larger basins. These may show evidence of extension with the development of organic-rich lakes or marine embayments in the downthrown area. Here source rocks are shales with above average organic carbon content. They have generated high pour-point waxy crude oils with low sulfur content and API gravities around 35°. Again, these characteristics suggest an important role for land-derived organic materials and this is supported by geochemical data for biomarker distributions, pristane/phytane ratios, etc. The simpler structural setting in back arc basins favors the development of larger fields, and several giants occur in this setting, for example, Minas in Sumatra.

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Seabed Morphology of George V Continental Shelf, Antarctica

Seabed processes at high latitudes are known to involve ice and ice-related processes. Antarctic sedimentologic studies have outlined the glacial domination of major modern sedimentary processes and topographic features of the Antarctic shelf. The troughs, basins, and shoals of the shelf exhibit glacial and slump deposits, turbidites, and preglacial outcrops. The bed forms associated with the glacial and ice-related processes, as well as with the slumping and current-related processes, have not yet been defined. This study investigates the smaller scale bed forms and their relation to seabed processes.

The outcome of a cruise during January 1984 to the George V continental shelf is expected to show the major influence of icebergs in determining the modern morphology of the shoals and bank tops. The bed forms related to grounding of such iceblocks will help define the nature of ice/sea-floor interactions. We postulate that significant oceanic energy is expended on the sea floor through grounding of ice on the banks during the winter when wave and current activity under the ice is minimized. The depth of these shoals may be controlled in part by the maximum dominant keel depths of the ice shelf and of glacially calved iceblocks. On the basin slopes and floors, glacial, mass-failure, and current-related morphologies are expected to dominate.

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Trapper Canyon Tar Sand Deposit Revisited

In 1981, the Trapper Canyon tar sand deposit, Big Horn basin, Wyoming, was selected for investigation by the Bureau of Land Management (BLM) because the deposit was threatened by immediate trespass. The purpose of the investigation was to resolve conflicts between mining and leasing interests and to pave the way for commercialization of the deposit. The Combined Hydrocarbon Leasing Act of 1981 was of little use in the immediate development of the deposit; it did not "grandfather in" existing oil and gas leases. Conditions governing development of the deposit were a 1965 Interior Department Solicitor's opinion based on the 1960 amendments to the Mineral Leasing Act of 1920, as reinterpreted by the BLM. The lessee must demonstrate that hydrocarbons can flow "naturally" by primary or secondary methods; tertiary recovery methods, are specifically excluded.

This administrative position has resulted in several expensive recovery projects for a relatively uncomplicated deposit.

There is no question that hydrocarbons underlie the area and that the most economical method of developing them would be to mine rather than pump the reservoir. There are serious questions as to whether the hydrocarbons of this deposit (2-5° API, 30,000 cp) can be induced to flow naturally. A water-injection, reverse circulation test was conducted on the Tensleep Sandstone reservoir of Pennsylvanian age in June 1983. Hydrocarbons were recovered at injection water temperature of 160-165° F (71-74°C) but not at the lower temperatures (reservoir temperature of 50-60°F, 10-16°C) requisite under the governing interpretation. The lessee has been authorized by the BLM to conduct an additional recovery project, injecting propane at reservoir temperature. On April 1, 1984, the lease expires automatically returning the Trapper Canyon deposit to the simultaneous oil and gas system or the competitive lease system.

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Macroborings and Epizoans on Late Cretaceous Rudists from West Coast Active-Margin Environments

Rudists are a major component of Cretaceous carbonate strata. Studies of rudists from these strata have demonstrated that epizoans are sparse but macroborings are relatively common. Previous studies have not been made of macroborings and epizoans on rudists from nearshore, clastic, active-margin environments.

Beds of the Rosario Formation lower sandstone containing the late Campanian rudist *Coralliochama orcutti* crop out along the northern coast of Punta Banda on the Pacific coast of Baja California, Mexico. Serial sections of rudist skeletons from this area show that borings include *Entobia* and varying forms of *Trypanites,* while epizoans include serpulid worms, the bivalve *Acila* and juvenile *Coralliochama.* Macroborings occur on 30% of examined specimens, primarily on the upper portion of the attached valve and on the free valve, while epizoans are found on 10% of examined specimens, typically from the middle third to the commissure of the attached valve and on the free valve. Only a small portion of the skeleton may be covered by epizoans, and some boring and encrusting appears to have occurred during life. Inhibition by rudists of epizonas, a concept proposed by Kauffman and Sohl, probably was not as effective in *Coralliochama* as in rudists from Antillean reefs. In addition, *Coralliochama* appears to be more heavily bored than Antillean reef rudists.

These results aid in understanding the broad environmental range of Late Cretaceous rudists and the adaptive response to this range. Rudists of clastic environments may have been more susceptible to boring and encrustation than those from reef associations.

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Dolomitization Stages in a Regressive Sequence of Hunton Group, Anadarko Basin, Oklahoma

The Upper Silurian Henryhouse Formation, of the Hunton Group (Upper Ordovician–Lower Devonian), is a major hydrocarbon reservoir in the Anadarko basin. Detailed examination of Henryhouse cores were conducted at many localities in the basin, west of T10 W. Sedimentary structures, lithology, fossil content, and fabric relationships were used as criteria to recognize various depositional facies. Subtidal, intertidal, and supratidal facies can be distinguished readily, and their spatial relationships consistently indicate a shallowing-upward sequence. Previously unreported nodular anhydrite (replaced and unreplaced) occurs at the top of the sequence, suggesting that hypersaline conditions developed in supratidal environments.

Three stages of dolomitization were documented in the Henryhouse Formation. Petrographic, cathodoluminescent, and isotopic techniques were used to investigate the genesis and textural relationships of various dolomite types. The following paragenetic sequence was discerned: (1) penecontemporaneous hypersaline dolomite occurring as brownish, hypidiotopic, 60-80 μm rhombs concentrated in the supratidal and intertidal facies; (2) marine water–fresh water mixing dolomite occurring as white rims around preexisting hypersaline dolomite and as anhedral, white rhombs in vugs and molds; (3) deep burial vug, mold, and fracture-filling baroque dolomite.

Cathodoluminescence reveals that typical Henryhouse dolomite exhibits dully luminescing cores with outer bright rims corresponding to the dark core and light rim seen in plane light. This zonation represents two stages of dolomitization.

Oxygen isotope ratios range from -2.2 to -9.9 (mean -4.6) ‰ vs. PDB, whereas the carbon isotope ratios range from 0 to +3.3 (mean + 1.4) ‰ vs. PDB. The considerably light $\delta^{18}O$ reflects a fresh water influence. Values of $\delta^{13}C$ may represent initial composition because of their resistance to alteration.