CHANNEL SEQUENCES AND BRAIDED-STREAM DEVELOPMENT IN SOUTH CANADIAN RIVER, HUTCHINSON, ROBERTS, AND HEMPHILL COUNTIES, TEXAS

The South Canadian River in the eastern Texas Panhandle and western Oklahoma has produced a complex anastomosing channel system. At least 8 aggradational channel sequences (including the present channel system) are present in this part of the Canadian River valley, and are distinguished on aerial photographs and in the field by vegetational changes and overlapping stratigraphic relations. Earlier channel sequences are represented by remnants of earlier active braided-channel systems.

Analysis of daily discharge data from 1938 to 1966 reveals, that though average flow in the Canadian River is quite low, a few large floods with a flow in excess of 20,000 cu ft/second have altered severely floodplain and channel morphology. These flash events eradicate parts of earlier channel sequences and set the stage for channel braiding under lower discharge rates.

Longitudinal and transverse bars are observed in the active and younger inactive channel sequences of the river. Average orientation of these bars is nearly parallel with the orientation of the active channel in a given reach. Despite the similar average direction, there is wide variation of bar orientation in all reaches studied.

Unvegetated areas of the Canadian River floodplain show widespread eolian-dune alteration. These dunes parallel the orientation of the river valley.

Channel-wall instability and variable discharge rate are the principal factors causing braiding in the Canadian River. Serious doubts are raised about the importance of stream gradient as cause of braiding in the Canadian River system.

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SAMPLES RETURNED BY APOLLOS 11 AND 12 AND THEIR INTERPRETATION

Lunar samples returned by Apollo 11 and 12 from Tranquility Base and the Ocean of Storms can be classified into 3 major types: (1) mafic holocrystalline rocks, (2) breccias and microbreccias, and (3) particulate material. The mafic holocrystalline rocks mostly have familiar volcanic and/or shallow intrusive rock textures. These rocks mostly appear to be a closely related suite, but have a wide range of modal mineralogy. The major minerals are calcic plagioclase, clinopyroxene, olivine, and ilmenite. Breccias and microbreccias are predominantly lithified particulate material from the lunar regolith, but other types of breccias may also be present. The microbreccias and particulate material contain lithic fragments that have a much wider range of modal mineralogy than the large rocks. Among the lithic fragments are a small percentage of "anorthosite" and other plagioclase-rich rock fragments that are not represented by the larger specimens. These fragments may have originated from the lunar highlands, and their chemistry is similar to the Surveyor 7 analysis obtained in the lunar highlands near the crater Tycho. Petrographic evidence of shock metamorphism by meteoroid impact is abundant in the particulate material and common in the large rocks. Hypervelocity impact craters are present on the surfaces of most rocks and many small particles. These are commonly excellently preserved with a central approximately hemispherical glass-lined crater surrounded by a zone of spalling and abundant microfractures. Most glass particles in the lunar regolith appear to be impact produced from the underlying rock fragments or fine material. The ages of the lunar mare materials dated thus far are very old, and many analyses show cluster around values of 3.6 and 4.2 b.y. The major and minor element and isotopic chemistry of lunar samples have some striking differences from terrestrial rocks and chondritic meteorites. No lunar samples have been recognized that are similar to tektites in their chemistry or petrography. Planned Apollo 14 through 19 landing sites will offer the opportunity to sample different types of lunar features and should lead to conclusions about the genetic relations of the lunar mare and highlands, and the chemical heterogeneity of the Moon.

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POSSIBLE FUTURE PETROLEUM PROVINCES OF UNITED STATES WESTERN GULF BASIN—EOCENE AND PALEOCENE

Two new important future petroleum provinces, gas in Texas and oil in Louisiana, are related to the Wilcox Group. The gas province in Texas covers 8,700 sq mi and has 12,000 cu mi of untested sedimentary rock. In Louisiana, the oil province covers 5,800 sq mi and contains, 3,800 cu mi of untested sedimentary rock. Another possible future oil province, which covers 8,000 sq mi in Texas and Louisiana and has 7,000 cu mi of untested sedimentary rock, is predicted for the Claiborne Group. No new province is foreseen for the Jackson and Midway Groups. New provinces for the Wilcox and Claiborne Groups more appropriately might be described as gulfward extensions of existing producing trends. This report, concerned with possible future Paleocene-Eocene provinces of the western Gulf basin, assumes that technologic advances will permit drilling and production of wells to depths of 30,000 ft.

Considerable quantities of both oil and gas have been found in the established Eocene trends. Currently, there are 501 gas, 1,048 oil, and 377 oil and gas fields which have produced from Eocene deposits. Cumulative production to January 1, 1969, totals in excess of 4.2 Tcf of gas and 2.8 billion bbl of oil. These figures do not include casinghead gas, natural gas liquids, and gas flared in past years.

Large structures are known to be present at shallower depths within the future prospective areas. Structurally, these areas will be similar to the established trends; regional growth faults will predominate. Faultline and salt-related structural traps will be prevalent. To reduce economic risk, it will be important to use all available subsurface information for detection and definition of depositional trends which may project into the provinces.

The greatest attraction in the provinces will be from the Wilcox sandstone. Claiborne exploration will be a by-product of the Wilcox wells. It is not expected that the industry will rush into the provinces, but deep exploration will move gradually farther gulfward as more knowledge is accumulated. Three present fields have provided, and will continue to provide, encouragement for gradual movement into the future areas. In Texas, Northeast Thompsonville and North Milton fields, with reserves estimated at 500 Bcf to 1 Tcf of gas, are along the landward edge of the predicted Wilcox gas province. Fordoche field, with Wilcox oil reserves estimated at 70-120 million bbl, also lies on the landward edge of

the predicted oil province in Louisiana. These 3 fields provide significant clues to productive possibilities within the future provinces.

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YESTERDAY, TODAY, AND TOMORROW IN SEISMIC EXPLORATION

The science of seismic exploration has successfully passed the birth of the digital revolution, and in its youthful presence we envision a significant improvement in its future resolving power through an expansion of the geologic information generated from reflection data.

In the early stages of this revolution the signal/noise ratio was improved, largely because the use of high-speed computers made practical the common-depth-point shooting techniques, the repetitive use of low energy, non-dynamite (low noise) source, and various signal-processing techniques.

The net gain to the interpreter has been a much improved seismic record section (in time or depth) from which, as in pre-digital days, he commonly develops only a geometric configuration description. The recorded data, however, contain information about the type of rocks through which the energy has propagated. Extraction of this information (*e.g.*, in the form of velocity and attenuation variations) will permit lithologic identification.

To measure the resolving power of the seismic exploration method one needs to evaluate the simple equation: geometric configuration plus lithologic distribution equals geologic section.

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GUM HOLLOW DELTA, NUECES BAY, TEXAS: DEPOSITIONAL MODEL FOR FAN DELTAS[1]

Modern terrigenous clastic deposits that are lobate in plan, wedge-shaped in cross section, and which prograde into a body of marine water or bay from an adjacent area of high relief are termed "fan deltas." Periods of construction are of short duration and sediment is dispersed across the subaerial fan by shallow braided streams. Both the subaerial segments and marine extensions of these features are relatively coarse grained. Because of the brief and sporadic progradational pulses, marine reworking of distal fan deposits is operative most of the time.

A study of depositional processes and resulting facies of a modern fan delta along the mainland shore of Nueces Bay has provided data for constructing a model with which ancient terrigenous clastic deposits may be compared. Recognizable facies of the modern fan delta are (1) the fanplain which extends from the apex downfan to a point where surficial features of braided streams are no longer identifiable, (2) the distal fan, a relatively featureless part of the subaerial fan, which lies in the realm of fluvial, wind, and tidal processes, (3) the prodelta, the marine extension of the distal fan, which bears a modified fluvial imprint, and (4) facies which include depositional features modified in the bay by physical and biologic processes, and abandoned parts of the subaerial fan modified briefly through fluvial processes.

[1] Publication authorized by the Director, Bureau of Economic Geology, The University of Texas at Austin.

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LOWER CRETACEOUS EDWARDS CARBONATE BEACH COMPLEX, COMANCHE COUNTY, TEXAS

The Lower Cretaceous Edwards Limestone of west-central Texas was deposited under shallow-marine, moderate-energy shelf conditions. Exposed insular areas were developed in response to remnant structural features combined with biologic and normal sedimentologic processes (sand banks and rudist reefs). The beach complex was developed in association with an insular area thought to be a rudist reef. The reef itself is not exposed due to Holocene erosion. This carbonate sequence is a direct ancient analog of Holocene clastic beach sequences which have been described by Bernard, Leblanc, and Majors.

The beach sequence, as exposed in a series of quarries at Round Mountain, Comanche County, Texas, consists of the following zones, from top to bottom: subaerial backshore, foreshore, upper offshore, and lower offshore.

The exposed backshore consists of a complex set of subaerial sedimentary environments: subaerial crust, paleosoil, supratidal dolomite, and washover deposits from the beach. The foreshore consists of a well-sorted rudist carbonate grainstone. The dominant sedimentary structures are parallel laminations and well-developed accretion bedding. The allochems have been leached and infilled by sparry calcite or silica. The upper offshore consists of a poorly sorted rudist carbonate packstone. This zone is characterized by poorly developed accretion bedding and localized festoon cross-bedding oriented perpendicular to beach accretion. Inversion textures are the dominant diagenetic fabric of the facies. The lower offshore consists of an echinoid pellet carbonate packstone. The dominant sedimentary characteristics of this facies are burrows, localized festoon cross-bedding, and abundance of micrite matrix.

The main points of similarity between this ancient carbonate beach sequence and Holocene clastic beach sequences are a general downward decrease in grain size and the sedimentary structure sequence from inclined laminations and beach accretion packages at the top to festoon cross-bedding and organic burrows at the base.

The main points of difference are the grain types present, particularly the abundance of biologically derived material in the carbonate beach, the preservation of the exposed backshore environments, and the complex diagenetic history of the carbonate beach which is a result of the original metastable mineral constituents.

The Cretaceous carbonate beach sequence is a further verification of the wide applicability of the conceptual process model as an interpretive sedimentologic tool regardless of sediment origin or mineralogy.

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CENTRAL MISSISSIPPI UPLIFT

A structural feature in east-central Mississippi covers more than 1,500 sq mi. The subcrop of the lower Paleozoic carbonate defines the feature, which is named the Central Mississippi uplift. Structural and isopach maps and a Paleozoic paleogeologic map show the configuration and age of the uplift. More than 10,000 ft of Mississippian-Pennsylvanian sediment was removed from the uplift during Triassic and Jurassic time. The southern part of the uplift was downwarped during formation of the Mississippi salt basin, and its