

Deltaic Sandstones in the Upper Cretaceous Eagle Formation: South Central Montana

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Outcrops of the Upper Cretaceous Eagle Formation form the rimrocks surrounding the city of Billings, in south-central Montana. The two lowermost sandstone intervals of the Eagle Formation, the basal of which is of primary interest in this study, are exposed in and to the south and east of the city along intersecting valleys, that provide access both along and down paleo-depositional strike. Data includes 13 measured sections, 60 thin sections and photomosaics of more than 10 km of near continuous outcrop exposure.

These two sandstones are stacked en-echelon and the data demonstrate that they comprise two coarsening upwards successions. The integration of sedimentological and ichnological data indicates that deposition of both sandstone bodies occurred within environments best fitting a deltaic setting. The lower sandstone interval gradationally overlies shales of the Telegraph Creek Formation and is comprised of 3 dominating facies stacked in an overall ascending order within the coarsening upwards succession.

Facies 1 is predominantly a very fine grained muddy sandstone. Extensive bioturbation destroyed all primary sedimentary structures. Trace fossils include Ophiomorpha, Terebellina, and Skolithos. Facies 1 is interpreted to be the primary deposit of an environment sheltered from high wave energy along the delta front.

Facies 2 is an interval of interbedded fine grained sandstones and silty sandstones. The sandstone beds have an average thickness of 15 to 20 cm, fine upwards, are sharp based, dominated by planar lamination, and show a moderate degree of bioturbation. Individual silty sandstone beds have an average thickness of 5 to 10 cm, contain planar lamination, locally contain terrestrial organic matter, and have a moderate degree of bioturbation. Trace fossils include Planolites, Ophiomorpha, Skolithos, and Diplocraterion. Facies 2 was deposited in a more proximal position along the delta front than facies 1.

Facies 3 is an interval of fine grained sandstone beds separated by very thin (1 cm or less) silty sandstone layers. The sandstone beds thicken upwards from 20 to 70 cm. Individual beds fine upwards, are sharp based, dominated by intervals of planar lamination or massive bedding, locally contain 30 cm high troughs, and have little bioturbation. Trace fossils include Monocraterion, Skolithos, Planolites, and Ophiomorpha. Facies 3 was deposited in the most proximal delta front environment.

The lower sandstone has a maximum thickness of 20 m. The contact between the lower sandstone and the overlying second en-echelon sandstone is defined by a burrowed cemented horizon. The second sandstone has a maximum thickness of 10 m and consists of facies 1 in the lower part and facies 3 in the upper part. Facies 2 is absent from the second sandstone. Facies thickness varies laterally in both sandstones. Both sandstones are truncated by a regional Glossifungites horizon that separates these sandstones from the sandstone of the upper Eagle Formation.