Lithofacies and Cyclicity of Mississippian Alida-Kisbey-Frobisher interval, Southeastern Saskatchewan

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Abstract

The Osagean (Latest early to earliest Middle Mississippian) strata of the Mission Canyon Formation of Southeastern Saskatchewan consist of four stratigraphic units that are Tilston, Alida, Kisbey and Frobisher beds, in ascending order. The strata contain a number of prolific oil and gas pools in Saskatchewan and the neighboring states of North Dakota and Montana. The Alida-Kisbey-Frobisher interval, forming roughly the upper 2/3rd of the formation, is dominated by carbonate lithofacies with subordinate sandstones / siltstones and evaporites. Core, cuttings, well logs and petrographic studies of these strata in Southeastern Saskatchewan have allowed identification of lithologic attributes and their lateral and vertical stacking patterns. Seven lithofacies have been identified: i) packstone / grainstone (Facies PG), ii) mudstone / wackestone (Facies MW), iii) dolomudstone (Facies DS), iv) sandstone (Facies SS), v) sandy dolomudstone (Facies SD), vi) sandy packstone / grainstone (Facies SP) and vii) anhydrite (Facies AH). The overall depositional setting of the studied rocks is envisaged to be a peritidal environment characterized by bioclastic and oolitic, high energy subtidal shoals and associated lagoonal to tidal mudflat system. The temporal (vertical) lithofacies arrangement of the studied stratigraphic interval shows vertically-stacked rhythmic units defined by shallowing-upward cycles of basal subtidal lithofacies (PG, SP, and/or MW) grading to restricted lagoonal / tidal mudflat deposits (MW, DS, SD SS and AH). Fischer Plot analysis of these rhythmic units suggests 4th- to 5th-order Milankovitch cycles that can be amalgamated into five 3rd-order depositional cycles. Preliminary comparison with global sea level changes suggests that the cyclicity of the studied strata may correspond to the Mississippian cyclothems recognized in other parts of the world, possibly indicating eustatic origin.