MEF Full Report

1: Name of Expedition: Sayan Mountains Expedition

2: Expedition Leader/Organiser: James English
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Preferred telephone number(s): Mobile: 07401074722
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3: MEF reference: 19-31
BMC reference: N/A

4: Country/Region: Russia, Siberia, Sayan Mountains

5: Names of all expedition members, indicating leader, climbing members, and support:

Climbing members:
James English - Leader
Megan Picken
Harry Williams
David Warnes
Dr Alexandr Shchetnikov
Dr Ivan Filinov

Support:
Prof. Elena Bezrukova
Dr Mikhail Kraymov
Olga Levina

6: Original objective(s) of expedition - mountaineering / scientific / medical, include location of objective (or study area) with indication of special points of interest (e.g. 'first ascent of NW Ridge') and heights of peaks:

Original expedition objectives:

- Expedition primarily for educational and research purposes, to provide material and data for undergraduate dissertations.
- Research aims to understand past climatic conditions in the Sayan Mountains region, using chironomids, diatoms and spheroidal carbonaceous particles (SCPs).
- To extract two cores each from four lakes in the Sayan Mountains, selecting the most suitable for further analysis, with the aim of filling the gap in understanding of how the Sayan Mountains have responded to past climate change.

7: Overall dates of expedition (e.g. 'March-June 2015'), showing time spent on approach, climbing, and return:

Overall expedition dates:
July 20th – August 10th
July 20th -22nd: Flights London-Mosocow, Moscow-Irkutksk.
July 23rd: Preparation of equipment and supplies, and meeting Russian colleagues.
July 24th: Travel by minibus from Irkutsk to Orlik.
July 25th: Travel by Ural Car from Orlik to Khoito-Gol.
July 26th: Hike from Khoito-Gol to field site.
July 27th: Walk to and sample Lake Kascadnoe-1.
July 28th: Walk to and sample Lake Khikushka.
July 29th: Walk to and sample Lake Kascadnoe-1.
July 30th: Hike from field site to Khoito-Gol.
July 31st: Travel in Ural Car from Khoito-Gol to Orlik.
August 1st: Travel in minibus from Orlik to Irkutsk.
August 2nd: Recovery day
August 3-4th: Weekend – Institute of Geochemistry closed. Consolidation of field observations.
August 5th: Preparation and subsampling of Kascadnoe-1 core.
August 6th-9th: Laboratory work – subsample preparation for diatoms, chironomids and SCPs.
August 10th: Flights Irkutsk-Moscow, Moscow-London.

8: Sketch map of the Area + Photo showing the line of our route(s)

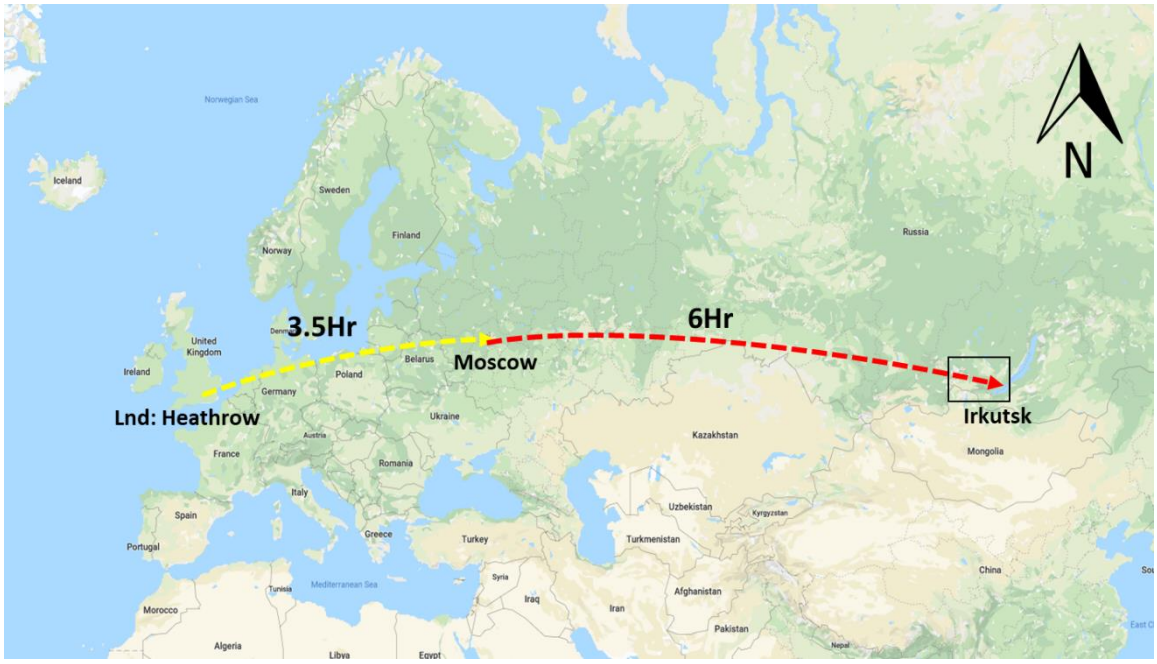

Figure 1: Map of Air travel from London Heathrow to Irkutsk via Moscow.

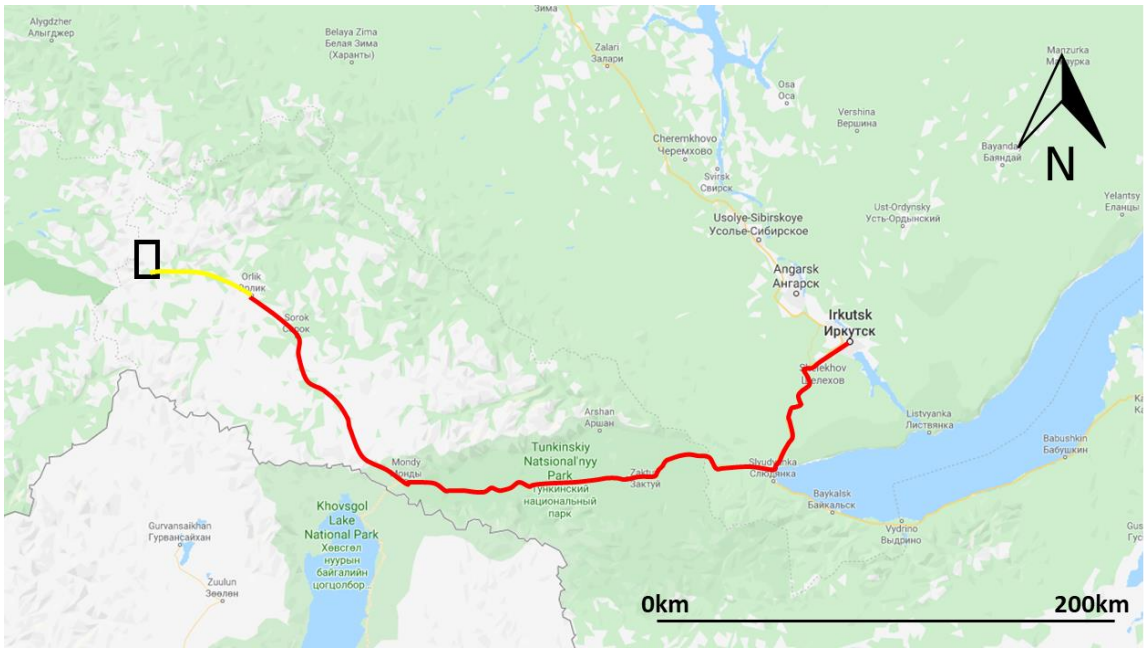

Figure 2: Car travel from Irkutsk to Khoito-Gol. Day one - car journey from Irkutsk to Orlik (red line). Day 2 - off-road Ural car travel from Orlik to Khoito-Gol (yellow line).

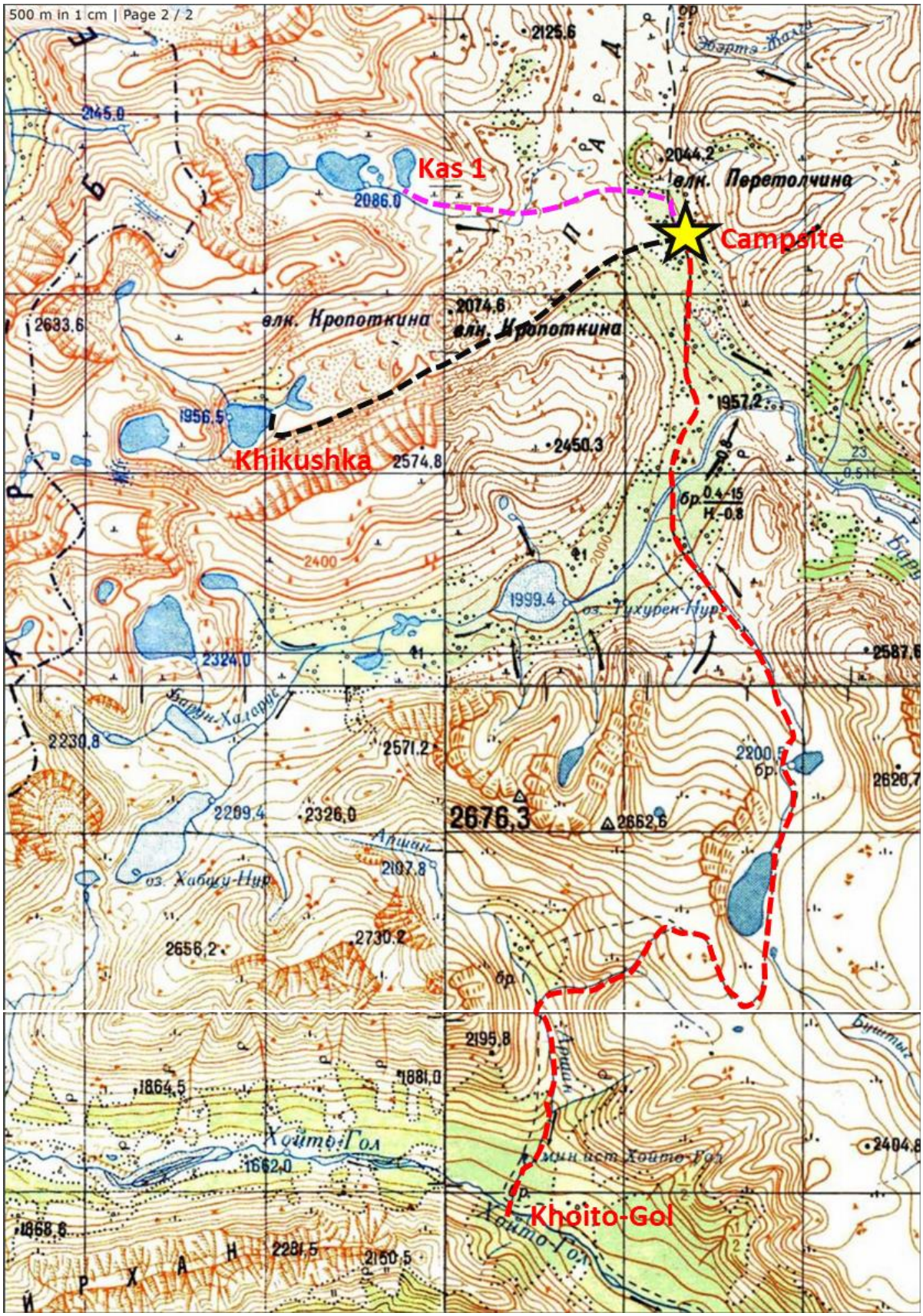

Figure 3: 17km walk from Khoito-Gol to campsite at Peretolchin Volcano (red line). Hike route to Lake Kascadnoe-1 (Kas-1) (pink line) and hike route to Lake Khikuska.

9: Give the following details for each route climbed or attempted: Name of mountain/crag, altitude, estimated route length, dates, grade, style (eg alpine, fixed rope), whether first ascent, successful or not, high point reached, reason for retreat (if applicable), weather conditions, and names of climbers:

Mountain – unnamed
Altitude – 1700-2450m
Estimated route length – 17km
Dates – July 26th outward hike, July 30th return hike.
Grade – N/A
Style - expedition
High point – 2500m, camp site ~ 1950m.
Weather conditions – persistent rain, poor visibility at high points for the duration of the hike and following two days. Sun and clear conditions for return hike.
Climbers – James English, Harry Williams, Meg Picken, David Warnes, Alexander Schetnikov, Ivan Filinov.

10: Photographs of glaciers for comparison with past and future pictures
Presently there are no glaciers at the fieldsite, just snow patches remaining at high altitudes from the previous winter (Fig.4). Snow cover is extensive in winter and the lakes are ice-covered.

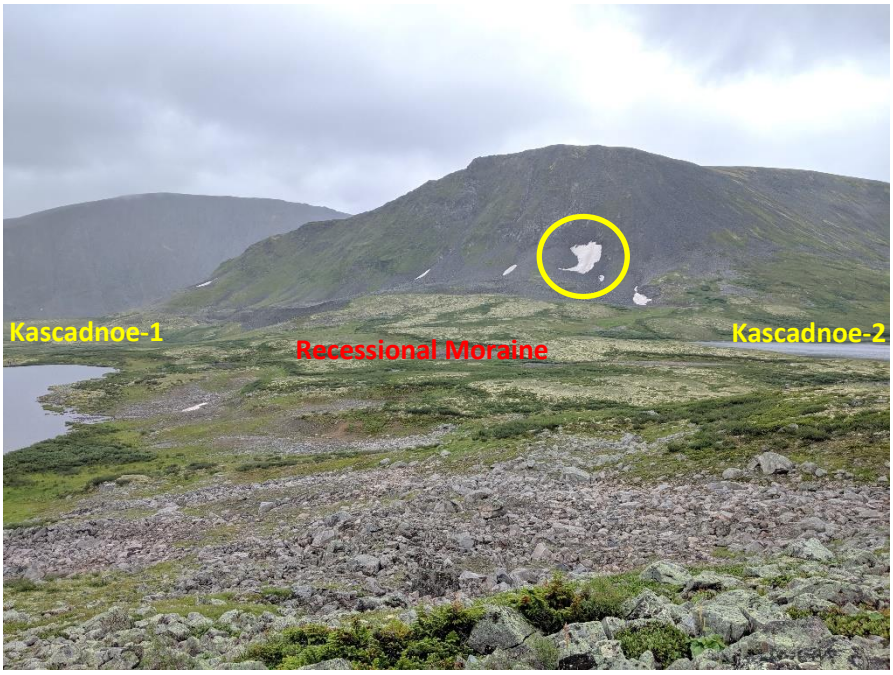

Figure 4: Recessional moraine located between lakes Kascadnoe-1 and 2. Snow at high altitude from previous winter circled.

However, the field site does show evidence of glaciation during the last glacial period, ~12,000 years ago. This is evident as the Kascadnoe lakes are situated in a U-Shaped valley containing raised recessional moraines and three major over-deepenings which trap a series of lakes: Kascadnoe-1, 2 and 3 (Fig.4, 5). The U-shaped valley likely formed by the erosion of a river valley by a previous glacier, whilst recessional moraines were emplaced as the previous glacier receded intermittently. Moraines formed from deposition during periods of stagnant or slower retreat, whilst over-

deepenings formed during periods of faster retreat, as no deposition took place. The same process also likely formed the U-shaped valley and recessional moraine system evident at Lake Khikushka (Fig.6).

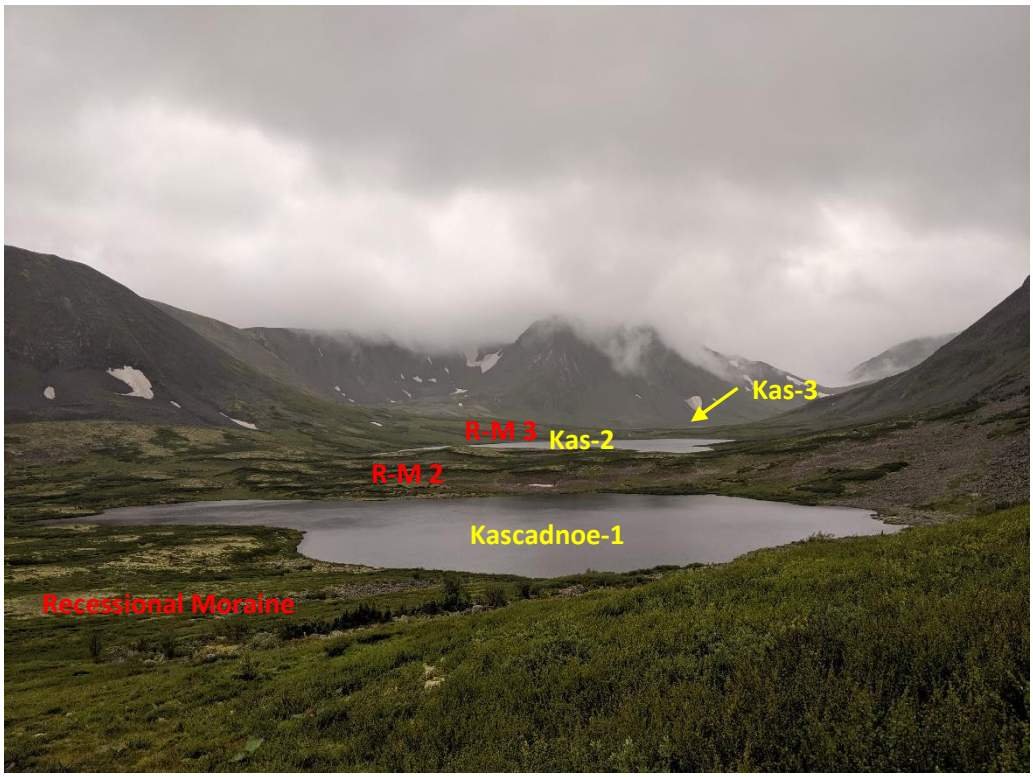

Figure 5: U-shaped valley containing lakes Kascadnoe 1, 2 and 3, separated by a series of raised recessional moraines. RM = recessional moraine.

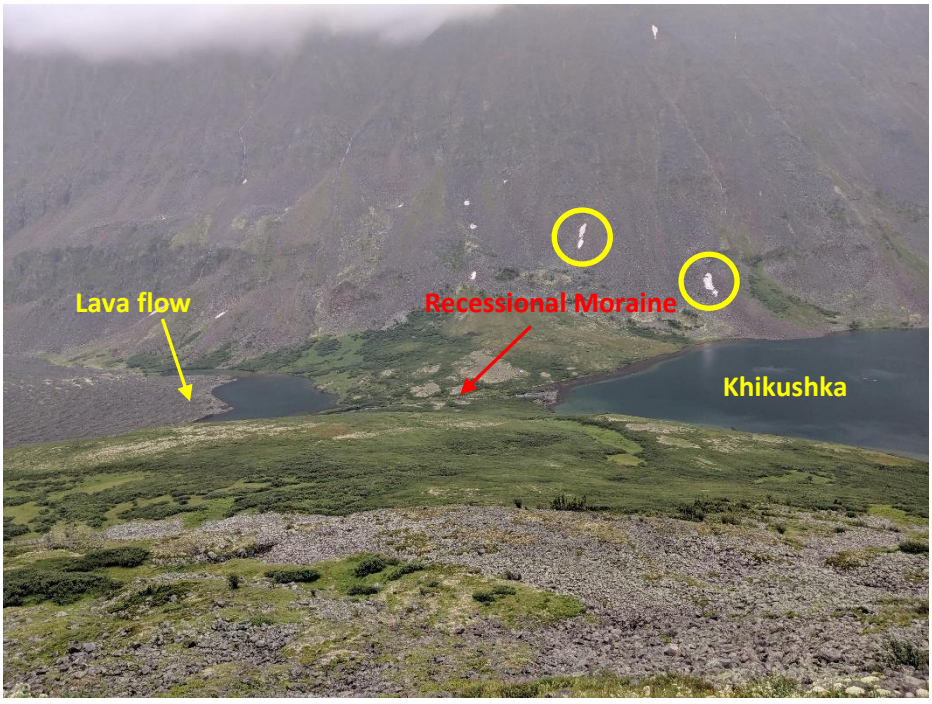

Figure 6: U-shaped valley containing lake Khikushka and another lake separated by a recessional moraine. Remnant winter snow is circled on the valley side.

Lake Kascadnoe-1 was hypothesised to contain the longest undisturbed sedimentary record due to its location at the mouth of the valley, suggesting it was formed earlier than Kascadnoe-2 and 3 as the glacier receded. A long core extracted from Lake Kascadnoe-1, measuring 1.09m, showed a transition from brown, organic material to minerogenic, grey, glacial material (Fig.7). Material of glacial age was confirmed by radiocarbon dating (Fig.8) – the deepest depth had a radiocarbon age of (14.30 ka BP).

Figure 7: Core extracted from lake Kascadnoe-1. Left is the top (0cm), right is the bottom (109cm). Grey material at the bottom is glacial clay.

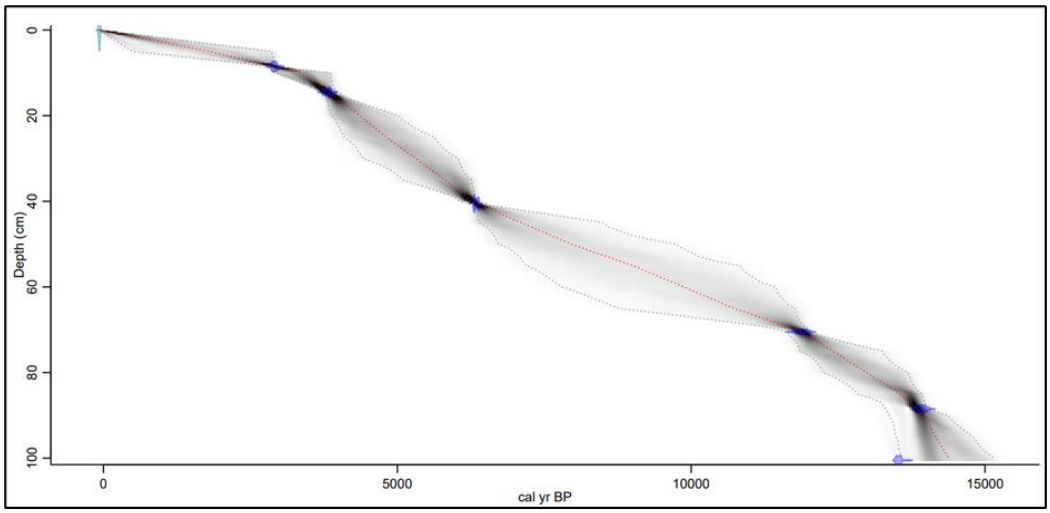

Figure 8: Age depth model of the sediment core extracted from Lake-Kascadnoe-1, modelled using Bayesian techniques and fitted with the IntCal2013 calibration curve. Beyond the last date of the model 14.30 ka BP, the age is extrapolated to 14.6 ka BP by assuming a constant accumulation rate.

11: Observations on the accuracy, or otherwise, of Google Earth images

Major routes in the Irkutsk Oblast and Buryatia regions (Fig.9) are well documented on Google Earth, demonstrated as all roads between Irkutsk and Mondy are accurately marked and street view is available between Irkutsk and Lake Baikal. However, the dirt track between Mondy and Orlik is not marked on Google Earth, as is the case for the off-road route navigated between Orlik and Khoito-Gol. This is likely because this is an informal route and sections of the route change dependent on weather conditions – large sections can become waterlogged after heavy rain making them impassable for vehicles. No footpaths navigated within the Sayan Mountains are marked on Google Earth, though it is accurately marked on Russian maps (see Fig.3). All locations visited on route: Irkutsk, Mondy, Orlik and Khoito-Gol, are accurately labelled on Google Earth.

All major rivers such as the Oka are accurately labelled on Google Earth, but the River Sentsa which was navigated on the walk from Khoito-Gol to the field site is not. Similarly, major landscape

features such as the two volcanoes, Peretolchin and Kropotkina, are accurately labelled on Google Earth. However, smaller features such as the majority of Sayan Mountain lakes, whilst evident in the Google Earth imagery, are not marked as lakes in the Google Earth database.

High resolution satellite images are available for the entire field site and depict all landforms, including lakes, accurately. However, Google Earth features very few ground level photos, to view the site in more detail. In addition, the fieldsite is located near the border between Buryatia and the Tuva Republic and the resolution of the Tuva Republic imagery is much lower (Fig.10), making it difficult to establish landforms in this area, though this was not necessary for our particular study.

Figure 9: Google Earth imagery showing the Irkutsk Oblast, Buryatia Republic, and Tuva Republic borders. Grey lines show territory borders, yellow line shows country borders. Red box represents location of Figure 10.

Figure 10: Google Earth imagery showing the Tuva Republic-Buryatia border.

12: Suggestions of new routes or new subjects for study in the area

The fieldsite in this study must be accessed from Khoito-Gol, so few other routes can be advised for access (see Fig.3). However, U-shaped valleys within the Sayan Mountains were usually easily navigable and had good terrain for walking. Therefore, there is scope for a new route travelling further north from Peretolchin volcano, along a U-shaped valley there.

Suggested new subjects for study in the area:

- Continuation of our studies researching contemporary and past environmental conditions in the Sayan Mountains. This could involve taking further cores from Lakes Kascadnoe-1 and Khikushka or from other lakes in the region such as Tukuren-Nur or Kascadnoe-2 and 3. Coring further lakes would be useful as this would enable a multi-proxy analysis of past environmental conditions if other indicators such as pollen are studied in addition to our chironomid and diatom research. This therefore will enable more confident conclusions, as multiple techniques are used to provide evidence of environmental change, rather than relying solely on chironomids and diatoms.
- Lakes in the region could also be studied for water quality, by investigating quality indicators such as oxygen (%), pH and BOD (biological oxygen demand). Water quality at the field site could be compared to water quality of a lake nearer to Irkutsk to investigate the impact of industrial pollutants on lake water quality.
- There is significant evidence of past glaciation at the field site such as U-shaped valleys, moraines and striae scarred rocks. Therefore, these glacial features could be used to investigate glacial geomorphology during the last glacial period, including the extent of previous glaciers and the speed they receded during the transition to the current interglacial.
- Our field site was also impacted by volcanic processes from the Peretolchin and Kropotkina volcanoes and extensive lava flows are present in the Khi-Gol valley where the campsite was situated. Multiple eruptions have taken place at different times leaving behind solidified lava flows as volcanic rock in the U-shaped valleys. However, the exact chronology and number of these eruptions is still under investigation. Timing and extent of previous eruptions in the region could be investigated by studying tephra within a lake core.

13: Notes on access, porters, or other issues of interest to future visitors

We travelled to Irkutsk on Humanitarian visas, as scientific research falls within this remit. The Humanitarian visa requires an invitation from the General Directorate for Migration for the Ministry of Internal Affairs of Russia, which was applied for by the administrative staff at the Vinogradov Institute of Geochemistry, Irkutsk. We were then issued with an electronic copy of this invitation to take to the Russian visa centre in London. Once in Russia, supporting documents had to be shown at the state border between Irkutsk Oblast and the Buryatia Republic. Then both passports and supporting documents had to be presented again when passing a military check point near Mondy in the Buryatia Republic. No permits were required to enter the Sayan Mountains themselves.

The field site is challenging to access, requiring extensive prior organisation and three days travel from Irkutsk. The first day involves travel by car from Irkutsk to Orlik, via Mondy. Then an off-road Ural car is required between Orlik and Khoito-Gol, before a 17km hike at up to 2500m altitude from Khoito-Gol to the field site.

Between Mondy and Khoito-Gol there are occasional shrines at the road edge, marked by coloured cloth tied to vegetation. Travellers are encouraged to pay their respects at these locations by placing spare change on a wooden plinth for good luck.

There is no access to Khoito-Gol besides an off-road Ural car from Orlik. Journeys between Orlik and Khoito-Gol take place 2-3 times a day. Pre-booking of this transport is advised. In Khoito-Gol itself, there is no electricity, but there are natural thermal springs, perfect for relaxing!

Our Russian counterparts liaised with local guides in Khoito-Gol to aid in reaching the field site and providing horses for transporting the scientific equipment (boats, corer, coring tubes etc.). It should be noted that 'guides' acted as porters and did little to help with navigation. Therefore, visitors should be equipped with an accurate map. Visitors should also note that the route to Peretolchin volcano features steep terrain and is at high altitude. Particularly difficult parts of the route included navigating a 2500m altitude mountain and a 20m wide, 1m deep river. Due to prolonged rainfall during the first three days of the expedition, this river and other smaller streams were faster flowing and deeper on the return hike.

At the field site itself all drinking water can be sourced from fast flowing streams. Whilst conducting field work, our expedition team sighted one brown bear which was scared away by a warning gunshot from the porters. Therefore, all visitors should ensure they have flares or are accompanied by porters with a gun to scare away bears if necessary.

When hiking each day to sample the lakes there were few clear paths and routes often involved traversing large lava flows which were sharp and uneven. Continuous rainfall also increased the risk of injury from slipping. Where possible the lakes were accessed by skirting around these lava flows.

14: Details of any injury or illness to expedition member and/or porters

One member of our team became ill whilst in the field, suffering from nausea, shortness of breath, dizziness, and swollen glands and limbs during the hike from Khoito-Gol to the field site. We overcame this by distributing items of their kit between other team members to lighten their rucksack, and by setting a slower pace. The ill team member stayed at camp during the coring days to recover and team members rotated to stay at camp each day to monitor them. It was considered best for them not to participate in fieldwork to avoid a detrimental impact on their recovery. Fortunately, the member recovered in time to be able to hike back to Khoito-Gol. No injuries were suffered during the expedition.

15: Details of Waste Disposal

All nonbiodegradable waste was transported back to Khoito-Gol where it could be disposed of appropriately. Paper, cardboard and some food waste were disposed by burning on a fire during our last night at the field site. Environmental impacts from disposal of human waste was minimal as there were only six expedition members and we only stayed at the site for three days.

16: Any other relevant comments:

The original plan was to core four lakes at the fieldsite, selecting the most suitable core to conduct further analysis on. This plan was changed, in part due to unfavourable weather conditions on the first three days of fieldwork and additionally due to illness of one team member. The result was that two lakes were cored, Lake Khikushka and Lake Kascadnoe-1, with Kascadnoe-1 being cored twice, as the first core taken was disturbed. We had also planned to sample a lake a day, camping at one

lake and sampling it before moving to the next lake the same day. However, due to weather conditions and team member illness this was changed to establish a permanent camp for the duration of the fieldwork, with team members hiking to and from the lakes each day. Lake Shas-Nur was not able to be cored because substantial rain made conditions poor for the Ural Car, meaning that the journey took 5 hours longer than expected due to navigating a large bog. It was judged to be unfeasible to core the lake with the remaining day light and finish the necessary travel for that day.

After returning from the field site, we began processing the core from Lake Kascadnoe-1 in the Vinogradov Institute of Geochemistry labs, Irkutsk. The samples were partially prepared in Irkutsk to make them ready for transport back to the UK. In Newcastle University labs sample preparation was completed to enable identification and analysis of proxy samples.

17: Summary of expedition accounts, including income and expenditure

Expedition income:

Newcastle University Expeditions Committee - £3,000

Royal Geographical Society – £2,500

Sonia Stonehouse Expedition Fund - £1,300

Mount Everest Foundation - £900

Gilchrist Educational Trust Expedition Grant - £1,500

DIMA - £1000

Total income: £10,200

Expedition expenditure:

UK travel = £335.08

International travel = £3257.68

Accommodation = £1686.61

Subsistence = £699.53

Equipment = £1264.73

Consumables = £150

Pre-fieldwork preparation (including vaccinations) = £929.20

Training = £50

Project report costs (including radiocarbon dating) = £1890

Total expenditure = £10,262.83

18: Below are some photographs to give a sense of the route taken to and from the field site: