SILURIAN CHITINOZOANS FROM FLORIDA WELL SAMPLES

Chitinozoans of Silurian age were recovered from four wells in Florida: Cone No. 1, Tillis No. 1, Hilliard No. 1, and Kie Vining No. 1. An attempt was made to establish a correlation between the four wells using the chitinozoan evidence, and the results are presented. The youngest assemblage probably is of Ludlovian age; the oldest is of late Llandoverian age.

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SOUTHWEST LAKE ARTHUR FIELD, CAMERON PARISH, LOUISIANA

Southwest Lake Arthur field is a classic example of one of the rare, non-salt-associated stratigraphic traps found in southwest Louisiana by geologic-geophysical exploration techniques. The stratigraphic trap is constituted by an E-W-trending sandstone barrier bar and a tabular shaped marine sandstone that grades laterally into shale toward the north, west, and south. The sandstone deposits are superimposed on a present day southeast-dipping homocline.

Integration and review of the geology and geophysics of this documented stratigraphic trap were undertaken to determine whether the *Planulina* no. 2 Sand pinchout could be observed visually on the available conventional split-spread reflection seismic-record section and if essential criteria could be developed to locate similar fields.

The procedure employed was: (1) a thorough geologic study was made from logs, cores, and production data of numerous wells in and around the field from which structure and isopach maps were made of the reservoirs constituting the stratigraphic trap; (2) the original field records were transcribed onto magnetic tape and then to a processed seismic-record section; (3) a synthetic seismogram was constructed from a sonic log of a well near the seismic line along with the spontaneous-potential and resistivity curves of the same well plus another well along the section; (4) the digitized spontaneous-potential and resistivity curves for these wells were converted to a time scale using the values of time depth derived from the integrated sonic log; and (5) the synthetic seismogram and digitized logs were superimposed and compared with the record section. A change of character was observed which showed thickening of the section approximately equal to the developed sandstone. Because conventional seismic recordings in the area are generally plagued with various noise problems, this change of character may be coincidental. Additional work is needed to confirm such a liberal interpretation.

Production is from the *Planulina* no. 2 Sand in the Erath member of the Anahuac Formation. This member coincides with the *Planulina palmerae* biostratigraphic zone which is early Miocene.

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GEOTHERMAL GRADIENTS IN FLORIDA AND SOUTHERN GEORGIA

Bottom-hole temperatures from electric-log surveys were collected from all nonconfidential oil tests that recorded temperature data. These data are from 287 wells in Florida and 33 in Georgia. Computed gradients were compiled into county averages, and a preliminary geothermal gradient map was drawn.

Peninsular Florida, south of a NE-SW-trending zone through Taylor and Nassau Counties, is characterized by gradients generally less than 1.0°F/100 ft. Northern Florida and southern Georgia are characterized by gradients that generally exceed 1.0°F/100 ft. A weak and questionable increase in gradient may occur over the Sunniland field in southwest Florida.

The observed NE-SW geothermal trend parallels the Appalachian Mountain belt and coincides with known magnetic and gravity features of the area. It also parallels the Cretaceous to Holocene clastic-nonclastic boundary in northern Florida.

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PHOTOGEOLOGIC APPLICATIONS IN GULF COAST

Much photogeologic interpretation depends upon late structural movement at the surface, either by rejuvenation or compaction around older structures. The Gulf Coast is one of the more active provinces from the standpoint of tectonism and compaction.

Actually, far more surface structure is mappable at the surface than many Gulf Coast geologists realize. By using special modern photography, and some of the more detailed geomorphic procedures that have been developed, much structural information can be obtained.

Detailed study of the air photos of the entire state of Louisiana, the Gulf coastal part of Mississippi and Alabama, and large parts of the Texas Gulf Coast have resulted in some interesting conclusions:

1. Far less distortion than can be measured with usual well control, or shallow seismic interpretation, is needed to create surface structural indications with the more sensitive geomorphic criteria.

2. A large percentage of the structural oil fields have recognizable surface features.

3. Some surface expressions associated with up- and down-to-coast faulting are not as expected from subsurface studies.

4. Geomorphically, an expression of the deeper causative structure commonly lies directly above on the surface, even in grabens and on the downthrown side of normal faults.

5. Special photography and more detailed and experienced interpretative effort are needed on the Gulf Coast.

6. Because the surface has been neglected by many explorationists, and because of the importance of inter-well control to prospecting, detailed photogeologic interpretation is an economical way to develop many prospect leads. Through better localization it substantially reduces seismic costs.

Subsurface-surface relations, and many air photo examples depicting the surface expression of pertinent oil fields and prospects, from both the Jurassic trend and the down-dip Gulf Coast, document the conclusions.

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RELICT NATURE OF SEDIMENTS AND SUBMARINE TOPOGRAPHY OFF ALLIGATOR HARBOR, FLORIDA

An offshore area south of Alligator Harbor, Florida, contains several linear offshore shoals separated by relatively flat-floored "valleys." Eighty-six samples from

this area were analyzed for texture by standard laboratory technique.

The simplest model of sediment distribution applicable is one of increased grain size and decreased sorting with increased water depth. The correlation of this pattern and other lithologic attributes with a vertical stratigraphic section from an onshore boring suggests that the sampled area represents a subaerially eroded surface in which there has been limited modification by marine processes during the most recent rise in sea level. This modification consists of movement of the finer fraction onto the shoals with minor return movement to some of the deeper channels. The deposition of finer sediments on these previous topographic highs may have accentuated the original (subaerial) relief.

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LATE CENOZOIC STRUCTURAL MOVEMENT, NORTHERN FLORIDA[1]

Pleistocene and Plio-Pleistocene sediments in northern Florida have been studied to detect tectonic displacement. Previous studies in southeastern Georgia defined six prominent former coastlines which are essentially horizontal and have altitudes (oldest to youngest) of 95–100 ft, 70–75 ft, 40–45 ft, and approximately 24, 13, and 4.5 ft above present sea level. The heights of the former sea levels were determined from the upper limit of littoral trace fossils and the altitude of salt-marsh sediments associated with each coastline. Each coastline is marked by a series of barrier-island deposits consisting of well-sorted, fine-grained, angular sand, and by lagoonal salt-marsh sediments of fine-grained sand, silt, and clay which accumulated landward of the barriers.

The former coastlines have been traced southward from Georgia into northern Florida where the lagoonal salt-marsh sediments of the Wicomico Formation (sea level 95–100 ft in Georgia) are found at progressively higher altitudes. Maximum uplift is east of Starke along the northeast flank of the Ocala uplift where salt-marsh sediments have an altitude of approximately 166 ft or 65–70 ft higher than those in Georgia. The Penholoway salt-marsh sediments (sea level 70–75 ft in Georgia) reach an altitude of 95 ft in Florida. The Talbot salt-marsh sediments (sea level 40–45 ft in Georgia) are not well preserved but appear to be displaced 5–10 ft in the area of maximum uplift in Florida. Pamlico salt-marsh sediments (sea level approximately 24 ft in Georgia) are as high as 32 ft south of St. Augustine; thus, there is progressively less warping of the lower, younger coastlines. South of the Ocala uplift the five lower Pleistocene coastlines are approximately the same altitudes that they are in Georgia. The oldest coastline, which may be of either Pliocene or Pleistocene age, maintains an altitude of 140–150 ft for more than 150 mi south of the area of maximum uplift.

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RELATION BETWEEN *Globorotalia truncatulinoides* AND *G. tosaensis* IN PLIOCENE-PLEISTOCENE DEEP-SEA CORE FROM SOUTH PACIFIC

Based on nannofossils, a carbonate core from the South Pacific (Eltanin 21–5; 36°41′S; 93°38′W; length 480 cm; depth 3,121 m) is late Pliocene to early Pleistocene in age. The Pliocene-Pleistocene boundary (325 cm) is placed at the last appearance of most discoaster species in the core including *D. pentaradiatus* and *D. surculus*. *Discoaster brouweri* extends higher, to 225 cm where it also becomes extinct. Above the top of the Pliocene, the presence of *D. brouweri* and absence of *Gephyrocapsa oceanica* indicate an earlier Pleistocene age; the middle Pleistocene and much of the late Pleistocene are missing in unconformity near the core top.

This core is significant in showing alternations of dominantly keeled and dominantly nonkeeled populations of the *Globorotalia truncatulinoides* – *G. tosaensis* plexus. The lower (425-480 cm) and upper (0-130 cm) core sections contain populations dominated (>78%) by keeled forms referable to *G. truncatulinoides*, whereas intermediate intervals between 198 and 400 cm contain populations dominated (>80%) by nonkeeled forms which agree well with topotypes of *G. tosaensis*. Transitional populations are present between 145 and 180 cm.

Globorotalia truncatulinoides is associated in the core only with marginal tropical foraminiferal faunas including *Globorotalia menardii*, *Globigerinoides conglobatus*, and "*Globigerina*" *dutertrei* whereas *G. tosaensis* is associated with a cooler water planktonic foraminiferal assemblage lacking these species and with higher frequencies of *Globorotalia inflata* and right coiling *Globigerina pachyderma*. Likewise, the coccolith *Unbilicosphaera leptopora* which prefers warm waters, exhibits marked increases in frequency in the upper and lower core sections containing *G. truncatulinoides*.

Although not decisive, this sequence suggests that during the late Pliocene–early Pleistocene, at least in this area, *G. truncatulinoides* and *G. tosaensis* were either phenotypic variants or separate subspecies or species with distinct environmental preferences. It also provokes speculation as to whether the *G. tosaensis* to *G. truncatulinoides* evolutionary bioseries near the Pliocene-Pleistocene boundary in tropical deep-sea areas, including the Gulf of Mexico, is the result of ecologic or oceanographic change.

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PLANKTONIC FORAMINIFERAL DATUMS AND LATE NEOGENE EPOCH BOUNDARIES IN MEDITERRANEAN, CARIBBEAN, AND GULF OF MEXICO

Late Neogene planktonic foraminiferal datums and epoch boundaries in Italy, as proposed by the Committee on Mediterranean Neogene Stratigraphy, are compared with those in the Caribbean and Gulf of Mexico. Datums recognizable in these regions include (1) appearance of *Globorotalia margaritae* in early Pliocene, (2) appearance of the *G. crassaformis* lineage in middle Pliocene, (3) appearance of *G. tosaensis* and *Sphaeroidinella dehiscens* in very late Pliocene, and (4) appearance of *Globorotalia truncatulinoides* within the early Pleistocene (middle or late Calabrian).

Initiation of the Pleistocene in these regions is recognized by abrupt onset of climatic deterioration, as indicated by marked changes in the planktonic and benthonic foraminiferal populations, and marked eustatic lowering of sea level, as demonstrated by regressive facies, nondeposition, or deep-water turbidites, de-

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