Microorganisms are sensitive to large-scale climate change in Antarctica

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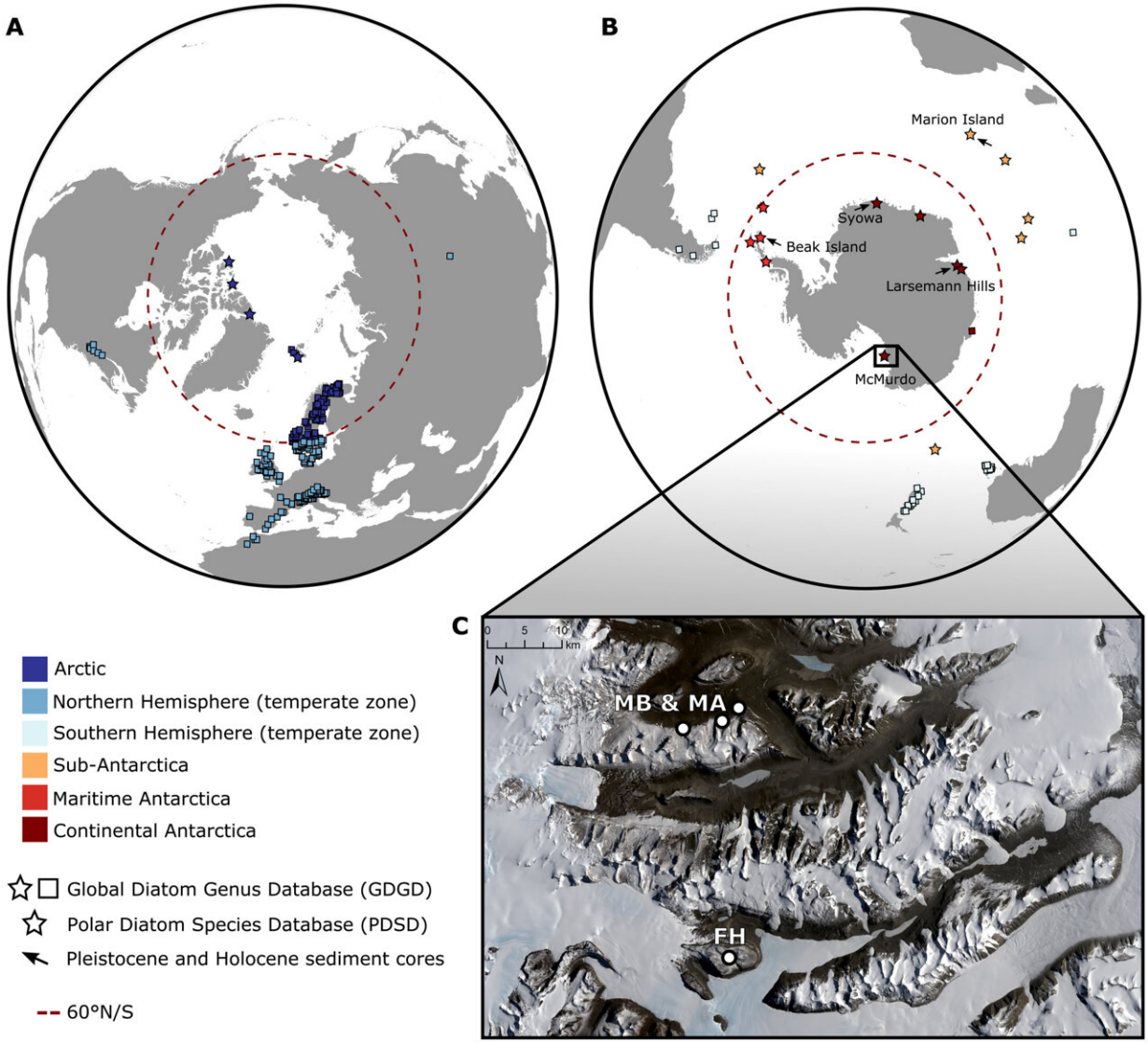

Fig. 1. Maps showing the sampling locations of modern and fossil material.Sampling locations of recent samples and Pleistocene and Holocene

(sub)fossil lacustrine diatom communities in the Northern (A) and Southern (B) Hemisphere. Sampling locations are colored by their geographic location, distinguishing six major biogeographical zones. Sample locations for contemporary communities belonging to the Global Diatom Genus Database (GDGD) are indicated with squares and stars, and those belonging to the Polar Diatom Species Database (PDSD) are indicated with stars. Sampling locations for (sub)fossil sediments that belong to the PDSD are indicated with arrows. Sampling locations may include multiple water bodies. A full list of sample numbers per location is given in tables S5 and S6. (C) Satellite image showing the location of the fossil Miocene diatom deposits in the McMurdo Dry Valley sector (Transantarctic Mountains), with indication of the sampling localities in Mount Boreas (MB), Mount Aeolus (MA), and the Friis Hills (FH). Image (C) represents a Landsat 8 image, courtesy of U.S. Geological Survey, taken on 17 December 2019. Credit: DOI: 10.1126/sciadv.abh3233

For a long time, scientists assumed that microorganisms, due to their broad distribution patterns, were much less affected by such climatic changes than plants and animals that often present very limited distribution areas. By examining fossils of Antarctic microorganisms, an international team led by researchers from Ghent University and Meise Botanic Garden showed that this assumption is incorrect.

During the Early Miocene, about twenty million years ago, the Antarctic Continent had a temperate to subpolar climate. The continent was largely covered with tundra vegetation and forests. This situation changed abruptly when fourteen million years ago, the continent began to cool down rapidly with ice sheets expanding over Antarctica, and plants and animals becoming extinct on a massive scale.

A diverse Miocene flora of diatoms

The researchers analyzed diatoms in 14 to 15-million-year-old Antarctic

lake sediments, deposited just before the great Miocene cooling began. Diatoms are one of the most diverse and ecologically important algal groups in the world and can easily fossilize thanks to their cell wall made of amorphous glass.

To their surprise, the team discovered more than 200 species of diatoms in the sediments. Virtually every species was new to science. For this reason, the researchers further analyzed the lake sediments at genus level, the classification level above the species. This analysis showed that the species composition in Miocene Antarctica was quite different from the diatom flora characteristic of Antarctica today, which has far fewer species. Instead, the Miocene diatom flora shows similarities with species-rich floras currently found in warmer regions of the southern hemisphere, such as South America, Australia and New Zealand. Based on these results, the researchers concluded that the Miocene diatom flora has largely died out in Antarctica due to the major climate changes of fourteen million years ago. The researchers postulate that the extremely species-poor diatom flora which characterizes Antarctica today evolved from the few survivors of the Miocene flora and new settlers that are adapted to cold conditions.

Extinction waves due to climate change

The researchers conclude that major climate changes, such as those in Miocene Antarctica, could have dramatic consequences for microorganisms and may lead to large-scale extinction waves. Since micro-organisms play a crucial role in the healthy functioning of ecosystems, it is crucial to better understand the impact of a changing climate and environment on their diversity.

More information: Eveline Pinseel et al, Extinction of austral diatoms in response to large-scale climate dynamics in Antarctica, *Science Advances* (2021). DOI: 10.1126/sciadv.abh3233

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