Heat-Flow and Heat-Production Studies in North Dakota

Thirty-one new heat-flow determinations made in both oil and water wells in North Dakota range from 0.6 to 1.9 HFU.

Heat-production data from basement rocks used with nearby heat-flow values indicate that only two of six sites may be considered to be similar to Basin and Range values for heat flow. One site occurs in southwestern North Dakota in a region west of 103°W where no heat-flow value is less than 1.5 HFU. The other site in north-central North Dakota is problematic, but an eastern United States interpretation is favored. The remaining four sites are interpreted as eastern U.S. values.

A transition in heat-flow character from eastern United States values to Basin and Range values occurs west of 103°W long. in southwestern North Dakota. The narrow width (28 km) of the transition zone between heat-flow provinces implies a shallow depth to partly molten lower crust or upper mantle.

The heat-flow results coincide with a zone of anomalous electrical conductivity. When used with experimental petrologic data for peridotite in the presence of excess water, temperature calculations suggest that a partial melt zone begins approximately at 45 to 55 km, which coincides with crustal thicknesses from seismic refraction data for southwestern North Dakota.

For southwestern North Dakota, uplift of the badlands appears to be a result of partial melting.

If the high heat-flow region extends northward into northwestern North Dakota, the generation of petroleum was controlled by the zone of high heat flow. This interpretation implies that source rocks are depleted in their mobile petroleum components within the region of high heat flow.

SCHAFERSMAN, S. D., Reservoirs, Inc., Houston, TX

Biostratigraphic Problems Generated by Deep Sea Coring—Biosystematic Analysis, Evolutionary Species, and Non-Validity of Lineage Zones

Recent availability of stratigraphically continuous and hiatus-free sequences of pelagic sediment in deep sea cores have encouraged biostratigraphers to interpret lineages of oceanic microfossils from a viewpoint of gradual phyletic evolution. A few taxa do show anagenetic evolution, but the excellent stratigraphic record obtained from deep sea coring reveals that the overwhelming majority of species show only cladogenetic evolution with no gradual speciation. Biostratigraphers nevertheless persist in recognizing ancestral-descendant relations whenever possible, and arbitrary limits must therefore be applied when an evolving lineage is divided. This typological practice may be good biostratigraphy, but it is poor biosystematics.

Phyletic biohorizons and lineage zones are explicitly defined and recognized by evolutionary criteria. For interpretation, these horizons and zones must rely on notions of phyletic gradualism and ancestor-descendant relations. These notions must rely on an evolutionary theory to allow their inference. However, biostratigraphy should not rely on evolutionary theory since biostratigraphy is the means by which we correlate strata to test evolutionary hypotheses about patterns of fossil phylogeny.

For good biostratigraphic practice, evolutionary species should be recognized as single lineages without arbitrary and typological subdivision. Biosystematic analysis should begin with a cladogenetic analysis which infers taxon relations from characters exhibiting shared derived similarities. Classification should immediately follow to preserve the monophyletic relations of the clades. This system results in universal and timeless taxonomic hypotheses which are potentially falsifiable and thus scientifically testable. A biozonation based on such taxa is independent of evolutionary theory. Untestable assumptions and ad hoc hypotheses of ancestral-descendant relations and gradual speciation, such as must be used to recognize phyletic biohorizons and lineage zones, are unnecessary.

SCHLEE, JOHN S., and C. WYLIE POAG, U.S. Geol. Survey, Woods Hole, MA

Seismic Stratigraphy of Atlantic Margin in Vicinity of Chevron COST B-3 Well

Correlation of key seismic reflectors with the lithologic, biostratigraphic, and paleobathymetric logs of the Chevron COST B-3 well shows that this part of the Atlantic continental slope changed from a platform-fringed shelf in the Middle to Late Jurassic and Early Cretaceous to a deep-water slope in the Late Cretaceous and early Tertiary. Closely matching paleobathymetric and eustatic sea-level cycles indicate that sea-level fluctuations strongly regulated deposition by cyclically shifting the loci of deposition among the shelf, slope, and rise. At the same time, the alternate loading and unloading of the shelf may have accentuated the relative change in sea-level by producing corresponding cycles of isostatic subsidence and rebound.

Some major seismic reflectors beneath the shelf appear to coincide with erosional disconformities formed during early Oligocene, early Paleogene, early Turonian, and early Barremian. Reflectors of Late Cretaceous through early Tertiary age are continuous from the present shelf to beneath the present rise; their continuity, seismic character, and structural geometry support the idea that the margin was broadly constructional during this interval and that the shelf break was poorly defined. Beneath the rise, reflectors are mainly conformable; their character suggests onlapping fill and slope-front fill facies. Broad downslope channels were cut during the middle Tertiary and late Quaternary presumably in response to major drops in sea level.

SCLATER, JOHN G., Massachusetts Inst. Technology, Cambridge, MA, and PHILLIP A. F. CHRISTIE, Cambridge Univ., Cambridge, England

Continental Stretching—Explanation of Post-Mid-Cretaceous Subsidence of Central North Sea Basin

The North Sea is a major continental basin filled with sediments ranging in age from early Paleozoic to recent. It has been active several times in the past. Since the last