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

Btu. In Texas, air-quality standards (AAQS and PSD) could restrict the siting of future power plants. Future use in atmospheric fluidized bed combustion and medium-Btu gasification is probable. Underground gasification should be commercialized by 1990.

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Revision of Tampa Formation, West-Central Florida

The Tampa Formation of west-central Florida historically has been defined primarily from biostratigraphic and geochronologic criteria. Formation definitions based on these criteria are not in accordance with the American Code of Stratigraphic Nomenclature. Furthermore, a type section of the Tampa has never been established. Currently, the Tampa Formation is recognized by ill-defined and conflicting criteria with boundaries that are vague. At the originally described localities on Tampa Bay, there is an interval of rocks that is mappable, has recognizable boundaries, and is capable of being defined in accordance with the code. It is proposed that this unit be designated the Tampa Formation. The unit is generally a quartz sandy limestone, having at least 10% quartz sand and less than 1% phosphate. The boundary with the units above the Tampa is defined by phosphate-bearing (5 to 50%) dolomites, clays, and quartz sands. The lower boundary is marked by a relatively pure carbonate unit containing only trace phosphates or quartz sands. The Tampa has been indirectly correlated with the Oligocene Chickasawhay Stage of the Gulf Coast. A type section for the Tampa is established in the Ballast Point core held by the Florida Bureau of Geology. The core was taken at Tampa Bay, Florida.

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Suitability Studies of Salt Domes in East Texas Basin for Geologic Isolation of Nuclear Wastes

The suitability of salt domes in the East Texas basin (Tyler basin), Texas, for long-term isolation of nuclear wastes is being evaluated. The major problems concern hydrologic and tectonic stability of the domes and potential natural resources in the basin. These problems are being approached by integration of dome-specific and regional hydrologic, geologic, geomorphic, and remote-sensing investigations. Hydrologic studies are evaluating basinal hydrology and groundwater flow around the domes to determine the degree to which salt domes are dissolving, their rates of solution, and the orientation of saline plumes in the freshwater aquifers. Subsurface geologic studies are being conducted: (1) to determine the size and shape of specific salt domes, the geology of the strata immediately surrounding the domes, and the regional geology of the East Texas basin; (2) to understand the geologic history of the dome growth and basin infilling; and (3) to evaluate potential natural resources. Geomorphic and surficial geology studies are determining whether there have been dome growth and tectonic movement in the basin during the Quaternary. Remote-sensing studies are being conducted to determine (1) whether dome uplift has altered regional lineation patterns in Quaternary sediments and (2) whether drainage density and ruggedness ratios indicate Quaternary structural movement.

By means of the screening criteria of McClain and others, Oakwood and Keechi domes were chosen as possible candidate domes. Twenty-three domes were eliminated because of insufficient size, too great a depth to salt, major hydrocarbon production, or previous use (e.g., liquid propane storage or salt mining or brining). Detailed geologic, hydrologic, and geomorphic investigations are being conducted around Oakwood and Keechi salt domes.

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Equilibrium in Modern Coral Reefs, Western Gulf of Mexico—Role of Ecology and Ostracod Microfauna

Two groups of modern patch reefs are present off Veracruz, Mexico. Terrigenous sediments of the Rio Jamapa are being deposited between the two complexes. Longshore drift of these sediments is causing declining coral growth on the southern (Anton Lizardo) group, although corals on the northern (Veracruz) group are healthy. These differences in coral diversity should be reflected in the water chemistry and microfauna.

Environmental data collected (depth, salinity, pH, temperature, Eh, and dissolved oxygen) were treated as random samples from populations whose normality (or lack thereof) was established by chi-squared goodness-of-fit tests. Chi-square testing at the 0.01 level demonstrated that of the six sample populations, only depth, pH, and dissolved oxygen were normally distributed. Depth, pH, and dissolved oxygen data were assembled into two populations representing the Veracruz and Anton Lizardo groups, to test the null hypothesis that the variances of the respective populations were equal ($F = 0.005$ level). The variances were found to be equal. T tests (0.01 level) on the population means of depth, pH, and dissolved oxygen of both Veracruz and Anton Lizardo groups disclosed that there is no significant difference between the two groups of reefs in terms of these characteristics. Analysis of the dominant ostracod species in 33 samples collected on the reefs indicates two distinct biofacies. *Loxocorniculum tricornatum* Krutak dominates the Veracruz group; whereas *L.* cf. *L. postdorsoalata* "group" (Teeter) characterizes the Anton Lizardo stations. Two ostracod species, *L. tricornatum* and *Morkhovenia inconspicua* (Brady), are cosmopolitan, and are present at all 33 sampling stations. Rare species living on the two reef complexes are generally restricted to the Veracruz complex. Simple diversity analysis (number of species/station) demonstrates that the Veracruz reefs are more diverse than those of Anton Lizardo. However, this difference is statistically insignificant. Comparisons of Shannon-Weiner information function and equitability values between the two complexes show that these diversity measures are also insignificant and do not reflect observed environmental differences. Ostracod species abundance and dominance on the scleractinian bioherms at Veracruz and Anton Lizardo