BURCKLE, L. H., and HAYS, J. D., Lamont Geological Observatory, Palisades, New York

Tertiary Sediments on Falkland Platform and Argentine Continental Slope

A preliminary zonation based on Radiolaria and diatoms from well cores has been constructed for Tertiary deep-sea sediments in high southern latitudes of the Western Hemisphere. Of 75 cores raised from the Falkland platform and southern Argentine continental slope at latitude 35°S., 31 penetrate Tertiary sediments. Early Tertiary sediments contained in eight cores raised from depths between 500–1,000 fathoms consist of diatom ooze and clayey silt. Middle and late Tertiary sediments are encountered at a variety of depths ranging from less than 1,000 fathoms to greater than 1,500 fathoms and show no correlation with isobaths. These sediments are primarily red clay and commonly contain manganese nodules. However, four cores of this age on the easternmost part of the Falkland platform are either silicoflagellate ooze, coccolith ooze, or diatom ooze. The lithologic characteristics of Tertiary sediments are in striking contrast to those of Pleistocene sediments, which consist of Foraminifera-rich sand and lutite.

Diatoms representing sub-tropical and temperate-water forms predominate in early Tertiary sediments, whereas middle and upper Tertiary sediments contain mostly temperate-water species. Pleistocene sediments are characterized by sub-Antarctic diatoms which appear to indicate a cooling of this part of the world since early Tertiary time.

The occurrence of Tertiary sediments within a few tens of centimeters of the sediment-water interface on the Falkland platform is similar to that found on the Blake plateau. The Falkland platform, like the Blake plateau, underlies a fast surface current, and erosion by bottom scour may explain distribution of the Tertiary outcrops.

BURST, JOHN F., General Refractories Company, Philadelphia, Pennsylvania

Diagenesis of Gulf Coast Clayey Sediments and Its Possible Relation to Petroleum Migration

An attempt has been made to establish reference intervals in the subsurface based on apparent systematic interlayer water loss of swelling clay minerals. The intervals are used in much the same way as the familiar indicators for metamorphism but occur at sufficiently shallow depths to be evident within oil-bearing strata of the Gulf Coast. The resulting conclusion is that clay-mineral diagenesis indicators may prove to be important petroleum-evaluation markers as well as fundamental properties of sedimentary basins.

In this study, sedimentary deposits are viewed as combinations of gases, liquids and semi-solids distributed through a solid matrix. During geologic development, the interstitial components segregate by migration and produce various commercially exploitable concentrations. Water, the principal fluid component of the sedimentary section, is thought to migrate in three separate stages. Initially, pore water and excessive (more than two) clay-water interlayers are removed by the action of overburden pressure. This initial water flow (which is essentially completed after the first few thousand feet of burial) reduces the water content of the sediment to about 30 per cent, most of which is in the semi-solid interlayer form. A second stage of dehydration is thought to occur when the heat absorbed by the buried sediment becomes sufficiently great to mobilize the next-to-last water interlayer in an $M(H_2O)_x + \Delta H_r = l + xH_2O$ fashion. The final stage of sediment dehydration which extracts the last remaining water monolayer from clay lattices is apparently slow, even by geologic standards, requiring tens or possibly hundreds of millions of years, depending upon the geothermal and burial history of the sample.

Petroleum hydrocarbons which are distributed throughout the matrices of potential source beds in normal frequencies of 300–3,000 ppm. are thought to be too sparse to initiate continuous fluid flow. In normal marine sediments, however, the water associated with clay minerals is present to a considerable depth in the order of 200,000 ppm., and it is therefore reasoned that this phase forms the connection between petroleum source and reservoir beds.

The first and last dehydration stages probably are unimportant in Gulf Coast oil migration inasmuch as they occur at levels which are too shallow or too deep, respectively, to intersect the interval of maximum liquid petroleum availability. However, the amount of water in movement during the second stage, which does intersect this interval, is 10–15 per cent of the compacted bulk volume, and represents a significant fluid displacement capable of redistributing any mobile subsurface component. A measure of the degree to which this second-stage interlayer water has been discharged into the system can be noted on X-ray diffractograms. It appears to occur in a relatively restricted, depth-dependent temperature zone in which the average dehydration temperature of the points measured is 221°F. With the use of an empirically derived P/T curve and a geothermal gradient map, a set of regional subsurface dehydration contours can be constructed. A plot of 5,368 liquid petroleum production depths referenced to this dehydration "surface" shows an almost perfect Gaussian distribution. It seems significant that, although the dehydration depths range from 4,000 to 16,000 feet, hydrocarbon production depths are distributed in a statistically consistent relationship to the calculated clay-dehydration contour surface.

CHAVE, KEITH E., Lehigh University, Bethlehem, Pennsylvania

Early Diagenesis of Carbonate Particles in Clastic Sediments

Complex carbonate mineral assemblages in modern sediments can undergo selective solution as a diagenetic approach to mineral stability. Oversaturation and undersaturation of associated sea water with respect to various mineral phases can be demonstrated by the use of pH-sensing techniques. Evidence for selective solution is found in decreases in the amount of more soluble phases, aragonite and, to some extent, magnesium calcites, in the finer fractions of the sediments.

Studies in Jamaica, Florida, Bermuda, and Maine suggest that submarine solution-diagenesis is active in most environments. Factors which control the amount of solution are temperature, salinity, and the amount and nature of associated organic material. Solution of soluble "fines" is most active in Maine and least active in impure carbonates of the north coast of Jamaica.