

Wedge-tip Relations of the Early Cretaceous Brooks Range Deformation Front Near the Dalton Highway

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The wedge-tip for the main phase of Brookian deformation, characterized by emplacement of far-travelled allochthons in the latest Jurassic and Early Cretaceous, lies buried beneath younger deposits and deformed by younger structures in the central and western Brooks Range. East of the Dalton Highway, however, the Early Cretaceous wedge-tip is exhumed along the margin of the northeast Brooks Range by uplift of the younger northeastern salient of the range. Exposures in this area reveal the structural architecture of the frontal part of the lowermost Endicott Mountains allochthon (EMA) and its relation to the axial part of the adjacent Colville foreland basin and provide a framework for understanding the petroleum resources in the foothills belt of the Brooks Range.

Near the Ribdon River, the base of the EMA is exposed on the flank of the northwest-trending ridge west of Elusive Lake. There, the allochthon consists largely of a thick sequence of moderately deformed slope and base-of-slope Brookian turbidites (Okpikruak Formation) that rest on a basal detachment in the Kingak Shale of the autochthon. Affiliation with EMA is demonstrated by local remnants of the Valanginian coquinoid limestone and associated clay shale and by fault slivers of the Triassic Otuk Formation near the base of the allochthon. To the northwest beneath a hanging wall syncline, the basal detachment cuts upsection in the footwall from the Kingak through a massive dark siltstone unit with floating chert pebbles that is inferred to be correlative to the Hauterivian-Barremian pebble shale unit on the Barrow Arch, and into a section of indurated sandstone-rich Brookian turbidites (probably Aptian) that are interpreted to compose the basal strata of the axial part of the Colville Basin. To the south and resting above the EMA are thin-bedded concretion-bearing siltstone turbidites of the lower part of the Aptian-Albian Fortress Mountain Formation. These strata are interpreted to depositionally onlap EMA at their northern limit of exposure. Down plunge to the west, they pass upwards into coarse-grained deposits of the upper Fortress Mountain exposed on the northern flank of Atigun syncline. This configuration suggests that the Fortress Mountain was deposited in a wedge-top basin formed by thrusting of the EMA onto the axial deposits of the Colville Basin in the Aptian or Albian. Subsequent thicker skinned northwest-directed Tertiary thrusts have beheaded the wedge-tip succession on the Atigun Gorge thrust to the south and back-rotated the entire deformation front on other thrusts on the north, forming the Atigun syncline.

These relations suggest that the wedge-tip of the EMA in the subsurface to the west of the study area consists largely of deformed post-Valanginian Brookian turbidites of the Okpikruak Formation that are overlain by younger wedge-top deposits of the Fortress Mountain Formation. Stratigraphically lower units of EMA that may hold promise as petroleum reservoir units, such as the carbonate rocks of the Carboniferous Lisburne Group, are limited to more southerly areas of the foothills belt where the basal thrust cuts deeper into the hanging

wall succession of EMA. The Early Cretaceous wedge-tip was subsequently buried by Colville basin deposits and imbricated by a younger system of thrusts and reverse faults in the early Tertiary.