LATE STRAWN AND EARLY CANYON HIGHSTAND AND LOWSTAND SHELF EDGES AND REEFS ON THE EASTERN SHELF WITH EXAMPLES FROM SCHLEICHER AND TOM GREEN COUNTIES, TEXAS

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ABSTRACT

Rapid glacio-eustatic sea level fluctuations with intermittent exposure, erosion and karsting controlled carbonate and clastic deposition on much of the Eastern Shelf during Late Strawn (Desmoinesian) and Early Canyon (Missourian) time. Relatively continuous subsidence of the area (associated with overall basin subsidence) was instrumental in the formation of major shelf edge carbonate buildups and smaller pinnacle reefs during Early Canyon time.

There has been a lot of confusion between the Late Strawn and Early Canyon in Schleicher and Tom Green Counties. Without modern (post 1960) fusulinid identifications it is very easy to correlate the Late Late Strawn into the Early Early Canyon based on wireline logs. Adding to this confusion is the fact that the early Hollingsworth Paleontological reports reflect the inclusion of the genus Eowaeringella (an Early Early Canyon guide fossil) in the genus Wedekindellina (a Strawn guide fossil). Many productive Early Canyon carbonate buildups have been called Strawn structures. Present evidence (in the area studied) indicates that the Strawn has good production only on true structural closure.

Within the Early Canyon, three fusulinid zones are present, the Early Early Canyon (Mf1), Middle Early Canyon (Mf2) and the Late Early Canyon (Mf3). All three of these zones are present as sea level highstand carbonate deposits on the Horseshoe Atoll, although they are considerably thinner than their equivalents on the Eastern Shelf. Two of these zones (Mf2 & Mf3) have been identified in sea level low-stand buildups flanking the atoll.

The Early Early Canyon (EEC) contains two distinct carbonate packages, a lower EEC1, usually deposited directly on the Latest Strawn (Late Late Strawn), and an upper EEC2 which may be locally stacked on the lower unit or, alternatively, forms its own distinct shelf edge and platform facies. The EEC1 unit is a prolific oil and gas reservoir, whereas the EEC2 is generally non-productive in the portions of Schleicher and Tom Green Counties studied to date. There are also two major upward shallowing facies packages in the Early Early Canyon on the Horseshoe Atoll which appear to be correlative with these Eastern Shelf cycles.

The Middle Early Canyon (MEC) contains three distinct carbonate packages, a lower MEC1, a middle MEC2 and an upper MEC3 package, which also may be stacked vertically (especially in major carbonate buildups). Each of these units also have their own shelf edge and platform facies, usually separated by clastic units (sand and shale). These clastics can be transgressive sand sheets, progradational deltaics and shelf or slope shales. Three major upward shoaling cycles have also been recognized in the Middle Early Canyon over much of the Horseshoe Atoll.

At the present time only one cycle is recognized in the Late Early Canyon (almost certainly due to the relatively small area studied). This cycle is called the Palo Pinto in this presentation, following informal usage by subsurface workers, even though there is no evidence of correlation with the Palo Pinto outcrops or other units called Palo Pinto in the subsurface of the Eastern Shelf. In fact, this unit does not even contain the same fusulinids that Hollingsworth Paleontological Reports generally refer to as Palo Pinto Types. Since this is the unit that we have hung all our stratigraphic cross sections on and since it is one of the few stratigraphic units in the area studied that is fairly consistently called the same thing by subsurface workers, the term Palo Pinto is used. Despite this usage, under no circumstances are we suggesting that this particular Early Canyon cycle should henceforth be known as the type Palo Pinto of the subsurface on the Eastern Shelf, nor are we suggesting that it is the same age nor stratigraphically equivalent to the Palo Pinto of outcrop.

Original facies distribution and shelf edge to shelf morphology (especially re-entrants oriented roughly perpendicular to the shelf edge) exerted significant control on subsequent carbonate removal by erosion (during

lowstands) on each one of these cycles. This paleotopography, in turn, exerted control on the subsequent deposition of quartz sandstones which also form prolific hydrocarbon reservoirs on this portion of the Eastern Shelf. For example, sand and shale tended to be deposited in the topographically low re-entrants during lowstands. During subsequent sea level rise, these sands were reworked into clean reservoir quality sand bodies and encased in shale.

The presence of paleosols (and associated exposure surfaces) has been recognized in outcrops on the Eastern Shelf for almost ten years (Brown, 1982). Once identified in samples, paleosols can be recognized on electric logs and are extremely useful as time lines for both regional and local correlations on cross sections. Although the type of paleosol formed depends of the substrate it formed on, and even though the paleosol may not be preserved in every well on a cross section, they form markers that are useful over many tens of square miles.

Depositional patterns similar to those found in the Early Canyon of the Eastern Shelf have a modern analog on the Yucatan Shelf, north of the Yucatan Peninsula in the Gulf of Mexico. Direct comparison of these Holocene Pinnacle reefs which have developed on the karsted Pleistocene substrate which was drowned during the Late Wisconsin rise in sea level can be made with productive Early Canyon carbonate buildups in Schleicher and Tom Green Counties.