SAMPLING AT VIADUCT FARM, POLSTRONG, CORNWALL, UK: IDENTIFYING THE SOURCE OF GROUP XVI GREENSTONES

A.M. Jones,[1] H. Quinnell,[2] R.T. Taylor[3] & A.C. Thomas[4]

ABSTRACT

Since petrological work in the 1930s enabled some Neolithic stone axe-heads to be defined as distinctive Groups which could be associated with their rock sources, it has been assumed that there were discrete 'axe factories' which could be pin-pointed on the ground for each Group. In some parts of Britain, fieldwork and excavation have confirmed the presence of axe production sites but, the source sites of the Cornish greenstone axe rock Groups have remained elusive. This is surprising as a large number of Groups have been assigned a Cornish origin with pin-point source locations provided. Recent work, however, on potential Group 1 sources and at an axe production site in West Penwith, has indicated that the picture is more complex than previously thought.

In this paper, the smaller Group XVI source is considered, and thin sections from locally found axe-heads, a significant number of which were from the nearby Neolithic tor enclosure of Carn Brea, are reappraised. A small inland greenstone site at Viaduct Farm, near Camborne, which has been identified with Group XVI, was focussed on to see if a discrete source could be established. Outcrops along the western side of the valley were sampled and examined against thin sections attributed to Group XVI to see if this material really was the source of Group XVI.

The results suggest that there was there was a low degree of matching between the axe-heads from Carn Brea and the outcrop at Viaduct Farm and that the axes themselves from were not derived from a single source. The variability instead suggests that the axes were made from a variety of materials from the Polstrong valley. In light of this, caution should be used in attributing specific source sites for Cornish axe rock groups.

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INTRODUCTION

The greenstones of the southwest peninsula have long been known to have been significant in Neolithic axe-head production (Keiller *et al.* 1941; Cummins 1979). The term "greenstone" was introduced by the geological surveyors in western Cornwall in the early 1900s as a descriptor for the generally dark green coloured amphibolitic metabasic rocks of the area. Greenstone is retained as a convenient name which is in common use to describe stone artefacts from southwest England. Group I, which outcrops in West Penwith forms, the most widely circulated rock type but a smaller number are made from other sources, such as Group XVI which, since the 1960s has been identified as cropping out in the Camborne area (Evens *et al.* 1962) (Figure 1). The production sites for Cornish axes were longheld to be unproblematic (Keiller *et al.* 1941; Cummins 1979; Mercer 1986). Samples taken from rock, sometimes from below current ground surface, were matched with thin sections taken from artefacts and the sites of potential 'axe-factories' were established. Then Peter Berridge (1993) pointed out the lack of evidence for actual axe working sites in Cornwall and called into question the existence of 'axe factories', although in fact, Cornish greenstones cannot be worked by flaking, which will leave obvious traces, but only by pecking and grinding. Experimental work (Mandal *et al.* 2004) has demonstrated that serviceable axes could be made from river or beach cobbles, indicating that extraction sites might be unnecessary for the production of greenstone axes.

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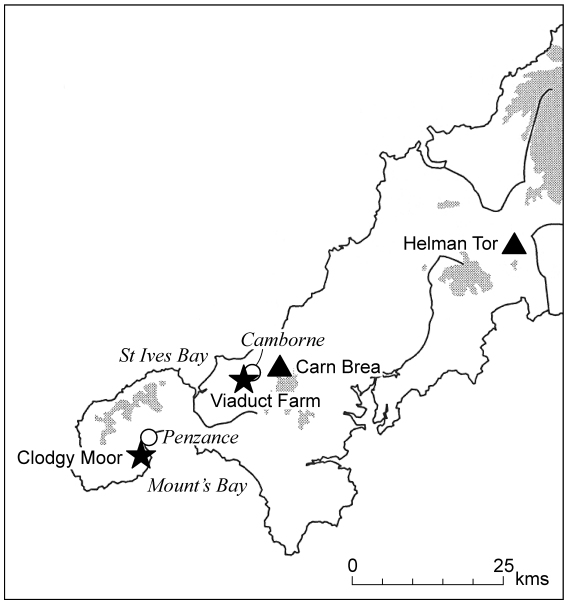

Figure 1. The location of Viaduct Farm in west Cornwall. Stars: axe production sites; triangles: tor enclosures.

Complexity of sourcing in Cornwall was reinforced by Mik Markham (2000) with several outcrops in West Penwith, including Gurnard's Head and Mounts Bay, indicated as the source for Group I axes. This Group 1 multiple sourcing is now supported by the artefactual assemblage from Clodgy Moor, near Paul in West Penwith, where greenstone axe rough-outs were manufactured from a range of beach and outcrop sources (Jones *et al.* 2013). Current data suggest that Group I axes are unlikely to have been produced in a single 'axe factory'.

It was now important to establish whether any of the Cornish greenstone axe Groups were made from a locatable and single source. One major problem here is the locating of rock crop outs on the surface which was available to both Neolithic people and modern archaeologists. Many of the samples on which the Cornish axes Groups are based, including Group XVI, have been taken from below-ground, or from quarried exposures which would not have been available to prehistoric people (Thomas 2005, 8). Also widespread quarrying across much of Cornwall has reduced the areas of greenstone rocks, available in the Neolithic, which can now be examined.

THE PROJECT

Group XVI: Viaduct Farm

Fortunately, Group XVI near Viaduct Farm in the Polstrong valley had a suggested inland source which crops out at the surface. Despite the loss of some greenstone for the railway viaduct, there are still a number of *in situ* outcrops which would have been available to Neolithic people.

The valley, to the west of Camborne (centred SW 162718 040296), is aligned north–south and bisects a broadly east–west band of greenstone, which otherwise lies below surface. In the immediate area of the railway viaduct the greenstone has been heavily quarried but greenstone boulders are visible all along the side of the valley. One prominent outcrop, now reduced by blasting, is known as the 'Giants Rock'. The placing of a Bronze Age stone battle axe and a hoard of 40 to 50 Late Bronze Age copper alloy axes at the base of the outcrop (Cornish 1880–1, 75; Hencken 1932, figure 18), indicates that it was a place of some significance in later prehistory.

The Carn Brea tor enclosure, some 5 kilometres east is the closest known major Early Neolithic occupation site to the outcrops, and Carwynnen Quoit megalith lies 2.6 km to the southeast. There are Neolithic lithic scatters from fields immediately west of the valley which include a significant quantity of nodular flint pieces (Thomas 2005, 16) obtained from networks of contact with communities in Devon (Tingle 1998) which might reflect the exchange of Group XVI for non-local flint.

There is a cluster of Group XVI axes from the Camborne–Redruth area mostly without associations. However, Carn Brea (Mercer 1981) has produced up to 18 artefacts, the densest known concentration of axes of this Group. Recent radiocarbon dating places the Neolithic occupation on Carn Brea in the period between 3900–3600 cal BC (Whittle *et al.* 2011, 509). Beyond Cornwall, Group XVI axes are found in small numbers across southern Britain (Evens *et al.* 1962), and as far north as the Midlands (Moore and Cummins 1974). Although close dating is limited, a radiocarbon determination of 3780–3370 cal BC was obtained from a pit at Hambledon Hill in

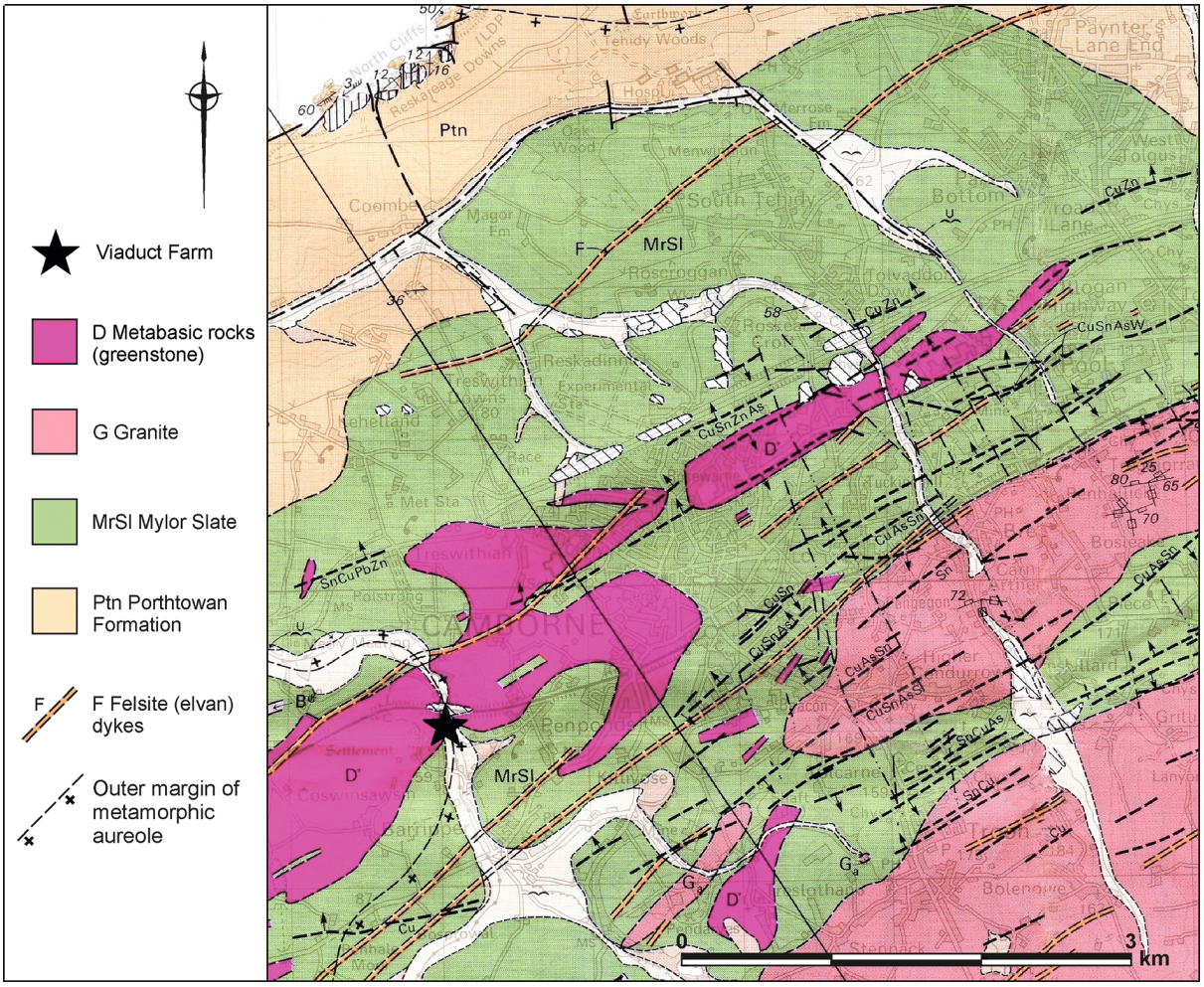

Figure 2. The geology of the Viaduct Farm area. Taken from the British Geological Survey 1:50,000 sheet Falmouth 352. Reproduced with the permission of the British Geological Survey © NERC 1990. All rights reserved.

Dorset, which contained a Group XVI axe-head (Healy & Mercer 2008, 387). This provides the most secure dating for axes of this group. The available evidence therefore suggests that, although not as important as the Penwith Group I greenstones, Group XVI axes were manufactured from the Early Neolithic period and were reaching Dorset and the Midlands in small numbers by the middle centuries of the fourth millennium cal BC.

The Geological setting

The stream that flows north from Barripper (SW 382 633) to Polstrong (SW 628 393) west of Camborne cuts across the outcrop of an area of metabasic rock (greenstone) in the area of Viaduct Farm where it is confined to a steep sided valley with some greenstone outcrops still accessible (SW 391 630). This is part of a band of greenstone cropping out, depicted as sill-like in the transverse section of the Falmouth 1:50,000 sheet 352 (Figure 2). The full history of these rocks is uncertain but it is likely that they were originally doleritic intrusions (Bristow 1996, 16). Some of the sections show faint textural features that may be relics of an ophitic texture characteristic of intrusive dolerites. The surrounding rocks are slates of the Upper Devonian Mylor Formation.

After their intrusion the dolerites were subject to multiple phases of folding and low grade metamorphism during the Variscan orogeny. Following the main phases of deformation, the intrusion of the granite masses of Carnmenellis-Carn Brea-Carn Marth subjected the surrounding rocks to thermal metamorphism. The thermal aureole is particularly wide north of these granites as they are linked and extend to the north at relatively shallow depth. The greenstones of interest lie within the extended

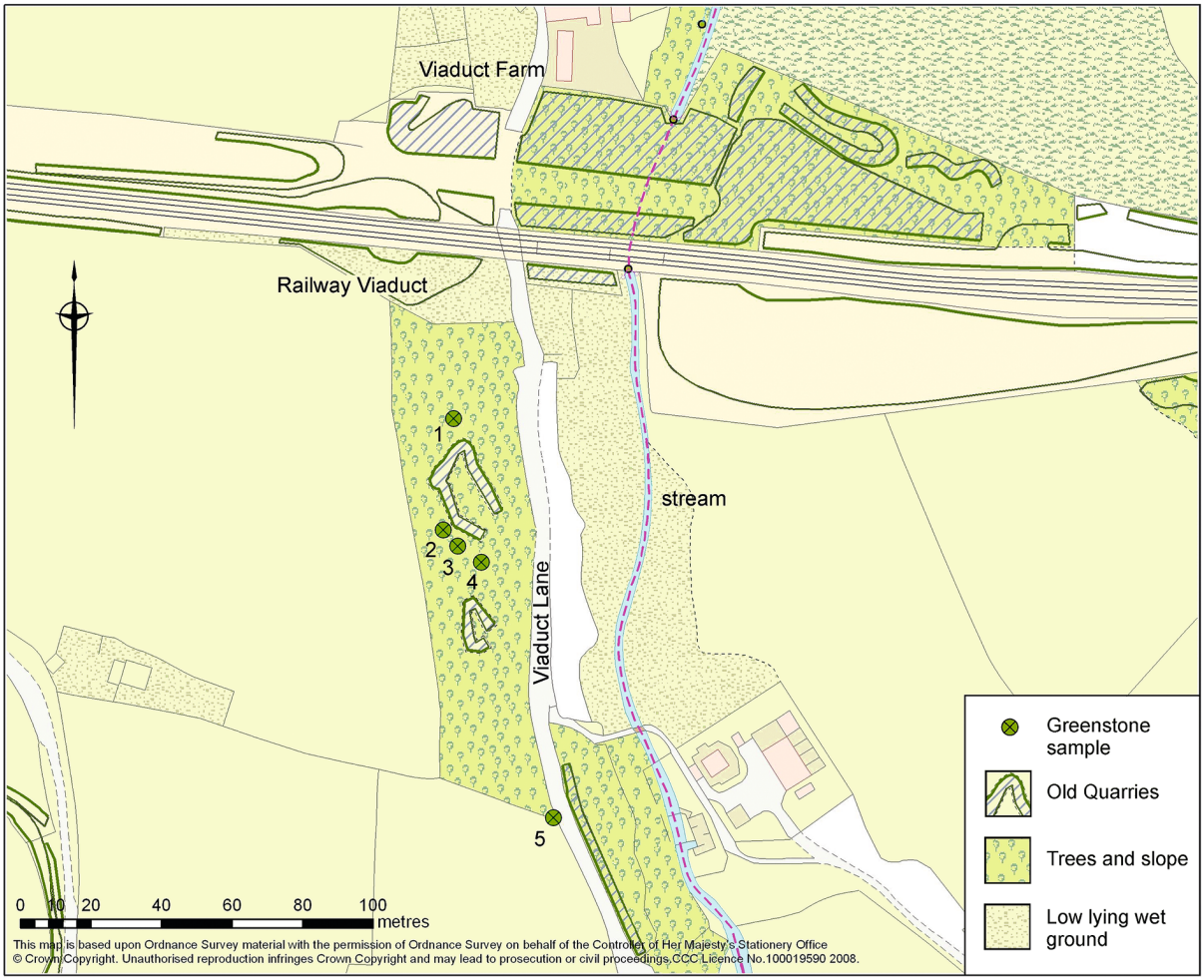

Figure 3. The locations of sampled outcrops.

aureole and were subject to contact metamorphism. A final phase of deformation followed producing a crenulation cleavage S_5 which can be seen to affect the contact metamorphosed rocks of the district (Leveridge *et al.* 1990).

Sampling

In 1970 five samples of greenstone taken from the Polstrong valley were submitted to the South West Implement Petrology Group (SWIPG) by Charles Thomas (2005). These were taken from locations around the valley, including a rock from the streambed. However, although these provided good matches for Group XVI, the submitted material either came from the quarried areas, or from loose blocks. (The thin sections of these samples are not included in the SWIPG lists published by Clough & Cummins [1979].) In 2008, further sampling took place, to obtain material from *in situ* outcrops which would have been available to people in the Neolithic period. Five outcrops south of the viaduct were selected for sampling (Figures 3 & 4), their positions recorded to a 12-figure grid reference accuracy. These samples were submitted to the South West Implement Petrology Group who sponsored the preparation of thin sections and their identification by their petrologist Roger Taylor. These thin sections were then compared with 22 thin sections from greenstone artefacts, identified as Group XVI, held in the SWIPG collection at the Somerset Heritage Centre in Taunton (Table 1). To minimise the chances of misidentification, all of the thin sections selected for comparison were from artefacts from the Camborne-Redruth area, with the largest number being axes from the Early Neolithic enclosure on Carn Brea. The thin sections are held in the SWIPG archive at Taunton.

Figure 4: Site 3 outcrop being sampled. The photograph reveals the character and scale of the Group XVI outcrops in the Polstrong valley.

Cornwall No	Thin section No.	Find spot of sectioned axe	Notes	Taylor Variant
2	146	Penponds, Camborne	Axe or rough-out	Variant 4
5	149	Camborne, Weeth	Hone?	Variant 3
114	689	Camborne, Rosewarne Mill	Axe or rough-out	Variant 3
120	695	Camborne, The Gilley	Axe fragment?	Variant 3
111	682	Carn Brea	Axe or rough-out	Variant 2
167	762	Carn Brea	Axe	Variant 2
168	763	Carn Brea	Axe	Variant 4
173	776	Carn Brea	Axe	Variant 2
174	777	Carn Brea	Axe	Variant 4
175	778	Carn Brea	Axe	Variant 4
177	780	Carn Brea	Axe	Variant 4
178	781	Carn Brea	Axe	Variant 3
254	1206	Carn Brea	Axe	Variant 4
255	1207	Carn Brea	Axe	Variant 4
335	1560	Carn Brea	Axe	Variant 4
336	1561	Carn Brea	Axe	Variant 4
338	1563	Carn Brea	Axe	Variant 4
339	1564	Carn Brea	Axe	Variant 3
340	1565	Carn Brea	Axe	Variant 4
341	1566	Carn Brea	Axe	Variant 4
346	1571	Carn Brea	Axe polisher	Variant 2
372	1641	Carn Brea	Axe	Variant 1

Table 1. SWIPG thin sections used as comparison with the samples taken from Viaduct Farm (numeration follows Clough & Cummins [1988]).

RESULTS

Viaduct Farm Samples

The five thin sections (2009.15.1–2009.15.5) were examined and were found to be sufficiently similar that only one representative thin section is presented here. Descriptions are based on features of the complete slide and could not be shown effectively on a single photo-micrograph: the provision of photo-micrographs covering whole slides was beyond the resources of this initial project.

2009.15.1 *ca* 5.9 cm^2 in area. *Amphibole* – fine-grained fibrous to acicular more or less randomly oriented aggregates of slightly bluish tinged pale green actinolite. It is weakly pleochroic from pale bluish green to pale buff with individual grains up to 0.2 mm long and forms irregular concentrations. *Feldspar* – very finely granular feldspar concentrations, possibly much sericitised, penetrating and enclosing the amphibole. *Opaque ore* – a dusting of extremely fine-grained irregular equidimensional grains predominantly concentrated within the amphibole. *?Epidote* – colourless irregular granules with high relief and high birefringence scattered through the rock, individual granules are up to 0.01 mm. *General texture*. This is particularly noticeable in the macro appearance of the section with darker irregular, centimetre-scale, amphibole-rich areas are penetrated and surrounded by neutral to colourless areas rich in feldspar of indeterminate composition. This gives the impression that the rock has been brecciated (fractured) at some time in its history prior to its main recrystallisation.

All five sections show complete recrystallisation with loss of all traces of original igneous texture. The 'greenstone' sampled is shown on the Falmouth 1:50,000 geological sheet 352 (Figure 2), to lie just at the mapped margin of the thermal aureole. This is reflected in the very fine, and largely random, crystalline state of the amphibole in the rock. This texture would give toughness to this lithology and contribute to its suitability for axe manufacture. The sampling distribution indicates a degree of uniformity in the outcrop. Implements made from this rock should be readily distinguished in thin section.

Re-examination of Group XVI axe thin sections

The original description of Group XVI petrology (Evens *et al.* 1962, 220) runs as follows: *The rock consists of hornblende in considerable quantities mainly occurring as patches of felted green needles and often with parallel arrangement. Very ragged fibrous plates of hornblende are scattered through the rock. The feldspar is very decomposed, almost isotropic but occasionally recrystallised and clear. Pale brown mica as patches of short interlacing laths in the hornblende is present in varying amount, and black iron ore forms small grains or larger skeletonised grains. A little epidote in small grains is present.*

This description refers to the amphibole as hornblende, but the pale green colour and frequent occurrence of colourless amphibole together with the recrystallisation in the contact aureole suggests that the tremolite-actinolite range of amphiboles is more likely. The presence of biotite in some of the Group XVI thin sections re-examined probably indicates a source deeper within a granite metamorphic aureole than for the rocks used in the Group XVI description. There is some correspondence between the five samples examined and this description for Group XVl but it is not exact. The absence of brown mica or biotite and lack of foliation in the Viaduct Farm material is noteworthy.

The 22 thin sections from the SWIPG collection categorised as Group XVI are not homogeneous in terms of texture nor, to some extent, in terms of composition compared with the original, but not very detailed, defining description of Evens *et al.* 1962: no thin section number was included in this description. The small areas of many of the older thin sections means that they cannot show the possible textural characteristics seen in the Viaduct Farm sections (Viaduct Farm average 5.3 cm^2 : thin sections re-examined average 0.7 cm^2, but as little as 0.25 cm^2).

An attempt has been made to place the SWIPG Group XVI sections in four subcategories as follows, with one section published for each. These variants provide a convenient way of presenting the thin section data, but it would be premature to regard these as 'sub-groups' of Group XVI.

Variant 1 Viaduct Farm texture (one example) Fine-grained actinolite as fibrous randomly orientated aggregates.

Variant 2 Original Group XVI. Coarser ragged pale green amphibole grains in a felted matrix with biotite, comparable with the original Group XVI description (four examples).

Variant 3 Pale green amphibole, as larger ragged grains in a felted matrix but lacking biotite (five examples).

Variant 4 Colourless amphibole, as large ragged grains but lacking biotite (12 examples).

The reference numbers of the thin sections assigned to each Variant are given in Table 1.

Variant 1 Corn 372 Thin section 1641 Carn Brea, 0.8 cm^2 in area. *Amphibole* – pale green, predominantly as a randomly oriented fine acicular crystals up to 0.1–0.3 mm, some with a stellate arrangement. *Feldspar* – irregular low birefringent grains, some showing twinning, up to 0.75 mm, penetrated by acicular amphibole.

Biotite – pleochroic light brown to colourless, relatively common as single grains and aggregates, 0.1–0.5 mm replacing amphibole. *Opaque ore* – probably ilmenite, relatively coarse single grains and aggregates, some skeletal, up to 0.5 mm.

Variant 2 Corn 346 Thin section 1571 Carn Brea 1 cm^2 in area. *Amphibole* – pale green, ragged grains and aggregates up to 1.5 mm surrounded by fine, randomly oriented, acicular grains. *Biotite* – pleochroic pale brown to colourless irregular areas and grains some replacing amphibole, 0.1–0.2 mm. *Feldspar* – irregular patches of untwinned low birefringent grains. *Epidote* – clusters of very small grains with high relief. *Opaque ore* – irregular grains and aggregates, some elongated up to 0.2 mm.

Variant 3 Corn 120 Thin section 695 Camborne 0.25 cm^2 in area. *Amphibole* – pleochroic pale green to colourless with some larger ragged grains and aggregates up to 1.25 mm, set in more or less randomly oriented finer-grained amphibole. *Feldspar* – untwinned scattered grains and some distinct elongated areas of low birefringent grains up to 1.5 mm long. *Opaque ore* – common as elongated strings and aggregates of irregular grains up to 0.025 mm. *Comment* Section too small to give an adequate description of texture. Possible trace of S_5 crenulation cleavage distorting amphibole crystals.

Variant 4 Corn 168 Thin section 763 Carn Brea 0.3 cm^2 in area. *Amphibole* – colourless and mainly as large ragged grains and aggregates up to 1.0 mm surrounded by a felted aggregate of randomly orientated amphibole laths. *Feldspar* – sparse areas of untwinned low birefringent grains, 0.3 mm. *Opaque ore* – probably ilmenite, a scatter of small equidimensional grains and clustered skeletal grains up to 0.15 mm. An irregular spaced cleavage is present.

Comment on the thin sections

Amphibole may be pale green pleochroic or colourless, biotite may be present or absent, epidote may be present or absent. Larger amphibole grains may be present or absent, foliation may be present or absent. Ghosting of relict ophitic igneous texture may be present or absent. Much of the group shows recrystallisation of amphibole in a manner suggesting thermal metamorphism. However, the thermal aureole to the north of the Carnmenellis Granite covers the main area of the greenstone outcrop and defines the source area for Group XVI to the north of Camborne suggested in Evens *et al.* 1962. Some sections show areas of brown staining (?ferruginous). This may result from post manufacture weathering of the implement, but is possibly the result of weathering of the rock prior to manufacture. The sections of axes that contain biotite are likely to be from greenstone most intensely affected by contact metamorphism from the Carnmenellis/Carn Brea Granite. The Red River cuts across the Greenstone outcrop in such an area and would be a potential source for cobbles yielding axes containing biotite.

The variations in lithological detail of the thin sections studied suggests that their parent axes had multiple sources. This seems at first unlikely given the lack of natural surface exposure on the outcrop of the greenstones north of Camborne. Indeed, the author's experience of geological survey in west Cornwall indicates that inland outcrops of unweathered greenstone are very rare. If such

outcrops were available a concentration of axes with similar petrography would be apparent. This is not the case with Group XVl and the proposed multivariant source is thus likely. Recent work on Group I material from Clodgy Moor (Jones *et al.* 2103) has indicated the use of cobbles from multiple sources. In the case of the Group XVI material it is suggested that the source of 'greenstone' for axe manufacture is from cobbles from the alluvial gravels of the rivers and streams flowing northwards across the greenstone outcrops. This would result in the mingling/a mixture of rocks from various parts of the outcrop as well as in the selection of sound, less weathered fragments.

CONCLUSIONS

The low number of close matches among the material studied echo the results from other recent and ongoing sourcing projects. Concern over the correct characterisation and classification of different axe Groups, and their attribution to a given source area, outcrop or 'axe-factory' are well-established and has led to the undertaking of work to address these issues and re-characterise certain Groups, including Group I Cornish axes (Markham 2000) and the Group XXXIV Carrock Fell gabbro axes (Davis *et al.* 2009) in recent years.

Petrological re-analysis of the sampled axes from Carn Brea has demonstrated that the axes attributed to Group XVI do not come from a single outcrop. This raises potential problems with Cornish greenstone axes that have been assigned to Groups without close inspection of the original source material on which a Group was first defined. In addition, the results indicate that a range of material was being used for the production of axe-heads. Petrological study has revealed that one of the Carn Brea axes had a match with the sampled outcrops, but all others are likely to have come from elsewhere along the length of the valley. As has been demonstrated at Clodgy Moor, potential source material could have included detached blocks, stream cobbles or other outcrops which have been removed or, like the Giant's Rock, unavailable for sampling.

This broad range of potential sources, both for Group XVI and for Group I (Markham 2000; Jones *et al.* 2013), contrasts with other parts of Britain, where there is good evidence for the utilization of specific places in the landscape for axes, such as Langdale Group VI and Myndydd Rhiw Group XXI (Bradley & Edmonds 1993; Burrow 2011).

In light of the importance of greenstone for axe-making in the Early Neolithic and the results from Viaduct Farm, Polstrong, and from Clodgy Moor, there is a clear need for a much larger project to both sample and better characterise more of the suggested greenstone sources across Cornwall and their products, so that the variability in the resource is better understood. Further work would, as had been demonstrated for Carrock Fell (Davis *et al.* 2009), usefully include petrological, geochemical portable X-ray fluorescence data, and geochemical inductively coupled plasma-atomic spectroscopy data to establish a signature for both sources and artefacts.

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REFERENCES

Berridge, P. 1993. Cornish axe factories: fact or fiction. In N.M. Ashton & A. David (eds) *Stories in stone*. Lithic Studies Society, London, 45–56.

Bradley, R. & Edmonds, M. 1993. *Interpreting the axe trade*. Cambridge University Press, Cambridge.

Bristow, C.M. 1996. *Cornwall's geology and Scenery: an introduction*. Cornish Hillside Publications, St Austell.

Burrow, S. 2011. The Myndydd Rhiw quarry site: recent work and its implications. In V. Davis & M. Edmonds (eds.) *Stone axe studies III*. Oxbow, Oxford, 116–123.

Clough, T.H. McK & Cummins¸ W.A. (eds) 1979. *Stone axe studies*. Council for British Archaeology, London.

Cummins, W.A. 1979. Neolithic stone axes: distribution and trade in England and Wales. In Clough & Cummins, 5–12.

Cornish, T. 1880-81. Bronze celts. *Penzance Natural History and Antiquarian Society*: 75.

Davis, A, Davis, V & Markham, M. 2009 From Implement to Outcrop: a model for identifying implement source rock at outcrop, Internet Archaeology **26**. http://dx.doi.org/10.11141/ia.26.9

Evens, E.D., Grinsell L.V., Piggott, S. & Wallis, F.S. 1962. Fourth report of the subcommittee of the South-western Federation of Museums and Art Galleries (England) on the petrological identification of stone axes. *Proceedings of the Prehistoric Society*, 28: 209–266.

Hencken, H.O'N. 1932. *The archaeology of Cornwall and Scilly*. Methuen, London.

Jones, A.M., Quinnell, H., Lawson-Jones, A. & Tyacke, A. 2013. Landscapes of stone: contextualising greenstone working and lithics from Clodgy Moor, West Penwith, Cornwall. *Archaeological Journal* 170: 2–29.

Keiller, A., Piggott & Wallis, F.S. 1941. First report of the subcommittee of the South-western Federation of Museums and Art Galleries on the petrological identification of stone axes. *Proceedings of the Prehistoric Society* 7: 50–72.

Leveridge, B.E., Holder, M.T. & Goode, A.J.J. 1990. Geology of the country around Falmouth. *Memoir of the British Geological Survey*. Sheet 352.

Mandal, S., Sullivan, A., Byrnes, E., Weddle, D. & Weddle, J. 2004. Archaeological experiments in the production of stone axeheads. In E. Walker, F. Wenban-Smith & F. Healy (eds) *Lithic in action*. Oxbow, Oxford, 116–123.

Markham, M. 2000. Provenance studies of British prehistoric greenstone implements using non-destructive analytical methods. Unpublished PhD Thesis, Open University.

Mercer, R. 1981. Excavations at Carn Brea, Illogan Cornwall: a Neolithic fortified complex of the third millennium bc. *Cornish Archaeology* 20: 1–204.

Mercer, R, 1986. The Neolithic in Cornwall. *Cornish Archaeology* 25: 35–80.

Mercer, R. & Healy, F. 2008. Hambledon Hill, Dorset, England. Excavation and survey of a Neolithic monument complex and its surrounding landscape. English Heritage, London.

Moore C.N & Cummins W.A. 1974. Petrological identification of stone implements from Derbyshire and Leicestershire. *Proceedings of the Prehistoric Society* 40: 59–78.

Thomas, A.C. 2005. *The Neolithic in the Gwithian area*. Privately published.

Tingle, M.1998. *The prehistory of Beer Head: field survey and excavations at an isolated flint source on the south Devon coast*. British Archaeological Reports, British Series 270, Oxford.

Whittle, A., Bayliss, A., Healey, F., Mercer, R., Jones, A.M. & Todd, M. 2011. The south-west peninsula. In A. Whittle, F. Healy & A. Bayliss. *Gathering time: dating the Early Neolithic enclosures of southern Britain and Ireland*. Oxbow, Oxford, 476–520.