Structural and Stratigraphic Implications of Detailed Geologic Mapping of Ellesmerian and Brookian Units in the Echooka and Ivishak Rivers Region, East-central North Slope, Alaska

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The North Slope foothills belt provides a unique opportunity to examine surface exposures of stratigraphic intervals that bear on the region's petroleum resources as well as local oil and gas prospectivity in the southern Colville basin. To this end, geologists from Alaska Division of Geological & Geophysical Surveys (DGGS), Alaska Division of Oil and Gas, and University of Alaska Fairbanks in 2009 extended our understanding of the region's geology by mapping ~500^2 miles adjacent to other recent DGGS mapping in the foothills belt. The map area lies in a key structural position that spans the transition from higher-relief basement-involved structures in the east and south to thin-skinned deformation of Brookian strata in the west and north. Local structure is strongly influenced by mechanical stratigraphy and generally comprises: 1) detachment folds in the Ellesmerian sequence, which constitutes the basement-cored Echooka anticlinorium's roof layer; and 2) a complex fold-and-thrust belt in the Brookian foreland basin deposits, which lie north of the prominent topographic range front. The Ivishak River's southern extent within the fold-and-thrust belt marks an abrupt transition westward from open and upright folds to tight and strongly overturned folds northwest of the southwest-plunging Echooka anticlinorium. This may reflect strain partitioning between northwest-striking transverse faults or transfer of displacement to shallower detachments at a lateral ramp. Key stratigraphic observations include new insights into the mid-Cretaceous Gilead succession, a >850-m-thick sand-rich, locally petroliferous package comprising dominantly sediment gravity flow deposits. We interpret these facies to record deposition in toe-of-slope to basin-axial environments, a setting that may have prospective subsurface equivalents to the west. Gilead strata thin and fine markedly from south to north across the map area, condensing entirely into Cretaceous Hue Shale. Additionally, we recognize two mappable units within the distal Hue Shale that are regionally separated by an intervening tongue of sand-prone Upper Cretaceous Seabee Formation; the latter formation—stratigraphically encased by excellent Hue source-rock facies—commonly exhibits a strong hydrocarbon odor. Also highlighted by this study are rare occurrences of volcanic and hypabyssal(?) rocks within the Carboniferous Lisburne Group that crop out southeast of the mountain front near the Ivishak River. Pending analytical results, these igneous rocks may provide local absolute age control and yield insight into the tectonic setting of this vast carbonate platform.