DETACHMENT TECTONICS IN THE SADLEROCHIT AND SHULBIK MOUNTAINS AND APPLICATIONS FOR EXPLORATION BENEATH THE COASTAL PLAIN, ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA

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ABSTRACT

Preliminary field investigations suggest three detachments in the Sadlerochit and Shublik Mountains: (1) the Kingak Shale; (2) along the pre-Mississippian unconformity; and 3) within the pre-Mississippian basement. The Kingak Shale décollement is the sole thrust for divergently branching subsidiary thrusts that repeat the Cretaceous Kemik Sandstone Member and overlying section. Well exposed footwall and hangingwall cut-offs together with multiple repetitions of Jurassic and Cretaceous over short distances demonstrate the detachment and provide permissive evidence of large scale shortening. The detachment along the pre-Mississippian unconformity is not a sole thrust for subsidiary thrust faults. It is marked by cleavage development and folding of the overlying Mississippian and younger rocks in marked disharmony with the underlying homoclinal pre-Mississippian strata. Detachment within the pre-Mississippian basement is not exposed but is interpreted from cumulative shortening across thrust faults observed and inferred in the Sadlerochit and Shublik Mountains. As envisioned, it would be a shallow south-dipping floor thrust for subsidiary faults largely controlled by the basement infrastructure. Thrust faults that cut the overlying Mississippian and younger section have horizontal displacements of 3-5 miles (5-8 km) and emplace pre-Mississippian rocks on Cretaceous strata. A large number of smaller thrust faults, responsible for deformation of the pre-Mississippian surface contribute to shortening. Structures involving the pre-Mississippian section trend east-west whereas earlier-formed structures related to the Kingak Shale décollment trend east-northeast to west-southwest. Possible exploration leads beneath the coastal plain include: (1) very large broad basement-involved structural culminations that may have subtle seismic expressions, and (2) pre-Mississippian potential reservoirs thrust over Cretaceous source beds. Possible applications for regional seismic interpretation include: (1) a means of discriminating basement-involved structures from pre-existing basement-detached structures, and (2) suggestion that two broadly different structural patterns exist under the coastal plain.

NORTHEASTERN BROOKS RANGE, ALASKA: NEW EVIDENCE FOR COMPLEX THIN-SKINNED THRUSTING

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ABSTRACT

Extensive fieldwork has shed new light on the style of deformation in the Franklin, Romanzof and British Mountains of the northeastern Brooks Range. Bedding-parallel thrusting controls the structure and two major décollements are recognized. In the mountain belt, the lower one lies variably at the base of the Kanayut, Kekiktuk or Kayak Formations; near the Sadlerochit and Shublik Mountains, it steps down into the Katakturk Dolomite. The upper décollement is poorly exposed in the mountains and lies in the Kingak shales. Locally these are removed by Early Cretaceous erosion and the décollement steps up-sequence.

The two décollements separate three tectonic sequences which deform differently. Firstly, Basement below the lower décollement: it deforms into a set of thrust duplexes; the core of these is well exposed in the Franklin Mountains; the Sagavanirktok sidewall ramp is a major Basement structure which causes the northern swing in the Brooks Range mountain front. Secondly, the Lower Cover between the two décollements: it deforms more complexly than Basement by both passive drape over the underlying duplexes and by active thrust stacking; large scale buckle folding occurs in a shear zone above the Sagavanirktok sidewall ramp. Thirdly, the Upper Cover above the upper décollement: it is poorly preserved in the mountains as allochthonous klippen in depressions in the Basement and Lower Cover duplexes.

Crustal shortening across the eastern Brooks Range is estimated by two-dimensional section balancing at more than 250 miles (400 km). This is substantially more than previous estimates and is comparable to those for the western Brooks Range. The inferred lack of relative rotation between the western and eastern Brooks Range does not substantiate a rotational opening for the Arctic Ocean.

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