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Geological report on a set of Archaeological rock specimens from the Northton site, Toe Head, South Harris, Scotland

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Foreword

This report is the published product of a study by the British Geological Survey (BGS) for Dr E. Murphy and Professor D. Simpson of the School of Archaeology and Palaeoecology, Queen's University of Belfast. The work forms part of a project undertaken by Dr Murphy to publish an excavation report on the prehistoric settlement at Northton in Harris on behalf of Historic Scotland.

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Summary

This report describes a suite of archaeological rock samples collected from the Prehistoric settlement at Northton in South Harris. The report also includes a summary of the geology of the Toe Head area of South Harris. The work forms part of a multidisciplinary study being undertaken by Dr E. Murphy and Professor D. Simpson of the School of Archaeology and Palaeoecology, Queen's University of Belfast on behalf of Historic Scotland.

1 Introduction

This report describes the geology of the Northton area on South Harris and includes descriptions of a set of archaeological rock specimens collected by Prof. D. D. A. Simpson. This work has been carried out for Dr. E. Murphy and Prof. D. D. A. Simpson of Queens University Belfast as part of a commercial minor repayment contract funded by Historic Scotland.

2 Geology of the Northton area

The bedrock geology of the Outer Hebrides is dominated by a suite of consists of coarse-grained, crystalline Precambrian (Archean) gneisses collectively referred to as the Lewisian Gneiss. These islands occupy a unique geological position in Europe, in that they represent a mere fragment of a much larger ancient craton, which was only finally broken up by the formation of the North Atlantic Ocean in Jurassic to recent times. Hence there nearest geological relatives are found in Greenland and eastern Canada, except for parts of the foundered continental material that make up the Rockall Plateau.

More recent, glacial and Holocene features and deposits recognised on the Outer Hebrides, are also dominated by Atlantic effects. On Uist, Bara and South Harris the main ice shed lay on the western side of the islands and ice movement took place from west to east into the Minches. The sand dune-machair system, which is commonly developed of the western seaboard, also results from the onshore movement of calcareous, shelly sand and fluvioglacial materials from the west by the prevailing westerly and south-westerly winds. The result is that these outermost islands of Scotland have a distinctive geology, dominated by Archean Lewisian Gneiss basement, and a peat- and sand-dominated cover.

For a more detailed description of the solid geology of the Outer Hebrides the reader is referred to the British Geological Survey memoir (Fettes *et al*., 1992) and, for the Quaternary geology, Peacock (1984).

2.1 GEOLOGICAL BACKGROUND

The basement Lewisian Gneiss Complex of South Harris is a product of a multiphase depositional, intrusive, deformational and metamorphic history that spans a time period between approximately 3000 million years (Ma) ago and 400 Ma ago. The major part of this activity occurred between 3000 to 1500 Ma. The oldest rocks within this ancient complex are the metasediments and associated metamorphosed banded mafic and ultramafic intrusions. By analogy with Greenland these units are probably between 300 and 2850 Ma old. The metasediments are distinguished from the surrounding orthogneisses by their biotite-garnet-bearing mineral assemblages. On South Harris these metasedimentary rocks occur as two discrete belts (Figure 1); (a) the Leverburgh Belt (Dearnley 1963; Fettes *et al*., 1992), extending from Toe Head south-eastwards to Rodel; and (b) the Langavat Belt, which extends from Borve Lodge in the north through Loch Langavat to Loch Finsbay in the south (Myers 1968; Fettes *et al*., 1992). These metasedimentary belts contain quartzites, limestones and pelitic gneisses, as well as finely banded amphibolite-acid gneiss units that are interpreted as possible metavolcanic rocks. However, some doubts have been raised about the age of the protoliths to these belts. Cliff *et al*., (1998) have recently published model isotopic (Sm-Nd) ages of between 2410 Ma and 2450 Ma for the metasedimentary rocks of the Leverburgh Belt. Spatially associated with the metasedimentary rocks are a suite of lithologically distinct, lenticular, finely compositionally banded, mafic and ultramafic bodies referred to as the 'Older Basics'.

The geology and scenery of South Harris is, however, dominated by the meta-igneous rocks of the South Harris Igneous Complex which intrudes the adjacent Leverburgh and Langavat metasedimentary belts (Fig. 1). This meta-igneous complex effectively separates the metasedimentary belts and comprises a suite of metagabbros, metatonalites, meta-anorthosites and metadiorites. These meta-igneous rocks have yielded model isotopic ages of 2180 ± 160 Ma (Cliff *et al*., 1983) and have been metamorphosed under granulite facies to lower amphibolite conditions.

To the north of the Langavat Belt metasedimentary rocks lies an extensive zone of Scourian (c. 2600 Ma) grey gneisses, pink granitic gneiss sheets and lenses, intruded by Laxfordian (c. 1700 Ma) granite sheets and pegmatites. To the southwest of the Leverburgh Belt, is a metanorite body (the pyroxene-granulite of Dearnley 1963) which underlies much of the Sound of Harris. This metanorite locally contains relict high-grade garnet-pyroxene and two pyroxene assemblages and is separated from the metasedimentary rocks by a Laxfordian shear zone which trends northwest along southwest coast of South Harris.

2.2. Geological description of the Northton site

This description of the geology of the Northton site is largely based upon the report provided by J. Myers, but has been updated using the work of Fettes et al., (1992).

The Northton site lies within the south-western extremity of the Leverburgh Belt high-grade of metasedimentary rocks; including foliated quartz-feldspar-biotite (± garnet) gneisses, with occasional bands of calc-silicate gneiss (dolomite-diopside) and rusty-weathering pyrite-bearing quartzofeldspathic gneisses (Fig. 2). Approximately 360 metres to the east of the site these rocks pass into a suite of foliated metapelitic gneisses which contain the assemblage: garnet + kyanite + sillimanite + biotite + quartz + feldspar.

These metasedimentary rocks are separated from the metanorite body which crops out along the south-west coast of South Harris by a prominent Laxfordian shear zone (the thrust of Myers). The dark grey metanorite (basic charnockites of Myers) is well exposed at Rudh' an Teampuill (Fig. 2), where it is relatively massive and locally retrogressed to feldspar-pyroxene-hornblende assemblage. On the western side of Rudh' an Teampuill, the metanorite is intruded by a dark grey porphyritic basalt dyke of probable Tertiary age and, further to the northwest,

by Laxfordian pegmatites (the 'Granite Injection Complex' of Myers). These coarse-grained, granitic pegmatites are well exposed in the cliffs and rocky shore.

The Laxfordian shear zone, which forms the western boundary of Leverburgh metasedimentary belt, passes through the eastern end of Traigh an Teampuill about 270 metres to the west of the Northton site (Fig. 2). Adjacent to this high strain zone the metanorite and metasedimentary rocks are highly deformed (cataclased) and bands of mylonite are locally developed within both lithologies. The widest development of mylonites occurs immediately adjacent to the shear zone within the quartz-feldspar-biotite (± garnet) gneisses. These rocks are highly deformed (sheared) with the early gneissose fabric having been transposed by a finely banded mylonitic fabric. A lenticular body of garnet-metagabbro, which crops out to the east of these mylonites, also shows signs of having been deformed.

Myers concluded that much of the area around the Northton site was covered by a Pleistocene till (variable thickness). This diamicton comprises poorly sorted angular rock fragments of local origin within a dark blue-grey clay-rich matrix. At the Neolithic site this diamicton is immediately overlain by a thin soil horizon, which is in turn overlain by stratified, calcareous sands. Immediately north of the broch on Rudh' an Teampuill a c. 10 cm thick peat horizon is developed between the diamicton and the sands. The wind blown calcareous sands locally form a narrow, elongate, east-west-trending deposit which occurs parallel to the coast line and the Chiapaval Ridge. Myers reported that these calcareous sands were being actively eroded (reworked) at the time of his investigation. Myers stated that the sands were being reworked by the dominant south-west and westerly winds, and transported across the Northton machair to be re-deposited at sea-level on the Traigh an Toaibh Thuath. Consequently, he concluded that the Northton site occupies the last remnant of sand dunes which once probably extended much further to the south.

Myers reported that no raised beaches have been recorded on either Harris or Lewis and that in many parts of the Outer Hebrides peat can be observed extending past the low-water mark; notably opposite Mealasta Island, Lewis and Vallay, North Uist (Jehu & Craig 1956, 1933). The absence of raised beach deposits was also noted by Gregory (1927) and Stevenson (1928). Myers also noted that Jehu & Craig (1926) recorded that local fishermen had reported raising of peat on the anchors of their boats several miles off the north-west coast of North Uist.

3 Description of the Archaeological samples

The archaeological samples provided for analysis have been described utilising the conventional terminology used by geologists for describing hand specimens and thin sections of rocks. The hand specimens were examined using a hand lens and under a low-power Zeiss binocular microscope. The weathering and, where applicable, fresh colour (observed on the broken surface) of the rock specimens have been characterised using the Munsell Color Chart issued by the Geological Society of America (1991). This colour scheme is a technique used by geologists and soil scientists for the standardisation and classification of the colour of consolidated and unconsolidated materials. The thin sections of the 'Harris mylonite' sample were examined under plane and crossed polarised light using a standard Zeiss petrological microscope.

3.1 SAMPLE DETAILS

Sample Number: (1). **Location Details:** Beaker II, V/VI, Northton site (1966). **Artefact Type:** Beach pebble.

Hand Specimen Description: This specimen is approximately 4.8 cm in length and is composed of a fine- to very fine-grained, crystalline, aphyric to weakly microporphyritic basaltic igneous rock. One side of the specimen is a broken, natural surface the other is convex, smooth, with a dull lustre and originally formed the outer surface of a small pebble. The colour of the fractured surface of the sample is a olive-grey (Munsell colour code 5 Y 3/2), with the smooth surface being a darker olive-black grey (Munsell colour code 5 Y 2/1) colour.

The bulk of the rock consists of a very fine-grained, massive groundmass which is rich in a dark coloured ferromagnesian mineral (possibly pyroxene) with occasional larger crystals (phenocrysts) of plagioclase. The phenocrysts are typically ≤ 2.0 mm in size (microphenocrysts). Occasional, small, rounded to irregular vesicles, originally gas bubbles within the igneous rock, are lined by very fine-grained coating of a ?carbonate mineral. Examples are also present where the vesicles are partially filled by a brown, resinous-looking mineral (composition unknown).

Rock Type: This specimen is composed of a very fine-grained basaltic igneous rock. This rock may have formed as part of a lava flow or a fine-grained igneous intrusion, such as a high-level dyke or sill. Further, detailed classification of this basaltic rock would require the preparation of a petrological thin section.

Provenance: A possible source for this stone is from one of a small number of approximately N-S to E-W-trending basaltic dykes (Tertiary in age) exposed on South Harris; examples are exposed to the south-west of Hacleit summit [NG 032 872], Eilean Quidnish [NG 095 861], and on the west side of Aird Harnasaig, Loch Grosebay [NG 157 925]. The location of these sheet-like intrusions are shown on the detailed geological map of the south-western part of South Harris published by the British Geological Survey (1982) (also see Fettes *et al*., 1992).

Myers in his original description of the geology of the Northton site records the presence of a dark grey Tertiary dyke of porphyritic basalt on the western side of Rudh' an Teampuill. This provides a potentially, very local source for this rocks sample. Basalt lavas and intrusions are also extensively exposed on the island of Skye and may also provide a potential source for this rock.

Sample Number: Artefact Number 140(2). **Location Details:** Beaker I, VII, Northton site. **Artefact Type:** Stone.

Hand Specimen Description: This specimen is of a relatively flat, equant disc-like rock fragment which is approximately 2.7 cm in length. It is composed of a very fine-grained, indurated, possibly argillaceous sedimentary rock (mudstone) which possesses a relatively dull lustre/sheen to its surface. The colour of rock ranges between a light grey (Munsell colour code N6) and a medium grey (Munsell colour code N5) with a slight mottled appearance to the surface of the sample.

The rock is massive and lacks any obvious primary sedimentary structures (e.g. lamination). The mudstone is relatively hard and indurated when compared to an average sample of mudstone; the latter tends to be relatively weak and can be easily broken by hand. Fracture surfaces are curved (concave) and produce a sharp edge to the fragment. The relative hardness of the rock suggests that the mudstone has been metamorphosed (changed by heat and pressure).

Thin hematitic veinlets or patches were also noted.

Rock Type: This specimen is composed of a indurated, metamorphosed (baked) grey mudstone. No thin sections of this sample are available.

Provenance: A possible source for this stone are the contact metamorphosed or baked the Jurassic rocks of the Shiant Isles which lie of the Minch off the west coast of the Isle of Lewis. These rocks are mainly composed of thermally metamorphosed (baked) mudstones due to their close proximity to three thick sills (Tertiary in age) of a gabbroic igneous rock known as a teschenite. A sill is a sheet like igneous intrusion.

No samples of these baked mudstones are available for comparison with this specimen.

Sample Number: Artefact Number 31(3). **Location Details:** Beaker II, V/VI, Northton site (1966). **Artefact Type:** Stone.

Hand Specimen Description: This specimen is of a relatively large, approximately 6.7 cm in length, fragment of a broken pebble. It is composed of a medium- to coarse-grained, crystalline, granoblastic, high-grade metamorphosed basic to ultrabasic igneous rock (gneiss). The weathered surface of the sample is a dark yellowish brown colour (Munsell colour code 10 YR 4/2). The broken surface is not fresh and is greyish olive-green (Munsell colour code 5 GY 3/2) in colour with an 'oily' to resinous lustre.

The rock is massive and lacks any obvious macroscopic structures (e.g. a gneissose foliation). It is mainly composed of oily green to brown pyroxene and plagioclase. Well developed crystal faces and/or mineral cleavage planes can be recognised of the broken surface of the sample.

Rock Type: This specimen is of a high-grade metamorphosed basic to ultrabasic igneous rock. No thin sections of this sample are available.

Provenance: A variety of high-grade meta-igneous rocks form a large volume of the Lewisian Complex exposed on South Harris (see section on the regional geology of South Harris).

Sample Number: Artefact Number 29(4). **Location Details:** Beaker I, VII, structure I, Northton site (1965). **Artefact Type:** large flat beach pebble.

Hand Specimen Description: This specimen is of a large, flat, wedge or 'axe-shaped' pebble which is approximately 10.0 cm long by 6.2 cm at its widest point. It is composed of a fine- to medium-grained, crystalline, metamorphic basaltic igneous rock (amphibolite). The weathered surface of the sample is mottled in appearance ranging from a moderate olive brown (Munsell colour code 5 Y 4/4) to a dark greenish grey (Munsell colour code 5 GY 4/1).

In detail, the rock is composed of fine-grained, radiating (≤ 2.0 mm long), needle-like crystals of amphibole resulting in texture known as garbenschiefer. This texture is developed on both of the large flat surfaces of the pebble. These surfaces represent a planar schistosity of fine gneissose foliation developed within this metamorphic rock.

Rock Type: This specimen is of a schistose to finely gneissose metabasaltic rock with a well-developed garbenschiefer texture.

Provenance: The source of this rock fragment is uncertain. It is possible that is was derived from one of the thin, laminated amphibolite layers or lenses present within the Langavat or Leverburgh belts of metasedimentary rock exposed on South Harris (see Fettes *et al*., 1992).

Sample Number: (4). **Location Details:** Beaker I, VII, structure I, Northton site (1965). **Artefact Type:** large beach pebble.

Hand Specimen Description: This specimen is of a large, elongate, rounded pebble which is approximately 10.0 cm in length by 5.5 cm wide. It is composed of a medium-grained, crystalline, metamorphic rock with a moderately well developed gneissose to coarse schistose foliation. It is likely that the protolith to this high-grade metamorphic rock was sedimentary in origin, possibly a impure sandstone or siltstone. The weathered surface of the sample ranges from a medium dark grey (Munsell colour code N4) to a medium grey (Munsell colour code N5) in colour. Distinct quartzofeldspathic bands or layers, which form part of the gneissose foliation, are a yellowish grey in colour (Munsell colour code 5 Y 8/1).

In detail, the rock is composed of fine- to medium-grained, inequigranular assemblage of quartz, biotite, muscovite and possible feldspar. The surface of the sample is pitted. The gneissose foliation to coarse schistosity is defined by alternating, 2.0 to 5.0 mm thick, micaceous and quartzose layers, referred to as domains or lithons.

Rock Type: This specimen is of a high-grade, gneissose metasedimentary rock.

Provenance: The source of this rock fragment is probably from either the Langavat or Leverburgh belts of metasedimentary rock which form part of the Lewisian Complex exposed on South Harris (see Fettes *et al*., 1992).

Sample Number: Artefact Number 161(5). **Location Details:** Neolithic II, Northton site. **Artefact Type:** Grey plano-convex knife-type.

Hand Specimen Description: This specimen is elongate, blade-like in form and is approximately 5.3 cm in length by up to 1.8 cm in width. It is composed of a fine-to very fine-grained, fragmentary looking igneous rock. The weathered surface of the sample is a light olive-grey (Munsell colour code 5 Y 5/2) to olive grey colour (Munsell colour code 5 Y 4/1) and possesses a dull sheen or patina. Fracture surfaces are weakly curved.

The rock is massive and lacks any obvious internal structures. It is mainly composed of olive-grey, massive, microcrystalline to possibly cryptocrystalline matrix containing small rounded very dark grey to black spots. Under the binocular microscope these are composed of a single crystal or very fine aggregate. These spots are typically < 1.0 mm in size and give the sample a slight fragmentary appearance.

Rock Type: This specimen is of a fragmentary looking fine-grained, possibly igneous rock. No thin sections of this sample are available.

Provenance: The source of this rock fragment is unknown.

Sample Number: Artefact Number 167(5). **Location Details:** Neolithic II, Northton site. **Artefact Type:** Grey chipped fragment.

Hand Specimen Description: This specimen is of a small, equant to slightly elongate, rock fragment which is approximately 2.8 cm in length by 1.7 cm wide. It is composed of a fine- to very fine-grained, indurated, hard mudstone which possess a dull/matt lustre. The weathered surface of the sample is a light olive-grey (Munsell colour code 5 Y 5/2). Fracture surfaces are weakly curved (concave).

The rock is essentially massive, but a weak sedimentary lamination or banding has been recognised under the microscope. The most distinctive feature of the sample is the mould of a c. 1 cm in diameter iron concretion or nodule on one of its surfaces. This mould has a yellow-ochre staining and is crossed by a fine-network of features which preserve the surface expression of micro-fractures within the nodule.

Rock Type: This specimen is of a indurated mudstone.

Provenance: The source of this rock fragment is uncertain. It is possible that is was derived from the Jurassic rocks of the Shiant Isles, or even the Inner Hebrides islands of Skye or Raasay.

Sample Number: Artefact Number 36(6). **Location Details:** Beaker II, layer BII, Northton site. **Artefact Type:** ? fragment of serpentine axe.

Hand Specimen Description: This specimen is of a small rock fragment which is approximately 3.7 cm in length by 1.9 cm wide, with a relatively flat uneven, broken surface and convex polished surface. The polished surface is pitted by a number of later marks. It is composed of a fine-to very fine-grained, medium- to possibly coarse-grained, crystalline metamorphosed basaltic or ultramafic rock which is apparently completely composed of ferromagnesian minerals (pyroxene and/or amphibole). The broken surface of the sample is a greyish black in colour (Munsell colour code N2), whereas the polished surface is black (N1).

Well developed, slightly bronzed, crystal faces (possibly pyroxene) where observed under the microscope on the broken surface of the sample. Pale green, very finely crystalline to cryptocrystalline material may be composed of chlorite and/or serpentine.

Rock Type: This specimen is of a metamorphosed basaltic or ultramafic rock.

Provenance: A possible source for this rocks is possibly one of the minor mafic to ultramafic intrusive bodies contained within the Lewisian Complex of South Harris (see Fettes *et al*., 1992).

Sample Number: Artefact Number 29(7). **Location Details:** Beaker II, Northton site (1968). **Artefact Type:** Rock fragment – Harris mylonite.

Hand Specimen Description: This specimen is of a small fragment (approximately 2.8 cm in length) of a very fine-grained, finely laminated mudstone. The primary sedimentary lamination is preserved by alternating laminae (£ 3.0 mm in thickness) of pale grey to buff to cream-grey mudstone to possible very fine-grained siltstone. This fine-scale structure is a primary feature of the rock and developed due to slight changes in the composition of the clay and very fine silt-grade material that settled out of suspension during the deposition of this argillaceous sedimentary rock.

The colour of the weathered surface of the sample ranges from greyish orange (Munsell colour code 10 YR 7/4) to greenish grey (Munsell colour code 5 GY 6/1). A dark red-brown thin hematitic coating or stain was noted developed along some of the sedimentary laminae.

The mudstone is relatively hard and indurated when compared to an average sample of mudstone; the latter tends to be relatively weak and can be easily broken by hand. Fracture surfaces on the sample are curved (concave) with the rock displaying a slightly glassy to 'flinty' appearance on the cut surface. The increased hardness and porcellanous to flinty appearance of the rock suggests that the mudstone sample has been metamorphosed. This finding supports the interpretation of Dr. G. H. Collins (petrologist with the British Geological Survey) in a letter (dated 25th October 1984) to Prof. D. D. A. Simpson that the 'Harris mylonite' sample is of a "baked clay sediment, altered by contact metamorphism".

Thin Section Description: A petrological thin section of the 'Harris mylonite' sample was made for, and examined by Dr. G. H. Collins in 1984. This sample was registered (registered number ED7243) as part of the Edinburgh Collection of rocks and thin sections held by the British Geological Survey in its Edinburgh office. The thin section was retained as part of this collection after the original sample was returned to Prof. Simpson. The original entry in the Edinburgh Collection register is shown in Figure 2. Due to the slightly poor quality of the original thin section, permission was granted by Prof. Simpson and Dr. Murphy for a second to be made (registered number ED7243b). Both thin sections have been examined during this present investigation.

In thin section the 'Harris mylonite' is composed of a very fine-grained (clay-grade), finely laminated or banded mudstone. The bulk of this mudstone is composed of very fine-grained to cryptocrystalline clay minerals and quartz. The clay minerals locally exhibit a preferred optical alignment (observed as the microscope stage is rotated under crossed polarised light) parallel to the sedimentary lamination. The slightly coarser grained laminae also contain angular, moderate to low sphericity, fine-silt sized grains of quartz, and opaque mineral and possible rare feldspar.

The sedimentary lamination preserved within this rock is defined by alternating dark grey to grey-brown, dusty looking mudstone layers and pale grey to colourless slightly silty laminae. These laminae range up to c. 3.0 mm thick. The contacts between the laminae vary from sharp, representing the original base of these sedimentary layers, to gradation. The gradational contacts preserve an original grain size grading from very fine silt to clay grade detritus

as it was being deposited, forming a primary sedimentary structure/feature known as graded bedding. One of the thicker silty laminae also possesses a fine, wispy-looking fabric or cross-lamination developed at an oblique angle to the main sedimentary lamination.

The rock is also cut by a number of very thin (c. 0.1 mm in thickness) veinlets composed of cryptocrystalline to finely microcrystalline quartz.

Although indurated during metamorphism, no evidence of new mineral growth has been recognised in thin section. This suggests that the metamorphic overprint occurred under low temperature and pressure conditions (i.e. low-grade metamorphism), comparable to conditions encountered during contact or thermal metamorphism associated with the emplacement of an igneous intrusion.

Rock Type: This specimen is composed of a indurated laminated mudstone which has been modified during low-grade (low temperature and pressure) metamorphism, possibly due to the thermal or contact effects associated with an adjacent igneous intrusion. Consequently, the term 'Harris mylonite' is rather misleading. A mylonite is a fine-grained, highly foliated metamorphic rock formed as a result of intense ductile deformation along deeply buried faults or related geological structures known as shear zones.

Provenance: Dr Collins (1984), based upon his comparison of the 'Harris mylonite' with a sample held within the British Geological Survey's Scottish rock and thin section collection (registered number S72034), suggested that this sample of metamorphosed mudstone may have been derived from the southern end of Staffin Bay, Skye. At this locality a lens of thermally metamorphosed mudstone is contained within a dolerite sill.

An alternative source for this mudstone sample may be from the Jurassic rocks of the Shiant Isles which lie of the Minch off the west coast of the Isle of Lewis. These rocks are mainly composed of thermally metamorphosed (baked) mudstones due to their close proximity to three thick sills (Tertiary in age) of a gabbroic igneous rock known as a teschenite. No samples of these baked mudstones are available for comparison with the sample of 'Harris mylonite'. For a more detailed description of the Jurassic rocks of the Shiant Isles the reader is referred to Fettes *et al*., (1992).

Sample Number: Artefact Number 136(8). **Location Details:** Beaker II, VII, Northton site. **Artefact Type:** Flint.

Hand Specimen Description: This specimen is of a relatively flat, slightly arcuate rock fragment and is approximately 4.0 cm in length and possess a distinctive porcellanous appearance. It is composed of an very fine-grained, possibly cryptocrystalline, indurated, cherty rock or silicified mudstone. The colour of the sample ranges from a very pale orange (Munsell colour code 10 YR 8/2) to a greyish orange (Munsell colour code 10 YR 7/4).

The rock is massive and it lacks any obvious internal structures (e.g. a sedimentary lamination). Fracture surfaces are curved (concave) and form a sharp edge to the sample.

Rock Type: This specimen is of a cherty rock or silicified mudstone.

Provenance: The source of this rock fragment is uncertain. Fettes *et al*., (1992) in their description of the geology of the Shiant Isles refer to a 'grey flinty porcellanous rock with a conchoidal fracture'. This rock is exposed on Eilean an Tighe and occurs within a 5 m long raft of contact metamorphosed Jurassic sedimentary rocks included within the upper of the three gabbroic sills exposed on these islands. However, no samples of this flinty rock are available for examination.

Sample Number: Artefact Number 139(9). **Location Details:** Neolithic II, (bulldozer) Northton site (1966). **Artefact Type:** Quartz.

Hand Specimen Description: This elongate, relatively flat specimen is approximately 4.0 cm in length of fine- to medium-grained, crystalline to massive quartz which exhibits a glassy to slightly opalescent lustre. The quartz is white to yellowish grey (Munsell colour code 5 Y 7/2) in colour. Small conchoidal fractures were noted on the broken surface of the sample.

Rock Type: This specimen is of polycrystalline quartz.

Provenance: Quartz is a common mineral with quartz veins being common in most metamorphic terranes.

Glossary

Amphibolite – A metamorphosed basic igneous rock with a mineral assemblage comprised largely of amphibole and plagioclase, usually with quartz and epidote.

Augen gneiss – A gneissose metamorphic rock with abundant *augen* (eyes) represented by porphyroblasts (typically K-feldspar) enveloped by the foliation.

Andesite – An intermediate volcanic rock, usually porphyritic, consisting of plagioclase (frequently zoned from labradorite to oligoclase), pyroxene, hornblende and/or biotite. Now defined modally on a Quartz-Alkali feldspar-Plagioclase-Feldspathoid diagram or geochemically using the Total Alkali-Silica diagram.

Basalt – A volcanic rock consisting essentially of calcic plagioclase and pyroxene. Olivine and minor feldspathoids may also be present. Now defined modally on a Quartz-Alkali feldspar-Plagioclase-Feldspathoid diagram or geochemically using the Total Alkali-Silica diagram.

Cleavage – A fabric developed within a metamorphic rocks defined by a sub-parallel set of closely spaced approximately planar surfaces produced during rock deformation. Defined by the preferred alignment of platy or elongate mineral grains (usually phyllosilicate minerals such as muscovite, biotite, chlorite).

Cement supported – Describes a fragmentary deposit where the detrital grains are, to varying degrees, isolated/supported within the cement.

Cement – The material bonding the fragments of clastic sedimentary rocks together and which was precipitated between the grains after deposition.

Clast supported – Describes a fragmentary deposit where all the detrital grains are in contact.

Cryptocrystalline – A term used to describe crystals in an igneous rock which are too small to be identified even with the petrological microscope.

Crystallinity – (a) H*olocrystalline*, an igneous rock composed of 100% crystals; (b) *holohyaline*, an igneous rock composed of 100% glass; and (c) *hypocrystalline*, intermediate between the two end-members and can be described more precisely by stating the relative proportions of crystals and glass.

Dacite – A volcanic rock composed of quartz and sodic plagioclase with minor amounts of biotite and/or hornblende and/or pyroxene. Now defined modally on a Quartz-Alkali feldspar-Plagioclase-Feldspathoid diagram or geochemically using the Total Alkali-Silica diagram.

Detritus – A general term for fragmentary material, such as gravel, sand, clay, worn from rock by disintegration. Detrital grains in clastic sedimentary rocks may be composed of single mineral grains (e.g. monocrystalline quartz, plagioclase), polycrystalline mineral grains (e.g. polycrystalline quartz) or lithic fragments including sedimentary, igneous and metamorphic rock fragments.

Dolerite – An igneous rock of intermediate grain size between a basalt and gabbro (i.e. synonym for *microgabbro*), and composed of essentially plagioclase, pyroxene and opaque minerals. Often contains an ophitic texture. If olivine is present may be called an olivine-dolerite; if quartz, a quartz-dolerite.

Equigranular – All the crystals in an igneous rock are approximately the same size.

Felsite – A rock term initially used for the microcrystalline groundmass of porphyritic igneous rocks. Now commonly used for microcrystalline rocks of granitic composition (i.e. dacite to rhyolite).

Gneiss – A coarsely banded high-grade metamorphic rock consisting of alternating, mineralogically distinct layers.

Granoblastic texture – An aggregate consisting of equidimensional, typically rounded to anhedral crystals in a metamorphic rock which are of approximately equal size.

Granulite – A high-grade metamorphic rock typically with a granoblastic texture and with an assemblage containing pyroxene and anorthite-rich plagioclase.

Greenschist – A low-grade metamorphosed basaltic rock consisting of the assemblage actinolite, chlorite, epidote, albite, quartz and accessory titanite (sphene).

Grain size – Refers to the size of fragmentary material present in unconsolidated sediments and sedimentary rocks: (a) clay < 0.0039 mm in size; (b) silt, 0.0039 to 0.0625 mm in size; (c) fine sand, 0.0625 to 0.25 mm in size; (d) medium sand, 0.25 to 0.5 mm in size; (e) coarse sand, 0.5 to 1.0 mm in size; (f) very coarse sand, 1.0 to 2.0 mm in size; (g) granules 2.0 to 4.0 mm in size; (h) pebbles 4.0 to 64 mm in size.

Grain size – Refers to the size of crystals present in igneous rocks: (a) coarse-grained, crystals > 5.0 mm in size; (b) medium-grained, crystals 1.0 to 5.0 mm in size; (c) fine-grained, crystals < 1.0 mm in size.

Hornfels – A hard, fine- to medium-grained granoblastic metamorphic rock produced by high-grade contact metamorphism.

Inequigranular – Term used to describe crystals present within an igneous rock which are of substantially different grain sizes. Common variety, porphyritic texture, can be subdivided into: (a) *microporphyritic*, phenocrysts ≤ 2.0 mm in size; and (b) *macroporphyritic*, phenocrysts > 2.0 mm in size.

Matrix – Material, usually clay minerals or micas, forming a bonding substance to grains in a clastic sedimentary rock. The matrix material was deposited with the other grains or

developed authogenically by diagenesis or slight metamorphism. Also used more generally for finer grained material in any rock in which large components are set.

Matrix supported – Describes a fragmentary deposit where the detrital grains are, to varying degrees, isolated/supported within a finer grained matrix.

Microcrystalline – crystals in an igneous rock which can only be identified with a petrological microscope. Crystals only just large enough to show polarisation colours (< 0.01 mm in size) are called *microlites*.

Olivine-basalt – A commonly used term for a basalt containing olivine as an essential constituent.

Packing – Describes, as the term suggests, how closely the individual detrital grains are packed together within a fragmentary deposit. The term closely packed is used where all the grains are in contact and there is very little obvious matrix or cement; moderately packed and open packed are used with an increase in the porosity, matrix and/or cement.

Porosity – The volume of voids expressed as a percentage of the total volume of the sediment or sedimentary rock.

Phyllite – A well-cleaved metamorphosed mudstone characterised by a distinctive sheen on foliation surfaces; generally of intermediate grain size and metamorphic grade between slate and schist.

Porphyroblast – A metamorphic mineral (e.g. garnet) that has grown to much larger size than the minerals of the surrounding matrix.

Porphyroblastic – A term used to describe a metamorphic rock containing large porphyroblasts within a finer grained matrix.

Pseudomorph – A mineral or aggregate of minerals having taken the form/shape of another mineral phase that it/they have replaced.

Quartz-dolerite – A variety of *microgabbro* (dolerite) composed mainly of plagioclase and pyroxenes with interstitial quartz. The rock has tholeiitic affinities and its pyroxenes are usually sub-calcic augite accompanied by pigeonite or orthopyroxene.

Rounded – Describes the smoothness of the surface of a detrital grain present within a sediment or sedimentary rock. The terms *well-rounded*, *rounded*, *subrounded*, *subangular*, *angular*, *very angular* are used to describe the increasingly angular/irregular/rough nature of the surface of detrital grains.

Sorting – Well sorted describes a fragmentary deposit in which all the detrital grains are of approximately uniform size. In reality most fragmentary deposits contain a range of grain sizes and can be described as moderately sorted, poorly sorted or in extreme cases unsorted.

Sphericity – Describes the how closely a detrital grains present within a sediment or sedimentary rock approximates to a sphere. The terms low sphericity, moderate sphericity and high sphericity are used to describe how spherical (ball-like) the detrital grains are.

Schist – A metamorphic rock of broadly pelitic composition (i.e. a metamorphosed mudstone) with a well-developed schistosity.

Schistosity – A planar structure developed in a metamorphic rock defined by the alignment of elongate minerals such as micas and amphibole.

Trachytic texture – The sub-parallel alignment of microcrystalline feldspar in the groundmass of a *holocrystalline* or *hypocrystalline* igneous rocks. Sub-divided into pilotaxitic texture and *hyalopilitic* texture depending on whether the material between the feldspar is crystalline or glassy. *Trachytoid* texture, alignment of tabular, bladed or prismatic crystals which is visible to the naked eye. The terms *flow* and *fluxion* texture are sometimes used as synonyms for trachytic and trachytoid textures. However, they are best avoided due to their genetic implications.

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Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

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Figures

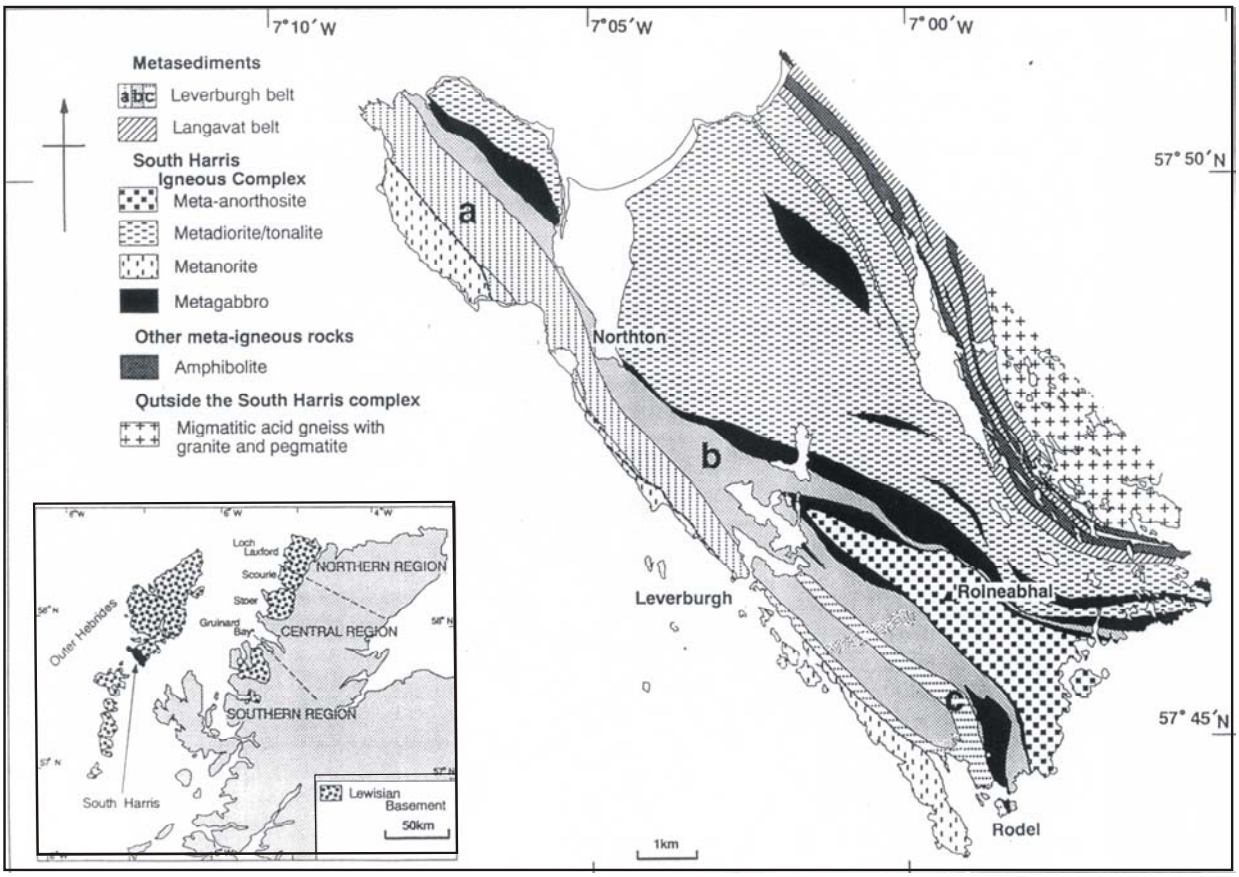

Figure 1. Simplified geological map of South Harris after Baba (1999).

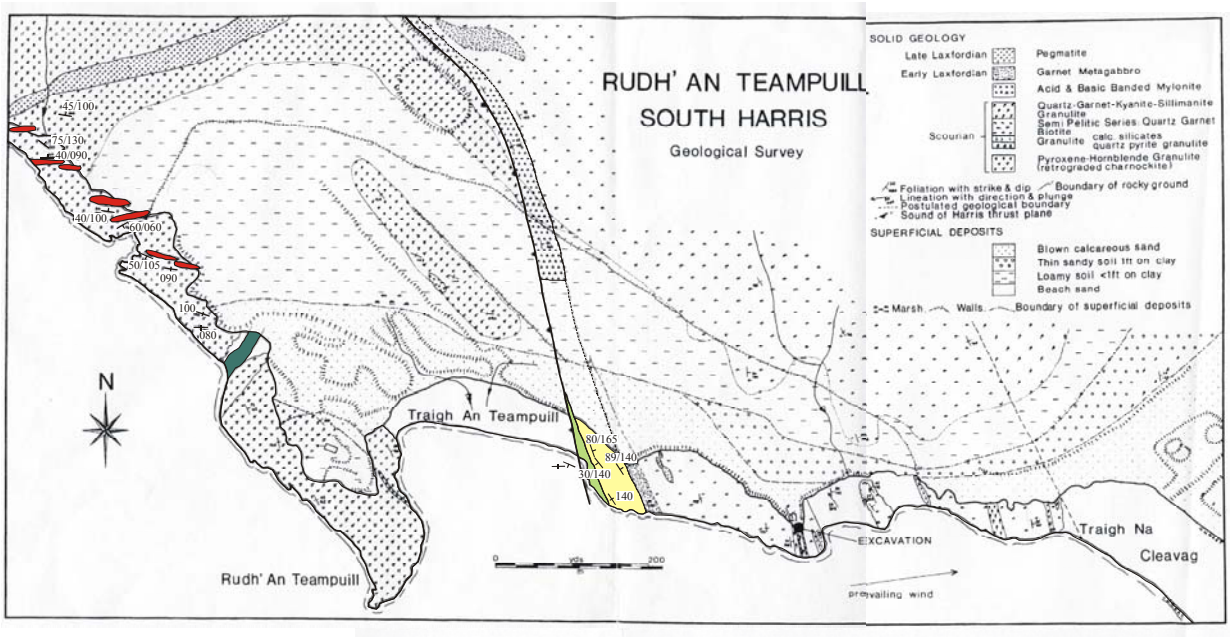

Figure 2. Geological map of the Northton site, Toe Head, South Harris (Myers un).