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The driftwoods of the Arctic Ocean

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Abstract

Eurola, Seppo. (Botany Dept., Univ., Oulu, Finland) The driftwoods of the Arctic Ocean. Rep Kevo Subarctic Res Stat 7. 74—80. Illus. 1971. — A review of the research carried out to date on the driftwoods of the area north of the Arctic Circle, including the whole of Greenland. Besides a short historical outline and a discussion of research methods, the information concerning driftwood available from the literature is presented. Provisional boundaries for the American and Siberian driftwood regions, along with the relevant ocean currents, are drawn. Further data are still required, however, for the Arctic islands of North America and European Russia. Some driftwood specimens collected by the author at Agardh Bay, Vestspitsbergen, and described here are clearly Siberian in origin.

1. Early driftwood discoveries

The cold regions bordering on the Arctic Sea are by no means treeless. The very first Arctic navigators observed driftwood on the shores. Örtenblad (1881) claims that the existence of driftwood on the shores of Iceland had been known about ever since the island was first colonized. Pet encountered driftwood on islands close to Novaya Zemlya in 1580, and when Willem Barents, the discoverer of Spitsbergen and Novaya Zemlya, was forced to spend the winter of 1596—7 with his expedition on the latter islands, driftwood became their chief source of fuel (de Veer 1598). Hudson found driftwood on Spitsbergen in 1607, as did Baffin in 1613, who estimated its quantity to be considerable (Rickard 1934).

In North America, Martin Frobisher's expedition of 1576 observed driftwood on the Meta Incognita peninsula in the southwestern part of Baffin Island, while in 1586, John Davis discovered pieces of wood on the South-West coast of Greenland (Rickard). The colony established in Greenland by Eric the red towards the end of the 10th century may well have made use of driftwood from this area (Ingstad 1965). The Eskimos certainly fashioned bows, arrows, spears and harpoons from this wood.

2. Research methods

The study of driftwood has tended to be concentrated on the determination of the origins of the samples obtained. Barents certainly approached the subject in this way, for he considered the driftwood he found on Novaya Zemlya to have originated from Moschow or Tartary or some such region (de Veer). Such speculations only asquired a scientific basis in the late 19th and early 20th centuries, when interest in the origins of driftwood samples was at its peak, thanks mainly to the large numbers of specimens brougth back by explorers. Since that time this aspect has attracted little attention.

Four methods may be used in studying the origins of driftwoods. The first is based on the plotting of the major ocean currents, and on the observation that greater amounts of driftwood tend to be found on shores reached by these currents than on the corresponding lee shores. Stefansson (1909) suggests that the driftwood (chiefly poplar) accumulated on the north shore of North America between Point Barrow and the Mackenzie delta had been transported there by the westward ocean current. He also reports (1913) that the quantity of driftwood found on the West coast of Victoria Land greatly exceeds that found on the South coast. Similarly, more driftwood is found on the North and West shores of Coronation Gulf, between Victoria Island and the mainland, than in the southern and eastern parts of the Gulf (see map of ocean currents, Fig. 4). Kindle (1921) claims that driftwood is more abundant on the western sides of the peninsulas which lie to the East of the Mackenzie delta than on the eastern sides. He gives no reason for this, but a glance at the map will show that one of the principal branches of the Mackenzie delta flows in a North-Easterly direction and a broken coastline extends in the same direction as a continuation of it. The driftwood of this region had already been described by Franklin (1828).

The second method relies upon the identification of exotic fruits and seeds to be found on the same shore as the driftwood. Once the source of these diapores is known, a corresponding hypothesis can be set up concerning the driftwood to be identified. Petermann (1870) mentions that Torell found on the westernmost peninsula of Nordaustland (Spitsbergen) a legume of *Entada scandens* from the West Indies which had been carried there by the Gulf Stream Lindman (1883) lists in addition to many driftwood species (see Fig. 1), a large number of fruits and seeds native to the West Indies and Central America specimens of which have been found on the West coast of Norway: *Entada scandens* (Mimosaceae), *Mucuna urens* (Papilionaceae), *M. macroceratides?*, *Cassia fistula* (Caesalpiniaceae) and *Garcinia magnostana* (Guttiferae) — both Eurasian in origin and cultivated in the West Indies, *Caesalpinia bonducella* (Caesalpiniaceae), *Anacardium occidentale* (Anacardiaceae), *Lagenaria vulgaris* (Cucurbitaceae) and *Cocos nucifera* (Palmae). Also found on the West coast of Norway, according to Lindman, are the mediterranean *Juniperus phoenicea* (sprays bearing clusters of berries), a red alga *Gelidium cartilagineum* from the warmer Atlantic waters, an American brown alga *Laminaria longicruris,* and pumice which may have originated from the Canary Islands, Iceland or Jan Mayen Island.

The third method depends upon the identification of the genus of wood involved. Franklin's findings (1824) concerning the driftwood of Coronation Gulf provide a good illustration of this method. He had recognised the principal species as poplar, but had noticed that no poplar grew beside the Coppermine River which enters Coronation Gulf from the South. In fact the northern limit of poplar runs along lat. 69°N East of the Mackenzie River, but then curves south-eastwards to touch the north-eastern tips of Gt. Bear Lake and Gt. Slave Lake. The basin of the Coppermine River thus lies outside the poplar limit (cf. Hustich 1966). The poplar in question must therefore originate from the Mackenzie River itself.

The methods described above are indirect and thus only partially reliable. The most accurate method available involves the determination of the species of wood in question by reference to its anatomical structure. In this sense Agardh is generally considered a pioneer of driftwood research. In a work published in 1869 he demonstrates that his material, 18 samples collected from Spitsbergen by Swedish expeditions, is of Siberian origin. As no systematic research into the anatomical structure of wood had been carried out at that time (Agardh only refers to the work of Mohl in the year 1862), he must have made all the comparisons himself. He also uses the appearance of the tree rings to deduce the climatic conditions under which the tree had grown, and from this evidence posits a latitude of origin. These procedures have all been taken up by later investigators, and Sweden has come to occupy a central place in the history of driftwood research with major publications by Örtenblad (1881), Lindman (1883) and Ingvarson (1903; 1910).

More recently the study of annual rings has been used principally in Alaska for locating the place of origin of driftwood, a dendrochronological method based on the variations observed in tree-ring sequences in different parts of Alaska (see Giddings 1941; Oswalt 1951; van Stone 1958).

3. Some more recent material

At the present time, 100 years after the publication of Agardh's work the classical school of driftwood studies could rightly be said to have died out. Since Ingvarson (1910) no paper appears to have been published which discusses the identification of driftwood species for its own sake. The present author was thus pleased to be able to collect 19 samples of driftwood stumps from Agardh Bay on the east coast of Vestspitsbergen on 5. VII. 1969 (cr. Fig. 2). 11 of these were taken from the present shoreline and 8 from positions ranging from 300 to 1000 metres inland. Identification was carried out from microscope slides, by reference to Ingvarson (1903) and Greguss

(1955). Comparison slides were prepared for the following species: *Larix gmelinii, L. laricina, L. sibirica, Picea abies* ssp. *europaea* and ssp. *obovata, P. glauca, P. mariana, Pinus banksiana, P. cembra* and *P. strobus.*
The full catalogue of driftwood species collected from Agardh Bay is:

Species	From shoreline	From 300—1000 m inland a few meters above sea level
Larix gmelinii	7	2
Picea abies ssp. *obovata*	3	5
Pinus cembra	1	—
Populus sp.	—	1

4. Driftwood species

An indication of the possible driftwood species may be gained from Figs. 1 and 2. A classification by species of the 680 specimens recorded appears in the following table (o = American, ● = Siberian, × = European, ✻ Eurasian, + = unknown, American or Eurasian in origin):

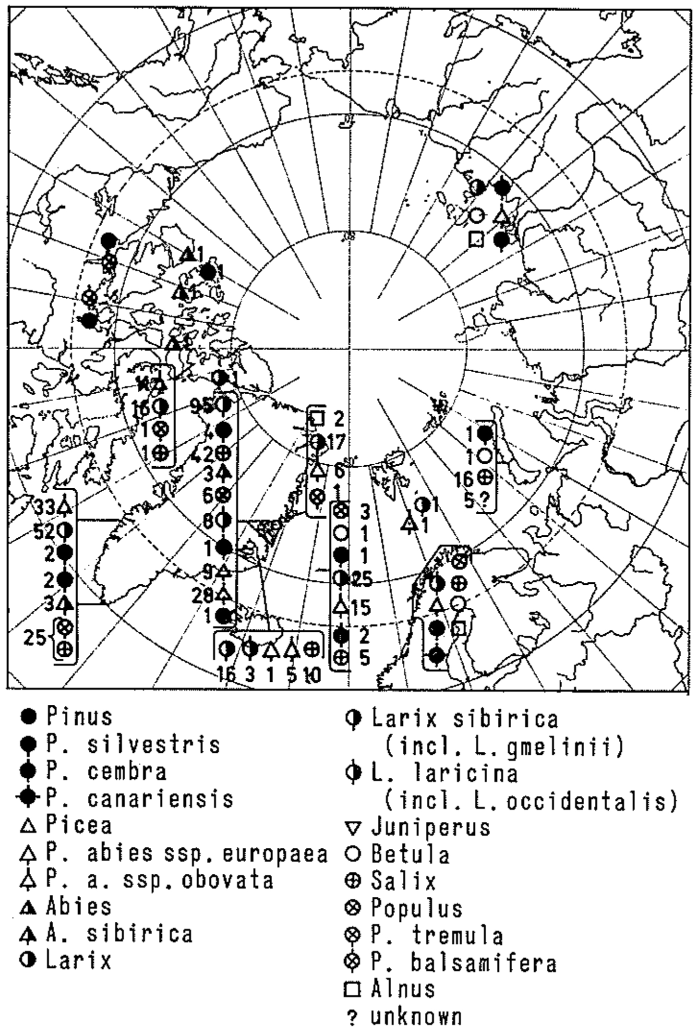

Fig. 1. Known driftwood species, after FRANKLIN 1824, BACK 1836, KRAUS 1872, WIESNER 1872, v. NÖRDLINGER 1873, ÖRTENBLAD 1881, SCHNEIDER 1886, LINDMAN 1883, INGVARSSON 1903, 1910, and ZUKOV 1940, excludning the driftwood of Spitsbergen (see fig. 2).

	Number of specimens	%
● *Larix sibirica* (incl. *L. gmelinii*)	318	47
● *Picea abies* ssp. *obovata*	146	22
+ *Salix* sp.	97	14
+ *Populus* sp.	13	4
✻ *P. tremula*	14	
o *Larix laricina* (incl. *L. occidentalis*)	21	3
✻ *Pinus silvestris*	18	3
× *Picea abies* ssp. *europaea*	14	2
● *Abies sibirica*	13	2
● *Pinus cembra*	9	1
+ *Betula* sp.	9	1
+ *Abies* sp.	3	1
+ *Alnus* sp.	2	
+ *Juniperus* sp.	1	
+ *Pinus* sp.	2	

Fig. 1 also includes some driftwood material for which no numerical data is available: from the West coast of Norway from the Lofoten Islands northwards (LINDMAN), from Yanskiy Bay in Siberia, East of the Lena delta (ZUKOV 1940), and from the North coast of America (FRANKLIN 1824; BACK 1836; STEFANSSON 1909; 1913; KINDLE 1921). The *Populus balsamifera* listed for the North coast of America may also include other *Populus* species (cf. HUCTICH).

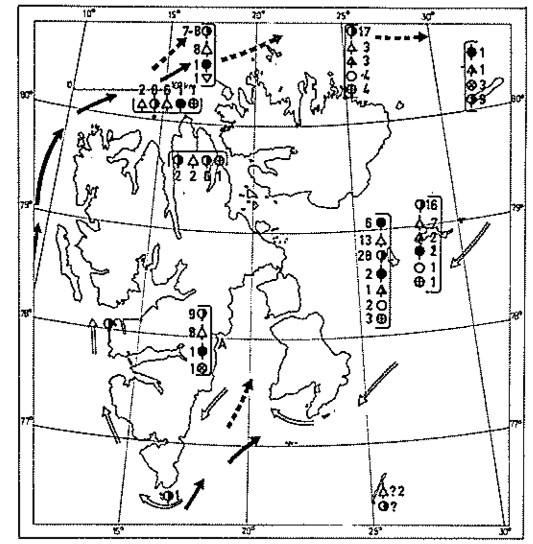

Fig. 2. The driftwoods of Spitsbergen, after AGARDH 1869, WIESNER 1872, INGVARSSON 1903, HOPPE et al. 1969, and the author's own material from Agardh Bay, Vestspitsbergen (A). For key, see Fig 1. Surface currents drawn according to SVENDSEN 1959, cf. also OMDAL 1953. Solid arrows = warm (Atlantic) currents, open arrows = cold (polar) currents. The *Larix gmelinii* from the west coast of Spitsbergen was collected by Prof. BIRGER OHLSON 1966. It was lying in small pieces on mineral soil under a peat layer (16 cm thick), 2 m above mean sea level. The age of the lower peat layer is 1980 ± 100 BP.

5. Driftwood regions

The driftwood area north of the Arctic circle may be divided into two regions: the American and the Siberian driftwood regions (Fig. 3).
The District of Franklin, consisting of the Arctic islands south of the McClure Strait, Viscount Melville Sound, Barrow Strait and Lancaster Sound and the western shores of Baffin Land, belongs to the American region. Driftwood of *Abies balsamea* and *Pinus strobus* was discovered from Queen Elizabeth Islands north of the McClure Strait at a time when closer examination under the microscope was not made (MURCHISON 1855); these are therefore included in Fig. 1 only under their generic names. The north coast of Alaska constitutes a further American driftwood zone. Occasional samples of American driftwood may be obtained from Greenland, from the region of Scoresby Sund and the fjords of Christian X Land. Under the influence of the Gulf Stream, American driftwood also appears on the west coast of Norway, where *Larix laricina* constitutes 2/3 of the coniferous wood found (LINDMAN), on the north and west coasts of Spitsbergen, though none is found in Nordaustland, and also, according to further discoveries by KJELLMAN (1877), probably on the west coast of Novaya Zemlya, and may be even the southern tip of Franz Josef Land.
The more northerly of the American Arctic islands, notably the southern and eastern shores of Ellesmere Island, should perhaps be classified as a Siberian driftwood region, as should Greenland, for in practice, 70 of its driftwood is Siberian in origin, 3 % American, 6 % Eurasian, most likely European, and 21 % of unknown origin. The driftwood of Novaya Zemlya and the north

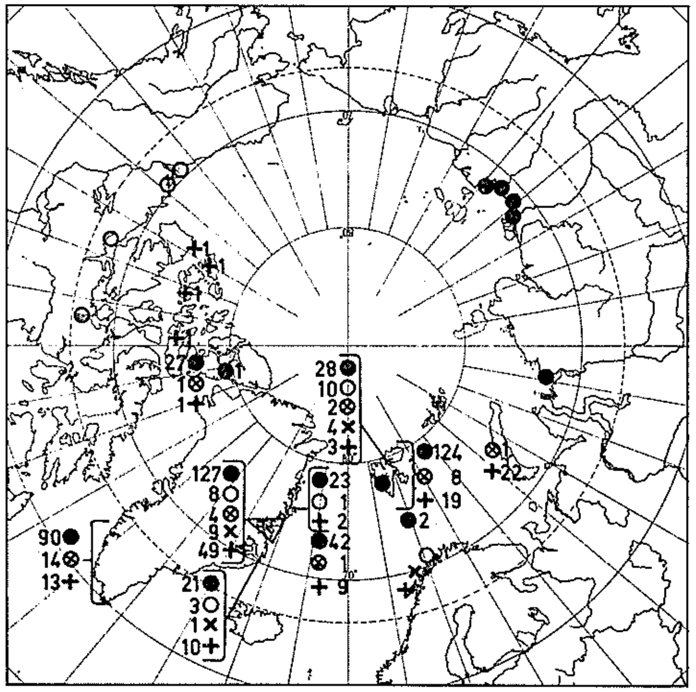

Fig. 3. Driftwood origins: ● = Siberian, o = North American, ⊕ = Eurasian, × = European, + = unknown. Compiled after FRANKLIN 1824, BACK 1836, AGARDH 1869, KRAUS 1872, WIESNER 1872, v. NÖRDLINGER 1873, ÖRTENBLAD 1881, LINDMAN 1883, INGVARSON 1903, 1910, STEFANSSON 1909, 1913, KINDLE 1921 and ZUKOV 1940. Little information is available on the origins of the driftwood of the north coast of America, except that between longitudes 96°W and 170°W species of American origin predominate (see FRANKLIN, STEFANSSON and KINDLE). With the exception of Greenland, only occurrence within the Arctic Circle are taken into account.

coast of Siberia, according to information available, probably originates principally from within the Soviet Union. No American driftwood has been reported east of Vestspitsbergen, while on the north coast of this island American and Siberian samples are found in the ratio 1:3.

Probably the most typically European driftwood species, determined by its area of distribution, is *Picea abies* ssp. *europaea* (cf. SOKOLOV et al. 1964; also HUSTICH). It may be encountered both on the north coast of Vestspitsbergen and in eastern Greenland.

A close correspondence may be observed between driftwood discovery data and ocean currents. Most surprising of all is the absence of American driftwood on the south-western shores of Greenland and on Novaya Zemlya. The existence of American driftwood species on the coast of Greenland must presumably be due to the cold, southerly East Greenland Current in the northern Atlantic or southern Arctic Ocean. Another explanation may be that these were carried from the Mackenzie delta via Point Barrow and thence towards the North Pole and into the East Greenland Current.

6. Present directions and applications of driftwood research

With the decline in research into driftwood species, most work has centred around the use of driftwood data for dendrochronology (GIDDINGS 1941; OSWALT 1951; VAN STONE 1958), for the plotting of ocean currents (GIDDINGS 1943; 1954), or for planning raw-material imputs for portable sawmills (FULLERTON 1945; also compare ZUKOV 1940). FULLERTON refers to a small sawmill maintained by the Royal Canadian Mounted Police on Herschel Island off the north coast of the Canadian Yukon Territory. KINDLE (1921) reports an immense quantity of driftwood on the shores between Herschel Island and the Mackenzie delta, which the local Eskimos even use for building their huts. There were at one time other sawmills at the Mackenzie delta itself. The high driftwood 'yield' is demonstrated by KINDLE's observation on 13.VII.1919 of »a nearly continuous mass a quarter of a mile of more in width» of drifting timber, largely spruce and poplar,

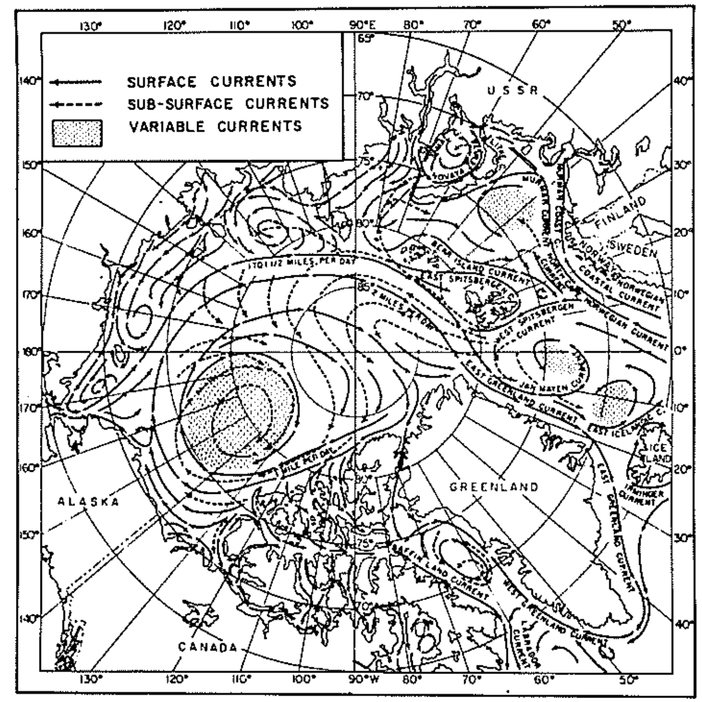

Fig. 4. Arctic Ocean currents after OSTENSO 1966.

accumulated at Fort Good Hope on the lower reaches of the Mackenzie River. ZUKOV (1940) also makes mention of the huge quantities of driftwood which are amassed at the mouths of Siberian rivers on delta islands and low-lying leeward shores. On a short stretch of shore one may find thousands of cubic metres of timber. Driftwood found on steep shores is generally buried in silt and gravel (ZUKOV). Species found are *Pinus silvestris, P. cembra, Picea, Larix, Betula* and *Alnus.*

The C_{14} dating of driftwood may nowadays be used for determining earlier shorelines (cf. BLAKE 1961; OLSSON & BLAKE 1961; HOPPE et al. 1969). In fact, it was the first driftwood samples obtained from significantly higher up the shore than the present waterline which served to confirm the fact that fluctuations in sea level have occurred even in the Arctic. MURCHISON (1855) mentions that MCCLURE and PIM found driftwood on a rise 350—500 ft. above the existing sea level on the northern shore of Banks Island, and at a height of 30ft. on the south coast of Melville Island, while INGVARSON (1910) reports that ISAACHSEN had collected driftwood specimens at 200—300 ft. from Bay Fjord on the western shore of Ellesmere Island, and NARES (1878) obtained samples from 40ft. on the North-East coast of the same island.

A revival of driftwood research is long overdue. Our knowledge of even the straightforward identification of species is far from complete, for we know nothing of the driftwoods of the western part of the North American Arctic islands, of the Sea of Chukchi to the north of the Bering Strait, of the Arctic coast of European Russia (especially the Kanin Peninsula), or of Franz Josef Land. One might almost say that the 'privileged research areas' of America and the Soviet Union are falling behind in this respect.

Moreover, with the aid of driftwood study data, modern dendrochronology and C_{14} dating procedures should be able to shed perhaps more light than ever on the small-scale climatic fluctuations of past ages and be of assistance even in the sphere of archeology (GIDDINGS 1954).

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