

ELEVEN

USE OF CERAMIC TECHNOLOGIES BY CIRCUMPOLAR HUNTER-GATHERERS

Current Progress and Future Research Prospects

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INTRODUCTION

One of the earliest appearances of pottery is in northern regions among hunting/gathering/fishing peoples of the Late Pleistocene, far from the temperate climates of early agriculturalists. As the editors and many contributors have made abundantly clear, *any* adoption of pottery in northern contexts is unexpected given the constraints and difficulties of pottery production and use in these environments. As some of the earliest hearths of pottery innovation, these occurrences simply seem baffling given the long standing assumptions in archaeology about the origins of pottery. Thus, it seems that there must have been some powerful motivations capable of overriding all the constraints and problems involved in pottery production and use in the north. What could those motivations have been?

The origin of pottery, like the origin of domestication and the origin of metals, is one of those pivotal technological changes that transformed the world, and maybe they are distantly related. For over two million years, there was no sign of pottery, metals or domestication. Yet in the comparatively short space of about 10,000 years at the end of the Pleistocene, they had all appeared in the world, in multiple geographical areas, and seemingly independently. Yet, the penecontemporaneity of these ceramic developments in a number of different places, particularly in the north – often with remarkable similarities in shapes, sizes, pastes and thickness in the form of similar conical jars found in the Baltic,

Siberia, Japan and northern North America – begs the question of how they could have been related. Some researchers see no relationship, or are mute about possible connections. They argue against any underlying principles or unifying causal factors, as represented in this collection by Vetrov and Hommel. The emergence of the same technology in different areas is portrayed as emerging under different causalities with contemporaneity and morphological similarities apparently only a coincidence. But, as the preceding chapters document, early pottery appears at strikingly similar time periods in Siberia (c. 14,000 BP or earlier) and in Japan (by 16,850 BP). We should remember that it also appears to have emerged independently in China (around 18,000 BP; Yuan 2002), the Near East (by 10,000 BP, Gibbs 2015), Africa (around 8500 BP, Garcea 2006) and coastal Amazon (c. 7000 BP, Roosevelt 1995), many of these occurrences being among hunter/gatherer/fishers as well.

So, leaving aside the issue of possible connections with domestication and metals, what are the possible explanations for the apparent independent invention and later adoption of pottery in the north? In my compass, they can be broken down into several basic themes. These are:

- *Diffusion of ceramic knowledge.* This assumes: A) a development in a core area as adaptation for survival (such as it may have been in the high arctic as argued by Admiraal and Knecht, and Frink and Harry) followed by diffusion throughout the world, including into areas where pottery was not critical for survival; or B) deep diffusion of more basic technologies such as the use of nets for fishing or the use of heated rocks for lipid extraction which probably only began in the Upper Paleolithic, but spread to many areas during the Mesolithic, followed by multiple independent developments of pottery technology to improve the effectiveness and efficiency of lipid extraction. The problem with the first diffusion explanation is that pottery has not been shown to be critical for survival in any of the study areas. Indeed, how did groups survive without ceramics before 3000 BP in the American Arctic? Pottery actually arrives quite late in areas like the Arctic where its survival value might be argued to be critical. The second scenario for deep diffusion connected to lipid extraction via heated rocks in large parts of the world seems more plausible. After all, microlithic technology (as part of bow and arrow technology) spread remarkably rapidly throughout the world during the same time period. Thus, basic technological concepts such as stone boiling and lipid extraction appear to have been very diffusible over many continents.
- *Genetic improvements in intelligence.* The argument that human intelligence only became developed enough to invent pottery after 20,000 years ago or so seems belied by arguments for the emergence of full *sapiens* mental abilities 100,000 or 200,000 years ago. In addition, there are good indications that Neandertals were fully aware of the ceramic properties of clays and used them for cooking (Villeneuve 1906: 55–6). If intelligence was not the sufficient condition for

inventing or adopting pottery, what were the new conditions that made it an optimal solution for processing food resources?

- *Achievement of critical masses of information.* This explanation for the emergence of pottery technology relies on the idea that information preconditions are required in order to advance to technologically more complex innovations. Thus, high temperature firing of ceramics had to be developed before ores could be smelted; metallurgy was needed before internal combustion engines could be invented; and electrical systems had to be in place before computers could exist. In Braidwood's terms, domestication – and by extension pottery – happened when cultures were ready for it. But the informational or technological preconditions of developing ceramics are not evident, and the chapters in this volume have repeatedly demonstrated that pottery developed or was adopted in the north under adverse conditions, while basic ceramic technology was known since much earlier times in the Paleolithic. We are constantly left wondering what people in many of these areas did before pottery appeared on the scene if it provided so many advantages for basic subsistence, especially if knowledge of the characteristics of fired clay existed 23,000 or 50,000 or even 100,000 years ago.
- *Common responses to new social contexts and demands.* A fourth type of explanation for the widespread development and adoption of pottery in the north is that socioeconomic complexity (involving feasting and the sociopolitical benefits that it could provide) is the most obvious new social development in the Eurasian Upper Paleolithic and Mesolithic world. While Uchiyama, and Boyd et al., among others support such a view, Vetrov and Hommel argue for the development of pottery in Siberia well before social complexity or feasts.

Thus, no single explanation for the widespread appearance of pottery in the north is without its flaws. Should we therefore abandon the quest for discovering why these events occurred and chalk them up to synchronicity or coincidence? I think such a conclusion would be premature, especially since archaeologists – who are well represented in this volume – are really only beginning to undertake serious research into all the relevant issues. In effect, the authors of the chapters in this volume represent an entirely new generation of researchers who are asking new questions (why did highly mobile hunter-gatherers make pottery in some of the most unsuitable environments for ceramics?), utilizing new techniques (residue analysis, isotopes, phytoliths, pollen, starch grain analysis, analysis of fire cracked rock), tying residue and faunal data to isotopic indications of diets, examining specific contexts, situating pottery use within regional exchange networks and using new analytical frameworks such as design theory (whether implicitly or explicitly). The result has been nothing short of revolutionary in the ceramic world. I continue to wonder whether DNA can be extracted from pottery or stone bowl residues, and if so, what more remarkable information about past uses such analyses might reveal, including about brewing.

CURRENT PROGRESS

The editors of this volume have performed a very insightful job of framing the issues and problems, and of bringing many of the key researchers together at the conference symposium that served as the springboard for this book. They sought to identify patterns in order to deal with the questions of how and why pottery was used in the north. However, with several exceptions, the patterns have been elusive, or at least are inconsistent. Moreover, it is important to recognize that a considerable time range is represented by the studies in this volume, from very early occurrences, c. 18,000 years ago, to more recent introductions c. 3,000 years ago in the Arctic and Boreal zones of North America. Over this 15,000 year time period, pottery undoubtedly evolved and new uses were discovered for the application of ceramic technology. No storage jars, finely made serving vessels or oil lamps occur in the very earliest assemblages, but they do occur later in time.

In addition, conditions undoubtedly changed as well, particularly in terms of cultural complexity and exchange. Thus, as Gjessfeld intimates, oil production after 2000 BP in the remote Kuril Islands may have been largely for export and trade, but could this also have been a motive for initially occupying the Kuril Islands and for adopting pottery in earlier times or in other locations such as Central Sweden, as discussed by Isaksson et al.? During the Pitted Ware occupations in central Sweden, groups were clearly in contact with Funnel Beaker communities whose members could have easily created a demand for fish oil or marine mammal oil either for consumption or lighting. Such an exchange demand for oil could have made large-scale oil production profitable and made pottery an efficient means of processing oil on larger scales. Sustained exchanges could also explain the gradual adoption of Funnel Beaker features by Pitted Ware groups. If groups were favorably situated for producing oils, they could have used the first pottery to produce oils for exchange much as furs were used in historic and contemporary times. Oil consumption would not be traceable with carbon isotopes based on protein or DNA remains.

Perhaps production of oil at the confluence of the Karenga and Vitim Rivers in Siberia, as described by Vetrov and Hommel, could have been for exchange with more complex cultural groups and larger-scale production was facilitated by the use of ceramic vessels. In this case, the producing groups might not need to exhibit any marked degree of complexity, although the groups acquiring the oils would be expected to display feasting or other complex social behaviors. Certainly, the production of fish oils for trade was a major feature of ethnographic Northwest Coast groups who carried this highly valued feasting food along “grease trails” to interior groups. However, this scenario for the Late Pleistocene in Siberia is speculative. The important point is that conditions may have changed over time, the functions of pottery

may have changed over time, and depending on when pottery first appeared in an area and what the conditions were, these may not fit patterns or models of the earliest developments of pottery.

For the earliest (and many later) appearances of pottery among northern hunter-gatherers, the arguments presented in this volume boil down to two main models of causality that form a theoretical dialectic:

- 1) Pottery was necessary for – or at least greatly facilitated – existence in extreme environments like the high arctic (e.g., for cooking, light and heating or lipid extraction or rendering animal fats into oils) as described in chapters by Admiraal and Knecht, Anderson, and Frink and Harry. But then, one wonders how people survived in these areas before pottery was adopted, and why early occurrences in Siberia and Japan involved very limited numbers of pots over many millennia?
- 2) A second type of model for the earliest development (and in some cases later adoption) of pottery in the north postulates that it was adopted in order to prepare highly valued foods for use in sociopolitical strategies, especially in feasts or special ceremonies, as argued by Uchiyama, Boyd et al. and Anderson, as well as Taché (2011; Taché and Craig 2015). But then some of the earliest pottery contexts in Siberia do not seem to reflect levels of complexity commensurate with ideas about feasting.

In addition to these positions, there are researchers who do not endorse any model of causality as with Vetrov and Hommel, and Deal et al.

Certainly one of the most striking patterns of the earliest occurrences, as well as many later adoptions, is the association between pottery and aquatic resources. However, fish can be eaten raw or roasted, and cooking can reduce the nutritional value of marine mammal flesh, as Anderson points out. So, what was the practical value of boiling aquatic resources, especially where fuel was scarce? Appeals to better flavor or gustatory traditions seem unsatisfactory given the difficulty and cost of manufacturing pottery or stone bowls in northern environments as documented by the editors, Admiraal and Knecht, Frink and Harry, and Anderson. The extraction or refining of lipids in the form of soups or oils seems to be the most viable reason for using pottery at least in conjunction with the *mass harvesting* of aquatic resources. Admiraal and Knecht note a strong association between pottery in the Arctic and reliance on marine fish and/or mammals, although Spencer (1959: 473) thought that maritime Eskimos preferred wooden tubs for processing fish. A similar strong relationship between early pottery and aquatic resources has been established for Japan (Uchiyama; Craig et al. 2013), for Early Woodland pottery in eastern North America (Taché and Craig 2015) and perhaps even for pre-agricultural pottery in the Sahara (Garcea 2006: 213). Lipids were highly valued for their caloric contributions and their role in digesting proteins. These are especially

important considerations in the north where the winters are cold, and carbohydrates (lipids or starches) are limiting factors for digestion and maintaining body temperatures. As such, lipids were ethnographically foregrounded in northern prestige contexts, both within local community feasts, as well as serving as a major commodity in exchange relations between groups. The famous use of fish oil at potlatches and the creation of the well-known “grease trails” for the exchange of oil between coastal and inland groups along the Northwest Coast of North America provides dramatic ethnographic documentation of this high value. The same use of pottery for preparing high value prestige foods has been advanced for the use of starch-rich foods such as maize (documented by Boyd et al.) and for the production of nut oils (Taché 2011). In the Near East, the first pottery was similarly used for rendering and/or storing animal fats, but not clearly for cooking (Hodder 2006: 49, 53–4, 83). The non-obvious observation by Boyd et al. that significant amounts of lipids were lost by inserting and removing heated rocks into and out of soups or mashes are important additional factors that need to be quantified and integrated into cost and benefit theoretical models.

Another intriguing pattern that emerged is the long period of very limited use of pottery over several millennia after its initial development (Gibbs, 2015: 348). If pottery provided major adaptive advantages for subsistence, wouldn't one expect a more rapid adoption and expansion of the technology as a major component of subsistence? On the other hand, if pottery was developed for special foods or special circumstances, this pattern would seem to make more sense.

It is at the level of general food strategies such as the use of heated rocks for boiling or rendering, that the emergence of pottery exhibits some semblance of coherent patterning in my estimation. Pottery in the aquatic contexts described earlier makes sense in terms of the development of mass harvesting and processing/extraction technologies during the late Paleolithic and Mesolithic of northern regions. Pottery often develops in tandem with the appearance of mortars and pestles (for crushing nuts or seeds), rock boiling, mass fishing technologies (nets, weirs) and storage facilities for abundant seasonal harvests. The Early Woodland societies described by Boyd et al. (see also, Taché 2011) provide another variant on the same theme since they used pottery for the preparation of other kinds of highly valued foods (maize) in the context of prestige goods, prestige foods, storage, regional exchange, special burials, ceremonial associations with pottery and other characteristics of transegalitarian complexity. The same use of pottery for highly valued foods appears plausible for the Incipient Jomon sites with pottery (Uchiyama), and some Eskimo groups (Anderson). The case of early pottery along the Vitim River in Siberia appears as an outlier that does not fit this pattern very well other than its association with important aquatic resources. One is left to

wonder if this really is a different kind of development or whether future research may change views of the cultural contexts in this region. In the case of the Incipient Jomon discussed by Uchiyama, the simple recovery of a few tuna/bonito remains (at a site which was at the time at least 10 km from the coast) profoundly changes our understanding of the maritime abilities and subsistence activities of these people 11–12,000 years ago. The successful offshore capture of such large fish implies much more sophisticated fishing abilities than previously assumed, and probably indicates even earlier origins for effective fishing, plausibly from the very beginning of the Jomon and the first development of pottery. One wonders if a similar game-changing discovery in the Vitim watershed might not also occur in the future.

FUTURE RESEARCH PROSPECTS

Chapters by Frink and Harry, Admiraal and Knecht, Gjesfjeld, Anderson, and Deal et al., implicitly adopt a design theoretical approach (see Horsfall 1987; Hayden, 1998) by examining the *costs* and *benefits* of pottery production, especially in the context of *tasks* to be performed and *alternative ways* of achieving those tasks, whether by use of baskets, bark containers, stone bowls, wood bowls, hide vessels or non-container alternatives (e.g., roasting, raw consumption). It would be interesting to apply the insights gained from the examination of pottery in the north to other areas where hunter-gatherers used stone bowls prior to adopting pottery such as California, the southeastern United States and the Near Eastern Late Epipaleolithic. Since the costs and constraints of pottery production were considerable in the Arctic and Kuril Islands, it follows that the benefits of pottery use must have been commensurate or greater than the costs. What those benefits were is still not clear, but appealing to better taste or gustatory traditions does not seem like a commensurate benefit to me.

The discussions concerning the change from well-made, well-fired, thin-walled pots with pointed bases to poorly-made, poorly-fired, thick-walled, flat-bottom pots in the Arctic is addressed especially well by the three papers dealing with Alaska and the Canadian Arctic (Frink and Harry, Anderson, and Admiraal and Knecht). The suggestions that a change of function may have been behind this change in pottery is intriguing and plausible. In addition to Anderson's suggestion that early pottery may have been primarily for ceremonial use, I might suggest that a shift could have occurred from the preparation of soups (as high-valued foods) in pointed pottery forms, to a later dominant use of pots for rendering blubber into oil. The implicit use of design theory concepts provides important approaches for understanding pottery developments in these papers, but the approaches can be further refined and augmented by adopting a more explicit design theoretical approach and dealing

with all design factors as outlined in Hayden (1998). These authors have begun the process, but it could be improved by developing the advantages and disadvantages for each alternative strategy (stone bowls, wood bowls, hide or bark containers and non-container strategies). This would be critical not only in understanding why pottery was adopted by certain northern groups, but as several authors have emphasized, understanding why pottery was not adopted or used by other contemporaneous sites or groups in the north, issues raised by Uchiyama, Vetrov and Hommel, Admiraal and Knecht. If pottery was primarily used for producing oils, the availability in abundance of lipid-rich fish or animals (as well as other factors such as availability of clay, soapstone and wood) may be key factors in explaining distributions as suggested by these authors. Mobility may not be as much of a constraint as sometimes assumed since pottery could have been cached at repeatedly used sites as suggested by Deal et al. The use of smaller vessels containing about a liter of liquid, noted by Vetrov and Hommel, Uchiyama, Deal et al., Anderson, and Admiraal and Knecht, need to be explored further. Were these for reheating oils (solidified in winter) or for consumption of soups in individual portions (as perhaps used in the later, more elaborate Jomon pots), or were they really used for initial processing of foods on small scales? The reporting of pottery vessels 100–200 cm in diameter by Anderson is exceptional and baffling, especially given the production constraints noted by chapters dealing with the Arctic. As outliers, they should be dealt with as special but very interesting cases.

While the ethnographic literature of northern groups concerning pottery use seems to have been covered fairly thoroughly, this should be expanded to include the study of other container technologies of fiber, bark, wood, stone and skin, as well as important ethnographic accounts of lipid extraction, value, scale and use, especially where containers with capacities of 8–12 liters are involved as part of the process of extraction or refinement. In general, I suggest that more attention needs to be made to the various container sizes represented by pottery and what small versus medium versus large containers imply about the types and quantities of foods being processed for different sizes of social groups, and by implication, the social contexts.

The ethnographies continue to be opaque about precise circumstances under which meat or fish was cooked rather than eaten raw in the north, so that continued experimentation remains a fertile area to pursue in future research. A similar situation was reported in California where pottery vessels were used for cooking, but “their purposes must have been special, since the ordinary cooking of the Yokuts is as regularly performed in baskets as among other groups” (Kroeber 1925: 537). Anderson’s reading of the ethnographic record concerning the ceremonial use and status of pottery in the Arctic is particularly revealing in this regard, and may form the basis for a radical reinterpretation of Arctic pottery. The conclusions concerning thin-walled

vessels with pointed bases for direct heating versus thick-walled, flat-bottomed vessels for stone boiling are particularly insightful, as is the critical observation by Gjesfjeld that rendering blubber is best undertaken at temperatures of 60–88 degrees, and that stone boiling is best for controlling temperatures below boiling points. The determinations of the nutritional value of uncooked meat compared to cooked meat, as well as the experimental studies of the comparative heating efficiencies of soapstone bowls versus clay pots undertaken by Frink and Harry, are also fundamental experimental approaches for understanding developments in the Arctic and perhaps elsewhere. One hopes that these research avenues will continue to be pursued.

One poorly developed research area in northern regions involves the transformations of initial pottery roles to subsequent roles. Under the socio-political model of initial pottery development, pottery would have been used first for either serving prestige foods or preparing them, a scenario suggested by Anderson. Once pottery technology was perfected, it could then be adapted to other uses such as daily cooking, lighting or storage. Gjesfjeld creates a false dichotomy between pottery used for feasting (only finely made serving wares), and pottery used for normal cooking (only coarse wares). Like Pearson (2005), he fails to take into account the fact that pottery used to prepare special foods for feasts would not need to exhibit finely made characteristics and could superficially resemble ordinary cooking vessels.

In contrast to the socio-political model of pottery evolution, the subsistence model for the origins of pottery postulates that initial pottery was utilitarian and once the technology was developed for basic needs, it later was refined and adapted for use in prestige contexts for prestige purposes. Whichever pathway one favors – the socio-political or the subsistence origins – the trajectory of added functions from initial development to historic varieties of use should be carefully charted.

Integrating DNA analysis into the study of residues should also be a future priority, not only for pottery, but also for fire-cracked rock and stone vessels. The issue of nut oil production needs to be examined in greater depth, especially in cases where vegetative markers are present in pottery residues. Questions as to how pollen became incorporated into any residues also need to be addressed, since mature dry grains traded from distant locations theoretically should not have contained any pollen, which only occurs in the very earliest stages of plant flowering rather than with ripe seeds.

In sum, this is an exciting time to be doing research into the early development and use of pottery by hunter-gatherers in the north. The chapters in this volume epitomize that excitement and have made a valuable contribution to the entire discipline, especially for understanding fundamental features of basic technological changes, with implications that extend far beyond northern regions.

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