CRETACEOUS AND TERTIARY (BROOKIAN) DEPOSITIONAL STYLE ON THE BARROW ARCH, NORTH SLOPE, ALASKA

T. S. Collett and K. J. Bird
U. S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
415-856-7029

C. M. Molenaar
U. S. Geological Survey
Box 25046, DFC, MS 940
Denver, CO 80225

ABSTRACT

Throughout Cretaceous and Tertiary time on the North Slope, clastic debris was shed northward from the rising ancestral Brooks Range to fill the adjacent foredeep and to prograde northeasterly across the subsiding Barrow Arch to form a passive margin sequence. Study of these southern source sedimentary rocks, known as the Brookian sequence, in wells and on seismic records along the Barrow Arch in the National Petroleum Reserve in Alaska (NPRA) and only in wells east of NPRA shows a consistent style of deposition. This style is characterized on seismic reflection records by a distinct topset-foreset-bottomset profile which is inferred to represent a time line and thus a depositional profile.

Topset reflectors coincide with deltaic and shelf deposits. Near the "shelf break", the boundary between topset and foreset reflectors, the distal topset and foreset reflectors coincide with fine-grained marine siltstone and mudstone. Bottomset reflectors coincide with interbedded turbidite sandstone and marine shale near the base of the "slope". Away from the base of the slope, bottomset deposits become progressively thinner and are composed primarily of organic-rich shale.

Cretaceous and Tertiary rocks along the Barrow Arch record several significant transgressions and regressions. The last stages of deposition of the Ellesmerian sequence and drowning of the remnant of the northern land mass is represented by a upper Neocomian transgressive marine sandstone grading upward into marine shale. The boundary between Ellesmerian (northern source) and Brookian (southern source) sequences lies within a distal condensed, high gamma-ray reading shale (the gamma-ray zone or HRZ). Subsequent progradation from the southwest to the northeast deposited the characteristic passive margin sequence. This prograding sequence has been interrupted by a minimum of three marine transgressions, once during the Cenomanian, again in the Campanian and most recently during the Eocene. The onshore North Slope record from Oligocene to Pleistocene is all deltaic topset deposition which presently cannot be resolved into any additional transgressions.

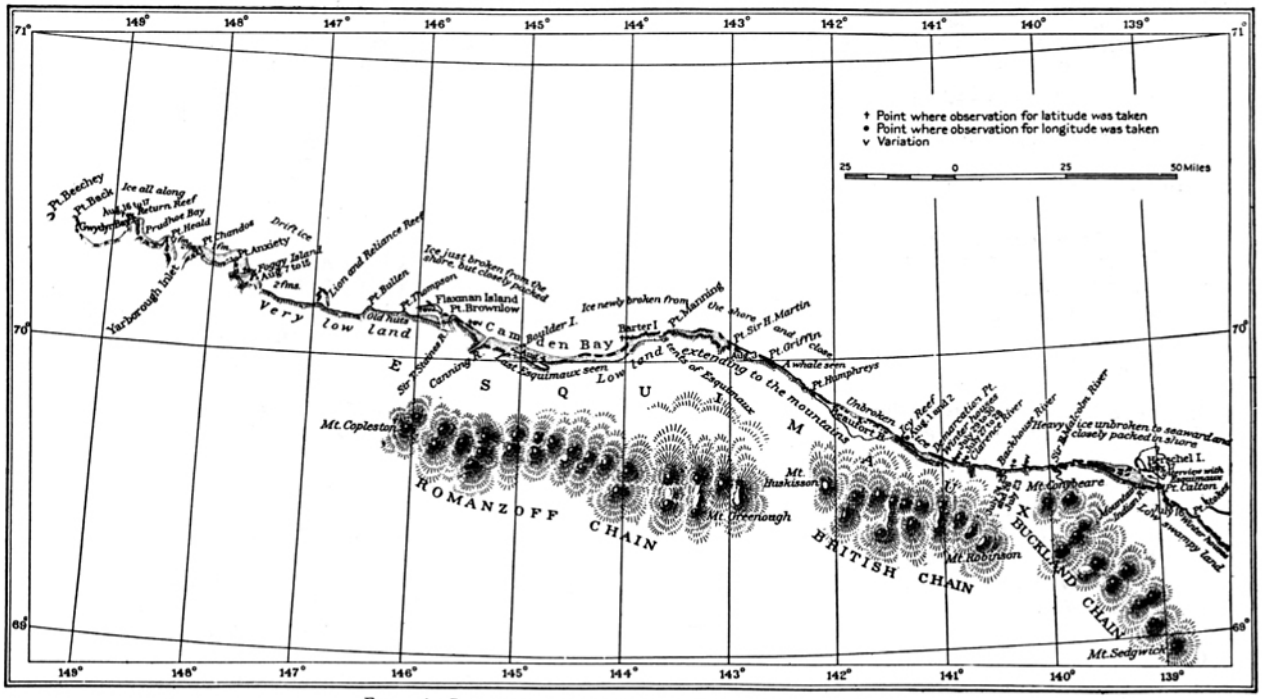

FIGURE 4.—Reproduction of Franklin's map of the north coast of Alaska.

Leffingwell, E. deK., 1919, The Canning River region, Alaska: U.S. Geological Survey Professional Paper 109, p. 70.

Alaskan North Slope Geology, Volumes I and II, 1987