MAKING POTS IN ORKNEY

Stephen Harrison

Introduction

During April 2007 a small group of volunteer potters, led by archaeologist Stephen Harrison and professional potter Andrew Appleby, began a three-year experimental research project into the making of Neolithic pottery. The project, an active collaboration between archaeologists and potters, with substantial community involvement, is based at Fursbreck Pottery, Harray, Orkney, and aims to come to some potential understanding of the processes involved in the manufacture and firing of prehistoric ceramics and their use during the third and early second millennia BC within a specifically Orcadian context. This broad aim subsumes a number of key objectives:

- To replicate a range of Neolithic ceramic styles experimentally.
- To explore the techniques needed for the manufacture of these types of pottery.
- To come to some assessment of the working properties of locally derived raw materials.
- To come to some assessment of the effects of adding a range of tempering agents to the raw materials used.
- To undertake a range of firing experiments.
- To experiment with the use of vessels.
- To assess weathering on vessels and sherds placed in a range of different environmental settings.
- To create a body of experience that will be of use in the interpretation of Neolithic pottery from the regional archaeological record.

All aspects of the experiment are recorded in a range of media: detailed written notes, audio recordings, still photography, and film.

Over the past sixteen months some 500 pots have been made and four firings have taken place, with more scheduled for later this year. This contribution focuses on the early stages of the experiment only, leaving as much out as it includes.

Orkney clays

Local clays are used for the experiment. Here the author's own fieldwork since 2005 in sampling and analysing Orkney's boulder clays for their potting qualities has proved useful in identifying potential sources of suitable raw material (Harrison *in prep*.). None of the county's clay deposits are particularly good for potting, but some are better than others. From a potter's perspective, clays found on North Ronaldsay, Stronsay, Shapinsay, Central and East Mainland, the South Isles and parts of Westray and Eday are much better than those found in the western part of the archipelago. Generally, those from the west are 'short', having far too much sand and rock rubble in them. For present purposes, two very different clays were selected, from Stackle Brae on the south coast of Eday and from the aptly named Clay Loan on the outskirts of Kirkwall. That from Clay Loan proved very good and was easily worked. The Stackle Brae clay, a rich chocolate brown colour, was found to contain too much sand, but when mixed with grass or other organic material immediately became plastic, proving very suitable for potting. In total, around 200kg of clay was extracted from the two locations in autumn 2006 and transported to Fursbreck Pottery, where it was left outdoors to weather over the winter 2006-2007.

Making pots

After initial processing of the clay (de-stoning and soaking) in early April 2007, the volunteer potters made around 150 Later Neolithic Grooved Ware vessels over a six-day period. The excavated assemblages from the settlement sites at Pool (Sanday; see MacSween 1990, 2007) and Barnhouse (West Mainland; see Jones 2005) served as the main analogues for the replication experiment. Pots were made in a range of sizes: from small cups, through medium sized tubs and vases, to a couple of very large vessels (over 60cm in height and with similar diameters). In terms of volume, the vessels covered the spectrum from a few hundred to in excess of 40,000cc, with the majority clustering between 2000 and 8000cc. Various building techniques were deployed and assessed: thumb/finger pinching ('pinch pots'), pinch-and-pull, coiling, coil-and-pinch, slab – really, more or less all variations on a theme, but some found to be eminently more practical than others.[1] A variety of rim types – flat, rounded, bevelled,

[1] An extensive examination of Grooved Ware in the collections of the Orkney Museum found minimal evidence for 'pure' coiling as a technique. From a potter's perspective, as the experiments have demonstrated, coiling is a time-consuming activity, producing inherent weaknesses in the finished vessel, especially where the base joins

notched, scalloped, inner shelved, grooved, upright, everted, inverted – and vessel wall widths (c.4-20mm) were also produced, reflecting perceived functions. Clays were used as dug (that is, after the removal of the larger inclusions) or with the addition of various tempering agents – crushed rock, crushed animal bone, crushed marine shell, seaweed and grass. Vessels were either left undecorated or decorated with a range of incised, impressed or applied motifs, used separately or in combination. Slip coatings and surface finishes (burnishing, hand smoothing or wiping with organic material, usually a piece of sheep's fleece) were applied to 50% of the pots made. The purpose of this part of the project was to examine in detail the processes involved and the choices that had to be made by the potter at various stages in the manufacture of vessels; a detailed assessment of time/labour investment in the making of selected pots also formed an important component of the overall recording strategy. A future paper will provide a detailed exploration of these issues.

Many invaluable observations were made during the potting process, just a few of which will be highlighted here. Vessels can be made on the ground, with the potter sitting, kneeling or squatting; they can also be constructed on an elevated surface, with the potter standing. In both instances, building the pot on a makeshift turntable – a roughly round, flat stone[2] – saved the maker from having to constantly change his/her position in relation to evolving vessel. When it came to applying decoration, the only suitable position was to have the vessel at eye-level, with the potter standing; once again, a turntable was a useful aid. During manufacture of the basic vessel shape there was a communal atmosphere, with the potters continuously engaged in conversation – usually, about anything and everything other than the task in hand! However, during the decorating process, the potters fell silent, became introspective, totally immersed in their own actions, intently and purposefully concentrating on their own particular decorative schemes; during this stage, all distractions were consciously avoided. It was as though basic vessel shapes could be constructed mechanically, with limited thought input, but when it came to the application of decoration, multiple choices and decisions had to be made, these requiring a very high level of sustained concentration.

After manufacture, the vessels were left to air-dry in the author's garage, where they were monitored regularly and measurements taken. As a general guide, during the drying process the pots lost c.10% of their original size through shrinkage. Shrinkage was rapid over the first three to four weeks, then slowed down, and was largely complete after six to seven weeks (of

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the walls; experiments have also demonstrated that vessels so manufactured are prone to leak when filled with liquid, no matter how well the coil joins appear to be sealed. Similarly, no evidence was found to indicate slab-building techniques.

[2] So-called pot lids – vaguely round, thin, flat stones, usually between 0.1-0.3m across, sometimes more; naturally occurring on rocky foreshores – are ubiquitous on prehistoric sites in Orkney. Are they really pot lids? Or are they residual indicators for potting? Or both? Or neither?

course, further shrinkage took place during firing, as the residual water content evaporated, bringing overall shrinkage to c.14%). Also, a small number of vessels (seven) developed substantial cracks during the drying stage; these were discarded.

Firing pots

How to fire the pottery – surface bonfire, pit or kiln – proved something of a dilemma. Conventional wisdom has it that no Neolithic pottery kiln have so far been unequivocally recognised in the British archaeological record. However, a structure discovered at the Knowes of Trotty, Harray, Orkney, in 2006 has been interpreted as a probable pottery kiln by its excavators (Card, Downes and Sharman 2006: 24-5). And, a literature search by this author has also revealed two possible kiln sites of similar age at Allt Chrisal, on the Outer Hebridean island of Barra, excavated in the 1980s (Branigan and Foster 1995: 85-8). All these features appear to have had turf superstructures and the capability of firing a large number of vessels at any one time.[3] Using the admittedly very limited evidence from these sites, a circular, turf-walled kiln was built. This structure, constructed on a level surface cleared of c.0.2m of topsoil (the subsoil comprised a stiff, stony orange-brown clay), was 1m in internal diameter at the base and 1m in height, with walls c.0.6m wide at the base tapering to 0.3m at the top. The upper layers of turf were slightly corbelled, giving the firing chamber an internal diameter of c.0.8m at the top. Hollow ceramic tubes were built into the turf wall at two locations around the circuit, one 0.18m and the other 0.5m above the base of the firing chamber, to allow for the insertion of thermocouples during firing. The turves (from improved pasture) were cut in square and rectangular blocks (c.0.3 x 0.3m and 0.6m x 0.3m) to a standard thickness of 0.15m, were dug from a loamy soil, and loosely laid in version of English bond (that is, one layer of headers followed by one layer of stretchers, repeated until the final height was achieved). Approximately 20m² of turf was used to construct the kiln. Rough flagstone blocks were occasionally added to the wall circuit to give added strength and stability and to level up individual layers of turf. In terms of labour investment, one person took 3½ hours to cut the turf, whilst two people took 4 hours to build the kiln.

The completed structure, although aesthetically pleasing, appeared to be very unstable; it would wobble dramatically whenever the slightest pressure was applied to the walls. However, after fourteen days the structure had consolidated and stabilised, the turf walls having settled and become more compacted than when originally laid; altogether it had become much more robust. Natural settling had reduced the height of the kiln to 0.9m. It was

also observed that the exposed loamy soil of the turf was beginning to erode as a result of wind and rain action. This was particularly noticeable on the western side, where a section of the upper wall, c.0.5m in length and 0.3m in height, slightly subsided and slumped inwards. Although this was monitored regularly, it was considered to be a minor structural failure and so no remedial action was taken.

A test firing took place on Saturday 19 May 2007, commencing at 8.45am. The day was overcast with intermittent drizzle and heavy showers, brief periods of sunshine, and a moderate to strong SW wind becoming gale force for a short time during the afternoon. The kiln was preheated with a wood fire. After thirty minutes the flames were allowed to die down and the glowing embers spread across the base of the firing chamber, producing a layer c.0.25m in depth, which was then covered with a c.0.3m layer of peat mould. A basal layer of loosely packed pots was then introduced and surrounded and covered with fuel, which consisted of peat mould and dried cattle dung. This process was twice repeated. An additional 0.3m of peat was placed over the upper layer of vessels to bring the contents level with the top of the kiln, which was then sealed with a slightly domed capping of wet seaweed, c.0.3m in thickness. The kiln was then left to its own devices.

Altogether 120 pots were packed into the kiln in a variety of positions: upright and inverted and inside each other; a representative sample of twenty-three vessels were retained for use in bonfire and pit firings at a later date. Approximately 300kg of peat mould and cattle dung provided the fuel, which would be, it was hoped, ignited by the still very hot wood ash embers of the preheating stage. The kiln took thirty-five minutes to load and seal.

Two thermocouples, inserted through the kiln walls, were used to record temperatures at regular thirty-minute intervals throughout the firing process. In addition, thermal imaging equipment was also deployed to monitor progress.

Firing proper, then, began at 9.50am. Somewhat surprisingly, the process turned out to be long and slow … and, truth be told, more than a little tedious at times! After twelve hours and forty-five minutes the recorded temperature had only reached 535.5ºC at the bottom of the firing chamber and 442.3ºC towards the top. This gave some cause for concern until it was realised that the fuel was merely smouldering rather than burning. In other words, the wood embers from the preheating had failed to properly ignite the peat. Also, prior to firing it was

[3] Such high capacity kilns, if they were a reality, point to episodic, communal firings, where the pots of an entire community were perhaps fired collectively. This observation may have implications for any consideration of the organisation of pottery production in the Neolithic.

anticipated that the inevitable gaps between the turves forming the wall would allow sufficient draught to enter the chamber, but this – even with a strong wind blowing throughout much of the day – proved not to be the case. In order to raise the temperature, some form of remedial action was therefore necessary. At 9.45pm the decision was made to vent the kiln: a broom handle was forced through the turf wall at about mid-height in seven places around the circuit. This action produced an almost instantaneous result. As well as allowing copious amounts of dense white-grey smoke to escape through the walls and top of the structure, along with a delicious peat aroma which filled the late evening air, the temperature began to rise steadily – if still rather slowly. Within ninety minutes, both thermocouples were recording temperatures of between 800ºC and 884ºC. The seaweed capping was also beginning to visibly crater at the centre and subside as the fuel was consumed at an increased rate. At 1am (20 May) the capping was vented (the broom handle was pressed into service once more and forced down through the fuel, just inside the wall perimeter, in four places). Twenty-five minutes later rolling yellow flames briefly burst through the top, indicative of an as yet incomplete combustion of the fuel. These were damped down by placing a heavy wooden door over the top of the structure, thereby introducing the only real element of control into the entire process. The covering was removed after twenty minutes and no further flames were observed. Between 1am and 3am the temperature rose from 920.3ºC to 987.6ºC, just passing the 1000ºC mark at 3.30am. At this time, the top layer of pots was beginning to appear through the partially consumed fuel. At 4.30am – eighteen-and-a-half hours after beginning – the temperature peaked, with the lower thermocouple registering 1067.2ºC and the upper 1062.2ºC. Thereafter the temperature began a slow decline, with the occasional high reading interrupting a steady downward trend. By 7.30am the lower thermocouple was recording a temperature of 773.4ºC; four hours later it was 643.6ºC; and four hours later still it had fallen to the mid-400ºC range. A similar reduction was recorded from the upper thermocouple.[4]

The thirty-six pots forming the upper layer were removed from the kiln at 7pm on the Sunday evening, with the remainder extracted at intervals during the following day. The firing was successful with a range of very passable Grooved Ware vessels produced; notwithstanding the fact that the archaeological material has been in the ground for 4,000 years (with all that this

[4] Some colleagues may object to the relatively high firing temperatures reported here, these being above the perceived normal range for most prehistoric pottery. It has become clear that, because of their character, Orkney clays require a high temperature and long exposure to heat if the pots are to survive the firing process. Experiments with short-lived, lower temperature bonfire firings have not been particularly successful, producing very high failure rates. Where they survive, the vessels have a very crumbly fabric, which, as we have discovered from our use experiments, makes them of limited utility in most domestic situations. Of course, these comments only apply to the clays so far used. As other, different clays are incorporated into the experiment the views expressed in this note may need refining.

implies), the experimental pieces are directly comparable. The survival rate was high: 70% of vessels remained intact; a further 15% had hairline cracks across their surfaces, but remained entirely useable; and only 15% broke during firing. Pots with the most coarsely tempered fabrics survived the best, presumably because of the bulk of inclusions rather than any particular efficacy on the part of this type of inclusion. Interestingly, those vessels made from Stackle Brae clay were the ones that failed most often, a result of the high sand content found in the clay in its natural state. Where additional temper in the form of organic material – chopped grass or seaweed – was added to this clay, pots survived perfectly well.

Kiln excavation

Following the experiment, the kiln was considered too damaged to survive a second firing. Therefore, in late August 2007 the turf superstructure was dismantled and the fuel ash deposits excavated and sampled. The kiln footprint was also subjected to a geophysical survey. The excavation provided additional insights into kiln behaviour during the firing process, greatly supplementing the temperature data and visually/aural observations; and, of particular note is the way in which these deposits appear to replicate those discovered at the Knowes of Trotty and at Allt Chrisal. Once the data and sample analyses are processed, a full report will be prepared. Having cleared the site, a second kiln was built, using turf cut from a clay topsoil. So far, this structure, with modest patching here and there, has survived three firings; it is anticipated that this kiln will be used for the rest of the experiment and then be allowed to decay naturally, before excavation at some future date.

Conclusions

Although still at an early stage the project has already produced many useful (sometimes unexpected) insights and a mass of technical data. Once the results are fully published, as well as being of benefit to the wider archaeological community, they will significantly increase our overall knowledge and understanding of the manufacture and use of Grooved Ware ceramics in Orkney. Here, only a flavour of the work to date and details of some of the results it has yielded has been given. What of the future? Pots continue to be made, with kiln firings earmarked for later this year and early 2009 (a winter firing is proposed, in order to assess the effects of different weather conditions on the firing process); surface bonfire and pit firings are also scheduled for autumn 2008; complete vessels and sherds have been placed in a wide range of environmental settings and a regularly monitored and recorded as they erode; experiments with the use of vessels (food preparation, cooking, and food storage) are ongoing, and will be reported on at a future date; further work is taking place on the analysis

of local clays; an assessment of the potential Neolithic resource base in terms of fuel availability, drawing on both archaeological investigations and environmental surveys, is underway; and, in 2009, it is hoped to begin experiments into the manufacture of earlier Neolithic round-based pottery, the so-called Unstan Ware tradition. Running parallel with the above will be the regular and detailed recording of the afterlife of the second turf kiln.

Any reader requiring further information is invited to contact the author at the following email address: stephen@midhouse.wanadoo.co.uk

As the project is run on a financial shoestring, and is very dependent on the goodwill of all concerned, the author would be pleased to hear from any PCRG member willing to undertake the thin-sectioning of a small number of the replicated vessels.

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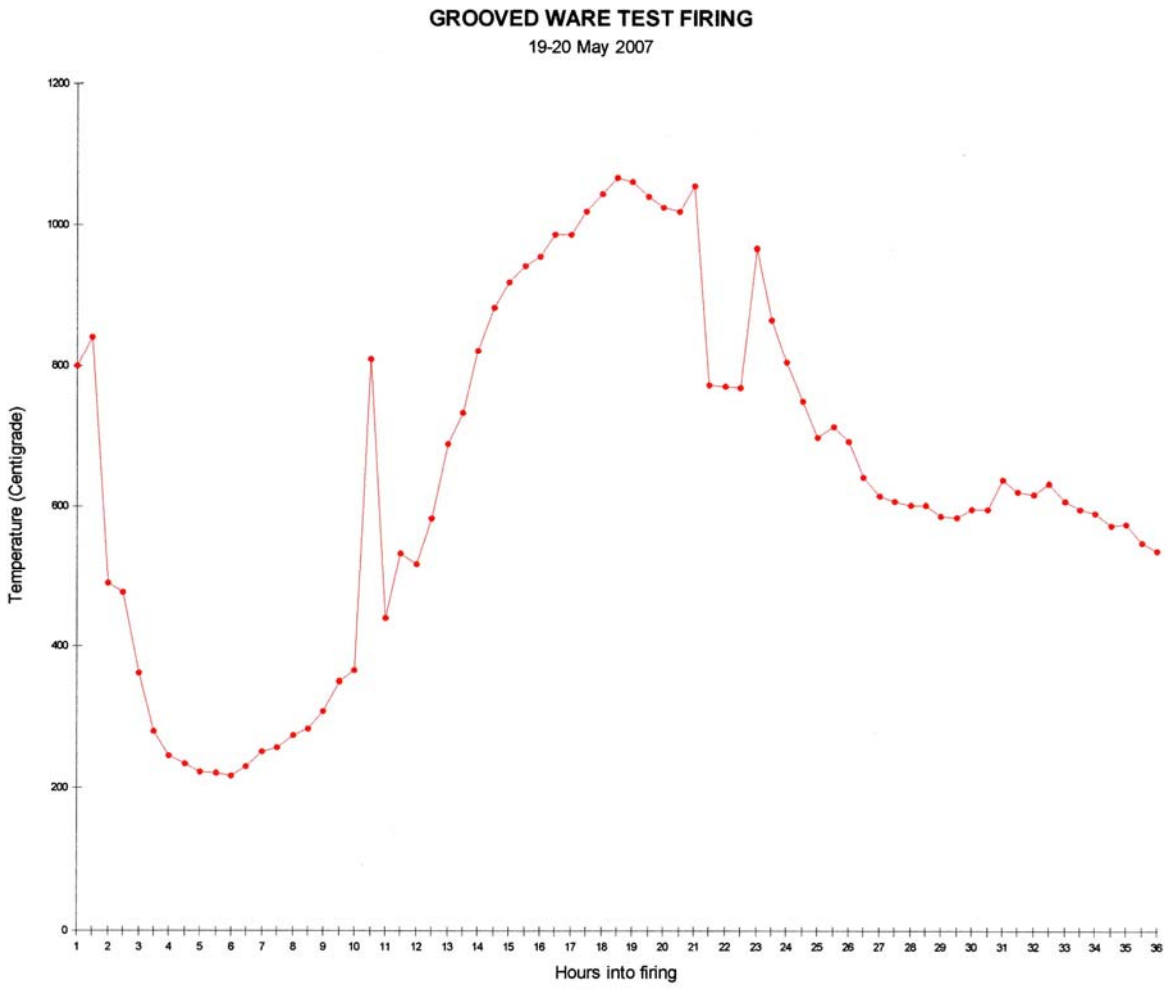

Figure 1. Recorded firing temperatures (lower thermocouple) from the first kiln firing.

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