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The procurement and use of stone for flaked tools in prehistoric Scotland

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SUMMARY

Throughout prehistory a wide variety of stones have provided the raw material for the manufacture of flaked tools. In western Europe, however, the abundance of fine quality, nodular flint led to its dominance as a lithic resource with the result that modern archaeological attention in this area has concentrated upon the use of flint in prehistory, often to the exclusion of anything else.

Scotland lacks any primary sources of flint nodules in situ *and there is no evidence that flint was imported on any scale, although well-developed exchange networks have been documented elsewhere in Europe (Balcer 1981). A wide variety of alternative materials were available in Scotland but this traditional preoccupation with flint as a raw material has meant that, until recently, they were given little attention and Scottish assemblages were regarded as somewhat impoverished. Increasing awareness of this variety has improved the recovery by excavation of lithic assemblages and their subsequent analysis.*

Such analysis poses its own problems. Knapping techniques may produce different detachment characteristics upon different raw materials and the development of regional comparisons is not as straightforward as in areas where only one, homogeneous, source of flint was utilized. As techniques develop, however, the variety of methods employed to utilize lithic resources is revealed and a sophisticated pattern of exploitation throughout prehistoric Scotland is emerging.

THE AVAILABLE RESOURCES

The lack of *in situ* flint in Scotland does not mean a complete lack of flint throughout the country. Extensive off-shore deposits bearing flint do exist (Gemmel & Kesel 1979, 66–7), and the erosion of these by marine and past glacial action has led to the creation of many derived deposits of varying size and quality containing flint pebbles. These have been well documented in the past (Wickham-Jones & Collins 1978), and new deposits are frequently uncovered (cf *Discovery Excav Scot 1985*). Recorded deposits concentrate around the periphery of the country (illus 1), and are supplemented by the occurrence of flint pebbles in both modern and raised beaches.

In general, the flint nodules from these deposits are both poor in quality and small in size. The action of frost and other natural agencies leads to the enhancement of any flaws and irregularities in the material, often resulting in the fracture of nodules. In addition, deposits may

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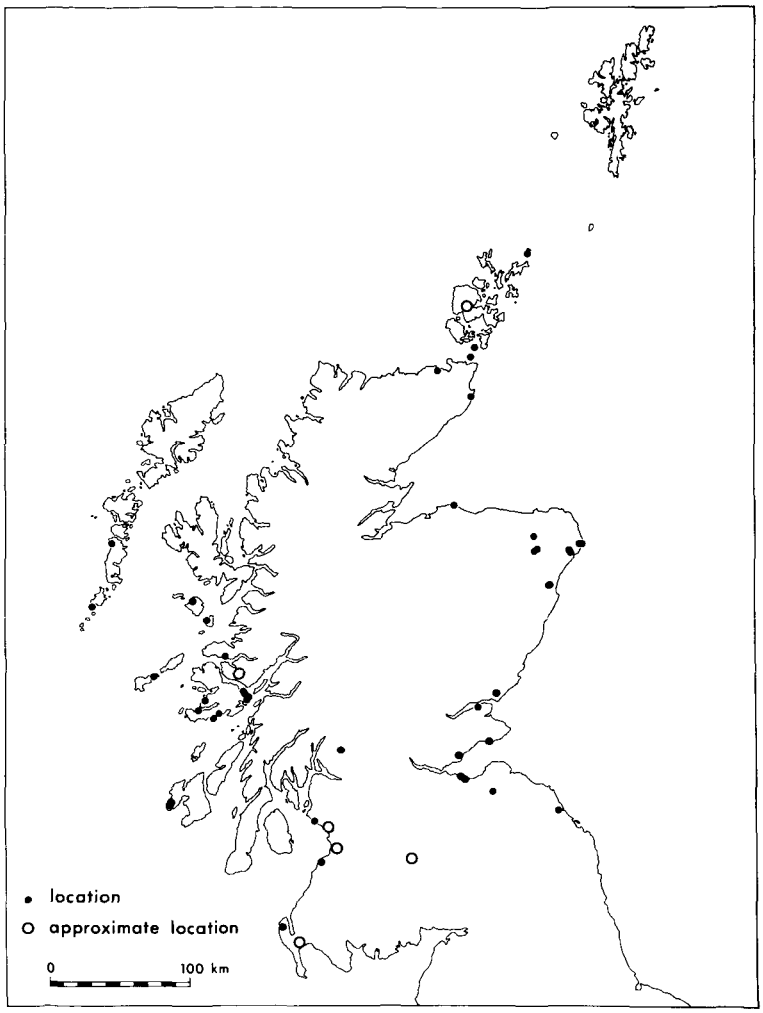
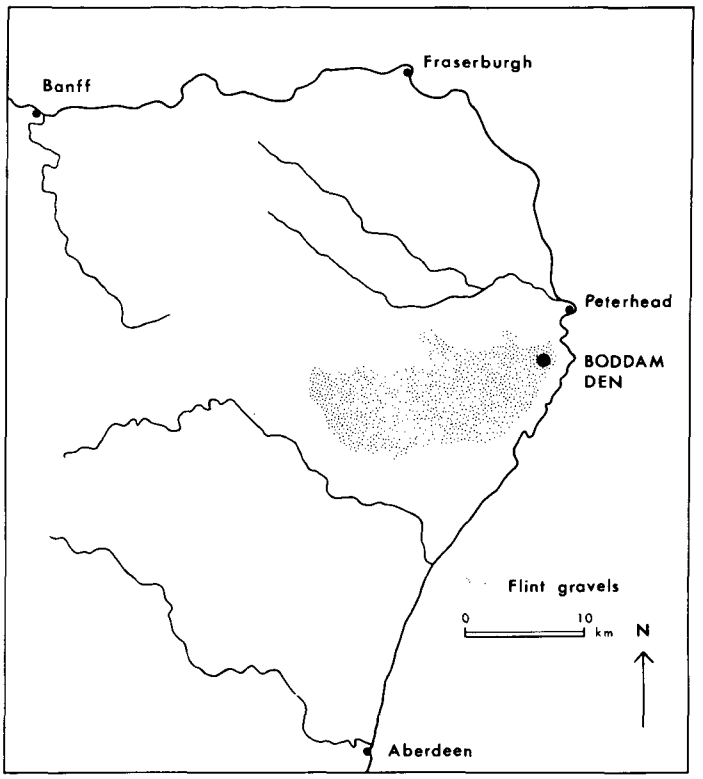


ILLUS 1 Sources of flint in north Britain excluding beach pebble locations

be inaccessible, either masked by more recent material or incorporated into intractable rocks (Harker 1908).

Gravel deposits of flint are usually well mixed with other materials. Only in one area are they composed predominantly of flint. This is the Buchan area of Aberdeenshire. Here abundant flint gravels form a low ridge running east–west for about 10 km inland from the coast, 35 km to the north of Aberdeen (illus 2). These gravels are of varying composition, predominantly of flint and quartz. To the eastern end flint cobbles account for about 90% of the gravels, to the west their frequency drops to around 1% (Gemmell & Kesel 1979). Many of the cobbles are of such a size as to have formed an important raw material source in prehistory.

Those materials used to supplement flint were predominantly siliceous rocks with similar technological characteristics to flint, although a few coarser-grained materials were also used.



ILLUS 2 Flint gravels, Buchan

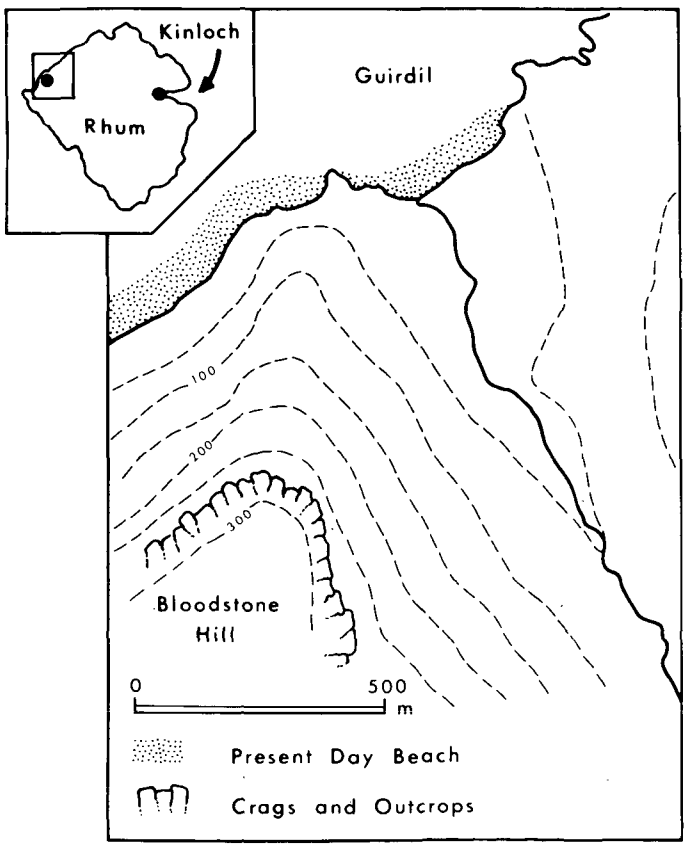
Across Scotland one of the most common materials used to replace flint was chert. Geological memoires do distinguish between flint and chert but it is notoriously difficult to define a geological distinction. In Scottish archaeology chert is generally considered to be of a coarser, less homogeneous, texture than flint and it may be more intractable to work. Both flint and chert occur in a wide range of colours. Like flint, chert does occur as derived pebbles but it also occurs in primary deposits (Wickham-Jones & Collins 1978, 7). Consequently, whilst in some cases similar extraction techniques could be used for either material, this would not always be the case.

Chert is not the only common siliceous material used to supplement flint. Quartz too is a common component of prehistoric assemblages. It occurs both as nodules and veins and is ubiquitous across Scotland. In quality, however, quartz varies considerably. It may be exceptionally fine and flake with ease, in other cases it may lack any homogeneous conchoidal fracture. Even in the latter instance it may be split to produce sharp edges but the knapper has little control over the work and it is invariably difficult for the archaeologist to distinguish artefactual material from natural pieces. Consequently, although commonly used to supplement flint, quartz was generally used only where other materials were not available. Quartz rarely occurs in combination with chert, for example. Not surprisingly, where possible there was a distinct preference for only the finer qualities of quartz. For these reasons, assemblages with quartz are most commonly found in the north and west. In these areas chert is not common and better quality quartz is available.

Other siliceous substitutes for flint include Rhum bloodstone and Arran pitchstone. In their finest quality both fracture like flint, although the nature of individual nodules may vary. As the names imply, the sources of both are geographically limited.

Rhum bloodstone is a hydrothermal chalcedony formed by the precipitation of silica inside the cavities created by gases in a cooling lava flow (Durant, pers comm). Nodules vary greatly in colour according to the minerals present, and technically a number of names apply to the rock but recent archaeological work on the material has loosely amalgamated them under the term, bloodstone. The main source of bloodstone is on the west coast of the island of Rhum (illus 3). They are to be found in the screes and gravels below the lavas of Bloodstone Hill from which pebbles have eroded probably due to frost action during the last stadial (Sutherland, pers comm). Other sources of bloodstone are recorded on the west coast of Scotland but recent work suggests that none would have produced nodules in great quantity, although the derivation of all archaeological material from the Rhum source is still being tested.

Unlike bloodstone, Arran pitchstone is more uniform in colour and always easily distinguished from flint. Pitchstone is a natural volcanic glass resembling obsidian. It is generally black or dark green in colour. It occurs in intrusions and lava flows associated with tertiary volcanics in north-west Scotland. Individual sources vary greatly in quality; many contain too many intrusions to make knapping practical. Throughout prehistory only the best quality



ILLUS 3 Bloodstone source areas, Island of Rhum

pitchstone was utilized. Recent analysis suggests that the sources on the island of Arran were the only sources exploited (Thorpe & Thorpe 1984).

Silicified sandstones and mudstones were also knapped on occasion (Lacaille 1954, 191–2). A wide variety of these occurs across Scotland. Although some are quite fine, in general they are all coarser and harder to knap than flint. Such stones rarely play a major part in any assemblage but there has been a tendency for excavation to fail to recognize them in the past. It is possible to produce fine edges of these materials, although in use they tend to abrade more rapidly than edges of flint.

In addition to the above materials, other potentially knappable stones occur throughout Scotland. Although none was used as frequently as those described above, most were occasionally utilized and many isolated instances of the use of agate and other chalcedonies occur (cf Barclay 1983, 163). Few of the highly siliceous rocks were not used. Those with no evidence of use, the volcanic glasses of the island of Eigg, for example, almost certainly reflect the lack of archaeological fieldwork in their immediate vicinity.

In some areas the limitations of available siliceous material led to the use of much coarser-grained materials and the development of particular localized technologies. In the Shetland Isles, flaked tools were commonly made of local quartz, but this was quite unsuitable for the heavier component of any industry. In many areas of Scotland heavy tools were made of bone or wood as well as stone; on Shetland both slate and sandstone, occurring locally, were utilized. Slate was chipped and ground into shape (Piggott 1954, 363–4). Sandstone was flaked: recent excavations of a Bronze-Age site at Kebister have uncovered much evidence for the flaking of coarse sandstone (Owen 1985: Clarke, A, pers comm). Finished artefacts of this material are common from Shetland but this is the first excavation to provide evidence of their manufacture.

Large sandstone flakes of a different nature were commonly used on Orkney. Here local flint, with some chert, could only provide the smaller elements of any lithic assemblage and, although heavier artefacts of other materials like bone are well known, a range of pieces of local micaceous sandstone occurs. Cobbles of this material are abundant on all Orcadian beaches and Skaill Knives, simple primary flakes removed from such cobbles, have long been recognized as an important element of late Neolithic material culture in the islands. Recent excavations at Skara Brae and Links of Noltland have produced varied assemblages based upon the flaking of such cobbles which apparently complement the smaller flaked flint artefacts. Experimental work has demonstrated not only the ease with which such tools are made, but also the efficiency with which they can perform a variety of tasks (Clarke, A, pers comm).

THE EXTRACTION OF RAW MATERIALS

No subterranean mines to exploit any type of lithic material are known from prehistoric Scotland. Clearly, such material could be collected with relative ease from the gravel sources within which it was situated. In some cases, however, the scarcity or poor quality or surface nodules must have made this collection rather time-consuming. In one notable area evidence survives to show that, where conditions were right, this could be overcome.

The Buchan flint gravels have already been described. Here, there is evidence of systematic workings to exploit the better quality nodules below the surface deposits. Sadly, cultivation of the area has destroyed most of the evidence for this extraction and the subsequent working of the nodules. 'Flint pits' survive only in one isolated patch, along the steep sides of a small valley, Boddam Den. In this area there are over 300 pits. On the surface the largest measures c 6·5 m by 7 m in plan and they are between 1·5 m and 2 m deep (Ralston, pers comm). Most are

surrounded by slight banks of detritus. No recent excavation has taken place; we are reliant upon the documentation of earlier archaeologists for any details of utilization of the ridge (Graham-Smith 1919).

The majority of gravel deposits in Scotland were not of sufficient size to allow extraction on this scale. It is likely that in many cases unspecialized lithic procurement from local gravels was embedded within the general round of daily activities. Evidence such as the range of local materials incorporated into many domestic assemblages would seem to support this.

Not all resources were derived from gravels. Quartz, although a common component of many gravel sources, was also collected from dykes, but no extraction sites have been discovered as yet. Arran pitchstone was apparently quarried from outcrops: there is little evidence of unweathered cortex amongst recorded assemblages. Once again, owing perhaps to the extensive modern development of this island, no extraction sites have so far been recorded.

In situ deposits of bloodstone and its related chalcedonies do exist, notably towards the summit of Bloodstone Hill, but none of those visible today would produce material suitable for knapping. These deposits were quarried in the 19th century for gemstones and traces of the shallow trenches employed still survive below the crest of the hill, but examination of the prehistoric material from Rhum suggests that the gravels below the hill provided ample material in earlier times (Wickham-Jones & Pollock forthcoming). Reworking of these materials since the last stadial has had the effect of destroying those nodules with many vesicular inclusions so that the quantity of material available today is probably less, but of consistently better quality, than in prehistory (Sutherland, pers comm). Preliminary analysis of excavated assemblages of bloodstone from elsewhere on Rhum suggests that initial testing and production of cores from the nodules took place at the source area on Guirdil Bay. No working floors to test this hypothesis have yet been exposed in the vicinity of the Bay.

In January 1986 an apparent extraction site for chert, at Flint Hill in Peeblesshire, was located. Chert screes downslope from shallow pits may represent preliminary testing and flaking of material extracted from a geological outcrop. Detailed analysis to examine the extent and date of this site has still to take place but the chert is known to be a major component of many local assemblages from the Mesolithic onwards (Mulholland 1970). Few such sites have been excavated recently, however, and until the identification of this site it has always been assumed that the chert was collected from the river gravels in the locality.

THE DISTRIBUTION OF RAW MATERIALS

The composition of most lithic assemblages throughout prehistoric Scotland reflects strongly the local availability of materials. Few materials were transported any distance from their source. Flint, chert and quartz are all available, in small quantities at least, across most of Scotland. The derivation from Buchan, once thought appropriate for all implements of red and yellow flint (Rankine 1952) has now been superseded as flints of this colour have been recorded from many sources, notably along the length of the east coast (Wickham-Jones & Collins 1978). Secure evidence for the transportation of flint is very difficult to obtain where nodule sources are concerned. So far, no sourcing of flint has been attempted in Scotland and there is no definite evidence for any long distance movement of this resource. Some importation of flint into south-west Scotland from north-east Ireland has been suggested. This area has extensive deposits of nodules derived from off-shore sources relating to the Irish material, however, so the matter must remain open to question in the absence of further information (Lacaille 1954, 255; Dawson, pers comm).

In two instances, however, there is evidence that raw materials were transported throughout well defined regions. Both are of very localized origin which has, of course, made the necessary source analysis much easier. Both occur in the west coast of Scotland. The northernmost example centres around the north-west coast of Skye where exposures of a banded mudstone exist. This material is a common component of many archaeological assemblages in the Western Isles. Under the local conditions of deposition it erodes heavily and the artefacts appear today to be very soft and friable. It is fine-grained, however, and when fresh it is hard and quite suitable for tool manufacture. This erosion has led to problems of archaeological recognition and identification in the past. (It is, for example recorded as mylonite in the excavations at Northton: Simpson 1976, 224.) Recent research by Dr G H Collins has isolated a single source for this material, that on the north-west coast of Skye (Collins, pers comm). We are severely hampered by the lack of archaeological fieldwork on the island of Skye itself so that we have little idea of the extent of utilization of this material but it is most interesting that its southernmost extent may correspond with the northernmost area of the distribution of bloodstone from Rhum.

To the south of Skye lies the island of Rhum. The deposits of bloodstone have already been described. Artefacts of bloodstone from the island occur amongst assemblages across a well defined area of the surrounding mainland and islands. The earliest dated of these assemblages is at Kinloch on the island itself, c 8500 bp (Wickham-Jones, forthcoming), but exploitation of this resource continued over a long time, into the early Bronze Age. Artefacts of bloodstone are associated with beaker pottery at the chambered tomb and occupied cave of Rudh' an Dunain on Skye (Lindsay Scott 1932; 1934). Past work has considered this distribution to be the result of trade (Ritchie 1968) but little detail of its mechanism has ever been studied. Work is now underway to examine this in greater depth. Other potential sources of bloodstone do exist in the area and electron spin resonance spectroscopy is being used to test the derivation of the archaeological pieces. On Rhum, the excavation of a large site with much evidence of knapping has taken place at Kinloch (Wickham-Jones & Pollock, forthcoming) and, in addition, details of all known assemblages utilizing bloodstone are being recorded (Clarke, A, forthcoming). As bloodstone was used over a considerable period of time it is quite possible that the nature of this use changed with time. At the moment examination of this complex problem has only just started, though preliminary results from the sourcing programme suggest that other sources besides that on Rhum may have been used (Griffiths, pers comm).

There is also well attested evidence for the transport of Arran pitchstone away from its source on the west coast. Unlike the banded mudstones of Skye or Rhum bloodstone, however, it was moved over long distances, as far afield as the north-east of Scotland over 300 km away (Masters, in prep). The use of pitchstone is recorded from the Mesolithic into the Bronze Age (Thorpe & Thorpe 1984, 25–34). Over such a long period of time and across such a wide geographical area it is likely that its use would show some variation. Although little detailed analysis has been done, some tentative points may be raised. On Arran and in the immediate vicinity pitchstone artefacts occur on a number of sites where they supplement artefacts of other materials. Flint is not rare in this area, it may be found in many of the local raised beaches, and it still formed the basis of much tool manufacture. Pitchstone, however, is particularly suitable for the production of blades. For this reason, perhaps, it was a common component of many Mesolithic assemblages both on the island and the adjoining mainland (Affleck & Edwards, pers comm). It was only transported further afield in later periods and then pitchstone comprises only a very minor part of any assemblage. It is often present as a few tiny blades or flakes, frequently upon sites that do not have predominantly domestic associations. A typical example would be the site of Balfarg Riding School where 18 pieces were found in an assemblage of 256 artefacts

(Wickham-Jones & Reed, in prep). In no case is the knapping of anything more than one small nodule represented, if indeed the material was knapped at its final resting place. It may well be that it was transported as finished artefacts. We have, at the moment, no idea of how, or why, pitchstone was dispersed over such a wide area in the late Neolithic and early Bronze Age. The small quantities of material involved suggest that it was either transported with other goods or possessed of some inherent value.

Generally there is little evidence for the movement of stone for flaked tools across prehistoric Scotland. That which took place probably reflects exceptional quality or abundance of a particular rock rather than any lack of flint or other basic materials. As discussed above the evidence for transportation is all based upon the west coast. In this area flint is not rare and, together with quartz, it continued in use as at least a supplementary resource on all archaeological sites. In most cases across prehistoric Scotland the locally available materials were quite adequate for the manufacture of flaked stone tools.

THE USE OF LITHIC RESOURCES

The flaking of any lithic material into artefacts follows certain general principles. These have been discussed with relation to flint by many authors (Crabtree 1972; Knowles 1953; Tixier *et al,* 1980). Where other stones are concerned some modification of technique may be necessary. Some analysis of such alteration for specific materials has been carried out (Barber 1981; Broadbent 1979, 48–118). In Scotland, however, little is known about the effects of the use of such a broad range of materials upon the artefacts of prehistory. The use of bipolar knapping, for example, has been cited as a response to the use of poor quality or sparse pebble nodules of both quartz and flint, but bipolar cores are also to be found in areas where the raw material was neither rare nor of poor quality. Conversely, on Orkney, the use of Skaill knives does seem to be an adaptation of technique to suit a particularly unpromising raw material, in this case with very efficient results. We are only just starting to analyse assemblages in the detail necessary to draw conclusions about the adaptations of knapping techniques in different areas.

In many areas a variety of materials was available to the inhabitants of any one site and some selection, for different reasons, is starting to be discerned, though only in a later period. It is not possible to discern deliberate selection of raw material prior to the Neolithic period for a variety of reasons including both the types of site available and the general lack of wide-ranging research into the Mesolithic settlement of Scotland. Only with the onset of farming communities have a range of monuments been recorded, including non-domestic sites. In this period there is increasing evidence for the deliberate selection, and sometimes curation, of particular types of stone for a variety of purposes. On domestic sites it appears that the majority of the population had the proficiency to make the tools necessary for every-day tasks out of common, locally available, materials. At the same time, there is increasing evidence for the presence of high quality, possibly specialist, knappers working for specific purposes. These specialists were able to reserve, or import, selected raw materials and they were able to invest their time and skill into the production of artefacts with a high quality, often impractical, finish. These objects were apparently produced for use and deposition upon sites not primarily associated with domestic settlement, they contrast greatly with the objects found upon such settlements (Wickham-Jones 1985).

The range of materials available to the prehistoric knapper in Scotland was clearly matched by the range of roles that flaked stone tools might play throughout all the complexities of prehistoric life.

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