

# South Greenland Geological Mapping Expedition

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# 1 Foreword

A group of four undergraduate Earth Scientists, we travelled to the village of Igaliku, South Greenland in June 2018 in order to complete a six week geological mapping project. We arrived in Greenland a few days after the last fresh snow had fallen on the mountains, and left at the end of August as snow was beginning to cover the mountain tops again. The two months we spent in South Greenland may have not always felt like summer, but spending so much time in such a stunning landscape was more than enough for me to fall in love with the place. This expedition was an opportunity of which I am unlikely to have quite the same again, and I am so grateful for having been able to experience it.

Isabel Carter  
Expedition Leader

## **2 Expedition Members**

### **Isabel Carter - Expedition Leader**

An Earth Sciences undergraduate at St Anne's College. Isabel has a love for field geology, with a particular interest in igneous petrology and mineralogy, as well as a genuine enjoyment of expedition planning. This love of rocks and the outdoors was sparked by numerous family walking holidays to areas of impressive geology such as the Alps, the Dorset coast, Iceland, California, and the Washington Cascades. Her fieldwork experience includes undergraduate trips to Pembrokeshire, Arran, Dorset, Oxfordshire and Gloucestershire, as well as an economic geology trip to Cornwall. She spent three weeks of summer 2017 hiking hut-to-hut across the Austrian Alps with two of her fellow teammates, and was also responsible for the planning and logistics of this trip (and they still let her plan this one). A remaining proportion of her summer was spent on a three week volcanology internship in the Oxford Earth Sciences department, cementing an interest in igneous petrology and geological research. As team leader, Isabel was responsible for expedition planning and logistics, and was the main project coordinator. She was also in charge of funding application submissions and finances.

### **Tamsin Savvides - Outreach Officer**

An Earth Sciences undergraduate at University College. Tamsin loves getting out and about on a field trip, and has an interest in structural geology (faulting and interesting cross-cutting relationships are particular favourites). She first took an interest in geology when on family walks in her local area, Gloucestershire, and has since been on field trips to Arran, Pembrokeshire, Dorset, Oxfordshire, and Gloucestershire as part of her degree, as well as to Cornwall for an economic geology field trip. She has also been on personal trips to Iceland, Glencoe, and one of the UK's only Precambrian outcrops, in the Malvern Hills. As Outreach Officer, Tamsin was responsible for arranging as many opportunities to get young people interested in Earth Sciences as possible.

### **Camille Lecoeuche - Medical Officer**

An Earth Sciences undergraduate at St Anne's College, with a particular interest in sedimentary petrology and all things exoplanets. She has previously completed field trips in Arran, Pembrokeshire, Dorset, Oxfordshire and Gloucestershire, as well as personal trips to other European localities such as Snowdonia and the Alps. Along with Isabel and Joanna, she spent three weeks of the 2017 summer trekking 250 km across the Austrian Alps. As Medical Officer, it was her job to ensure all members of the team were

briefed on the risk assessment and underwent appropriate first aid training. She was also in charge of assembling the expedition first aid kit.

### **Joanna Male - Social Media Coordinator**

An Earth Sciences undergraduate at St Edmund Hall. Joanna enjoys learning about palaeoenvironments in the field and what they can tell us about today's climate. Her field work experience includes undergraduate field courses in Pembrokeshire, Arran, Gloucestershire, Oxfordshire and Dorset, as well as two weeks (summer 2017) as a field assistant for a DPhil student in the Indian Himalayas (looking at continental subduction). In the summer of 2016 she had a two week internship in the vertebrate palaeontology department at the Yale Peabody Museum of Natural History (attached to Yale University), where she helped with the digitisation of specimen information. Summer 2017 she spent three weeks hiking across the Austrian Alps, and previously she had completed a similar expedition walking the northern section of the GR20 in Corsica. Joanna was the Social Media Coordinator for the expedition; this involved writing blogs, updating twitter and taking carefully arranged Instagram photographs.

### 3 Aims

This was an expedition focused on encouraging public engagement in earth sciences and expeditions, and highlighting their global importance.

- Production of geological maps of an area totalling approximately 30km<sup>2</sup> surrounding the village of Igaliku, in the Kujalleq municipality of southern Greenland.
- Raising awareness amongst young people in the UK of the study of geology and promoting the value of expeditions (in particular targeting girls and pupils in state schools).
- Initiating discussions about the role of resource management in the Arctic with UK students, bring back personal accounts and evidence from Greenland (obtained at meetings with locals about the proposed mine near to the town of Narsaq).

## 4 Expedition Diary

**28/06**

The expedition team assembled at Heathrow for the flight to Reykjavik. We arrived late in Reykjavik as the flight was slightly delayed, took the Flybus to the city centre, and check into an Airbnb.

**29/06**

We spent the day sightseeing in Reykjavik.

**30/06**

We took a flight from the domestic airport to Narsarsuaq, South Greenland. The weather was overcast with light rain. We checked into the hostel and collected our hired equipment (SIM cards, roll mats, table, chairs, water carriers and mess tent) from Jacky Simoud at the Blue Ice Café.

**01/07**

We got a lift from the hostel to the port with all of our luggage. We took the short journey across the fjord to Itilleq in a small boat. It was raining, but we were still happy to get our first glimpse of the many icebergs on the the fjord. Jo and the luggage got a lift to the village with one of the hotel workers, whilst the rest of us walked. The walk was not difficult and took about an hour, but the rain made it not terribly pleasant, as we did not have our waterproof trousers on and were wearing jeans. There was a bit of deliberation about where we were allowed to camp, but we did eventually find out that we were able to camp at the front of the village, between the fjord and the service hut. Once the tents were up and our kit finally out of the rain, we headed to the hotel to warm up.

**02/07**

The morning started with stocking up at the small village shop (Pilersuisoq). The shop is very small, but has all of the essentials (including lots of tinned goods) so we did not have issues with getting enough suitable food. This was the reconnaissance day for Tamsin and Camille's mapping area. We walked back along the road towards Itilleq, before following a track west into the area until the track disappeared. We had hoped to reach the back boundary with the basement, but time meant that we did not reach it as the track took a more convoluted route than we thought. Most of the main lithologies were identified.

### **03/07**

The reconnaissance day for Izzy and Jo. There was a long (about 2 hours) walk to get into the area that we wanted to look at, walking around a big lake before a steep uphill onto the plateau. We were able to cover most of the plateau section of this mapping area, and the weather was beautiful, making a real change to the first couple of days of drizzle and grey! Whilst we did manage to look at some of the main lithologies, this day was mostly figuring out routes in and out of the area due to the length of time that took. It also confirmed to us that wild camping closer to the plateau would probably be necessary to avoid Jo and Izzy spending 4+ hours each day walking into and out of the area.

### **04/07**

This was meant to be the first proper day of mapping in separate mapping pairs. It was raining heavily from the morning, but we set out mapping anyway as we did not want to take a rest day so early on. Both groups mapped until just before lunchtime, Jo and Izzy returning to camp, Tamsin and Camille taking a break from the rain in the hotel. Shortly after, with only Izzy and Jo in camp, the wind began to quickly pick up to the point at which the mess tent was beginning to buckle. They tried to take the tent down, but with the strong winds and our sleeping tents also starting to struggle (due to being pitched badly), the mess tent snapped and tore in the process, including taking Jo flying over a table in the process. Camille and Tamisn were alerted and returned to camp, and we took the poles out of our sleeping tents and weighed them down with rocks and took refuge in the service hut until the storm passed. The winds continued until the evening before dying down, but we decided to sleep overnight in the service hut as we were concerned they would start up again.

### **05/07 – 07/07**

The weather on the 5th was dry again so we were able to get in a full day of mapping. We did another day of mapping on the 6th, the weather was dry but overcast. On the 7th we had a rest day to visit the shop for food supplies, do laundry and shower. The afternoon was spent in the hotel, writing up some work and doing some admin that required the internet. This was the formula that pretty much all of our rest days would follow.

### **08/07 – 12/07**

Jo and Izzy set off on their first stint of wild camping on the morning of the 8th. Four days of mapping followed for both pairs, with Izzy and Jo returning to Igaliku in the evening of the 11th and a rest day on the 12th.

The weather was varied between rainy, overcast and sunny, we managed to avoid a very wet day on the 12th by taking a rest day.

### **13/07 – 15/07**

These were three days of mapping, with both groups based in the village. The weather was fair so these were several long days.

### **16/07 – 20/07**

Izzy and Jo set off on another stint of wild camping. The first three days were dry, though with some strong winds in the nights. On the 19th it was heavily raining all day. Camille and Tamsin managed a reasonable day of mapping, staying close to the village so they were able to take breaks out of the rain. Izzy and Jo had to call off the day at midday and returned to the tents, spending a miserable afternoon confined to the tent with little to do. It was lucky that they did return at that time rather than pushing on with the mapping- by the afternoon the river next to their campsite had risen to the point of being uncrossable (needed to access the campsite from the path to the plateau). Luckily, the river level dropped once the rain stopped overnight, meaning that there were no issues with not being able to get out of the campsite to return to Igaliku on the 20th. The evening of the 20th was spent packing and sorting the tents before our week off in Narsaq.

### **21/07 – 27/07**

This week was our week off in the nearby town of Narsaq. We hiked the hour and a half along the road to Itilleq, before taking the scheduled ferry down the fjord to Narsaq. We had hired an Airbnb house, which made a welcome break from tent life. The kitchen (and several large supermarkets in the town) allowed us to get pretty adventurous with cooking, including a roast dinner and baking brownies – a change from the vegetable pasta and porridge diet we had been experiencing in Igaliku! We were also able to do some proper laundry, as we had experienced difficulty in getting enough change to wash and dry everything using the Igaliku service hut washing machines (though we were still grateful for their presence). Some time was spent sightseeing, going on hikes and visiting the museum, as well as writing up work from the first half of the mapping project. On the 27th we got the boat back to Itilleq and returned to Igaliku, ready to start mapping again.

### **28/07 – 31/07**

Three long days of mapping (both groups based in Igaliku), with good weather. The 31st was taken as a rest day.

### **01/08 – 04/08**

Four more days of mapping, with Izzy and Jo wild camping. The weather was mixed, mostly overcast and chilly, but with some patches of sun and little rain.

### **05/08 – 12/08**

The 5th was taken as a rest day, and it was raining for most of the day anyway. On the 6th, Izzy and Jo set off of their final wild camping trip, and both pairs mapped for six mostly dry days. Izzy and Jo returned to Igaliku on the evening of the 11th, and we took another rainy day as a rest day on the 12th.

### **13/08 – 15/08**

These were the last few days of mapping. It was raining for all of these days, which was a shame but we managed to get all of the necessary remaining bits of mapping done. Both pairs did have a few small elements that they were not able to get done due to the weather not making it safe to do so, but this shouldn't have had an adverse effect on the project. Izzy and Jo finished on the 14th, Tamsin and Camille on the 15th. On the 15th, Jo and Izzy spent time photographing and cataloguing the rock samples which were to be posted home, so that export permit could be sent off.

### **16/08**

The afternoon was spent doing work and admin in the hotel.

### **17/08**

As it was our last day in Igaliku, and also Jo's birthday, we went on a hike to some waterfalls in Camille and Tamsin's mapping area. We also gave a small presentation about our work to the staff and guests in the hotel. In the evening we treated ourselves to a meal in the hotel, something we had been looking forward to all trip.

### **18/08**

We packed up camp in the morning, ready for our boat to Qaqortoq in the early afternoon. Once in Qaqortoq, we took a taxi to the hotel, then spent the late afternoon taking a look around the town.

**19/08**

After taking a look around the Qaqortoq museum, we spent the evening sorting out all of our camping and geology equipment to be posted home with the rocks.

**20/08**

The morning was spent in the Tele-Post centre (post office), boxing up our rocks and equipment to be posted and filling out many forms! In the afternoon we got a boat to Nanortalik, for our holiday exploring the far South around Nanortalik.

**21/08 – 28/08**

We spent eight days exploring Nanortalik and Tasermuit Fjord (this was our section of personally funded travel). We did a mixture of hiking and boat trips, and it was great to be able to explore a little more of Greenland.

**29/08 – 01/09**

We travelled back to London Heathrow from Nanortalik, via Qaqortoq, Narsarsuaq and Copenhagen (spending a day in Copenhagen).

## 5 Scientific Research

We spent a total of 33 days mapping in the field. The first two of these days were spent as a group of four carrying out reconnaissance for the main rock types in each mapping area, as well as access routes. The remaining days were spent in two mapping pairs, mapping the two areas either side of the village. Mapping was carried out in a traditional manner, using notebooks, compass clinometers, hand lenses and geological hammers for sampling. We did use GPS for location data, which was a necessity in our areas due to poor quality of the base maps.

Izzy and Jo mapped an area of 18km<sup>2</sup>, to the east of Igaliku. The west half of the area consists of a granite basement, overlain by the bottom few units of the Eriksfjord Formation sequence of sediments (a sandstone, a quartzite and two lava flows). These are cross cut by many east-west trending dykes measuring from metres to half a kilometre in length. The east of the area is the edge of the Illerfissalik Intrusion, a syenitic igneous pluton containing many unusual alkali composition minerals. We divided this outermost section of the intrusion into several different laterally continuous units parallel to the edge of the intrusion. The emplacement of the intrusion has caused several interesting effects with the surrounding sediment and basement rocks, including east dipping sediments and an igneous breccia.

Camille and Tamsin mapped an area of similar size to the west of the village. The area consists mainly of a sequence of sediments interbedded with lavas (part of the Eriksfjord Formation), bounded to the east and west by a granite basement. There are also many dykes crossing the area, the largest exposed for several kilometres long. The area has a complex structure caused by a series of east west trending normal faults.

We are currently in the process of digitising our maps and writing up a full report of our geological findings. This should be complete by mid-January 2019, and at that point can be given on request.

## 6 Outreach

Before the expedition, we carried out the following outreach events:

- Talk and workshop to several school groups visiting the Earth Sciences Department
- Activity table at parents STEM evening, St Andrew's CofE Primary School (Oxford)
- Stand at Super Science Saturday (Oxford Museum of Natural History), Woodstock Primary School Science Evening, Hartwell Science Park Family Fun Day
- Talk and workshop to classes at Botley Primary School (Oxford), Harriers Banbury Academy (Banbury), Cheney School (Oxford) and Little Heath School (Reading), Cirencester Deer Park School (Cirencester)
- Talk to students at Alton College (Alton)

The school visits mostly followed the format of a short presentation about our expedition plans (tailored to the age group), then an interactive workshop based on describing and identifying basic rock samples. We also had a couple of microscopes set up with thin sections, which we took students to look at in small groups. The activity stands were generally scaled down versions of the workshops, with rock hand samples and microscopes.

We had very positive responses from the events we did, with several of the schools inviting us back for post expedition return visits. We are currently in the process of trying to arrange these and further outreach events, which will probably take place in late spring/early summer. A talk was given at Alton College in December.

In the planning stages leading up to our expedition, and during the expedition itself, we ran a blog and associated social media pages documenting our progress. We are hoping to update this in the coming months with some posts summarising the expedition.

## 7 Arctic Resource Management

This section of our aims was where we had the least success. In Igaliku, we did not speak to many people as mapping work took up so much of our time and this was our priority. The people we spoke to had little knowledge and few opinions of the mine in Narsaq (as village is not in direct proximity to it). Local people who may have had more knowledge, we were not able to speak to as they did not speak English well enough to properly communicate the ideas. In Narsaq, we also did not manage to speak to many people. Unfortunately, employees from the mining company were not present in Narsaq when we were there so we could not speak to them. We spoke to someone in the museum who said that progress on the mine had been halted for the present due to local opposition and concern for the environmental impacts of uranium by-products. However, the mining company (Greenland Minerals and Energy) still has a presence in the area, and since returning to the UK we heard that the mine may be close to approval. We are interested to continue following the situation, and this expedition has certainly made us think more about the role in which mining might play in Greenland's future.

## 8 Logistics

### Travel

We travelled to Greenland via Reykjavik, and back via Copenhagen. There are only two airlines which fly to Narsarsuaq (the closest airport to Igaliku), Air Iceland Connect which flies via Reykjavik and Air Greenland which flies via Copenhagen. Our choices of what route to fly were very much based on cost- Air Greenland was generally cheaper, but they had very expensive extra baggage costs (paying by the kilogram rather than by the bag) so we did not want to use them on the way out when we had all of our camping and geological equipment with us as well. On reflection, this would have also been the cheaper option for return flights due to the large additional postage costs we ended up incurring. However, having all of our rocks and camping equipment with us until we flew home would have caused additional logistical issues for our holiday.

Boats and luggage transfers between Narsarsuaq and Igaliku, and Igaliku and Qaqortoq, as well as the Narsarsuaq hostel, were booked via Jacky Simoud of the company Blue Ice Explorer. We also bought fuel and SIM cards, and hired several items of camping equipment through Blue Ice, and Jacky also acted as our in country contact. His advice was invaluable for planning our expedition and we are hugely grateful to him for all the help he gave as many aspects of the expedition would have been a lot more of an unknown without him. His company (Blue Ice Explorer) is very professionally run and all of the boat transfers etc. that we arranged through him went smoothly.

The boats to Narsaq, as well as most of the boats in our holiday section, were scheduled services run by Disko Line. These were also generally fine, although on several occasions the boat times did get rearranged (due to weather) and we had difficulty with finding out that the re-arrangements had occurred. This was not Disko Line's fault, but was due to problems with what phone numbers we had on their record, and they generally did try to make an effort to get in contact with us as best as they could. When travelling in Greenland, you do have to accept that boat travel will not always occur at the scheduled time due to weather, including bringing travel times forward. However, the travel companies are used to dealing with this so do their best to ensure that bad weather does not leave you stranded or adversely affect other travel plans.

### Camping Arrangements and Daily Life

In Igaliku, we camped at the front of the village (by the fjord) next to the service house. This was perhaps a bit more of an exposed site than we would have liked, but was the only place within the village that we had permission to camp, and did provide easy access to the service house facilities. Our

camping set up consisted of two tents, which were large enough to keep all of our equipment and also for all four of us to sit in and socialise in the evening. We had three stoves for cooking, and a hired table and chairs to eat at. We had originally hired a large tent for equipment and a social/eating space, however this was ruined by a storm in the first week and we did not replace it. Our setup with the two tents and outdoor table was found to be perfectly liveable (even in bad weather) and did not feel overly cramped. We had permission to use facilities in the service house, a small building designed for use by local people without running water in their homes. It contained a toilet, showers, laundry facilities and a small kitchenette. There were also a couple of tables which we used for writing up of our maps in the evenings, and occasionally we ate in there when the weather was very bad. Without this facility our cooking and hygiene arrangements long term would have been very difficult, so we are very grateful to the people of Igaliku for allowing us to use them. Technically, we (as tourists rather than local residents) were only allowed to use the toilets and showers, but we found that people tended to turn a blind eye to us using the rest of the facilities as long as we used them in the evenings when few of the villagers were using them.

In Igaliku there is a hotel which has a restaurant/café that we would go to on rest days to do some writing up of work, and also to use the internet and charge our electrical devices. We would generally go in after lunch and stay until dinner, the hotel staff did not mind, especially once they got to know us, and they were interested in hearing about the work we were doing. The hotel staff would also check the weather for Camille and Tamsin each morning on their way to mapping.

It was quickly established on the reconnaissance that Izzy and Jo would need to wild camp due to the distance of the mapping area from Igaliku. To get to the edge of the plateau, the part of the mapping area we wanted to spend much time on, it took two hours each way, and over three hours to get to most north-easterly corner. The southern limit of the mapping area (which we did map whilst based in the village) took a similar amount of time to get to. Whilst we were not limited by daylight, we found that doing a full day of mapping plus four to six hours of walking was very tiring and would not be sustainable for many days in a row. Therefore, we decided to wild camp at the base of the plateau for four to six days at a time whilst we were mapping this area. Access to the campsite was about an hour and a half walk, mostly on an undulating gravel track, and was manageable with our full rucksacks. Whilst we could have camped on top of the plateau, which would have eliminated the half an hour walk each way onto the plateau from camp, we decided not to as it would have been a struggle to carry bags up, and also the plateau tended to have colder temperatures that would have made sleeping less pleasant. We took one of the tents and one of the stoves with us, and ate the dehydrated meals in the evenings which reduced our

food weight. Camille and Tamsin meanwhile had all of the group kit, as well as all of their and some of Izzy and Jo's personal gear, piled in the porch of their tent! For safety, the mapping pairs would exchange texts in the morning and evening (Camille and Tamsin would also send weather updates) and had agreed an emergency procedure if any of these texts were missed.

In the middle of our project, we spend a week on a break in Narsaq, a bigger town just over an hours boat ride from Itilleq. We stayed in an Airbnb house, which was not only cheaper than the hostel but also gave us plenty of space to ourselves to work, cook and relax. This week was a very welcome break from camping and from work, and we think greatly improved our morale and productivity in the second half of the trip and the week leading up to our break. We would highly recommend that extended expeditions take a break (preferably with a change of scene) part way through the expedition if they have the ability to do so, even if it is just for a couple of days.

## **Communication**

Mobile phone service was good within the village, although there was no data service. Once out of sight of the village there was no signal, this included most of the mapping areas and the spot where Izzy and Jo wild camped. However, there were several spots on the edge of the plateau which were in sight of the village and therefore had signal, we passed these on the way to and from mapping so were able to send morning and evening texts (as well as receiving ones from the others).

## **Food**

All of our food purchased whilst in Igaliku was from the small village shop, 'Pilersuisoq'. The shop was very small, but had a surprisingly good selection of foods. It was open every day, but did not open until 10am and had quite limited hours, so we could not visit the shop on days that we wanted to go mapping. Due to the fact that we did not have a fridge, and would only go shopping on rest days once a week, we were limited to cupboard staples and canned goods, apart from rest days where could vary up meals with items from the frozen section. We also found that some things such as rice and potato were not easily cooked on the camping stove. This meant that we didn't have a huge variety and generally ate variations on the same thing day on day, but quantities of food were never lacking so we did not have any complaints! A typical day consisted of the following:

- Breakfast: porridge with cocoa powder or dried fruit
- Lunch: Rye bread with liver pate, biscuits

- Snacks: biscuits
- Dinner: Pasta with tinned tomatoes and tinned vegetables, followed by tinned fruit, biscuits and occasionally chocolate

We did find that once we had bought the shop out of a particular item, it would not generally be replaced so by the end we were having to get more inventive with substitutions, but this never presented any major issues. We brought with us 68 meal packets of dried food purchased in the UK. These were primarily bought for use by Jo and Izzy when wild camping to reduce weight that they had to carry, but as we had spares they were also used in Igaliku for quick meals on long or rainy days. They were purchased from the companies Base Camp Food and Firepot Foods, both of whom had given us a small bulk expedition purchase discount. We had a variety of meals from Firepot, Summit to Eat and Expedition Foods, and we were impressed with the taste and ease of preparation of all of the meals. Particular favourites were Summit to Eat chicken fajita and Firepot posh pork and beans.

## 9 Equipment

Most of our equipment was fairly standard and generic camping equipment, with nothing technical. Particular aspects which may be of particular interest to future expeditions have been highlighted below.

### Electricals

We took two laptops with us. Unfortunately, one did not work at any point whilst in Greenland, possibly due to a cold or damp battery. We coped very well with just a single laptop for essentials (such as emailing, applying for permits), however having a spare was vital for us as otherwise we would have had to do without! For charging, we had with us two Anker power banks and two Anker solar panels. These ended up being used very little as electricals generally lasted for more time than expected, and we had good access to charging in the village. We only really needed one power bank for use by Izzy and Jo when wild camping (the seven charges by one power bank was more than sufficient for over a week). The solar panels would also have been more use if the weather had been less rainy and overcast.

### Tents

We had 2 Hilleberg Nammatj 3GT tents. A lot of time was spent evaluating whether we would need four season tents. We probably didn't need as good tents as these, but we were glad to have them as we knew that we were able to trust the tents in the often less than ideal conditions we encountered. They coped well in strong winds and were very waterproof (even when pitched in a puddle).

At the start of the trip, we also had a large mess tent that we had hired. This tent was destroyed on our fourth day in the village by a storm. We decided not to replace it as our campsite was quite exposed and we didn't want to risk it in another storm. Whilst it would have been nice to have a space to eat out of the rain, and have a larger area for storage, we coped fine without a mess tent as the porches on our tents were fairly large.

### Stoves

We had three MSR branded stoves- a Pocket Rocket 2, a Windburner and a Whisperlite Universal. The remote canister stoves were best for cooking with a large pot due to stability, but we did have a few instances with catching long grass on fire due to their proximity to the ground. Luckily we had a fire blanket! We purchased the Whisperlite International as we were recommended to have a multifuel stove in case we could not purchase enough gas canisters. Whilst this is a valid consideration, we had no problems with sourcing gas canisters (especially if you arrange purchase before you leave

the UK, as we did), and other expeditions to this area could get away with only canister stoves.

### **Clothing and Personal Camping Equipment**

Each expedition member took their own, which varied greatly, but there were several points of general consensus. Synthetic puffa jackets were very useful for sitting around in camp in the morning and evenings. Waterproof trousers are also highly recommended. Sleeping bags were rated down to about zero degrees Celsius, and this is about the limit of temperatures we experienced. Possibly bags of a slightly warmer rating would have been better for the coldest nights, but certainly the bags we had were perfectly adequate. For general repairs of clothing and many other things, duct tape and superglue goes a long way.

### **Geological Equipment**

A GPS unit per mapping pair (plus a spare) was an absolute necessity for geological in this area due to the lack of landmarks and poor quality of our base maps, as that was the only way to locate ourselves on the map.

## **10 Funding**

Funding for the expedition was secured from a range of sources which are detailed below, totalling £15700. A summary of all of the expenses incurred by the expedition can be seen in the appendix.

### **Grants**

Grants made up the majority of our funding. We applied for twenty four grants and were successful with ten, totalling £11100. These were from The Gino Watkins Memorial Fund, The University College Travel Grant, The St Anne's Travel Grant, St Edmund Hall Mapping Grants (Chevron Award and The Keith Gull Fund), The Alpkit Foundation, The Lord Mayor's 800th Anniversary Awards Trust, The Andrew Croft Memorial Fund, The Jeremy Willson Charitable Trust, The Explorer's Club and The Everest Lewis Golden Foundation.

### **Crowdfunding**

We ran a crowdfunding campaign in March/April 2018, run with the support of St Anne's College through their crowdfunding platform. This was successful and raised just over £3000 including gift aid.

### **Donations in Kind**

We contacted several outdoor gear and food companies in the hope of sponsorship or discounts. The majority of these we got no reply from, but several did give us discounts which allowed us to save money on equipment we would have purchased anyway. The backpacking food companies Base Camp Food and Firepot both gave us small expedition discounts for bulk purchases of dehydrated meals. Hilleberg the Tentmaker allowed us to use the 30% professional discount to purchase our two tents directly from them.

### **Other Sources**

£400 per expedition member (£1600 total) was given by the University Of Oxford Department Of Earth Sciences. This is an allowance given to every second year earth scientist undertaking their mapping project.

## 11 Acknowledgments

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| <b>Category</b>                  | <b>Item</b>              | <b>Cost (£)</b> | <b>Total cost (£)</b> |
|----------------------------------|--------------------------|-----------------|-----------------------|
| <b>Food</b>                      |                          |                 | 2980                  |
|                                  | In country               | 2565            |                       |
|                                  | Dried meals              | 415             |                       |
| <b>Travel</b>                    |                          |                 | 5995                  |
|                                  | Flights                  | 4530            |                       |
|                                  | Boats                    | 1305            |                       |
|                                  | Buses, taxis and subway  | 160             |                       |
| <b>Accommodation</b>             |                          |                 | 1435                  |
| <b>Assorted in country costs</b> |                          |                 | 1630                  |
|                                  | Laundry                  | 25              |                       |
|                                  | Internet                 | 145             |                       |
|                                  | Postage                  | 1460            |                       |
| <b>Kit</b>                       |                          |                 | 2875                  |
|                                  | Tents                    | 1010            |                       |
|                                  | Other camping equipment  | 1295            |                       |
|                                  | Geological equipment     | 320             |                       |
|                                  | First aid kit            | 250             |                       |
| <b>Admin costs</b>               |                          |                 | 465                   |
|                                  | Grant applications       | 55              |                       |
|                                  | Printing                 | 75              |                       |
|                                  | Crowdfunding rewards     | 30              |                       |
|                                  | Foreign currency charges | 305             |                       |
| <b>Miscellaneous</b>             |                          |                 | 320                   |
|                                  | <b>Total</b>             |                 | <b>15700</b>          |

## 12 Appendix: Expenses