HAM NESS

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OS Grid Reference: HP639010–HP634017

Introduction

The site lies in the SE of Unst where continuous coastal sections and good inland exposure reveal a klippe of serpentinized ultramafic rock (the Mu Ness Klippe) of the Upper Nappe and its basal thrust resting on the Lower Nappe. The Lower Nappe is formed of two tectonically juxtaposed fragments. Rhythmically banded lower metagabbro lies to the south and a fine-grained facies of the upper metagabbro with quasi-sheeted-dyke-like metabasic sheets, quartz-albite ('plagiogranite') veins and lamprophyre dykes, lies to the north (Gass *et al*., 1982; Prichard, 1985; Flinn, 1996). The site presents an easily accessible view of all these features characteristic of the highest level of the Shetland Ophiolite pseudo-stratigraphy and also illustrates the overthrust nature of the Upper Nappe.

Description

The Mu Ness Klippe is composed of highly sheared and serpentinized ultramafic rock forming the highest parts of the Mu Ness peninsula (Figure 2.12). The serpentinization is of antigorite type and has completely transformed the olivine in the rock so that the protolith of the serpentinite is not immediately obvious in the field. Thin-section examination shows that the klippe is composed of a mixture of metadunite, clinopyroxene-bearing dunite and wehrlite–clinopyroxenite. At the south end of the klippe are chromite prospecting pits and trenches, dug early in the 20th century, the waste from which shows the presence of banded coarse chromite in the dunite (see also The Punds to Wick of Hagdale GCR site report).

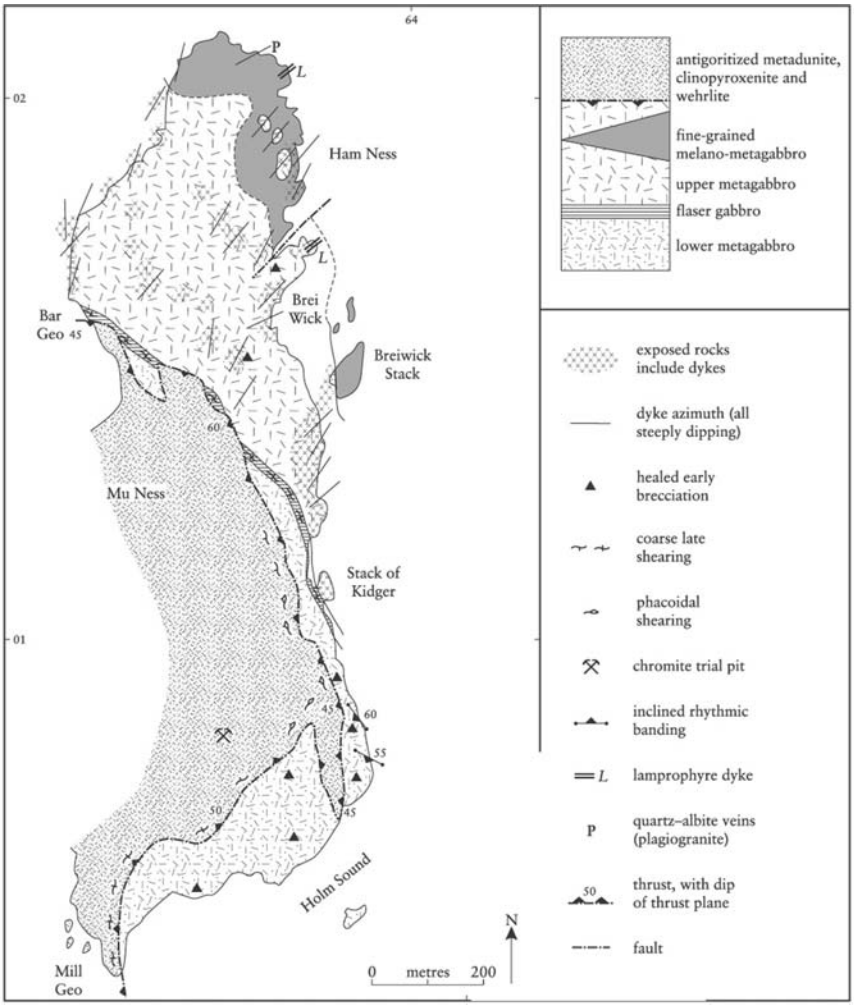

Figure 2.12: Map of Ham Ness and Mu Ness, Unst.

The klippe is separated from the underlying metagabbro by a thrust plane, which in many places is clearly exposed and easily accessible (Figure2.13). At 638 009 it is flat lying and the overlying serpentinite is coarsely sheared parallel to the thrust, imparting a slate-like lamination enclosing sporadic fat, unsheared lenses. At 6388 0068 the shear zone includes a thin lens of blackish phyllite, which could be mistaken for a metasedimentary rock belonging to the Middle Imbricate Zone (Figure 2.4a). In the SE corner of the site, at 637 005, the thrust plane forms an upright, isoclinal synform in the cliffs with the closure only just above sea level. Here the shearing parallel to the thrust is very well displayed in both the serpentinite and the metagabbro.

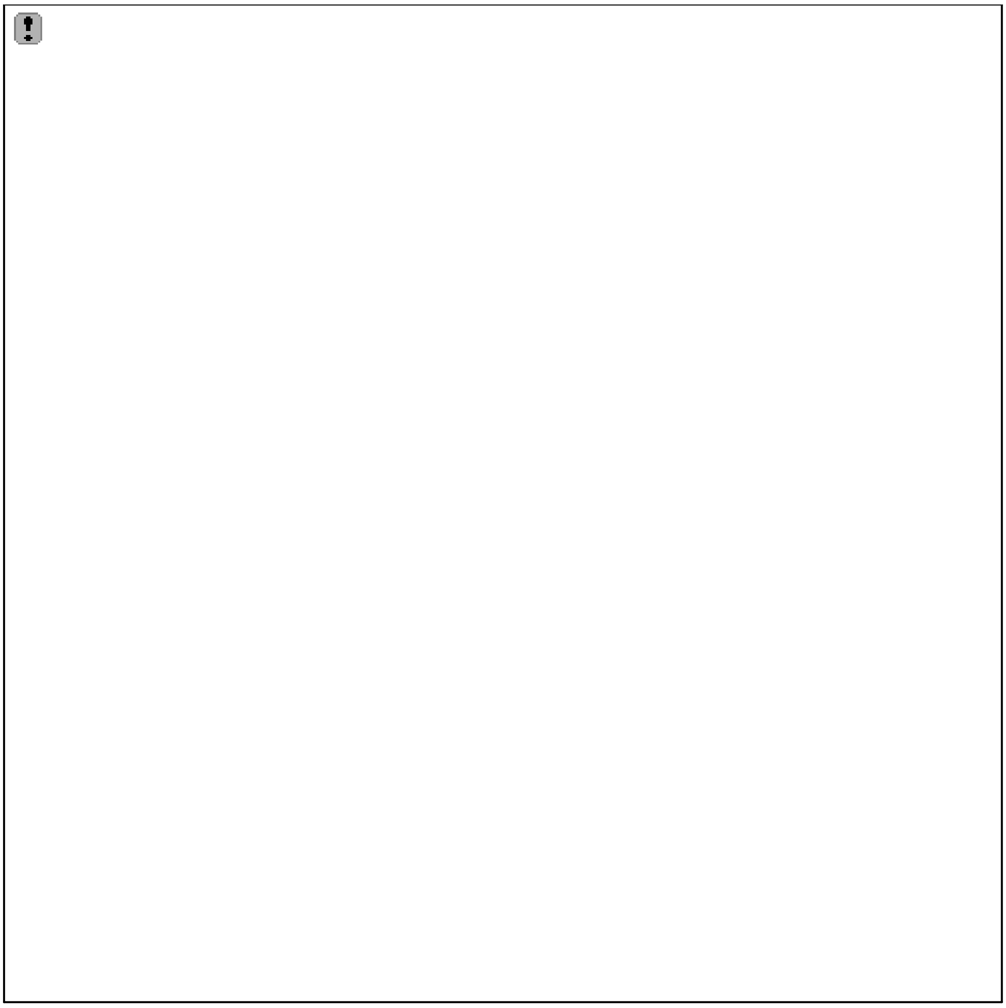

Figure 2.13: The Mu Ness serpentinite klippe (dark coloured) resting on lower metagabbro of the lower nappe (light coloured) as seen from (HP 637 000). (Photo: D. Flinn.)

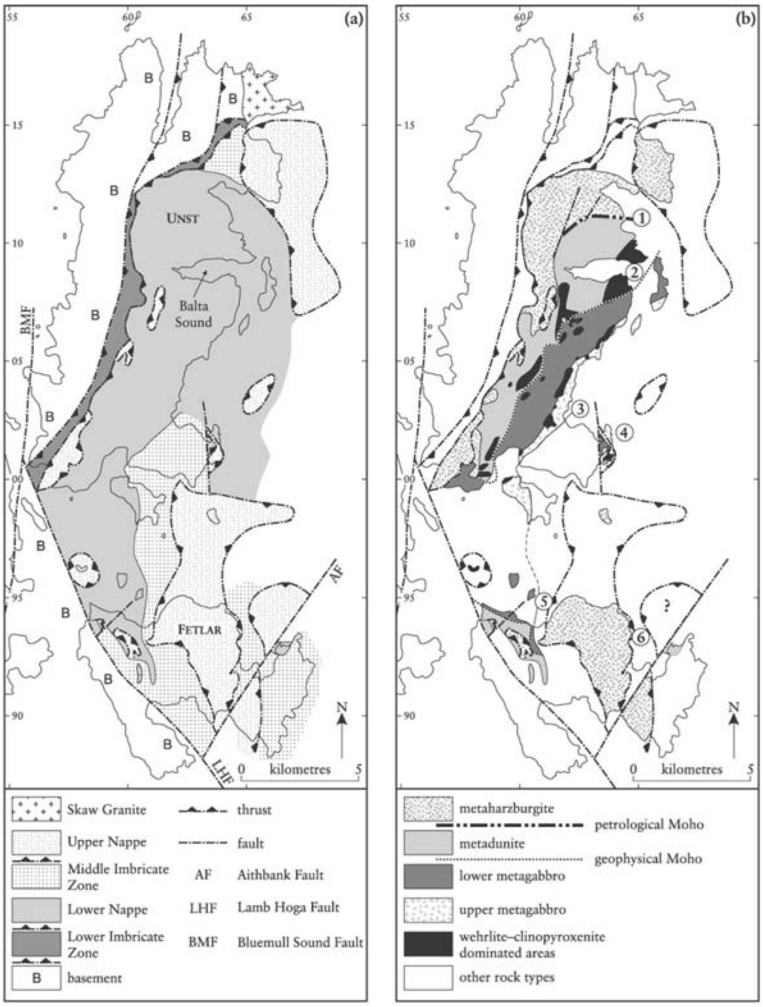

Figure 2.4: Maps of the Shetland Ophiolite (after Flinn, 1996): (a) principal tectonic units, (b) lithological outcrops. GCR sites: 1, The Punds to Wick of Hagdale; 2, Skeo Taing to Clugan; 3, Qui Ness to Pund Stacks; 4, Ham Ness; 5, Tressa Ness to Colbinstoft; 6, Virva.

The metagabbro mass on which the serpentinitic klippe rests is divided into two parts by a steeply dipping, structurally complex zone of gneissose or flaser gabbro. To the south of the flaser zone the metagabbro is of typical lower metagabbro type, both in its possession of the medium-grained, white and green speckled appearance and of the characteristic lower metagabbro rhythmic banding and the healed early brecciation (compare with theSkeo Taing to Clugan GCR site). North of the flaser zone, the rocks have many of the characteristics of the upper metagabbro (compare with the Qui Ness to Pund Stacks GCR site) with variable, fine- to medium-grain size and abundant metabasic sheets of quasi-sheeted-dyke type. The sheets range up to half a metre thick and alternate with screens of host metagabbro in equal volume. The intrusive sheets are particularly well displayed on the beach, at 6758 0160 and around 638 014, where they have been etched out by differential marine erosion, though large boulders interrupt the continuity. A reconstruction of the occurrence (at 638 014) has been published by Prichard (1985). Inland exposures also show metagabbro intruded by many metabasic sheets but these are more difficult to detect without the enhancing of visual contrast between the intruded rock and the host rock provided by marine erosion.

The north tip and the east side of the peninsula have been intruded by a fine-grained, epidote-hornblende gabbro. A lithologically similar rock forms The Vere, a half-tide rock in the sea 1.5 km to the NNE. This intrusion cuts the metabasic sheets, but is itself cut by several similar sheets of similar orientation. It is also cut by a quartz-albite vein (‘plagiogranite') and by several lamprophyre dykes.

Interpretation

Within the square kilometre of Mu Ness and Ham Ness a thrust mass of ultramafic rock rests on metagabbro and on fine-grained metagabbro intruded by quasi-sheeted dykes. Three of the four main components to be expected in an ophiolite complex are thus clearly displayed in visible tectonic contact, in an easily accessible environment. The same components are also displayed elsewhere in the Lower Nappe in their natural (non-tectonic) relationship to each other (see Skeo Taing to Clugan and Qui Ness to Pund Stacks GCR sites).

Comparison of the two gabbroic ophiolite components represented in Mu Ness with the larger, in-situ bodies in the Lower Nappe reveals so little difference that the same interpretation may be applied. The serpentinite forming the Mu Ness Klippe is formed of metadunite, clinopyroxene-bearing metadunite and wehrlite –clinopyroxenite, similar to that described in the Skeo Taing to Clugan GCR site but here occurring at the base of the Upper Nappe. It is probably a tectonic slice cut from a level in the ophiolite above the mantle and tectonically emplaced immediately below the Upper Nappe, rather than forming a part of it. Elsewhere in the Shetland Ophiolite the island of Sound Gruney is lithologically and tectonically similar (Figure 2.4).

An upright isoclinal fold of the thrust plane below the Mu Ness Klippe, with a northerly axial trend and an amplitude of about 10 m, is clearly exposed in the cliff in the SE corner of Mu Ness. It is of interest in determining the history of obduction. No obduction can have taken place to either the east or the west in the presence of this synformal downfold as such movement would have had the effect of detaching it from the base of the klippe. The axis of the fold is approximately parallel to, and in line with, the axis of the major downfold of the thrust below the Vord Hill Upper Nappe klippe to the south in Fetlar (see theTressa Ness to Colbinstoft and Virva GCR site reports). Both these axes are approximately parallel to the lineations, fold axes, pebble elongations and L-tectonite fabrics of the metasedimentary rocks of the Middle Imbricate Zone between the Upper and Lower nappes (Flinn, 1958). Evidently at some time after the emplacement of the nappes by obduction they were constricted about a north to north-easterly axis, which resulted in folding on this axis and a pebble extension and lineation parallel to it (Flinn, 1958, 1992). The alternative interpretation, that thrusting during obduction took place in a northward direction parallel to the lineation and the fold axes (Cannat, 1989), was based largely on the conventional concept that lineations are parallel to transport directions, but this seems less plausible in the context of the Shetland Ophiolite.

Conclusions

The Ham Ness GCR site provides an easily accessible view of a detached thrust slice (klippe) of ultramafic rock from the Upper Nappe, resting on quasi-sheeted-dyke complex and lower metagabbro. There are abundant inland exposures and a continuous coastal section. This site is of particular importance for the Shetland Ophiolite in that it provides examples of the component ophiolitic units in tectonic juxtaposition and allows their structural relationships to be deduced. It is thus of major importance for any large-scale interpretations of the Caledonian Orogen.

Reference list

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