The Quaternary ice age

This Centrepiece looks at some of the environmental changes that took place during the Quaternary ice age. These cycles of change — from glacial to interglacial and back again — are a remarkable feature of recent Earth history

What is the Quaternary Period?

The Quaternary (2.58 million years to present) is the most recent period in Earth history. Climate has alternated between cold **glacial** and warmer **interglacial** conditions throughout this period. We are currently living in an interglacial — the Holocene — that began just over 11,700 years ago. During glacials, large ice sheets developed in the high middle latitudes of the northern hemisphere, and global sea levels fell. They were more than 120 m lower than today at the last glacial maximum.

Ecological change

Figure 1 shows Europe under typical glacial and interglacial conditions. The shift from one state to another involved continental-scale ecological upheavals. During glacial stages, there were few trees north of the Alps and the steppe tundra was the domain of woolly mammoths and other large herbivores. At the end of glacials, as the climate warmed, trees migrated northwards from the Mediterranean mountains.

Geomorphologists working in the Alps in the early twentieth century found evidence of four glacials and four interglacials during the Quaternary.

Records from marine sediments

The sedimentary records in the regions that have been glaciated are incomplete because the erosive action of ice sheets removes the deposits of previous glacials and interglacials. We have to look elsewhere to obtain a complete record. The sediments that accumulate on the deep ocean floor preserve an undisturbed record of global climate change, stretching back millions of years. Figure 2 shows how glacial–interglacial cycles have been a feature of the climate system for all of the Quaternary Period. Around 50 cycles can be seen in the marine record — a far greater number of climate shifts than the four originally recognised in the Alps.

One million years of big ice sheets

For the last 1 million years or so glacial–interglacial cycles have followed a 100,000 year cycle in line with changes in the eccentricity of the Earth's orbit around the sun (Figure 2). These longer glacial periods allowed very large ice sheets to develop in the northern hemisphere.

In the earlier part of the Quaternary, glacial–interglacial cycles were much shorter and they appear to have been paced by fluctuations in the tilt of the Earth (41,000 year obliquity cycle) which affects the length of the seasons. A Serbian engineer, Milutin Milankovitch, was the first to work out that these astronomical cycles affect the amount of solar energy reaching different latitudes through the year. They influence feedbacks in the climate system and the carbon cycle.

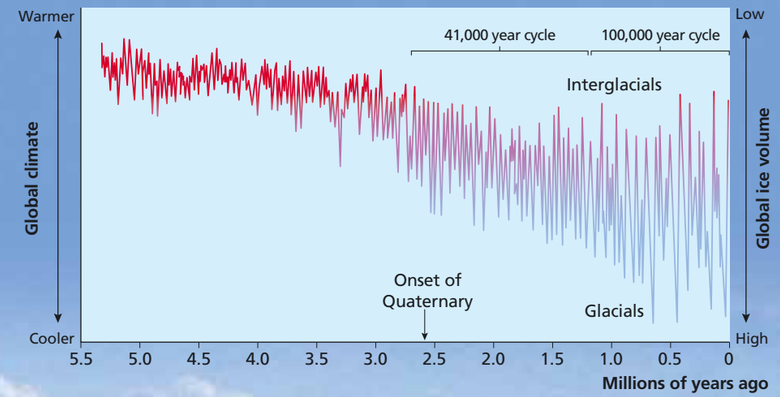

Figure 2 Global climate change for the last 5 million years or so.

Why should we study ice-age geography?

- We have a rich array of well-preserved sediment and fossil records that document Quaternary environmental change.
- We can test ideas about ice-sheet stability and how ecosystems respond to changing climates.
- We can study the interaction between climate and the carbon cycle over various timescales.
- If we wish to better understand the physical geography of the present, it is essential to explore the environmental records of the Quaternary ice age.

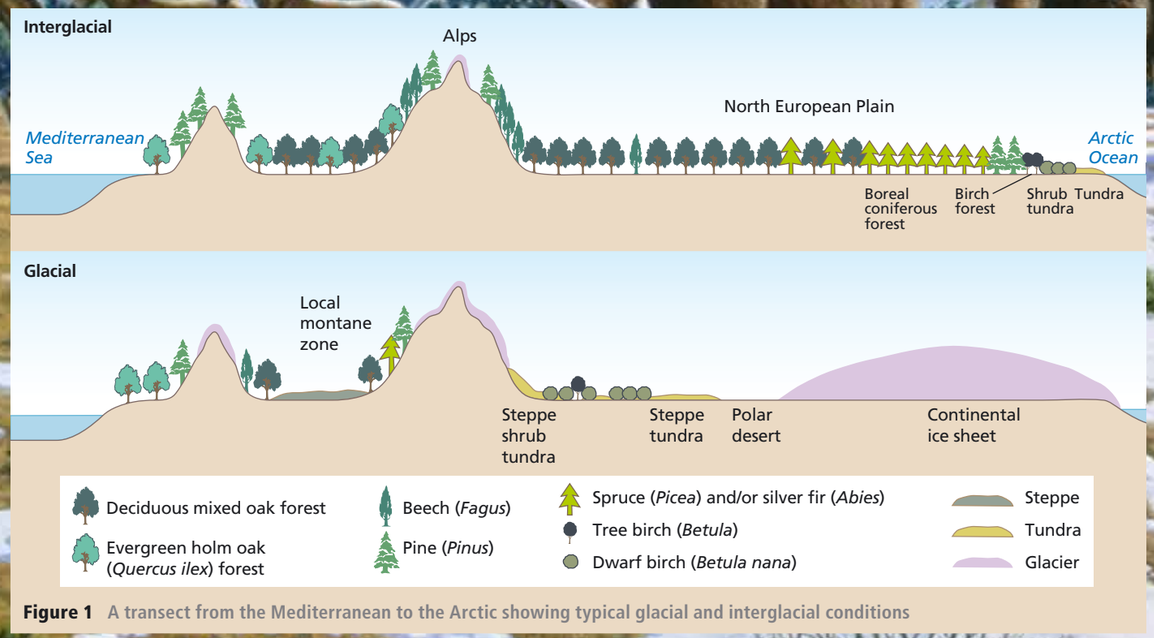

Figure 1 A transect from the Mediterranean to the Arctic showing typical glacial and interglacial conditions

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