equatorial currents are diverted poleward. The reverse situation is true along west-facing coastlines where cooler waters are brought into low latitudes by polar currents. Here, buildups are usually restricted to near the ancient equator. Another control on the distribution of carbonate buildups might be related to a decrease in light penetration poleward due to an increase in the angle of incidence of light striking the oceans. Work done by others suggests that significant seasonal reduction in light penetration occurs between 30° and 40° from the equator.

Maps showing the global distribution of carbonate buildups have been constructed for several intervals in the Mesozoic and Tertiary. These reconstructions illustrate the effects of ocean circulation, and continental placement and orientation on the distribution of carbonate buildups.

DEAN, W. E., U.S. Geol. Survey, Denver, CO, E. J. BARRON, U.S. National Center Atmospheric Research, Boulder, CO, R. E. BOYCE, Scripps Inst. Oceanography, La Jolla, CA, et al

Cretaceous Black-Shale Deposition Within an Oxidized Red Clay, Turbidite Environment, Southern Angola Basin, South Atlantic Ocean

Beds of black shale, intercalated with red and green claystone of Albian to Coniacian age, were recovered at DSDP site 530 in the southern Angola Basin. The 260 beds of black shale have an average thickness of 4.3 cm (range of 1 to 62 cm) and an average organic-carbon content of 5.7% (range of 1.4 to 16%). The green claystone beds resulted from reduction of iron in red claystone beds around black shale beds. A green-black-green reduced sequence may occur alone within predominant oxidized red claystone, or several, closely spaced reduced sequences may merge to form interbedding of black and green lithologies. The predominant red claystone beds were deposited as distal turbidites. Many of the black shale beds contain graded silt laminae, very low amplitude ripple cross-lamination, and fine, indistinct, discontinuous laminae, suggesting that the material in the black shale beds also may have been transported by turbidity currents. All lithologies are commonly bioturbated. The sequence, including the black shales, at Site 530 suggests that deposition of the distal turbidites, low in organic matter, in an oxidized bottom-water environment was interrupted periodically by the deposition of organic-carbon-rich clay. We conclude that the cyclic interbeds of more- and less-reduced strata, with frequencies and durations measured in thousands or even hundreds of years, resulted from variable supply of organic matter, most of which is of marine origin, and not from bottom-water stagnation. We favor periodic regional increases in organic productivity that resulted in increases in production of organic matter, and an expanded and intensified mid-water oxygen minimum that impinged on the continental margin, as a cause of periodic increases in accumulation of organic matter. These conditions would produce variations in the amount of organic matter in both time and space, and result in interbedding of organic-carbon-rich, reduced sediments and organic-carbon-poor, oxidized sediments, a characteristic of all so-called anoxic sequences in the Atlantic Ocean.

DE LA GRANDVILLE, B., Petroleum Development Oman Ltd., Muscat, Oman

Marmul Field, South Oman: Appraisal and Development of Structural and Stratigraphic Trap Oil Field with Reservoirs in Glacial/Periglacial Clastics

The Marmul field lies in the Dhofar province of the Sultanate of Oman. The heavy oil accumulation was discovered in 1956 by Dhofar Cities Services who drilled five wells, but the field was not considered commercial and operations were abandoned. Petroleum Development Oman acquired the concession in 1969. Producible oils occur in Paleozoic clastics overlain unconformably by a Cretaceous sealing shale. Initial appraisal showed the complex nature of the reservoir distribution to be due to its glacial/periglacial environment of deposition, and a simple geologic model was conceived. Seismic impedance contrast at the seal's unconformity surface was then used as a predictive tool to differentiate glacial waste zones (tillites) from periglacial reservoirs and as support to the continuing appraisal and development drilling. The glacial/periglacial geologic model was progressively refined by further development drilling. The appraisal effort based on geologic and seismic impedance models was then deliberately pursued toward possible additional younger stacked reservoirs stratigraphically trapped at the periphery of the field. These reservoirs were proved by drilling to be separate from the main field and oil bearing. The unraveling of the field's complex trapping mechanisms, and the buildup of the geologic models needed for primary development and secondary recovery schemes, could only be achieved through an integrated and dedicated approach by geologists and geophysicists.

DENHAM, L. R., and R. E. SHERIFF, Seiscom Delta, Houston, TX

What is Horizontal Resolution?

Horizontal resolution is the smallest interval measurable in the horizontal direction by the seismic method. Because both migrated and unmigrated sections are used for interpretation, the resolution of both must be evaluated. On unmigrated sections, the horizontal resolution is generally limited by Fresnel zone size for dominant frequency of the reflection being mapped. Features smaller than this seen on the section are probably noise or processing artifacts.

The horizontal resolution of a migrated section is much better than that of an unmigrated section and, theoretically, is directly related to the vertical resolution and angle of migration. In practice, the horizontal resolution is limited by uncertainties in velocity, inadequate spatial sampling, and presence of coherent noise, as well as shortcomings of, and approximations used in, the stacking and migration algorithms.

DIBBLE, WALTER E., JR., and AMOS NUR, Stanford Univ., Stanford, CA

Effect of Non-Hydrostatic Stress on Chemical Processes During Diagenesis

Non-hydrostatic stress facilitates porosity reduction in sandstones at elevated temperatures. Experimental results indicate that chemical equilibrium between fluids and solids in fluid-saturated, porous rocks will not be attained under conditions of directed stress. In rocks in which pore fluid pressures are less than lithostatic ($P_f < P_L$), downward directed stress at grain contacts can produce an inhomogeneous distribution of mineral solubilities. High strain at grain contacts causes higher solubilities of the solids and leads to dissolution (pressure solution), whereas growth may occur at solid/water interfaces with low surface strain. The driving free energy for coupled dissolution and growth reactions under non-hydrostatic loading is proportional to $P_L - P_f$. Consequently, the magnitude of the