

Sequence stratigraphy of the Carboniferous Lisburne Group carbonates, northeastern Brooks Range, Northern Alaska

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The Carboniferous Lisburne Group carbonates, specifically the proximal upper Lisburne, is an important oil-producing reservoir at Prudhoe Bay. We have found that distal lower Lisburne reservoir facies are in coral boundstone, dolomitic, and coarse-grained bioclastic units. This differs from the proximal upper Lisburne reservoir influenced by subaerial exposure and later unconformity related diagenesis. A sequence stratigraphic interpretation is necessary to define successful exploration strategies for the distal Lisburne Group.

We have identified several sequences and corresponding systems tracts within the Lisburne Group based on bounding surfaces, parasequence and parasequence set stacking patterns, and lateral lithofacies relationships. The spatial distribution of the sequences documents overall northward onlap during the deposition of the Lisburne Group. The Pre-Permian Unconformity truncates the top sequence to the north and at least two sequences to the south. The lowermost sequence to the south has thick distal systems tracts that are interpreted to have been deposited during a long-term increase in accommodation space. Proximal systems tracts in the north, with the exception of the lowermost sequence, have a progradational geometry that thins towards the south.

A change in parasequence stacking patterns is observed between the Mississippian and Pennsylvanian Lisburne Group. We interpret the differences between sequences to be related to changes in paleoclimate. Relatively thick parasequences and non-cyclic intervals record minor migration of facies in the Mississippian sequences and are interpreted to have been deposited during a greenhouse climate. Parasequences in the Pennsylvanian sequences are thin, juxtapose deep over shallow water facies and are interpreted to have been deposited during an icehouse climate.