Petrological Analysis of Neolithic Pottery from Helmsdale, Sutherland

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Three Neolithic pottery vessels from Helmsdale, Sutherland, were examined in thin section. The thin sections were prepared at the School of GeoSciences, University of Edinburgh, and were stained using Dickson's method (Dickson 1965).

Description

3946-C107

The following inclusion types were noted in thin section:

- Metamorphic rock. Abundant, subangular and sub-rounded rock fragments consisting mainly of muscovite, acicular biotite, poikiloblastic cordierite and accessory iron oxide. There is considerable variation in texture and mineral content in these fragments which range from less than 0.3mm to 3.0mm across. Some fragments contain quartz and have a granulite texture.

- Relict clay pellets. Abundant angular fragments of clay, containing metamorphic rock fragments. These pellets vary considerably in texture and colour.

- Opaque grains. Sparse euhedral and subangular grains up to 0.5mm across.

- Quartz. Sparse subangular and rounded monocrystalline grains up to 0.5mm across. The grains have slightly undulose extinction.

The groundmass is heterogeneous and consists of optically anisotropic baked clay minerals with variable quantities of quartz, muscovite and opaque grains up to 0.1mm across.

3946-C148

The following inclusion types were noted in thin section:

- Metamorphic rock. Angular fragments of rock containing quartz, a green amphibole, biotite, opaque grains and altered feldspar. The fragments range from c.0.3mm up to 4.0mm across. There is slight rounding of the corners of the fragments but no sign of surface alteration.

- Metamorphic rock. A single angular fragment of rock, 1.0mm across, composed of strained quartz and altered plagioclase feldspar grains up to 0.5mm across.

- Quartz. Abundant subangular grains up to 0.5mm across and sparse sub-rounded grains of similar size.

- Muscovite. Sparse laths up to 0.3mm long.

The groundmass consists of optically anisotropic baked clay minerals with abundant angular silt, composed of quartz and muscovite up to 0.1mm across.

3946-C130

The following inclusion types were noted in thin section:

- Mudstone. Abundant angular fragments of a dark brown mudstone, similar in colour to the groundmass. The rock shows some signs of bedding, in the form of rare darker beds, and beds containing quartz silt, up to 0.1mm across, but also contains sparse muscovite laths up to 0.5mm which do not seem to lie on bedding planes. The margins of some, but not all of the fragments show signs of dark staining. Some fragments have a lower iron content than the remainder.

- Quartz. Abundant angular and subangular monocrystalline grains, mostly with straight extinction with some showing slight undulose extinction, well sorted c.0.2mm across.

The groundmass consists of optically anisotropic baked clay with no visible inclusions.

Interpretation

C107 has a texture which suggests the use of a boulder clay in which detrital grains of varying origin and roundness are mixed together. The relict clay pellets are probably the result of a lack of kneading of the clay before use rather than being deliberate additions, in the form of dry clay or grog added to the clay to control plasticity and water content. The rock and mineral inclusions come from two quite different terrains: the rounded quartz grains are evidently from a sedimentary rock with no indications of metamorphism whereas the metamorphic rock fragments probably originated in the Moine schist series. Kyanite is present in these rocks only in a limited area of the highlands but kyanite-bearing schists do outcrop less than 30km from the site. Sedimentary rocks outcrop along the east coast.

C148 also contains rocks and minerals from two different terrains but is rather different from C107, not only in the character of the metamorphic rock, which is much less variable and clearly derived from a coarse gravel. The groundmass contains no fragments of metamorphic rock, nor any of the distinctive green amphibole. Instead, the quartz and mica inclusions again suggest a sedimentary derivation. It is possible that the coarse inclusions were naturally present in the clay but it is also possible that they represent deliberate temper

using gravel from a stream or river draining an outcrop of schist. As with C107, it is likely that the raw materials could be found in northeast Scotland.

C130 is different again. The groundmass is similar in colour and texture to the mudstone inclusions and it is likely that the parent clay was formed by the weathering of this mudstone. However, a fine, well-sorted quartz sand is present which cannot be derived from the mudstone and there is no evidence for lamination and lensing which might be expected if a fine sand were added to the parent clay. The most likely source of the mudstone is the Caithness Flagstone, which includes mudstones, siltstones and fine-grained sandstones. It is possible that the quartz sand is present as a result of the erosion of such a sandstone, although the grains show no sign of cement, nor is there any sandstone remaining.

All three samples therefore have very different petrological characteristics and come from vessels made using different raw materials and employing different methods of clay preparation.

Bibliography

Dickson, J. A. D. (1965) "A modified staining technique for carbonates in thin section." *Nature*, 205, 587.