

6500 BP Oldsquaw Duck (*Clangula hyemalis*) from Northern Ellesmere Island, Arctic Archipelago, Canada

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(Received 5 October 1989; accepted in revised form 23 January 1990)

ABSTRACT. A nearly complete skeleton, including partially preserved feathers, of an Oldsquaw duck (*Clangula hyemalis* L.) was recovered from Holocene marine deposits in Clements Markham Inlet, Ellesmere Island, N.W.T., Canada. The specimen was 2 m lower in the section than allochthonous terrestrial plants previously dated at 6400 ± 60 BP (SI-4314) and is estimated to be 6500 years old. These deposits represent a marine, prodeltaic sedimentary environment that emerged from the fiord as the result of postglacial isostatic uplift. Comparison of the specimen's present elevation and age with the inlet's emergence curve indicates the duck was buried in a paleowater depth of 38 m. Isostatic uplift is ubiquitous in the Canadian Arctic, exposing ocean bottoms and prodeltas. The deposits from these environments deserve closer scrutiny for fossils by Quaternary scientists, as they can contribute to a better understanding of the biologic development of the Canadian Arctic.

Key words: *Clangula hyemalis*, Oldsquaw duck, feathers, Quaternary paleontology, arctic paleontology, Holocene, Ellesmere Island

RÉSUMÉ. On a retrouvé, dans les dépôts marins de l'holocène de Clements Markham Inlet dans l'île Ellesmere située dans les T. N.-O. au Canada, un squelette presque complet (comprenant des plumes en partie conservées), d'une harelde du Nord (*Clangula hyemalis* L.). Ce spécimen se trouvait 2 m plus bas dans la coupe que des plantes terrestres allochtones datées précédemment de 6400 ± 60 avant notre ère (SI - 4314) et on évalue l'âge du squelette à 6500 ans. Ces dépôts représentent un environnement sédimentaire marin prodeltaïque, qui a émergé du fjord à la suite d'un relèvement isostatique post-glaciaire. La comparaison de la hauteur à laquelle on a découvert le spécimen et de son âge avec la courbe d'émergence du bras de mer indique que l'harelde a été enterrée dans une eau du paléolithique à une profondeur de 38 m. Le relèvement isostatique a touché tout l'Arctique canadien, exposant le fond des océans et les prodeltas. Les dépôts de ces environnements méritent d'être étudiés de façon plus approfondie par les spécialistes du quaternaire, vu que leurs fossiles pourraient aider à mieux comprendre le développement biologique de l'Arctique canadien.

Mots clés: *Clangula hyemalis*, harelde du Nord, plumes, paléontologie du quaternaire, paléontologie arctique, holocène, île Ellesmere

Traduit pour le journal par Nésida Loyer.

INTRODUCTION

Bird remains are extremely rare in the extensive nearshore marine deposits of the Canadian Arctic and Greenland. To our knowledge, only an ulna of a Dovekie (*Alle alle*) has been found in such sediments in this region, and this deposit is ca. 41 500 ± 1460 BP (GSC-2786), dating from a possible mid-Wisconsinan warm interval (Blake, 1980). Here we report the finding of a well-preserved bird skeleton from Holocene, isostatically uplifted, nearshore deposits on northern Ellesmere Island. This specimen is noteworthy because: it is an almost complete skeleton with partially preserved feathers; it is the first report of a specific early mid-Holocene bird in the Canadian High Arctic; and it occurs at the northernmost portion of its contemporary range.

LOCATION, SITE STRATIGRAPHY AND AGE

The bird specimen was collected from the inner south shore of Clements Markham Inlet (82°38'N, 68°05'W), a northeast-southwest trending embayment that penetrates the Grantland Mountains of northern Ellesmere Island (Fig. 1). Isostatic uplift caused by glacial unloading (deglaciation) began ca. 10 000 BP and has resulted in postglacial emergence reaching 123 m a.s.l. (above sea level) in the lower inlet (Bednarski, 1986). During this emergence, proglacial outwash prograded into the falling Holocene sea level, producing a series of deltas each successively inset beneath higher and older deltas. Today gullying has produced an extensive badland topography in these inactive deltaic deposits and former sea floor.

The specimen was collected at 16.5 m a.s.l. in a gully cut into the front of the deltaic complex related to a north-flowing

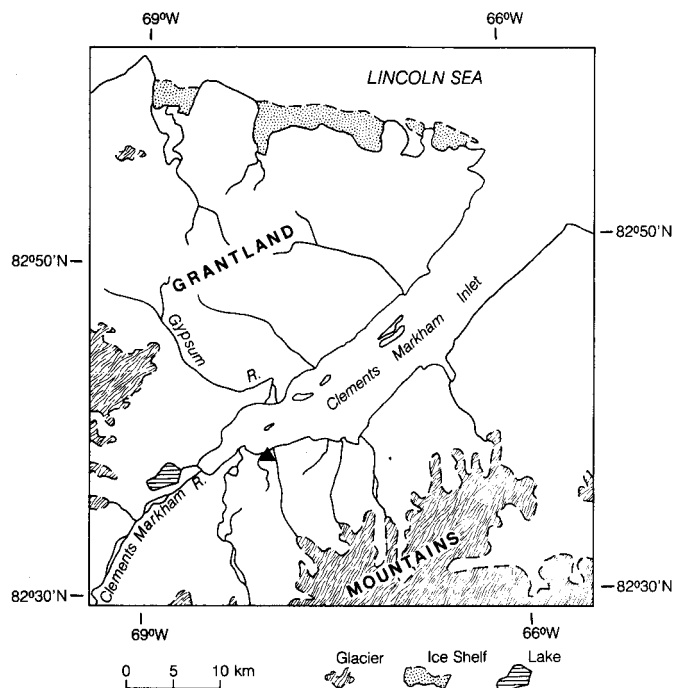


FIG. 1. Location map. Triangle marks the specimen collection site. The name Grantland Mountains is commonly used but is not formally accepted by the Canadian Permanent Committee on Geographic Names.

unnamed river draining the Grantland Mountains (Figs. 1, 2). Here the deposits consist of alternating sands, silts and clays that are interpreted as the proximal bottomset beds of

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FIG. 2. Oblique aerial photograph of the deltaic complex, view to the southeast. The arrow indicates the gully where the dated plants and the Oldsquaw specimen were collected.

deltas occurring upslope (Stewart, in press; Stewart and England, 1983). The sediments exposed in this gully also contain abundant terrestrial vascular plants and bryophytes that were previously dated 6400 ± 60 BP (SI-4314; Stewart and England, 1983). The plants' presence in these marine beds is allochthonous — i.e., they grew on the land surface, were eroded by a stream and then were transported across the delta into the fiord. Hence the plants provide a maximum age for these sediments. Comparison of the plants' age with the well-established emergence curve for lower Clements Markham Inlet indicates that they relate to a former sea level of 53 m a.s.l. and therefore they were deposited in a paleowater depth of about 36 m (Stewart and England, 1983).

While later re-examining this site, the first author discovered the bird specimen about 2.0 m below the dated plant beds. The specimen is therefore >6400 BP and was buried in a paleowater depth of 38 m. Although absolute rates are unknown, prodeltaic environments have the highest depositional rates in non-glacial fiords. Consequently, the specimen is likely of similar age to the overlying plant deposits and deposition of the bird must be approximately 6500 BP. We emphasize that the sedimentary environment of this deposit, and specimen, is a former fiord *bottom* — not a subaerial beach.

SPECIMEN

When found in the sediment the bird lay on its back with its head toward the inlet. The right wing and legs extended outwards, while the left wing was folded across its body. The skeletal material was intact and the feather preservation was particularly striking (Figs. 3, 4). Both the bones and feathers were oxidized to a reddish color. Preserved feathers have been reported previously from arctic peat deposits (Brassard and Blake, 1978; Bennike, 1986).

The specimen was identified as *Clangula hyemalis* (L.), Oldsquaw or Longtailed duck, using a reference skeleton from the faunal collection housed in the Department of Anthropology, University of Alberta, Edmonton. This identification was confirmed by Dr. C.R. Harington, National Museum of Natural Sciences, Paleobiology Division, Ottawa. The sex of the bird is uncertain, although it compares most favorably

with male specimens from Quebec and Ontario (C.R. Harington, pers. comm. 1984).

The skeletal remains represent most of an osteologically adult individual (Fig. 3) and include the following elements: most of the left portion of the cranium, part of the hyoid apparatus, most of the left dentary and the posterior segment of the right dentary, 30 tracheal rings, 17 vertebrae, 26 ribs and rib fragments, the furcula, sternum, pelvis, three fragments of scapula, left and right coracoids, left and right humeri, left and right radii, left and right ulnae, left and right ulnar carpals, part of a radial carpal, left and right car-pometacarpals, left phalanx I, digit II, three wing digits, the distal portion of the right femur, the right tibiotarsus, the right fibula, and the distal end of the right tarsometatarsus. Only the feet are not represented among the recovered remains. The specimen (NMC 43777) has been donated to the Paleobiology Division of the National Museum of Natural Sciences, Ottawa.

DISCUSSION

The specimen obviously died, sank to the fiord bottom and was buried by the prodeltaic sediments. Oldsquaws can dive as deep as 60 m (Ellarson, 1956), but even if it died at depth, gases produced from decomposition could have kept it afloat for some time. Schafer (1972) reports that bird carcasses can float as long as 38 days before sinking to the bottom. The excellent preservation of this specimen therefore may have been partially dependent on the low population densities of any scavenger species (fish or benthic organisms) in these high arctic waters. Alternatively, the preservation of feathers and most of the skeleton may relate to relatively rapid initial sinking. In either case, preservation would be further aided by rapid sediment deposition in the prodelta environment. Bennike (1986) discusses the few other reports of intact feathers from a variety of settings.

At 6500 BP the Oldsquaw specimen is the oldest Holocene bird so far reported from the Canadian High Arctic. Bennike (1986) identifies a feather within peat in North Greenland as that of a Lapland Bunting (*Calciarius lapponicus*). Based upon estimated accumulation rates extrapolated from a single radiocarbon date, that feather is thought to date between 6050 and 6650 BP. Though Lapland Buntings are a fairly regular visitor to the Hazen Plateau on Ellesmere Island (and perhaps an irregular nesting bird; Gould, 1988), on North Greenland it is considered a range extension related to a warmer early Holocene (Bennike, 1986).

Ecology and Distribution

The Oldsquaw is presently one of the most ubiquitous seaducks in northern North America. It is a truly arctic duck that winters in high latitudes where open water remains (southern Bering Sea, southwest Greenland, Great Lakes; Godfrey, 1966; Palmer, 1976). Oldsquaws are presently considered a regular breeder on northern Ellesmere Island, primarily utilizing nearshore tundra ponds. Nesting pairs do occur farther inland on the Hazen Plateau (Gould, 1988). Radiocarbon dates of basal peats indicate that such coastal pond environments were well established in the early mid-Holocene (Smol, 1983; Stewart and England, 1983; Hyvärinen, 1985; LaFarge-England, 1988). The Oldsquaw feeds in such tundra ponds as well as the nearshore marine

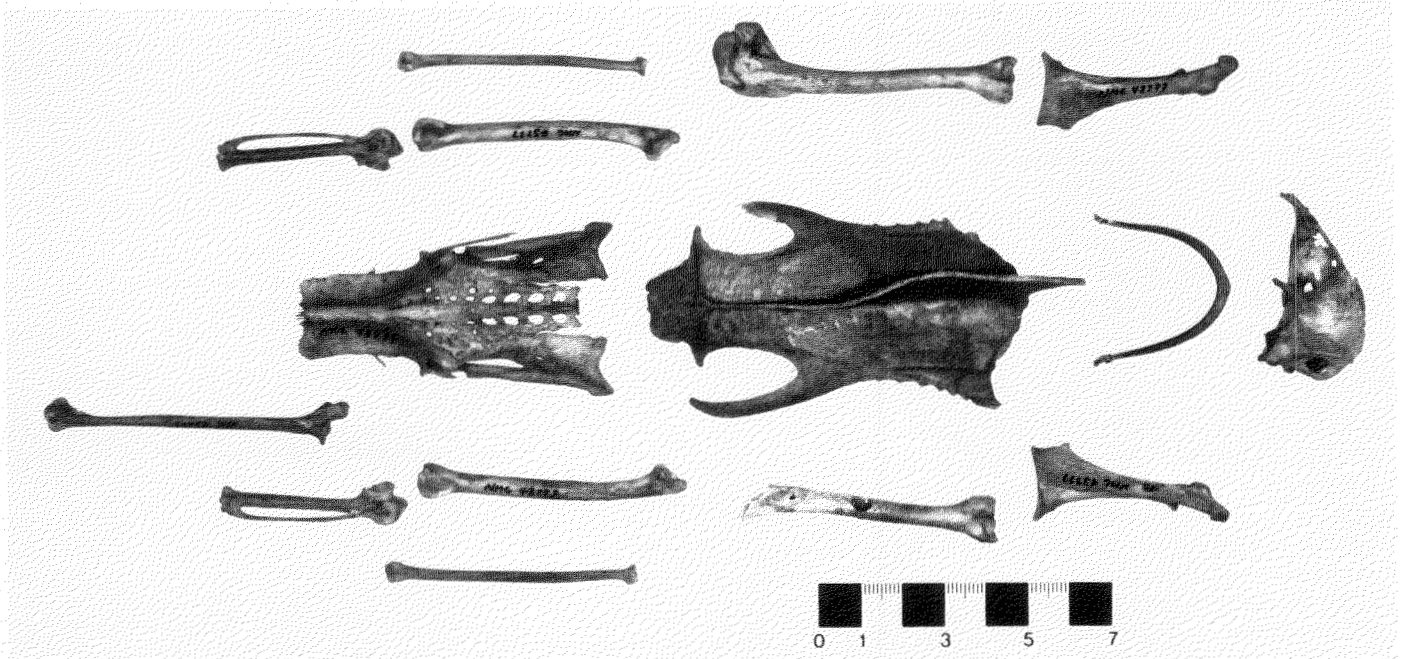


FIG. 3. Photograph of selected skeletal elements. Scale in centimetres and millimetres.

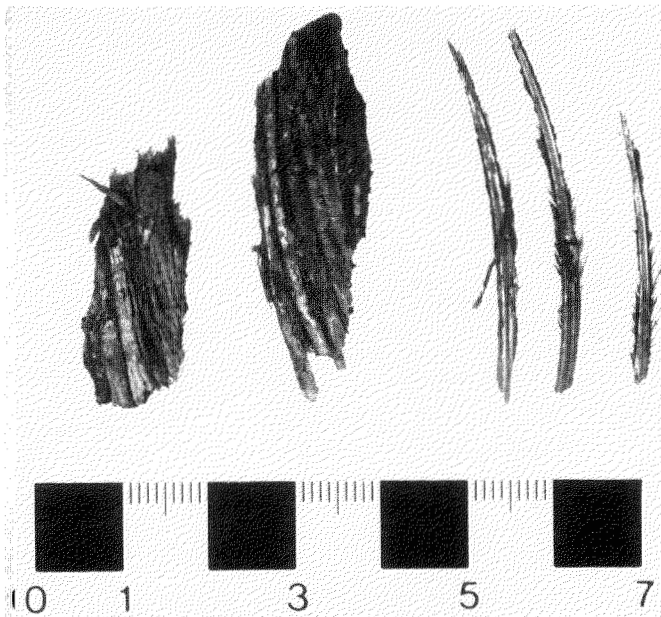


FIG. 4. Photograph of selected feathers. Scale in centimetres and millimetres.

environment (Schell, 1983). Additional information on Oldsquaws in the Canadian Arctic Islands and Greenland is presented by Hussell and Holroyd (1974), McLaren and McLaren (1982), McLaren and Alliston (1985), Alerstam *et al.* (1986), and Elander and Blomqvist (1986).

Presently, northern Ellesmere Island has an avifauna consisting of 35 species (England *et al.*, 1981). This number compares with >105 species in the southern Beaufort Sea, emphasizing the sharp latitudinal gradient in species diversity. Concomitant with this low number of species is a reduction in numbers of individuals commonly visiting these areas in summer. For example, in the southern Beaufort Sea >240 000 Oldsquaw males make the molt migration and many hundreds of thousands of Oldsquaws are reported (Richardson and Johnson, 1981; Johnson and Richardson, 1982). In Lancaster

Sound-Baffin Bay approximately 4000 individuals have been observed (McLaren and McLaren, 1982). In contrast, on west-central Ellesmere Island only about 1000 individuals have been sighted in a single season (Parmelee and Macdonald, 1960). Observations on northern Ellesmere Island indicate much smaller numbers, principally small flocks and individual pairs, sometimes with broods (Godfrey, 1953; Savile and Oliver, 1964; Nettleship and Maher, 1973; Gould, 1988). If similar numbers occurred in the mid-Holocene, then the discovery of this individual is indeed fortuitous.

The large populations and widespread distribution of Oldsquaws in the contemporary environment are echoed by the number of fossil occurrences in the Late Pleistocene. They have been reported from Azerbaijan (Serebrovsky, 1941), Denmark (Brodkorb, 1964), Fossil Lake, Oregon (Howard, 1946), Florida (Ligon, 1965) and Utah (Emslie and Heaton, 1987). The species is also reported from numerous archeological sites in Alaska (Brodkorb, 1964) and arctic Canada. McGhee (1979) recovered several elements, perhaps representing as many as 23 individuals, from two components at Port Refuge, Devon Island. Those remains are affiliated with the Independence I culture, dating to about 4000-5000 BP. Oldsquaws were also discovered in pre-Dorset deposits (3400-3800 BP) on Devon Island (McGhee, 1979). Excavations of Thule sites (approximately 1200 AD) on Baffin Island (Rick, 1980; Stenton, 1983) and Silumiut Island (Staab, 1979) have also yielded remains of this species.

Although Ploeger (1968) postulated that Oldsquaw survived the last glaciation in a high arctic refugium, the present find is the oldest Western Hemisphere high latitude specimen yet reported. Although the possibility of Wisconsinan refugia on Ellesmere Island exists (Stewart and England, 1986; Lemmen, 1989), the present specimen is too young to be relevant to this issue.

Many vertebrate fossils, particularly whale remains, are recovered from raised beach deposits in the Canadian Arctic (Dyke, 1980; Evans, 1989; Bednarski, 1990). Though fossils are less commonly recovered in the extensive nearshore

deposits of the region, a variety of specimens and species have been recorded (e.g., Harington, 1978; Blake, 1980; Stewart and England, 1986; this report). These reports are slowly expanding our understanding of Quaternary terrestrial animal distributions, paleoecology and paleoenvironments. Quaternary scientists should pay further attention to these deposits and to reports of specimens from "raised beaches" (e.g., Fielden and DeRance, 1878; Harington, 1978). Some raised beach sediments actually may be former sea floors and prodeltaic environments that could be of Holocene, full glacial, or even older age (e.g., Blake, 1980).

CONCLUSION

The Oldsquaw reported here is the earliest Holocene bird specimen yet reported in the Canadian High Arctic. The nearly complete skeleton and excellent feather preservation make the find especially noteworthy. The Oldsquaw originally died in the inlet, sank to the ocean bottom and was buried by prodeltaic sediments in a paleowater depth of 38 m. Isostatic rebound and erosion then exposed that site. The ubiquity of isostatic rebound in the Canadian Arctic and the possibility that some specimens previously reported from raised beach deposits actually may be from former sea floors indicate that these deposits and specimen localities deserve closer scrutiny from Quaternary scientists.

ACKNOWLEDGEMENTS

Funding for this study was provided by the National Science and Engineering Research Council of Canada (Grant A6880, to J. England, Department of Geography, University of Alberta) and by the Boreal Institute for Northern Studies and the Arctic Institute of North America (to T. Stewart). Logistical support was provided by Polar Continental Shelf Project, Department of Energy, Mines and Resources, Ottawa. Darryl Oakley provided superb field assistance. Specimen identification was verified by C.R. Harington, National Museum of Natural Sciences, Paleobiology Division, Ottawa. Steve Emslie (Point Reyes Bird Observatory, Stinson Beach, California) kindly provided bibliographic material. The manuscript benefitted from the critical reading of J. England and Arctic reviewers J. Bednarski and C.R. Harington.

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