EATON, GORDON P., U.S. Geol. Survey, Reston, VA

Deep Drilling and Current Models of Cenozoic Crustal Deformation in Western United States

Seismic reflection, heat-flow, earthquake, gravity, and magnetic data have been interpreted in recent years to suggest that the crust of the actively deforming Basin and Range province may consist of two layers that have contrasting physical properties and mechanical behavior. The boundary between them, a subhorizontal zone of decoupling to weak coupling, is pictured as a thin zone of decollement. Above this zone the crust fails in extension through the formation of listric faults tangential to it. Below it, the crust dilates horizontally through the injection of dikes of basalt from the mantle. The boundary is pictured as inherited from master thrusts that formed during Mesozoic and Paleogene compressional regimes. The upper crustal layer is essentially brittle; the lower layer is relatively ductile.

This model, if correct, has implications for a wide variety of matters of practical interest. Prominent among them are: the design of strategies for oil and gas, geothermal energy, and mineral resources exploration; the underground storage of hazardous wastes; and the occurrence and surface effects of regional earthquakes.

The model is amenable to testing by drilling to depths of 16,000 to 40,000 ft (5 to 12 km). Outcrops of subhorizontally foliated metamorphic rocks as young as Miocene have been interpreted as locally uplifted with exposed parts of the zone and may provide information on its lithologic characteristics; however, deep drilling (and attendant in-situ testing of rock and fluid properties, measurements of stress and their variation with depth, and surface-to-borehole geophysical communication) offers the only viable means for determining the state of the crust and for testing the postulated dynamic processes associated with it.

EDWARDS, BRIAN D., U.S. Geol. Survey, Menlo Park, CA

Lebensspuren of Dysaerobic, Bathyal Basin, California Borderland

The low oxygen waters and bathyal depths of Santa Cruz basin provide harsh conditions for marine life, yet the basin supports a surprisingly high density and diversity of macrofauna. In contrast, biogenic sedimentary structures are low in density. Bottom photographs from 117 stations show a biogenically produced micro-hummocky topography with few resolvable biogenic traces. Recognizable lebensspuren are of three main classes: tracks and trails, depressions, and fecal matter. Echinoderms, the most abundant epifauna on the slope and adjacent basin floor, produce most of the large tracks and trails. Significantly, many tracks and trails are less distinct than similar markings of the abyss owing to the soupy, thixotropic nature of the basinal sediment. Depressions made by asteroids, regular urchins, and bottom-dwelling fish are most common at relatively shallow depths. A characteristic, circular depression made by a feeding, tubicolous polychaete is restricted to the lowermost slope and adjacent basin floor. Holothurian fecal strands dominate the photographically resolvable feces of this bathyal environment. These holothurian feces take the "clothes-line" form common to the abyss.

X-ray radiography and photography of box-core sediment slabs reveal an indistinct burrow mottling resulting from the thixotropic response of the sediment to biogenic disturbance and lack of density contrast for radiography. Although open burrows are common in bottom photographs, few are recognizable in box-core slabs. Similarly, surface lebensspuren have poor preservation potential. When lithified, this bathyal sediment will probably be bioturbate-textured.

EDWARDS, MARC B., Bur. Econ. Geology, University of Texas at Austin, Austin, TX

Growth Faulting and Sedimentation in Upper Wilcox Delta System, South Texas

Well logs from the deep Wilcox trend of south Texas delineate the upper Wilcox Rosita delta system which comprises three locally developed delta complexes comparable in scale to deltas in the lower Wilcox Rockdale delta system of middle and upper Texas Gulf Coast.

Each delta comprises several lobes, some of which can be traced across the deep zone where they thicken as much as tenfold, owing to progradation over a series of active growth faults. Characteristic upward-coarsening progradational units are interpreted to include prodelta, delta-front, distributary-channel, and interdistributary facies. There is an overall change from delta-plain to prodelta facies basinward across the growth-fault zone.

Growth faults are large-scale slumps formed by basinward gravity gliding of huge masses of deltaic sediments. Faulting was initiated and maintained as sand and mud of the delta front prograded over previously deposited prodelta mud. The growth faults influenced the thickness of sediment which accumulated on each side of the fault by controlling the relative rates of subsidence (growth ratio). Constant growth ratios for a series of consecutive progradational sequences indicate that rates of subsidence were insensitive to local fluctuations in sedimentation. Log patterns suggest that sedimentary processes were continuous across fault traces; no important surface expression of faults is evident.

EFFIMOFF, I., and A. R. PINEZICH, Shell Oil Co., Houston, TX

Tertiary Structural Development of Selected Valleys Based on Seismic Data—Basin and Range Province, Northeast Nevada

Reflection seismic data in Railroad, Diamond, Mary's River, and Goshute Valleys provide information on their structural development that cannot be deduced solely from outcrop and well data.

These valleys contain Tertiary sediments which, in dip section, define an asymmetrical basin bound along the eastern flank by a major listric normal fault with about 10,000 to 15,000 ft (3,048 to 4,572 m) of displacement. The west flank is defined by a gentle east-dipping ramp. Seismically the trace of the listric fault is interpreted to dip westward and sole into the Paleozoic section exploiting regionally recognized Mesozoic decolle-