

## **Lochaber 2<sup>nd</sup> trip**

**Fri 5 May – Mon 8 May 2017**

16 participants

Friday 5<sup>th</sup> May, pm

**Report by Maggie Donnelly**

Our party gathered, under wall-to-wall blue skies, beside the Ballachulish tourist information centre at 11.45 am, and had time for a visit to the South Ballachulish Slate Quarry which cuts into a large deposit of the Ballachulish Slate Formation (graphitic pelite). Originally laid down as a very fine-grained mud, around 800 million years ago, this underwent low grade metamorphism during the Grampian Orogeny (peak ~ 470 Ma), converting the mud into slate, with a bluish hue due to the presence of iron and sulphur.

Established in 1692, the Ballachulish Slate Quarry thrived during the 18th Century, producing many of the slate roof tiles for surrounding areas as well as those for Edinburgh and Glasgow. In 1845, the quarry supplied 26 million slates. However, much of the quarried slate was of poor quality due to the presence of small quantities of iron pyrite which weathered rapidly in the Scottish climate and increased the porosity of the tiles. The quarry employed many of the villagers and had a major impact on their lives. All were affected directly or indirectly by its activities, with the intermittent deafening explosions and the continual drilling, hammering and chiselling by both machine and man. There were also two long running disputes over medical care between the management and the workers, before the quarry eventually closed in 1955.

A short and interesting walk takes the visitor round the quarry, with interpretation boards on its history, the people, the nature and versatility of Ballachulish Slate, as well as an excellent interpretation of the geology of the area (Lochaber Geopark Association). There are good views of the exposed quarry faces with complex, almost vertical bedding planes, sub-parallel to the slaty cleavage planes; the rock faces are cut by basalt dykes and quartz veins, and we had fun looking for samples of pyrites.

We then drove 2 km west to St John's church, NN 065 587, on the shores of Loch Leven, in order to see the Ballachulish Slide

. For a description of the locality and geology of this shore section with the Slide, see the first report for **'Lochaber, Fri 21 April – Mon 24 April 2017'**.

Having accomplished this, we returned to the cars and had a brief lunch break in the parking area before crossing the Ballachulish Bridge. We stopped for a short time to take in the views across Lochs Linnhe and Leven of the Ballachulish Igneous Complex and the Pap of Glencoe, as well as to examine the old slate quarry on the north side before continuing to the Corran ferry. On this second occasion the cloudless skies and sunshine made the sail even more magnificent than on the first. Once across, we drove to Strontian where we parked a few cars, and continued on to the Silica Mine at Lochaline – again our appointment was for 4.30 pm.

### **Reference**

<https://www.wildlochaber.com/glencoe/geology/balachulish-slate-quarry>.

Friday 5<sup>th</sup> May, pm

**Report by Bob Diamond**

### **Lochaline Silica Mine**

During Friday afternoon we were given the opportunity to visit the Lochaline Silica Mine, which is owned by Lochaline Quartz Sand Ltd, a joint venture between an Italian mining company and the owners of Pilkington Glass. This is the only silica sand mine in Britain, and the purity (particularly the very low iron concentration) of the sand makes it ideal for high quality glassmaking. We were privileged to be able to walk a short way down one of the main adits which was high enough to accommodate a substantial dumper truck, accompanied by three very knowledgeable mine employees. The silica is mined using the room and post system. After blasting, the sandstone is taken to the surface where it is crushed, screened and washed. We were also able to see how the mine water is pumped to the surface to be used in the washing process, making this a very environmentally friendly system. The sand is then put into ships via a conveyor belt system, and taken directly to Runcorn

The mine exploits a seam of almost pure silica (99.8%) which is up to 12 m thick in places. The sand was deposited in Cretaceous times (*ca.* 93 Ma) in a shallow tropical sea close to the shore. As a result of repeated reworking by tides and storms, the deposit was sorted until it became almost pure quartz sand. The sand overlies Jurassic shales and limestones and is capped by the later Mull basalt flows. As a consequence, the top layer of the sand has become very hard, and this makes it a perfect roofing material for the mine. Only the middle 5 m is mined.



An Archimedes Screw used to lift the sand and water slurry.

*Jim Martin*

The sandstone was first mentioned at the end of the 19<sup>th</sup> century but it was not actually mined until the outbreak of War in 1940 when high quality silica was needed for periscope lenses and gun sights. Nowadays most of the output is used for Pilkington's Optiwhite glass, an extra clear float glass with very high light transmission.

It was a pleasure to visit this site which is not only geologically special, but has played an important part in the modern industrial history of Lochaber.

Saturday 6<sup>th</sup> May, am  
**Report by Joyce Stewart**

After a hearty breakfast we all met in the carpark including our guide Jim Blair at the Strontian hotel in the village of Strontian (Gaelic for “Point of the Fairies”) to car share. It was an ideal day with a cloudless blue sky.

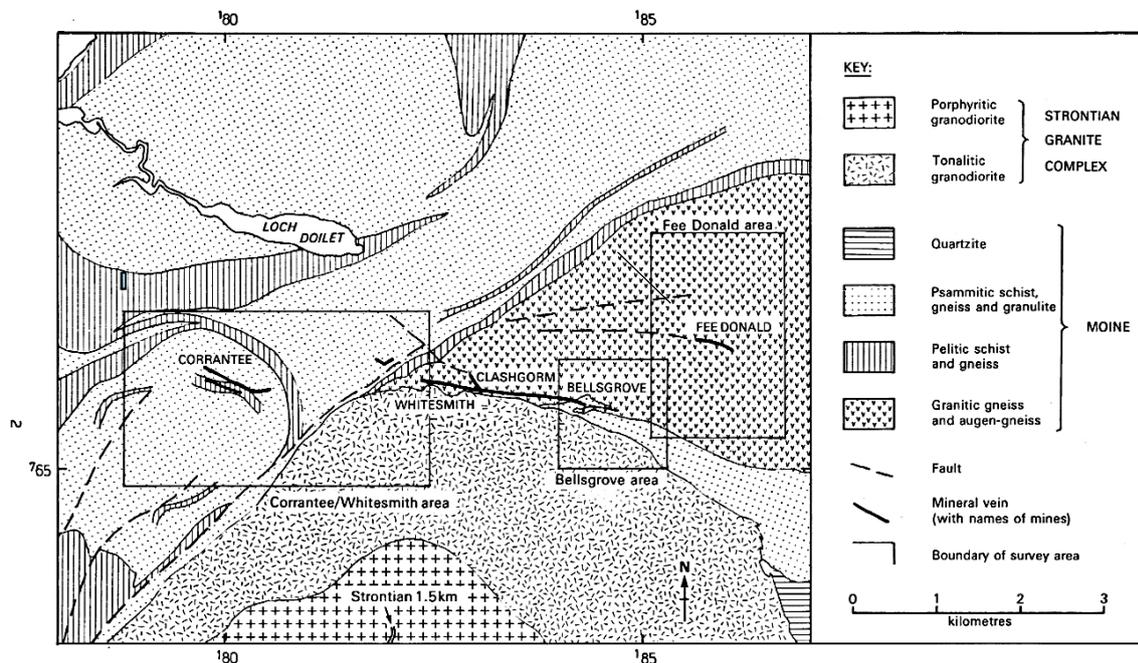
We drove north to the Ariundle Forest road and saw Glacial drift with locally derived materials. Further up the road, we had a lively discussion on exposures of the granite with xenoliths. One theory was that a dyke was trying to intrude into a crystal mush – this was discounted. Other theories were that it was a stream of xenoliths as the magma moves or maybe a crystal mush on the move.

The edges are clean and this hints that it is some form of xenolith, possibly a xenolith stream in the process of being absorbed back into the magma? The xenoliths seem to be aligned, stretched or streaked out or a mixture of both. See the picture and decide for yourself. Further on, there were angular inclusions which looked more xenolith-like. After this we moved on to see granodiorite with lenses.



Our next stop was at Bellsgrove mine where we saw the settling pond which was used in the 1980's when mining baryte for North Sea oil drilling mud. The water from the settling pond then run off into Strontian River. The mining stopped in 1990 when the company went bankrupt. The opencast baryte mining practically obliterated the old lead/zinc mines.

Jim told us the history of the mines. In 1720 Sir Alexander Murray of Stanhope bought the Ardnamurchan estate and starting mining in 1722. The lead ore vein complex goes on for about 8 km across the hillside. After the Napoleonic wars there was less demand for lead and the mines went through various hands without much success. Silver was a by-product of the lead mining and out of 300 – 400 tonnes of lead around 40lbs of silver was extracted. We saw the entrance to 60 – 70 ft. deep shafts which are not safe to go down. We then had a safety talk for overhanging faces in the Whitesmith quarry. The quarry faces were Argyle Granite Gneiss and we saw cockscomb baryte. We saw the veins of calcite following the faulting. After a busy and enjoyable morning, we stopped to have our lunch at the quarry before continuing on to the next location.



British Geological Survey; Mineral Reconnaissance Programme Report, No. 85 Geophysical surveys near Strontian (page 2), Highland Region; Director, Geological Society; Authored by G.S. Kimbell (1986)

Saturday May 6, pm: Rubha na h'Earba  
**Report by Bill Gray**

This afternoon's walk took place in sunny conditions with a gentle east breeze. We parked at a farm near Kilmalieu at the northeast end of the Morvern peninsula (NM 897 558). This locality lies on the southern boundary of the Northern Highland terrane, which is separated from the Grampian terrane by the Great Glen Fault. The plan was to walk round the bay to the headland of Rubha na h'Earba to the east and to examine the metamorphic rocks of the Moine Supergroup and the sedimentary rocks of a Devonian outlier on the way.



Walking towards Loch Linnhe and the start of the excursion. The headland of Rubha na h'Earba lies beyond the sandy bank in the bay. *Bill Gray*

We started by inspecting a wave-cut platform at the beach near the path. Jim explained that this area was near the centre line of the Great Glen Fault, which has been active since 450 Ma and along which there has been a displacement of between 200 and 2000 km. (According to the account in *The Geology of Scotland*, 4th edition, 2002, there was a sinistral displacement of probably no more than 200-300 km between 430 and 400 Ma and a later post-Devonian dextral displacement of 25-30 km along the fault.) The platform on which we were standing was composed of metamorphic rocks belonging to the youngest group of the Moine Supergroup, the Loch Eil Group. The rock types were psammite (metamorphosed sandstone) and semipelite (metamorphosed mudstone) and there was a prominent fault intrusion of granite pegmatite.

Jim standing on a platform of psammite and semipelite with a granite pegmatite in foreground. *Bill Gray*



We now walked further round the bay towards Rubha na h'Earba, which is a Devonian outlier in the Moine. At the unconformity between the Moine and the Devonian (NM 908 555), the rock type changed from psammite/semipelite (Moine) to angular breccia (Devonian), which was deposited during a flash flood in a desert environment. The time gap represented by the unconformity is of the order of 450 Ma, as the Moine sedimentation finished at around 870 Ma and the Devonian period started at around 420 Ma.

As we walked along the shore, which alternated between grassy sward and bare rock, the breccia became progressively finer in texture. As we were walking along the direction of dip towards younger rocks (southwards), this indicated that the environment of deposition had become less energetic with time. Jim explained that the coarse basal sediments were derived from the Moine rocks of the Northern Highland terrane on the northwest side of the Great Glen Fault while the finer sediments at the top of the succession were derived from the Dalradian rocks of the Grampian terrane on the southeast side of the fault. We passed a Palaeogene dyke on our way to the point of the headland (NM 910 553), where we had a refreshment break on the shore. While enjoying the sunny sheltered location, we could, with the help of binoculars, see seals and cormorants on the small island of Sgeir nan Gillean. We were still on Lower Devonian rocks, but after our break we searched for members of the Ardgour lamprophyre dyke swarm, which dates from 300 to 290 Ma (Carboniferous-Permian). While looking for the dykes, we saw an exposure of tufa limestone, precipitated by evaporation from water percolating through the rocks. With Jim's help we eventually found one of the lamprophyre dykes, which ran parallel to the shoreline before turning through a right angle into the sea.

We now made our way back to the cars and drove back to the Strontian Hotel along the raised beach via Kingairloch. On the descent to Loch Sunart we stopped at a viewpoint with a wonderful panoramic view north to the Ariundle mine and beyond, and took the opportunity to capture a group photo.

Geology field days don't get much better than this.



Group photo. *Bill Gray*



Course angular breccia at base of the Devonian outcrop.  
The lens cap is 52 mm in diameter  
*Bill Gray*

### **Sun 7<sup>th</sup> May, am & pm Report by Walter Semple**

Day 3 allowed us to view the three dominant rock types of Morvern: the underlying Moine schist, the Strontian granite and the extensive Mull flood lavas spreading far into Morvern, and protecting the pre-existing rocks from erosion.

Our guide, Jim Blair, took us to the granite on the north shore of Loch Sunart, east of Strontian, near the cattle grid. He pointed out xenoliths in the granite all aligned in the same north-south direction. They resembled aligned xenoliths in the granite about 2 miles north of Strontian which we had seen on day 2. He challenged us to explain these features. We moved on to Stop 2 which took place at a quarry on the west side of the road south to Lochaline. The Strontian granite in the quarry featured large red feldspar crystals giving it an attractive appearance. Intruded into the granite were multiple dykes, thought perhaps to be associated with the Ardgour dyke swarm. The age of these dykes is not settled beyond doubt. They may be at least partly lamprophyre, and may represent intrusions associated with the movement of the Great Glen fault over long geological periods.

Stop 3 took place at the Rahoy junction where Jim Blair showed us a roadside unconformity between Permian red sandstone and the underlying Moine schist, sparkling with Muscovite in the sunshine, and demonstrating the variety of rocks to be seen in the area. Stop 4 took us a short way up a forest track whose excavation had revealed Jurassic limestone pavement bearing *Gryphea* fossils. Protected from erosion by the Tertiary flood basalts, these are the Broadford Beds deposited with the Pabay Shales. Stop 5 at a roadside cutting revealed further rocks protected by the Tertiary lavas. These are known as the Stornoway formation. They are composed of thermal Triassic sandstone and nodular limestone formed the Triassic and Permian periods. The appearance was that of an unstructured set of dark red rocks containing miscellaneous poorly sorted clasts.



Jim indicating the position of the lamprophyre dyke at Rubha na h' Earba  
*Bill Gray*

Stop 6 took us through the Ardtornish Estate to the "Fossil Burn" on the East shore of Lochaline. Here was exposed hard Jurassic limestone pavement with liberal examples of fossils on the limestone boulders lying amongst the basaltic rocks which had tumbled down the burn.

New collective term – a “hat” of geologists.

Having lunch in the sun on the bank of the River Aline.

*Alison Grant*



The next stage was to walk up the hill to "Tennyson's waterfall" flowing over a basalt terrace. The volume of water passing over the waterfall had suffered from the wonderful dry and sunny West Highland May weather which we were much enjoying.

Stop 7 was in a large road cutting on top of the Mull lavas high above the western Lochaline. Searching for olivine crystals in the volcanic rocks produced good success. The final stop 8 took us again to the West Shore of Lochaline where we found many Jurassic

fossils which had survived thanks to the protection of the Tertiary lavas. They included *Gryphea*, *Pentacrinus* and Ammonites.

Monday 8<sup>th</sup> May, am

**Report by Eve Gilmour**

Those of us who had stayed to participate for Monday morning's excursion went back over the Corran ferry and assembled at the Holly Tree pub in Kentallen. We went down to the shore to be shown wave worn vertical beds of the Dalradian country rock with an intrusion of a granodiorite and were introduced to the Kentallen intrusion. This is a member of the Duror of Appin cluster of appinitic diorite intrusions. Kentallen is the type locality of 'Kentallenite', a melanocratic, olivine monzonite. The rocks post-date the deformation and metamorphism of the Dalradian country rocks, and probably pre-date emplacement of the Ballachulish granite pluton.

We then followed the No 7 cycle path for a short distance where a Lochaber Geopark information board gives a good view Loch Linnhe (part of the Great Glen fault) and the geologic scenery of the Kentallen intrusion, the Ballachulish complex and Dalradian country rocks. We could also examine the Kentallenite in more detail, looking for phenocrysts of olivine and augite. There is also an igneous breccia boulder near the board, an erratic from Glen Coe.



Our group beside the Kentallen information board. *Maggie Donnelly*

A short walk along the shore led to a shore side site which exposes an actual junction of the Kentallenite Metamorphic Aureole with the country rocks. The junction is very clear, even to those of us who have more to learn. A nearby exposure of Kentallenite has a coating of cordierite, which has weathered with a distinctive honeycomb pattern.

Back at the Holly Tree Jim Blair was thanked for excellent leadership, showing the depth and breadth of knowledge which he shared with us with enthusiasm – an excellent few days.

### **Additional attractions in Lochaber, May 2017**

It was early May, and the sun shone in an almost cloudless sky for the full four days of our trip to Sunart and Morvern. As well as the fascinating geology, Lochaber had many other natural history attractions, especially the early spring woodland flowers and the spring bird song. Just behind the Strontian Hotel lies a stretch of community woodland, with Scottish bluebells, cuckooflower, celandine and pink purslane covering the forest floor. Past the village, another short woodland walk follows the Strontian River up the east bank, crossing the river then joining the Ariundle road back to the village. The light foliage of the ancient oak trees, famous in the Sunart area, gave a dappled shade to a carpet of wood anemone, studded with cuckooflower and dog violet. From both sides of the hill up to the lead mines, cuckoos were calling repeatedly.

We picked up the call of the cuckoo again the following day on our excursion into Morvern, calling across the sheltered glen as we made our way south to Loch Aline. Here oak woods were replaced with ancient birch groves, fresh in bright green leaves. On a delightful walk along the east shore of the loch towards the sound of Mull, a pair of ravens croaked above the craggy horizon. Near the Fossil Burn, the steep grassy banks leading down to the lochside were covered with thousands of primroses, interspersed with dog violet. The more shaded banks were covered with delicate carpets of bluebells, and everywhere the cuckooflower. In the warm afternoon sunshine, pairs of small white, green-veined white and orange-tipped butterflies visited them. The warmth of the afternoon also brought out the coconut scent of the gorse.

Swallows darted across the shores of the loch, the occasional goldfinch perched on roadside bushes, and on the crags high above Loch Linnhe on our final day, a pair of stonechat watched our scrutiny of the Kentallenite along the cycle path above Kentallen. We did not spot the white-tailed eagles or golden eagle which are known to frequent the Morvern area, but we came home with lots of memories of a beautiful spring visit to Lochaber.

*Anne Gray*