

## **Oxford University Liverpool Land expedition**

Surrounding the settlement of Ittoqqortoormiit, at the mouth of Scoresby Sund in North-East Greenland, is a geological terrain that records evidence of subduction to ultra-high pressures (depths of over 100km). These so called 'ultra-high-pressure terrains', typically found within mountain belts, provide a direct record of a poorly understood process: the subduction of continental crust. The Liverpool Land terrain, located in a steeply mountainous area within the Arctic Circle, is inaccessible even by the standards of ultra-high-pressure terrains and is therefore particularly understudied. The combination of excellent geology combined with a mountaineering challenge was part of the motivation for organising an Oxford University expedition during the summer of 2018.

The aim of this expedition was to understand the metamorphic and structural history of this geological unit and collect samples for further petrological work, to archive with the geological survey of Denmark. As per any expedition plan, it was modified and changed on arrival into Greenland to account for weather, terrain and polar bears. The boat journey from Constable point across Hurry Inlet was relatively short and was reliant on my navigation skills using a 1:250,000 scale map whilst trying not to get sea sick or lose any maps to the wind. We were set down on the western side of the field area with a plan to back pack east onto the 'plateau' where we be in an ideal position to move around the area. As soon as we landed, many of the team members looked at the terrain sloping quite steeply to the east up to a high point of 700m, the incised rivers forming deep canyons filled with snow, the long, frozen lakes which feed these rivers and force you on a huge detour, and the miles of boulder fields with few or no campsites. We soon realised that tackling this terrain with 30-35kg backpacks was out of the question. Our new plan involved following the coastline and approaching the field area from the south, on a 4 day detour.

This route turned out to be an amazing backpacking route with a view of the mountains and Scoresby Sund, the largest fjord in the world. During the first night, many icebergs were blown into the fjord which, combined with the midnight sun, made the night watches magical. The journey along the coast, as well as introducing us to the variation in the geology in the boulders and some interesting outcrops, took us along sandy beaches at the bottom of cliffs of snow and littered with icebergs. At the mouth of the glacial Jaettadal river, we turned inland and painfully crossed a muddy (Triassic) bog where the difference between the solid ground and the sinking ground, to this day, leave me baffled.

After our 4 day detour, we arrived at the Tvaerdal river, which runs down from the southernmost of the frozen Tvaerdal lake and the entrance to our field area. The terrain dramatically changed to the almost barren boulder fields with small arctic flowers and birch peeping out between the boulders or forming small arctic meadows, the steep sided, snow covered mountains and glacial landscape. Access to the plateau every day involved crossing the boulders and rivers which was slow progress. However, the amazing geology displayed in the boulders made up for this. Over the next few days we saw migmatites (melted rocks), eclogites (high pressure, red and green rocks), gneisses (these are stripy rocks which were originally a granite in this case) and peridotites (mantle rocks which weather a horrible crumbly brown but have glassy purple garnets). Our ascent of Kronen (1100m) took us up a steeply inclined boulder field onto a wide, gently sloping summit ridge covered in periglacial stone circles.

The geology by our basecamp and eastward across the braided Jaettadal river was different from up by the Tvaedal lakes because the original rock was a sediment rather than a granite. However, it was strongly metamorphosed into marbles, amphibolites (basalts), and quartzites, layered together and then sheared at high temperatures, smearing it all together. There is no evidence of high pressure

rocks and the melting here is more extensive. The samples that I have collected show a huge range in rock types, pressures and temperatures and could provide some interesting information petrologically if studied under the microscope. Their relationship in the field provides the crucial context for this type of study. The limited time and difficult terrain meant that we were unable to study the contact between these rock types in detail and were also unable to access the northern end of the field area. However, the preliminary results from this field season provide us with a good building point for future trips.



*Figure 1 Photo of the field area looking north from the Plane. The deep incised valley is the Tvaerdal valley and the snow covered glacier on the right the Jaettadal.*



*Figure 2 The journey along the coast*



*Figure 3 The discovery of an abandoned Inuit settlement, Kap Hope, across the fjord from the inhabited settlement of Scoresby Sund*



*Figure 4 The view of the Tvaerdal valley from our basecamp*



*Figure52 Polar watch and the midnight sun*



Figure 3

*Granite dykes in the cliffs*



*Figure 7 Crossing the Jaettadal river*