LATE QUATERNARY DEPOSITIONAL HISTORY OF THE ALASKAN BEAUFORT SHELF

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ABSTRACT

Diverse nonmarine and shallow marine deposits blanketing the coastal plain and continental shelf of northern Alaska are known collectively as the Gubik Formation. In the Beaufort coastal region between Barrow and Prudhoe Bay and along the Chukchi coastline southwest of Barrow, five distinct marine subunits have been recognized within the Gubik, ranging in age from middle Pliocene to late Pleistocene. A sixth pre-Holocene transgressive marine subunit, about a meter thick and bearing abundant ice-striated dropstones that originated in the Canadian Arctic Islands, is present along much of the Alaskan Beaufort coast. The aggregate thickness of the Gubik Formation on the coastal plain is no more than a few tens of meters. Offshore beneath the Beaufort shelf, however, the Gubik Formation is locally thicker than 330 feet (100 m) and includes not only deposits that probably correlate with those mapped onshore, but also subunits of intermediate and younger ages. These have been studied mainly through the interpretation of a network of high-resolution seismic reflection profiles that covers most of the Alaskan Beaufort shelf at 10- to 20-mile (18-35 km) intervals seaward of the 80-foot (25-m) isobath.

In general, the Gubik Formation offshore appears to be a stack of wedge-shaped transgressive marine units that thicken toward the shelf break, beyond which they are disrupted by active slumps and landslides. This idealized geometry is altered in the area east of Canning River, where active faulting and folding have created persistent local highs and depocenters, and in the area between Smith and eastern Harrison Bays, where a complicated Quaternary drainage history has resulted in extensive local erosion of the marine wedges, and in the deposition of relatively large deltaic sequences.

Accumulation of the marine wedges must have occurred during periods when depositional rates were considerably higher than at present, perhaps during deglaciations of the Canadian Arctic Islands, when great volumes of sediment-bearing ice are likely to have been debouched into the Arctic Ocean.

LATE PLEISTOCENE MARINE TRANSGRESSIONS OF THE ALASKAN ARCTIC COASTAL PLAIN

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ABSTRACT

Two late Pleistocene marine transgressions of contrasting character are recorded by deposits of the Arctic Coastal Plain. Deposits of the oldest transgression extend from Harrison Bay west to near Barrow and contain a fauna that documents interglacial conditions. Five thermoluminescence (TL) dates on the marine deposits average 127 Ka and indicate a correlation with oxygen isotope stage 5e. Sedimentary structures characteristic of the swash zone occur at altitudes within the commonly accepted range 20 ±13 feet (6 ± 4m) for eustatic high sea level at that time, showing that this part of the coastal plain has been tectonically stable for the past 125,000 years.

Deposits of the youngest transgression are glaciomarine sediments that contain ice-rafted erratics of Canadian provenance. They compose the Flaxman Member of the Gubik Formation and occur locally along the Beaufort Sea coast and inland to altitudes of about 23 feet (7 m). TL dates on these sediments suggest that the Flaxman transgression occurred between 70 Ka and 80 Ka and is correlative with deposits dated to this interval that are exposed near sea level on the North Carolina coastal plain. However, the deep sea oxygen isotope record is commonly interpreted to indicate that sea level was below its modern position at that time. The present altitude of the Flaxman deposits cannot be attributed to tectonism because their distribution includes the part of the coastal plain determined to be tectonically stable for the past 125 Ka. Isostatic depression and subsequent elevation is unlikely considering the correlative deposits of North Carolina. This paradox could be explained if enormous volumes of floating glacial ice were produced by the rapid break-up of a large part of the Laurentide ice sheet, and recent work indeed suggests that the Hudson Bay Lowlands were ice free at this time (Shilts, W. W., 1984, Geol. Survey of Canada Paper 84-10).

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