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Karst Controlled Reservoirs of the Jura-Cretaceous Success Formation and Mississippian Madison Group, West-Central Saskatchewan

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Abstract

In west-central Saskatchewan the Madison Group has been divided into an Upper and Lower Unit based on geophysical well log signatures, drill cuttings and core descriptions. The Lower Unit is comprised of alternating limestone and shale and the Upper Unit is represented by calcareous shale transitioning upward gradually to a muddy limestone.

Within the Madison's Upper Unit, a brecciated horizon is occasionally observed. The breccia within the interval is dominantly chert with a matrix commonly comprised of fine quartz sandstone to occasional mudstone and is interpreted as an amalgamated paleokarst system. The paleokarst system can be as much as 27m below the top of the Madison and is generally preserved in a rectilinear pattern when observed in map view.

Where the Madison subcrops, a significant regional karst-modified unit exists known as the Success Formation. This strata is a chert-rich rubble breccia that may transition to a mosaic or chaotic breccia at its base, along with green-red paleosols. The Success in the study area formed during the extended period of sub-aerial exposure and erosion of the Madison. Mapping of the Success commonly reveals a near inverse relationship to that of the Madison below. The Success thins over Madison structural highs and similarly is thickest where the Madison is structurally low. Where the Success is thickest, and much of the Madison Upper Unit is absent, it is interpreted that the Madison paleo-karst system has coalesced with the overlying Success.

The newly recognized subsurface paleokarst system of the Madison Group and the Success Formation are especially interesting due to their economic significance. Both units are considered heavy oil bearing intervals with abundant trapping opportunities due to the heterogeneous nature of paleokarst systems and their propensity for compartmentalization. This study is the first time these reservoirs have been mapped and characterized at the pool scale. This will assist in furthering the understanding and development of the economic potential of these strata.