

Raasay 4:

The Raasay Ironstone Mine



The abandoned ironstone mine on Raasay, active during the First World War, provides an engaging story of the development of an economic resource on a relatively remote Scottish island. The iron ore was extracted from both surface outcrop and underground, processed and shipped to the Scottish Mainland to help fulfil demands caused by the war and the lack of material from abroad. In addition to a brief summary of the geological development of the stratigraphic unit of interest, the Lower Jurassic Raasay Ironstone Formation, a brief history of the discovery and exploitation of the ironstone is outlined, followed by details of locations where both the relevant geological aspects and the mining infrastructure can be examined. The mine, for obvious reasons of safety, cannot be accessed, although the entrance can be viewed.

Aspects covered: stratigraphic development and environment of formation of the Lower Jurassic Raasay Ironstone Formation; discovery of the ironstone; development of the opencast site and mine(s); end of the mining activity; field aspects of the Raasay Ironstone Formation; features of the mining activity.

Route: [Inverarish](#) – [Mine #2 site](#) – ‘[Burma Road](#)’ – [Mine #1 site](#) – [opencast site](#) – [line of Mine #1 to East Suisnish track](#) – [East Suisnish](#) (-return [Inverarish](#)).

Distance: 7 kilometres.

Time: 5 hours.

General comments: This excursion combines an interesting piece of economic geology that was an important resource during the First World War (1914-18) and provided valuable employment to the island. All sites described are easily accessed. The sole mine entrance is barricaded for obvious reasons of safety. The order in which the various locations are visited is not crucial. Care should be exercised whilst investigating the remnants of the old infrastructure and buildings. Before outlining the excursion locations, the text and figures set out, below, provide a summary of the geology and the chronology of the mining activity.

The publication *The Raasay Iron Mine (where enemies became friends)* by Laurence & Pamela Draper (1990) is an excellent account of the development of the opencast and mining operations and much of the summary, below, is dealt with in more detail in this publication. The black & white photographs are from the British Geological Survey archive (codes P000038, 39, 41, 43, 44, 47 & 48).

Stratigraphic development and environment of formation:

The Raasay Ironstone Formation is a chamositic ooidal ironstone that ranges from massive, through to thinly bedded, and is locally cross-bedded. It overlies a sequence of dark grey to black, organic-rich, micaceous mudstones (the Portree Shale Formation) with sparse benthic fossils. Combined, these two units are typically 5-6m thick. They are of Lower Jurassic age (Toarcian; 174-183 Ma) and overlie shallow marine siltstones and sandstones of the Scalpay Sandstone Formation. The overlying Bearreraig Sandstone Formation marks a return to significant coarse clastic sediment input to the basin and was deposited in a shallow marine environment.

Deposition of the Portree Shale Formation and the Raasay Ironstone Formation occurred throughout the Hebrides Basin, although they are best developed (or at least recognised) on Raasay and north Skye. Ironstones of similar age occur elsewhere, for example the Cleveland Basin of NE England. Development of the Raasay Ironstone Formation is considered to have taken place during one of the two main Phanerozoic ironstone-forming periods in shallow marine subtidal to intertidal waters during a period of sea-level change and negligible clastic sediment input. Ammonites and belemnites are relatively common and confirm a marine environment of deposition. Weathering was important at this time, facilitated by the Toarcian warm humid climate, producing iron-rich waters delivered into the basin. The dominance of chamosite (an Fe-rich chlorite) ooids in a calcium carbonate matrix, together with cross-stratification, indicate the important role of intertidal

currents during their formation. Other indicators of a shallow water depositional environment include the (uncommon) presence of crinoids and stromatolites.

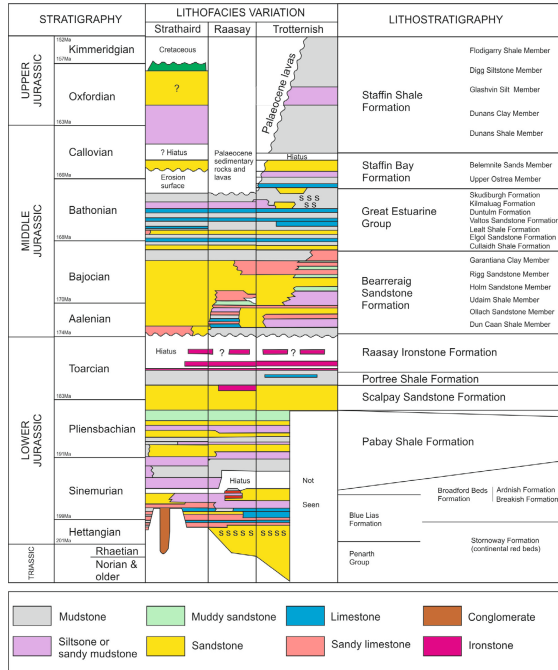


Figure Raasay 4.1: Stratigraphy of the Jurassic sequences within the Hebrides Basin.

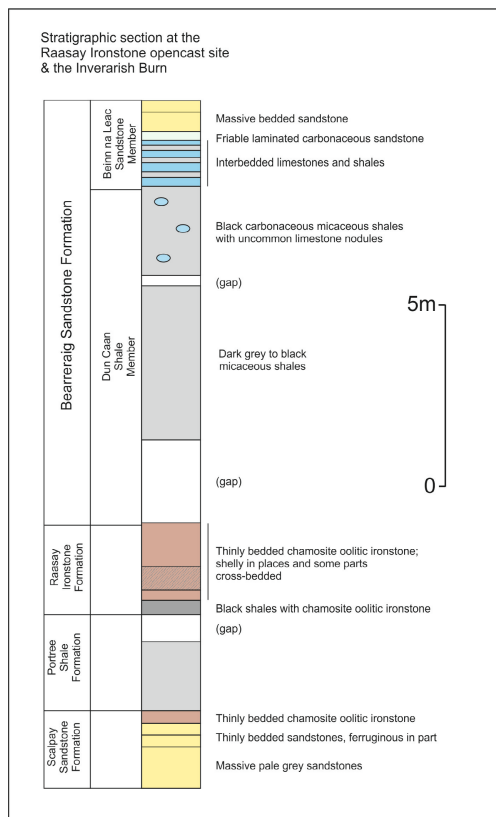


Figure Raasay 4.2: Details of the stratigraphy of the Raasay Ironstone Formation, together with underlying and overlying strata.



Figure Raasay 4.3: Photomicrograph of the Raasay Ironstone Formation chamositic ooidal ironstone with echinoderm fragments in a carbonate matrix. Image c. 5mm across. View is under plane polarised light.

Discovery of the Raasay Ironstone Formation:

The Raasay Ironstone Formation was discovered with sleuth-like tenacity by Horace B. Woodward of the British Geological Survey in 1893. References to earlier observations are difficult to substantiate. Exposures are rare and it was where the outcrop crosses the [Inverarish Burn](#) that the discovery was made. Prior to the development of the mine, the distribution of the ironstone was determined by exploratory (manually drilled) boreholes. A typical and workable thickness of c. 2m was recorded and an estimated 10 million tons of extractable material determined.

Exploitation of the ironstone was restricted to Raasay, where it has an extensive outcrop, albeit of variable thickness (or is not present) but is typically very poorly exposed. It had no commercial value (in the context of the early 20th Century) except in the area NE of [Inverarish](#) (the sole village on Raasay). The lack of good exposure is in part due to the ironstone’s relatively rapid decomposition when directly exposed to the atmosphere. When fresh it is dark green, but, upon exposure, or (brought) near (< 5m) to the Earth’s surface, the carbonate within it is leached out and oxidation occurs, producing a dull rusty brown material. Typical fresh (green) ironstone has an iron content of 20-30%, whereas weathered/alterd (brown) material is somewhat enriched. The presence of calcium carbonate within the ironstone is advantageous with respect to its processing.

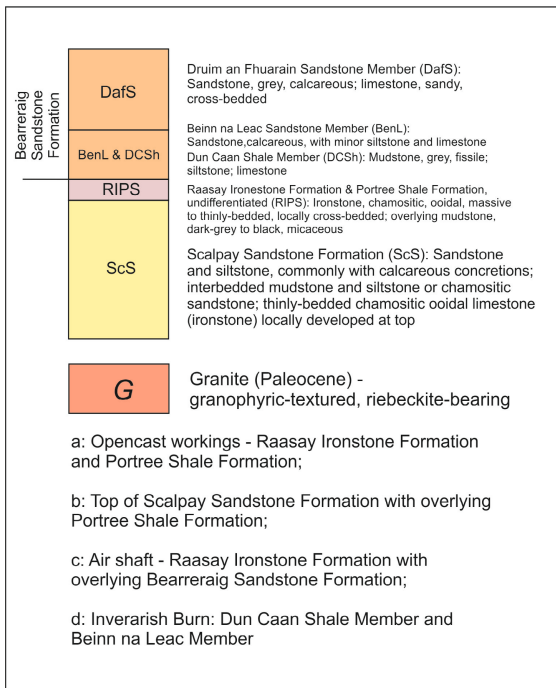
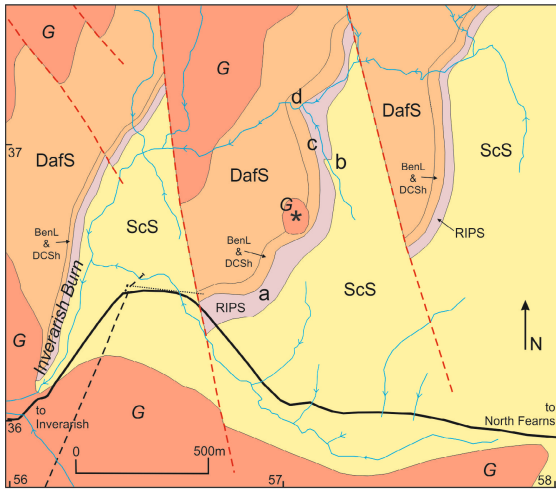


Figure Raasay 4.4: Simplified geological map and stratigraphic details of the opencast area and mine in the vicinity of the Inverarish Burn.

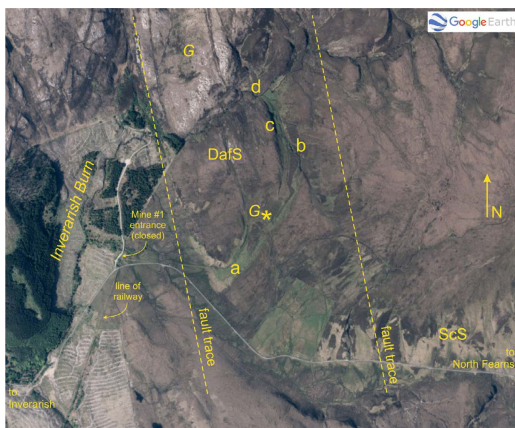


Figure Raasay 4.5: Annotated Google Earth® image of the opencast area and Mine #1 entrance in the vicinity of the Inverarish Burn.

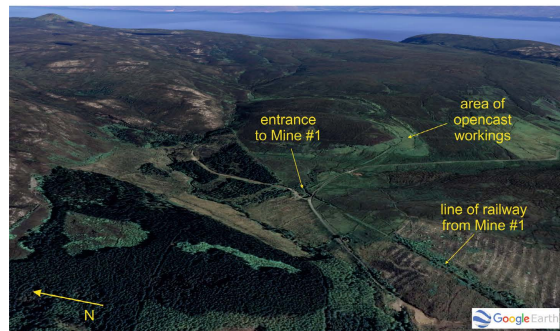


Figure Raasay 4.6: Annotated Google Earth® images of the area involved in the exploitation of the Raasay Ironstone Formation, including the opencast area and Mine #1 in the vicinity of the Inverarish Burn. Box defines area depicted in Figure Raasay 4.4.

Development of the opencast site and mine(s):

Initial serious interest to exploit the Raasay ironstone can be traced back to 1910, when William Baird & Company Ltd of Glasgow, with interests in iron and coal, approached the then proprietor of Raasay, Wallace Thorneycroft, a mining engineer and coal mine owner with an interest in geology, to determine the extent of the reserves and subsequently sell (them) the estate (in 1911).

The initial stage of the mining activity was the extraction of ore from the surface outcrop. Two mine entrances were then identified (Mine #1 & Mine #2) and infrastructure was gradually installed. For Mine #1, which ultimately was the sole underground entrance, a straight double-track narrow-gauge (2'3" or 0.7m) cable-haulage rail, c. 2.5km long, was built to the coast at the newly constructed [East Suisnish Pier](#) (specifically for the mining

activity) at [East Suisnish](#), where the processing plant, including kilns, was also built. Prior to the completion of the railway, ore was transported by horse and cart to the [old pier](#) at Clachan.

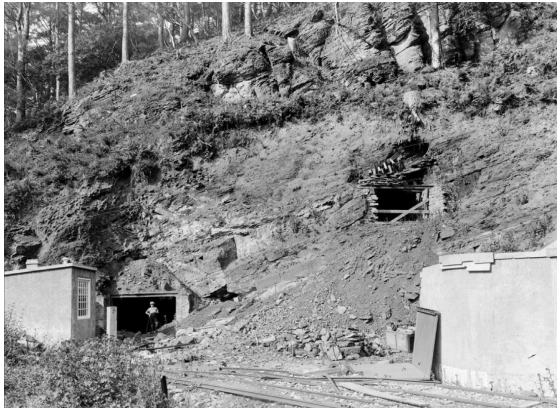


Figure Raasay 4.7: Entrance to Mine #2. This mine was not productive due to unforeseen geological complexities, most likely faults. The site was later used as a sawmill, to produce pit props, rail sleepers and power poles. [BGS P000041]



Figure Raasay 4.8: Trial adit into the Raasay Ironstone Formation located at the top of the incline in the area where opencast production occurred. Note rail head. Person for scale. [BGS P000039]

The processing plant at [East Suisnish](#) was constructed by Robert McAlpine & Sons and comprised a crusher (where coal was added), kilns to calcine (roast, to create a concentrate of) the ironstone, and a large hopper to store processed material prior to shipping. Not all the ore was processed on the island, with some shipped directly after passing through the crusher.

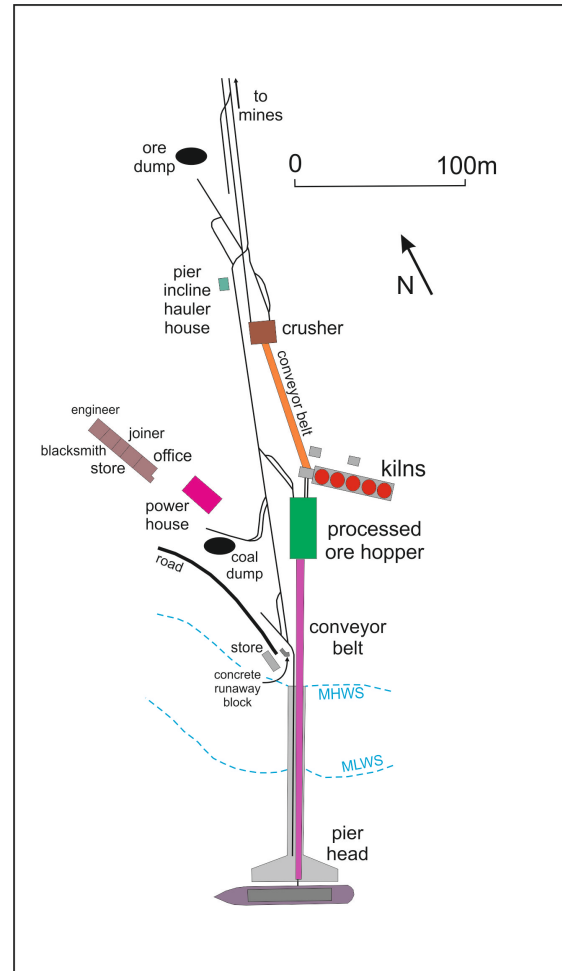


Figure Raasay 4.9: Layout of the East Suisnish processing plant.

Other onsite facilities included an office for administration staff, and workshops for joiners, blacksmiths and engineers. Dynamite and detonators were stored in a remote stone building surrounded by a blast bank, and with a lightning conductor on the roof.

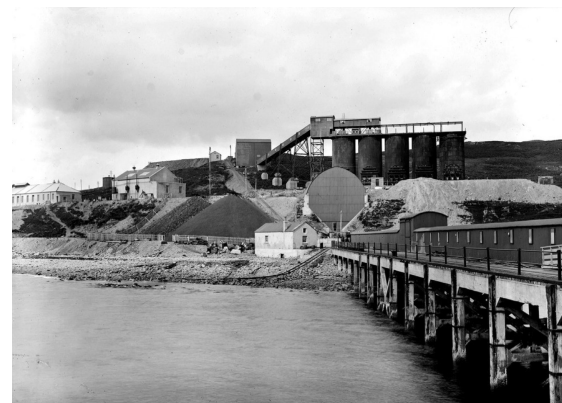


Figure Raasay 4.10: Pier and processing plant at East Suisnish, including five cylindrical calcining kilns, store (to left of pier), coal dump and storage hopper (with arch roof). At the top of the short rail incline is the pier hauler incline house, to the right of which is the crusher with a

conveyor to the top of the kilns. Coal was taken to the crusher via the short rail incline, where it was mixed with the unprocessed ore and thence fed into the kilns. View is towards the north. [BGS P000043]



Figure Raasay 4.11: Processing plant at East Suisnish, viewed towards the east. At the top of the short rail incline is the pier hauler incline house, to the right of which is the crusher (arched roof) and conveyor to the top of the kilns. Coal was taken to the crusher via the short rail incline, where it was mixed with the unprocessed ore and thence into the kilns. The white building, to right, comprises offices, stores and workshops for joiners, blacksmiths and engineers. [BGS P000044]

Opencast mining commenced in August 1916, involving the stripping of overburden from the area to the east of the entrance to Mine #1 by a Bucyrus Steam Dragline ('Steam Navy'), and the ironstone then extracted using two Bucyrus Rev Shovels. Material was then conveyed via a two-stage cable-haulage rail to the processing plant at [East Suisnish](#), first on a single-track from the opencast area to near to the entrance of Mine #1 and then via the double-track cable-haulage system, downhill to the processing plant.



Figure Raasay 4.12: A Bucyrus Steam Dragline ('Steam Navy') near to the entrance to Mine #1, used to remove superficial material from the area developed for opencast extraction. [BGS P000047]



Figure Raasay 4.13: Detail of Bucyrus Steam Dragline ('Steam Navy') near to the entrance to Mine #1, used to remove superficial material from the area developed for opencast extraction. Note armed guard, suggesting that at least some of the workers perched on the dragline are German prisoners-of-war. [BGS P000048]

The underground mining operation also commenced in the Summer of 1916. The electrically driven cable-haulage system from near to the entrance to Mine #1 was the main transport mechanism, involving wagons ('hutches') that were attachable to the haulage cable, allowing them to be transported downhill full of ore, and back to the mine entrance to collect further material.

The failed Mine #2 joined the main (Mine #1) track via a single-track at a junction downhill from the entrance to Mine #1, where ore would be transferred to the 'main' line. However, due to geological complexities not identified prior to the initiation of Mine #2 it was not able to provide a significant quantity of ore and was abandoned.

The drop in height of the main haulage track is c. 120m over the c. 2.5km from the mine to the processing plant. At the processing plant the track was diverted around a large concrete block, installed to stop any runaway wagons. A variety of embankments and cuttings were constructed to produce the constant gradient of the 'main' line from the Mine #1/#2 junction. Two viaducts were also necessary; one over a gully close to the entrance to Mine #1 and a second where the spur line to Mine #2 crossed the [Inverarish Burn](#) and the [road out to Fearnis](#).

Mining involved the traditional room and pillar (or bord and pillar) technique. First, two adits (tunnels; one for extraction, the other for ventilation and access for the miners) were driven (excavated), c. 14m apart from the Mine #1 entrance, NE for c. 300m to the main extraction area. From here, a quasi (N-S & E-W) grid system of 'rooms' was excavated (i.e. the ore that was removed, leaving the pillars that supported the roof). Ore was not extracted fully to the top of the Raasay Ironstone Formation stratum; the overlying Dun Caan Shale Member is unstable and capable of collapsing, so a c. 0.3m thickness of ironstone was left *in situ*, enabling a thickness of c. 2m to be removed. The overall gradient of

the floor of the mine (adits and extraction 'rooms') was c. 1 in 100 towards the SW, which aided drainage from the mine and removal of the ore in wagons to the mine entrance.

Extraction involved drilling and blasting, followed by removal on an evolving underground rail system to the mine entrance. The workers operated a three-shift system: drilling from late afternoon until late evening; blasting during the night; and extraction of the ore during the day. British miners worked the drilling and blasting shifts, with the German prisoners-of-war working the daytime extraction shift. Lighting was primitive, using small oil lamps, attached to the miners' helmets.

A weigh bridge at the top of the main line recorded the quantity of ore extracted. An estimated 12,000 tons of ore were extracted from the opencast site, compared to c. 150,000 tons from the underground operation.

Houses for the workers were constructed in [Inverarish](#), comprising four terraces, each of sixteen houses. In addition, [Churchton House](#) and [Suisnish House](#) were built at this time, also for employees of William Baird & Company Ltd.

Extraction of ore was delayed for a variety of reasons, the main one being the start of World War 1 and its significant impact on the availability of suitable workers. However, the difficulties of obtaining suitable iron ore from outside the UK at this time caused the Government to investigate and back the extraction of Raasay ironstone to help with the war effort. After much discussion it was agreed the William Baird & Company Ltd should manage the operation on behalf of the Government and that German prisoners-of-war would be made available to partially man the operation.

Necessary security was put in place by the British Army for the duration of the mining. Funding was provided for any outstanding construction and infrastructure costs, including repairs to and depreciation of the plant. Prisoners-of-war started to arrive in mid-1916 and rose to c. 250, with a further c. 60 Britons involved, some from Raasay, others from elsewhere in the United Kingdom. Most of the Germans were selected based on appropriate mining and other skills and were housed in the suitably fortified Inverarish terraced houses. Worker unrest in early 1917 occurred due to significant wage disparities between the Raasay workers and those from elsewhere, and grievances due to the presence of the German prisoners-of-war workers. These issues were resolved early in 1918 by an increase in pay, although friction continued, and various minor disputes erupted from time-to-time.

End of the mining activity:

A significant fall in demand for iron occurred after the end of World War 1 and the UK Government moved to shut down the Raasay production in early 1919. Repatriation of the prisoners-of-war was completed by early 1920. However, twelve of the Germans died during the 1918-19 Spanish flu pandemic. A further two of the prisoners-of-

war died because of accidents whilst involved in the mining operations.

William Baird & Company Ltd sold the estate in 1921-22 to the Scottish Board of Agriculture. Thereafter, the natives of Raasay were able to access land suitable for crofting. Soon after, a small amount of mine infrastructure material was removed from the island. However, the main plant was kept on a care-and-maintenance basis, with the thought that production may again be required. This did not happen and by 1941 it was determined that, because of the availability of cheaper ore from elsewhere, the mine and all its plant be abandoned. Salvageable material, for example the kilns, was removed and transported off the island to be used elsewhere. The present-day state of the buildings and other infrastructure is the result of removal of materials and natural degradation over the decades.

Localities:

A convenient and useful place to start is [Inverarish](#). The route to be followed is: [Inverarish](#), [Mine #2 site](#), [Mine #1 site](#); [opencast mine site](#); [processing plant at East Suisnish](#), then return to [Inverarish](#). The entire route is easily walkable.

In [Inverarish](#), accommodation for the miners took the form of four terraces of houses.



Figure Raasay 4.14: Miners' cottages, Inverarish.

From the community shop in [Inverarish](#), head NE along the road for c. 300m to the T-junction, then c. 50m to the west (left), then take the sharp right-turn and go a further c. 300m along the road to where there is a short track leading to a parking area. This is the [site of the failed Mine #2](#).

[Mine #2](#) failed to produce a significant quantity of ore: complexities in the geology, possibly a fault(s), meant that the adit did not successfully intersect the ironstone for a significant distance when driven into the hillside.



Figure Raasay 4.15: Information board close to the entrance to Mine #2.



Figure Raasay 4.16: Derelict Mine #2 building close to the now disappeared adit entrance.

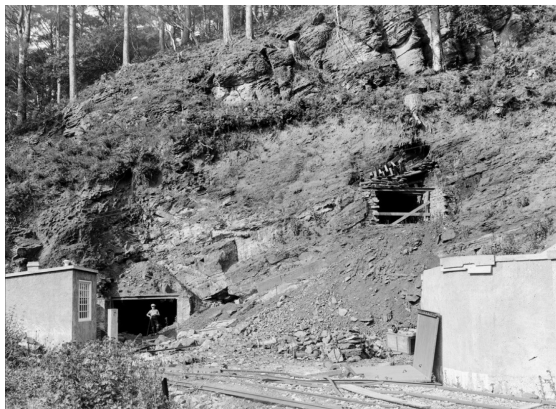


Figure Raasay 4.17: Entrance to Mine #2. This mine was not productive due to unforeseen geological complexities, most likely faults. The site was later used as a sawmill, to produce pit props, rail sleepers and power poles. [BGS P000041]



Figure Raasay 4.18: Storage building for explosives, north side of track, east of Mine #2 site.

From the [Mine #2](#) site, take the narrow forest track, which starts on the SE side of the parking area, east. Continue past a small derelict stone building, originally an explosive store for the mining operations, then onto the broad forest track, part of the so-called [Burma Road](#), named for the dense forest that was encountered during its construction in the 1950s. This track heads north along the west side of the [Inverarish Burn](#), where it crosses to the east side and heads southwards along the edge of the trees to the [Mine #1 entrance](#). The waterfall where the path crosses the burn is due to the resistant Middle Jurassic Druim an Fhuarain Sandstone Member, below which is the softer and more easily eroded Lower Jurassic sequence that includes the Raasay Ironstone Formation.

Useful information boards are located at the [Mine #1 site](#), detailing the mining activity. The entrance to the mine is still present and can be viewed, albeit closed over with a strong metal grille.



Figure Raasay 4.19: Information boards close to the entrance to Mine #1 and derelict main hauler house.



Figure Raasay 4.20: Derelict buildings at entrance to Mine #1 (right of centre in the middle ground) and beyond, the ventilation (fan) house. View is towards the NE.



Figure Raasay 4.23: Partially flooded Mine #1 adit, leading to a network of (reputedly) 8km of tunnels from which the ore was removed.

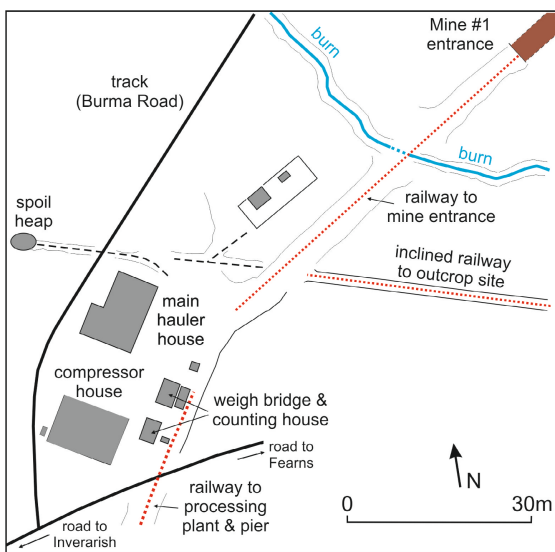


Figure Raasay 4.21: Sketch plan of area around entrance to Mine #1.



Figure Raasay 4.24: Derelict main hauler house (nearest) and compressor house, close to the entrance to Mine #1. The hauler house contained the winding gear used for the cable haulage system.



Figure Raasay 4.22: Mine #1 entrance.



Figure Raasay 4.25: Track leading to the opencast area, east of entrance to Mine #1. View is towards the east. *In situ* Raasay Ironstone strata is present to the north (left-hand) side of the track.



Figure Raasay 4.26: Opencast area, east of entrance to Mine #1. View is towards the SW. The large peak on Skye (in the distance) is Glamaig.



Figure Raasay 4.29: Exposure of Raasay Ironstone Formation strata at the opencast area. Pole c. 1m long.



Figure Raasay 4.27: Opencast area, east of entrance to Mine #1. Above (beyond) the outcrop of inclined Raasay Ironstone Formation strata are (overburden) spoil heaps. View is towards the north.



Figure Raasay 4.30: Exposure of Raasay Ironstone Formation strata at the opencast area. Pole c. 1m long.



Figure Raasay 4.28: Trial adit into the Raasay Ironstone Formation located at the top of the incline in the area where opencast production occurred. Note rail head. Person for scale. [BGS P000039]



Figure Raasay 4.31: Detail of Raasay Ironstone Formation strata at the opencast area. The pale green 'cores' are fresh material, surrounded by a boxwork of rusty-brown weathered (oxidised) material. Ruler 30cm long.



Figure Raasay 4.32: Detail of Raasay Ironstone Formation strata at the opencast area. The pale green 'cores' are fresh material (with cored out plug holes), surrounded by a boxwork of rusty-brown weathered (oxidised) material. Ruler 30cm long. Holes due to core extraction.



Figure Raasay 4.33: Randomly oriented belemnites on a bedding surface within the uppermost part of the Portree Shale Formation (below the Raasay Ironstone Formation) in the opencast area. Ruler 30cm long.



Figure Raasay 4.34: Exposures of Bearreraig Sandstone Formation strata above the Raasay Ironstone Formation in the opencast area. View is towards the NE.

From the [Mine #1 buildings](#), cross the road to the [signposted track \(Ferry Pier / Miners' Trail\)](#) and head downhill, SW along the [path](#), which follows the line of the cable haulage rail track, which follows the line of the cable haulage rail track. Where the line of the track [crosses a burn](#), the piers of the viaduct built to cross it indicate the scale of the mining operation. Steps lead down to the burn and back up the other side, where the

line of the track can be followed to the coast. Where the Mine #1 track met the track from the failed Mine #2 there is a [derelict building](#), the Mine #2 hauler house.



Figure Raasay 4.35: Piers of the viaduct constructed to cross a burn from Mine #1 to the processing plant at East Suisnish.



Figure Raasay 4.36: Line of track from Mine #2 and hauler house. View is towards the SE.



Figure Raasay 4.37: Line of main track from Mine #2 hauler hose to the processing plant at East Suisnish.

Continue SW for c. 1.5km to the processing plant at [East Suisnish](#). To better understand the uses of certain (of the now derelict) buildings, it is instructive to consider the plant when it was in operation. The most obvious buildings are the kilns and the large, processed ore hopper.

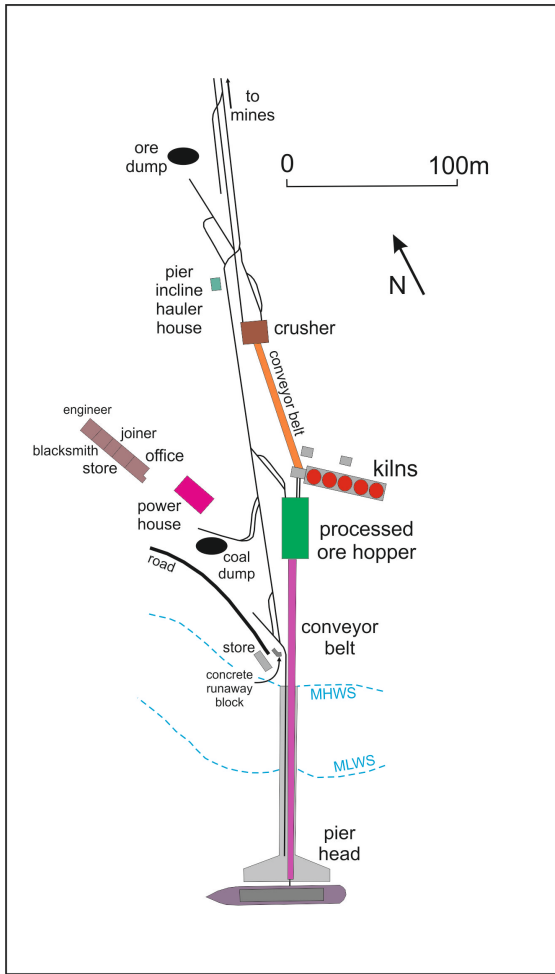


Figure Raasay 4.38: Layout of the East Suisnish processing plant.

Other onsite facilities included an office for administration staff, and workshops for joiners, blacksmiths and engineers. Dynamite and detonators were stored in a remote stone building surrounded by a blast bank, and with a lightning conductor on the roof.

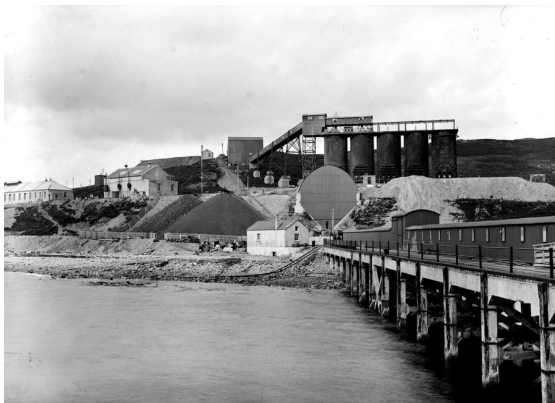


Figure Raasay 4.39: Pier and processing plant at East Suisnish, including five cylindrical calcining kilns, store (to left of pier), coal dump and storage hopper (with arch roof). At the top of the short rail incline is the Pier Hauler Incline House, to the right of which is the crusher with a

conveyor to the top of the kilns. Coal was taken to the crusher via the short rail incline, where it was mixed with the unprocessed ore and thence fed into the kilns. [BGS P000043]



Figure Raasay 4.40: Processing plant at East Suisnish, viewed towards the east. At the top of the short rail incline is the pier hauler incline house, to the right of which is the crusher (arched roof) and conveyor to the top of the kilns. Coal was taken to the crusher via the short rail incline, where it was mixed with the unprocessed ore and thence into the kilns. The white building, to right, comprised offices, stores and workshops for joiners, blacksmiths and engineers. [BGS P000044]



Figure Raasay 4.41: Remnants of cable railway system above the main processing plant at East Suisnish and the ore shipping pier, beyond. View is south towards Skye.



Figure Raasay 4.42: Derelict base of the kilns above the processed ore hopper, East Suisnish.



Figure Raasay 4.45: Interior of derelict kilns, East Suisnish.



Figure Raasay 4.43: Derelict kilns at the ore processing plant, East Suisnish.



Figure Raasay 4.46: Processed ore hopper within the processing plant, East Suisnish. View is towards the NE.



Figure Raasay 4.44: Derelict kilns at the ore processing plant, East Suisnish.



Figure Raasay 4.47: Processed ore hopper within the processing plant, East Suisnish. View is towards the NE.

The pier was constructed specifically for the removal of the processed (calcined) and some unprocessed ore.



Figure Raasay 4.48: The East Suisnish pier, and the main processed ore hopper and kilns of the processing plant.

Return to [Inverarish](#), west along the coastal road (c. 1.5km).

You may wish to make one final stop as part of this excursion. *Outside* the Raasay [Cemetery](#) in [Orchard Wood](#), accessible via a track in the wooded area NE of [Raasay House](#), a stone commemorates the deaths of two of the German prisoners-of-war (Georg Kagerer and Paul Sosinka), who worked in the mine during the First World War (1914-18). The stone also commemorates a further twelve PoWs who died due to the influenza pandemic of 1919.

The easiest road route to the cemetery is located west of the [Raasay Distillery](#) and runs NE through [Kennel Wood](#), past [Loch a' Mhuilinn](#), towards the Walled Orchard. The cemetery track is a minor spur off this road.

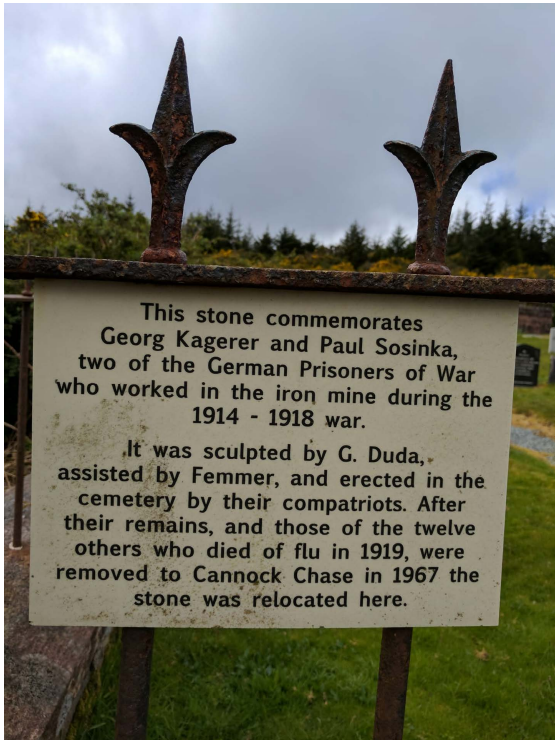


Figure Raasay 4.49: Information board on the railings of the Raasay Cemetery, with details of German prisoners-of-war who worked in the Raasay mine.



Figure Raasay 4.50: Commemorate stone outside the Raasay cemetery.

Return to Inverarish.

End of excursion.