cate petroleum production in the vicinity of volcanic centers.

Considering a history of active volcanism, the Mississippian and Rio Grande embayments may be reconsidered as small aulacogens.

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Chemical Differentiation of Temperate and Tropical Limestone-Derived Soils

Chemical analyses of soils formed by the weathering of limestone bedrock in the U.S. Gulf Coast, Missouri, Tennessee, Mexico, and Guatemala were used to determine whether any significant differences were present that would allow identification of soils of rocks weathered under tropical as contrasted with temperate climatic conditions. Over 100 samples were analyzed for their major oxides (SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, K_2O, Na_2O, and TiO_2) and, for selected samples, certain trace elements were determined as well (Ba, Zn, Sc, La, Ce, Eu, Lu, Rb, Hf, Cr, and Co). X-ray diffraction analyses were also carried out on representative samples for each climatic zone.

Cluster analysis was then applied to the chemical and mineralogic data to determine the number of distinct limestone soils that could be identified and to compare soils from the two major climatic regions. Discriminant analysis was then used to test whether the tropical soils were, truly, different from their temperate-zone counterparts.

Variation in trace-element chemistry was not found to be particularly useful in differentiating samples from the two climatic zones but was useful in establishing depositional patterns within a given region. Variations in the major oxide chemistry were useful, however, as climatic-zone indicators and were also found to reflect tectonic conditions in the adjacent land areas at the time the carbonates were being deposited offshore and diagenetic changes that have occurred since deposition.

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Facies, Diagenesis, and Porosity Relations of Buda, Georgetown, McKnight, and West Nueces Carbonate Rocks of Maverick Basin

Through much of Dimmit and northern Webb Counties, the Buda and Georgetown limestones are remarkably homogeneous; both consist of very dense algal calcisphere, *Globigerina, Inoceramus,* and echinoderm wackestones and packstones; calcispheres constitute the predominant biotal component in both.

In central and western Dimmit County dolomitization produced secondary intercrystalline porosity in several Georgetown intervals; these voids are now filled with solid hydrocarbon. In this area gas is produced in the Georgetown from tertiary voids which were formed when fresh groundwaters dissolved replacement anhydrite after hydrocarbons had accumulated in secondary intercrystalline voids. The Buda has no reservoir potential in this area.

Westward from eastern Dimmit County, the McKnight and West Nueces change facies from oobiograinstones and packstones to biopelgrapestone grainstones and packstones to biopelwackestones in western Dimmit County. The McKnight exhibits well-developed depositional and diagenetic cycles. These cycles record interaction of the following: (1) eustatic fluctuations in sea level, (2) regional progradation of supratidal, intertidal, and subtidal facies during stillstands of sea level, (3) changes in climate from arid to semiarid or subhumid, (4) continuous subsidence. Consequently, the McKnight has been subjected to highly complex multicycle diageneses that include freshwater diagenesis, dolomitization, anhydritization, silicification, and dedolomitization. Anhydrite layers of the upper and lower "anhydrites" were formed by replacement of carbonates. Secondary intercrystalline porosity in dolostone layers has been filled by what is now solid hydrocarbon which accumulated at shallow depths. Gas production in the McKnight, throughout the area, is from tertiary anhydrite molds which were created after solid hydrocarbons had accumulated in secondary voids. Much dickite cement also is present in secondary voids in the McKnight.

The West Nueces apparently contains no anhydrite, but tertiary anhydrite molds were abundantly formed and then largely filled by carbonate cements, as were primary and secondary voids. Reservoir potential of the West Nueces probably has not been properly evaluated.

Because mechanisms of anhydrite emplacement are so poorly understood, the distribution of porosity, formed by its dissolution, is unpredictable.

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Gulf Coast Lignite—Status Report

Gulf Coast lignite occurs mainly in Eocene strata with the majority of the resources in the lower Eocene Wilcox Group. Strippable resources in the Gulf Coast area are about 20 to 25 billion short tons (18 to 22.5 billion Mg) of which one-half are in Texas. Grade (5,000 to 7,000 Btu/lb or 11,630 to 16,282 kJ/kg, 20 to 50% moisture, 10 to 40% ash, and 0.5 to 2% sulfur) decreases from west to east and with progressively younger stratigraphic units. Seams are typically 2 to 10 ft (0.6 to 3 m) thick; differences in continuity and grade can be correlated with depositional system.

Large acreages are under lease—2.5 million acres (1,000,000 ha.) in Texas alone. At the near-surface, development drilling is most common whereas exploration drilling is now under way for deep-basin lignite. Deposit size depends on end use, for example, a 150 million ton (135 million mg) reserve for power plants and 15 million tons (13.5 million mg) for industrial boilers. Mining is by dragline or scrapers at less than 120 ft (36 m) and stripping ratios of less than 10:1; minimum seam thickness is 2 ft (0.6 m). Reclamation cost is approximately $1,000/acre ($400/ha.). Bucket-wheel excavators are inevitable as multiseam thin-bed deposits are mined at increasing depths.

All current production is in Texas and was about 21 million tons (19 million Mg) in 1978. Almost all the production is pulverized fired in mine-mouth plants where lignite-produced energy costs 50¢ per million