

Early Cretaceous Syntectonic Sedimentation along the Southern Margin of the Colville Foredeep - Stratigraphy and Depositional Facies in the lower Fortress Mountain Formation

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Field work along the Philip Smith Mountains and central Brooks Range front has produced a composite stratigraphy of the poorly known, Lower Cretaceous (mostly Aptian?) lower Fortress Mountain Formation (Kfml). Stratigraphic elements assembled from scattered outcrops of structurally dismembered strata include (1) basal olistostrome, (2) basin-floor fan system, (3) marine slope succession, and (4) upper slope - outer shelf facies that grade into shallow marine to nonmarine deposits of the upper Fortress Mountain Formation (Kfmu).

Locally present olistostromes include chaotic deposits of gravity mass wasting (debris flows, slumps, and slides) in which olistoliths range from pebble-sized clasts of chert to building-sized (10s of meters) blocks of chert, shale, and coquinoid limestone in a matrix of silty mudstone to scaly argillite. These are locally interbedded with, or overlapped by, less chaotic sandstone and conglomerate sediment-gravity-flow deposits. Clasts and blocks in these deposits are similar in composition to lithologies present in nearby exposures of tectonic mélange. Thus, we infer derivation from, and deposition on, an active tectonic wedge comprising slivers of the Endicott Mountains and higher allochthons.

The basin-floor fan system includes sediment-gravity-flow deposits comprising sandstone through cobble conglomerate of the Cobblestone Sandstone Member of the Fortress Mountain Formation (Kfmc). Outcrop observations and regional distribution of the Kfmc suggest that it onlaps and interfingers with the basal olistostrome, and that northward-bulging promontories of the underlying tectonic wedge may have formed western and eastern margins of a broad depocenter in which the Kfmc was accommodated.

The Kfml slope succession comprises a kilometer or more of silty mudstone, siltstone, and local sandstone. Various slope facies are distinguished based on the occurrence of outcrop-scale gravity-mass-failure features, including contractional folds in lower slope facies and rotated blocks of strata bounded by extensional faults in upper slope facies. The slope succession also includes incised channels containing sediment-gravity-flow deposits of sandstone and pebble to cobble conglomerate. Hand-speciman petrofacies of the incised slope-channel deposits include clast compositions and textures intermediate between those of Kfmc and Kfmu, suggesting that the slope channels were intermediate in the sediment-dispersal system between proximal non-marine environments (Kfmu) and distal basin-floor fans (Kfmc).

The Kfml-Kfmu transitional facies, where exposed in Atigun Gorge, comprise interfingering silty mudstone of the upper slope and overlying sandstone deposited by sediment-gravity flows. We interpret the sandstone as a series of event beds deposited near the shelf edge, perhaps as hyperpycnal flows during flooding of the fluvial feeder systems. These are overlain by stacked shoreface or delta-front parasequences of the Kfmu.

Many elements of the Kfml succession indicate deposition at the front of an active tectonic wedge and, in fact, southward onlap of the entire section onto that wedge. Moreover, the thickness and vertical succession of facies is typical of a progradational depositional system characterized by a shelf-slope-rise geometry and northward offlap into the deep Colville basin. In essence, this depositional succession defines the southern, tectonically active margin of the basin during the Early Cretaceous.