Short Papers and Notes

THE RECOGNITION OF ARCTIC BROWN SOILS IN NORTHEAST GREENLAND

Soil studies in the arctic regions of Alaska[1,2] have revealed the existence of mature, well-drained soils which have been named Arctic Brown soils. The recognition of these well-drained soils as zonal soils establishes continuity of zonal soils from the equator to the poles. The poorly-drained Tundra soils, so widespread in the wide expanses of the Arctic, once considered zonal, are now included among the intrazonal (hydromorphic) soils.

Soils similar to the Arctic Brown have been reported under the names of Dry turf-lichen tundra[3] and Arctic Sod soil[4] in the arctic zone of Russia. No reports, however, are available on their existence in the ice-free areas of Greenland. A pedological investigation in this region offered, therefore, the possibility to close the gap between the North American and the Eurasian continent and to test the zonality concept of the Arctic Brown as a circumpolar soil.

During the summers of 1961 and 1964 the writer had an opportunity to visit Northeast Greenland under the auspices of Dr. A. L. Washburn of Yale University and to conduct a pedological investigation in the Mesters Vig district.

Mesters Vig district is part of Scoresby Land and is located on the south side of Kong Oscars Fjord at 72°14'N. 23°55'W. (Fig. 1). The area includes Paleozoic sediments — marine and continental — consisting of shale, sandstone, and conglomerate. Basaltic sills and dikes intruded the sediments, probably during the Tertiary. Pleistocene deposits of various kinds — glacial, glaciomarine, fluvial, and colluvial — are common.[5]

The Arctic Brown soils were encountered on lateral moraines, on kames, delta remnants, old beaches, and on bedrock exposures. The morphology and the distribution of these soils becomes a function of drainage, texture of the substrata, stability of the site, and time. Only the simultaneous occurrence of favourable factors would produce an Arctic Brown profile. These favourable conditions limited the areal distribution of the Arctic Brown soil to no more than 10 per cent of the land.

Table 1. Profile description of a typical Arctic Brown Soil.

A cover of *Vaccinium uliginosum*, *Cassiope tetragona*, *Salix arctica*, mosses and lichens was found in the area of this profile.

Depth cm.	*Horizon*	*Morphology*
0 to 1,2	A_{00}	Black organic layer, fluffy, well rooted, discontinuous with woody and fibrous plant remains.
1,2 to 3,4,6,7	A_0	Black organic mineral horizon, well humified with a fine texture and a greasy feel. It shows a wavy, pocket-like distribution. These pockets now filled with humus and fine mineral matter suggest a process of deposition on a microknobby topography.
3,4,6,7 to 13	A_1	Dark brown (7.5 YR 3/2)* loamy sand, single grained and with roots. Loose and friable. Pebbles are present.
13 to 40	B	Dark yellow brown (10 YR 3/3) cobbly with a matrix of pebbles, coarse sand and some silt. Roots are present. Single grained.
40 to 63	C	Gray brown (10 YR 5/2) cobbly with a pebbly matrix.

*Munsell Soil Color Notation, Munsell Color Co., Inc., Baltimore, Md.

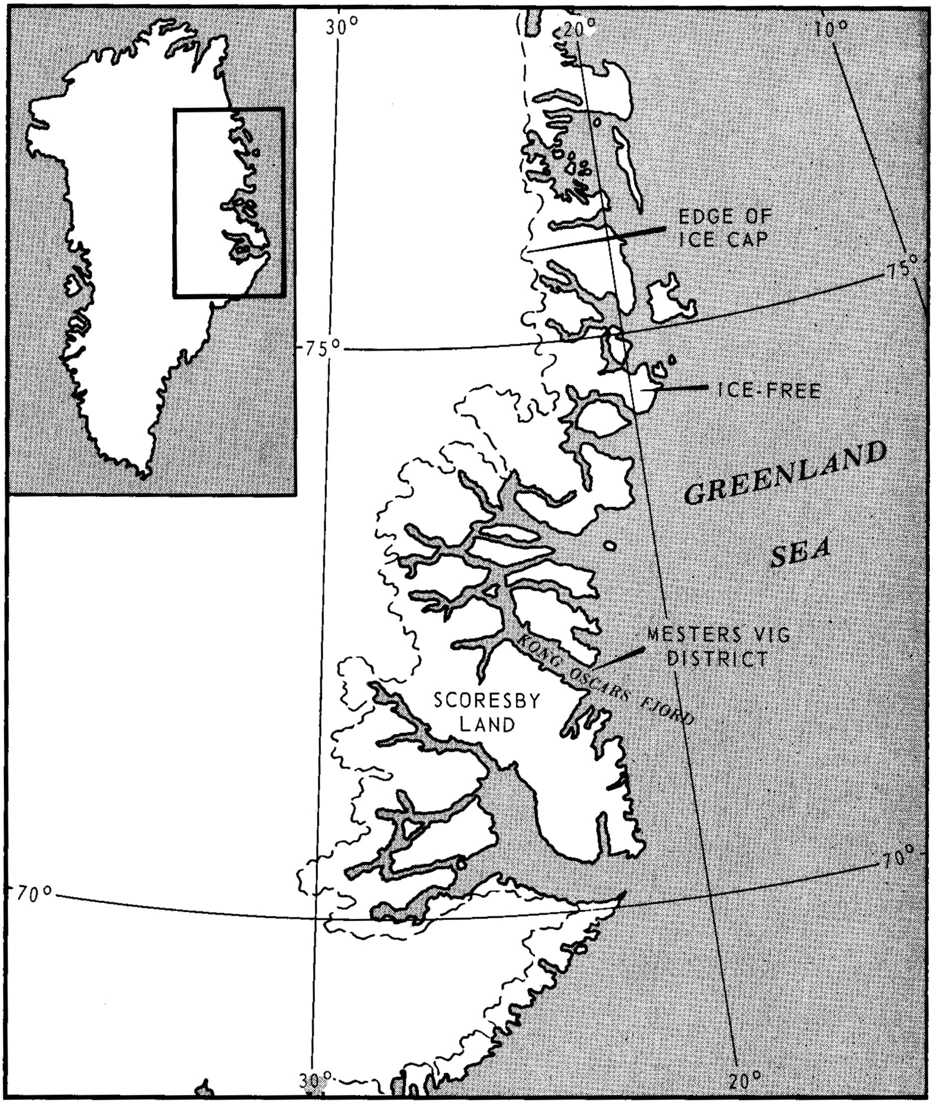

Fig. 1. Mesters Vig District, Northeast Greenland.

Of particular interest in the morphology of the Arctic Brown soils is the impact of frost processes and of surficial cracks. Frost-active areas may prevent the establishment of normal profiles, while established profiles may be undermined and disrupted by intruding tongues of frost-heaved material. Surficial cracks tend to increase root penetration with the result that the A_1 horizon becomes enlarged. This seems to be a unique situation as yet unreported in the arctic regions.

Although glacial deposits of different ages showed Arctic Brown soils with different degrees of development, time was a more determinative factor among soils developed on fluvial terraces of different ages.

The latitudinal limits of the Arctic

Brown in Greenland are not known. It is implied, however, that north of the Arctic Brown, Polar Desert soils should be encountered.[6]

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[5]Washburn, A. L. (In press). Geomorphic and vegetational studies in Northeast Greenland, General introduction. Meddelelser om Grønland, Vol. 166, No. 1.

[6]Tedrow, J. C. F. and J. Brown. 1962. Soils of the Northern Brooks Range. Alaska: Weakening of the soil-forming potential at high arctic altitudes. Soil Sci. 93, p. 254.

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ICE DRILLING IN FLETCHER'S ICE ISLAND (T-3) WITH A PORTABLE MECHANICAL DRILL

A scientific station (T-3) has been maintained on Fletcher's Ice Island by the Arctic Research Laboratory of the University of Alaska since 1961. In April 1964 it was located at 80°30′N. 140°20′W., close to the centre of the Canadian Basin. The apparent permanence of the ice island in both location and size (it is about 7 mi. long, 4 mi. wide and 100 ft. thick) makes it an ideal site for long-term underwater acoustic studies of ambient noise and transmission characteristics.

For all-year use of the station for such tests, however, it is desirable to install permanent hydrophones and seismometers, both in and below the ice of the island. To determine the feasibility of drilling through the island in a convenient manner to make such installations and to measure the thickness, temperature, and salinity of the ice, test holes were drilled by engineers from GM Defense Research Laboratories, General Motors Corporation, in April 1964.

The device used for the tests was a mechanical drill, model V-100, manufactured by the Houston Tool Company of Santa Susana, California (Fig. 1). The 700-lb., wheel-mounted drill is powered by two 6-hp., 4-cycle gasoline engines. One engine drives a rotary table, using a step-down gear and 2-speed transmission, which in turn rotates a kelly attached to a hollow drill string. Two- and three-cutter carbide-tipped bits with outer diameters of 3 in. were used. The second engine powers an airpump that can be connected either to blow air into (pressure mode) or suck air out of (vacuum mode) the hollow drill bit and drill string.

In the vacuum mode the ice cuttings travel through the drill pipe and are deposited in four separate vacuum chambers. During drilling these chambers have to be emptied periodically. One of the chambers provides cutting samples if they are desired. In the pressure mode the cuttings are forced up through the annulus of the hole to the surface where they are shovelled away by hand.

It was found quickly that the vacuum mode was not satisfactory in the cold ice of the island. The maximum drilling rate was only 0.5 ft./min. in the cold uppermost layers of T-3. Even more discouraging was the rate at which the vacuum tanks became plugged with the ice cuttings, which were of the consistency of very fine snow and caused the pump to lose suction and the hollow drill bit to plug with ice. No way was found

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