[PS]Stylolites and Porosity in a Lower Cretaceous Limestone Reservoir, Onshore Abu Dhabi*

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Abstract

The vertical distribution of stylolites in cores from the Lower Cretaceous Thamama-B reservoir zone (approximately 50 m thick) has been compared between the oil-filled crest and the water-filled flanks of a giant oilfield where oil has previously been interpreted as having preserved higher porosity on the crest. The results tend to support this existing model, whereby the oil inhibited precipitation of calcite cement derived from nearby stylolites. The process of porosity loss by calcite cementation derived from nearby stylolites is supported by negative correlation between porosity and both amplitudes and proximity of stylolites. The volume of calcite cement calculated to have been derived from the thickness of strata dissolved on the flanks closely matches the overall porosity difference between the crestal wells (25%) and the flank wells (13 -18%). And the crest/flank thickness difference is approximately matched by the difference in the sums of stylolite amplitudes between crestal and flank cores.

Abundant stylolites are present near the top and base of the studied reservoir zone in both crestal and flank wells, but only the flank wells have abundant stylolites throughout the main, central part of the zone. This pattern is suggested to indicate that stylolites formed before oil emplacement at the top and base of the zone, but only after oil emplacement in the center interval. Earlier timing of stylolite formation in the top and basal intervals is attributed to higher clay content and greater depositional concentration of clay.

The common occurrence of dolomite concentrated along stylolites probably results mainly from local redistribution of eogenetic dolomite. This is supported by the bulk-chemical profiles showing that magnesium variations appear to be stratigraphically determined. Higher dolomite contents throughout the lower two thirds of the reservoir zone (averaging around 9 to 12 wt. %) than in the upper one third (around 2 to 3%) are suggested to reflect differences in early dolomitization by seawater resulting from slower sedimentation rates in the lower, mud-dominated part of the zone.

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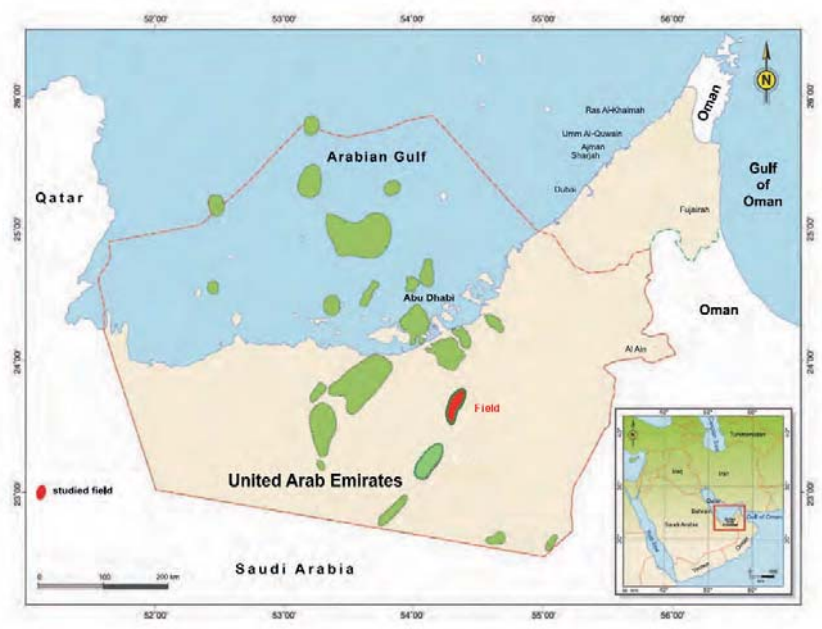
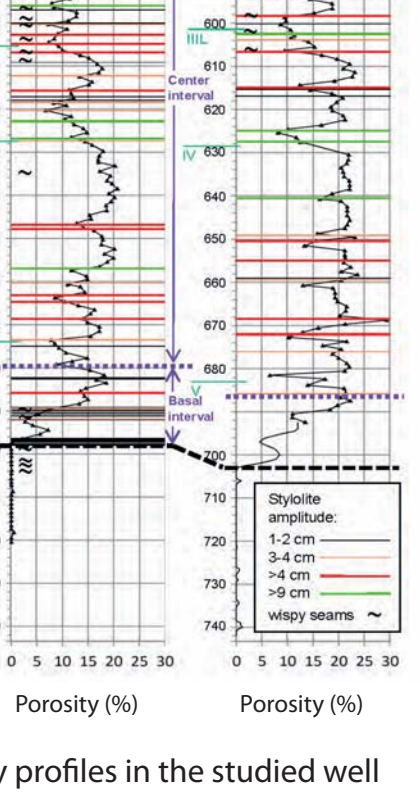
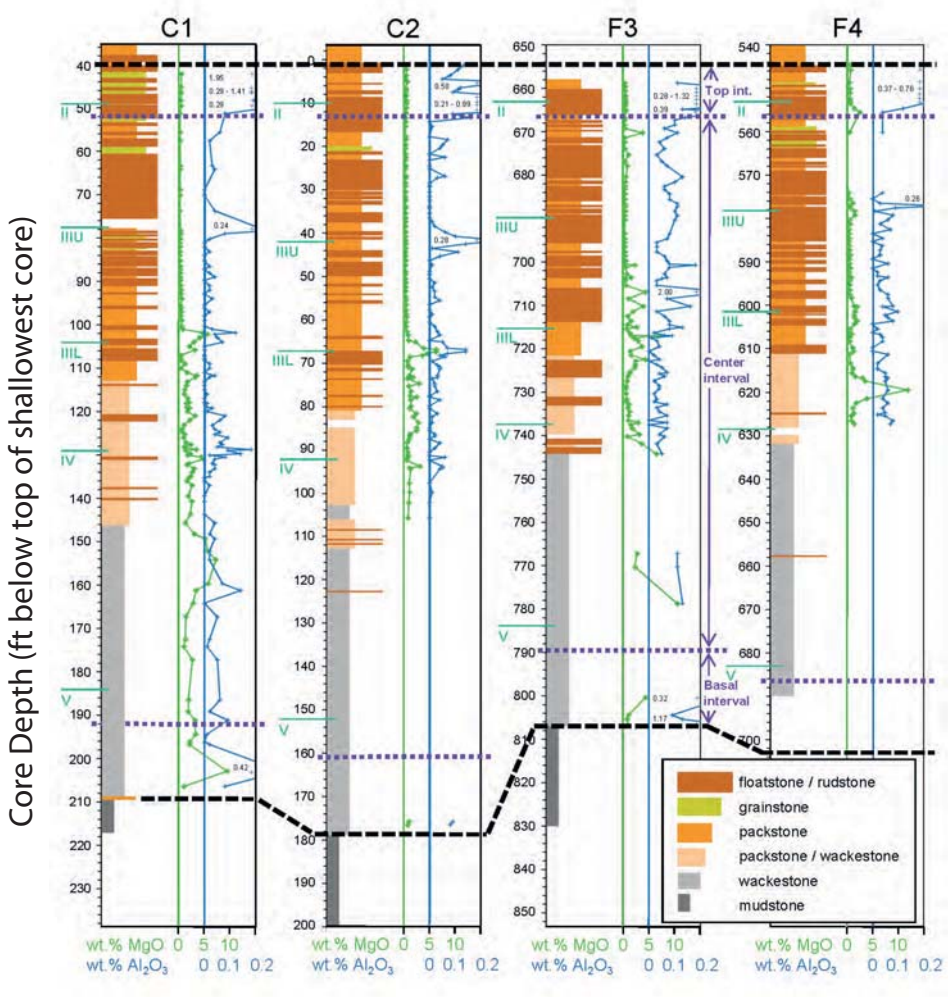


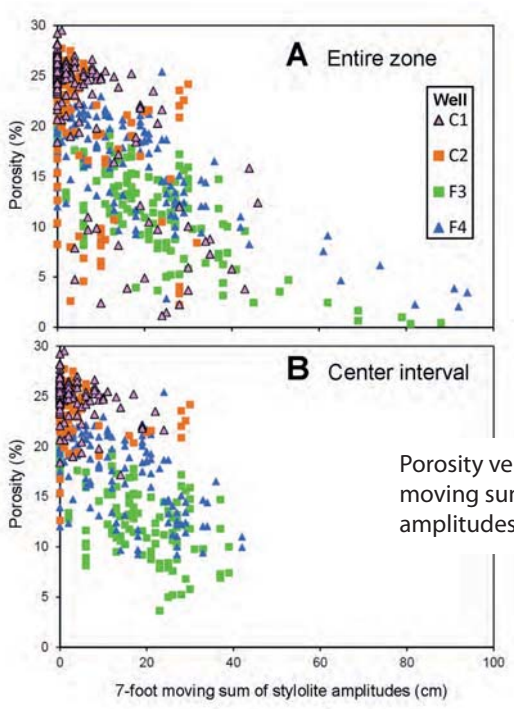
Location map (above) and structural map (right) of the studied oilfield. Colored symbols at right = wells examined in the present study (colors correspond with plotting symbols in figures below). A and B = wells of Oswald et al. (1995). Thin lines = 100-foot contours below structural crest. Thick dashed line = oil/water contact.



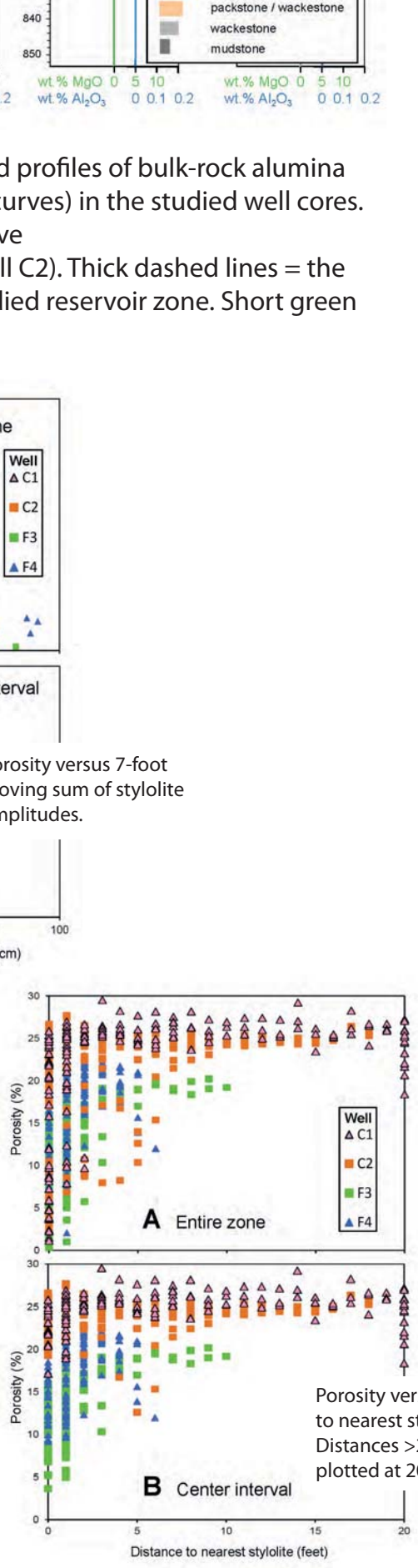


Simplified core descriptions and profiles of bulk-rock alumina (blue curves) and MgO (green curves) in the studied well cores. Depth scale is core depth relative to top of shallowest core (in well C2). Thick dashed lines = the top & basal contacts of the studied reservoir zone. Short green lines represent sub-zone tops.

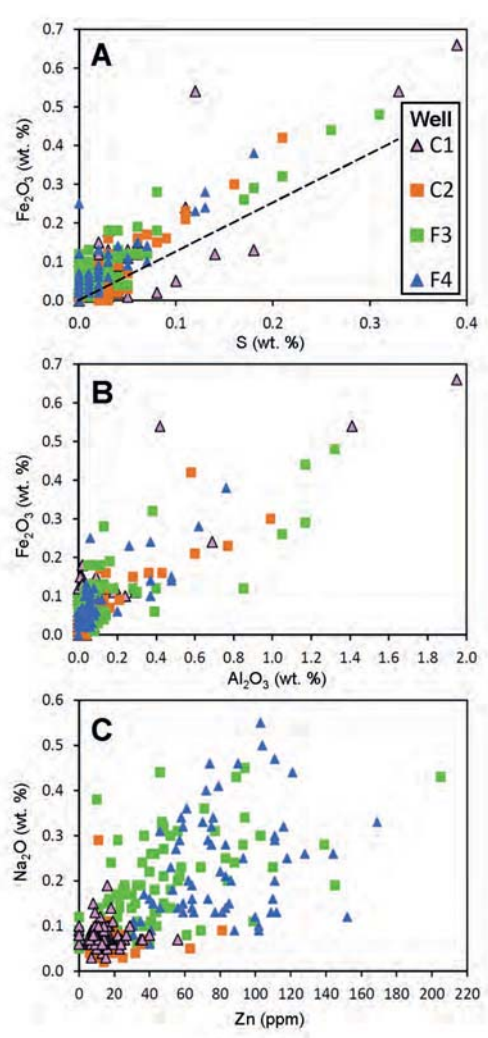
Stylolite occurrences and porosity profiles in the studied well cores. Depth scale is core depth relative to top of shallowest core (in well C2). Thick dashed lines = top & basal contacts of the studied reservoir zone. Short green lines represent sub-zone tops.



Porosity versus 7-foot moving sum of stylolite amplitudes.



Porosity versus distance to nearest stylolite. Distances >20 ft are plotted at 20 ft.



Bulk-chemical analyses:

A- Total iron as Fe2O3 vs. sulfur
Dashed line indicates variation trend resulting from varying pyrite content.

B- Total iron as Fe2O3 vs. alumina

C- Sodium vs. zinc