
Chapter 19 Economic geology

In the area covered by the Western Shetland One-inch Geological Sheet the only mineral which has been exploited commercially for export is the magnetite from Clothister Hill, near Sullom. Bulk materials quarried and removed in the area during the last 20 years include schists of the Green Beds Assemblage, granite, diorite, sandstone and boulder clay, which have been used locally for road construction, and shore gravel and sand used for the manufacture of concrete blocks and other building purposes. Peat is cut by the crofters as a source of fuel, but is not exploited commercially on a large scale. Though outcrops of limestone are present in the area they are too small and scattered to be quarried as a source of agricultural lime or cement.

Clothister Hill Magnetite

The orebody at Clothister Hill, Sullom [HU 342 729] (Figure 30) consists of massive magnetite of a high degree of purity and with an exceptionally low phosphorus content. It is situated in the north-east corner of the area, 850 yd (770 m) due north of Mavis Grind. It was discovered in 1933 by Mr. D. Haldane of the Geological Survey of Great Britain (Summ. Prog. 1934, p. 71). Between 1941 and 1943 it was investigated in detail and developed with a view to exploitation by the Scottish Home Department (Groves 1952, pp. 263–95). This development work included the driving of a shaft, a longitudinal mine, an adit mine, as well as several cross-cut mines. At the same time a magnetometer survey covering a considerable area around the mine, and a drilling programme, involving the sinking of 13 bores, were carried out on behalf of the Home Ore Department of the Ministry of Supply.

The exploration programme commenced with the extensive trenching of the known exposures of the orebody in order to determine its exact outcrop and to obtain channel and bulk samples for analysis. As the ore was found to contain 60 to 67 per cent iron and less than 0.006 per cent phosphorus it was decided to sink a shaft at the widest part of the orebody to prove its extension at depth. Cross cuts were driven at depths of 32 and 72 ft (9.75 and 22 m). A horizontal shaft with cross cuts leading from it was then driven along the length of the ore-body at the 72 ft (22 m) level. The exploratory work which was supplemented by a magnetometer survey and by three inclined boreholes was completed in July 1942, and, as an estimated 12 000 to 20 000 tons of ore were thought to be available, an adit was driven with a view to commencing commercial exploitation. The project was abandoned at that stage because of the lack of skilled labour in Shetland, and because the available coastal shipping to transport the ore could not be guaranteed.

The exploratory development has provided precise data regarding to the size, shape, quantity, quality and geological environment of the orebody (Groves 1952, pp. 285–82). These are summarized below:

Form of orebody

The orebody is elongated in a north-south direction and is lenticular in horizontal section as well as in E–W vertical section. Its outcrop trends north-north-east, has a length of 174 ft (53 m) and is slightly sinuous, several of the bends being apparently due to small faults. Its width varies from a few feet to a maximum of 22 ft (6.7 m). The orebody has a westerly inclination, which averages 51° at its northern end and 85° at its southern end. In consequence of this 'twist' it trends exactly north–south at the 72 ft (22 m) level, where it is 169 ft (51 m) long. Its maximum width at the 72 ft (22 m) level is 21 ft (6.4 m) and its average width is 11 ft (3.35 m). Groves believes that the orebody plunges northwards in a series of steps which may in part be due to the presence of a number of small faults.

Three inclined boreholes (Figure 30) were put down to prove the extension of the known orebody in depth. One borehole (No. 6) intersected the projected position of the orebody at about 67 ft (20.4 m) inclined distance below the 72 ft (22 m) level but no ore was encountered. A second borehole (No. 7) was directed to intersect the orebody at an inclined depth of 13 ft (3.9 m) below the 72 ft (22 m) level and encountered only patches of ore which did not exceed 5 ft 6 in (1.67 m) in total width. These boreholes suggest that below the 72 ft (22 m) level the orebody is dying out rapidly downwards. The third borehole (No. 8) intersected the northern part of the orebody some 15 ft (4.5 m) below the 72 ft (22 m) level and proved two bands of compact magnetite respectively only 2 ft 6 in and 1 ft 3 in (0.76 and 0.38 m) thick.

Estimated tonnage of orebody

It was estimated that the orebody has an average width of 10 ft (3 m) at the surface and 11 ft (3.35 m) at the 72 ft (22 m) level. Groves calculated the average height of the orebody down to the 72 ft (22 m) level to be 85 ft (26 m), its average length 171 ft (51) and its average width 10 ft (3 m). This gives an estimated volume of 144 500 cub. ft (4000 m³) of ore. By assuming that 8 cub. ft of the Clothister Hill ore produce one ton of magnetite, and allowing 32.8 per cent by weight for dilution by skarn, Groves estimated that the proved ore reserve above the 72 ft (22 m) level was 18 000 tons. There are also a probable 2000 tons below this level, making a total of proved and probable ore of 20 000 tons.

Quality of ore

Analyses of samples of the Clothister Hill ore indicate that its iron content varies from 60 to 67 per cent. The sulphur content, which has been lowered by weathering at the outcrop, rises on the average to about 0.5 per cent at depth. It occurs as pyrites and is very unequally distributed. Except at the extreme northern and southern ends of the orebody, where it rises slightly but is still within the limits for hematite iron, the phosphorus content is uniformly 0.006 per cent.

Post-war development and exploitation

The magnetite was mined between 1954 and 1957 by Deering Shetland Mining Limited, a subsidiary of Deering Products Limited. This firm supplied the ore to the National Coal Board for use in the manufacture of heavy mud used in coal flotation. The ore was extracted both by mining through the existing adit and by opencast methods. It is believed that between 6000 and 10 000 tons of ore were obtained and that the rate of extraction during 1955 amounted to 300 to 400 tons of crushed rock per month. An appraisal made in 1956 suggested that the total quantity of ore remaining and extracted is higher than the amount suggested by the wartime investigations.

Possible additional orebodies on Clothister Hill

During 1941 a magnetometer survey was carried out over the Clothister Hill magnetite body, and this survey was subsequently extended further northwards where it proved a number of magnetic anomalies similar to that produced by the known orebody. In all, four anomalies were found at distances 800 to 11 000 ft (0.24–3.4 km) N of the known ore mass. Two of these are positive and two negative (Figure 30). All the anomalies are on the ridge of Clothister Hill and several of them, including the strongest, appear to be in alignment with the elongation of the outcrop of the proved ore-body. In 1942 several of the anomalies were tested by diamond drilling. Altogether nine vertical and inclined boreholes were put down in positions calculated to intersect the supposed magnetite orebodies responsible for the anomalies C, A and B. Although zones of calcite and intermittent epidote veining were encountered, no magnetite ore was found.

The systematic magnetometer survey was continued northwards to the Loch of Kirt Shun [HU 343 738] and southwards to the north end of the Loch of Lunnister [HU 345 718]. Though two small magnetic anomalies were found, the ground had no major anomalies. Similarly, scattered traverses and isolated observations made between the south end of the Loch of Lunnister [HU 343 711] and the Bight of Haggrister [HU 348 701] gave no suggestion of the presence of possible large anomalies.

Road metal

Though most of the rock used at present for surfacing on the roads of Western Shetland is obtained from Scord Quarry [HU 412 400] situated on the west slope of Wind Hamars, 4 mile (1.2 km) NE of Scalloway, bulk material used in road reconstruction is derived locally from roadside quarries scattered throughout the area. The quarry on the east slope of Clothister Hill [HU 343 734] within the Green Beds Assemblage has supplied road metal for local needs. The granite and the diorite of the Northmaven and Sandsting complexes as well as the Walls Sandstone have been extensively used. Boulder clay obtained from the quarry [HU 272 157] near Murraster, mile (1.2 km) NE of Bridge of Walls, and from many smaller quarries is used as fill material.

Building materials

Owing to the lack of raw material for brick making in the Shetland Islands the most commonly used building material at the present day is light concrete blocks. These are made locally from either crushed schist or from beach gravel. In recent years the gravel from the beach of the Ness of Little-Ayre [HU 318 629] on the south shore of Muckle Roe has been used for the manufacture of such blocks.

Sandy beaches are rare on the mainland of Western Shetland, and most do not contain sufficient sand to permit its removal for building purposes. Small quantities of sand have been obtained from the beach at The Crook [HU 197 577], north of Norby.

Limestone

The bands of crystalline limestone within the metamorphic rocks of Western Shetland (pp. 44–45, (Plate 2)) have never been worked either as a source of agricultural lime or as a raw material for cement. This is probably due to the fact that limestone is more accessible and available in much greater quantities in Eastern and Central Shetland. The bulk of the agricultural lime at present used in the Shetland Islands is obtained from a quarry in the Girlsta Limestone at Girlsta [HU 429 505] 6.25 miles (10 km) NNW of Lerwick. Several of the limestones in the area between Norby and Bousta reach a considerable thickness and crop out close to the existing road. These could provide a suitable local source of limestone.

Peat

The deposits of as yet unworked and relatively easily accessible peat in Western Shetland are of considerable extent (pp. 278–280, (Figure 28)). Peat is cut extensively by crofters as a domestic fuel, and in the area [HU 308 525] a short distance west of Effirth, close to the head of Bixter Voe, it is cut on a small scale by the conventional methods for sale in Lerwick. In south-eastern Shetland peat briquettes were manufactured for a short time in a small factory on the shores of the Loch of Brindister [HU 431 368], 3.5 miles (5.5 km) SW of Lerwick. This venture, however, did not prove financially viable.

Ornamental and semi-precious stones

Western Shetland is less well endowed with the raw materials for stones which can be used for lapidary and ornamental work than other parts of the Shetland Islands.

Agate

Agates up to 4 in (10 cm) in diameter are present in the vesicular tops of the basalt flows exposed on the south shore of Papa Stour between Hirdie Geo and Aesha Head [HU 149 608] and between Scarvi Taing [HU 175 593] and Kirk Sand [HU 177 598]. These agates, however, commonly have a central core of barytes, which makes them unsuitable as gem stones. Many are cut by joints and break up easily.

Serpentine

A small outcrop of green and reddish mottled serpentine occurs close to the north-west corner of Maa Loch on the island of Vementry [HU 297 604]. This serpentine has attractive green and deep red colour mottling and could prove an excellent material for making polished brooches and ornaments.

Scapolite

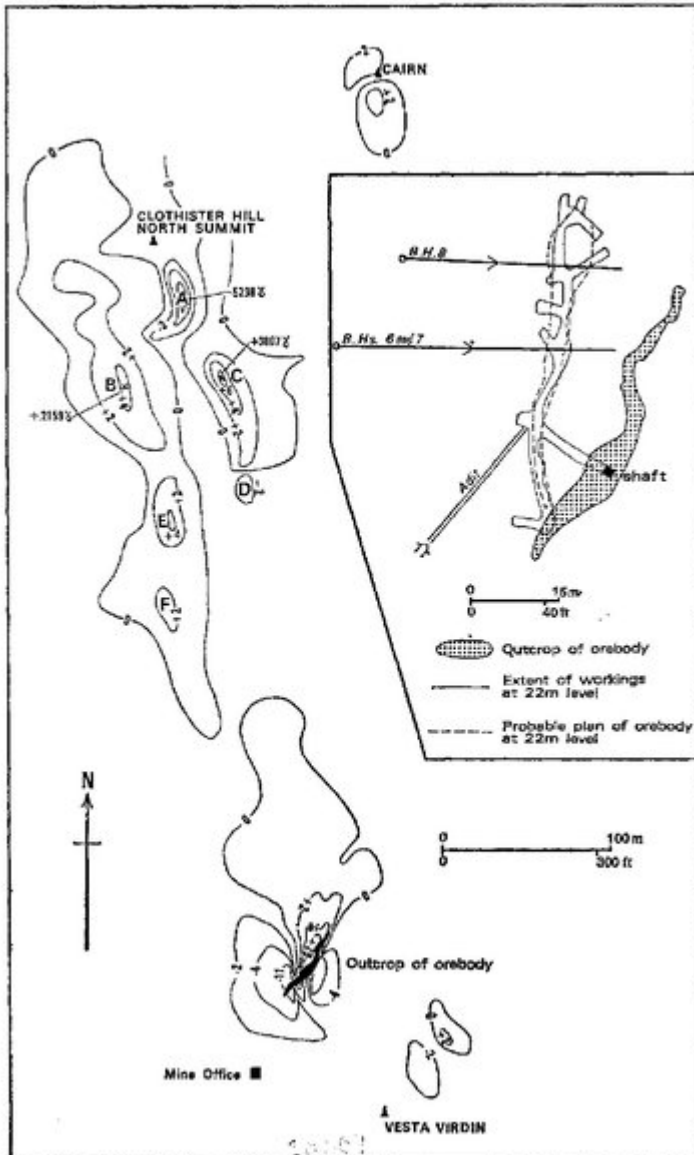
Scapolite forming a vein, up to 8 ft (2.4 m) thick, exposed in the south-east shore of Shelda Ness [HU 303 405], 490 yd (440 m) NE of the southern tip of the peninsula, has an attractive silky sub-translucent lustre and ranges in colour from white to pale pink or reddish. It takes on a high polish, but is rather closely jointed and tends to break down into fairly

small pieces. Other scapolite veins containing material suitable for polishing crop out on the east shore of Wester Wick [HU 286 423].

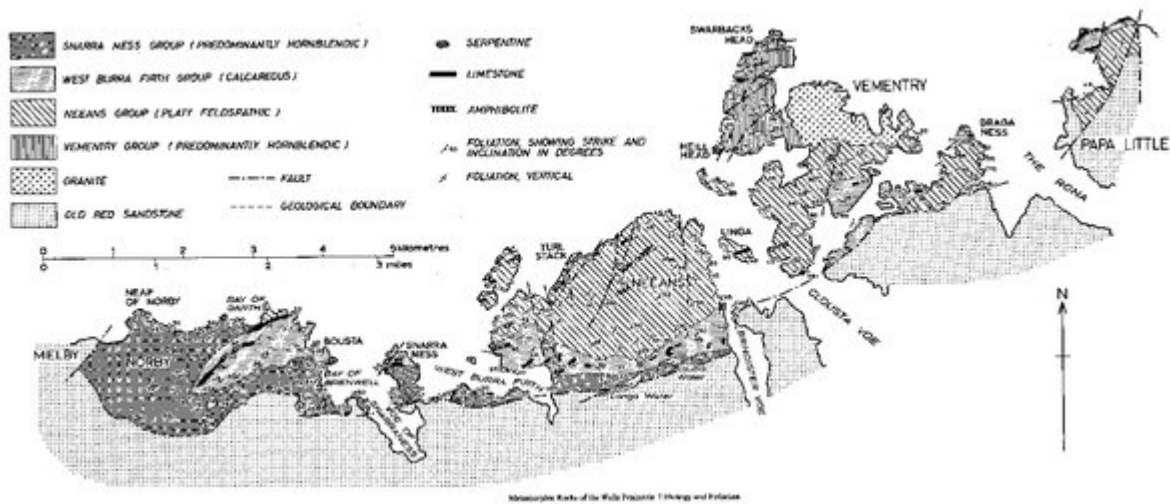
References

GROVES, A. W. 1952. Wartime Investigations into the Haematite and Manganese Ore Resources of Great Britain and Northern Ireland. *Ministry of Supply, Permanent Records of Research and Development.*

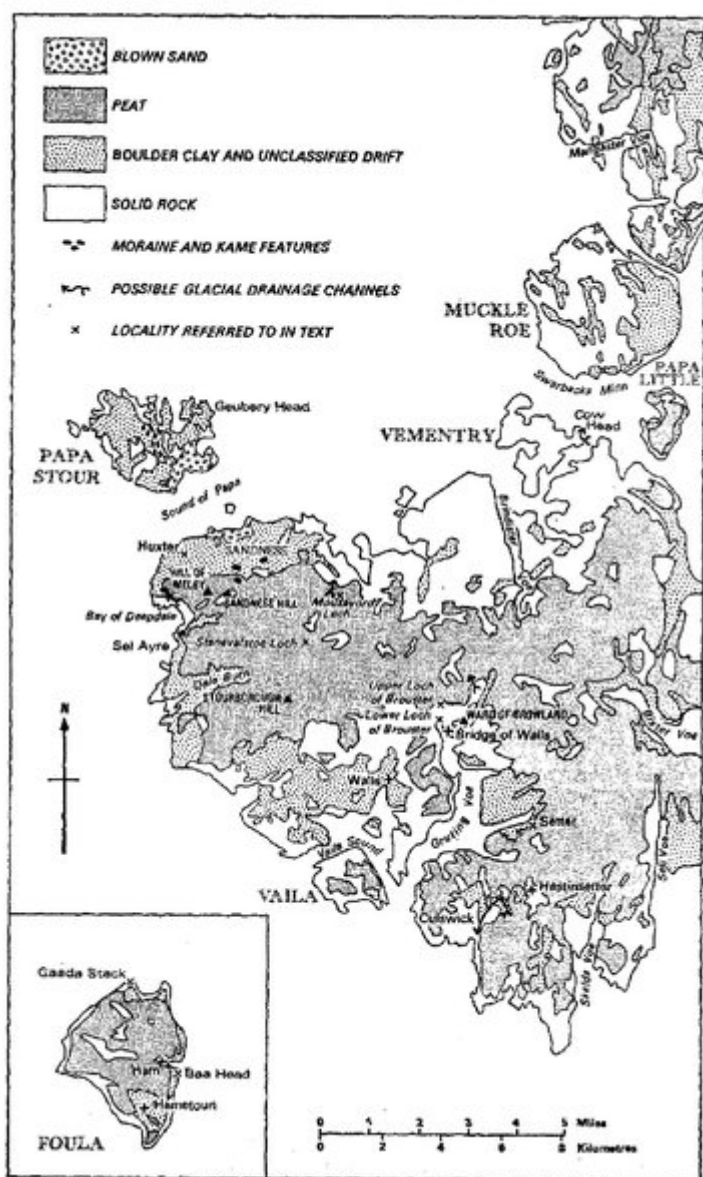
SUMM. PROG. 1934. *Mem. geol. Surv. Summ. Prog. for 1933.*



(Figure 30) Magnetic anomaly map (of the area around and north of Clothister Hill magnetite mine. Contour interval 2 gammas except in areas of high magnetic gradient. Inset: Plan of outcrop of orebody at surface and position of orebody at 22m level. Also positions of three inclined bores sunk to prove orebody at depth.



(Plate 2) Metamorphic rocks of the Walls Peninsula: Lithology and foliation.



(Figure 28) Superficial deposits and possible late-glacial drainage features.