Reconstructing past environmental conditions in the Sayan Mountains, Siberia, Russia

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1: Introduction

The expedition aimed to extract lake cores to study chironomids (non-biting midges), diatoms (single celled algae) and SCPs (spherical carbonaceous particles), to reconstruct past environmental conditions in the Sayan Mountains, Siberia.

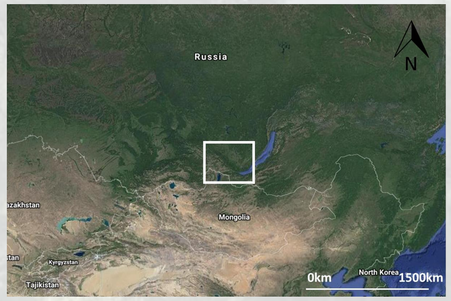
Although Siberia is important to the global climate system; containing large quantities of fresh water and acting as a carbon sink, the region has few quantitative paleoclimate reconstructions compared to North America, Europe and China.

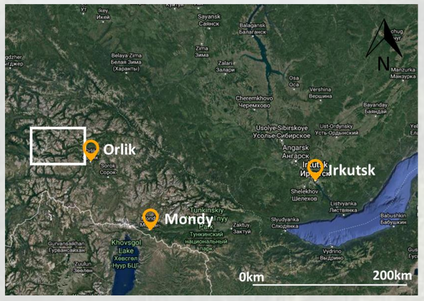
With climate change at the forefront of news coverage and increasing pressures from policy-makers to understand and predict the future planetary response to increasing temperatures, there has never been a more imperative time to explore areas with little to no scientific research history.

2: Aims

- Core two lakes: Lake Khikushka and Lake Kascadnoe-1.
- Analyse biological proxies - chironomids (non-biting midges) and diatoms (single celled algae) to reconstruct past temperature and ecological change during the Holocene (last 10,000 years).
- Reconstruct air pollution using SCPs to infer the extent of recent industrial pollution.

3: Field Site





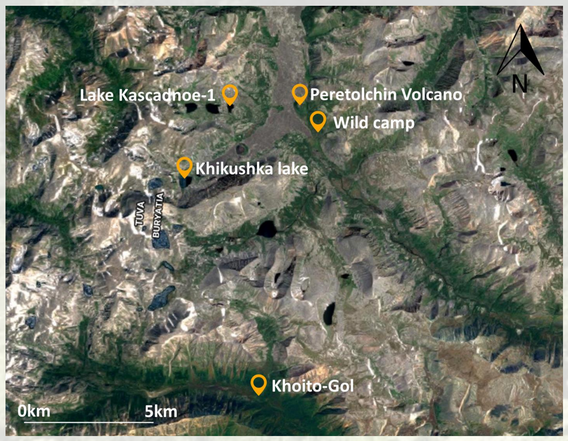


Figure 1 – Fieldwork Location maps.
Important locations and lakes visited are marked by yellow checkpoints.

To reach the field site we travelled for 3 days:

- Day 1: Car from Irkutsk to Orlik.
- Day 2: Off-road Ural car from Orlik to Khoito-Gol.
- Day 3: Hiked 17km at ~2000m altitude from Khoito-Gol to the Wildcamp, accompanied by horses and local guides.

4: Coring Methodology

- Row to the lake centre in two inflatable rubber boats. The lake centre is cored because it is deeper so the lake sediment is less disturbed.
- Anchor one of the boats and measure depth of the lake using an echosounder.
- Submerge the handheld percussion corer, connected to a piece of rope to the bottom of the lake.
- Hammer the corer manually using the rope to penetrate the lake sediment.
- Connect both boats using rope and pull up the corer. Put a bung in the bottom of the corer before it reaches the surface.
- Core taken to shore where it was cut to size and then transported back to Irkutsk for subsampling

Figure 2a: Expedition member James English preparing a core for transport with a Russian colleague.
Figure 2b: Expedition member David Warnes rowing onto lake Kascadnoe-1

5: Results

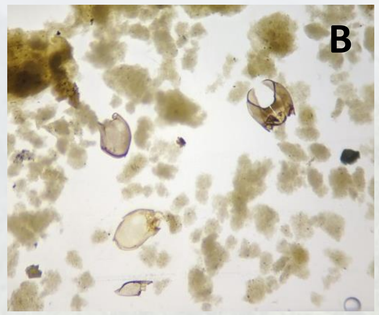
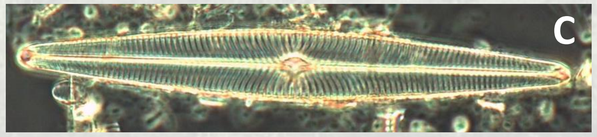


Figure 3a: Lake Kascadnoe-1.
Figure 3b: Chironomids under low-power microscope.
Figure 3c: Diatom of genus Navicula under high-power microscope.



Long and short cores were successfully extracted from two lakes in the Sayan Mountains – Lake Kascadnoe-1 and Lake Khikushka. The long core from Kascadnoe-1 was subsampled in labs at the Institute of Geochemistry, Irkutsk, and will be used for chironomid and diatom analysis. The short core from Kascadnoe-1 will be used for SCP analysis to assess the extent of anthropogenic pollution in the region, complementing the temperature and ecological reconstructions.

The Lake Kascadnoe-1 long core measured 1.09 m, indicating a relatively low accumulation rate in the lake. The Jom-Bolok lava field and the U-shaped valley geomorphology of the fieldsite also indicates the presence of both volcanic and glacial activity in the area. The bottom of the core includes several centimetres of grey clay, interpreted as being of glacial origin, indicating that the core encompasses the entire Holocene, which will allow for whole-Holocene analysis of temperature change in the region.

Chironomid and diatom slides have been prepared in Newcastle University labs and identification and counting is underway.

6: Conclusions

- Successful collection of two lake sediment cores from a remote fieldsite in the Sayan Mountains, Siberia
- First use of chironomids and SCPs in the region and the first use of diatom analyses on these lakes
- Each member gained valuable new skills from the fieldwork and subsequent lab work
- Lab work to complete projects is ongoing within Newcastle University labs

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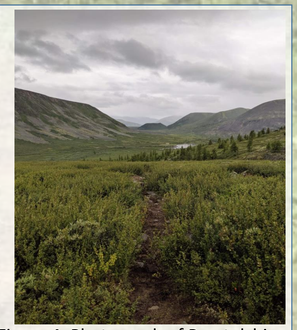

Figure 4: Photograph of Peretolchin Volcano in the Jom-Bolok valley navigated on the 17km trek