

# THE ARCTIC

The Arctic is essentially an ocean (the smallest of the five oceans), Greenland, the northern extremities of three continents (Asia, Europe, and North America) and several archipelagos. The boundaries are not distinct but are best defined by a combination of the tree-line and the southern limit of continuous permafrost on land, and the average extent of winter pack ice at sea.

The Arctic Ocean includes the Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea, Beaufort Sea, and Lincoln Sea. It receives a large, although seasonably very variable, fresh-water influx from many of the world's greatest rivers, especially those draining Siberia. Its surface area is  $14.5 \times 10^6$  km<sup>2</sup> of which a summer minimum of 50% is permanently covered by *pack ice*; this increases to 85% in winter. The mean ice thickness is 3 m; the average duration of a floe is 3 years before it melts or escapes from the Arctic Ocean. At the North Pole ice may drift as much as 20 km daily. The greatest oceanic depth is 5608 m (78°N, 02°W) and the depth at the *North Pole* is 4179 m (the floating ice is about 1.5 m thick). Its submarine topography is complex with several ridges, trenches, abysses, deep and shallow plains. The average depth is 1800 m, thus it is the shallowest ocean. Siberia has an extensive continental shelf while that off North America is narrow and drops abruptly. The remote Northern Pole of Inaccessibility (84.05°N, 174.85°W) is 1100 km from the nearest coast (first reached in 1941 by aircraft). The North Magnetic Pole was at 82.3°N, 113.4°W in 2004, off Rolf Ringnes Island moving about 40 km NW annually; it was first reached in 1831 when farther south.

Greenland, with a surface area of  $2.8 \times 10^6$  km<sup>2</sup>, has the only Arctic *ice sheet* which has an area of  $1.8 \times 10^6$  km<sup>2</sup>, maximum elevation of 3231 m (73°N, 40°W), and a volume of  $2.5 \times 10^6$  km<sup>3</sup> which is 9% of the ice on Earth. The greatest ice depth measured is 3350 m (72°N, 40°W) and mean depth 1200 m. Bedrock is depressed to a maximum depth of 450 m below sea level in some places. Greenland also has the highest peak in the Arctic; Gunnbjørns Fjæld at 3693 m (68.9°N, 29.9°W, first climbed on 18 August 1935). The many Arctic ice caps are of comparatively minor size; no large ice shelves exist. The most northern land on Earth is Odâq Ø, or a small shingle bank in its vicinity (83.7°N, 30.7°W), off Greenland.

The Arctic has had a peripheral *indigenous population* for many millennia. These include tribes of Eskimo (including Inuit), Lapp, Samoyed, and Chukchi. Abandoned Eskimo settlements have been found beyond 80°N in Greenland, which were occupied during warmer epochs. About 80% of the present population of the Arctic immigrated during the 20th century during which urbanization began, nomads settled, and several major population centres were established. *Exploration* of the continental coasts was largely complete almost two centuries ago but many of the islands were charted subsequently. Most of the extreme north regions of the

Canadian Arctic archipelago and Greenland were mapped by 1900. The last major discovery of land on Earth was Severnaya Zemlya in 1913, and the last of the smaller islands was identified in 1947. The *North Pole* was first seen on 12 May 1926, from an airship; first reached by aircraft on 23 April 1948, by a submarine on 3 August 1958, over the pack-ice surface on 6 April 1969, and by icebreaker on 17 August 1977.

*Sealers, whalers, hunters, and trappers* have been active in the Arctic for millennia. Extraction of metals, hydrocarbons, and other *minerals* is currently a major economic activity. Many air and some sea routes cross Arctic regions. *Tourism* is minor but increasing. Russia maintains the *Northern Sea Route* (Northeast Passage) for much of the year with icebreakers, some atomic powered; thousands of transits have been made. In contrast the *Northwest Passage* is not a commercial waterway; only about 100 transits are recorded.

Many countries conduct research and maintain meteorological observatories and other stations around the Arctic Ocean, on the continents and islands. Drift stations have been deployed on ice floes which circulate around the ocean. A large number of Russian stations have been closed from the early 1990s. Several *military stations* are maintained, both offensive and defensive, although numbers have also decreased greatly after 1990. *Novaya Zemlya* has been the principal Arctic nuclear bomb testing site for the Soviet Union, with 132 detonations from 1955 to 1990; its vicinity has also been used for disposal of radioactive waste. The United States used sites in Alaska for testing three nuclear explosions and four atomic bombs, in a crashed aircraft, spread contamination near Thule, Greenland, January 1968.

The Arctic *climate* is extreme but the low elevation and proximity of the sea ameliorate it compared with that of the Antarctic. Winds may be severe and precipitation, mainly snow, is generally abundant. The record Arctic minimum temperature is -71.1°C, at Oymyakon, Siberia (63.3°N, 143.2°E), in 1964. The *Aurora Borealis* may be prominent on dark nights.

Arctic *flora* and *fauna* are closely related to those of surrounding continents but have adapted to the harsh climate. *Polar Bears* and Ringed Seals have been found north of 88°N. Migratory birds occupy breeding sites in immense numbers during the brief summer. Barely 5000 years ago Mammoths were present.

Most of the Arctic is unrestricted nationally as 'high seas'. The *Spitsbergen Treaty* (1920) allows access to the Norwegian Svalbard archipelago by the 42 signatory countries. Eight countries govern territory north of the Arctic Circle (66.5°N): Canada, Denmark (for Greenland), Finland, Iceland, Norway, Russia, Sweden, and United States. Coordination of *scientific research* between these, and nearly all other countries involved, is largely through the International Arctic Sciences Committee (founded in 1990), with a Secretariat in Oslo.

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