divisible into five formations. In ascending order they are named the Atco Chalk, Vinson Chalk, Jonah Limestone, Dessau Chalk, and Burditt Marl. The group as a whole is characterized in this area by medium- to massive-bedded chalk and marly chalk with distinct, laterally persistent key beds and a general absence of fragmental limestone.

From Travis County south to Bexar County, on the southwest flank of the San Marcos arch, the Austin Group thins to approximately 100 ft. Formations recognized in the Roundrock syncline lose their identity as the entire section changes facies to a thin- to medium-bedded, slightly fragmental, commonly glauconitic, dense biomicrite. Diastems occur within the unit and a disconformity separates the Austin Group from the overlying Anacacho Limestone.

From Falls County north through McLennan County the Austin Group thins over the Belton high to less than 150 ft, and facies changes occur which are similar to those on the San Marcos arch. A disconformity separates the Austin and Taylor Groups in the area.

From Hill County north to Dallas County the Austin Group thickens into the Dallas basin to more than 600 ft and can be subdivided into three informal units called the "lower," "middle," and "upper chalk." Farther north in Grayson and Hunt Counties another positive element, the Preston anticline, separates the carbonate sequence of the Austin Group from its clastic equivalents in northeast Texas.

General criteria that may be useful in the recognition of positive areas that existed during deposition of the Austin Group include the following: (1) thinning of the group; (2) a facies change from massive-bedded chalk and marly chalk to thin-bedded, commonly fragmental, and glauconitic chalk; (3) loss of identity of formations and key beds recognized in adjacent negative areas; and (4) the appearance of local diastems in the section.

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DELTA-FRONT DIAPIRS OFF MAGDALENA RIVER, COLOMBIA, COMPARED WITH HILLS OFF OTHER LARGE DELTAS

Exploration of the slope off the Magdalena River with reflection profiling has shown a series of large diapiric intrusions with hills rising as much as 600 ft above the sea floor. These diapirs mostly are bordered by down-bent formations in contrast to the usual, but not invariable, upbending around salt domes. Because salt domes are unknown in the entire area, and because plastic mud layers must be common in the delta-front beds, it seems likely that these are mud diapirs or possibly some type of underwater mud volcanoes.

The mud lump islands off the Mississippi delta generally have been considered rather unique. However, the finding of diapiric intrusions, which are probably mud, off the Magdalena delta and the finding of many hills off other deltas suggest that such intrusions may not be unusual.

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ENVIRONMENTAL RELATIONSHIPS OF RECENT OSTRACODA IN MESQUITE, ARANSAS, AND COPANO BAYS, TEXAS GULF COAST

(No abstract submitted.)

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SUBSURFACE UPPER CRETACEOUS STRATIGRAPHY OF SOUTHWESTERN ARKANSAS

The subsurface Gulf Series of southwestern Arkansas is characterized by uniformity in lithologic features, a minimum of facies variations except on a local scale, general eastward thinning of units toward a shoreline area, and features typical of neritic, eulittoral to sublittoral, and alluvial to prodeltaic environments.

The Woodbine Group of southwestern Arkansas consists of the Lewisville Formation of fluvial to littoral varicolored shale and sandstone and the overlying Eagle Ford Formation of dark gray to black littoral to sublittoral shale. The Woodbine is unconformable on Comanchean rocks throughout the area studied. The Austin Group in this area is represented by the Tokio Formation of littoral to sublittoral ashy sandstone and shales and the Brownstown Formation of more offshore calcareous, glauconitic shale and sandstone.

The Taylor Group here consists of the Ozan Formation of slightly calcareous shale and glauconitic sandstone with a basal glauconitic sandstone (Buckrange Sand Lentil) followed above by the neritic Annona Chalk, Marlbrook Marl, and Saratoga Chalk. The Ozan Formation tends to thin southwestward in contrast to the underlying Gulf deposits which generally thicken in that direction. The chalk formations of the Taylor Group mark the onset of large numbers of Senonian planktonic coccoliths and foraminifers in this region. In northeastern Texas the Austin Chalk (Tokio equivalent) represents an earlier Senonian invasion of calcareous planktonic organisms. In this region the Austin and Taylor planktonics are associated with typical benthonic fossils and require a neritic environment.

The Navarro Group of southwestern Arkansas consists of the Nacatoch Sand and Arkadelphia Marl. The Nacatoch is neritic, littoral, and sublittoral glauconitic sandstone and shale whereas the Arkadelphia is neritic calcareous shale and marl, in part glauconitic.

The base of the Paleocene marine Midway Group is distinct throughout the area studied but there is little or no evidence of an unconformable relation with the Gulf Series. There is some evidence of a paleontologic break at the contact, and it probably should be termed a paraconformity.

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FAULTS OF SOUTH AND CENTRAL TEXAS

The map entitled "Faults of South and Central Texas" shows the location, depth of trace, and approximate vertical displacement of the various normal faults located in the area covered by the investigation. The information on the faults was derived from: published sources (listed in text); various individuals including especially, William Pittman, Wilford Stapp, and Porter Montgomery; and studies in company files.

The writer found that most reports on a particular area were broadly about the same, but might differ considerably in detail. Certainly, no two maps were identical; each geologist seems to have his particular style of fault interpretation. Additional faults undoubtedly will be discovered in the future and the interpretations presented will require alteration.

Most of the faults in the region occur within the

major fault systems. A few of the faults are over structures of "punch-type" origin such as salt domes and igneous masses; radial fault patterns and grabens are commonly associated with these structures (for example, see northern McMullen Co.). Several faults are associated with folds such as the Pearsall and Chittim anticlines. Finally, there are many faults which appear to be structurally independent and which lie outside the fault systems.

The largest known fault displacement in the region is less than 1,000 ft; most displacements do not exceed 200 ft. The total displacement of the down-to-the-coast faults is usually about the same as the total displacement of the opposing nearby up-to-the-coast faults. The individual faults and fault systems generally have strikes which are within 10 to 20 degrees of the strikes of the beds in which they occur. Surface and subsurface studies both show that the ends of controlled faults commonly turn in a downdip direction.

The actual movements on the faults constituting the major fault systems appear to have occurred only in the downthrown blocks; these blocks are almost invariably lower than persistent regional stratigraphic surfaces. The upthrown blocks are usually even with these surfaces.

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BATHYMETRY OF GULF OF MEXICO

The Gulf of Mexico can be divided into two major provinces: a carbonate province on the east and a terrigenous one on the west. The steep side slopes of the Campeche (Yucatan) and Florida (U.S.A.) escarpments are not fault scarps, but were formed during the Cretaceous by carbonate deposition along the seaward edge of the subsiding continental block. After the algal banks or reefs that formed the steep side slopes died, sediment progradation and upbuilding formed the shelf and the smooth and gentle upper continental slope. Seaward progradation extended to the top of the escarpments and buried the algal banks.

The continental margin within the terrigenous province between De Soto Canyon and Campeche Canyon was formed by upbuilding and outbuilding. The resulting sedimentary framework has been altered by salt intrusions. The Sigsbee escarpment at the seaward edge of the sedimentary framework was also formed by salt intrusion. Diapiric structures are not limited to the continental margin, but extend into the center of the Gulf of Mexico basin. Structures in the center of the basin appear to be restricted to the eastern margin of the Sigsbee abyssal plain and are aligned in a northeasterly direction. This trend and concentration, if real, may delineate a fracture zone extending from De Soto Canyon to the Golfo de Campeche.

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IS THERE LONGSHORE DRIFT CONVERGENCE ON CENTRAL PADRE ISLAND, TEXAS?

The existence of a convergence of longshore drift in the vicinity of central Padre Island has been postulated by several workers. Support for this hypothesis has been obtained from a detailed study of shell distribution on Padre Island beaches integrated with a study of the actual nearshore currents with drift bottles and theoretical predictions of longshore currents from Corpus Christi wind records.

Three sedimentologic provinces occur on central Padre Island: a northern province, a southern province, and a transition zone between them. The northern province has a finer grain size mode and a heavy mineral suite characteristic of rivers and Pleistocene deposits on the north. The coarser grain size mode and the heavy mineral suite of the Rio Grande characterize the southern province. Central Padre Island is unique on the Texas coast in having a high percentage (10–80%) of shell material in the beach sediment. On the basis of the distribution of this shell material, the writer has distinguished a southern province, a northern province, and a transition zone all of which correspond closely to the terrigenous provinces described above. Thus three separate sedimentary parameters indicate that the sediment along Padre Island is being transported from southern and northern sources to be mixed in a central transition zone.

Although the study is incomplete, the close correlation between drift-bottle paths and local winds suggests that the latter may be used to determine the current direction and perhaps velocity. This analysis of the local wind system suggests that there is a net annual convergence of longshore drift in the vicinity of the sedimentologic transition zone on central Padre Island. The net annual convergence is probably responsible for the distribution of the sediments of central Padre Island into three transitional sedimentologic provinces.

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GEOLOGIC FRAMEWORK OF GULF OF MEXICO BASIN

The basin contains more than 6,000,000 cu mi of predominantly Mesozoic and Cenozoic sediments. Deep-water sediments overlying an oceanic crust occupy its central part.

Late Paleozoic orogenies influenced the basin shape: the "buried" Llanoria structural belt along the northern margin, the Chiapas-Guatemalan structural belt along the southern margin, and a "connecting" structural belt (now "buried") along the western margin. This last margin was more strongly established by Nevadan (Jurassic) and Laramide (early Tertiary) orogenies. A complex system of transcurrent faulting, created as the Gulf basin (and Mexico) drifted westward (leaving the Caribbean "Pacific tongue" behind), marks the southeastern margin.

Great thicknesses of Jurassic salt occur in major depressions within the basin. Much of this salt apparently was deposited rather abruptly in deep water. During salt deposition, the African continent probably marked the eastern margin of the Gulf basin. The Nevadan orogeny restricted normal gulf circulation from the Pacific, creating conditions favorable for salt sedimentation.

Post-salt sediments came from two major provenances: Mesozoic from the Appalachians and Cenozoic from the Rocky Mountains.

The history of the Gulf basin supports modern concepts of continental drift. The Gulf "salt basin" appears to be related genetically to a series of "salt basins" which formed from north to south as continents began to drift apart along the Mid-Atlantic "swell." Progressive decrease in age from late Paleozoic at the north to Early Cretaceous at the south suggests the supercontinent began rifting apart first at the northern end. The sedimentary and structural records indicate that drift was spasmodic rather than continuous.