of the large river environment. As the basin subsided further, the major drainage facies encroached onto the flanks of the La Barge platform, resulting in buildups of thick channel, bar, and point-bar sands into the lower energy muds and silts. It is at this transition between the high- and low-energy environments the Paleocene is most commonly productive.

In early Eocene time the disturbed belt gave a last shudder, reflected by the La Barge thrust and other faults that break Paleocene strata. Of particular interest are two east-dipping thrusts, and the tendency for the young thrusts to terminate as tear faults which assist in controlling accumulation. Tectonic activity since early Eocene time has been confined primarily to regional elevation and slight basinward tilting.

The Frontier sandstones are the major gas reservoirs on the platform, and demonstrate a marked thinning from west to east. The second Frontier appears to reflect paralic depositional environments and strikingly variable reservoir conditions. Following deposition of the second Frontier, transgression resulted in the deposition of a few thousand feet of marine shale, except over the western part of the La Barge area, where a major drainage from the west built a delta into the shallow Coloradan sea. This unit is locally called the first Frontier.

Regression from west to east in Montanan time deposited the fluival and paludal sediments of the Mesaverde Formation. Littoral transitional sands at the base of the Mesaverde commonly are productive both on subcrop and across structure.

Isopach maps of Cretaceous units suggest the existence of the Moxa arch, a structural feature that now plunges southward from the La Barge platform. It was a northward-plunging positive feature during Cretaceous deposition. In latest Cretaceous and early Paleocene times, the Big Piney-La Barge area was uplifted and folded into a large anticlinal feature, with erosion stripping away newly deposited Mesaverde.

MCHURON, ERIC J., KENNETH J. MCMILLEN, and JOHN E. WARME, Dept. Geology, Rice Univ., Houston, Tex.

GEOMETRY AND MORPHOLOGY OF CRUSTACEAN BURROWS IN TORREY PINES AND BODEGA ESTUARIES, CALIFORNIA

Resin casts were used to document the geometry and morphology of crustacean burrows from two California estuaries. Burrows studies include those of two ghost shrimps (*Callianassa californiensis* and *C. longimana*), a fiddler crab (*Uca crenulata*), and two grapsoid crabs (*Pachygrapsus crassipes* and *Hemigrapsus oregonensis*). Further documentation is under way with the use of direct observations and radiographs of ghost shrimp burrowing through layered sediment in aquaria.

The *Callianassa* burrows are in muddy to clean sand found in the lower parts of tidal creeks and on sand flats. Their burrows have a main shaft up to 1 m long with constant diameter (up to 2 cm) except for narrowing produced by excurrent activity either at the surface or between burrow systems, and except for enlarged turn-around nodes commonly present at branches or direction changes. Up to 5 openings were observed per system; they are connected by twos and threes in horizontal to inclined Y's with the junction of the Y up to 15 cm below the surface. The geometry of the main shaft is dependent on species, intertidal position, sediment size, and layering. The burrows have a smooth internal and external morphology.

The grapsoid burrows are on and above the banks of tidal creeks in slightly silty clay to slightly muddy sand. They vary from complex shapes, with several layers and entrances in a box-type framework, to a simple U-shape depending on topography, tidal level, and the number of organisms and species per system. Commonly two *H. oregonensis*, one *P. crassipes*, and one or more *U. crenulata* are found using parts of the same burrow system. The numerous entrances allow only lateral passage but internal enlargements permit turning around and passage of individuals. In cross section the burrows are lenticular, and the morphology of the walls *is very knobby*. Burrow entrances of *Uca crenulata* are at, or near, higher high water and extend either into a grapsoid system or a simple J-shape (up to 20 cm), both of which may have a Y-shaped entrance. The entrance and extremity chamber are about twice the diameter of the knobby, cylindrical shaft which normally has a diameter less than 1 cm.

MCKELVEY, V. E.

USGS VIEWPOINT

No abstract available.

MECHALAS, BYRON J., Dept. Geol. Sci., Univ. Southern California, Los Angeles, Calif.

INTERACTIONS BETWEEN MICROBIAL POPULATIONS AND ORGANIC-MATTER DISCHARGES

Organic matter in the form of waste discharges entering an aquatic environment stimulates the growth of the resident microorganisms. The size of the resultant microbial population depends on the quantity of organic matter and the ease with which the organisms can metabolize this to obtain energy and nutrients. The oxygen supply that is essential for energy conversion is the dissolved oxygen of the water. As long as oxygen is available bacteria can oxidize the organics to simpler compounds such as CO_2, H_2O, NO_3^-, PO_4^- and mitigate adverse environmental effects.

In the natural environment microbial populations are made up of heterogeneous groups of species. Each group has a different set of nutritional requirements, and the ability to utilize specific compounds shows a great deal of variation. Complex mixtures of wastes require a heterogeneous mixture of microbial types to bring about complete degradation.

Crude petroleum is an example of a complex organic mixture. No single microbial species can bring about its complete degradation. However, a mixed population provided with the proper environmental conditions can bring about dramatic changes in oil composition. These changes follow a predictable sequence proceeding from the light-molecular-weight compounds to the heavier end of the molecular-weight spectrum and are related to natural weathering processes that occur in the marine environment.

MERRILL, GLEN K., 138 Westwood Dr., Cumberland, Md.

UPPERMOST CARBONIFEROUS STRATIGRAPHY AND DEPOSITIONAL HISTORY NEAR HUNTINGTON, WEST VIRGINIA

Excellent exposures of Conemaugh strata are present in road cuts along both sides of the Ohio and Big Sandy rivers near their confluence. Dense locality spacing permits a detailed 3-dimensional reconstruction of these repetitive, vertically and laterally diverse rocks. Most of the succession was deposited by an actively prograding delta and consists of upper-delta-plain channel, natural levee, lacustrine, and oxidized flood-plain deposits. Lesser amounts of lower delta-plain sediments include laminated, interdistributary bay and backswamp deposits, and a few thin coal seams and seat rocks.

Intercalated into the lower delta-plain sediments is one prominent, laterally extensive marine unit correlated with the Ames Member of southeastern Ohio. In this area, the Ames is tripartite and as much as 40 ft thick. The lowest part is a bluish-green, calcareous, highly fossiliferous shale, with a megafauna dominated by *Neochonetes*. It becomes coarser grained and less fossiliferous upward and is succeeded by a brackish-marine, fissile, maroon shale with pectens and ostracods. The maroon shale similarly grades upward into a massive, calcareous, crinoidal sandstone, formed as a regressive barrier, that ranges in thickness from 0 to 22 ft within a few miles. The entire marine succession was formed under extremely near-