



Sheridan, Alison, Davis, Mary, Iain Clark and Hal Redvers-Jones, Hal (2002)
Investigating jet and jet-like artefacts from prehistoric Scotland: the National
Museums of Scotland project. *Antiquity* 76. pp. 812 – 825.

<http://repository.nms.ac.uk/458>

Deposited on: 21 April 2011

Investigating jet and jet-like artefacts from prehistoric Scotland: the National Museums of Scotland project

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with contributions by IAIN CLARK & HAL REDVERS-JONES*

Introduction

The black spacer plate necklaces and bracelets of the Early Bronze Age (FIGURE 1) are among the most technically accomplished prestige items of this period in Britain and Ireland. There has been much debate over the years as to whether these artefacts and other prehistoric black jewellery and dress accessories are the product of specialist jetworkers based around Whitby in North Yorkshire — Britain's only significant source of jet. As early as 1916, for example, Callander was arguing that the Scottish finds had been made using locally available materials — cannel coal, shale and lignite

— rather than Whitby jet. There has also been much confusion over the identification of these various materials. Furthermore, the conservation of newly discovered jet and jet-like artefacts can be problematical, and the correct identification of raw material is important in determining the best method of treatment.

The advent of non-destructive methods of compositional analysis (e.g. Bussell *et al.* 1982; Pollard *et al.* 1991; Hunter *et al.* 1993) has facilitated raw material identification; and it was with the aim of clarifying the material and provenance of some of the Scottish finds that one of us (MD) undertook analysis in 1990 (Davis

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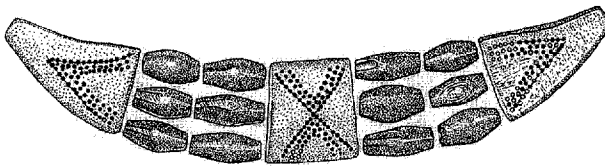
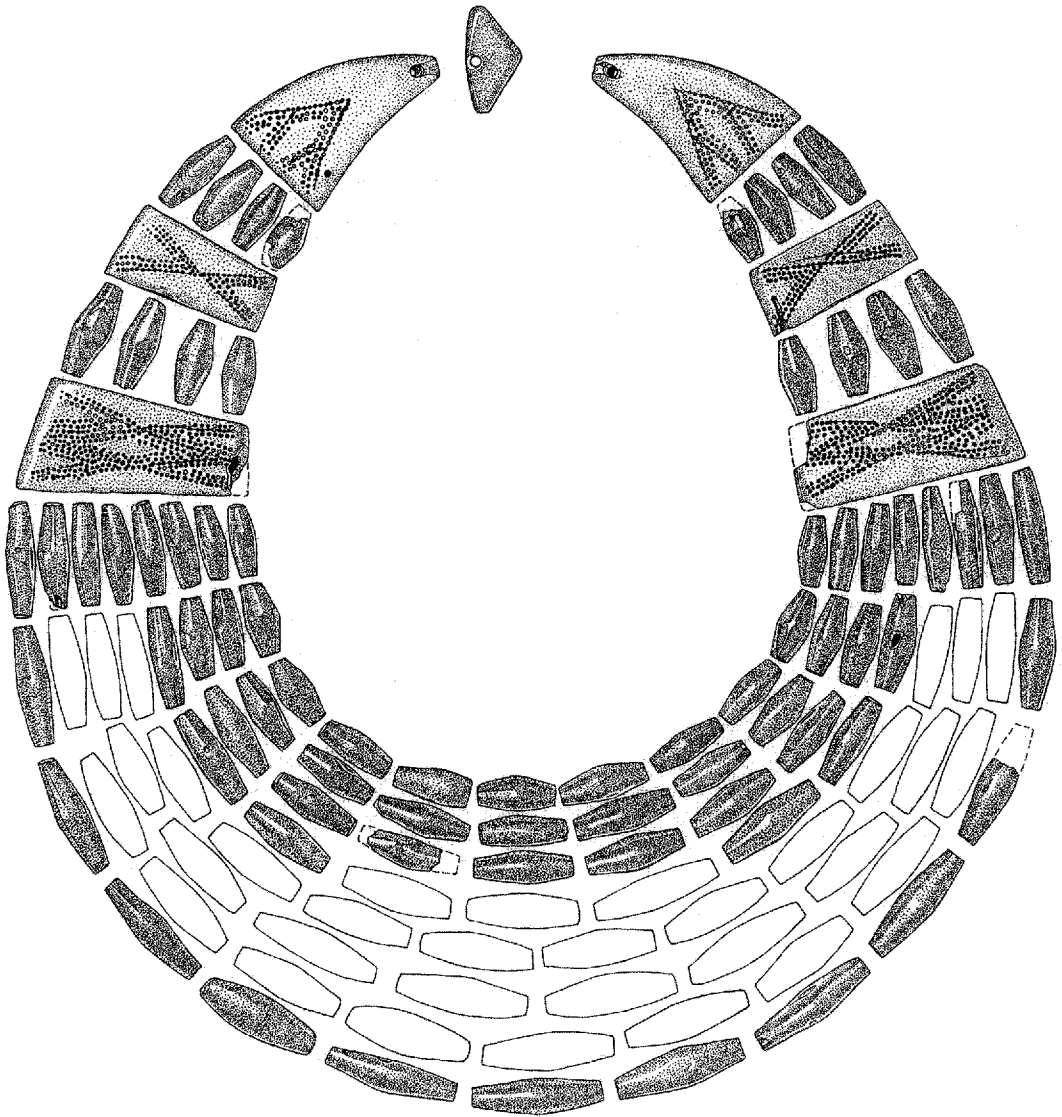


FIGURE 1. *Spacer plate necklace and bracelet, East Kinwhirrie, Angus. (Drawing Helen Jackson for National Museums of Scotland.)*



FIGURE 2. *Finds, including elliptical beads, from Greenbrae, Aberdeenshire. (Photo National Museums of Scotland.)*

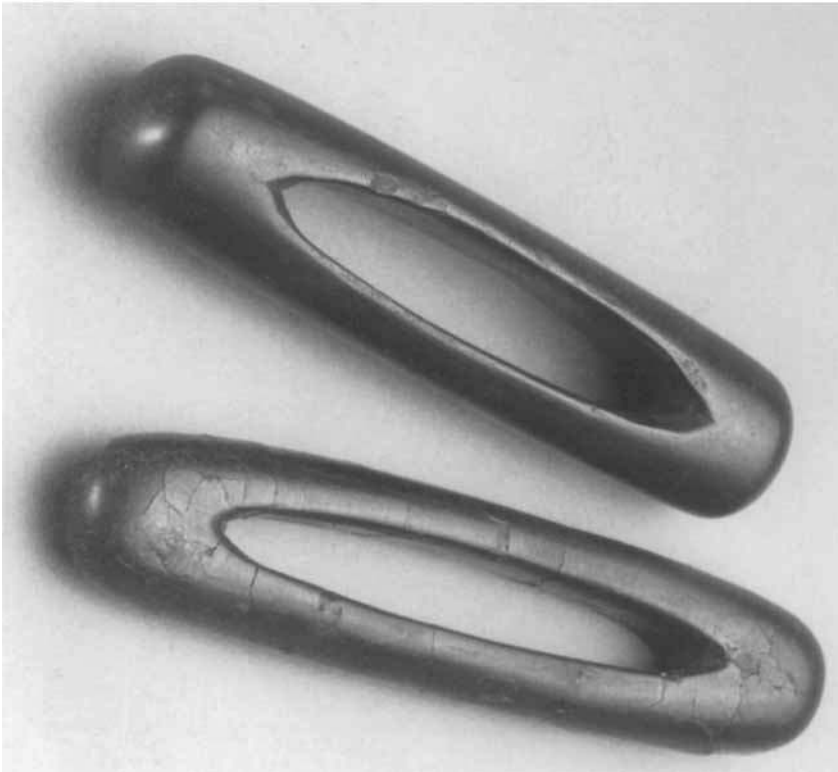


FIGURE 3. *Sliders from Skye (top) and Beachtra (bottom). (Photo National Museums of Scotland.)*



FIGURE 4. *V-perforated buttons and (centre) 'pulley' belt ring, Harehope, Scottish Borders. (Photo National Museums of Scotland.)*

1990). This work then developed into a long-term National Museums of Scotland research programme, focusing on all pre-Iron Age artefacts of jet and jet-like materials from Scotland. It aims to:

- 1 document them in a fully-illustrated *corpus*;
- 2 identify raw materials and provenance, and hence patterns of movement;
- 3 elucidate the processes, technology and organization of their manufacture; and
- 4 understand their use and significance.

To date around 170 Scottish artefacts (including part or all of 27 spacer plate necklaces and bracelets — half of all the Scottish examples) have been analysed. Indeed, the scope of the project has expanded, to cover the Welsh material (Sheridan & Davis 1998) and some English finds (e.g. Sheridan & Davis 1994; Davis forthcoming). This paper will focus, however, on the Scottish material. As space is limited, full bibliographic details of the artefacts discussed here will not be given; these are available from the authors.

The use of jet and jet-like artefacts in Neolithic and Bronze Age Scotland

The earliest use of jet and similar materials in Scotland — as elsewhere in Britain — dates to the first half of the 4th millennium BC, with the use of elliptical beads, some of considerable size (Smith 1974). A set of 12 of these was found, with four amber beads and an edge-pol-

ished flint axehead, at Greenbrae, Aberdeenshire (FIGURE 2). Four or possibly five other examples are known from Scotland. The other Neolithic artefact type to note here is the belt slider, of which there are eight Scottish examples. By analogy with the one found in a male high-status grave at Whitegrounds, North Yorkshire (Brewster 1984), this artefact type should date to the second half of the 4th millennium BC. Although most of these Scottish beads and sliders have been stray finds, at least one — the slider from the chamber tomb at Beacharra, Argyll & Bute (FIGURE 3) — is likely to be from a funerary context.

There appears to have been a marked increase in the use of jet and jet-like materials, particularly as grave goods, during the last few centuries of the 3rd millennium BC. In Britain as a whole, the earliest of these Copper/Bronze Age items are some necklaces with tiny disc beads, as at Chilbolton, Hampshire (see Sheridan forthcoming for discussion). In Scotland the paucity of dated specimens makes it hard to establish a relative chronology for the appearance of the various artefact types, but it is clear that V-perforated buttons (FIGURE 4) were in use from at least as early as *c.* 2100 BC (at Migdale, Highland; Sheridan *et al.* 1995).

TABLE 1 describes the range of black jewellery and dress accessories in use between *c.* 2200–1800 BC. Of these, 'napkin rings' appear to be the latest addition to the repertoire, and

object type	no. of examples	gender association	comments
V-perforated buttons & studs (FIGURE 4)	c. 91	M&F	See Shepherd 1973 & 1985 for suggested developmental sequence & evidence for their use and gender associations
spacer plate necklaces & bracelets (FIGURE 1)	c. 54	F	Tightly strung; lower necklace strands plain, not cross-strung
disc-bead necklaces (FIGURE 5)	c. 34	F	Single-strand, except at West Water Reservoir, Scottish Borders where had unique second strand of lead beads. One necklace has tiny beads c. 4 mm diameter; others range in diameter c. 4–11.5 mm
disc-&-fusiform bead necklaces	8	F; 1M	Single-strand, except Masterton, Fife (FIGURE 6) (5-strand, echoing spacer plate necklaces). Three include tiny disc beads; many incorporate 'recycled' components from other necklaces, including spacer plate fragment used as fastener (Almondbank cist VII, Perth & Kinross)
disc-&-fusiform bead belt	1	F	Comprises recycled disc and fusiform beads plus hundreds of tiny disc beads
'pulley' belt rings (FIGURE 4)	7	[M]	Gender association by analogy with English examples
plain belt or strap ring	1	–	In hoard at Isbister chambered cairn
'napkin rings' (FIGURE 7)	46+	–	Probably attachments for fastening cloak: pair found at neck position at Camps Reservoir, South Lanarkshire
other, miscell	9+	–	Includes 6 beads shaped like N European battle axes (?Coulter, S Lanarks.), 2 pendants (Barns Farm, Fife) and plectrum-shaped piece (Auchenharvie Estate, Ayrshire)

TABLE 1. *Jet and jet-like artefact types in Scotland, c. 2200–1800 BC.*

as Fraser Hunter has pointed out (1998), they represent a markedly localized fashion, whose distribution is restricted to southern Scotland and northern England.

Some distributional patterning is also evident with the other artefact types (FIGURE 8A–C). Spacer plate jewellery is less common in south-central and southwest Scotland, and more common in Argyll and the northeast, than are buttons, pulley belt rings and disc bead necklaces. Furthermore, while the latter are associated with both Beakers and Food Vessels, the former is found virtually exclusively with Food Vessels in Scotland (Coutts 1969). This may be because spacer plate jewellery had a different design origin. While V-perforated buttons have clear Continental origins — and the boat-shaped variant has good North European parallels — spacer plate necklaces are likely to have been inspired by Irish gold lunulae (Shepherd 1973;

Taylor 1980). Notwithstanding the paucity of dating evidence for both artefact types (Needham 1996; 2000a), and the fact that spacer plate decorative motifs are best paralleled among Beakers of step 5–6 in Yorkshire (Shepherd 1973: 66–75; 1985: 214), the balance of evidence suggests that the spacer plate necklaces copied the lunulae, and not *vice versa*. The fact that a few lunulae have been found in Scotland may well account for the popularity of their black skeuomorphs, particularly in areas such as Argyll where contacts with Ireland were strong (Ritchie 1996). Nearly two-thirds of all the black spacer plate necklaces in Britain and Ireland have been found in Scotland. It may be that the élite in Scotland 'commissioned' such necklaces from the Whitby jetworkers, wishing not only to emulate these precious items, but also to appropriate a little of their 'magic' as symbolically-charged objects. Indeed, perhaps the



FIGURE 5. *Disc-bead necklace from Barbush Quarry, Stirling. (Photo National Museums of Scotland.)*

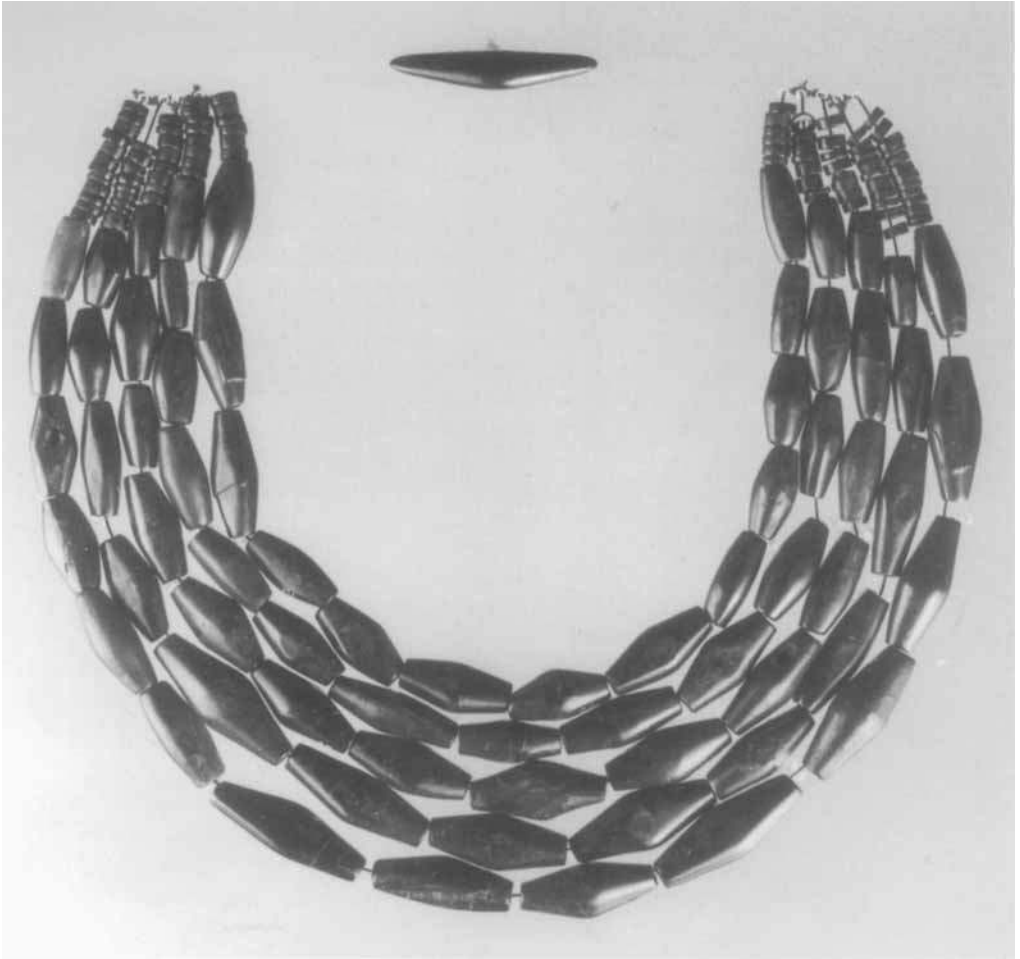


FIGURE 6. *Disc-and-fusiform bead necklace from Masterton, Fife. (Photo National Museums of Scotland.)*



FIGURE 7. *Pair of jet 'napkin rings' from Camps Reservoir, South Lanarkshire. (Photo National Museums of Scotland.)*

symbolic referents were amended in the translation from gold to jet, with the latter's clear female associations.

There appears to have been a marked decline in the use of jet and jet-like jewellery, allied to a change in the orientation of fashion and the appearance of new prestige items such as faïence, once cremation had become the dominant funerary rite in Scotland around 1800 BC. Of course, some such jewellery may have perished in the pyre; but there are enough examples where unburnt grave goods were deposited with cremations to suggest that this decline was genuine. Some of the finds dating to c. 1800–1400 BC, such as the single disc bead from a Cordoned Urn burial at Fence's Farm, Ayrshire, may well represent heirloom items. Others — such as the globular bead from Cairnholy, Dumfries & Galloway (Clarke *et al.* 1985: figure 5.42), the biconical beads from Mouswald, Dumfries & Galloway, and the belt hook skeuomorph from Law Hill, Dundee (Clarke *et al.* 1985: figure 5.47) — echo contemporary fashions in Wessex, and reflect its importance as a centre of power (Needham

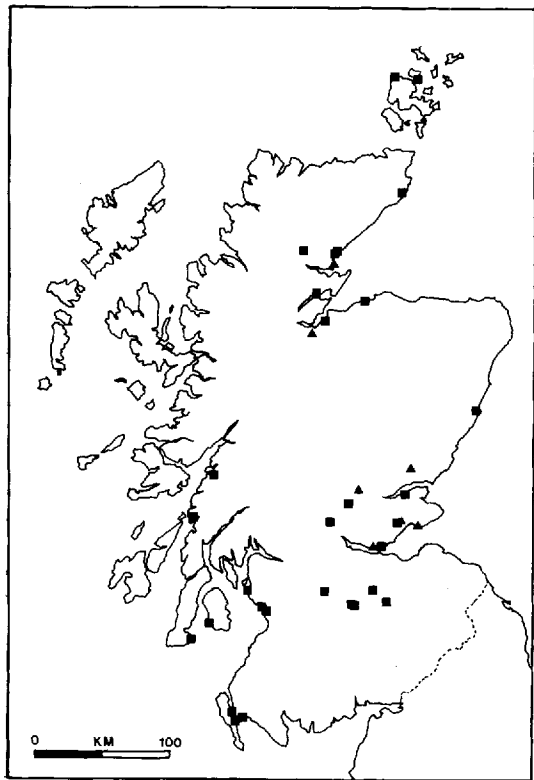
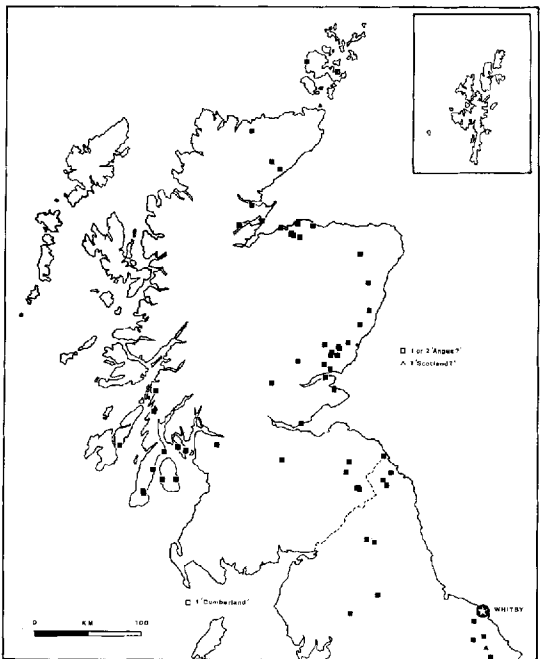
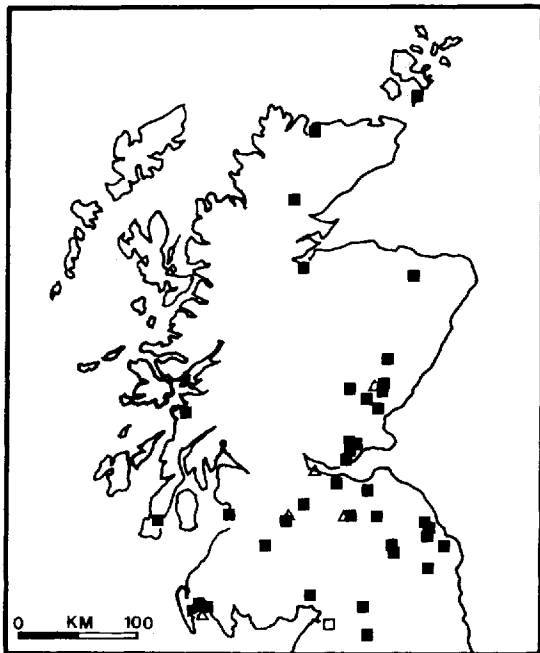


FIGURE 8. Distribution of jet and jet-like artefact types. A Spacer plate jewellery; B V-perforated buttons (squares; from Shepherd 1973, with additions) and 'pulley' belt rings (triangles); C Disc-bead necklaces (squares) and disc-and-fusiform bead items (triangles) — excluding north English examples. (Image National Museums of Scotland.)

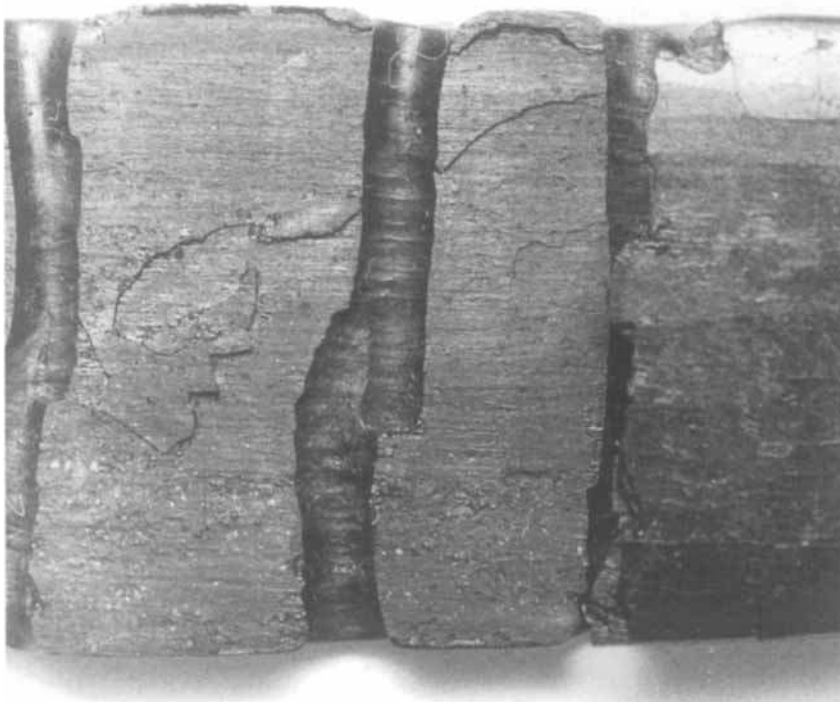


FIGURE 9. *Split spacer plate from Balgay, Angus, showing conjoining boreholes with parallel rilling. (Photo National Museums of Scotland.)*

2000b; Sheridan & Davis 1998). Also within this period appear the earliest examples of bangles, at Bodsberry Hill, South Lanarkshire.

Findings from 1400–600 BC are fewer still, the principal discoveries being three bangles from the Late Bronze Age hoard at St. Andrews, Fife, a bangle from Orrock, Fife, and beads from the necklace in the Late Bronze Age hoard from Balmashanner, Angus.

Identifying raw materials and patterns of movement

Identifying and sourcing the raw materials of these artefacts has involved the collection of reference samples from Scotland, Whitby and elsewhere, and the use of a combination of non-destructive investigative techniques, namely: inspection of colour, texture and degradation characteristics using a binocular microscope; X-raying; and X-ray fluorescence spectrometry (XRF) to determine inorganic elemental composition (Davis 1990; 1993a; 1993b). Latterly it has been possible to explore a wider range

of lighter elements including oxygen, carbon and sulphur, and also to examine the microstructure of the material, using a controlled-pressure scanning electron microscope. This helps further to refine the characterization of jets, lignites, cannel coals and shales, and could potentially offer a non-destructive method of discriminating between Whitby jet and jet from the much smaller deposit at Kimmeridge in Dorset (Watts *et al.* 1997).

Using these techniques it has been relatively straightforward to distinguish between jet and lignite on the one hand, and cannel coal and shale on the other, thanks to their differing parent materials and formation processes. Distinguishing between low-quality jet and high-quality lignite can occasionally be problematic, since the compositional and textural ranges are not mutually exclusive; and distinguishing some cannel coals from some shales can similarly pose compositional problems, as the materials grade into each other. Help with sourcing the latter has been provided by Dr J. M. Jones, whose

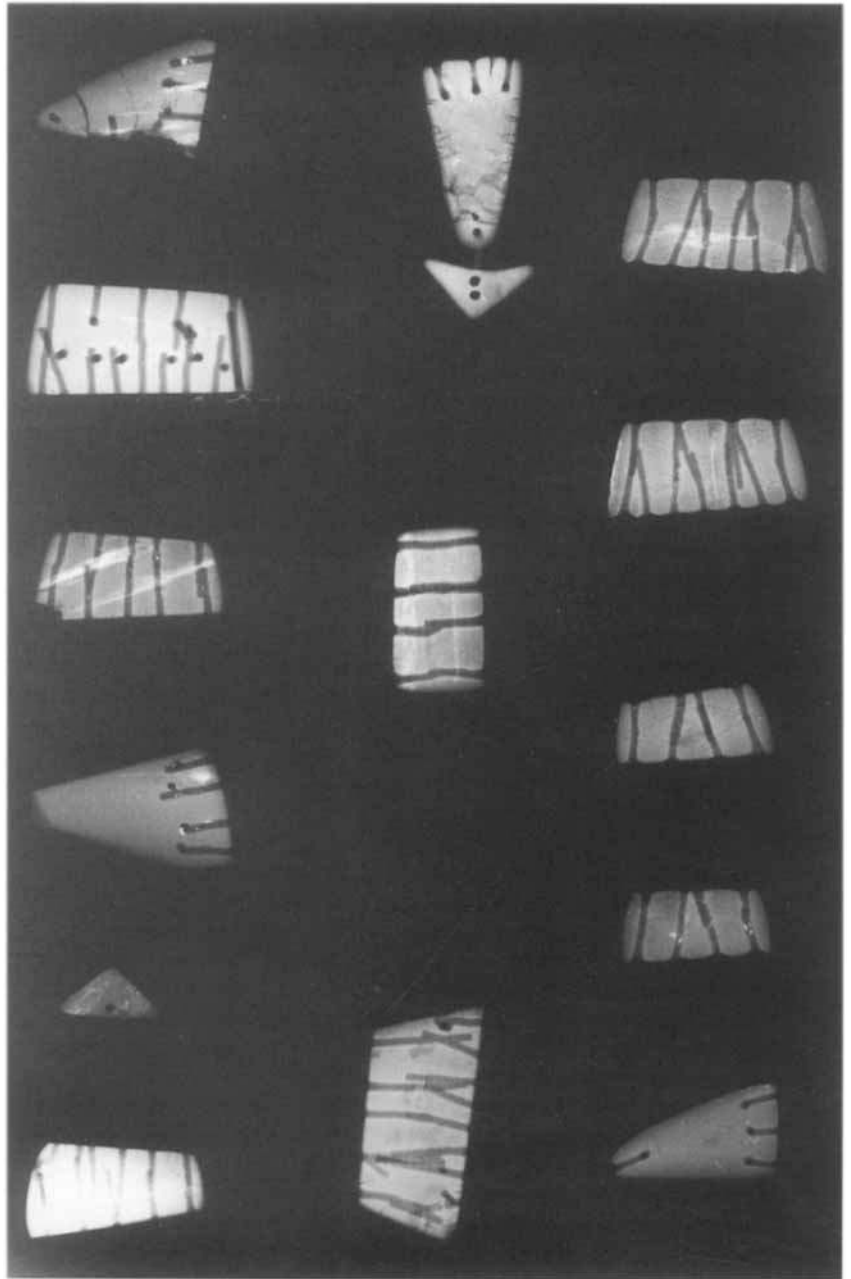


FIGURE 10. X-ray of terminal and spacer plates, showing modes of perforation. (Photo National Museums of Scotland.)

reflected light microscopy technique (involving minimally destructive sampling), and access to a large reference collection, allows the identification of materials to specific deposits or areas (Allason-Jones & Jones 2001). As for sourcing the jet non-destructively, it was clear from our initial fieldwork that Scottish jets are of insufficient quality, extent and size to have been viable source

material; furthermore their inorganic elemental composition is distinguishable from the Whitby range. The artefactual analyses have given no indication that either Scottish or Kimmeridge jet had been used; rather, the compositions are consistent with the range observed for Whitby jet.

The results so far have revealed that both Whitby jet and other materials such as cancell

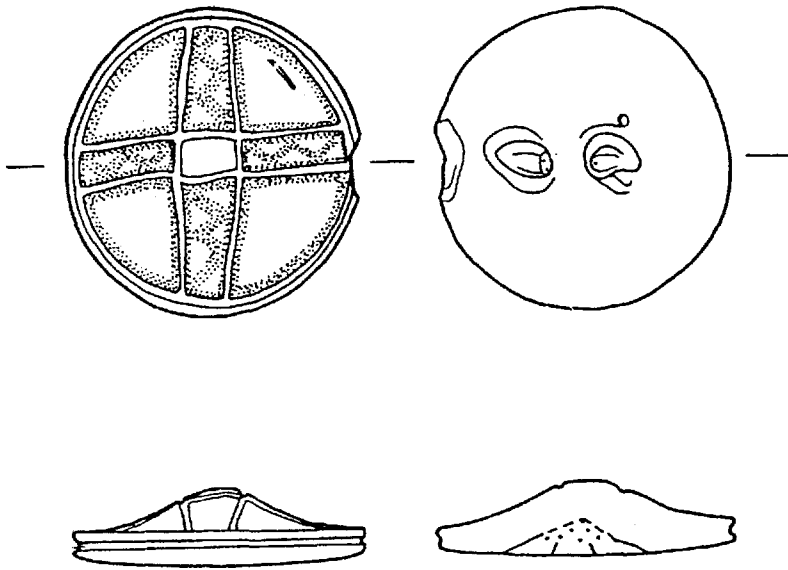


FIGURE 11. *The Rameldry button with tin inlay and selectively dulled surface. (Drawing Sylvia Stevenson. Crown Copyright: Historic Scotland.)*

coal had been used from the Neolithic onwards, indicating that the export of jet from Whitby, and its emulation in locally-available substitute materials, is of considerable antiquity. Ten of the Greenbrae beads are clearly of Whitby jet (and indeed the accompanying flint axehead and amber beads may well have come from Yorkshire too), while Scotland's other large elliptical beads are of cannel coals and shales which may well have been obtained relatively locally. Similarly, the three Scottish sliders so far analysed have been of cannel coal or canneloid shale, while two others (from Hallmyre, Scottish Borders, and Beacharra, Argyll & Bute) are likely to be of jet.

With the Early Bronze Age finds, the analytical results leave no doubt that a range of jewellery and artefact types was being made in Whitby by skilled specialists and exported to Scotland. In the case of buttons and 'pulley' belt rings emulation of jet originals in locally available materials was clearly taking place. At least one example from the set of 33 plain and decorated V-perforated buttons from Harehope, Scottish Borders, is of a high-quality cannel coal, like that used for a disc-bead necklace from an adjacent cist. Ian Shepherd has pointed out (1985: 208–9) that the differential wear and quality of decoration on the buttons suggests their acquisition at different times, and he has argued that the arrival of a batch of decorated jet buttons from Whitby to join the plain jet

examples may have inspired a local craft worker to embellish the largest of the pre-existing ones likewise. The cannel coal example may have been added at the same time.

The analyses of spacer plate jewellery have revealed an intriguing picture. Some necklaces and bracelets (e.g. Pitreuchie, East Kinwhirrie and Balcalk in Angus) are exclusively of Whitby jet, or have just a few beads of non-jet material. Where the spacer plates are decorated, they are clearly the original components, made as a set; and in most cases the necklaces and bracelets show relatively little sign of wear, and were apparently complete when buried, suggesting that they had not been worn for very long before being consigned to the grave. In most instances, the local non-jet components may well have been replacements for broken jet beads. However, with the necklace from Poltalloch, Argyll & Bute, a set of 15 small and narrow cannel coal beads probably represents the addition of a plain fusiform bead bracelet, made by a local person, to create a *parure* of black jewellery.

Some other spacer plate necklaces have a greater proportion of non-jet components. The one from Law Park, Balnacarron, Fife, for example, contained jet, cannel coal, and a distinctive high-yttrium lignite, used for spacer plates as well as beads. Usually such necklaces seem to have been incomplete when buried, and some or most components show heavy wear,

suggesting a considerable period of use. Some pieces have been modified: and with the mainly lignitic necklace from Monybachach, Argyll & Bute, one of the triangular terminal plates had been taken from another necklace and used back to front. In perhaps the most extreme example, from Melfort, Argyll & Bute (Clarke *et al.* 1985: figure 5.48), the 'necklace' comprises pieces from four or five necklaces of various materials, showing varying degrees of wear. It includes more than the normal number of plates, and many fewer beads than the full complement of over 100, and it could not have been strung as a 'normal' necklace.

Four examples have been identified so far where spacer plate necklaces have been made exclusively of local materials. Inverbrora canneloid shale, for example, had been used for the necklace from Burgie Lodge Farm, Moray. This indicates that local craft specialists were able to replicate the technically demanding task of necklace manufacture, using high quality local materials. Indeed, they tended to 'gild the lily' by incorporating more strands than was normal. Three of these necklaces were probably complete when buried, and all show few signs of wear.

Disc beads appear almost exclusively to be of cannel coal and shale, which in one case (Barns Farm, Fife) has been proven to be local. Only one item — the disc bead necklace from Cloburn, South Lanarkshire — contained jet beads. The reason for this is discussed below. 'Napkin rings' also seem to be predominantly or exclusively of cannel coal.

Non-jet materials predominate among the later artefacts; the few Whitby jet items include a couple of 'heirloom' beads and the globular bead from Cairnholy, Dumfries & Galloway (Clarke *et al.* 1985: figure 5.42).

Manufacturing techniques

The project has built on previous experimental work by Ian Shepherd (1981; 1985) and others to enhance our understanding of the tools and techniques used to manufacture jet and cannel coal artefacts. Discussions with Whitby jetworkers Hal Redvers-Jones and Alec Mackenzie, and with Fife cannel coal carver Donald Lowe, together with experimental work with Bronze Age-type tools by HR-J and Iain Clark, lead us to conclude *inter alia* that:

cutting and *abrasion* using flint saws (many of which have been found in Bronze Age

graves in Yorkshire), and sandstone or a similar material, were the techniques used for roughing-out and shaping;

perforation (undertaken at the roughout stage) would not have been done using bronze awls, since these are tools designed for leatherwork use and are not efficient for drilling jet etc. A more likely candidate is bronze wire, with perhaps a lozenge-shaped cutting tip. Long, narrow flint points chip too easily; bird bones are not hard enough; and although a tubular metal bit would have been capable of drilling, the observed tool-mark evidence is consistent with the use of a solid bronze bit, with a shank narrower than the tip. The use of a bow or pump-action drill is possible (*contra* Shepherd 1981: 48). As HR-J points out, it could be operated slowly and accurately enough to avoid damage; it would significantly speed the drilling process; and it is consistent with the neat pattern of parallel rilling observed in some fusiform beads, spacer plates and buttons (FIGURE 9). Drilling of spacer plates was difficult, and was done with varying degrees of skill (FIGURE 10). Some workers avoided making the technically demanding 'Y' perforation by creating an L-shaped 'elbow' bore, emerging at the back of the plate;

polishing could have been done in the manner suggested by Shepherd (1981), using a range of agents. A final embellishment, seen in some spacer plates, was the application of a white material as a paste inlay into the hollowed dots (punctulations). Analysis has revealed the use of several substances, including barium sulphate and burnt bone, presumably used with an organic binder. This white material must have been applied after the final polishing stage, as application any earlier would have discoloured the filler with jet dust;

both soft and hard jet were used at Whitby, with the latter capable of being polished to a brilliant sheen; the workers probably did not realize that the easier-to-work soft jet was prone to cracking over time. In other respects, the carvers of jet and other materials understood their working properties, and exploited them skilfully. Slightly laminar cannel coals and shales (which

are softer than jet) would generally have been preferred for making disc beads, as they have natural cleavage planes that aid the shaping process. Jet, being of more homogeneous texture, may have required that each disc bead be shaped individually. For making non-jet spacer plate necklaces, people selected the most compact (i.e. least laminar) kinds of cannel coal/canneloid shale.

One of the most intriguing Bronze Age finds is a V-perforated jet button from Rameldry Farm, Fife (FIGURE 11). This has a cruciform design picked out by inlaid metallic tin, and a second decorative effect, seen for instance in the zig-zag design along the cross arms, which was initially thought to have been achieved through differential polish. Hal Redvers-Jones has demonstrated, however, that it is more likely to represent selective dulling of the already-polished surface with a stick, to create a subtle interplay of black and brown, contrasting with the tin's silvery colour. Quite how the latter had been applied — and in particular whether it had been poured into the grooves in a molten state, as pure tin melts at 232°C — will be investigated by further experimental work.

Conclusions: the significance of jet and jet-like artefacts

Jet — like amber — has been treasured for millennia, not only as a rare, precious and beautiful substance, but also as an allegedly magical one, owing to its electrostatic properties, its warmth to the touch and the way it burns. Roman beliefs about its curative powers, especially in respect to female ailments, are discussed by Allason-Jones (1996); and it has been used as an amulet at many periods, and in different parts

of the world. Within a European context, Whitby jet is particularly important as it was exported to the Continent, for use as amulets and other items, during the Roman and Viking periods. It is therefore likely that Whitby jet was accorded special status and symbolic significance during the period considered here.

The NMS project has demonstrated that the prehistoric élite 'jet set' in Scotland enjoyed links with distant Yorkshire from before 3500 BC, and that others were emulating jet jewellery and dress accessories in local, non-electrostatic materials from this time onwards. Consignment to the grave of these prestigious objects would have been a powerful statement about the status accorded to its wearers. Similarly, the timing of this removal from circulation would have been significant, with some being buried after relatively little (if any) use, and others being old and worn. Ownership was clearly of crucial importance: perhaps the former were buried with their original owners, while the latter were treasured heirlooms, whose 'biography' would have been well known.

The work of the NMS project will continue, and with its growing database it may be possible to fill in a few more 'biographical' details of these fascinating artefacts.

Acknowledgements. The kind co-operation of Richard Brewer (NMGW), Drs Sheridan Bowman, Stuart Needham and Mike Cowell (British Museum) and of numerous curators and fieldworkers who have lent material for study, especially Tam Ward, is warmly acknowledged. Paul Wilthew, Dr Kathy Eremin and Fraser Hunter (NMS) and Dr J.M. Jones are thanked for their analytical work. Ian Shepherd, Dr David Clarke and Lindsay Allason-Jones are thanked for information and advice, and Major Patrick Cave-Browne, John Mainwaring and Donald Lowe for practical help with the experimental work. FIGURE 11 is reproduced by permission of Patrick Ashmore and Sylvia Stevenson.

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