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Early Historic Specialisation and Standardisation: the Technology of Rouletted Ware and Associated Wares at Anuradhapura

Introduction

This paper attempts to study the pattern of ceramic specialisation and standardisation during the Early Historic period at Anuradhapura. The main aim of this research is to assess the technology of three fine wares, namely Grey ware, Rouletted ware, and Arikamedu Type 10. The second aim is to examine the degree of specialisation and standardisation of these wares and to infer the level of productive organisation. This is achievable through the use of the macroscopic examination of the sherds, thin-section petrography, and chemical analysis, namely Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Selected sherds of Grey ware, Rouletted ware, Arikamedu Type 10, Arikamedu Type 18, Omphalos ware, and coarse wares from various south Asian sites including Anuradhapura, Kantarodai, Mantai (Sri Lanka), Arikamedu, Alagankulam, Vaddamanu, and Kopbal (India) were analysed (fig. 1). These analyses involved the use of both spatial and temporal perspectives, the former by analysing selected sherds from multiple Early Historic sites, such as Arikamedu, and the latter through the well dated radiocarbon sequence at Anuradhapura.

Definitions

Rouletted ware and Arikamedu Type 10 are both fine wares found predominantly in Sri Lanka, notably at the site of Anuradhapura, and on the eastern coast of India, particularly Arikamedu. They are thought to be tablewares and display distinct decorations. They are both slipped and well-fired and demonstrate a variety of colours ranging from red to grey to black (Wheeler/Ghosh/Deva 1946). Arikamedu Type 10 is cup-shaped and displays stamped decoration of birds, notably peacocks, on the interior placed in between incised lines (Wheeler/Ghosh/Deva 1946). It dates

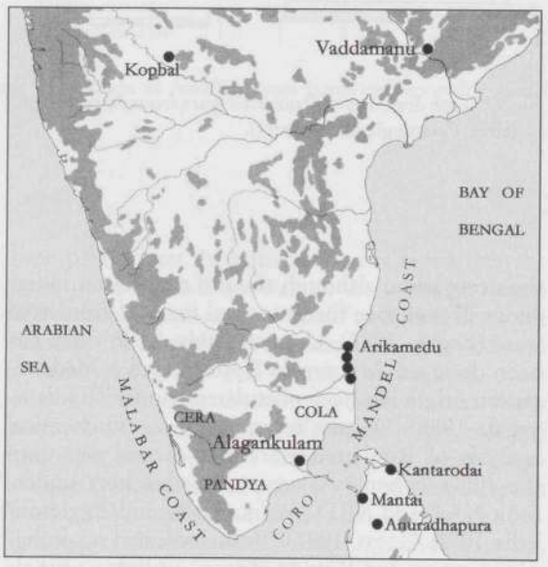

Fig. 1. Map of the discussed sites (after Begley 1991, 177).

from c. 200 BC to 300 AD based on radiocarbon dates from Anuradhapura (Coningham 1999). Rouletted ware is dish-shaped and contains bands of indentations on the interior base, which include a variety of shapes, such as parallel lines, triangles, and diamonds (Wheeler/Ghosh/Deva 1946). Rouletted ware is a key ceramic in south Asia in terms of its use as a relative dating technique for Early Historic sites. Wheeler was the first to use it as such, although more recent research at Anuradhapura has extended its chronology from c. 400 BC to 300 AD (Coningham 1999). Wheeler proposed a Roman origin for these wares due to the presence of Arretine ware and amphorae in the same levels (Wheeler/Ghosh/Deva 1946). However, further research has indicated that Rouletted ware actually preceded the Roman layers, which later led V. Begley to postulate a Mediterranean origin for

Ware	Period at Anuradhapura	Radiocarbon date
Grey ware	Period J	c. 510 cal BC – 340 cal BC
Rouletted ware	Period I	c. 360 cal BC – 190 cal BC
Arikamedu Type 10	Period G	c. 200 cal BC – 130 cal AD

Fig. 2. Table depicting the chronological sequence of the wares in this study.

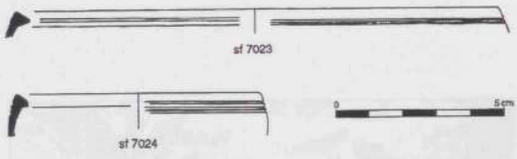

Fig. 3. Line drawings of Rouletted ware from Anuradhapura (after Conningham, in press).

the decoration, although she did suggest an indigenous provenance for the actual form of Rouletted ware (Begley 1988). Unfortunately, little work has been done on Arikamedu Type 10 and a Mediterranean origin has been postulated (Bouzek/Deraniyagala 1985). Despite its importance, no chemical analysis of Rouletted ware was carried out until the 1990s, when two separate researchers undertook NAA and XRD (Ardika/Bellwood/Eggleton/Ellis 1993; Gogte 1997). Both indicated an indigenous origin for Rouletted ware utilising a single geological source. Thin-section analysis by Krishnan and Coningham has demonstrated clear relationships between Rouletted ware and Grey ware at Anuradhapura and also between Rouletted ware from Anuradhapura and Arikamedu, therefore indicating both temporal and spatial similarities (Krishnan/Coningham 1997). Grey ware is found at both Anuradhapura and Arikamedu, although only the samples from Anuradhapura have been analysed here. It displays a similar form and fabric to Rouletted ware, although it is not slipped. It dates from c. 500 BC to 300 BC (Coningham 1999) and therefore pre-dates both Rouletted ware and Arikamedu Type 10 and also coincides with Rouletted ware. By analysing Grey ware, it is possible to match any chemical correlations with Rouletted ware and Arikamedu Type 10. If this is indicated, then it can provide useful information about any temporal changes and would support the theory of an indigenous origin for these wares as Grey ware was produced prior to any external contact (fig. 2).

Technology

These wares have been analysed using various techniques, such as ICP-AES and ICP-MS, thin-section petrography, and the macroscopic examination of the sherds. The results of the chemical analysis of 127 sherds suggest the exploitation of a single source for the fine wares. The rare earth element profiles suggest that multiple sources were exploited for the coarse wares, whilst the fine wares again indicate a single geological source (Ford/Pollard/Coningham/Stern, forthcoming). This suggests a high degree of standardisation for the production of the fine wares, although a low degree for the coarse wares. The results and the figures of all the chemical analyses are presented in a forthcoming paper.

The thin-sections and the macroscopic examination of the sherds can provide more detail on the technology with information about the clay paste preparation techniques, forming and firing methods. The clay paste preparation of Grey ware displays variations with varying amounts and sizes of quartz grains. The vessels were wheel-thrown with two main forms of bowls and dishes, although the dish form is present in the earlier levels. The firing temperature has been assessed based on the optical properties of the groundmass and the presence of certain minerals, such as muscovite mica. Another indicator is the presence of a metallic ring when the sherd is tapped. This evidence has indicated a temperature of between 750 and 900 degrees Celsius for all the Grey ware sherds analysed. The redox conditions are also consistent with reducing conditions. This evidence suggests a moderate to high degree of standardisation and becoming increasingly standardised over time at Anuradhapura.

Rouletted ware also displays uniformity both over time at Anuradhapura and spatially at the other sites. The thin-sections display an even distribution of grains and an equal size of grains. This indicates a high degree of standardisation for the clay paste preparation techniques. The forms do not vary significantly over time with no diameter changes or much variation in the shapes. Indeed, only four different forms have been identified from the excavations of Trench ASW2 at Anuradhapura with no temporal trends. These forms include plain round-edged rims, undercut rims and beaked rims (fig. 3). However, there is some variation with the estimated diameters suggesting a lack of standardisation in the size of the forms and may indicate multiple potters. The firing is consistent over time with a temperature range of around 750 to 900 degrees Celsius and in a reduced atmosphere. This high level of standardisation over such a long time period of around 700 years indicates a very complex picture of organisation.

The Arikamedu Type 10 samples display some textural discrepancies in thin-section with varying

Ceramic	Level of Organisation	Level of specialisation & standardisation	Equipment	Market	Chemical, Petrographic, Macroscopic
Coarse wares c. 500 BC to 300 AD	Household production	Part-time specialisation and low degree of standardisation	Turntable and wheel, open, oven and pit kilns	Local	Multiple geological sources and multiple techniques
Grey ware c. 500 BC to 300 BC	Noncentralised production	Part-time specialisation, moderate level of standardisation	Temporary tanks for levigation, sieves, wheel, oven or kiln	Local	Single geological source and multiple techniques
Rouletted ware c. 400 BC to 300 AD	Centralised production	Full-time specialisation, incipient specialisation and high degree of standardisation	Permanent tanks for levigation, sieves, wheel, kiln	Local and international	Single geological source and standardised techniques
Type 10 c. 200 BC to 300 AD	Administered production	Full-time specialisation and high degree of standardisation	Permanent tanks for levigation, sieves, wheel, kiln, storage area for clay	Local and international	Single geological source and standardised techniques

Fig. 4. Table displaying a model for the organisation of ceramic production at Anuradhapura based on Sinopoli's model (1988).

sizes and amounts of quartz grains. This may suggest that the potters were not as specialised or a change in clay paste preparation techniques. It may also be explained as grading of the silt in the clay deposit. This is quite likely, as we already know from the chemical analysis that a single source was exploited for several different wares over a long period of time. The source may therefore contain textural differences that are reflected in the thin-sections. The forms are very similar with no temporal or spatial differences, although there are variations in the size of the vessels. The firing is consistent with the other wares in terms of both temperatures and redox conditions. This suggests that similar equipment was utilised with perhaps the use of a kiln or oven type structure to control the temperature and the redox conditions. As this evidence indicates a high level of standardisation, it further supports the notion of silting grades in the clay source, as there are no changes in the formation or firing methods.

Discussion

This evidence can now be used to assess the level of productive organisation during the Early Historic period. Sinopoli proposed a model for craft production at the Medieval capital of Vijayanagara (Sinopoli 1988), which can be applied to the development of three fine wares, Grey ware, Rouletted ware, and Arikamedu Type 10, at Anuradhapura (fig. 4). For Grey ware, it is predicted that Sinopoli's 'noncentralised production' was practised, which allows for both part-time and full-time production. It is therefore envisaged that the level of specialisation was at an incipient stage. Workshops tend to be small and tied in with kinship. The local clay resource is exploited and a variety of forms and variable techniques used. If this is the case, the thin-sections should show textural differences (i. e. differences in grain shape and size) and therefore different clay paste preparation techniques and possibly multiple potters at work. The chemical analysis should display similarities, as all the samples are from Anuradhapura, and should represent the chemical signature of the region, although there may be slight variations due to varying clay paste preparation techniques, such as different amounts of inclusions. As Grey ware is predicted to be at an incipient level of specialisation, the materials and technology are also expected to be slightly different. A wheel would have been used to produce the wares and perhaps the use of a kiln structure to fire the vessels. As these Grey ware sherds pre-date the Rouletted ware sherds, it is envisaged that they were produced using a slightly less advanced technology at a moderate level of standardisation. The evidence from Anuradhapura supports this theory with the wares becoming increasingly standardised over time.

It is envisaged that Rouletted ware is at a higher level of standardisation and operated within a model of 'centralised production'. It is expected that full-time specialists operated in workshops and produced regularised wares and that there was exploitation from a single geological source and production was aimed at a wide 'market'. If this

is the case, the thin-sections and the sherds should show similar compositions (both mineralogy and texture) and should display technical similarities, such as in the clay paste preparation techniques and firing conditions. The chemical analysis should exhibit compositional similarities also and it is expected that this will be apparent both spatially and temporally. The materials include the use of wheels and kilns for the manufacture of Rouletted ware and possibly the use of specialist tools to produce the 'rouletted' design. This again appears to fit in with the model, although there is a lack of a developmental phase within the Rouletted ware from Anuradhapura as there are no examples of coarse rouletting or a gradual increase in standardisation. This may be because Rouletted ware was not produced at Anuradhapura, or that it evolved from the Grey ware and hence the forms were already highly standardised. The skilled potters may therefore have not required an experimental stage.

It is predicted that Arikamedu Type 10 is part of the standardised production system that began during the development of Rouletted ware. It may therefore fit with Sinopoli's model of 'administered production' in which a non-producing elite, such as a government or religious institution controls the manufacture. Indeed, evidence for this may lie in the spread of Buddhism, which develops and co-occurs with the distribution of both Rouletted ware and Arikamedu Type 10 and with trade both within the Indian subcontinent and with the east and west. Again full-time specialists would have been producing precise forms, possibly for a specific 'market'. Exploitation of a single geological source is again expected. If this is the case, the thin-sections and the chemical analysis should both display similar compositions. The thin-sections should also demonstrate similar technical processes. The materials used would include wheels, kilns, and standardised equipment to produce the decoration, such as stamps. The evidence again appears to support this model with the only discrepancy found in the clay paste preparation techniques, which, as mentioned above, is thought to be due to natural processes rather than human intervention.

However, there are a number of problems with the application of this model to these Early Historic ceramics. Firstly, the coarse wares remain at a low level of specialisation and standardisation, despite their continued presence throughout the Early Historic sequence at Anuradhapura and contemporaneity with the fine wares within a state-level society. Rouletted ware and Arikamedu Type 10 do not display any developmental stages, which may suggest that they were not produced at Anuradhapura. However, Grey ware appears to be a transitional ceramic that eventually became Rouletted ware as attested by the technological, mineralogical, and chemical evidence. This evidence suggests that the different wares had different manufacturing cycles and that the pattern for one ceramic category is not necessarily the same for another. This has supporting evidence at Anuradhapura with other craft activities of metal, bone and shell working (Coningham 1997). The evidence indicates that these different crafts were carried out within the same localities, rather than separate specialised areas as expected within a state-level society. As there appears to be a co-occurrence of these crafts, this suggests a very different and a more 'noncentralised' pattern and refutes the theory of spatial segregation as a necessary component of craft specialisation. Clearly, the site of Anuradhapura does not fit with some of the expected patterns indicating the need for new theories in order to understand Early Historic productive organisation further.

Conclusion

To conclude, this paper has presented the technological data on three Early Historic fine wares, namely Grey ware, Rouletted ware, and Arikamedu Type 10. From this evidence, it is possible to infer the degree of specialisation and standardisation and the level of productive organisation. This research provides a unique insight into the development of ceramic manufacture at Anuradhapura, a radiocarbon dated site in North Central Sri Lanka. It has also used selected samples from a number of other Early Historical sites including Kantarodai, Mantai (Sri Lanka), Arikamedu, Alagankulam, Vaddamanu, and Kopbal (India), which allows for a spatial perspective. The application of this data to a theoretical model, such as that proposed by Sinopoli (1988) has questioned the application of traditional models of craft specialisation and standardisation and therefore suggests the need for new approaches to understand ceramic specialisation and standardisation during the Early Historic period.

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