anastomosing fluvial channels. West of Gillam Draw, the anastomosing fluvial system directly overlies shoreface and storm washover deposits. The multistoried lenticular sandstones are thicker (20 to 30 m, 66 to 100 ft).

Sedimentation kept pace with subsidence in the eastern, basinward sections. Lower reaches of streams were tidally influenced even though the area was not inundated by marine waters. The western succession represents aggraded fluvial systems formed inland from the coast. Both sequences are characteristic of areas of rapid subsidence.

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Origin of Chert in Permian System in Southwestern Utah and Northwestern Arizona

Within the Permian System in southwestern Utah and northwestern Arizona, the Brady Canyon Member of the Toroweap Formation and the Fossil Mountain and Harrisburg Members of the Kaibab Formation contain five different forms of chert. These chert forms provide information about the origin and emplacement of chert in the Permian System. The forms present are: rounded chert nodules, ribbon chert, silicified burrows, disseminated chert, and massive chert that grades into limestone. Sources of chert are attributed to upwelling of deep bottom waters, silica-derived from freshwater mixing with saline water in deltaic complexes, and precipitation of silica through biological processes. Examination of fossiliferous rounded chert nodules, silicified burrows, ribbon chert, disseminated chert, and stringers of chert, indicate that deposition was the result of secondary solution moving through areas with greater porosity. Disseminated chert, found in the Fossil Mountain Member, was deposited in the areas where the porosity was greatest. Massive chert in the Harrisburg Member formed at the water table where dissolution of the limestone occurred. This chert layer was then exposed to erosion. Chert emplacement occurred following the partial dolomitization of the limestone early in the diagenetic history. Some chert appears to have been deposited as secondary cement in the carbonate rock following cementation and dolomitization. Chert horizons in the upper part of the Kaibab Formation suggest that chert may have developed much later during an erosional cycle. This is supported by colloform structures and gradation from a massive chert down to limestone.

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Evaluation of a Structurally Disturbed Portion of Wilcox Lignite Trend