Origin of the Northeast Alaskan Orocline

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Summary

The northeast Alaskan orocline is a latest Cretaceous-Early Tertiary feature formed by a complex interplay of far-field tectonic drivers and local boundary conditions.

Introduction

In the 1980's the indentor tectonics model became popular in the interpretation of convergent zones bounded by fault systems with apparently conjugate geometry. As applied to the latest Cretaceous-Tertiary northeast Alaskan orocline (Collot et al., 1984), this model failed to account for much of the north Yukon Fold Complex, although a regional kinematic setting dominated by east-west convergence was supported (e.g., Lane, 1998). The northeast Alaskan orocline refers to the continuous curvature of structural trends from east-west in the Brooks Range, through the arcuate Beaufort Foldbelt into the north-south trend of the North Yukon Fold Complex (Fig. 1). Most of the deformation in the region of the orocline occurred in the ~70-45 Ma time interval, although the age of onset is approximate (e.g., Lane and Dietrich, 1995; Lane, 2004). Although more than 1000 km from plate boundaries, two sets of tectonic interactions are responsible. First, northward emplacement of Alaskan terranes on strike-slip faults within the Cordillera and subduction of Pacific-side plates were responsible for widespread north-directed displacements in Alaska and Canada. Second, east-west convergence likely related to latest Cretaceous - Early Tertiary opening of the north Atlantic Ocean has been identified as the probable driver of east-west shortening that was more localized in the area of the orocline (Lane, 1998, and references therein).

Conclusions

Interactions between these far-field tectonic drivers and local boundary conditions, including the north-facing Beaufort Sea continental margin of Early to mid-Cretaceous age, an ancient promontory of continental crust (the Yukon stable block) and thermally softened lithosphere in the previously-rifted northern Yukon region, can explain all the distinctive features of this orocline (Fig. 1). These features include the broad arc of the orocline itself, the 500 km long north-south trending North Yukon Fold Complex, the eccentric distribution of high-strain zones, the Yukon Flats and Old Crow Tertiary piggyback basins, locally important Paleogene magmatism, and perhaps also an apparent kink in the Arctic Alaskan regional gravity low. Consequently, some inferences can be made regarding where the lower crust may have participated in the deformation.

An improved understanding of this latest Cretaceous - Early Tertiary deformation history will lead to a better-defined model for the geological evolution of the Late Cretaceous post-rift,

pre-orogenic Beaufort-Mackenzie continental margin. This region contains important oil and gas resources. A more refined geological framework will provide a more accurate basis for models of basin and hydrocarbon evolution.

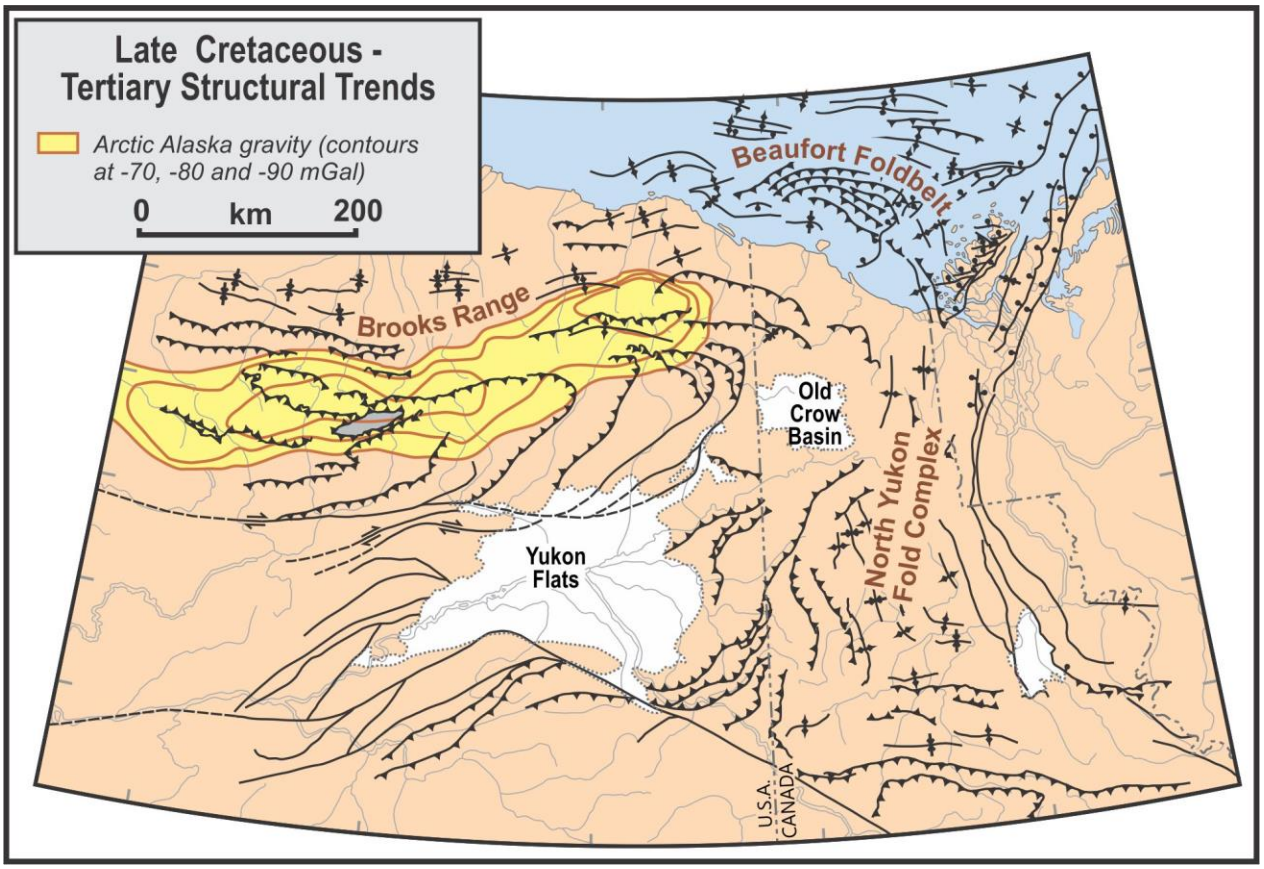

Figure 1. Regional structural trends in northeastern Alaska and northern Yukon. Structural trends in the Brooks Range, Beaufort Foldbelt and North Yukon Fold Complex together define the northeast Alaskan orocline (simplified from Lane, 1998, and references therein).

References

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