

## **Residential field trip to Raasay**

Friday 27<sup>th</sup> to Monday 30<sup>th</sup> April 2018

**Leader: Dr Brian Bell**

**Friday 27<sup>th</sup> April**

We drove to Skye in shared cars and boarded the ferry at Sconser for the twenty-five-minute sail to Raasay. By late afternoon the group had all met up at Raasay House where we would be staying.

**Saturday 28<sup>th</sup> April, am.**

Report by Seonaid Leishman

When Brian Bell was asked by Maggie Donnelly to take a GSG excursion to Raasay it was clear that long notice was required, not only to fit in with Brian's reputation and busy schedule, but because of the popularity of the main accommodation on the Island! We therefore had 18 months to build up high expectations – all of which were all met!

The original Macleod house was burned following Culloden and rebuilt in 1747. Boswell, visiting in 1773 states, "we found nothing but civility, elegance and plenty". Not much has changed. The Raasay House Community Trust has worked hard to set up the Hotel and Outdoor Centre in this elegant building. On the Friday we joined Brian and his colleague Ian Williamson at the House and had the first of many excellent meals followed by an introductory talk in the House library provided for our Group's use. The Island has well exposed rocks ranging in age from Archaean Lewisian Gneiss, through Torridonian sedimentary rocks, Triassic and Jurassic including Raasay Ironstone and topped by Palaeogene lavas and sills. We would see all these exposures – however not necessarily in the right order!

Saturday morning before breakfast photos were urgently being taken of sun on the Red Cuillins – this weather and view wouldn't change all weekend!



The Red Cuillins from Raasay House

Brian then explained that *because* of the sun he wanted to skip sequence and NOT start with the oldest rocks, in order to ensure a great photo that morning on the east coast at Hallaig. Having parked at Fearn, the end of the tarmac, we walked along the well preserved ancient track towards the deserted village of Hallaig. We noted landslips in the Late Devensian diamictite below the ridge of Jurassic Scalpay sandstone. The village of Hallaig, cleared in 1852, is just beyond Rubha na' Leac where a memorial stands. There Iain Allison recited the first verse of Sorley McLean's Gaelic poem, Hallaig, inscribed on the cairn to Sorley of this air. To the north of us was laid out the whole stratigraphy of Raasay from Lewisian upwards topped by the Palaeogene lava on Dun Caan. A photo opportunity indeed!

Track to Hallaig



View from Hallaig of East Coast stratigraphy



At sea level on Rubha na' Leac there are exposures of the Triassic Stornoway Formation consisting of fine and coarse sedimentary rocks. As the crust stretched, basins formed in arid equatorial conditions not unlike Death Valley today. Alluvial fans deposited red siltstone interspersed with cobble conglomerates when the current was stronger. Some of these varied clasts are recognised as Cambrian and Moine. Brian described this environment as a 'sink' with no exit so that calcretes formed as the shallow lake waters evaporated. The exposure also includes Palaeogene dykes and sills which have baked the country rock.



Rubha na' Leac



Triassic Stornoway Formation

After clambering back up to the road and enjoying the views to South Skye, we took our lunch at Fearn and set off north for the Lewisian Gneiss complex.

*All photos by Seonaid Leishman*

**Saturday 28<sup>th</sup> April, pm.**

Lewisian and Torridonian

Report by Iain Allison

After a sunny lunch at the road end in SE Raasay with views over the Isle of Scalpay to Kyleakin, Kyle of Lochalsh, the Crowlin Islands and the southern Applecross peninsula, we retraced the route and drove north. En route we stopped to view the landslips on the Isle of Skye below Beinn Tianavaig, south of Portree bay, (Fig. 1) where the Palaeogene basalt lavas have slipped down on Lower Jurassic shales, as at the more famous locality of The Storr, clearly visible in the distance.

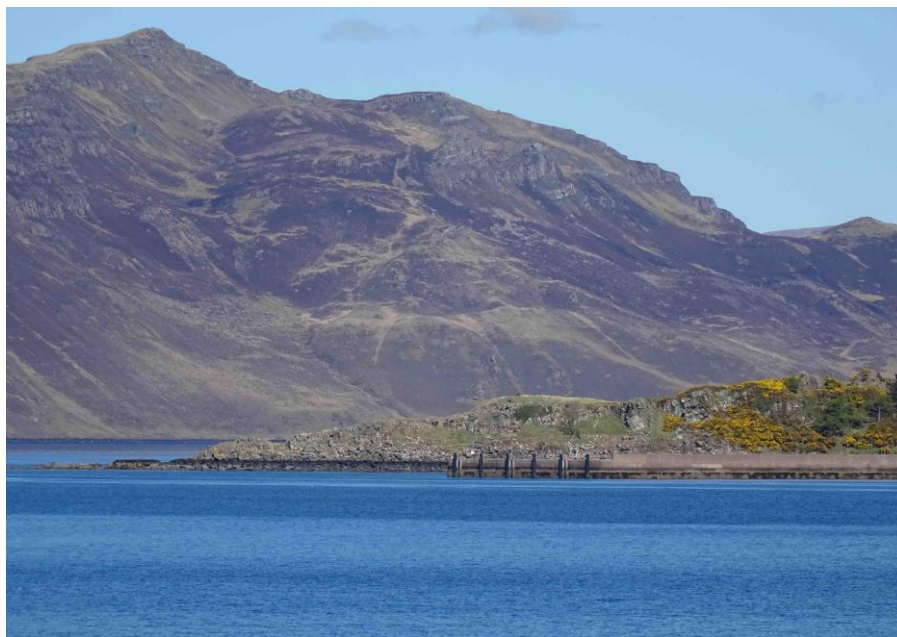


Fig.1

We continued north past the sign for Calum's Road to the end of the public road before turning around and parking near some well exposed road cuttings.



These show all the important features of the Lewisian gneiss which forms the metamorphic basement of the Hebridean and Northern Highlands terranes (Fig. 2).



Fig.2

These gneisses, originally of Archaean age ( $2790 \pm 210$  Ma), were reworked during the Laxfordian event and the fabrics now seen reflect this overprinting. In the period 2400-2200 Ma a suite of mafic intrusions was emplaced and subsequently deformed and metamorphosed. These now occur as sheets parallel to the dominant gneissic foliation. The enclosing 'granitic' gneisses are grey to pink and have an average composition of granodiorite yielding ages of  $1680 \pm 170$  Ma. Laxfordian deformation has caused pinch and swell structure to form in the mafic sheets and, in places, separation to form boudins with the space between filled with granite pegmatite. The minerals and structures represent deformation at mid to lower crustal levels. The attitude of the gneissic foliation is very variable but here it was flat-lying.

We headed south and parked at Brochel Castle, which sits on the Triassic conglomerate, and ascended the slope above the sign "Calum's Road," to see the relationship between the Triassic conglomerate, seen in the morning at Rubha na' Leac, and the underlying rocks.

Here the conglomerates overly the Lewisian gneisses but all the clasts are of the Torridonian (Fig. 3, BRB).

The steep contact implies that the Triassic breccias infilled a hilly landscape.



Fig.3

The clasts were a mixture of tabular angular fragments of shaly rock as well as more rounded clasts of sandstone.

The clasts are cemented with calcite and in places we saw drusy nail-head spar calcite lining small cavities (Fig.4). Walking to the top of the rise and NW across the moorland we could see, to the north,



Fig.4



Loch an Uachdair and the westerly dipping Torridonian overlying the gneisses. It was possible to trace the unconformity south down the east side of the loch and round to the west beneath our feet. It then turns SE close to our previous exposure showing that there was indeed a local source of Torridonian clasts. To the NW we could just pick out the third small outlier of Triassic rocks which form a line from Brochel Castle.

Continuing south, we parked north of Glam and walked up to low cliff exposures on the west side of Beinn a' Chapuill to see the internal structure of the beds of Applecross formation sandstones which here on Raasay are called the Leacstearnan member (Fig. 5).



Fig.5

These thickly-bedded fluvial sandstones deposited in braided rivers show dramatic soft-sediment deformation and dewatering structures preserved after overpressuring gave rise to quicksands. The cross-bedding is very distinctive – in places the foresets can be traced laterally and their dip increases until they become overturned. As well as the cross-bedding to indicate way-up, many layers show grading from pebble sandstones through granules to coarse sand.

This ended an excellent day of spectacular scenery and excellent rocks seen under blue skies and we returned to Raasay House.

*All photos by Iain Allison*



**Sunday 29<sup>th</sup> April, am.**  
Report by Monica Reilly

### Outcrop 1- Breakish Formation

The first locality of the day focused on the south of Raasay near East Suisnish. Here, after a short walk from the pier, through numerous derelict buildings associated with the iron ore mining industry, the Breakish Formation is exposed. The exposure consists of calcareous sandstone interbedded with mudstone and limestone and abundant in bivalves, notably gryphea. The depositional environment for this unit has been described as nearshore (as the gryphea are largely intact) with periods of higher energy washing in sand.



*Breakish Formation showing stratification between gryphea rich beds and calcareous sandstone.*

### Outcrop 2- Pabay Shales

The second locality of the day was a short walk, approximately 500 m, north of the pier along the single-track road to a cutting through Pabay Shale Formation. The Pabay Shales, also lower Jurassic, comprise fine grained laminations of mudstones and siltstone with calcareous nodules. This unit shows an obvious transition to a deeper, offshore environment in comparison to the Breakish Formation. Calcareous nodules have been described as a result of burial and dewatering and are not associated with the deposition of the mudstone and siltstone sequences.

*Pabay Shale formation*



### Outcrop 3- Granite Sill in Pabay Shale

The third locality was approximately 400 m north from the previous location and in a roadside cutting. At this location, pale grey Palaeogene granite has intruded into the Pabay Shale Formation. This has caused disturbance within the shale beds. Contact metamorphism has also been noted between the shale and granite intrusion. Shale at the margins is typically less weathered due to alteration from the granite. It has also been noted that there is a dyke intrusion through the shale formation which terminates at the point of contact with the granite.



*Granite intrusion into Pabay Shale Formation.*

*Photos by Monica Reilly*

**Sunday 29<sup>th</sup> April, pm.**  
Report by Katerina Braun

### Dun Caan Summit

Just before reaching the summit of Dun Caan, a change in rock type is observed marked by a straight NNE-SSW cliff line and two lochs, Loch na Meilich and Loch na Mna situated below the cliff line. This linear feature marks the position of a fault that separates granitic rocks to the west and the basic igneous rocks that form the summit of Dun Caan to the east. There is no granite present east of this feature; hence the fault must post date the granite intrusion.



View of Dun Caan Summit, Loch na Meilich, fault line and granite cliff line.

Flow banding is evident in the basic igneous rock outcrops on Dun Caan summit and is also visible in thin section. Dr Brian Bell informed the group that he believes these basic igneous rocks are extrusive and formed from lava flows. Dr Brian Bell also reported that red horizons have also been observed in these basic igneous rocks exposed on Dun Caan summit, further supporting his lava flow theory. Dr Brian Bell considers the suite of Dun Caan basic igneous rocks therefore to be a remnant of the Skye lava plateau. Evidence of landslide activity east of and below Dun Caan summit is easily visible from the summit.





*Close up view of Dun Caan basic igneous rock outcrop with flow banding structure*

*Easterly view from Dun Caan summit and evidence of landslide activity below*



### Oskaig Point

The last locality of the day included a visit to an ultrabasic sill at Oskaig Point. This sill is faulted against granite to the northeast and Jurassic strata are present to the southwest. This sill is composed of Picrite, which is more basic

than basalt and has a higher olivine content. Dr Bell informed the group that this sill is similar to other sills observed across northern Skye. This sill is chemically related to Little Minch sill complex on northern Skye. There is also a large offshore intrusion in Jurassic rocks between Lewis and Harris of similar chemistry. The sill chemistry is chemically distinct to the Skye lava pile, which has a lower silica content and higher alkali content. Dr Bell noted that all these chemically similar sills have been intruded into Jurassic rocks and that currently, there are no known exposures where these sills have been intruded into the Skye lava flows.

*All photos by Kat Braun*

## **Monday 30<sup>th</sup> April, am.**

Report by Jim Martin

### Visit to the Raasay Iron Mine Workings

On Monday morning we visited the workings of the now derelict iron mine, opened prior to the first war, to exploit the Raasay Ironstone. It is situated at the very southeast of the island near the old pier, and after parking near the adit of No 2 Mine, we climbed up to the remains of the surface workings, close to No 1 Mine. The ironstone formed during the Toarcian, within the Jurassic, in a shallow marine environment and is described as thinly-bedded, chamositic (silicate) ooidal, dark grey to black and micaceous. It is typically 2-3 m thick. The ironstone was extracted using an extensive network of eight kilometres of underground tunnels and surface strip mining. On the Portree Shale formation, the strata below that previously strip mined, we observed fossilised ammonites and belemnites. The surface material was quarried first, having a higher iron content and being more easily won. A system of draglines, hutches, cables, winches and narrow-gauge railways was created to transport the ore from the mines to the processing plant at Suishnish. Here, prior to shipping, the ore was concentrated and then shipped out via Ardrossan in Ayrshire for onward transport to Coatbridge and Glengarnock. Concentration was achieved through calcination, a process which involved a controlled burn of crushed ore mixed with imported coal.

To support the operation William Baird and company, operating on behalf of the British government, created an infrastructure to support the community of workers, managers, a doctor, and up to 200 German prisoners of war along with 60 officers and soldiers as their guards. The employment of the prisoners was justified on the basis that soldiers could not be released to do the work, but was contentious because mining for iron could be in contravention of the 1907 Hague Convention. Fourteen German soldiers died while working on Raasay, two from accidents and the others from influenza. The works produced a total

of 200,000 tons of ore with peak production occurring in 1916. The works were maintained in readiness to resume production until being dismantled for scrap during World War 2.

We returned downhill and walked a short distance to view the adit of No 2 Mine. An iron railing now closes the entrance (danger of rock falls and poisonous gas) but we could look inside. It is thought that because of severe faulting there was virtually no production from this mine. It must have been an expensive white elephant considering the cost of constructing the high viaduct, hauler house and other mine-head buildings. However, it was not entirely unused as Baird's built a sawmill here and all timbers used in the mine for pit props, railway sleepers power poles and other purposes were sawn here and transported by rail.

Back at the cars our leader was given a **very** big "thank you" for providing us with such an interesting and enjoyable weekend, and was presented with the customary gift of appreciation, before we all set off to catch an afternoon ferry.

### **References:**

The Iron Ore Mine on the Hebridean Island of Raasay *Der ANSCHNITT 51*  
1999

The Raasay Iron Mine Where Enemies Became Friends *Laurence and Pamela Draper*.