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POSSIBLE FUTURE PETROLEUM PROVINCES OF THE UNITED STATES

WESTERN GULF BASIN - PRE-JURASSIC

*Not given orally at conve

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ABSTRACT

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The Paleozoic Ouachita tectonic belt completely rims the western Gulf of Mexico coastal plain. It provides a natural separation between the Paleozoic hydrocarbon provinces of the mid-continent foreland areas, on the north, and the Jurassic and Cretaceous productive trends of the interior Gulf coastal plain, on the south. Jurassic sediments of the coastal plain are underlain by unproductive Paleozoic and Late Triassic rocks. Historically, tests penetrating the pre-Jurassic have found little to encourage further exploration. Consequently, stratigraphic control is relatively sparse, and there are very few complete penetrations of the pre-Jurassic section Gulfward from the Ouachita tectonic front.

The known Paleozoic consists mostly of orogenic sediments of Ouachita facies, but some late-orogenic sediments of Pennsylvanian and Permian age are present and are virtually unexplored.

On the basis of tectonic history, lithofacies, and geographic setting, the pre-Jurassic section of this region can be discussed under four reasonably distinct headings: (1) Paleozoic foreland facies, (Black Warrior basin), (2) Orogenic, geosynclinal facies, (Ouachita tectonic belt), (3) late-orogenic, Paleozoic, and (4) post-orogenic. Triassic. A good potential for existence of petroleum provinces of economic interest can be recognized in the Black Warrior basin, of northeastern Mississippi and northwestern Alabama, and on the Gulf of Mexico side of the Ouachita tectonic belt in late-orogenic Paleozoic shelf sediments. A remote possibility is recognized for the presence of a hydrocarbon province in lower Paleozoic shelf carbonates beneath the Ouachita overthrust, especially in the north-central part of Region 6. The hydrocarbon potential of rocks of the Ouachita tectonic belt, and of the Triassic post-orogenic section is considered to be negligible.

The Black Warrior basin covers about 35,000 square miles in northeastern Mississippi and northwestern Alabama. A thick section of normal foreland Paleozoic sediments is present, ranging in age from Cambrian to Lower Pennsylvanian. Adequate porous objectives occur in many parts of the section, and shows of oil and gas have been numerous and widespread. The occurrence of extensive asphalt deposits in outcrops of Mississippian and Pennsylvanian rocks suggests that large volumes of oil have been generated in the basin. The potential of the Black Warrior basin as a petroleum province has long been recognized. However, there have been only a few small discoveries, mainly gas, and almost entirely in Mississippian sandstones. The proved reserves of the basin are insignificant.

Deep exploration has been deterred by the inability of industry to find attractive structural anomalies, and by the lack of any previous success in the deeper beds. There is good reason to believe that the deep structure is comparable to that of the other foreland Paleozoic basins. One of these is the Val Verde basin of west Texas, where large gas reserves have been found in Ordovician carbonates on deep, large faulted structures. Inasmuch as the Cambrian and Ordovician carbonate objectives in the Black Warrior basin are only sparsely tested at depth, the hydrocarbon potential for this part of the section appears good.

Subsurface data from northeastern Texas and southwestern Arkansas document the previously unreported occurrence in the northern Gulf coastal plain of highly fossiliferous, shallow shelf carbonates and sandstones of Desmoinesian, Pennsylvanian period. Lying on the Gulf of Mexico side of the Ouachita tectonic belt, these sediments are relatively undeformed and are indistinguishable from marine facies of the Des Moines in foreland areas of the mid-continent. They contrast sharply with the highly indurated, locally metamorphosed, steeply dipping Ouachita facies, which comprise most of the subcrop in this area. Although the Des Moines occurs in southwestern Arkansas as shallow as 4,300 feet, only a few wells have penetrated this section. Good porosities have been encountered in both sandstones and carbonates in several of these wells. There have been no substantiated hydrocarbon shows, but these tests probably were not designed to test Paleozoic prospects.

Only fragmentary data are available concerning the important geological parameters of this section, but the mere presence of these sediments suggests that a potentially large, virtually unexplored, late Paleozoic petroleum province might exist in the Gulf coastal plain. At present, parts of northeast Texas, southern Arkansas, northern Louisiana, and west-central Mississippi appear to offer the best opportunities.

Accumulations might exist in a wide variety of traps, and a structural style completely different from that of the overlying coastal plain strata is visualized. In some areas the presence of thick Jurassic salt, or thick Triassic red beds will make it highly expensive, perhaps prohibitively so, to test the underlying Paleozoics. Definition of the most promising prospects will depend on sound concepts of pre-Jurassic structure and stratigraphy and the ability to obtain satisfactory seismic records below the Louann Salt.

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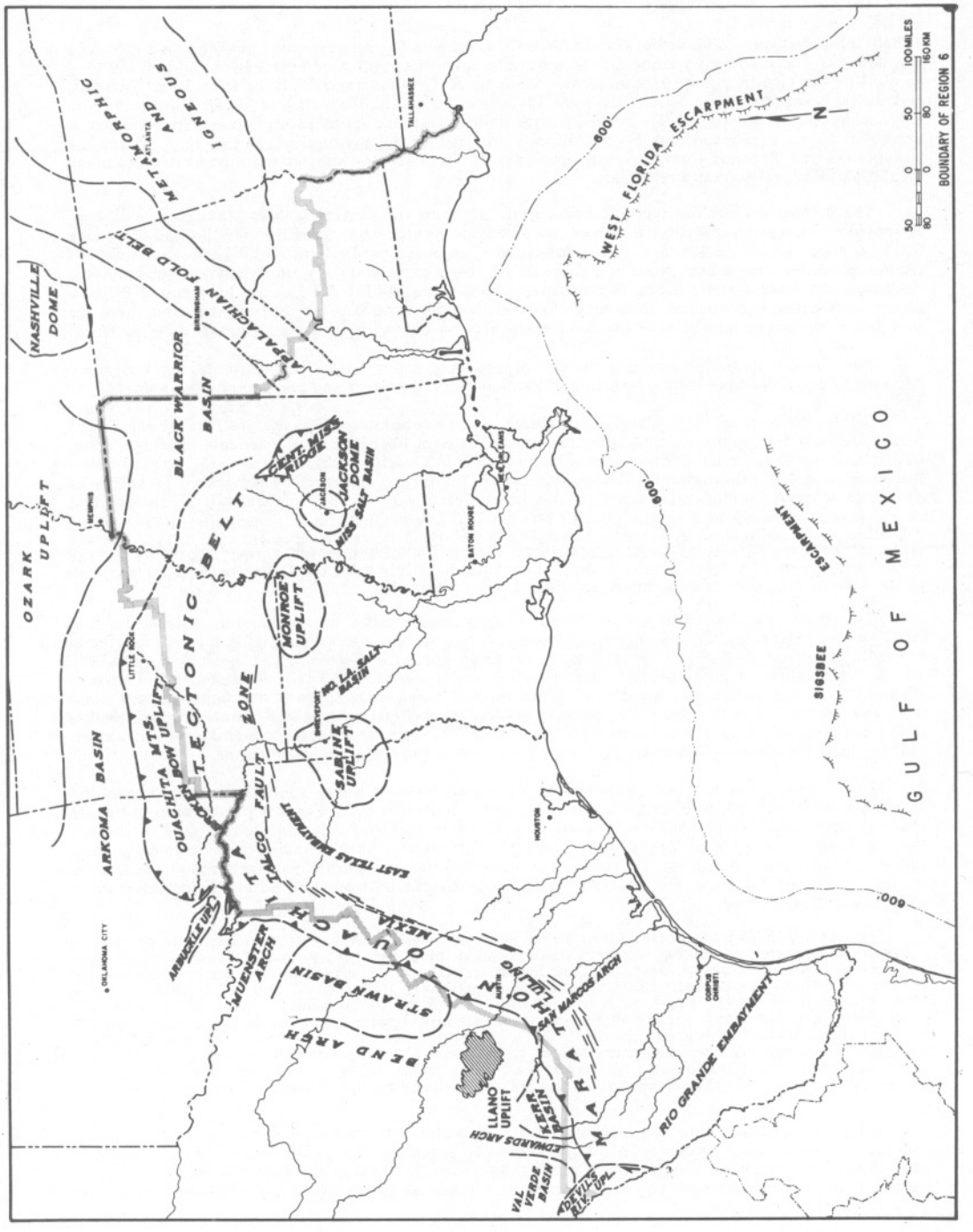

Figure 1 – Major tectonic features of the interior Gulf coastal plain and adjoining areas.

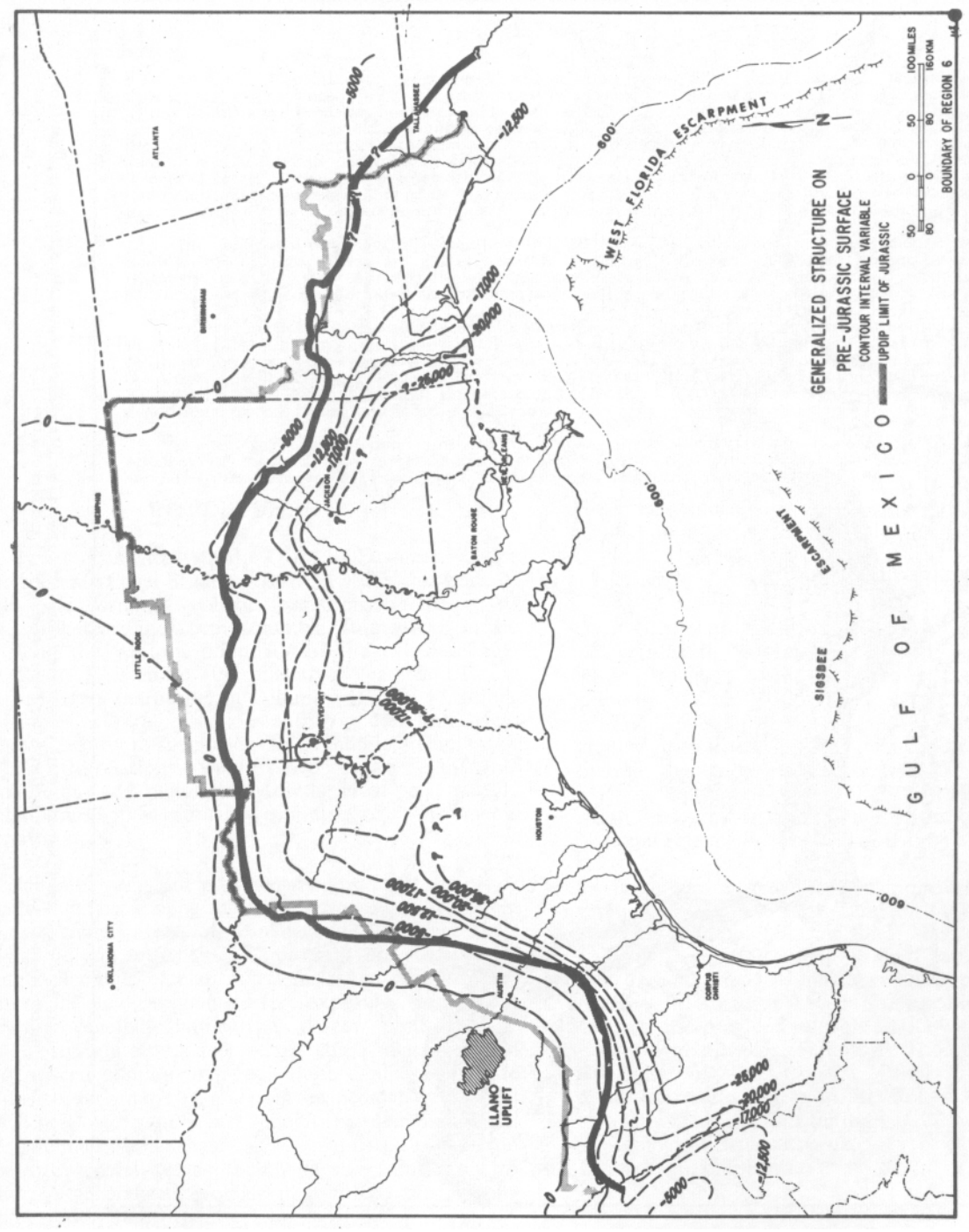

Figure 2 — Generalized structure of the pre-Jurassic surface. Depths are in feet subsea. Note that mapping extends well beyond the subcrop edge of the Jurassic. Deeper contours are based on scattered seismic data. Modified after map furnished by Humble Oil and Refining Company.

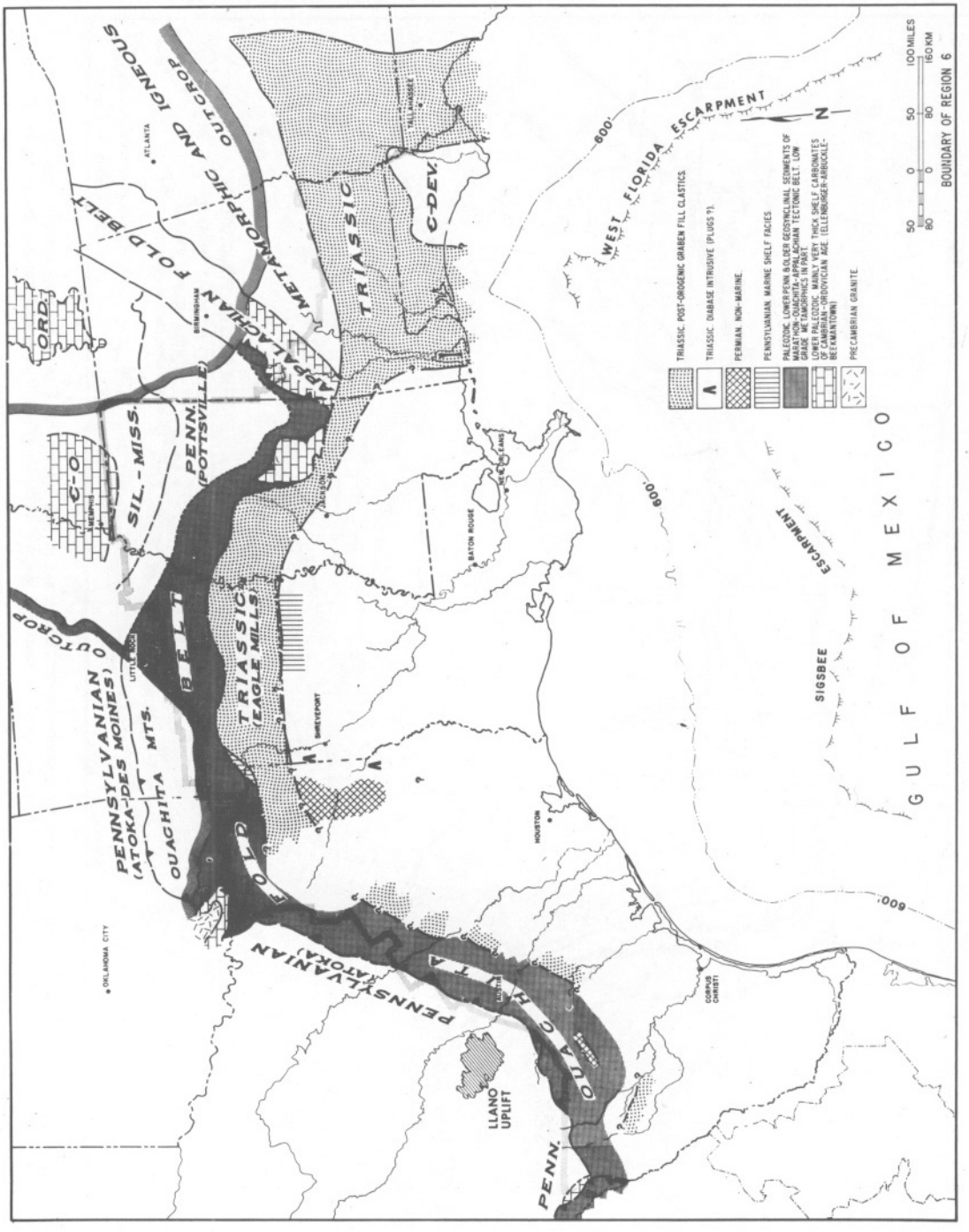

Figure 3 — Pre-Jurassic subcrop map, western interior Gulf coastal plain. Mappling extends inland far beyond limits of Jurassic (see Fig. 1). In part modified after Flawn *et al.* (1961) and Mellen (1947).