Preliminary Sequence Stratigraphic Framework for a Mississippian Shelf Margin, Madison Group, South Boulder Canyon, Southwest Montana

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ABSTRACT

A well-exposed, near depositional-dip oriented, Mississippian carbonate shelf margin outcrop was studied and is placed into a sequence stratigraphic framework for the first time. The exposure is situated on southwest facing slopes above the South Boulder River, 11 kilometres south of Cardwell, Madison County, Montana. Lithostratigraphically, Mississippian Madison Group strata at South Boulder Canyon are comprised of generally poorly-exposed Lodgepole Formation calcareous shales and argillaceous carbonates grading upward into more resistant Mission Canyon Formation carbonates. Two complete and several partial stratigraphic sections were measured, the Madison Group section at South Boulder Canyon being over 300m thick. The paleogeographic setting of the carbonate shelf appears to reflect a margin facing north-northwest into the Central Montana Trough. Regionally, outer shelf and basinal deposits existed both to the north and west (Rose, 1976; Sando et al., 1981). The Madison Group at the studied outcrop is described in the context of Sonnenfeld's (1996) regional sequence stratigraphy. This defined the Madison and related strata as a second-order depositional sequence comprising five third-order component sequences, of which parts of the upper four are recognized at South Boulder Canyon. The base of the outcrop exposes the highstand (HST) of Sonnenfeld's Sequence II: cherty wackestones of the outer ramp shoaling upward into coarse skeletal and oolitic grainstones of the ramp margin. The base of Sequence III has restricted ramp interior deposits abruptly onlapping open marine facies of the uppermost Sequence II. A skeletal-oolitic grainstone complex dominates the lower half of Sequence III (lowstand to early transgressive); the late transgressive to highstand is dominated by outer to mid-ramp wackestones. A thin, in situ lowstand (LST) comprising skeletal grainstones resting abruptly on Sequence III, forms the base of Sequence IV. The remainder of this sequence consists of middle to outer ramp strata. Restricted inner ramp deposits of the basal Sequence V sharply overly these units. Above this ramp interior LST, the remainder of Sequence V comprises skeletal-oolitic units and tidal flats. The third order depositional architecture of the Madison Group at South Boulder Canyon provides a useful analogue for the subsurface. It serves to provide a better stratigraphic understanding of reservoir and non-reservoir facies relationships. A well-exposed, near depositional-dip oriented, Mississippian carbonate shelf margin outcrop was studied and is placed into a sequence stratigraphic framework for the first time. The exposure is situated on southwest facing slopes above the South Boulder River, 11 kilometres south of Cardwell, Madison County, Montana. Lithostratigraphically, Mississippian Madison Group strata at South Boulder Canyon are comprised of generally poorly-exposed Lodgepole Formation calcareous shales and argillaceous carbonates grading upward into more resistant Mission Canyon Formation carbonates. Two complete and several partial stratigraphic sections were measured, the Madison Group section at South Boulder Canyon being over 300m thick. The paleogeographic setting of the carbonate shelf appears to reflect a margin facing north-northwest into the Central Montana Trough. Regionally, outer shelf and basinal deposits existed both to the north and west (Rose, 1976; Sando et al., 1981). The Madison Group at the studied outcrop is described in the context of Sonnenfeld's (1996) regional sequence stratigraphy. This defined the Madison and related strata

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