STRATIGRAPHY, STRUCTURE, AND PALINSPASTIC SYNTHESIS OF THE WESTERN BROOKS RANGE, NORTHWESTERN ALASKA*

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ABSTRACT

This report is an effort to describe and decipher the mid-Paleozoic to Lower Cretaceous stratigraphy and the orogenic evolution of the western Brooks Range. The western Brooks Range primarily is composed of stacks of complexly deformed thrust sheets that contain mostly coeval sequences of rocks with slightly different lithologic facies. In order to simplify the thrust-faulted stratigraphy and palinspastic restoration, the rocks are grouped into eight principal structural levels. The lowest structural level is believed to be autochthonous or parautochthonous and above that, each succeeding level is designated allochthon one through seven. Allochthon seven is composed of the remnants of an extensive ophiolite sheet. Allochthon six is composed of pillow basalt with subordinate intermediate volcanic rocks, chert, and Devonian limestone. It is not certain whether this allochthon was formed in a continental or oceanic setting. Allochthons five through one consist of distinctive and coeval sequences of Devonian to Lower Cretaceous sedimentary rocks that were deposited in a continental setting. The present geographic distribution of each structural level is shown on the allochthon map of the western Brooks Range.

The stratigraphy of the southern part of northern Alaska has been reconstructed by systematically unstacking lower allochthons to the north of higher allochthons. The palinspastic map that results from this procedure shows that the minimum thrust displacement between allochthon seven and the autochthon is approximately 700 to 800 km. Schematic cross sections drawn across the palinspastic map show how the stratigraphy of the southern part of northern Alaska most likely appeared prior to the orogeny. During Devonian and Mississippian time, the sedimentary sequences that are now part of allochthons one to five are inferred to have been deposited in an ensialic basin with both northern and southern margins. During Pennsylvanian time, the sequences seem to have become part of a southward-sloping continental shelf when a southern land area moved away from northern Alaska by an inferred plate tectonic process of rifting or strike-slip motion. In Early Jurassic time just prior to the Brooks Range orogeny, northern Alaska probably was an extensive continental shelf with oceanic conditions to the south and land to the north.

The Brooks Range orogeny seems to have begun in the Middle Jurassic as the Arctic Alaska plate was underthrust (subducted) southward beneath oceanic crust of allochthon seven. At progressively later stages in the underthrusting process, the upper parts of the continental shelf were detached from the subthrust basement on which they were deposited, resulting in the other allochthons of the western Brooks Range. The period of major thrusting ceased by Albian time in the Early Cretaceous. During middle and Late Cretaceous time, epeirogenic uplift in the Brooks Range caused large quantities of clastic detritus to be shed into successor basins to the north and south. Broad folds and reverse faults in Upper Cretaceous sediments north of the Brooks Range provide evidence for a later period(s) of less intense deformation in northern Alaska.

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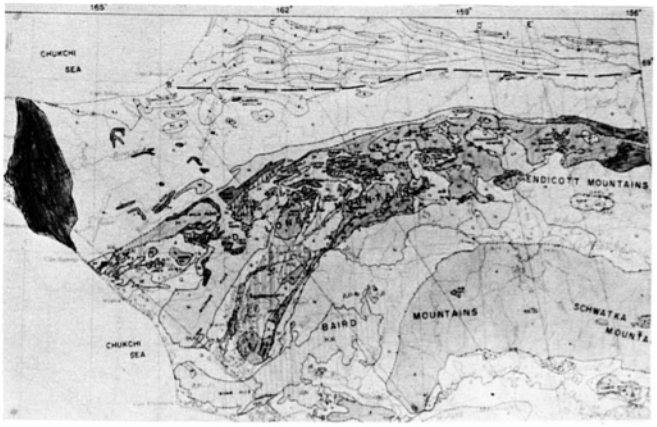

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