OR/15/053 Appendix 1 – Sampling and petrographic descriptions

Everett, P A, Gillespie, M R and Tracey, E A. 2015. Provenance of building stones in four 'galley castles' in Argyll. *British Geological Survey Internal Report*, OR/15/053.

Details of sample collection and petrographic descriptions of thin sections are provided for the following sampled locations:

Location	Type	Sample number	Stone type
Doide quarry	quarry sample	ED11442	Metamafic rock
Lag na Luinge quarry	quarry sample	ED11445	Metamafic rock
Kilchurn Castle quarry	quarry sample	ED11447	Metamafic rock
Dunstaffnage Castle	decorative stone	ED11439	Sandstone
Dunstaffnage Chapel	decorative stone	ED11440	Sandstone
Castle Sween	decorative stone	ED11441	Sandstone
Castle Sween	walling stone	ED11449	Metamafic rock
Kismul Castle	decorative stone	ED11450	Metamafic rock

SAMPLE ED11442 — DOIDE QUARRY

Sample collection and visual observations

The sample was collected from a large pit, 25 m wide, 20 m deep, located below Doide farmhouse (located at OS Grid Ref: [NR 7041; 7688]). The outcrop consists of near vertical, highly tabular slabs of rock, (typically 20–40 cm thick) cut by parallel joints (photograph above left). The presence of tool marks are evidence of quarrying activity in the past (photograph above centre). The sample is a strongly foliated, dark greenish grey metamafic rock (photograph above right). A number of rock exposures along a crag by the shore have probably also been quarried.

Thin section observations

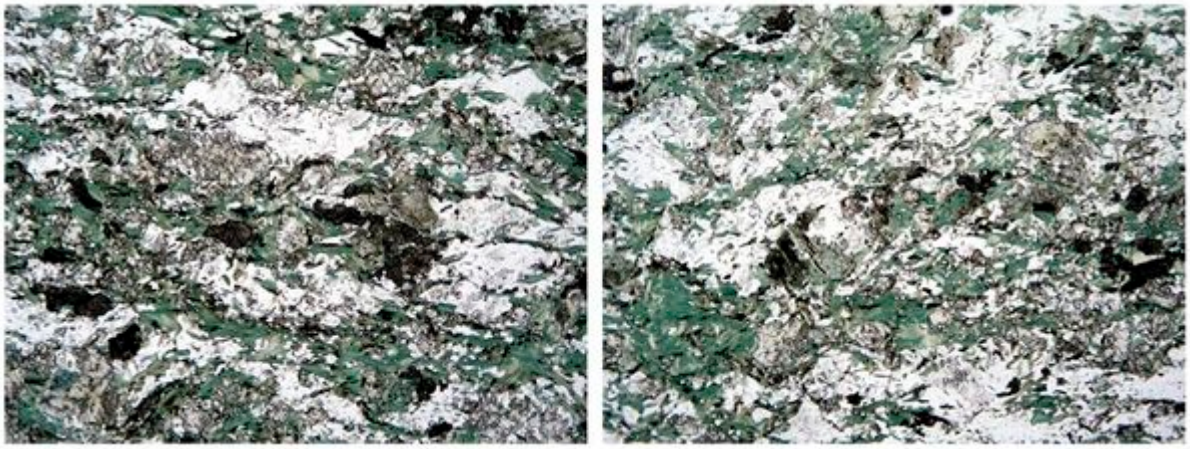

The sample from Doide quarry is a medium-crystalline metamorphic rock containing the minerals chlorite (appears green in thin section photographs above), calcite, quartz, (both appear white) and iron oxide (black). Elongate mineral components define a strong foliation in the stone. These mineral-textural features allow the stone to be classified as a quartz-chlorite-calcite schist. The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide.

SAMPLE ED11445 — LAG NA LUINGE QUARRY, LOCH AWE

Sample collection and visual observations


The sample was collected from a rock exposure in a large pit located nearby Lag na Luinge, by Loch Awe (located at OS Grid Ref: [NN 1257; 2553]). The shape of the pit outcrop and relatively un-weathered rock surfaces suggest that this site was once quarried for stone. A smaller pit also exists c.20 m to the north. The sample is a very weakly foliated, greenish grey metamafic rock (photograph above right). Quartz/calcite veins traverse the stone in the quarry, and are both concordant and discordant to the foliation. The quarry displays generally parallel joint spaces and could have yielded tabular blocks of stone.

Thin section observations



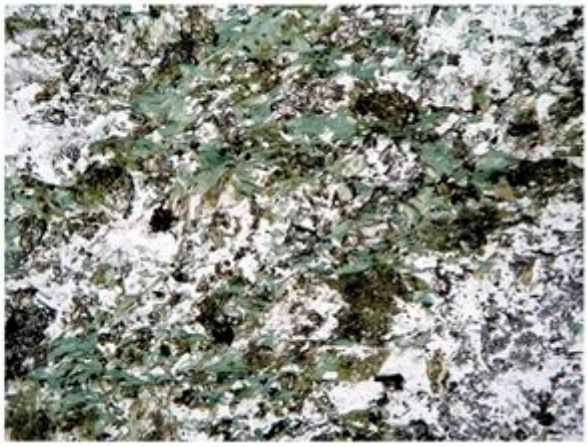
The sample from Lag na Luinge quarry is a fine-to-medium crystalline metamorphic rock containing the minerals chlorite (appears green in thin section photographs above), quartz (which appears white), epidote, titanite (appear as mottled grey patches) iron oxide, and pyrite (both appear black). The mineral constituents are broadly aligned, defining a weak foliation in the stone. These mineral-textural features allow the stone to be classified as a quartz-chlorite-epidote-titanite schist. The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide.

SAMPLE ED11445 — KILCHURN CASTLE QUARRY

Sample collection and visual observations

The sample was collected from a rock exposure located c.10 m to the south of Kilchurn Castle, by Loch Awe (located at OS Grid Ref: [NN 1328; 2761]). Part of this exposure at the base of the castle appears to form a “scoop” which has almost certainly been quarried for building stone in the past; “unquarried” sections of the outcrop nearby show evidence of glacial erosion on exposed surfaces, whereas the quarried faces do not. The outcrop is generally cut by oblique joints which would have been exploited as planes of weakness, allowing the extraction of sub-tabular blocks for masonry. The sample is an un-foliated, greenish grey metamafic rock (photograph above right).

Thin section observations

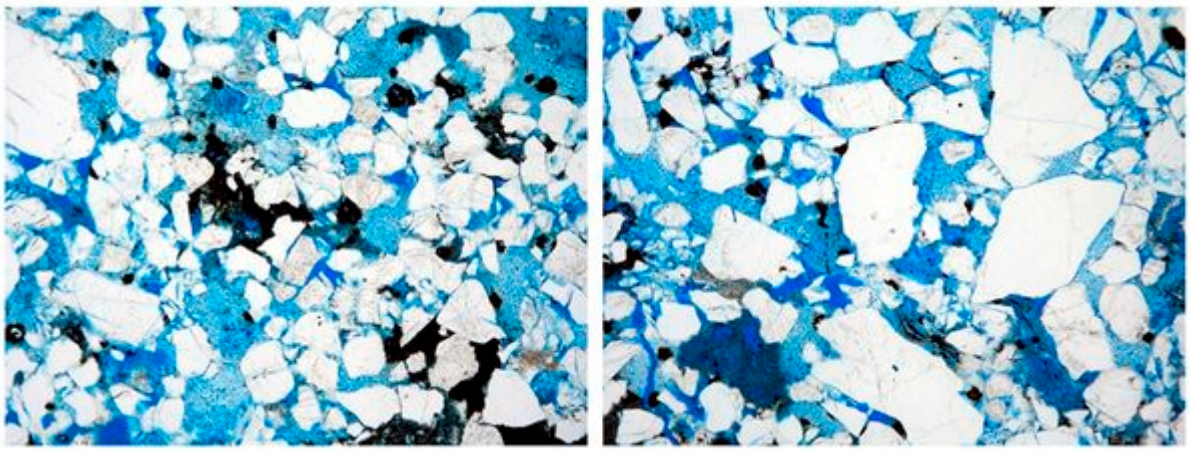
The sample from Kilchurn Castle quarry is a fine-to-medium crystalline metamorphic rock containing the minerals chlorite (appears green in thin section photographs above), quartz, calcite (which both appear white), epidote, titanite (appear as mottled grey patches) iron oxide, and pyrite (both appear black). The mineral constituents define a very weak alignment; the stone is very weakly-foliated. These mineral-textural features allow the sample to be classified as a quartz-chlorite-epidote-titanite-calcite granofels. The images above were taken in plane- polarised light, and the field of view is c.3.3 mm wide.

SAMPLE ED11439 — DUNSTAFFNAGE CASTLE — SANDSTONE DRESSINGS

Sample collection and visual observations


The sample represents a small (c.1.5 x 1.5 x 1 cm) fragment of the window dressings of the northwest facing, ground floor level window of the east tower of Dunstaffnage castle (photograph above, at left). The stone is a uniform, white to buff sandstone, which in places contains some coarse, gritty fragments. The sample collected was a small fragment (photograph above, at right), which has detached from one of the blocks forming the window dressings. It was compared to the stone in the window dressings to ensure that it is representative.

Thin section observations



The sample is a medium to coarse sand-grade, sub-feldspathic arenite. The sample reacts weakly to 10% HCl solution, indicating the presence of a carbonate mineral. It contains minor volumes of rock fragments, mica, carbonaceous matter (plant fragments) and iron oxides, which appear to have been re-mobilised from an iron-bearing carbonate mineral which has now almost entirely dissolved. The sand grains forming the stone are moderately poorly sorted and typically sub-angular.

The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide. Grains of quartz and feldspar appear white. The black areas are mostly iron oxide particles; some are carbonaceous matter (charred plant material). Pore space appears blue.

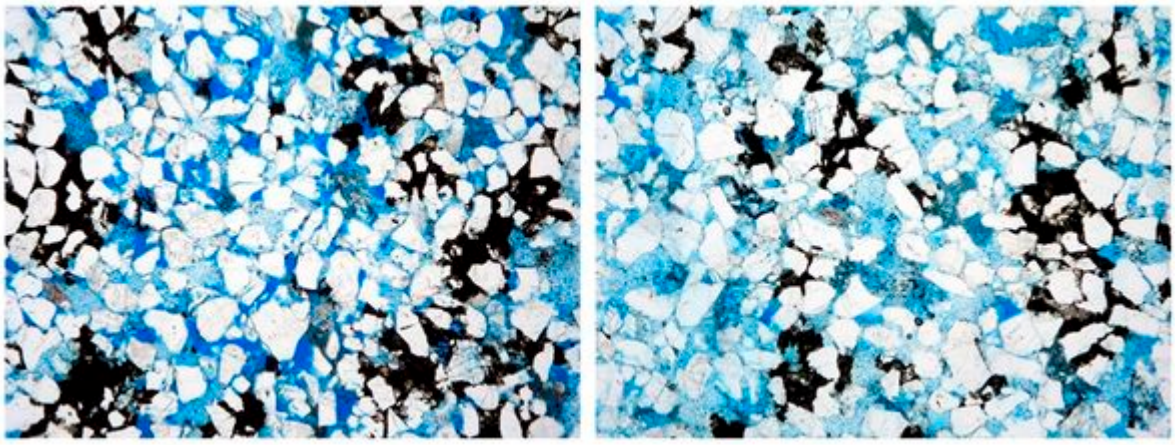
SAMPLE ED11440 — DUNSTAFFNAGE CHAPEL — SANDSTONE DRESSINGS

Sample collection and visual observations

The sample represents a small (c.3 x 3 x 2 cm) fragment of the window dressings of the north facing, paired windows of the north elevation of Dunstaffnage Chapel. (photograph above). These are thought to have been constructed at a similar time to the mid-13th

century sections of Dunstaffnage castle. The stone is a uniform, white to buff sandstone. The sample collected was a small fragment which has detached from one of the blocks forming the window dressings. It was compared to the stone in the window dressings to ensure that it is representative.

Thin section observations

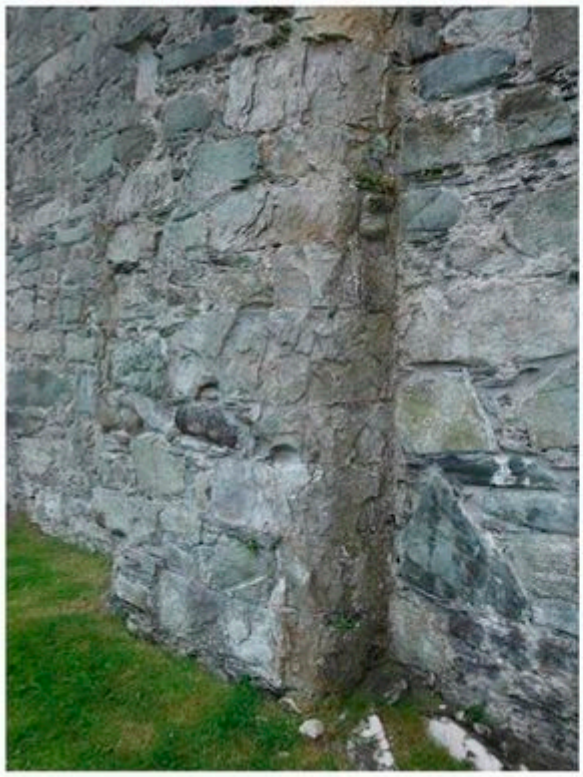


The sample is a fine grained, sub-feldspathic arenite, containing minor proportions of rock fragments, mica, and carbonaceous matter (plant fragments). The sample contains abundant iron oxides in intergranular spaces which are associated with a (presumably iron-bearing) carbonate mineral, from which they have been re-mobilised. The sand grains forming the stone are moderately sorted and typically sub-rounded.

The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide. Grains of quartz and feldspar appear white. The black areas are mostly iron oxide particles; a some may be carbonaceous matter (charred plant material). Pore space appears blue.

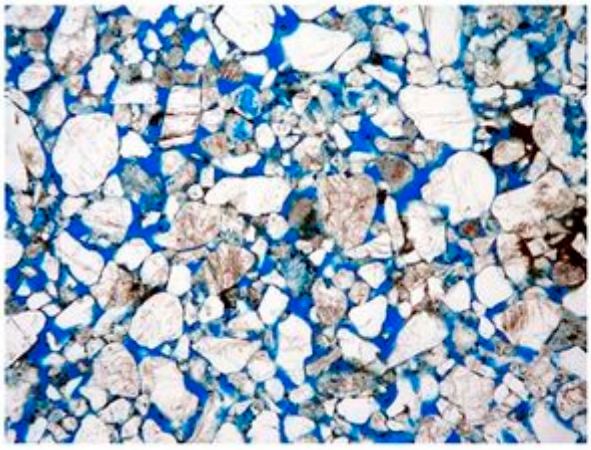
SAMPLE ED11441 — CASTLE SWEEN — SANDSTONE DRESSINGS

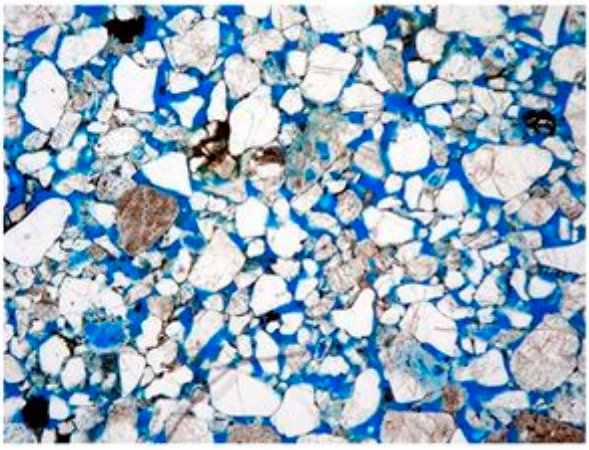
Sample collection and visual observations



The sample represents a number of fragments from the quoins of a protruding section of the curtain wall on the east elevation of Castle Sween (photograph above, at left). The stone is a fine to medium-grained uniform, light brownish grey sandstone. The sample is a number of small fragments (photograph above, at right) which were found on the ground having detached from one of the blocks forming the quoins. It was compared to the stone in the quoins to ensure that it is representative of the sandstone used as the a decorative stone in Castle Sween.

Thin section observations





The sample is a fine- to medium-grained, sub-feldspathic arenite. The sand grains forming the stone are moderately poorly sorted; the fine-sand-grade grains are typically sub-angular while the medium-sand-grade grains are typically rounded; a significant proportion of these are of metamorphic type. The sample reacts vigorously with 10% HCl solution, indicating the presence of a carbonate mineral (likely calcite). Fringes of carbonate observed around pore spaces suggest that a greater proportion of carbonate mineral was formerly present, but this has since dissolved due to weathering.

The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide. Grains of quartz and feldspar appear white. Mottled grey to brown grains are rock fragments. Pore space

appears blue.

SAMPLE ED11449 — CASTLE SWEEN — FLAGGY METAMAFIC ROCK

Sample collection and visual observations

Sample ED11449 was collected from the ground on the exterior of the west curtain wall of Castle Sween (photograph above, at left). The sample is an entire masonry block consisting of light greenish grey metamafic rock (photograph above right) which was found detached from the castles' walling. It is variably covered in a light green patina of biogenic growth (algae). The sample was compared to the flaggy metamafic rock used in the castle; it is representative of the material used in much of the castles' lintols and sills as well as in parts of the rubble walling.

Thin section observations

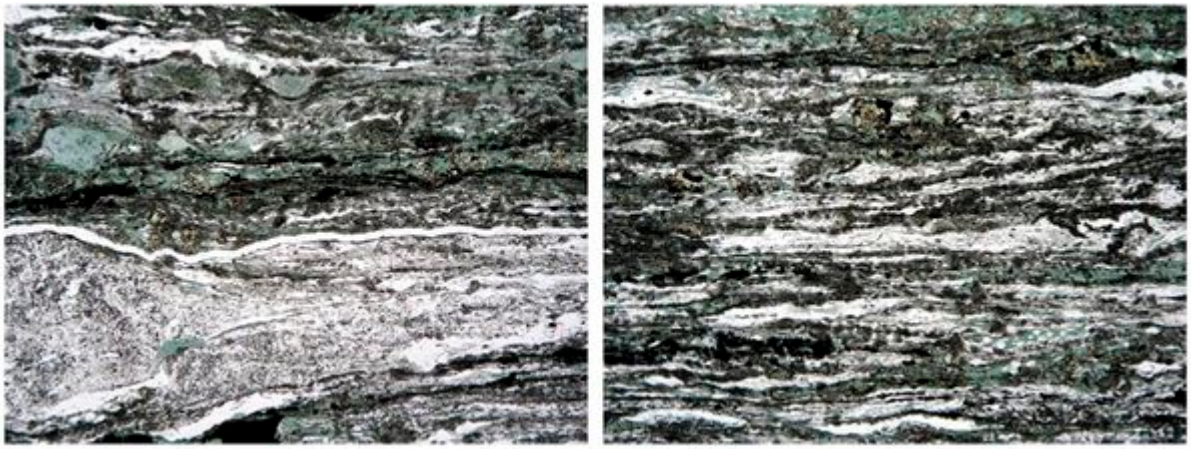
The sample is a fine-to-coarse crystalline metamorphic rock containing the minerals chlorite (appears very pale green in the thin section photograph above) quartz, (white) epidote (appears as light grey mottled grey patches), and titanite (dark grey patches). The mineral chlorozoisite is also present in minor proportions. The mineral constituents are aligned, defining a foliation in the stone. These mineral-textural features allow the stone to be classified as a quartz-chlorite-epidote-titanite schist. The sample is traversed by <0.25 mm wide microfractures which are infilled with quartz and calcite; these are concordant (parallel) to the foliation. The images above were taken in plane-polarised light, and the field of view is c.3.3 mm wide.

SAMPLE ED11450 — KISIMUL CASTLE

Sample collection and visual observations

A sample of dressing stone (photograph above) from Kisimul castle was provided to BGS by Historic Scotland staff; the site was not visited by BGS, but it is assumed to be representative of the main dressing stone type used in the castle. The sample is a greyish green, tabular piece of metamafic rock.

Thin section observations



The sample is a very fine-crystalline metamorphic rock. Ribbons of very fine-crystalline material (mainly quartz — appearing white in thin section, and chlorite — green) indicate that substantial grain size reduction has occurred due to mechanical breakage of larger grains associated with strong shear deformation. The orientation of these ribbons defines a strong foliation in the sample. Medium-crystalline porphyroclasts of quartz, chlorite and epidote are also present. These mineral-textural features allow the sample to be

classified as a quartz-chlorite-epidote mylonite.

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