

An Enigmatic Interval Rich in Quartz Sand-Size Particles in the Mississippian of Southeastern Saskatchewan: A Possible Solution to Its Origin Based on Sequence Stratigraphic Principles

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Abstract

The overwhelmingly carbonate succession of the Mississippian on the northeastern flank of the Williston Basin is interrupted by an interval rich in quartz sand-size particles. In places, quartz sand grains are sufficiently abundant that the interval is a dolomite-cemented quartz arenite. The arenite may grade both laterally and vertically into a sandy argillaceous dolostone, and in places the lateral equivalents of this interval may be an argillaceous dolostone with 1 to 5% quartz grains or an argillaceous dolostone completely lacking any quartz grains. The concentrations of quartz grains may range in thickness from a few centimetres to 50 m. In plan view, they may have a narrow linear appearance or a more blanket-like form. They may be interspersed with carbonate rocks or in places, with evaporites.

In Holocene and Quaternary cool-water settings, mixtures of siliciclastic and carbonate sediments are common, the carbonate components being fragmented and comminuted shell debris. However, in warm-water settings where the formation of carbonates is dependent on clear-water conditions, the presence of siliciclastics would inhibit carbonate formation. Therefore, the presence of siliciclastic sediments in a warm-water carbonate succession suggests a cessation of carbonate sedimentation and influx of siliciclastics from an external source, ideal conditions for postulating a sequence stratigraphic scenario.

The Mississippian carbonate rocks of southeastern Saskatchewan are interpreted as having been deposited in a warm-water setting, so a sequence stratigraphic approach should help to unravel the origin of the quartz-rich rocks that are commonly and, in places, mistakenly identified as the Kisbey. The Kisbey interval is interpreted to include a lowstand sequence followed by a transgressive sequence that terminates in a highstand regressive succession. In extreme southeastern Saskatchewan, the highstand regressive succession is marked by evaporites and thin interbedded carbonates commonly referred to as the Hastings and Frobisher evaporites. Applying sequence stratigraphic principles would require a significant change in perspective regarding the present stratigraphic understanding of the Alida-Kisbey-Hastings-Frobisher units, and would probably get rid of some of the confusion that exists regarding their stratigraphic relationships.

Keywords: Saskatchewan, Mississippian, sequence stratigraphy, arenite, dolostone.

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