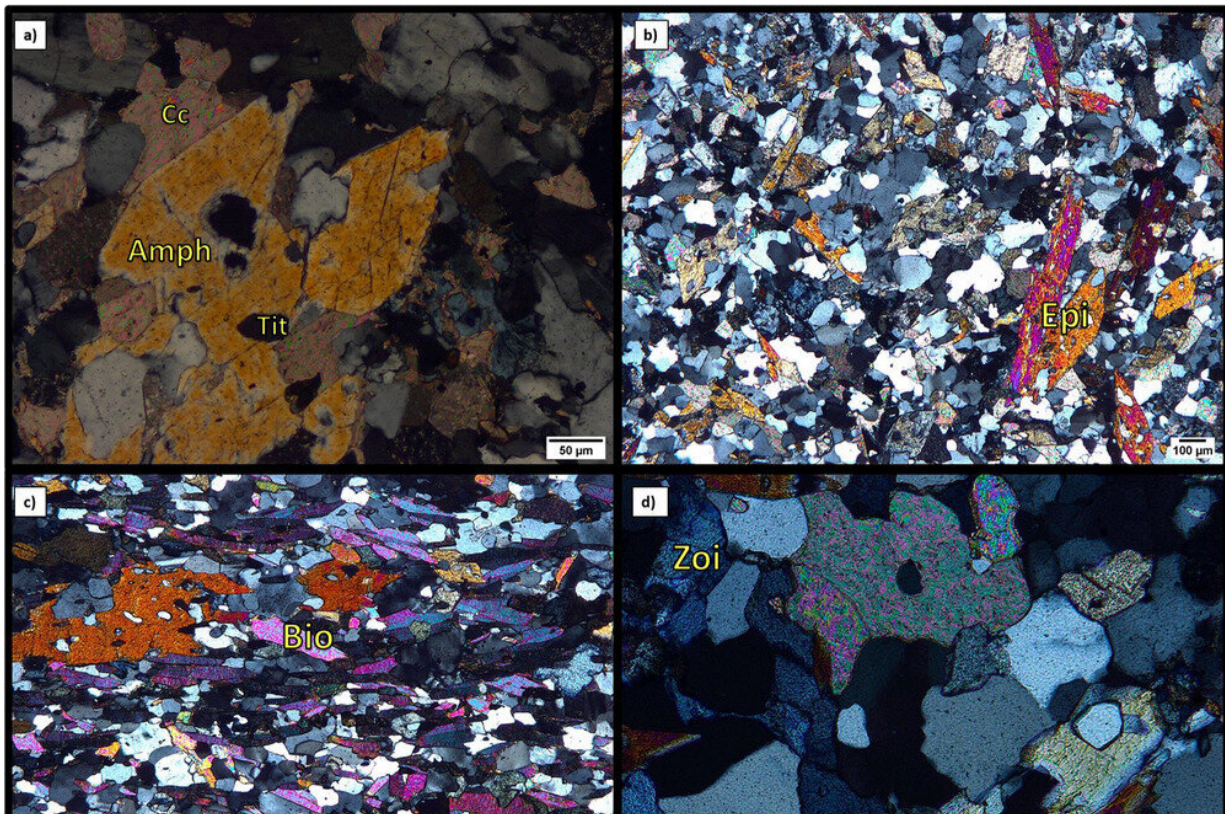


How did the forest develop at the Hailuoguo glacier area?

March 1 2023



Photomicrograph of thin sections of selected rocks collected from the Hailuoguo glacial debris. Metasedimentary rocks (a–e) contained (a) calcite (Cc), amphibole (Amph), and titanite (Tit), (b) Epidote (Epi), (c) biotite (Bio), and quartz (Qtz), (d) some zoisite (Zoi), and (e) high amounts of interstitial calcite between the grains. (f) The only meta-volcanic rock collected contained a carbonate layer (Cc), few quartz layers (Qtz) and plagioclase (Plag). The red line in f illustrates the banding/layering by separating the coarser grained upper part from the finer grained lower part of the photomicrograph of the meta-volcanic

rock. Credit: *Soil Science Society of America Journal* (2022). DOI: 10.1002/saj2.20473

Since the mid-19th century, increasing temperatures have resulted in the retreat of mountain glaciers on all continents. When glaciers retreat, they leave "glacial debris." This debris serves as new substrate for soil and ecosystem development.

A team of scientists studied a unique glacier, the Hailuoguo glacier, to learn more about how a forest system quickly established itself in this region. This glacier is located in Sichuan, China, at an elevation of 2,900 to 3,000 meters above sea level. Strikingly, the Hailuoguo glacial area has a mature forest that developed surprisingly quickly in less than 100 years. This is despite the local glacial debris being dominated by nutrient-poor granite with a small contribution of carbonate minerals.

In glacier retreat areas, "pioneer plants" start colonizing young surfaces soon after glacier melt. In the Hailuoguo area such plants include sea buckthorn, willow, or poplar. Growing colonies frequently last decades, if not sometimes centuries, to develop a full cover.

The team was able to study a glacier retreat area that had developed in approximately the last 130 years. The glacier retreated by about 2 kilometers, or an average of 15 meters annually during this time. The initial vegetation development from bare [soil](#) was scattered mosses, lichens, grasses, and bushes. The area then was covered fully by bushes and [deciduous trees](#). This correlated with a fast weathering of the calcium-carbonates in the parent material and thus a fast initial delivery of calcium.

The presence of carbonates kept the soil pH in a favorable near-neutral

range. This makes the [essential nutrients](#) more bioavailable to plant life. Neutral pH favors the release of nutrients from [organic matter](#) such as nitrogen, phosphorus, and sulfur by bacteria and fungi as well.

According to the study, it suggests that it is the calcium-carbonates in the parent material that contributed to the fast establishment of a closed forest cover in only a few decades. There were other slower chemical weathering processes that guaranteed a sustained delivery of potassium, calcium, and magnesium in the later stage, albeit at a lower level.

The development of the coniferous forest is also explained by the decreasing nutrient supply despite the young age of the soil. Deciduous trees need more nutrients to continue developing leaves every year, but coniferous trees do not. In addition, coniferous trees lose less [leaf litter](#) yearly, which also reduces nutrient requirements.

The study suggests that the vegetation development along the Hailuogou Glacier retreat chronosequence was well-synchronized with the changing weathering of different minerals. This synchronization, which is not possible on soils developed from carbonate-free or particularly carbonate-rich parent material weathering very slowly, explained the fast forest development.

The team published their study in *Soil Science Society of America Journal*.

More information: Nuria Basdediós et al, Base cations release in soils along the 127-year Hailuogou glacial retreat chronosequence, *Soil Science Society of America Journal* (2022). [DOI: 10.1002/saj2.20473](https://doi.org/10.1002/saj2.20473)

Provided by Soil Science Society of America

Citation: How did the forest develop at the Hailuogou glacier area? (2023, March 1) retrieved 24 June 2024 from <https://phys.org/news/2023-03-forest-hailuogou-glacier-area.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.