Contrast in Style and Evolution of Structures Between the Central and Eastern Foothills of the Brooks Range

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Structures differ significantly between the central and eastern foothills of the Brooks Range in their character, orientation, age, and origin, as does the stratigraphy involved in those structures. The transition corresponds with the boundary between the east-trending range front of the central Brooks Range and the northward salient of the northeastern Brooks Range (NEBR). Structural studies associated with the foothills mapping project of the Alaska Division of Geological & Geophysical Surveys have documented these differences, which have important implications for the character and timing of petroleum generation, migration, and trap formation in the foothills.

Early Cretaceous emplacement of the Endicott Mts. allochthon (EMA) as a wedge provided the framework for later deformation of the central foothills. Olistostromes (Okpikruak) were deposited on the wedge late during its emplacement, followed by more proximal deposits (Fortress Mt.). Paleocene reactivation of the wedge formed the present mountain front and caused breaching thrusts and folding in the wedge and its cover. A low-taper triangle zone formed to the north in the Brookian foreland basin deposits. Large anticlines formed above a detachment near the base of the Brookian and were cut locally by north- or south-dipping thrusts, favored by a mechanical stratigraphy with a thick competent unit (Nanushuk Fm.) overlying a thick incompetent unit (Torok Fm.). The back-thrust under the roof of this triangle zone is exposed to the south along the Tuktu escarpment, which overlies the tip of the EMA wedge.

Paleocene deformation formed E-trending structures along the full length of the Brooks Range and its foothills. To the east, the northward salient of the NEBR formed north of the EMA wedge in Eocene and younger time. Mostly ENE-trending structures overprinted older foothills structures and deformation migrated northward into different stratigraphy. This deformation occurred in multiple phases, and structural style and orientation varied in time and space. Some differences reflect relative sequence but do not uniquely indicate absolute age of deformation. Folding and imbrication above detachments in Kingak Shale and higher incompetent units occurred before detachment of basement formed large hangingwall anticlines that continue upward through the entire section. Minor parasitic folds and thrust faults are present above several detachment intervals, but the eastward change in the mechanical stratigraphy of the foreland basin deposits does not favor formation of the large detachment folds characteristic of the central foothills. E-trending anticlines that formed to the north above unusually steep faults reflect reactivation of basement faults, perhaps with a right-lateral component.