



CHERT RESERVOIR DEVELOPMENT IN THE DEVONIAN OF WEST TEXAS: CONTRASTS BETWEEN PROXIMAL AND DISTAL SETTINGS



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ABSTRACT

The lower Devonian Thirtystone Formation of West Texas and New Mexico is the largest chert reservoir succession in the world, having produced more than 750 million barrels of oil. As much as 650 million barrels of additional mobile oil remains in these reservoirs, making this play an important target for further exploitation.

All Thirtystone chert reservoirs have much in common, including relatively high porosities and low permeabilities and a bimodal pore distribution containing abundant microcrystalline pores. However, distinct differences in depositional geometries and styles of reservoir heterogeneity are apparent between reservoirs in proximal and distal settings. Proximal reservoirs are composed of a single, thick (up to 100 ft), sheetlike chert unit that extends for hundreds of square miles. Heterogeneity in these reservoirs, which were deposited on a gently sloping outer platform during regional transgression, is a function of faulting, fracturing, and dissolution of associated carbonate along unconformities.

By contrast, distal reservoir successions comprise thin, vertically stacked and laterally discontinuous chert intervals whose origin is a function of transport and deposition of siliceous sediments as debris flows and turbidites. Flow units in these reservoirs are thin (10-20 ft), spatially limited in size, and separated vertically and laterally from one another by low-permeability mud-rich, siliceous sediments and hemipelagic deposits. Flow unit distribution is the result of both paleotopography and sea-level cyclicity. Cherts are most abundant in transgressive and early highstand legs of sea-level rise/fall cycles and display offset stacking suggestive of topographically controlled reciprocal sedimentation. Faults and fractures appear to be less significant contributors to reservoir heterogeneity in distal reservoirs.

ACKNOWLEDGMENTS

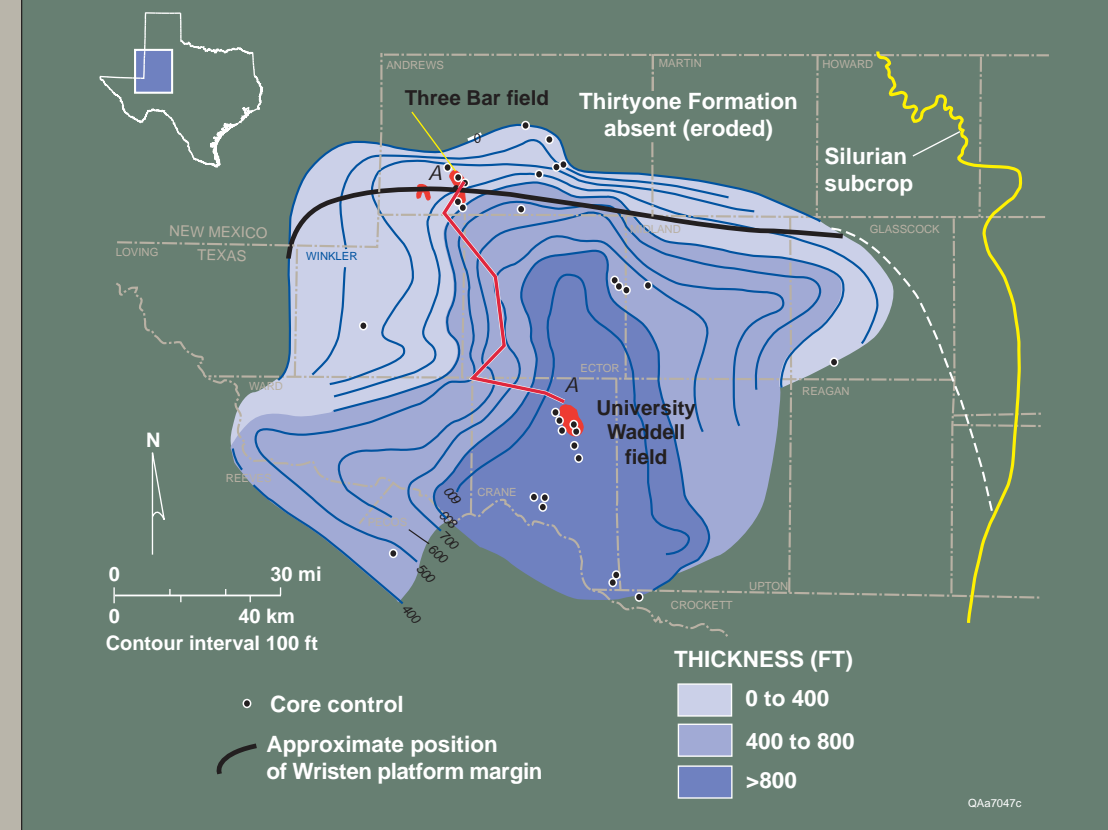
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MIDDLE PALEOZOIC STRATIGRAPHY

System	Series	Stage	Time (m.y.)	Sea-level fall	Texas		Oklahoma	Illinois Basin	
					S	N	S	N	
DEVONIAN	Upper	Famennian	367		Woodford	Woodford		New Albany	
		Frasnian	377						
	Middle	Givetian	381					North Vernon	
		Eifelian	386					Jeffersonville	
	Lower	Pragian	390		Thirtystone				
SILURIAN	Pridolian	Lochkovian	409		Wristen Group	Frame	Henryhouse	Moccasin Springs	Salina
		Ludlovian	424		Wink	Fasken	Clarita	St. Clair	Salamonie
		Wenlockian	430		Fusselman		Chimney Hill	Cochrane	Sexton Creek
	Llandoverian		439						
		Ashgillian	Hirnantian					Keel	Maquoketa

Thirtystone chert deposits are early Devonian (Pragian) in age, a time of widespread chert deposition along the margins of the Laurussian craton.

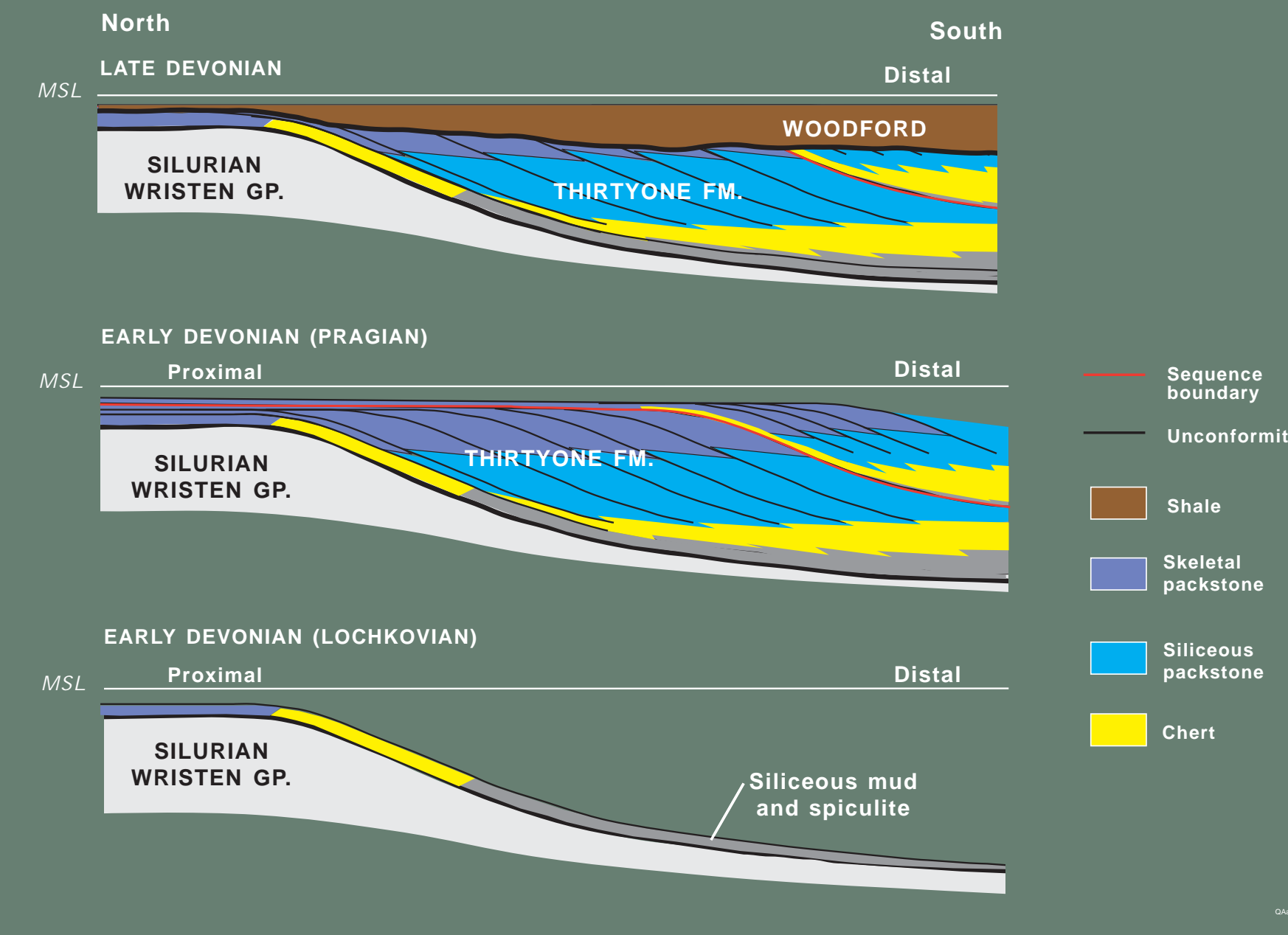
THIRTSTONE FORMATION THICKNESS



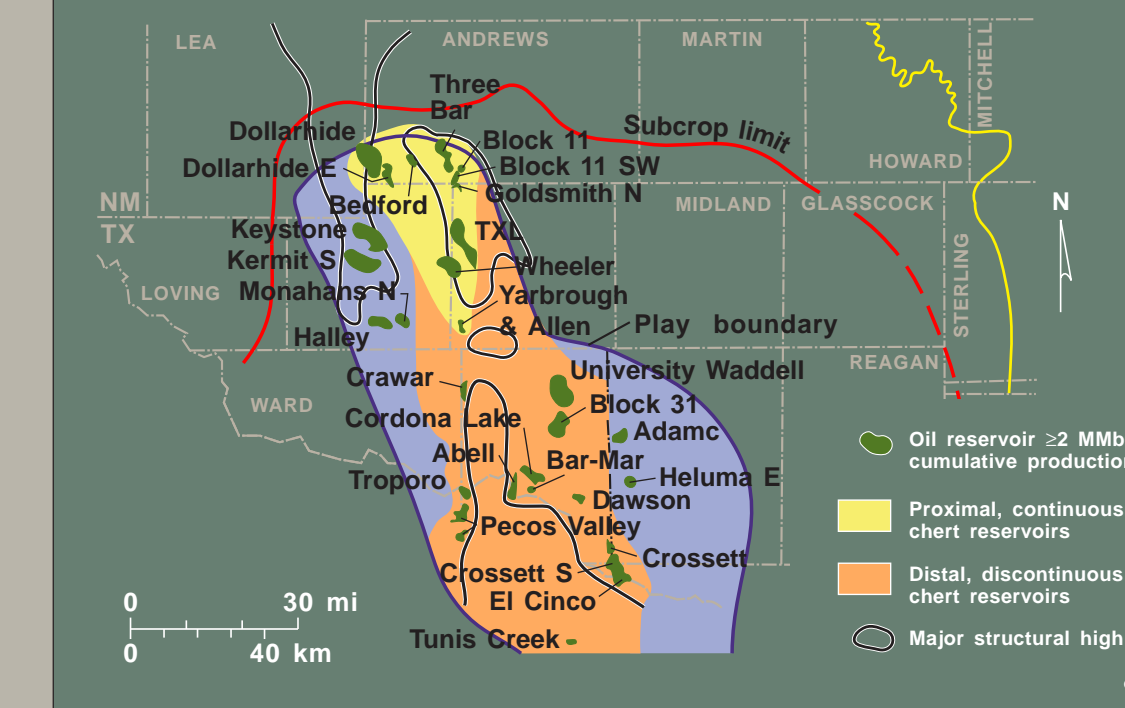
Thirtystone Formation thickness patterns are the result of early Devonian paleotopography (inherited from middle Silurian crustal flexure) and middle Devonian erosion.

REGIONAL SETTING

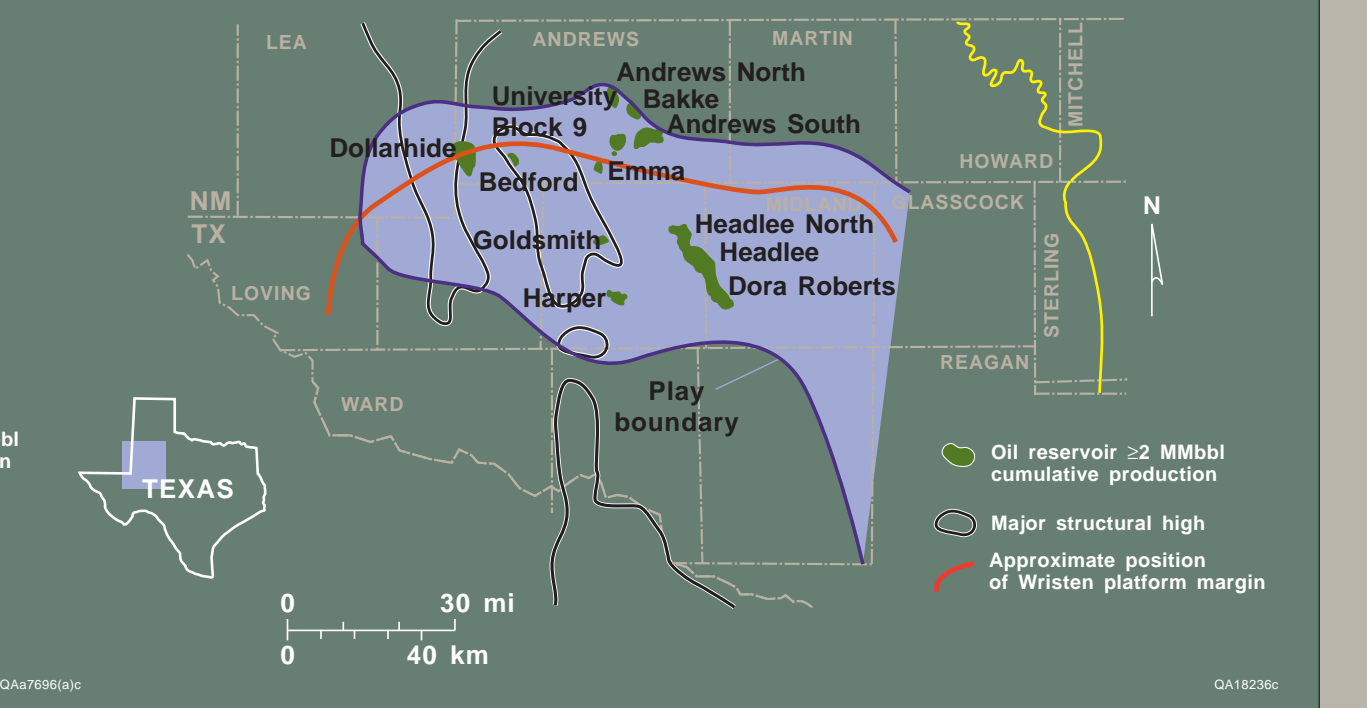
DEVONIAN DEPOSITIONAL HISTORY: WEST TEXAS



CHERT RESERVOIR DISTRIBUTION

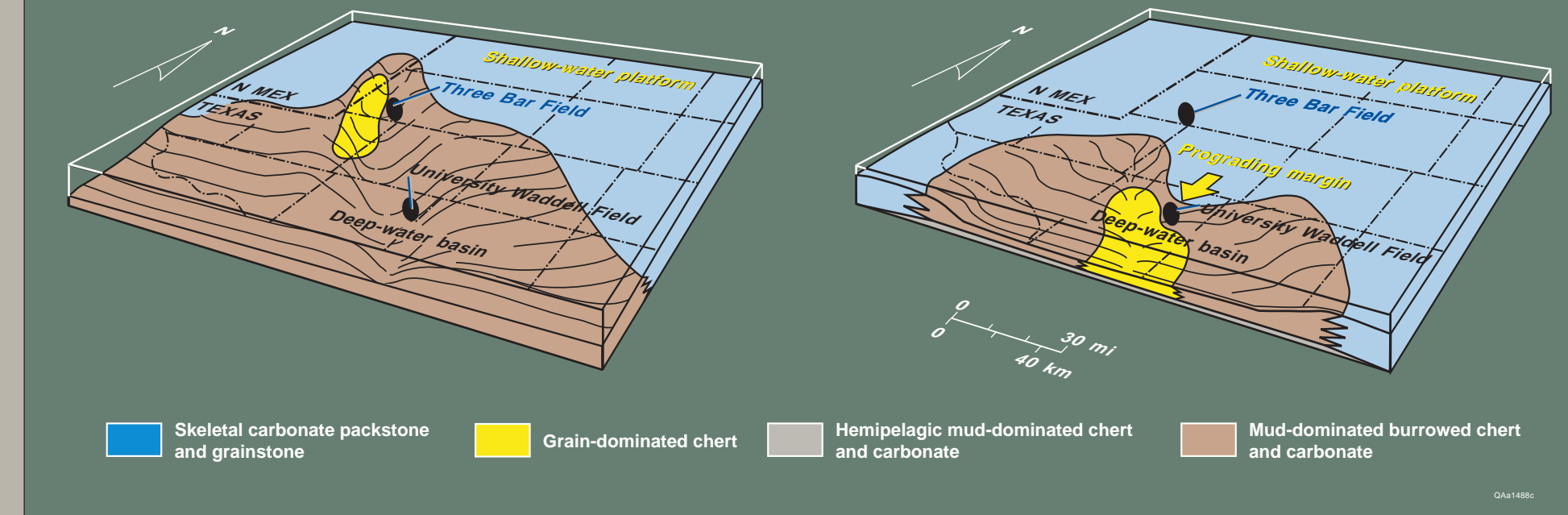


RAMP CARBONATE RESERVOIR DISTRIBUTION

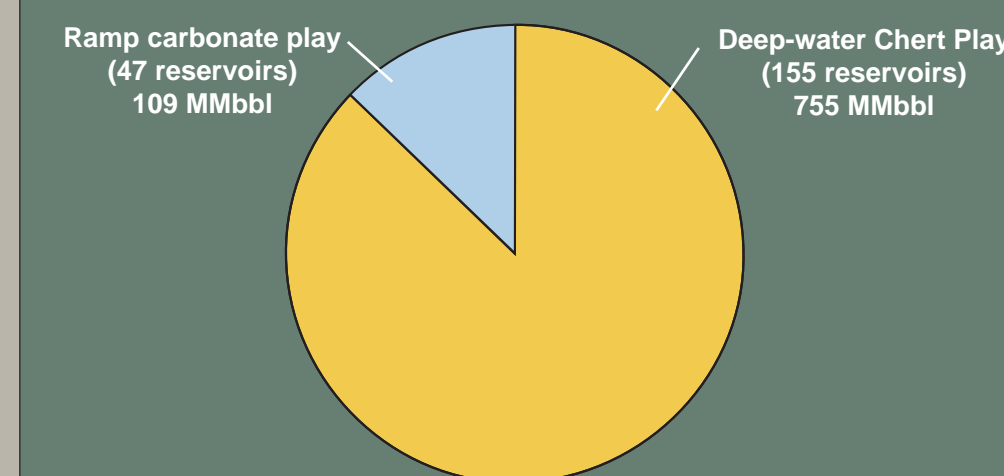


The Thirtystone Fm is productive from both carbonates and cherts. Carbonates, which are dominantly shallow-water deposits that are locally dolomitized or silicified, are productive along the margins of the Thirtystone platform. Cherts are deeper water deposits that occupy outer platform to slope/basin areas.

THIRTSTONE FORMATION PALEOGEOGRAPHY



CUMULATIVE OIL PRODUCTION THIRTSTONE FORMATION, TEXAS

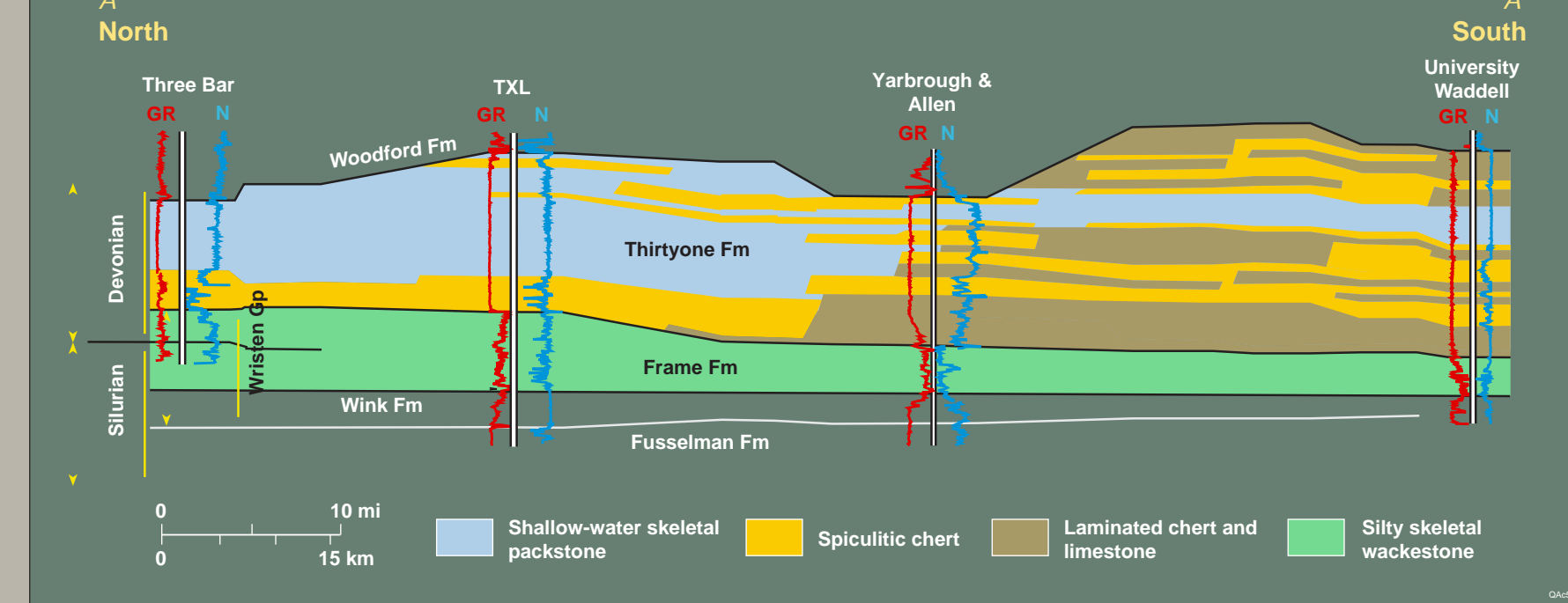


Estimated original oil in place in Thirtystone cherts in the Permian Basin is nearly 3 billion barrels, making this the largest chert reservoir accumulation in the world.

THIRTSTONE FORMATION CHERT PLAY RESERVOIR ATTRIBUTES

Attribute	Samples	Mean	Minimum	Maximum
Porosity	35	14.9%	2.0%	30.0%
Permeability	33	8.6 (md)	1.0 (md)	100.0 (md)
Initial water saturation	31	31.5%	10.0%	45.0%
Residual water saturation	22	29.2%	14.0%	48.2%
Oil viscosity	21	0.68 cp	0.07 (cp)	1.03 (cp)

THIRTSTONE REGIONAL STRATIGRAPHIC ARCHITECTURE



Stratal relationships within the Thirtystone Formation along approximate depositional dip demonstrate basinward progradation. An apparent sequence boundary is defined by platformward shift in facies tracts caused by sea-level rise.

