Short Papers and Notes

Cardiac Physiology of Polar Bears in Winter Dens*

The physiology of polar bears is of particular interest because of their unusual adaptations, uncertain status as a species, and because of questions concerning their relationship to grizzly bears and black bears. By the use of implanted radio-capsules, we have determined that a conspicuous bradycardia exists in the grizzly bear and black bear when in a condition of dormancy in the winter den. In a series of black and grizzly bears studied under arctic and subarctic conditions, summer sleeping heart rates were seldom below 40 b/m, and all specimens demonstrated a gradually-acquired bradycardia during the winter until a rate as low as 8 b/m was reached.

We looked for the same phenomenon in two polar bears maintained together under winter den conditions during the winters of 1967-68 and 1968-69. This study was technically difficult to make because of the value of the specimens and lack of information on how to predict the behaviour of the animals. They were deprived of food and water, the standardized procedure for inducing dormancy in these experiments with bears. During the first summer, sleeping heart rates of one specimen seldom reached 50 b/m. During the winter, bradycardia was gradually acquired by this specimen until a rate of 35 b/m was achieved. At this point the experiment was terminated because of uncertainty as to whether one animal might attack the other. During the second summer, the other polar bear (weight 260 kg., 570 lbs.) was instrumented. This specimen showed no sleeping heart rates below 60 b/m during the months of July, August, and September. From October to the end of January the animals were observed by closed circuit television and were provided with minimal food. Their behaviour indicated the possibility of dormancy, and during the month of February rigid conditions to simulate denning in the outdoor environment were followed (complete darkness, isolation from camp noise, abundant hay in which to prepare winter dens, and removal of food). The temperature of the enclosure varied from −20°C. to −50°C. The instrumented animal once again initially demonstrated sleeping heart rates of 60 b/m which changed slowly week by week until rates of 27 b/m were obtained. The steady downward trend undoubtedly would have continued since both animals remained in the position of dormancy (head under belly near tail). However, on 1 March, one month after the experiment began, the radio-capsule in the abdominal cavity of the animal failed. The results from these 2 winters is strong evidence that the polar bear has the capability of reducing its circulatory activity in dormancy in the same fashion as the grizzly and black bear. In all 3 species excellent EKG recordings by radio were made in winter and summer. The S-T interval of this measurement indicated that bears have an intermediate relationship between hibernator-mammals and non-hibernators.

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*Research supported by the Arctic Institute of North America under contract with U.S. Office of Naval Research.

Early Holocene Warm Interval in Northern Alaska

New evidence for an early Holocene warm interval has been obtained from northern Alaska. This evidence is a radiocarbon date

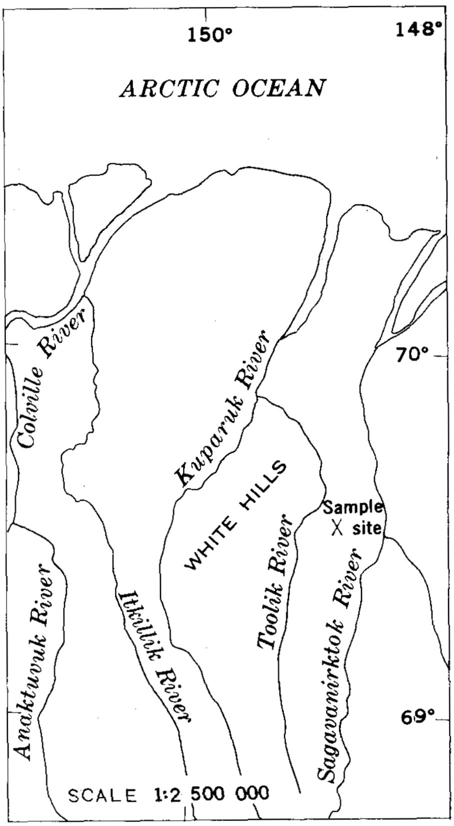

FIG. 1. White Hills section of the Arctic Coastal Plain.

of 8,400 ± 300 years B.P. (Sample number W-1993, U.S. Geological Survey Radiocarbon Laboratory) obtained from a deeply buried poplar log near the Sagavanirktok River (Fig. 1).

The early Holocene (early Recent) warm interval is well-documented by McCulloch and Hopkins[1] in the Kotzebue Sound-Seward Peninsula area of northwestern Alaska. Evidence north of the Brooks Range is less complete and McCulloch and Hopkins used radiocarbon dates from discontinuous organic horizons in permafrost at Point Barrow[2, 3], and a glacial recession along the Anaktuvuk River[4] as indicators of the warm interval. The date reported here from wood near the type area of the Itkillik Glaciation[5] confirms this correlation with the warm interval on the Seward Peninsula and defines a period of warming between the Antler Valley and Anivik Lake advances of the Itkillik Glaciation. The date confirms, also, the warm interval as a widespread climatic event and not a local event confined to the Seward Peninsula (the Sagavanirktok area is about 500 miles (800 km.) northeast of the Seward Peninsula and about 225 miles (362 km.) north of the Arctic Circle).

The sample was taken from a section of well-preserved log about 13 cm. in diameter and 0.6 m. long. The log was identified by R. A. Scott of the U.S. Geological Survey as *Populus* sp. Small groves of Balsam poplar (*Populus tacamahacca*) grow today in protected, well-drained sites along the north side of the Brooks Range and in the foothills north of the mountains. The nearest grove is about 50 km. southeast of the sample site. The log was in good condition and showed no signs of abrasion, suggesting that it was buried near the site where it grew. The occurrence of this wood at a considerable distance north of the present range of poplar indicates that the climate was somewhat warmer than at present.

The log was found about 6 m. below the surface in sandy terrace gravel with interbeds of dark silt. The gravel is well rounded, with individual clasts 1 to 15 cm. in diameter. The gravel probably represents a glaciofluvial deposit formed during one of the younger advances of the Itkillik Glaciation. The log site is about 30 km. northwest of the Itkillik morainal front; consequently, the deposit cannot be correlated with a specific glacial event.

The Itkillik Glaciation is represented by multiple advances in the Sagavanirktok area as it is along the Anaktuvuk River where Porter defined four advances. The youngest, which he named Anivik Lake, is similar in position and morphology to the Echooka Glaciation[5] in the Sagavanirktok area. Due to this similarity with the Anivik Lake advance of the Anaktuvuk River area, the terms Echooka Glaciation[5] and Echooka River Glaciation[6] are considered invalid and are abandoned. Porter[4] obtained a date of 7,241 ± 95 years B.P. on the recession of the Anivik Lake advance. The onset of the advance is less well dated; he suggests a date of 8,300 ± 270 years B.P. for the beginning of the advance. This date was extrapolated from a herbaceous pollen zone and radiocarbon dates reported by Livingstone [7, 8] from the Umiat and Chandler Lake areas. The herbaceous pollen zone and radiocarbon dates indicate a cold climate. The poplar log, on the other hand, suggests a climate warmer than at present, and a date possibly more recent than 8,300 years for the onset of the Anivik Lake advance. In general, however, the date reported here is in good agreement with the established glacial chronology of northern Alaska.

The sample was collected by Marvin D. Mangus of the Atlantic Richfield Company during construction of an airstrip by Atlantic Richfield Company and Humble Oil and Refining Company at 69°31′ N. and 148°52′ W., T. 2 N., R. 13 E., sec. 22, Umiat Meridian.

I would like to express my gratitude to the companies and individuals mentioned above for granting permission to publish the information in this note.

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Bison Antiquus from the Northwest Territories

A partial skull of a bison from the Northwest Territories of Canada has been identified as *Bison antiquus* on the basis of craniometrics and photo-interpretation[1]. The skull (Figs. 1 to 3) was found in mid-July 1967 by an Indian friend (name unknown to me) of Jack Turner of Nahanni Butte, Northwest Territories. Turner, recognizing that the horn cores were much larger than those of modern bison, shipped the specimen to the University of Calgary for identification.

I have been unable to visit the discovery site but Turner states that it was on the Liard River 3 miles (4.80 km.) above the mouth of the Blackstone River on the opposite shore (61°5′25″N., 123°0′W.). It was half buried near the water's edge at the base of a 60-foot (18 m.) bank. The bank is composed entirely of alluvial sand and silt; an underlying stratum of blue clay is exposed during periods of low water. Even though the skull may have been washed from its original location, its excellent condition suggests that it had not been transported far. However, no attempts to date have been made to locate other parts of the skeleton *in situ.*

The posterior portion of a skull of a mature individual, including the horn cores, is present. The anterior part, including part of one orbit, is missing. The horn cores are large, extend from the skull almost at right angles to the longitudinal axis of the skull, are depressed proximally, and swing upwards at the tips (see Figs. 1 and 2).

When considering the average cranium measurements for bison species as given by

TABLE 1. Measurements of Bison Skulls of Several Species (averages are from Skinner and Kaisen).

(*All measurements are in millimetres. For the Liard River specimen, averages of measurements from both sides are considered where possible.*)	average for *B.athabascae*	average for *B.crassicornis*	average for *B.bison*	average for *B.antiquus*	average for *B.occidentalis*	Liard River specimen
Horn core spread; tip to tip	665	963	581	881	747	877
Horn core spread; outside curve	683	986	612	—	782	897
Upper curve core length; tip to burr	216	409	186	281	279	302
Lower curve core length; tip to burr	255	458	233	336	340	370
Length; core tip to upper base at burr	189	265	168	245	243	266
Vertical core diameter; 90° to long. axis	85	98	74	98	91	106
Core circumference; 90° to long. axis	271	324	235	320	290	336
Greatest width at auditory openings	263	284	258	—	275	325
Condylar width	130	136	125	—	131	141
Depth; occipital crest to upper border of foramen magnum	—	—	—	—	—	119
Depth; occipital crest to lower border of foramen magnum	149	159	150	—	158	162
Transverse core diameter; 90° to longitudinal axis	92	110	78	107	98	113
Width between base of cores	—	—	—	—	—	260
Cranium width between core and orbit	288	288	264	319	299	319
Greatest post-orbital width	355	349	317	353	351	393
Angle of posterior core divergence	—	—	—	—	—	80°
Angle of proximal core depression	—	—	—	—	—	15°
Index of horn core curvature	135	125	139	138	140	139
Index of horn core compression	92	90	95	93	93	94
Index of horn core proportion	80	126	79	88	97	90
Index of horn core length	75	143	71	89	95	95