New regional structural log cross sections, Permian Basin, New Mexico

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Five regional structural wireline log cross sections are being prepared for the New Mexico Bureau of Geology and Mineral Resources to summarize stratigraphy and tie key subsurface and surface sections. Emphasis is on Permian stratigraphy but the entire stratigraphic column in Eddy and Lea counties is correlated. Four of the cross sections will pass through the Shell #1 James Ranch (Eddy Co., NM: API 30 -015 -04735), a Lower Ordovician (Ellenburger) test which is selected as a "type section" for the northern Delaware Basin. Although it is an older well, it is near numerous modern logged wells; has been well studied; and is on several published classic cross sections.

The five planned cross sections include:

1. NW – SE section A –B –C from the flank of the Pedernal Uplift (Chaves Co., NM) to the southeastern corner of Lea Co., NM on the Central Basin Platform.
2. N – S section D –B –E extending from the Pecos Slope (Chaves Co., NM) through the Artesia Group type section; the Chevron (Gulf) PDB 04 cored research well in the Capitan Reef complex; a Precambrian test in Reeves Co., TX and to the Chevron (Gulf) PDB 03 cored research well in Loving Co., TX.
3. W – E section F –B –G from the Algerita Escarpment (Guadalupe Mountains) through the Capitan Reef complex in the Dark Canyon area just south of Carlsbad and eastward to the New Mexico portion of the WTGS (1992) cross section which crosses the Central Basin Platform.
4. SW – NE section H –B –I from the Sierra Diablo (Hudspeth Co., TX) to the San Simon Channel (central east Lea Co., NM). This section summarizes a cross section presented at the 2007 WTGS Fall Symposium and included on the CD (Pub. 07 -119) for that meeting.

5. N – S outcrop (classic Guadalupe Mountains) to subsurface. This section J –K extends from the Algerita Escarpment through the McKittrick Canyon area and ties section H –B –I above.

Only the N – S regional cross section (2 above) and a supplementary section in Vacuum Field are presented as "work in progress" posters at this (2009) symposium. The latter is included to show possible San Andres – Brushy Canyon relationships based on the published seismic section in Pranter, Hurley and Davis (2004, AAPG Mem. 81). As shown on these poster cross sections, there are questionable correlations and the author would welcome critique and new information. The cross sections have not benefited from modern seismic data which no doubt would improve questionable interpretations.

The N – S cross section D –B –E extends from the surface to the Precambrian. The vertical scale (1" = 800') does not permit detailed facies analysis or sequence stratigraphy. Emphasis is on the Permian Cisuralian and Guadalupian Series and on wireline log defined marker beds. The horizontal scale is variable being expanded in the Capitan Reef margin area and in the shelf margin area of the San Andres Formation and the Brushy Canyon Formation pinch out.

Where possible thin marker beds are shown and include the:

Cowden Anhydrite in the lower Salado Fm.

Ocotillo silt in the Tansill Fm.

Base of the Bowers sand interval in the lower Seven Rivers Fm.

Lovington sand in the upper San Andres Fm.

Reef Trail and Lamar Members of the Bell Canyon Fm.

Hegler Limestone Member (two finger limestone) of the Bell Canyon Fm.

Manzanita Mbr. (and contained BCB bentonite marker), U. Cherry Canyon Fm.

Pipeline Shale

Cutoff sandstone

Following the research of numerous workers and in part shown on the 1992 WTGS regional cross section, the following shelf to basin correlations are followed;

Ocotillo Silt and upper Tansill = Reef Trail Member (uppermost Guadalupian) which makes up most of what is called Lamar (or Delaware lime) in the central Delaware Basin

Tansill Formation below the Ocotillo Silt = Lamar Member

Lower Seven Rivers Fm. (below Bowers sand) = Hegler Ls. Mbr. (two-finger ls.)

Upper Shattuck Mbr. of Queen Fm. = (approx.) Manzanita Mbr. in the upper Cherry Canyon Fm.

Lovington sand (u. San Andres Fm.) = lower Cherry Canyon sandstone tongue

Basal Lovington sand bypass surface = (?) Brushy Canyon Formation

This relationship remains controversial but I did not force the BC to be equivalent to Kerans and Fitchen's (1995) middle San Andres bypass surface which cannot be identified regionally on wireline logs. A Lovington bypass surface = BC may be supported by the Vacuum field modern seismic line interpreted by Pranter et al., (2004)

"Upper Glorieta" or its bypass surface = 1st Bone Spring sand

"Lower Glorieta" or its bypass surface = (?) 2nd Bone Spring sand

Tubb Formation or its bypass surface = 3rd Bone Spring sand

Of note in the Delaware Basin is the regional parallelism of the Pipeline Shale, uppermost Cutoff limestone (Williams Ranch Mbr.?), and the thin Cutoff sandstone. Is it possible that the Cutoff sandstone is equivalent to Kerans' middle San Andres bypass surface? Picking a Cutoff Formation – Bone Spring Formation contact on wireline logs remains a problem.

Near the southern end of the cross section in Reeves Co. TX is shown the thick lower Wolfcamp conglomeratic shaly sandstone (as shown on WTGS 1964 cross section) or conglomeratic sandy shale (as shown on WTGS 1984 cross section) which was sourced from southern uplifts.

The wide spread. thin-bedded, highly cyclic basinal limy shale unit above the Strawn limestone in the central Delaware Basin is commonly thought to be mostly upper Pennsylvanian and probably represents deep water deposition during late Carboniferous and early Permian (?) rapid sea level changes due to Gondwana glaciations