sea level through time to trends in sedimentation in the oceans. For example, sea level lowstands are expected to result in increased supply of both detrital and chemical (biogenic) sediment to the deep sea. Thus, shelf unconformities, resulting from exposure and erosion of shelf sediments, should correlate with relatively high rates of sedimentation and low incidence of hiatuses in the deep sea. Global sea level highstands would have the opposite effect. The co-occurrence of widespread shelf and deep-sea unconformities, as found in the Oligocene and lower Paleocene contradicts such simple models. These and other examples show that terrigenous and biogenic sediment flux to deep-sea basins is not totally dependent on relative sea level, and that there are commonly significant time lags in the response of deep-sea sedimentation to changes in sea level and shelf sedimentation. Rates of rise and fall of sea level, however, are a major determining factor. Additionally, global and regional climate and overall patterns of oceanic circulation, fertility, and chemistry are equally important in controlling sediment supply to the deep sea and in the development of sedimentary lacunae in deep marine basins.

ASQUITH, GEORGE B., Search Drilling Co., Amarillo, TX, and ROBERT D. SAWVELL, West Texas State Univ., Canyon, TX.

Evolution of Lower Permian Oolite Shoal in Northwest Anadarko Basin

The Lower Permian (Wolfcamp) Council Grove B-zone in the northwest part of the Anadarko basin in Ochiltree County, Texas, is represented by two carbonate rock types: (1) bioturbated oolitic bioclastic wackestones; and (2) cross-stratified oolite grainstones. These oolite and oolitic facies are underlain and overlain by bioturbated argillaceous bioclastic wackestones.

A Council Grove B-zone isopach map indicates that the oolite shoal has an east-west depositional strike. The presence of north-south-trending tidal bars and channels superimposed on the oolite shoal suggest that the tidal currents responsible for the formation of the oolite flowed north and south. A transverse cross section reveals that the base of the oolite facies is stratigraphically higher in a southward direction, indicating that the direction of maximum tidal flow and/or storm surge and direction of oolite progradation was to the south. Paleogeographic time slice maps from a lower datum reveal that the oolite shoal initially formed as two isolated shoals which were superimposed on prominent structural highs. These shoals later merged and prograded southward.

After deposition, the shoal was exposed to early, freshwater phreatic diagenesis, as indicated by oomoldic porosity and equant calcite cementation. Later diagenesis resulted in bladed anhydrite and coarse baroque dolomite partly filling oomoldic porosity.

Oomoldic porosity results in conventional log-derived water saturations (S_W) that are often overly optimistic. Therefore, to adequately evaluate oomoldic reservoirs using logs, the Production Ratio Index (PRI = S_W sonic $\times$ ϕneu-den) should be used to predict the ratio of hydrocarbon to water production.

AUBERT, JANE, ELF-Aquitaine Oil Co., Pau, France, and W. A. BERGGREN* and K. G. MILLER, Woods Hole Oceanog. Inst., Woods Hole, MA, et al

Flysch-Type Agglutinated Benthic Foraminifera and Maestrichtian to Paleogene History of Labrador and North Seas

Virtually identical agglutinated (arenaceous) benthonic foraminiferal assemblages (ca 30 genera, 45-50 taxa), characteristic of the Alpine-Carpathian flysch basins, occur in the Upper Cretaceous–Paleogene fine-grained clastic (?turbidite) sequences of the East Newfoundland basin, Labrador and North Seas. The assemblages terminate in both areas in the late Eocene or Oligocene although, in the central (deepest) part of the North Sea, elements of this flysch-type fauna have been observed extending into lower or middle Miocene levels.

Independent geologic evidence indicates that these assemblages have an extensive (paleo)bathymetric distribution (< 200 m to > 4 km). Depth alone is not considered a significant factor in their occurrence. In marginal basins, we favor a model which involves relatively rapid deposition of organic rich, fine-grained clastics under somewhat restricted bottom-water circulation conditions, leading to lower pH and low positive or negative eH at the sea floor. The disappearance of the agglutinated assemblage in all but the deepest part of the North Sea may have been due to the shallowing of the basin by sediment infilling resulting in shallower, more oxygenated conditions.

On the Canadian margin, decreases in clay and organic carbon content are associated with the exit of the agglutinated assemblages. In contrast, in the deep Labrador Sea (Site 112), lithology and percent organic carbon are relatively constant across this faunal change. This suggests that, at least in the deep sea, these properties may not be critical to the development of predominantly agglutinated assemblages. We suggest that the exit of agglutinated assemblages in the deep Labrador Sea was due to a change in hydrographic properties associated with the evolution of the psychrosphere. Sedimentologic evidence indicates initiation of northern sources of vigorous bottom water in the late Eocene-early Oligocene which may explain the exit of agglutinated foraminifera. This circulation change resulted in the influx of higher oxygen bottom waters and a lowering of the CCD which may have favored the replacement of predominantly agglutinated assemblages by calcareous assemblages.

BAARS, D. L., Consulting Geologist, Evergreen, CO, and G. M. STEVENSON, Fort Lewis College, Durango, CO

Subtle Stratigraphic Traps in Paleozoic Rocks of Paradox Basin

Significant quantities of petroleum occur in stratigraphic traps of Devonian, Mississippian, and Pennsylvanian age in the Paradox basin. Devonian reservoirs are isolated marine sandstone bodies; the Mississippian and Pennsylvanian traps are biohermal carbonates. Exploration in the past has proven the reservoirs to be elusive and relatively unpredictable, but the realization that the subtle traps are localized on paleostructures simplifies exploration and has led to several recent discoveries.

The tectonic framework of the Paradox basin, which includes a northwesterly series of major basement rifts and a subordinate series of northeast-trending fractures, was already set by late Precambrian. The basin was repeatedly rejuvenated throughout the Paleozoic. Vertical movements along the basement fractures were sufficient to alter sedimentary facies during Cambrian, Late Devonian, and Mississippian throughout the basin. These Paleozoic elements served to localize reservoir facies by creating shoaling conditions that produced Devonian offshore sandbars, Mississippian crinoid banks, and Middle Pennsylvanian algal bioherms.

Algal bioherms grew over subtle paleostructures along the southern and western margins of the Paradox basin in Middle

Pennsylvanian, providing reservoirs in numerous oil fields such as Aneth and Cache-Ismay. Although these are generally considered to be randomly distributed stratigraphic traps, there is ample evidence that sedimentary growth of the bioherms was localized on very gentle, basement-controlled paleostructures. Although the reservoirs are generally too thin for recognition on present-day seismic sections, seismic mapping of paleostructure, not Laramide structure, is the key to further exploration of the lucrative basin.

BACHMAN, STEVEN B., Cornell Univ., Ithaca, NY

Mesozoic and Early Cenozoic Arc-Trench System of California—Do the Pieces Still Fit?

The Mesozoic and early Cenozoic arc-trench system of California has been interpreted to include the Franciscan Complex as a subduction complex, the Great Valley sequence as a fore-arc basin, and the Sierra Nevada batholith and volcanic rocks in the western states as the magmatic arc. The similar ages of these elements and the stacking sequence in the Franciscan Complex (youngest to the west) are consistent with this interpretation. However, some recent studies in paleomagnetics, radiometric dating, and sandstone petrology, particularly in the Franciscan Complex, suggest that a simple model of subduction and accretion does not explain many relations.

With the growing evidence for lateral translations of microplate along the Pacific margin during the Mesozoic and Cenozoic, some authors have attempted to explain Franciscan complexities by these large-scale lateral translations. Limestone and volcanic blocks in the Franciscan melange have been shown to be allochthonous, but there is yet no definitive evidence for large-scale translations of the melange as a whole. Several problems remain unsolved, including the relation between blueschist terranes, the large time delay between deposition of some sediments and their subsequent metamorphism to blueschist facies, the relation of sandstone provenance between the fore-arc basin and subjection complex, the distribution of sedimentary facies across the entire trench slope/fore-arc region, and the differing styles of deformation in the various Franciscan belts. Recent studies of modern and ancient arc-trench systems help explain some of these problems, but others remain enigmatic.

BAKER, DONALD R., JOHN L. CUDDIHEE, and DANIEL B. PEARSON, Rice Univ., Houston, TX

Thermal Effects on Sedimentary Organic Matter and Recognition and Mapping of Subjacent Igneous Plutons, Ruby Range, Colorado

The Ruby Range igenous complex, west-central Colorado, is characterized by mid-Tertiary granodiorite plutons which intrude Paleozoic, Mesozoic, and Tertiary strata. Conventional contact metamorphism is limited to a mile-wide zone adjacent to the Ruby Range axis. Geochemical and related studies, including hydrocarbon levels and types, kerogen composition, visual kerogen, and vitrinite observations, on the organic matter in intruded sediments demonstrate that low-grade thermal metamorphic effects extend about 6 mi (9.6 km) from the Ruby Range intrusive axis. This is an unusually wide thermal aureole and indicates important heat sources in addition to the intrusions along the Ruby Range axis. Peripheral sills and laccoliths caused little thermal effect on the sediments. It is concluded that the thermal aureole adjacent to the Ruby Range is enlarged because of subjacent intrusions. Specifically, it is postulated that the White Rock pluton projects into the subsurface beneath the sedimentary cover. Recognition of organic matter metamorphism in the overlying sediments permits tracing the approximate margin of the pluton from its outcrop area in the northeast for a distance of about 10 mi (16 km) to the southwest along its subjacent trend. Relations between the trend of metamorphic isotherms and topography indicate that the pluton has a steep (stocklike) southeast margin. Significantly, the recently discovered molybdenum deposit beneath Mt. Emmons, near Crested Butte, Colorado, is located approximately along the projected trend of the subjacent extension of the White Rock pluton. Recognition of very low grades of thermal metamorphism of organic matter may also have application to the location and evaluation of geothermal reservoirs.

BAKER, ED., and ROBERT W. ADAMS, Energy Fuels Nuclear, Inc., Denver, CO

Corporate Strategies Among Domestic Uranium Explorationists

Exploration by the uranium industry has responded to adverse market conditions in a uniform and predictable manner. Exploration personnel were reduced drastically, and even eliminated entirely in some places. Grass roots exploration has all but come to a halt, with selected properties being designated for drilling in the near future. Only those properties with relatively high grade, high tonnage potential will be designated for exploration. The grade cutoff may be as high as 0.50%, depending on distance from the processing mill and other economic factors. The goal of exploration, as well as the production phase of the industry, is to weather the economic storm and survive. Exploration efforts must be concentrated close to a mill, with most activities being conducted by a small number of people. The geologic targets, if previously unexplored, must bear close resemblance to ore bodies that have proved productive in the past. Diversification into other mineral ventures, such as base and precious metals, may also be required for survival.

Foreign countries with exploration interests in the United States are subject to the same pressures as domestic companies, but are able to weather the storm more effectively than domestic companies due to government backing or ownership of many foreign exploration companies.

BAKER, P. A., M. KASTNER, and G. E. ANDERSON, Scripps Inst. Oceanography, La Jolla, CA

Mechanism and Kinetics of Sulfate Inhibition on Dolomitization of Calcium Carbonate

Calcite and aragonite transformation to dolomite has been accomplished in a few days in hydrothermal experiments using artificial seawater without sulfate and in $MgCl_2$ + $CaCl_2$ + NaCl solutions of seawater ionic strength, at 200° and 150°C. Calcium carbonate transformation to dolomite is retarded and frequently inhibited, depending on the concentration of SO_4^{2-} in solution. The mechanism of this reaction is being investigated. Preliminary results indicate that it is a surface-controlled mechanism.

These results explain: (1) the formation of either primary or replacement dolomite in organic-rich sediments, especially in sedimentary environments or rapid sedimentation, in which microbial sulfate reduction prevails, and diffusive communication of the interstitial water with seawater is precluded; (2) the observed large variations—from negative to strongly positive