Jones, William V., EMNRD

From: Kay Havenor [khavenor@georesources.com]
Sent: Sunday, September 04, 2011 8:51 AM
To: Jones, William V., EMNRD
Subject: Re: Disposal application from Cimarex: Secrest et al #1 30-015-22321 Canyon Disposal
Attachments: Jones Stratigraphy questions reply 9-3-2011.pdf

Will,

I understand the questions you pose, but you should know I cannot respond with only a brief statement! Please review the attached response. If you have additional questions I will try hard to be succinct.

At 05:19 PM 8/31/2011, you wrote:

Hello Kay,
Just received and reviewed this application.

Would you please estimate the formation tops, such as:
Top and bottom of salt
Top of the Penn, Canyon, and Strawn

This seems close to the Dagger Draw, any ideas on why this area is not productive?
And why are the waters so fresh at those depths?

Thanks for the application,

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Dear Mr. Jones: September 3, 2011

Reference Cimarex's C-108 Secrest Sec. 7, T19S-R26E 30-015-22321 questions in your email of Aug. 31, 2011.

The Pecos River alluvium appears to be only from the surface to 104' at the Secrest. This is supported by a water well driller's log (RA-6813) in Unit D, Sec. 9, T19S-R26E describing the top of water at 97' and base of the valley fill sediment at 120'.

There is no Salado or shallow salt in this area west of the Pecos River. The relatively thin alluvium in this area rests unconformably upon eroded Artesia Group. In the Secrest well the depth to top of San Andres is 805'.

Other tops in the Secrest: Glorieta 2504, Bone Springs 4160, Wolfcamp 6102, the following are OCD tops: Cisco 7330, Canyon 7680, Strawn 8240, Atoka 8790. My calls were for Canyon 7683 and Strawn 8252. The top of Cisco in the this area is difficult to make, but the OCD's 7330 is probably good. Cimarex's proposed perfs are 7780 - 8010, all in Canyon.

Your question as to potential production like Dagger Draw intervals is both good and reasonable, unfortunately Mother Nature is not always accommodating in providing traps.

The Dagger Draw reservoirs are a combination structural-stratigraphic trap. Technically, they are a complex signold-oblique clinoform of Cisco-Canyon formations. Uniquely, they are an extension of the Indian Basin depositional system, but the favorable depositional trend is both narrow and discontinuous. The "Figure 4", below, is a seismic view of the tectonically disturbed Dagger Draw. Note the top of faults are buried by overlying Wolfcamp.

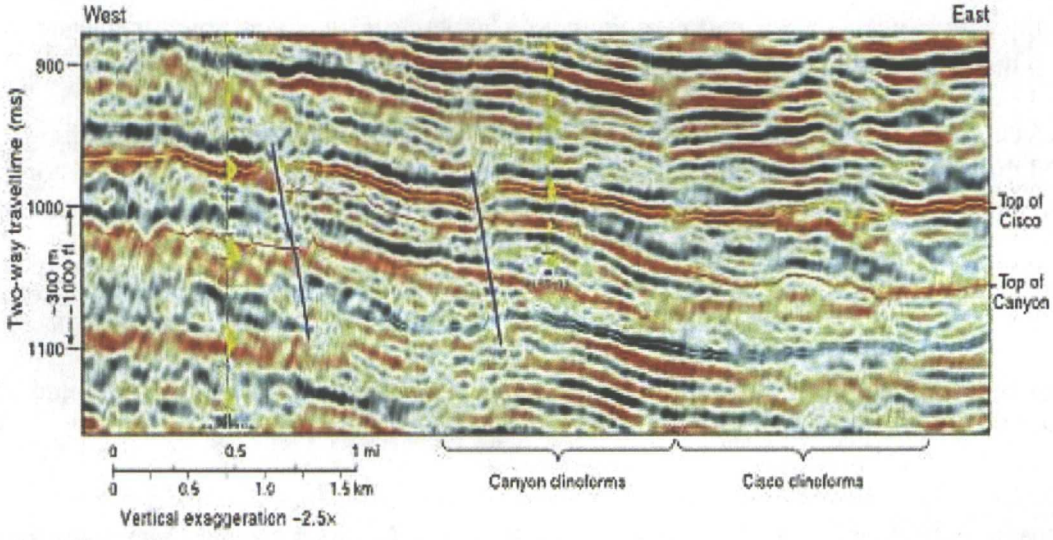

FIGURE 4. Seismic line oriented perpendicular to the Canyon margin strike. Faults parallel to Huapache are indicated.

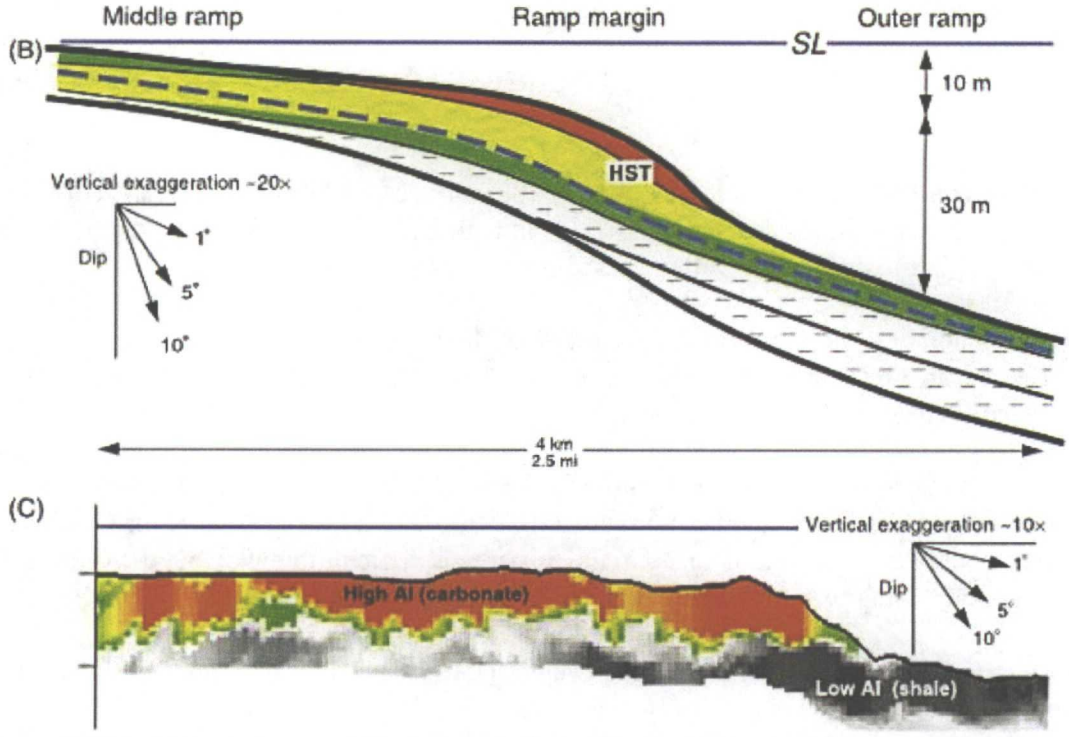

FIGURE 5. Depositional models for a high-frequency sequence. (A) Facies distributions in the lowstand systems tract (LST) and transgressive systems tract (TST). The lower sequence boundary (SB) is thick black line, the upper boundary of LST is thin black line, and the maximum flooding surface (MFS) is heavy, dashed blue line. Note the textural changes from outer to middle ramp. (B) Facies distributions in the highstand systems tract (HST). The ramp margin was most likely deposited in at least 10 m of water, depending on its position within the longer-term composite sequence. (C) Acoustic impedance (AI) cut from 3-D seismic inversion illustrating validity of depositional model. Colors represent general lithologies depicted in (A) and (B). Scale is similar, but vertical exaggeration is half of (A) and (B). Blue line represents datum on top of Cisco.

The unique conditions of deposition are shown in "Figure 5". The productive zones are quite thin and essentially trapped by shales and dense carbonates. The deposits were formed in tectonically active times, the formation of Pangea. The deposits were very shallow marine and subject to tidal variations as well as tectonic activity. (Tinker, et al, AAPG Memoir 81, 2004)

In the AAPG meeting in Ruidoso, June 2002, Humphrey and Freeman (Yates Petroleum) discussed this field. They reported, ". . .production is from two facies: the Algal Boundstone and Grainstone facies. . . . both of these appear to have been deposited in linear strike-oriented belts. No evidence of shoreline facies have been observed; this would suggest that these deposits represent a shelf-edge or offshore, barrier-type buildup not physically connected to the shoreline." That strike direction of Canyon-Cisco in now east-west.

The point is: local unique conditions in a tectonically active time. Penn traps are not found with these conditions to the north of this trend, but have been seen south-southeast.

The short answer to this part of your question is the difference of depositional/structural conditions, not developed in the Secrest area, resulted in some unique Dagger Draw traps for oil/gas. A similar accumulation occurred southeast in New Mexico and West Texas.

As to the less saline waters found in the pre-Permian Paleozoic beds as compared to the toxic waters of the Permian, I can only offer my deductions. We know that in most of the Laramide uplift, early Tertiary intrusive activity and formation of the Rio Grande Rift, the crust east of Tularosa was hooked onto the older continental North America. Uplifted Yeso and Abo are exposed at the surface at Tularosa by Basin and Range faulting . Eastward we see steady regional dip that puts the top of San Andres at 5000' beneath the surface at the Texas state line. The pre-Permian was deformed by the Late Paleozoic closure forming the Pangea super continent. Later uplift to the west, with erosional stripping, exposed faults, fractures and bedding planes that allow(s) surface water to be transported (seep) eastward down-dip. The super saline Permian waters are trapped stratigraphically above the Pennsylvanian to Cambrian formations. 70- to 100 million years of uplift and seeping has allowed that less-saline water to move eastward via formational porosity, faults and fractures. Of course, with distance of travel the water increase TDS.

That scenario is highly simplistic, but in general that is why less saline water is in the pre-Permian formations. It is, however, natural and not man-made. Probably only locally slightly modified by man.

Finally, to address the oil/gas production probability of Cimarex's intended disposal zone in the local area, a DST was run by the original operator (Dorchester) over the entire zone. The results of that test were:

DST #2:
(Test was run 11/20/77)
7770-7828 (Cisco-Canyon) 3 Min PF, TO w/good blow increased to strong blow, 75 Min ISI 90 Min, FF strong blow, decr to fair blow, no gas to surf, 120 min FSI, Rec 4415' black salty sulf wtr w/tr oil and gas. Sample Chamber rec 2000 cc fluid and 14.5 CFG @ 850#.

IHP	3692#
PFP	214-903#
ISIP	3068#
FFP	1044-2053#
FSIP	3050#
FHP	3657#
BHT	144°

This test effectively demonstrates no commercial productive capacity for the Canyon.

Please contact me should you require additional information.

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