Proceedings of the Prehistoric Society 88, 2022, pp. 25–52 © The Author(s), 2022. Published by Cambridge University Press on behalf of The Prehistoric Society. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.
doi:10.1017/ppr.2022.12 First published online 17 November 2022

Light Production by Ceramic Using Hunter-Gatherer-Fishers of the Circum-Baltic

By HARRY K. ROBSON[1], ALEXANDRE LUCQUIN[1], MARJOLEIN ADMIRAAL[1], EKATERINA DOLBUNOVA[2], KAMIL ADAMCZAK[3], AGNIESZKA CZEKAJ-ZASTAWNY[4], WILLIAM W. FITZHUGH[5], WITOLD GUMIŃSKI[6], JACEK KABACIŃSKI[4], ANDREAS KOTULA[7], STANISŁAW KUKAWKA[3], ESTER ORAS[8], HENNY PIEZONKA[9], GYTIS PILIČIAUSKAS[10], SØREN A. SØRENSEN[11], LAURA THIELEN[12], GÜNTER WETZEL[13], JOHN MEADOWS[14], SÖNKE HARTZ[15], OLIVER E. CRAIG[1] *and* CARL P. HERON[2]

Artificial illumination is a fundamental human need. Burning wood and other materials usually in hearths and fireplaces extended daylight hours, whilst the use of flammable substances in torches offered light on the move. It is increasingly understood that pottery played a role in light production. In this study, we focus on ceramic oval bowls, made and used primarily by hunter-gatherer-fishers of the circum-Baltic over a c. *2000 year period beginning in the mid-6th millennium cal* BC. *Oval bowls commonly occur alongside larger (cooking) vessels. Their function as 'oil lamps' for illumination has been proposed on many occasions but only limited direct evidence has been secured to test this functional association. This study presents the results of molecular and isotopic analysis of preserved organic residues obtained from 115 oval bowls from 25 archaeological sites representing a wide range of environmental settings. Our findings confirm that the oval bowls of the circum-Baltic were used primarily for burning fats and oils, predominantly for the purposes of illumination. The fats derive from the tissues of marine, freshwater, and terrestrial organisms. Bulk isotope data of charred surface deposits show a consistently different pattern of use when oval bowls are compared to other pottery vessels within the same assemblage. It is suggested that hunter-gatherer-fishers around the 55th parallel commonly deployed material culture for artificial light production but the evidence is restricted to times and places where more durable technologies were employed, including the circum-Baltic.*

Keywords: prehistory, circum-Baltic, hunter-gatherer-fishers, ceramic containers, North America, stone lamps, organic residue analysis, illumination, aquatic fats

[1]BioArCh, Department of Archaeology, University of York, York, YO10 5DD, UK
[2]Department of Scientific Research, British Museum, London WC1B 3DG, UK
[3]Institute of Archaeology, Nicolaus Copernicus University, Szosa Bydgoska 44/48, 87–100 Toruń, Poland
[4]Institute of Archaeology & Ethnology, Polish Academy of Science, Sławkowska 17, 31–016 Kraków, Poland
[5]National Museum of Natural History, Smithsonian Institute, 1000 Madison Drive NW, Washington, DC 20560, USA
[6]Institute of Archaeology, University of Warsaw, Krakowskie Przedmieście 26/28, 00-927 Warsaw, Poland
[7]Brandenburg Authorities for Heritage Management & Archaeological State Museum, Wünsdorfer Platz 4–5, D-15806 Zossen, Germany
[8]Institute of History & Archaeology and Institute of Chemistry at the University of Tartu, 18 Ülikooli St, 50090 Tartu, Estonia
[9]Institut für Ur- und Frühgeschichte, Christian-Albrechts-Universität zu Kiel, Johanna-Mestorf-Straße 2–6, D-24118 Kiel, Germany
[10]Lithuanian Institute of History, Tilto St 5, Vilnius 01101, Lithuania
[11]Museum Lolland-Falster, Frisegade 40, 4800 Nyk. F., Denmark
[12]Archäologisches Institut, Edmund-Siemers-Allee 1, Westflügel, 20146 Hamburg, Germany
[13]Saarbrücker Str. 5a, 03048 Cottbus, Germany
[14]Centre for Baltic & Scandinavian Archaeology (ZBSA), Schleswig-Holstein State Museums Foundation, Schloss Gottorf, Schlossinsel 1, D-24837 Schleswig, Germany
[15]Stiftung Schleswig-Holsteinische Landesmuseen, Schloss Gottorf, D-24837 Schleswig, Germany

There is a growing interest in the archaeology of light production (eg, Monteith *et al*. 2022; Papadopoulos

& Moyes 2022). The power to illuminate one's surroundings quickly, safely, and efficiently is often taken for granted but this must have been a key challenge faced by our prehistoric ancestors. The timing of the controlled use of fire is a key question in human evolution. Fire, generating heat and light, extended daylight hours, provided warmth and protection, and enabled technological developments, such as cooking food and producing adhesives for hafting (Roebroeks & Villa 2011). As a focal point for social interaction and cohesion, fires also connected people.

Over time, new resources were used to produce light and heat, as in the case of flammable materials used as torches. Material culture has played an increasing role. Objects used in the production of sustained light, initially through lamps fashioned from stone with fuel and a wick, developed during the Palaeolithic (de Beaune 1987; Pettitt *et al.* 2022). These lamps were widely used in the Eurasian Middle–Upper Palaeolithic when cave art flourished and experimental investigations have confirmed the efficacy of these vessels compared to other forms of illumination (Medina-Alcaide *et al.* 2019). The ability to illuminate one's surroundings while on the move probably also facilitated hunting and fishing of a wide range of nocturnal animals.

One class of portable artefact, namely stone and ceramic lamps, has been directly associated with illumination. Perhaps the best examples are those used by Arctic populations, which are well-documented in archaeological, ethnographic, and historical accounts (eg, Hough 1898; de Laguna 1940; Grønnow *et al.* 2014). In the western North American Arctic, the oldest stone lamp was found on Kodiak Island and is associated with the Ocean Bay I tradition (from *c.* 7500 cal BP; Clark 1966; 2001). Although there is a possible specimen dating to the early stage of the Anangula tradition (*c.* 9000–7000 cal BP) on the Aleutian Islands, this has not been verified (McCartney & Veltre 1996). By contrast, ceramic lamps were introduced during the Norton and Old Bering Sea cultures (*c.* 2500–1300 cal BP) throughout western and northern Alaska for heat and light (Collins 1937; Giddings 1964; Dumond 1969; Griffin 1970).

In the northern North American Arctic, soapstone lamps appeared during the ASTt-derived Paleoinuit tradition Saqqaq culture (*c.* 2500–800 BC) (Grønnow *et al.* 2014, 403) as small round lamps and continued to be used by Late Paleoinuit Dorset communities (*c.* 800 BC–AD 1300), and by the following Thule culture (*c.* AD 600–1500). Ceramic vessels, some of which may have been lamps, appeared briefly in the early Thule culture in the eastern Arctic and then disappeared. Overall, these vessels were essential for providing heat and light throughout the tundra zone where fuel was scarce, particularly during the dark winter months. In the central Canadian Arctic and Greenland, Dorset Paleoinuit perched soapstone pots on inclined rock slabs over stone lamps while Thule and Inuit cultures suspended stone pots over the flame of a soapstone lamp for rendering fat and parboiling marine mammal meat (Grønnow *et al.* 2014; Frink & Harry 2019, 158–9). Throughout south-west Alaska, however, stone lamps were used for illumination rather than for cooking, using marine mammal oil as fuel (Fitzhugh 1996). Organic residue analysis has recently demonstrated that aquatic fats or oils had been used as fuel in several stone lamps throughout the North American Arctic (Solazzo & Erhardt 2007; Admiraal *et al.* 2019).

Ceramic analogues of these stone and ceramic lamps are widely documented among hunter-gatherer-fisher communities of the circum-Baltic. In the eastern Baltic they are largely associated with Narva, Porous, and Rzucewo wares, and have been referred to as either 'oval bowls', 'shallow oblong bowls', 'elongated bowls', 'rounded bowls', 'shallow saucer-shaped vessels', 'low plates', 'oval dishes', 'prolonged bowls', or 'extended bowls' (Kilian 1955; Żurek 1954; Rimantienė 1989; 2005; Timofeev 1998; Bērziņš 2008; Saltsman 2013; Heron *et al.* 2015; Kriiska *et al.* 2017; Oras *et al.* 2017). Others have used the term 'boat-shaped', 'bowl-type', or 'navicular' vessels (Loze 1988; Girininkas 1994; Saltsman 2016). In the western Baltic, the designation of these shallow oval bowls as 'blubber lamps' is in fact directly based on analogy with ethnographic parallels from the Arctic (Mathiassen 1935), while Mathiassen (1935), Clark (1936), and Andersen (1994–1995) have also referred to these vessels as 'elongated bowls', 'oval saucers', and 'oval bowls' respectively. Given their broadly similar form throughout the circum-Baltic (Fig. 1), the term 'oval bowl' is used in this study. To date, a limited number of chemical analyses have been conducted on these vessels. Some of these have yielded heat-alteration markers derived from aquatic fats that are presumed to have been combusted (Heron *et al.* 2013; 2015; Oras *et al.* 2017; Papakosta *et al.* 2019). However, systematic analysis of these intriguing artefacts over their distribution range throughout the circum-Baltic in particular is so far lacking.

The aims of our current study are three-fold: 1) to document the spatial distribution, frequency, mode of

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

Fig. 1.
Two of the oval bowls sampled in this study. Note the similarities in form despite being recovered from sites situated in Denmark (A: Ronæs Skov; Fd. Nr. BFE) and Lithuania (B: Šventoji 6; Fd. Nr. 17h). Scale: 5 cm (photographs by Gytis Piličiauskas and Harry K. Robson; composite by Harry K. Robson)

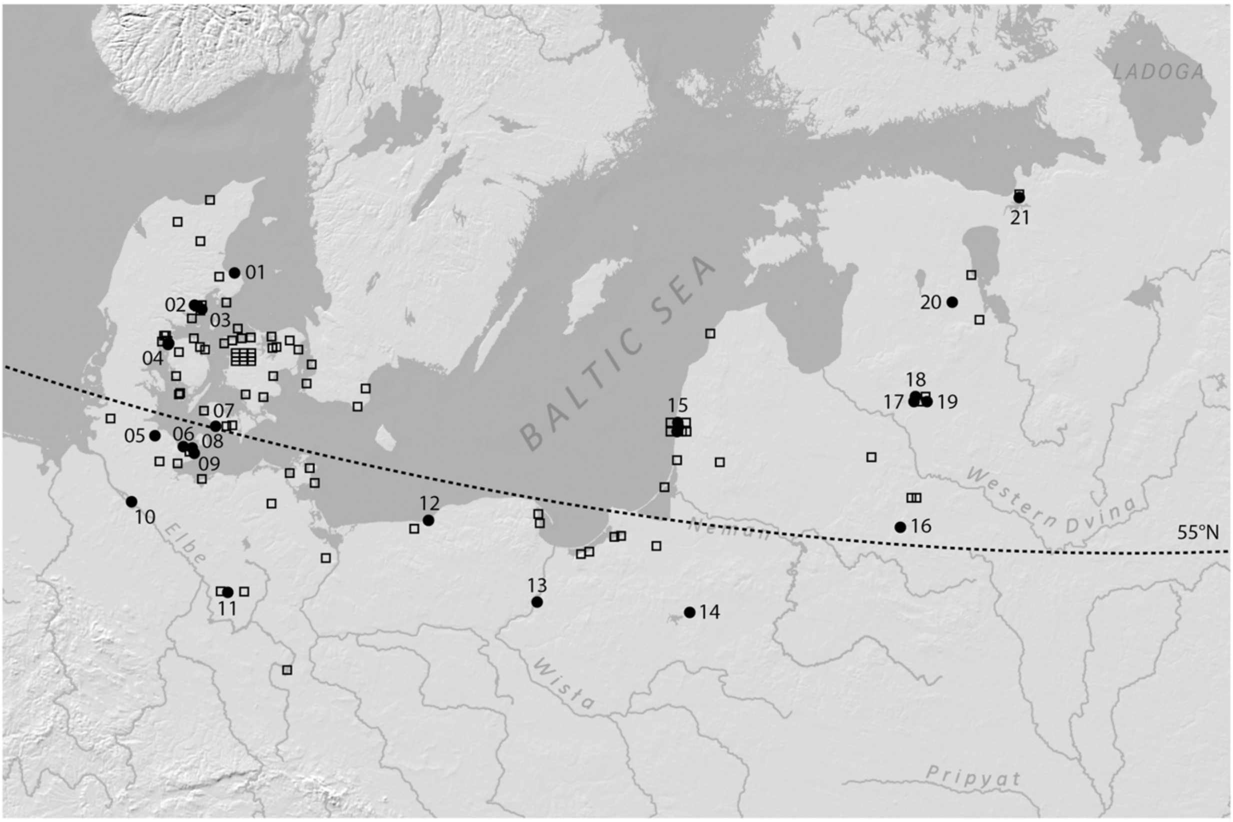
deposition, and manufacture of oval bowls in the circum-Baltic; 2) to determine the temporal range of their production and use; and 3) to determine the contents and patterns of oval bowl use from across the region. For the latter, chemical analysis of 115 oval bowls from 25 sites in the circum-Baltic was undertaken and compared alongside molecular and isotopic data from larger pots, many with S-shaped wall profiles and pointed bottoms, which co-occur with the oval bowls and had likely been used for cooking. These data are supplemented with the analysis of a small number of stone lamps from the North American Arctic.

WHERE ARE THEY FOUND?

The majority of sites where oval bowls have been found in the circum-Baltic fall around the 55th parallel. The site of Speichrow 10 in north-eastern Germany is the southernmost find, at 52° north (Wetzel 2021). Oval bowls have a broad geographic range in the circum-Baltic region with findspots in modern-day Estonia, Latvia, Lithuania, Kaliningrad Oblast, northern and north-eastern Poland, northern and north-eastern Germany, Denmark, and southern Sweden (Fig. 2). Oval bowls commonly co-occur with other vessel types, including cooking pots. One hundred and twelve oval bowl find sites have been documented (Table S1) from a range of environmental settings, periods, and pottery-making traditions. These locations appear to be closely associated with waterways, including former water bodies. The majority of sites ($n = 68$; 526 vessels) are located on or near the coast,[1] including estuaries, fjords, inlets, islets, and lagoons, although an appreciable number of inland localities ($n = 44$; 247 vessels) have yielded oval bowls, mostly associated with riverine and lacustrine settings.

There are fewer sites with oval bowls in the eastern ($n = 26$) than the western Baltic ($n = 76$), although this may be partly explained by a longer research history and differing excavation priorities in the latter region. Moreover, ten sites are known in modern-day Poland, which is somewhat of a borderland between the two regions. Despite this, at the time of writing there are more oval bowl sherds in the eastern Baltic ($n = 437$) compared to the western Baltic ($n = 245$) and Poland ($n = 91$).

Oval bowls, often found as single vessels, occasionally occur in hunter-gatherer-fisher pottery assemblages east of the circum-Baltic. Some have been recognised at sites in north-west Russia, eg, Veksa 3, the Middle Volga basin, eg, Kalmykovka I, in western Siberia, eg, Barsova Gora II/17 and IV/5, and the Urals, eg, Kushnikovo 8 (Chemyakin 2008; Dubovtseva 2015; Piezonka *et al.* 2016; Andreev *et al.* 2016). An 'elongated' vessel from Rakushechny Yar in south-west Russia (Bondetti *et al.* 2021a) may represent the most southern example from such a context.[2] To the west of the circum-Baltic no evidence of oval bowls has come to light. This includes the ceramic-using hunter-gatherer-fisher Swifterbant culture that was distributed throughout Belgium, western Germany and the Netherlands, dating from the late 6th to the mid-4th millennium cal BC (Menne & Brunner 2021).



● *Sampled sites*

01. Meilgaard	06. Wangels	10. Hamburg-Boberg 15 & 15-east	14. Szczepanki 8	18. Osa
02. Ringkloster	07. Syltholm II & XIII	11. Friesack	15. Šventoji 4 & 6	19. Ića
03. Flynderhage	08. Grube-Rosenhof	12. Dąbki 9	16. Kretuonas 1B	20. Kääpa
04. Ronæs Skov & Tybrind Vig	09. Siggeneben Süd	13. Wełcz Wielki 10B	17. Zvidze	21. Narva Joaorg
05. Kiel-Ellerbek				

Fig. 2.
Map showing the sites sampled in this study (closed black circles) as well as known oval bowl bearing sites (open black squares) throughout the circum-Baltic. All sites are listed in Table S1 (Harry K. Robson)

Oval bowls are found at settlement sites throughout the circum-Baltic (Table 1). Many examples appear to have been discarded near or within hearths and/or alongside other forms of material culture (ie other ceramics, lithics, bone and antler tools), within cultural layers, refuse zones, or dwelling structures (Jaanits 1965; Loze 1988; 1992; Rimantienė 2005; Bērziņš 2008; Hartz 2011; Kotula 2015). In the western Baltic, they are also frequently recovered from submerged contexts but are seldom found in shell middens.

Several examples, notably from Denmark, were recovered from the seafloor (Mathiassen 1935; Andersen 2009) and may have been accidentally lost from a dugout canoe during fishing ('eel-flaring') and/or sealing at night (Hulthén 1977; 1980). Alternatively, their presence at these locations may indicate erosion from a cultural layer or refuse zone of now submerged deposits. They are frequently recovered from wetland areas, including peat bogs, rivers, and lakes, and are often single/stray finds, such as those from Kongemose, Nøddekonge,

TABLE 1: FIND SPOTS OF OVAL BOWLS ACCORDING TO SITE TYPE IN THE CIRCUM-BALTIC

Site type	*No. sites*	*No. oval bowl sherds*
Open-air settlement site	87	712
Open-air shell midden	12	15
Submerged find spot or settlement site	13	46
Totals	112	773

Præstelyngen, Spangkonge, and Åkonge in Denmark (Fischer 1986; 2002; Fischer & Asmussen 1988; Andreasen 2002), or in considerable numbers (Rimantienė 2005; Hartz 2011; Kotula 2015) which may imply further meaning and/or ascribed status. The single/stray finds may indeed represent votive offerings (or *ad hoc* accidental loss) as has been suggested for the so-called ‘bog pots’ of the Funnel Beaker culture (Koch 1998; Robson *et al.* 2021).

There is an uneven distribution of oval bowls in the circum-Baltic. They are rare or even absent at many sites; at others they are recovered in substantial numbers (Andersen 2010; 2011; Kriiska *et al.* 2017). Although 112 sites throughout the circum-Baltic have yielded oval bowls, quantitative data is only available for 87 sites (Table S1). The majority ($n = 57$) are represented by 1–3 oval bowl sherds per site. A further 23 sites are represented by between four and 16 oval bowl sherds per site, whilst only seven sites have between 29 and 114 oval bowl sherds. The occurrence of oval bowls may be under-represented in highly fragmented assemblages since the body sherds can often be difficult to distinguish from those of other vessels.

The frequency of both oval bowl sherds and other pottery containers for several of the sampled sites is compiled in Table 2. The contribution of oval bowl sherds to the ceramic assemblages for the eight sites is low, ranging from 0.2% to 9.5% and rarely exceeding *c.* 6%. The low number of oval bowls compared to other vessel types may be explained by differences in use-life. According to Bērziņš (2008, 165), oval bowls were ‘subject to much less stress than cooking pots and so would probably have had a longer use life, a factor that could explain their relatively low frequency’. Moreover, taphonomic processes, especially fragmentation, are likely to have affected both their distribution, frequency, and recovery.

HOW WERE THEY MADE?

Oval bowls were made by one of two means, either by pinching from a lump of clay or via a combination of pinching and coiling, including the N-technique (van Diest 1981; Bērziņš 2008; Glykou 2010). There are, however, differences in terms of the raw materials used which appear to be regional but may indeed be temporal. In the eastern Baltic, clay was tempered with crushed shells, plants, rock debris, and/or sand while, in the western Baltic, clay was tempered with feldspar/quartzite, lime, plants, and/or sand (Hulthén 1977; Kriiska 1996; Dumpe *et al.* 2011; Povlsen 2014; Kriiska *et al.* 2017).

In general, the bowls have an oval, elliptical, oblong, or rounded outline terminating in a pointed or rounded end (Fig. 3). In cross-section their bottoms are usually slightly rounded, although some examples with flat bottoms exist (Andersen 2010; 2011). In the eastern Baltic in particular, Rzucewo Ware oval bowls tend to be flat-bottomed. Whilst their walls are straight, they often possess handles or knobs on their sides (Kilian 1955; Żurek 1954; Rimantienė 2005; Bērziņš 2008). The Rzucewo Ware oval bowls are chronologically younger and are assumed to have been inherited from the preceding Narva culture (see below). The bowls vary in size, from *c.* 6–30 cm in length and, *c.* 2–15 cm in width, although there seems to be no fixed relationship between length and width in western Baltic forms (Povlsen 2014, 148). The walls of the oval bowls are low, with heights not usually greater than 5.5 cm (Prangsgaard 1997[1992], 37; Glykou 2011, 184).

Oval bowls in the eastern Baltic are often decorated on their rims and interiors and include oblique hatches/incisions that were made by a sharp-edged implement, indistinct ‘knot’ impressions, and parallel pitted lines (Timofeev 1998; Bērziņš 2008; Kriiska *et al.* 2017). Floral designs are known from several vessels from the Narva culture sites of Osa and Žemaitiškė 3B in Latvia and Lithuania respectively (Girininkas 1994), while ornamentation is infrequent in the western Baltic (Clark 1936; Andersen 2010; 2011; Povlsen 2014). Occasional finger or finger-nail impressions have, however, been recorded, which are sometimes present along the rim (eg, Fig. 3, D). Indeed, this may be the result of the production process used, ie, pinching and/or coiling (see Glykou 2011). Unusually, at Dąbki 9 in northern Poland *c.* 50% of the oval bowls are decorated (Kotula 2015).

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

TABLE 2: FREQUENCY OF OVAL BOWL SHERDS VS SHERDS FROM OTHER FORMS OF CERAMIC CONTAINERS FOR SEVERAL OF THE SAMPLED SITES IN THIS STUDY

Site name	*Location*	*Pottery-making tradition*	*No. oval bowl sherds*	*No. vessel sherds*	*% oval bowl sherds within assemblage*
Eastern Baltic					
Zvidze	Inland	Narva	40	1896	2.1
Western Baltic					
Dąbki 9	Inland	Late Mesolithic–early Funnel Beaker	87	<1700	>5.1
Grube-Rosenhof	Coastal	Ertebølle	70	<1060	>6.6
Hamburg-Boberg 15-east	Inland	Friesack-Boberg	2	30	6.7
Ronæs Skov	Coastal	Ertebølle	14	504	2.8
Siggeneben-Süd	Coastal	Ertebølle	4	1639	0.2
Tybrind Vig	Coastal	Ertebølle	4	823	0.5
Wangels	Coastal	Ertebølle–early Funnel Beaker	19	<200	>9.5

Sources: Meurers-Balke (1983); Loze (1988); Andersen (2009; 2013); Hartz (2011); Prangsgaard (2013); Kotula (2015); Thielen & Ramminger (2015)

In a comparison of oval bowls from the western (Grube-Rosenhof in northern Germany) and eastern Baltic (Sārnate in Latvia), Dumpe *et al.* (2011, 432–3) highlighted differences in fabric and morphology. Nevertheless, the presence and distribution of carbonised surface deposits on both vessel types indicated a common pattern of use (see below). They suggest that the oval bowls represent a widespread functional type that was shared by different pottery-making traditions.

WHEN DID THEY APPEAR?

The first appearance of oval bowls in the circum-Baltic is uncertain. Although there is a lack of direct dates on these vessels from north-west Russia and the eastern Baltic, oval bowls are synchronous with the large pots with pointed bottoms of the Narva culture in the eastern Baltic (Fig. 4) which emerged during the late 6th–5th millennium cal BC (Liiva & Loze 1993; Timofeev 1998; Piezonka 2012; 2015; Piezonka *et al.* 2016; Kriiska *et al.* 2017; Courel *et al.* 2020). Several centuries later, from the mid–late 5th millennium cal BC, similar shaped vessels are found in northern Poland and the western Baltic (Fig. 4), concordant with the Late Mesolithic ceramic phase at the site of Dąbki 9 and the late phase of the Ertebølle culture of northern Germany, Denmark, and southern Sweden respectively (Hallgren 2004; Andersen 2010; 2011; Brinch Petersen 2011; Povlsen 2014; Kotula 2015; Courel *et al.* 2020).

Oval bowls are also known from several sites attributed to the Friesack-Boberg Group in northern and north-eastern Germany (Fig. 4; Table S1), which is an adjacent hunter-gatherer-fisher pottery tradition in the western Baltic dating from the mid-5th to the mid-4th millennium cal BC (Kotula *et al.* 2015; Wetzel 2015; 2021; Thielen 2020; Wetzel & Beran forthcoming). Although it is generally assumed that production ceased with the introduction of agriculture in the western Baltic (*c.* 4000 cal BC) and adjoining regions, oval bowls are sometimes found alongside early Funnel Beaker ceramics or other forms of material culture (eg, Dąbki 9 and Wełcz Wielki 10B in northern Poland, Baabe, Siggeneben-Süd, and Wangels in northern Germany, and Syltholm II and XIII in Denmark) and may have been inherited from the potters of the preceding Late Mesolithic. Despite this, unclear stratigraphy has precluded a definitive chronological assignment. The two examples from Dąbki 9 in northern Poland, however, displayed decoration in the form of a single row of irregular stamps on the edge of the rim (Fig. 5), bearing similarities with vessels of the early Funnel Beaker culture at the site, and were manufactured differently than other oval bowls in the ceramic assemblage (Czekaj-Zastawny & Kabaciński 2015; Kotula 2015).

There are, however, no known examples throughout the entire region that are securely dated to the mid-4th millennium.[3] Then, they 're-appear' in the eastern Baltic at the end of the 4th millennium and

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

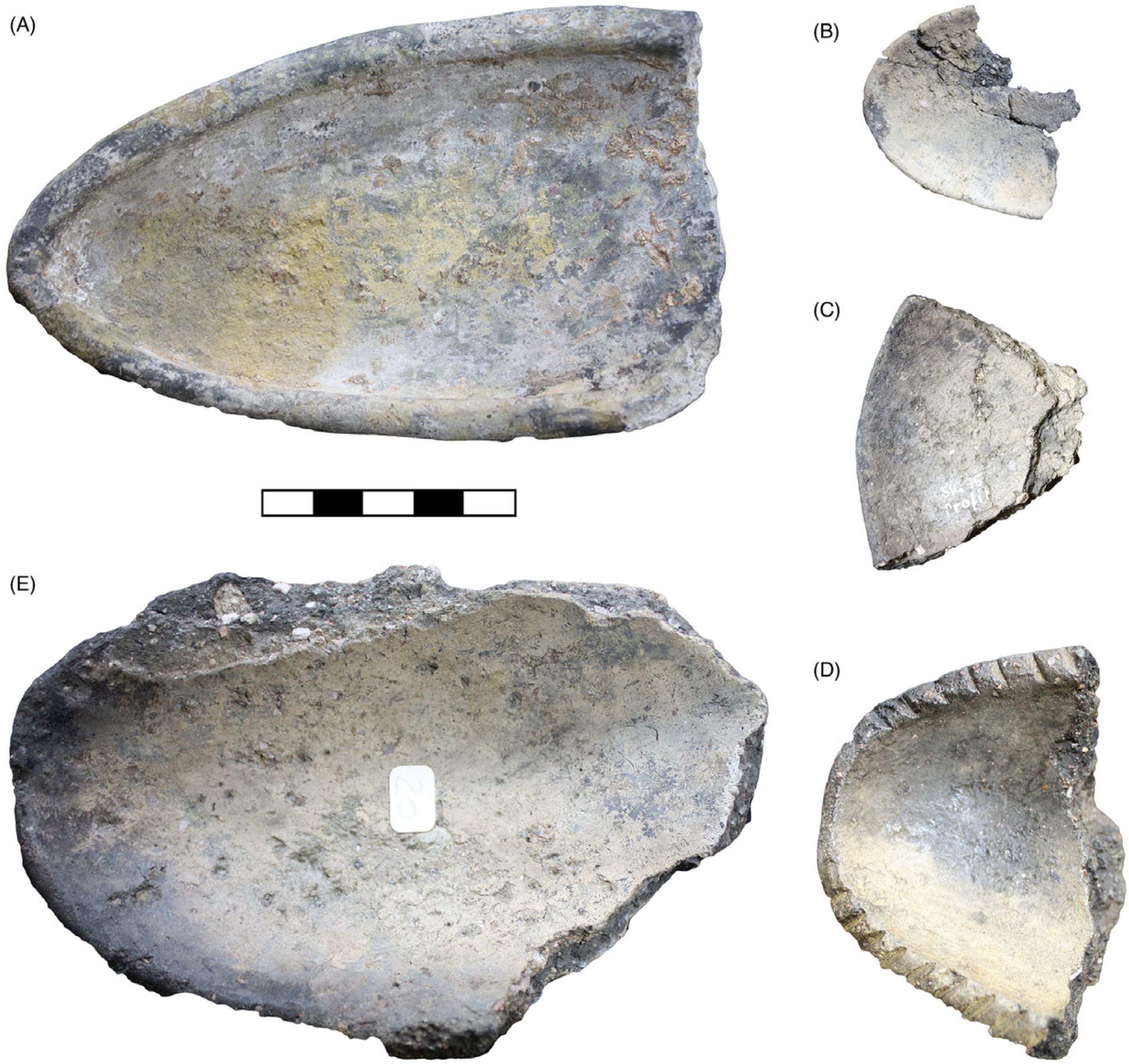


Fig. 3.
A selection of oval bowls dating to the Ertebølle culture of the western Baltic: A. Wangels (old excavation; Fd. Nr 1); B. Wangels (Fd. Nr 753; KE492); C. Siggeneben-Süd (SIG'75; profil); D. Grube-Rosenhof (1970; Sud gr. 1, 6d; Fd.-Nr 273); E. Wangels (Fd. Nr 317; KE20). Scale: 5 cm (photographs and composite by Harry K. Robson)

remain in use until the first half of the 3rd (Fig. 4). In general, these later examples (from eg, Sārnate in Latvia and the Šventoji sites in Lithuania) are associated with the coastal hunter-gatherer-fisher communities using Narva Ware/Porous Ware ceramics, which are technologically different to the earlier examples in the eastern Baltic (see Piličiauskas *et al.* 2019, fn. 2). Oval bowls are also known from contexts associated with Rzucewo Ware pottery throughout the eastern/western Baltic boundary area (Gaerte 1927; Ehrlich 1936; Rimantienė 1989; 2005; 2016; Kabaciński *et al.* 2011; Saltsman 2013; Piličiauskas & Heron 2015). While these younger examples are assumed to have been 'inherited from the older local coastal cultures' (Rimantienė 2016, 98), the scarcity of radiocarbon dates (see below and the Supplementary

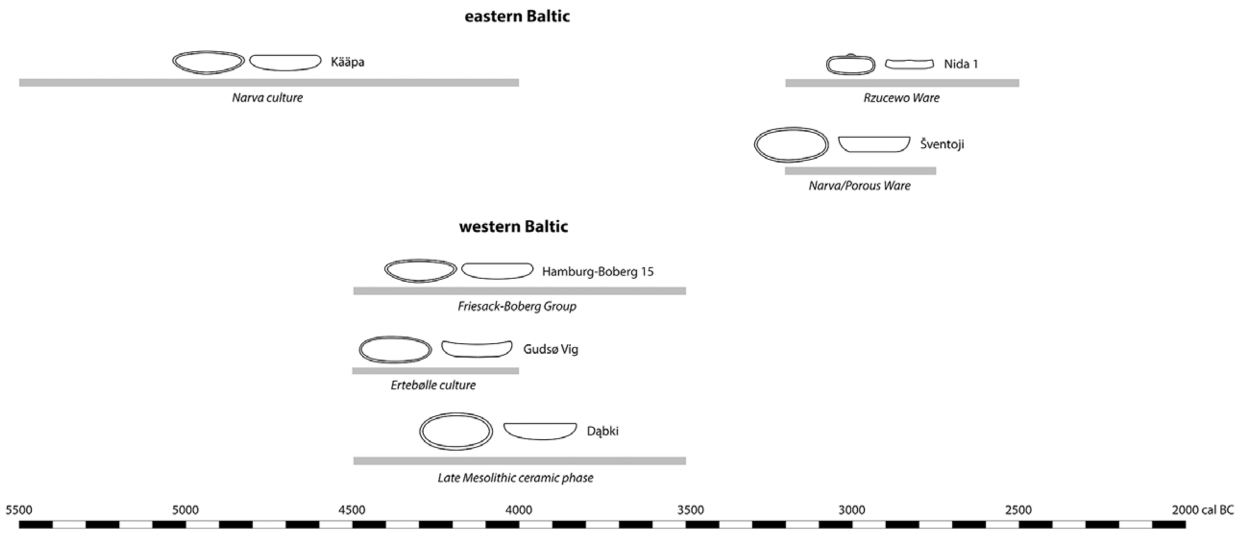


Fig. 4.
Periodisation of the oval bowls throughout the circum-Baltic, including the pottery-making traditions (italicised) and outlines of examples (Harry K. Robson)

Fig. 5.
Oval bowl with a single row of irregular stamps on the edge of the rim from Dąbki 9 in northern Poland. Scale: 5 cm (photographs by Agnieszka Czekaj-Zastawny; composite by Harry K. Robson)

Material, Appendix S1) and the low frequency of oval bowls more generally likely explain the apparent hiatus shown in Figure 4. It is conceivable that oval bowls were continuously used throughout this sequence but the evidence is currently absent in certain periods.

A total of 14 radiocarbon dates are known from carbonised surface deposits adhering to oval bowls found at sites in the western Baltic (Table S2). Without making any allowance for radiocarbon reservoir effects, these bowls appear to date mainly to the second and third quarters of the 5th millennium cal BC. If it is assumed that most of the carbon extracted for dating was derived from aquatic organisms, these dates are misleadingly early. A more realistic interpretation places the earliest dates in the third quarter of the 5th millennium, while most date to the earlier 4th millennium (Fig. S1). Full details of the dating methods employed are outlined in Appendix S1.

HOW WERE THEY USED?

Regardless of location and/or vessel size, the interior and exterior surfaces of the oval bowls are often coated with carbonised deposits. These deposits are frequently found on the ends and along the rims (Vankina 1970; Andersen 2011; Dumpe *et al.* 2011; Povlsen 2014). Occasionally, either broken or cracked oval bowls have been found (eg, Gudsø Vig, Kolding Fjord, Ronæs Skov, and Teglgård-Helligkilde in Denmark) and the charring present indicates that they continued to be used during this event or were used afterwards (Andersen 2009; 2011). One oval bowl from the site of Sārnate in Latvia had a drilled perforation which indicated to Bērziņš (2008) that it had been repaired by crack-lacing. Oval bowls are usually black, brown, and grey in colour but some examples with a red tan have been identified (Mathiassen 1935; Andersen 2011).

Whilst internal protuberances or ridges functioning as wick stands are frequently seen on North American Arctic stone lamps (de Laguna 1940), they are notably absent on circum-Baltic oval bowls, suggesting that if they were used as lamps the wick must have floated on the fuel. Despite a previous claim stating that a moss wick was in a Rzucewo Ware oval bowl from the site of Nida in Lithuania (Rimantienė 2016, 97), a re-analysis of the ceramic assemblage has not corroborated the finding. Since the majority of stone lamps in the North American Arctic used moss wicks, which were sometimes mixed with cedar bark or cotton grass (Grønnow *et al.* 2014), similar combustibles may have been available and used throughout the circum-Baltic.

ORGANIC RESIDUE ANALYSIS OF OVAL BOWLS

The analysis of use-derived residues associated with ceramic vessels offers a useful approach to determine the functional properties of oval bowls (Heron *et al.* 2013; 2015; Oras *et al.* 2017; Papakosta *et al.* 2019). Lipids (ie, fats, oils, and waxes) are readily identifiable using this approach and would be expected to be the major component if the vessels had been used as 'oil lamps'. Identification of specific molecular biomarkers and comparative analysis of the isotopic characteristics of bulk charred matter or specific lipid molecules has already been widely applied to prehistoric ceramic containers from the circum-Baltic (Craig *et al.* 2011; Robson 2015; Papakosta *et al.* 2019; Courel *et al.* 2020), providing an ideal comparative dataset. Organic residue analyses of oval bowls from the circum-Baltic have been more limited (Craig *et al.* 2011; Heron *et al.* 2013; 2015; Piezonka *et al.* 2016; Oras *et al.* 2017; Papakosta *et al.* 2019).

For this study, we sampled a further 115 oval bowl sherds from 25 archaeological sites, representing a range of environmental settings throughout the region (Table 3). A key aim of the study was to explore the use of oval bowls compared to other vessels, often considered to be cooking pots, from the same or similar assemblage. These data are supplemented with examples of a small number of stone lamps from the site of Adlavik Harbour in Canada as well as Amaknak Island, Atka Island, Nunivak Island, and Kodiak Island (Uyak Bay) in Alaska.

Materials and methods

The samples analysed include powdered ceramic potsherds ($n = 63$) and carbonised surface deposits ($n = 101$), often from the same vessel (Table 3). The oval bowls were sampled from some of the earliest pottery producing sites in the region, including for instance, the Narva culture (*c.* 5500–4500 cal BC) sites of Osa and Zvidze in the eastern Baltic, and the Ertebølle culture site of Grube-Rosenhof in the western Baltic (*c.* 4500–4000 cal BC). Oval bowls were also sampled from later sites, for example those spanning the transition to agriculture in the western Baltic (ie, Siggeneben-Süd, Syltholm II and XIII, Wangels). A large collection of oval bowls associated with both the Late Mesolithic ceramic phase (*c.* 4500–4000 cal BC) and the early Funnel Beaker culture (*c.* 4000–3500 cal BC) were also sampled from the site of Dąbki 9 in northern Poland. Furthermore, several oval bowls from the eponymous sites of Friesack 4 and Hamburg-Boberg (15 and 15-east), which form the Friesack-Boberg Group (*c.* 4500–3500 cal BC) of northern and north-eastern Germany were sampled. One oval bowl from the Zedmar culture (*c.* 4500–4000 cal BC) site of Szczepanki 8 in north-eastern Poland was sampled. Since it was atypical for the ceramics of the Zedmar culture in both form and technology, it likely represents an import from the area occupied by the early farmers of the Brześć Kujawski Group of the Lengyel culture (Gumiński 2011; 2020). One early Funnel Beaker culture oval bowl from the site of Wełcz Wielki 10B in northern Poland (*c.* 3500 cal BC) was sampled and is probably a Narva culture

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

TABLE 3: SUMMARY OF THE OVAL BOWL & STONE LAMP SAMPLES ANALYSED IN THIS STUDY

Site name	*Site type*	*Approx. dates cal* BC *(unless specified)*	*Culture/ware*	*No. carbonised surface deposits*	*No. potsherds*	*Total no. samples*	*No. oval bowls*
Oval bowls							
Denmark							
Flynderhage	Coastal shell midden	4500–4000	Ertebølle	1	0	1	1
Meilgaard	Coastal shell midden	4500–4000	Ertebølle	0	1	1	1
Ringkloster	Inland waterlogged lakeshore settlement	4500–4000	Ertebølle	3	0	3	1
Ronæs Skov	Coastal submerged settlement	4500–4000	Ertebølle	10	7	17	14
Syltholm II	Coastal waterlogged settlement	4500–3500	Ertebølle–early Funnel Beaker	9	0	9	7
Syltholm XIII	Coastal waterlogged settlement	4500–3500	Ertebølle–early Funnel Beaker	2	0	2	1
Tybrind Vig	Coastal submerged settlement	4500–4000	Ertebølle	1	0	1	1
Estonia							
Kääpa	Inland waterlogged islet settlement	5000–4000	Narva	4	0	4	4
Narva Joaorg	Inland waterlogged estuarine settlement	5000–4000	Narva	0	4	4	4
Germany							
Friesack 4	Inland waterlogged lakeshore settlement	4500–3500	Friesack–Boberg	6	1	7	5
Grube-Rosenhof	Coastal waterlogged settlement	4500–4000	Ertebølle	9	5	14	11
Hamburg-Boberg 15	Inland sand dune	4500–3500	Friesack–Boberg	1	4	5	4
Hamburg-Boberg 15-east	Inland sand dune	4500–3500	Friesack–Boberg	0	2	2	1
Kiel-Ellerbek	Inland riverine settlement	4500–4000	Ertebølle	2	1	3	2
Siggeneben-Süd	Coastal waterlogged settlement	4000–3500	Ertebølle–early Funnel Beaker	4	3	7	4
Wangels	Coastal waterlogged settlement	4400–3700	Ertebølle–early Funnel Beaker	13	6	19	12
Latvia							
Ič̌a	Inland waterlogged riverine settlement	5500–4000	Narva	3	3	6	3
Osa	Inland waterlogged islet settlement	5500–4000	Narva	2	2	4	2
Zvidze	Inland waterlogged lakeshore settlement	5500–4000	Narva	5	5	10	5

(Continued)

TABLE 3: (CONTINUED)

Site name	*Site type*	*Approx. dates cal* BC *(unless specified)*	*Culture/ware*	*No. carbonised surface deposits*	*No. potsherds*	*Total no. samples*	*No. oval bowls*
Lithuania							
Kretuonas 1B	Inland lakeshore settlement	3500–3000?	Narva	0	2	2	2
Šventoji 4	Estuarine/ lagoonal waterlogged settlement	3200–2700	Narva Ware/ Porous Ware	3	0	3	2
Šventoji 6	Estuarine/ lagoonal waterlogged settlement	3200–2700	Narva Ware/ Porous Ware	5	0	5	5
Poland							
Dąbki 9	Inland waterlogged islet settlement	4500–4000	Late Mesolithic–early Funnel Beaker	18	15	33	21
Szczepanki 8	Inland waterlogged islet settlement	4500–4000	Brześć Kujawski Group	0	1	1	1
Wełcz Wielki 10B	Inland waterlogged riverine settlement	3500	early Funnel Beaker	0	1	1	1
Totals				101	63	164	115
Stone lamps							
Canada							
Adlavik Harbour	Coastal settlement	AD 1750	Inuit	1	0	1	1
United States							
Amaknak Island	Coastal midden and settlement	2400–900 cal BP	Aleutian Tradition	1	0	1	1
Atka Island	Coastal midden and settlement	2400–900 cal BP	Aleutian Tradition	2	0	2	2
Nunivak Island	Coastal ‘old Eskimo burials’	AD1700–1800	Cup’iq	2	0	2	2
Uyak Bay	Coastal midden and settlement	4000–950 cal BP	Early/Late Kachemak	2	0	2	2
Totals				8	0	8	8

influence/inspiration, whilst the Narva Ware/Porous Ware (*c*. 3200–2700 cal BC) oval bowls from the sites of Šventoji 4 and 6 in the eastern Baltic represent the youngest investigated samples.

For further comparison, eight stone lamps from five archaeological sites in the North American Arctic (Canada and the US) were sampled (Table 3). The samples include two stone lamps from the Early/Late Kachemak (*c*. 4000–950 cal BP) site of Uyak Bay on Kodiak Island, and three stone lamps from the Aleutian Tradition (*c*. 2400–900 cal BP) sites of Amaknak Island and Atka Island, all in western Alaska (Solazzo & Erhardt 2007). The youngest stone lamp samples from this region were from the 18th century AD sites of Adlavik Harbour (Labrador) and Nunivak Island (Alaska), associated with the Inuit and Cup'iq respectively (Solazzo & Erhardt 2007). Full details of the methods employed in this study are outlined in Appendix S1.

RESULTS

Elemental and bulk isotope analysis of carbonised surface deposits

Figure 6 compares the bulk carbon ($\delta^{13}C$) isotope data of carbonised surface deposits on oval bowls with those from other vessels (hereafter termed cooking pots). At the inland sites from both the eastern and western Baltic,[4] the range of $\delta^{13}C$ values of oval bowls is significantly lower than the range of $\delta^{13}C$ values of the cooking pots often from the same sites (Wilcoxon rank sum test with continuity correction $W = 2011$, $p = <0.001$), consistent with either the processing of a higher proportion of fats or oils, which are depleted in ^{13}C compared to other food constituents (carbohydrates and proteins), and/or freshwater fish, which also tend to be more depleted in ^{13}C. At these sites, it has been shown that the cooking pots were used primarily to process freshwater resources (Craig *et al*. 2007; Robson 2015; Oras *et al*. 2017; Piličiauskas *et al*. 2018; Courel *et al*. 2020), so the lower $\delta^{13}C$ values in the oval bowls are consistent with fat from freshwater tissues. A similar pattern is also evident in the oval bowls recovered from estuarine/lagoonal sites in the eastern Baltic, consistent with the processing of resources from the nearby Baltic Sea, which are also known to be depleted in ^{13}C (see Robson *et al*. 2016). In contrast, at coastal sites, a shift to higher $\delta^{13}C$ values in the oval bowls compared to cooking pots is observed (Wilcoxon rank sum test with continuity correction $W = 3324$, $p = <0.001$). All these sites are located in the western Baltic where the molecular and isotope data from cooking pots indicates that a wide range of foods was processed, including marine and freshwater as well as terrestrial animals (Craig *et al*. 2007; 2011; Robson 2015; Papakosta *et al*. 2019; Courel *et al*. 2020). Multi-source food processing in the cooking pots is reflected in the generally lower $\delta^{13}C$ values in the carbonised surface deposits, whereas the higher $\delta^{13}C$ values in the oval bowls is consistent with preferential use of fat or oil from marine resources.

Generally, carbonised surface deposits on the cooking pots contained a greater amount of nitrogen than oval bowls (Fig. 7). And the difference in the atomic ratios of carbon to nitrogen (C:N atomic) between carbonised surface deposits in the oval bowls and those from cooking pots is highly significant (Wilcoxon rank sum test with continuity correction $W = 28402$, $p = <0.001$). The elevated C:N ratios in the oval bowls are consistent with the presence of higher amounts of lipid and less nitrogen-containing proteinaceous molecules, in keeping with their notional function as 'oil lamps'. Overall, the difference in bulk $\delta^{13}C$ values combined with higher atomic C:N ratios supports the specialised function of fat or oil processing in oval bowls compared to the cooking pots in the same assemblage, confirming previous observations (Heron *et al*. 2013).

Lipid biomarker and compound-specific carbon isotope analysis

Additional analysis was undertaken to further investigate the use of the oval bowls. Gas chromatography-mass spectrometry in scanning (102 extracts) and selected ion monitoring (99 extracts) modes was used to identify extracted lipids according to established criteria for the characterisation of archaeological residues (Hansel *et al*. 2004; Evershed *et al*. 2008; Cramp & Evershed 2014; Lucquin *et al*. 2016; Bondetti *et al*. 2021b). Carbon stable isotope values ($\delta^{13}C$) of individual mid-chain fatty acids (palmitic, $C_{16:0}$ and stearic, $C_{18:0}$) were also obtained from the extracts of 59 oval bowls ($n = 70$ samples) from the circum-Baltic and eight stone lamps ($n = 8$ samples) from the North American Arctic (Table S7). This dataset was augmented with published data from 27 oval bowls ($n = 32$ samples) from the circum-Baltic and a single stone lamp ($n = 1$ sample) from the North

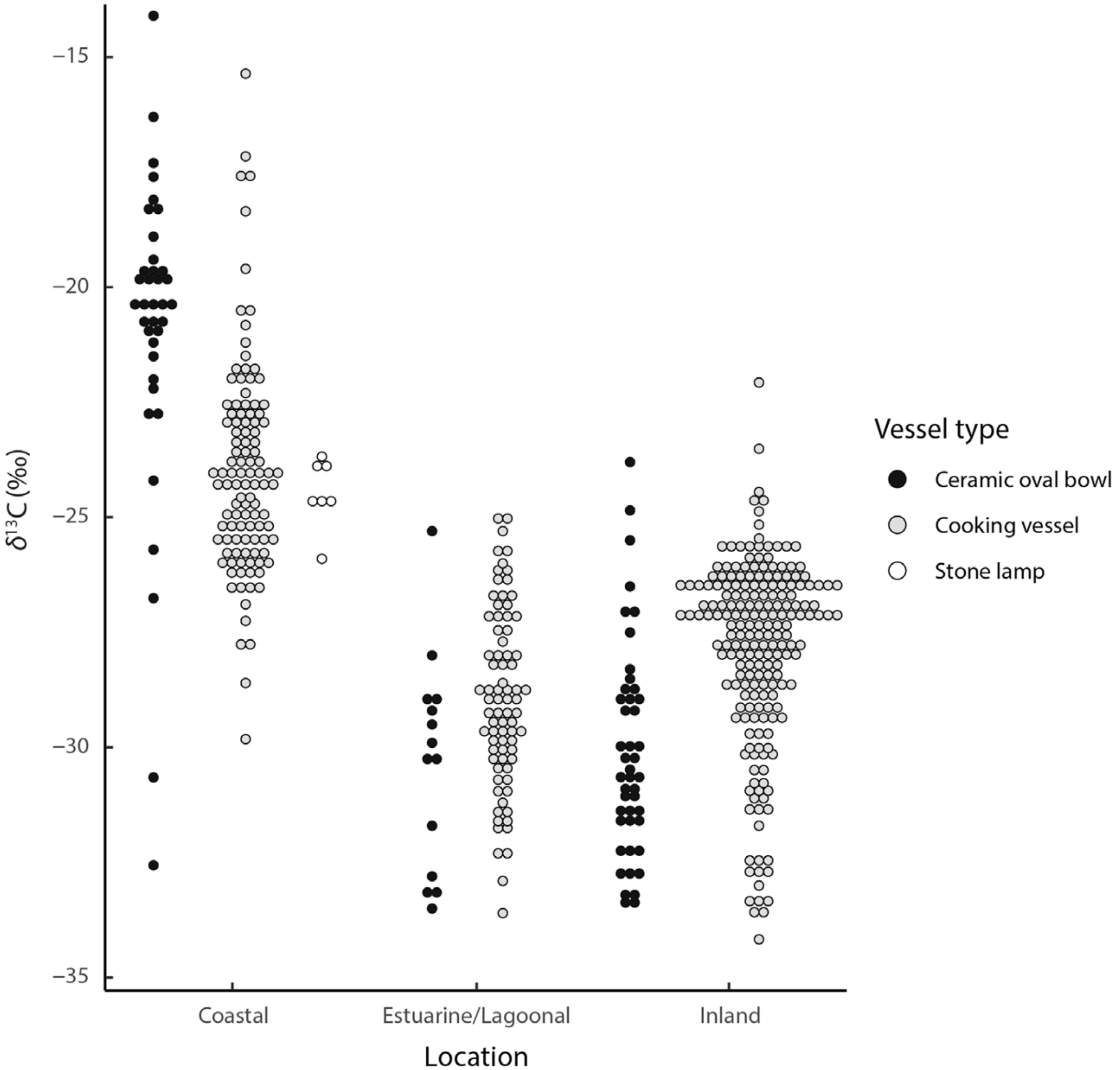


Fig. 6.
Bulk δ^{13}C isotope data obtained from carbonised surface deposits adhering to oval bowls and cooking pots throughout the circum-Baltic disaggregated according to location. Stone lamps from the North American Arctic are plotted for comparison, yielding similar δ^{13}C values to the cooking pots from the coastal sites in the western Baltic (data presented in Tables S3–S6)

American Arctic (Table S8) as well as data from contemporaneous cooking pots ($n = 426$ samples) from the circum-Baltic (Table S9). Table S10 summarises the complete molecular and isotopic dataset of the oval bowls analysed in this study.

The presence of biomarkers typically derived from heating aquatic organisms (Bondetti *et al.* 2021b) were frequently observed in both the oval bowls and cooking pots from sites in the circum-Baltic. These lipids could conceivably include fish, birds feeding on aquatic organisms, aquatic mammals, including beaver and seal, and molluscs. Figure 8 shows the distribution of ω-(*o*-alkylphenyl)alkanoic acids (APAAs) with 16, 18, 20, and 22 carbon atoms in an oval bowl

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

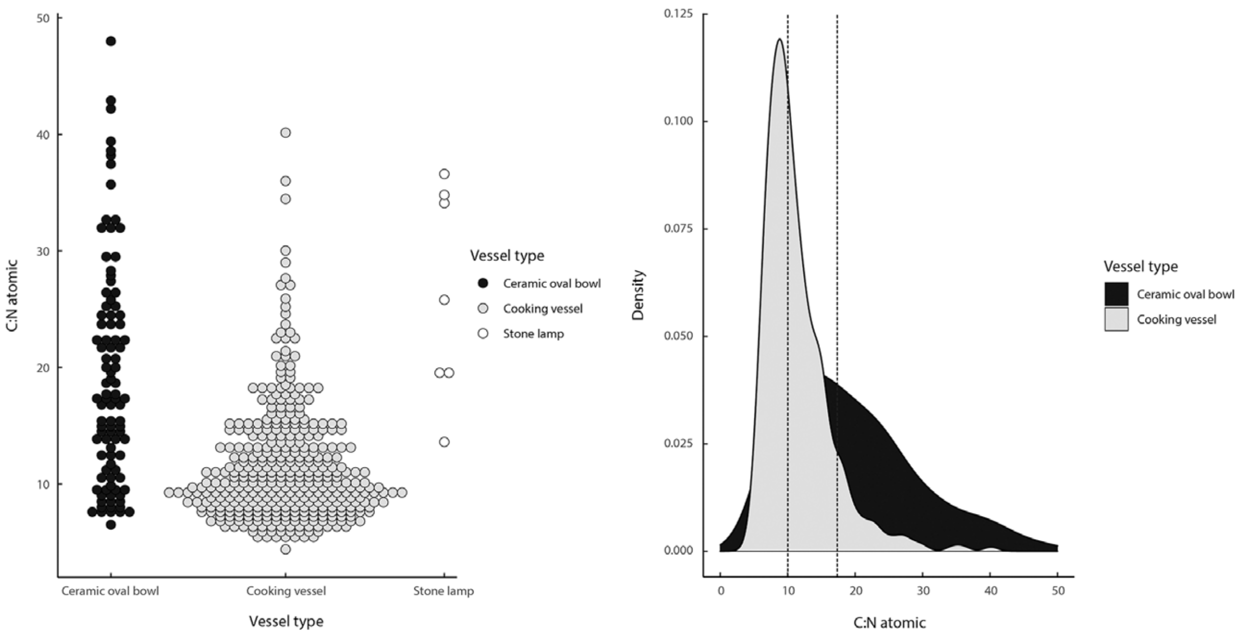


Fig. 7.
Left: atomic C:N ratio data obtained from carbonised surface deposits adhering to oval bowls and cooking pots throughout the circum-Baltic disaggregated according to location; right: kernel density estimate of C:N ratios. The dashed lines show the median values of the cooking pots (left) and oval bowls (right). Stone lamps from the North American Arctic are plotted for comparison (left), yielding similar C:N ratios to the oval bowls throughout the circum-Baltic (data presented in Tables S3–S6)

from the site of Ička in the eastern Baltic and a stone lamp from the site of Uyak Bay in the North American Arctic. These compounds form from prolonged heating of mono- and polyunsaturated fatty acids; the latter are particularly concentrated in the tissues of aquatic organisms (Cramp & Evershed 2014). Diastereomers of phytanic acid (SRR and RRR) are also shown and provide further evidence of the presence of aquatic fats (Lucquin *et al.* 2016). Regardless of the pottery-making tradition and/or environmental context (ie, coastal, estuarine/lagoonal, inland), aquatic fats were identified in a substantial proportion of oval bowls (61/91, 67.0%). Of the eight stone lamps from the North American Arctic, aquatic fats were identified in seven.

Figure 9 displays the compound-specific δ^{13}C data from oval bowls and cooking pots against statistical reference ranges (1σ) calculated from the analysis of modern authentic animal tissue samples from Eastern Europe (see Dolbunova *et al.* forthcoming). At the inland sites from both the eastern and western Baltic, the majority of samples from oval bowls and cooking pots plot within the range established for freshwater fats. These results support the bulk δ^{13}C data and reflect the site locations proximal to inland riverine and lacustrine settings. Here, then, it seems that both oval bowls and cooking pots were used for processing freshwater products but that the bowls contained a greater proportion of fats or oils than the cooking pots, confirming their different function. Despite this, some of the oval bowls and a greater proportion of cooking pots, particularly from western Baltic sites, plot within the ranges of authentic wild ruminant fats and wild non-ruminant fats, hinting at some diversity of use.

At the estuarine/lagoonal sites in the eastern Baltic, a similar pattern is evident with virtually all the samples from oval bowls plotting within the range established for freshwater fats. In contrast, the cooking pots from eastern Baltic sites in estuarine/lagoonal settings exhibit more variability plotting within the ranges of authentic freshwater fats, wild ruminant fats, and wild non-ruminant fats. However, a focus on the processing of aquatic resources in these vessels is supported by the presence of aquatic biomarkers in many of the samples (Heron

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

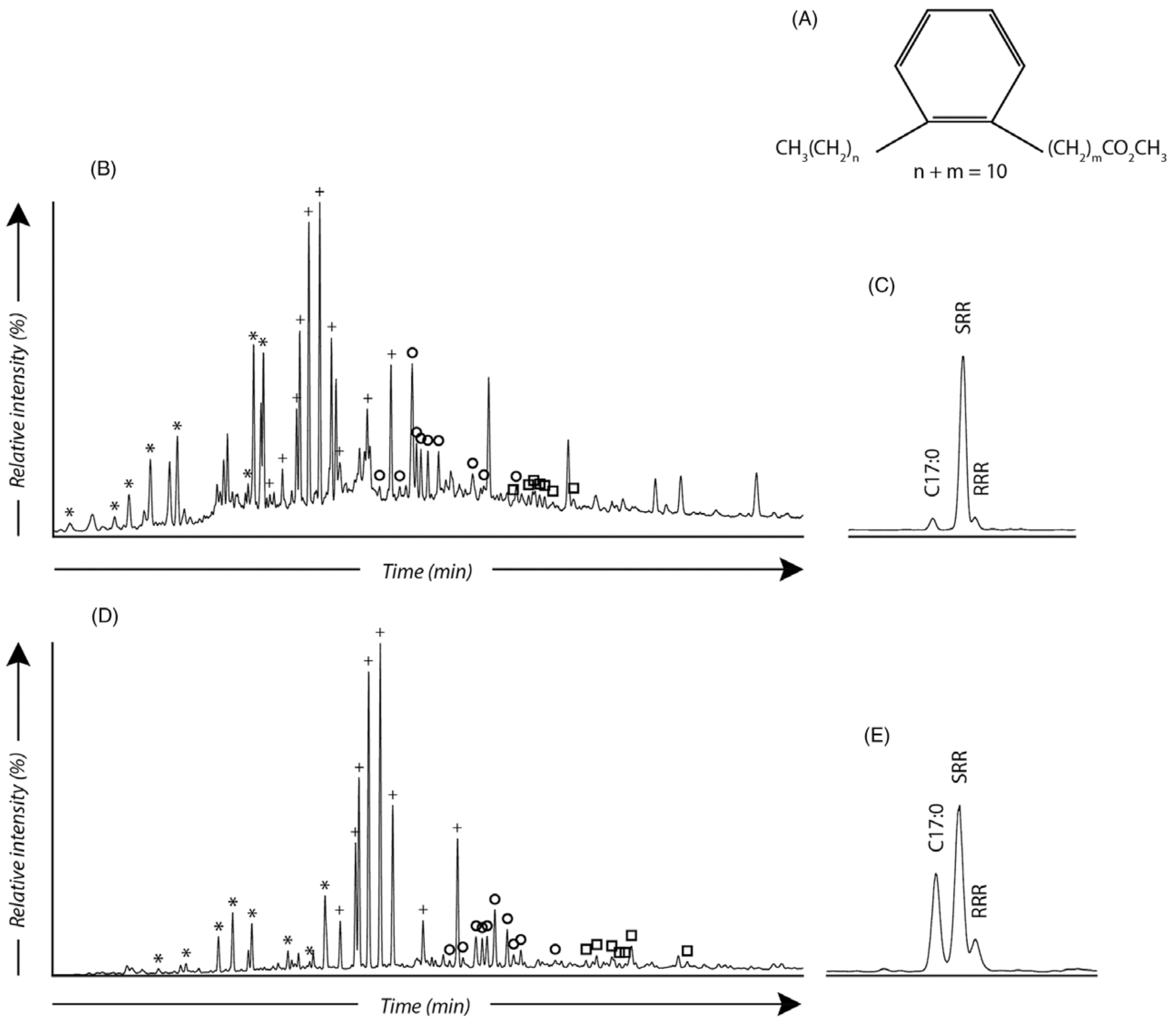


Fig. 8.
Molecular evidence for the processing of aquatic fats in an oval bowl from the circum-Baltic and a stone lamp from North America: (A) chemical structure of APAAs (after Hansel *et al.* 2004); (B & D) partial summed mass chromatograms (*m/z* 105) showing the presence of APAAs with 16 (*), 18 (+), 20 (open black circles), and 22 (open black squares) carbon atoms in a stone lamp from the North American Arctic (B; sample UB-1), and an oval bowl from the circum-Baltic (D; sample ICA 799-F); (C and E) partial summed mass chromatograms (*m/z* 101) showing the diastereomers of phytanic acid (SRR and RRR) in the same samples

et al. 2015; Oras *et al.* 2017; Cramp *et al.* 2019; Robson *et al.* 2019).

At the coastal sites a clear difference emerges. The majority of the oval bowls in the western Baltic and all of the North American Arctic stone lamps are consistent with marine fats and contain aquatic biomarkers. There are, however, some oval bowls from the western Baltic lacking aquatic biomarkers and plotting within the range established for wild non-ruminant fats. As previously reported (ie, Craig *et al.* 2011; Robson 2015; Papakosta *et al.* 2019; Courel *et al.* 2020), a much wider range of values is evident in the cooking pots from this region with samples plotting within the ranges of authentic wild non-ruminant fats and wild ruminant fats in addition to the ranges established for marine fats

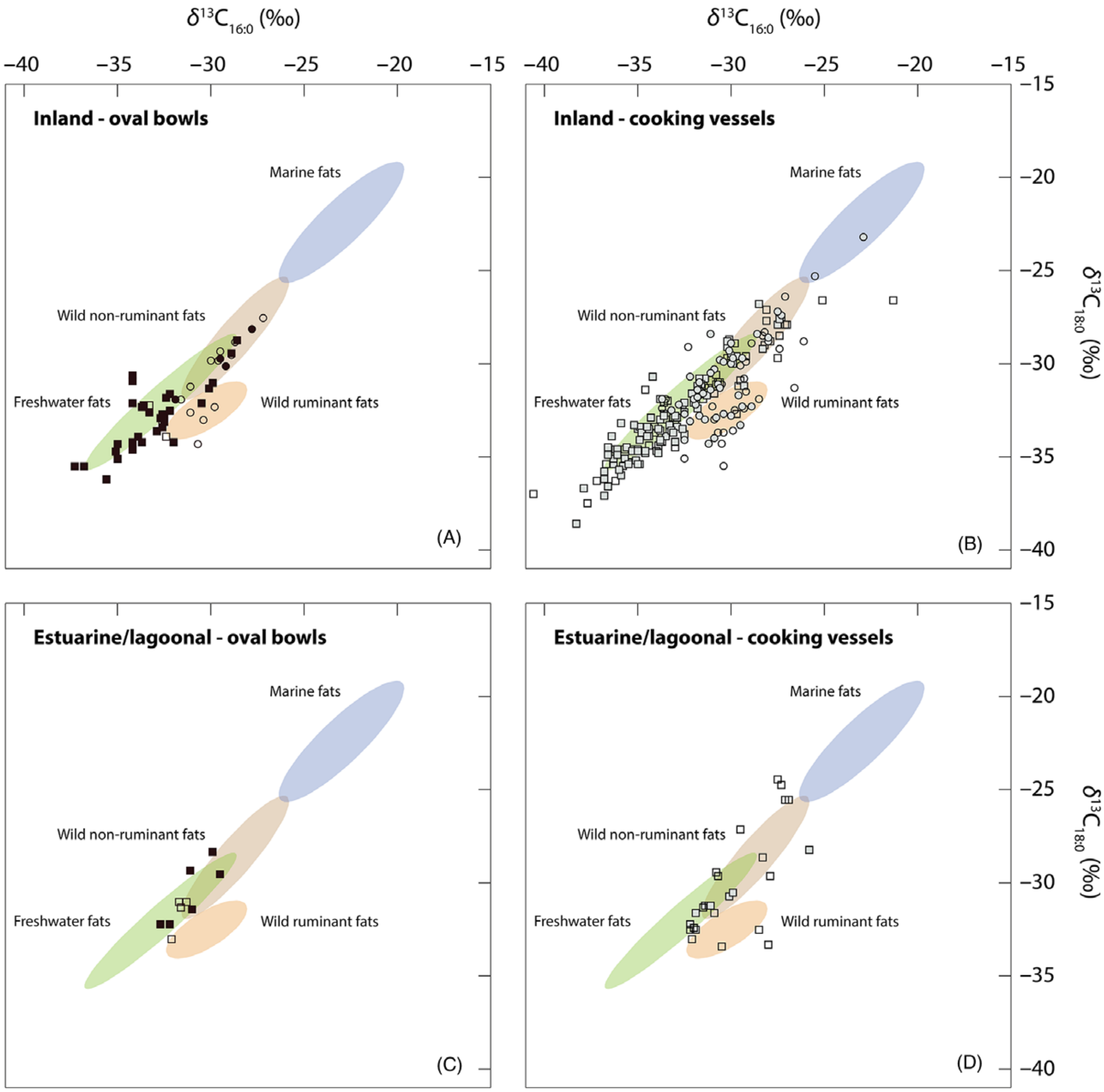


Fig. 9.
δ^{13}C values of the individual mid-chain length fatty acids ($C_{16:0}$ and $C_{18:0}$) obtained from 86 oval bowls ($n = 103$ samples) throughout the circum-Baltic disaggregated according to location (A, C, E). Data obtained from the North American Arctic stone lamps are also plotted (black circles). For comparison, data obtained from cooking pots throughout the circum-Baltic are plotted (B, D, F; data presented in Tables S7–S9). The statistical reference ranges (1σ) were calculated from the analysis of modern authentic animal tissue samples from Eastern Europe (see Dolbunova *et al*. forthcoming). *Key*: closed, sample with aquatic biomarkers; open, sample without aquatic biomarkers; square, eastern Baltic; circle, western Baltic

and freshwater fats. The wider range of resources in these vessels reflects the differences in the bulk δ^{13}C values between the two vessel types in the western Baltic and it seems that the oval bowls had a more specialised use associated with marine fats or oils.

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

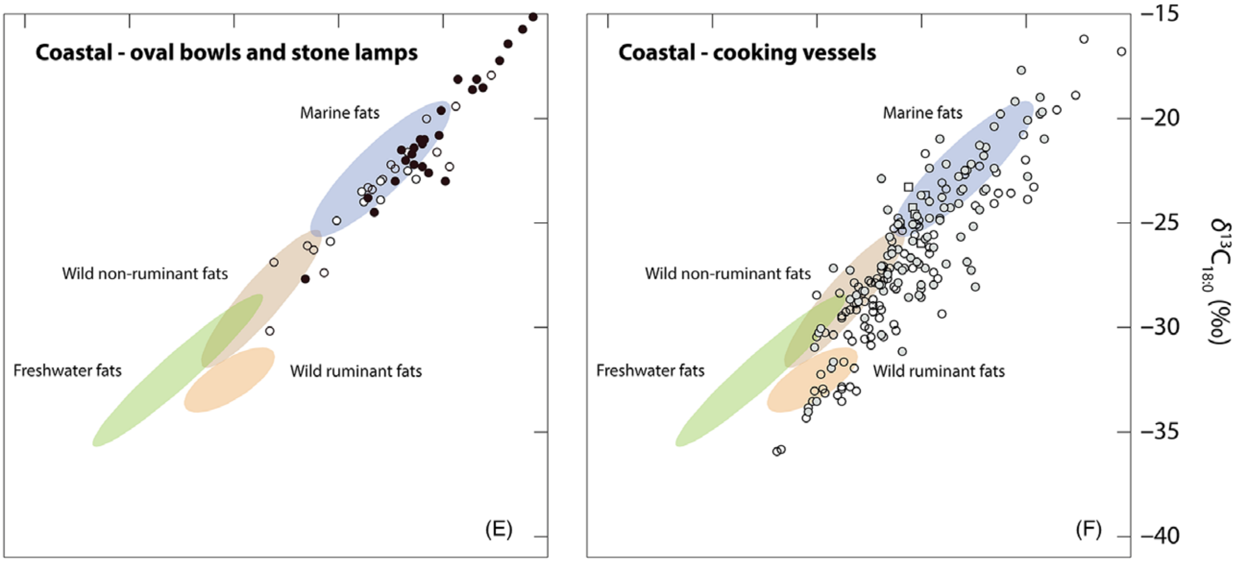


Fig. 9.
(Continued).

As a final confirmation, we compared the bulk $\delta^{13}C$ values of the carbonised surface deposits to the mean $\delta^{13}C$ values of the individual mid-chain length fatty acids extracted from them (Heron *et al.* 2015; Admiraal *et al.* 2020). For an oil rich substance, these values should be similar, as the carbon is derived from the same source, whereas for a substance also containing carbohydrates and/or proteins the values should be different. Normally, the $\delta^{13}C$ values of the individual mid-chain length fatty acids are depleted in ^{13}C compared to the bulk $\delta^{13}C$ value,[5] which includes the contribution of carbon from other classes of biomolecules. As shown in Figure 10, this is only true of the cooking pots. The oval bowls from the circum-Baltic and North American Arctic stone lamps, regardless of location, generally have a negligible difference between the bulk and individual mid-chain length fatty acid $\delta^{13}C$ values, indicating the residue is predominantly derived from a fat or oil rich substance, in keeping with their function for burning such resources. This is seen clearly in the kernel density estimate of $\delta^{13}C$ offsets in the oval bowls and other vessels (Fig. 10).

DISCUSSION

Organic residue analysis reveals a consistent pattern across the circum-Baltic that distinguishes oval bowls from other vessels in the same assemblage over a period of *c*. 2000 years. The oval bowls were utilised by hunter-gatherer-fishers for burning fat or oil as fuel for lighting and/or heating. Given that 67% of the vessels yielded APAAs and have compound-specific $\delta^{13}C$ values consistent with marine and freshwater tissues, we suggest that aquatic fats were commonly used as the fuel source in these vessels. Terrestrial animal carcass fats are also likely to have been used but to a much lesser extent. Notably, wild ruminant animal fats, which are readily identifiable in cooking pots of the Ertebølle culture in the western Baltic, are virtually absent in the oval bowls from many of the same sites, or sites located in similar settings. More generally, organic residue analysis has shown that hunter-gatherer-fisher cooking pots, often with pointed bottoms, appear to have been used for processing mixtures of foodstuffs (Craig *et al.* 2011; Robson 2015; Papakosta *et al.* 2019; Courel *et al.* 2020), including aquatic resources.

Although many uses have been suggested (Table 4 lists some of the proposed uses of archaeological vessels alongside observations made from ethnographic and historical contexts), we hypothesise that oval bowls were used primarily to provide controlled sources of illumination for extended periods of time. Experiments conducted by van Diest (1981) demonstrated that reconstructed oval bowls with seal

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

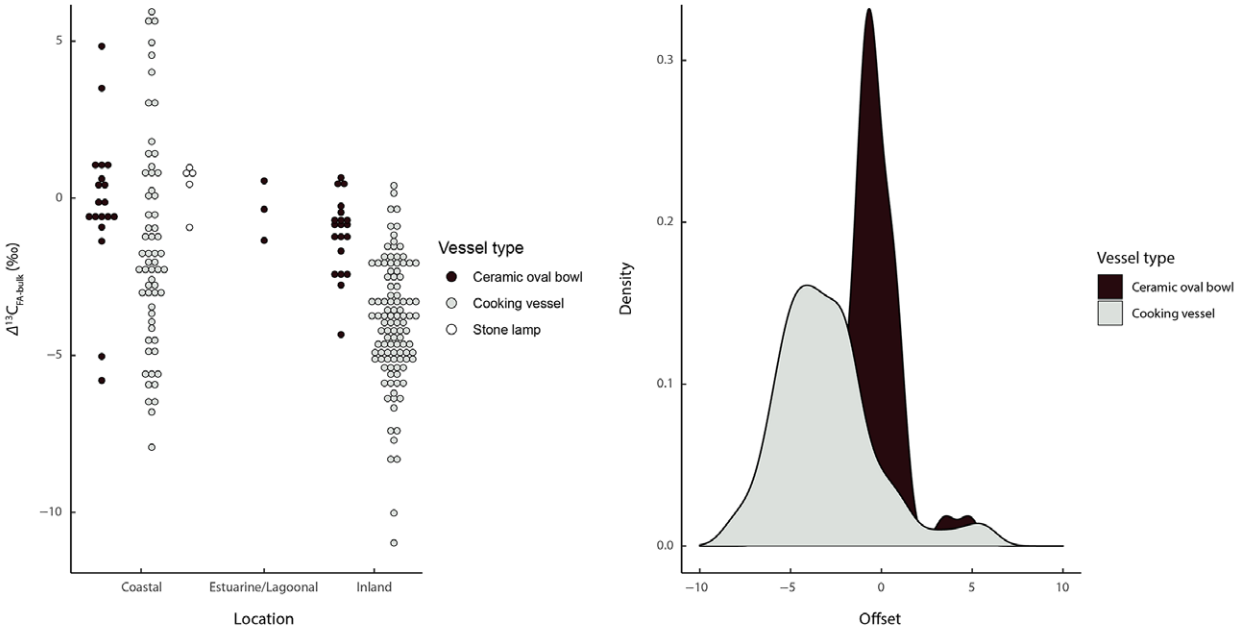


Fig. 10.
Left: δ^{13}C offsets between the δ^{13}C values of the individual mid-chain length fatty acids (ie, mean $\delta^{13}C_{16:0}$-$\delta^{13}C_{18:0}$) and the corresponding bulk δ^{13}C values of the carbonised surface deposits from the same sherd (ie δ^{13}C offset = δ^{13}C FA_{mean} - $\delta^{13}C_{bulk}$) (Heron *et al.* 2015; Admiraal *et al.* 2020). The plot includes the oval bowls and cooking pots from the circum-Baltic and North American Arctic stone lamps disaggregated according to location: right: kernel density estimate of δ^{13}C offsets (data presented in Tables S7–S9)

blubber fuel and a moss wick could burn for several hours. The form of the vessels also allowed them to be lit at both ends. Van Diest (1981) found that when the vessels were used as lamps, patterns of sooting and carbonised surface deposits consistent with those on the oval bowls from the site of Grube-Rosenhof in northern Germany were observed.

While the suggestion that oval bowls in the circum-Baltic were used as sources of illumination is not new (Mathiassen 1935; Żurek 1954; Bērziņš 2008; Heron *et al.* 2013; 2015; Oras *et al.* 2017; Papakosta *et al.* 2019), the findings presented here and the occurrence of these vessels specifically during the third quarter of the 5th and the earlier 4th millennium cal BC warrants further discussion. The exploitation of aquatic mammals and fish from the Baltic Sea, and riverine and lacustrine settings throughout the region pre-dates ceramic technology. For example, there is widespread evidence for fishing as well as apparatus and mass capture/processing facilities from the late 10th millennium cal BC onwards (eg, Boethius 2016; Robson & Ritchie 2019; Robson *et al.* forthcoming). Although difficult to procure, render, and refine, we can presume that both fish oils and marine mammal blubber were readily available and, given their energy content, were highly valued commodities for consumption. Yet, their use exceeded basic subsistence and implies they were available in such quantities that other roles, such as burning for heat or illumination, were incorporated into lifeways.

In the North American Arctic, the use of marine oils for generating heat and light is often explained by the lack of other suitable fuel sources. The same applies to local historical sources. For example, ethnographic sources from the first half of the 20th century from eastern Estonia describe the production of fish oil from fat-rich internal organs and its use for lighting purposes by pouring oil on a small plate and lighting it with a wick (Paurman 1940). At more southerly latitudes wood was readily available, making the use of procured oils for this purpose more perplexing. Here, one can perhaps draw a better analogy with the Roman lamps of the circum-Mediterranean that used olive oil as a combustant; a prized, perishable product that could be produced in such surplus that it was put to a wide diverse range of non-culinary uses

TABLE 4: PROPOSED USES OF OVAL BOWLS, INCLUDING EXAMPLES DRAWN FROM ANALYSES OF PALAEOLITHIC & NORTH AMERICAN STONE LAMPS

Proposed use(es)	*Utilitarian or non-utilitarian?*	*Reference(s)*
Illumination; heat for cooking food, drying clothes, & melting snow for drinking water	Utilitarian	Hough 1898
Salt extraction; medicine; paint	Utilitarian	Klinge 1932; 1934; Rimantienė 1989; 2016
Illumination; heat	Utilitarian	Ekman 1910; Mathiassen 1935; Holland 1992; Heron *et al.* 2013; 2015
Mobile heating unit whilst travelling & hunting	Utilitarian	de Laguna 1940
Enumeration	Utilitarian	Spencer 1959
Cooking pans; indoor lighting	Utilitarian	Kilian 1955; Żurek 1954; Vankina 1970
Illumination in conjunction with fishing ('eel-flaring') & sealing from a dugout canoe during the night	Utilitarian	Hulthén 1980
Ritual/symbolic: portal to the underworld	Non-utilitarian	Girininkas 1994
Serving food; light for craftwork & other activities; maintain fire & rekindle hearth; carry fire to other locations	Utilitarian	Bērziņš 2008
Drying meat and/or wet clothing; illumination; heat; cooking	Utilitarian	Frink & Harry 2019
Central location for maintaining a fire that could be used to ignite mobile illumination technologies; wood burning to produce pigment; signalling; brûloir or roaster; ritual/symbolic: create heat, light & smoke; utilitarian: create fire, light, heat & for protection	Utilitarian; non-utilitarian	Medina-Alcaide *et al.* 2019

and transported far and wide as a luxury commodity (Mattingly 1996). Largely sedentary, surplus producing hunter-gatherer-fishers of the circum-Baltic might have had the capacity to produce oil at this juncture in prehistory and with the introduction of ceramic technology, they would have had the means, but what specific need did 'oil lamps' fulfil?

As we have noted, the stone lamps of south-west Alaska were used primarily for lighting rather than cooking. In this relatively southern location, warming a dwelling or cooking was less important than providing smoke-less light, which wood could not provide. On the other hand, the need for both warmth and light was extreme in treeless Arctic regions where work had to be conducted in tents or sod houses with little ventilation in order to conserve heat. Although wood was available in the circum-Baltic region, the need for smoke-less light for sewing clothes and other craft production, illuminating social gatherings, story-telling, ritual, and other activities would have been important. One of the functions of the many tiny lifelike soapstone and ivory carvings made by Late Dorset people might have been for lamp-light projection of their shadows on darkened house walls, accompanied by theatrical recitation by shamans or elders of stories and legends.

Parallels between circum-Baltic oval bowls and Arctic stone lamps have been made for decades (eg, Mathiassen 1935). The evidence from our study highlights clear similarities in use that centre on the burning of fats/oils. Evidence beyond these contexts is rare. One exception is the study of 'oval plates' and cooking pots in a ceramic assemblage from the 10th–16th century AD site of Kame Hills, Manitoba, Canada (Sherriff *et al.* 1995). Bulk stable isotope analysis of the carbonised surface deposits from the 'oval plates' had lower $\delta^{13}C$ values and higher C:N ratios compared to those from the cooking pots. Due to the higher proportion of fat in the deposits on the 'oval plates' the authors suggested that they were used as 'frying pans or … fat-burning lamps' (Sherriff *et al.* 1995, 110). Tisdale (1987, 367) notes that the Kame Hills site is situated in a productive fish-spawning location in an otherwise sparse resource setting, hence aquatic fats were available in abundance for burning in these vessels. Clearly there is potential for distinguishing patterns of use in vessels used by hunter-gatherer-fishers where markedly different vessel forms are present.

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

With light comes heat, however modest, and there is evidence that this attribute was also utilised in the Arctic. Frink and Harry (2019, 159) note that 'driftwood racks for drying meat and/or wet clothing were often suspended' over stone lamps and were a feature during the winter months when 'wood resources were buried under snow and cooking took place indoors'. Boas (1964, 136) states that rectangular, flat-bottomed cooking pots in the North American Arctic were suspended over the flame of the lamp 'whose size could be controlled by manipulating the wick with a bone or piece of wood' (Frink & Harry 2019, 159). De Laguna (1940, 56) suggested that the function of lamps was dictated by size, arguing that larger vessels were used for heating, while smaller examples were used solely for illumination. According to the Eastern Arctic Tunit (Dorset) legends, Dorset people used miniature lamps only a few centimetres in diameter to warm themselves while they waited for seals at the breathing holes. This indicates that different circumstances and motivations may have driven the manufacture and use of these types of vessels in the North American Arctic, many of which could have been utilised in the circum-Baltic.

Ethnographic sources also show that utilitarian and non-utilitarian functions of oval bowls are inseparable. Grønnow *et al.* (2014, 417–19) highlight the symbolic and spiritual meanings of heat and light during the dark and cold season in the North American Arctic. Writing about the eastern North American Arctic Inuit, they state that 'both physically and psychologically, the flame of the lamp meant survival, comfort and life' (Grønnow *et al.* 2014, 403). Historical accounts describe the central place of the lamp in family life. According to Hough (1898, 117), 'The lamp is peculiarly the possession of the women. Each head of a family must have a lamp, though two or more families may live in the same hut … After the death of a woman her lamp is placed upon her grave'. Inupiat culture in western Alaska is full of stories linking women with lamps, whales, and dwellings, including stories of a woman who tends the life-giving lamp (heart) in the belly of a whale (Kaplan *et al.* 1984). Ceramic lamps were occasionally used as grave goods or grave markers in the Yukon-Kuskokwim Delta of the western North American Arctic (Broderick & Pratt 2009, 134). Historical accounts also testify to the use of stone lamps as indoor light sources (Dawson *et al.* 2007; Grønnow *et al.* 2014). Recent simulations of illumination levels within Inuit structures indicate that lighting may have been used to make interior spaces appear larger, to enhance the metaphorical associations of dwellings with marine mammals and to facilitate the making and repairing of clothing and tools (Dawson & Levy 2022).

At the wetland coastal site of Sārnate in Latvia, dating from the late 5th–3rd millennia cal BC, Bērziņš (2008) notes that oval bowls were primarily recovered from the hearth or outer wall of dwellings. He suggested utilitarian roles such as 'lighting for craft work and other activities undertaken after dark, particularly in winter in the warmth of the fireside. They could have been conveniently placed in the sand along the edge of the hearth. The lamps may have served as a means of maintaining the fire and rekindling the hearth. Presumably, they also provided a convenient way of carrying fire to other locations' (Bērziņš 2008, 164).

The role of oval bowls in portable illumination technology in the western Baltic has been proposed by Hulthén (1980). In this context, oval bowls were used for night fishing, such as 'eel-flaring' or sealing, particularly from a dugout canoe. De Laguna (1940, 55) states that (miniature) stone lamps throughout south-western Alaska were also used for drying and heating while on the move both for hunting and travelling, which could be the difference between life and death in Arctic conditions. Non-utilitarian roles for fat-burning oval bowls in the circum-Baltic have been proposed, albeit rarely. Girininkas (1994, 235–6) suggested that those in the eastern Baltic symbolised boats and were connected 'with the belief that the dead were ferried from the world of the living to the world beyond' (Bērziņš 2008, 165), a belief that was expressed much later in Viking Age boat burials and mortuary ritual of West Siberian Nenets and Sami people.

Although light production is a well-established phenomenon during winter months in North American Arctic regions (Hough 1898; Lucier & Vanstone 1991; Dawson & Levy 2022), the manufacture and use of lamps extends to many archaeological, ethnographic, and historical populations in circumpolar contexts. Ethnohistorical studies in the Russian Far East testify to the widespread use of stone and ceramic lamps by coastal and inland populations in the late 19th/early 20th centuries AD (Bogoras 1904, 184–5; Jochelson 1905, 565–7). Coastal communities used seal oil as fuel whereas inland herders used fat obtained by boiling crushed reindeer bone (Jochelson 1905, 565–7). In addition to stone and ceramic, other much less archaeologically visible materials, such as unfired clay, hollowed-out bone, and wood, could have been used. In the North American Arctic there is evidence that lamps were also made from perishable materials, including wood (Lucier & Vanstone 1991, 8–10). One of the most likely prototypes of stone lamps may have developed from birch bark technology, which included all manner of watertight bowls and containers that could have served as oil lamps lit by floating wicks.

CONCLUSIONS

Hunter-gatherer-fishers in the circum-Baltic adopted and used a durable material culture for light production. Once introduced it was sustained for a maximum of *c*. 2000 years, albeit 'discontinuously' throughout the region. Burning animal fat, especially from aquatic species, represents a consistent pattern of use and differentiates oval bowls from other containers in the same pottery assemblages, which were primarily used for preparing meals. Why oval bowls ceased to be used is unknown and especially puzzling given the wide range of utilitarian and non-utilitarian functions these artefacts might have fulfilled, as highlighted above. Recently, however, it has been shown that the function of hunter-gatherer-fisher ceramics is culturally transmitted along with aspects of their production (Dolbunova *et al*. accepted). The tradition of producing oval bowls might have arisen and dispersed through hunter-gatherer-fisher communities in contact with each other and not necessarily across all ceramic producing hunter-gatherer-fisher groups.

These vessels are seldom present in early farmer contexts and each occurrence needs to be interrogated carefully based on stratigraphic and chronological evidence; they rarely exist in areas without a preceding hunter-gatherer-fisher ceramic phase. The persistence of aquatic resource exploitation in the circum-Baltic after the introduction of farming is well documented (Craig *et al*. 2011; Robson *et al*. 2021), which strongly suggests that their disappearance is not associated with major economic change. Together with fat from terrestrial animals, fish oil and marine mammal blubber were surely available to sustain the use of ceramic bowls for illumination, and these products are frequently found in Early Neolithic Funnel Beaker cooking vessels from coastal western Baltic sites. One must also consider the possibility that farming brought about technological changes in heating and lighting, such as the introduction of tallow candles.

The demise of oval bowl production and use could be associated with fundamental changes in lifeways brought about by the introduction of farming. The introduction of agriculture and pastoralism may have significantly altered the 'taskscape' (Ingold 1993), the socially constructed space of human activity, which expanded to incorporate new routines associated with animal husbandry and crop cultivation, in addition to hunting, gathering, and fishing. The need for portable illumination, so essential for extending working hours in the darker, winter months[6] and facilitating the procurement of resources away from settlements, might have had less importance when new stores of food could be accessed during the winter, whether 'on the hoof' or from granaries. Fundamental changes in the seasonality of tasks at the transition to agriculture in the circum-Baltic require further corroboration but such considerations should include the manufacture and use of artefacts, which themselves may have a seasonal dimension. Finally, further work is needed to examine the more precise function of 'oval bowls' and similar shaped vessels described in other agricultural contexts from more southerly latitudes, such as those assigned to the post-LBK Brześć Kujawski Group of the Lengyel culture (second half of the 5th millennium cal BC) in north-central Poland (Grygiel 2008; Czerniak *et al*. 2016), the Malice culture (first half of the 5th millennium) in Little Poland (Czerniak 2012), and the 'ceramic boats' from the Early Neolithic (second–third quarters of the 6th millennium) site of La Marmotta in Italy (Fugazzola 2019).

Acknowledgements: This study has received funding from the British Academy (postdoctoral fellowship to H.K.R.), the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant Agreement No. 695539) to C.P.H., the Polish National Science Centre (Grant No. 2017/27/B/HS3/00478) to J.K., and the Estonian Research Council (Grant No. PSG 492) to E.O. We thank Marise Gorton (University of Bradford) and Matthew von Tersch (University of York) for under taking the bulk EA-IRMS analyses; Blandine Courel (British Museum) and Valerie Steele (University of Bradford) for sample preparation and GC-MS analysis; Harald Lübke (ZBSA) for permission to use the unpublished radiocarbon date obtained from an oval bowl from the site of Timmendorf-Nordmole I; Peter Moe

Astrup (Moesgård Museum), Valdis Bērziņš (University of Latvia) and Ann-Katrin Meyer (University of Hamburg) for answering the many questions asked concerning the distribution and frequency of oval bowls throughout the circum-Baltic; Ilze Loze (University of Latvia), Søren H. Andersen and Lise Frost (Moesgård Museum) for permission to sample the oval bowls housed in their respective institutions; Stephen Loring and Caroline Solazzo (Smithsonian Institute) for both permission to sample and information pertaining to the stone lamp samples from the North American Arctic; Lena Diana Tranekjer (University of Copenhagen) for providing data from an unpublished Masters Dissertation; Thomas Terberger (University of Göttingen) for assisting in the acquisition of samples from the site of Friesack 4; and Daniel Groß (Museum Lolland-Falster) for answering several queries raised concerning the dating of the Syltholm sites. Lastly, we thank the referees for their insightful queries that helped to improve the manuscript.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/ppr.2022.12

NOTES

[1] In this study a site is classified as 'coastal' when it was originally located within 100 m from the contemporaneous coastline; the majority of these sites are represented by settlements, shell middens, or submerged sites in which the principal component of the faunal assemblage is represented by marine animals. In contrast, a site is termed as 'inland' when it was originally situated on or near the shoreline of a freshwater source. Throughout the text coastal and estuarine/lagoonal sites are often grouped as one although they are differentiated in the figures and tables.

[2] This site is also close to the southern limit of similar pottery vessels made by hunter-gatherer-fishers. Otherwise, seasonal variation in day length, which increases with latitude, might be regarded as an explanatory factor for the distribution of oval bowls, if they were used to provide light to extend the working day in winter.

[3] Given the lack of direct dates on oval bowls, and uncertainty in the freshwater reservoir effect applicable to direct dates on carbonised surface deposits adhering to pottery, it is possible that the oval bowls affiliated with the Friesack-Boberg Group date to this interval.

[4] In this study the data obtained from oval bowls from sites in modern-day Poland has been aggregated with the western Baltic data, except Szczepanki 8.

[5] This is because fats are isotopically depleted compared to carbohydrates and proteins when derived from the same source. However, in some cases the bulk values may be depleted compared to the fats if, for example, the carbohydrates and proteins are derived from a terrestrial source and the fats from a marine source. This is observed in several cases.

[6] At 55°N the difference in daylight hours between the summer and winter solstice is *c*. 10 hours.

BIBLIOGRAPHY

Admiraal, M., Lucquin, A., Von Tersch, M., Jordan, P. & Craig, O. 2019. Investigating the function of prehistoric stone bowls and griddle stones in the Aleutian Islands by lipid residue analysis. *Quaternary Research* 91(3), 1003–15

Admiraal, M., Lucquin, A., Von Tersch, M., Craig, O.E. & Jordan, P. 2020. The adoption of pottery on Kodiak Island: Insights from organic residue analysis. *Quaternary International* 554, 128–42

Andersen, S.H. 1994–1995. Ringkloster: Ertebølle trappers and wild boar hunters in eastern Jutland. *Journal of Danish Archaeology* 12, 13–59

Andersen, S.H. 2009. *Ronæs Skov: Marianarkæologiske undersøgelser af kystboplads fra Ertebølletid*. Højbjerg: Jutland Archaeological Society

Andersen, S.H. 2010. The first pottery in Southern Scandinavia. In Vanmontfort *et al.* (eds) 2010, 167–76

Andersen, S.H. 2011. Kitchen middens and the early pottery of Denmark. In Hartz *et al.* (eds) 2011, 193–215

Andersen, S.H. 2013. *Tybrind Vig: Submerged Mesolithic settlements in Denmark*. Højbjerg: Jutland Archaeological Society

Andreasen, N.H. 2002. *Ertebøllekulturens indlandsbopladser – et overset potentiale? En arkæologisk analyse af Præstelyngen – en naturvidenskabeligt udgravet boplads i den vestsjællandske Åmose*. Unpublished Masters Dissertation, University of Copenhagen.

Andreev, K.M., Vybornov, A.A., Vasilyeva, I.N. & Somov, A.V. 2016. New Neolithic materials from the site Kalmykovka I. *Археология и этнография* 18(3), 130–9.

Beaune, S.A. de 1987. Palaeolithic lamps and their specialization: a hypothesis. *Current Anthropology* 28(4), 569–77.

Bērziņš, V. 2008. *Sārnate: Living by a Coastal Lake during the East Baltic Neolithic*. Oulu: Acta Universitatis Ouluensis B 86

Boas, F. 1964. *The Central Eskimo*. Lincoln NE: University of Nebraska Press.

Boethius, A. 2016. Something rotten in Scandinavia: the world's earliest evidence of fermentation. *Journal of Archaeological Science* 66, 169–80

Bogoras, W. 1904. The Jesup North Pacific Expedition. *Memoirs of the American Museum of Natural History* 7, 184–5

Bondetti, M., González Carretero, L., Dolbunova, E., McGrath, K., Presslee, S., Lucquin, A., Tsybriy, V., Mazurkevich, A., Tsybriy, A., Jordan, P., Heron, C., Meadows, J. & Craig, O. E. 2021a. Neolithic farmers or Neolithic foragers? Organic residue analysis of early pottery from Rakushechny Yar on the Lower Don (Russia). *Archaeological and Anthropological Sciences* 13, 141

Bondetti, M., Scott, S., Courel, B., Lucquin, A., Shoda, S., Lundy, J., Labra-Odde, C., Drieu, L. & Craig, O. E. 2021b. Investigating the formation and diagnostic value of ω-(o-alkylphenyl) alkanoic acids in ancient pottery. *Archaeometry* 63(3), 594–608

Brinch Petersen, E. 2011. Hundred and fifty years of Ertebølle ceramics in the western Baltic. In Hartz *et al.* (eds) 2011, 217–39
Broderick, F. & Pratt, K.L. 2009. Vestiges of the Past. In K.L. Pratt (ed.), *Chasing the Dark: perspectives on place, history and Alaska Native Land Claims*, 134–8. Anchorage AK: United States Department of the Interior Bureau of Indian Affairs, Alaska Region
Chemyakin, Yu P. 2008. *Barsova Gora. Ocherki Arkheologii Surgutskogo Priob'ya. Drevnost'*. Surgut, Omsk: OaO „Omskij Dom Pechati“
Clark, D.W. 1966. Perspectives in the prehistory of Kodiak Island, Alaska. *American Antiquity* 31, 358–71
Clark, D.W. 2001. Ocean Bay. In P.N. Peregrine & M. Ember (eds), *Encyclopedia of Prehistory, Volume 2: Arctic and Subarctic*, 152–64. New York: Springer
Clark, J.G.D. 1936. *The Mesolithic Settlement of Northern Europe*. Cambridge: Cambridge University Press
Collins, H.B. 1937. Archaeology of St. Lawrence Island. *Smithsonian Miscellaneous Collections* 96(1), 1–431
Courel, B., Robson, H. K., Lucquin, A., Dolbunova, E., Oras, E., Adamczak, K., Andersen, S.H., Astrup, P.M., Charniauski, M., Czekaj-Zastawny, A., Ezepenko, I., Hartz, S., Kabaciński, J., Kotula, A., Kukawka, S., Loze, I., Mazurkevich, A., Piezonka, H., Piličiauskas, G., Sørensen, S. A., Talbot, H.M., Tkachou, A., Tkachova, M., Wawrusiewicz, A., Meadows, J., Heron, C. P. & Craig, O.E. 2020. Organic residue analysis shows sub-regional patterns in the use of pottery by Northern European hunter-gatherers. *Royal Society Open Science* 7(4), 1–16 [https://doi.org/10.1098/rsos.192016]
Craig, O.E., Forster, M., Andersen, S.H., Koch, E., Crombé, P., Milner, N.J., Bailey, G. & Heron, C. 2007. Molecular and isotopic demonstration of the processing of aquatic products in Northern European prehistoric pottery. *Archaeometry* 49(1), 135–42
Craig, O.E., Steele, V.J., Fischer, A., Hartz, S., Andersen, S. H., Donohoe, P., Glykou, A., Saul, H., Jones, D. M., Koch, E. & Heron, C. 2011. Ancient lipids reveal continuity in culinary practices across the transition to agriculture in Northern Europe. *Proceedings of the National Academy of Sciences of the United States of America* 108(44), 17910–15
Cramp, L.J.E. & Evershed, R.P. 2014. Reconstructing aquatic resource exploitation in human prehistory using lipid biomarkers and stable isotopes. In H.D. Holland & K.K. Turekian (eds), *Treatise on Geochemistry* (2nd edn, vol. 14), 319–39. Oxford: Elsevier
Cramp, L.J.E., Król, D., Rutter, M., Heyd, V.M. & Pospieszny, L. 2019. Analiza pozostałości organicznych z ceramiki kultury rzucewskiej z Rzucewa. *Pomorania Antiqua* 28, 245–59
Czerniak, L. 2012. After the LBK. Communities of the 5th millennium BC in north-central Europe. In R. Gleser & V. Becker (eds), *Mitteleuropa Im 5 Jahrtausend Vor Christus Beiträge Zur Internationalen Konferenz in Münster 2010*, 151–74. Münster: LIT
Czerniak, L., Marciniak, A., Bronk Ramsey, C., Dunbar, E., Goslar, T., Barclay, A., Bayliss, A. & Whittle, A. 2016. House time: Neolithic settlement development at Racot during the 5th millennium cal B.C. in the Polish lowlands. *Journal of Field Archaeology* 41(5), 618–40
Czekaj-Zastawny, A. & Kabaciński, J. 2015. The early Funnel Beaker culture at Dąbki. In Kabaciński *et al.* (eds) 2015, 203–17
Dawson, P. & Levy, R. 2022. Thirty days of night: The role of light and shadow in Inuit architecture north of the Arctic Circle. In Papadopoulos & Moyes (eds) 2022, 473–99
Dawson, P., Levy, R., Gardner, D. & Walls, M. 2007. Simulating the behaviour of light inside Arctic dwellings: Implications for assessing the role of vision in task performance. *World Archaeology* 39(1), 17–35
Diest, H. van. 1981. Zur frage der 'lampen' nach den ausgrabungsfunden von Rosenhof (Ostholstein). *Archaölogisches Korrespondenzblatt* 11, 301–14
Dolbunova, E., Lucquin, A., McLaughlin, T.R., Bondetti, M., Courel, B., Oras, E., Piezonka, H., Robson, H.K., Talbot, H., Adamczak, K., Andreev, K., Asheichyk, V., Charniauski, M., Czekaj-Zastawny, A., Ezepenko, I., Grechkina, T., Gunnarssone, A., Gusentsova, T.M., Haskevych, D., Ivanischeva, M., Kabaciński, J., Karmanov, V., Kosorukova, N., Kostyleva, E., Kriiska, A., Kukawka, S., Lozovskaya, O., Mazurkevich, A., Nedomolkina, N., Piličiauskas, G., Sinitsyna, G., Skorobogatov, A., Smolyaninov, R.V., Surkov, A., Tkachov, O., Tkachova, M., Tsybrij, A., Tsybrij, V., Vybornov, A.A., Wawrusiewicz, A., Yudin, A.I., Meadows, J., Heron, C. & Craig, O.E. forthcoming. The transmission of pottery technology amongst prehistoric European hunter-gatherers. *Nature Human Behaviour*
Dubovtseva, E.N. 2015. The traditions of pottery industry in the north of West Siberia. In V.M. Lozovski, O.V. Lozovskaya & A.A. Vybornov (eds), *Neolithic Cultures of Eastern Europe: chronology, paleoecology and cultural traditions*, 208–12. St Petersburg: IIMK RAS
Dumond, D E. 1969. The prehistoric pottery of southwestern Alaska. *Anthropological Papers of the University of Alaska* 14, 19–42
Dumpe, B., Valdis, B. & Stilborg, O. 2011. A dialogue across the Baltic on Narva and Ertebølle pottery. In Hartz *et al.* (eds) 2011, 409–41
Ehrlich, B. 1936. Succase. *Elbinger Jahrbuch* 12/13, 41–98
Ekman, S. 1910. *Norrlands Jakt och Fiske*. Stockholm: Almqvist & Wiksell
Evershed, R.P., Copley, M.S., Dickson, L. & Hansel, F.A. 2008. Experimental evidence for the processing of marine animal products and other commodities containing polyunsaturated fatty acids in pottery vessels. *Archaeometry* 50(1), 101–13
Fischer, A. 1986. Kongemose A and L. *Journal of Danish Archaeology* 5, 258–9
Fischer, A. 2002. Food for feasting? An evaluation of explanations of the neolithisation of Denmark and southern Sweden. In A. Fischer & K. Kristiansen (eds), *The Neolithisation of Denmark: 150 years of debate*, 343–93. Sheffield: J.R. Collis Publications

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

Fischer, A. & Asmussen, E. 1988. Spangkonge. *Journal of Danish Archaeology* 7, 245

Fitzhugh, J. B. 1996. *The Evolution of complex hunter-gatherers in the North Pacific: an archaeological case study from Kodiak Island, Alaska*. Unpublished PhD Thesis, University of Michigan

Frink, L. & Harry, K.G. 2019. An exploration of Arctic ceramic and soapstone cookware technologies and food preparation systems. In P. Jordan & K. Gibbs (eds), *Ceramics in Circumpolar Prehistory: technology, lifeways and cuisine*, 152–67. Cambridge: Cambridge University Press

Fugazzola, M.A.D. 2019. Modellini di natanti neolitici: possibili lucerne? In A. Asta, G. Caniato, D. Gnola & S. Medas (eds), *Rassegna di studi di archeologia, etnologia e storia navale*, 17–23. Padua: Navis 6

Gaerte, W. 1927. *Die steinzeitliche Keramik Ostpreußens*. Königsberger: Gräfe & Unzer.

Giddings, J.L. 1964. *The Archaeology of Cape Denbigh*. Providence RI: Brown University Press

Girininkas, A. 1994. *Baltų kultūros ištakos*. Vilnius: Savastis

Glykou, A. 2010. Technological and typological analysis of Ertebølle and early Funnel Beaker pottery from Neustadt LA 156 and contemporary sites in northern Germany. In Vanmontfort *et al.* (eds) 2010, 177–88

Glykou, A. 2011. Neustadt LA 156: a submarine site from the Late Mesolithic-Ertebølle and earliest Neolithic Funnel Beaker in northern Germany – first results of the typological and technological analysis of the ceramics. In Hartz *et al.* (eds) 2011, 277–86

Griffin, J.B. 1970. Northeast Asian and northwestern American ceramics. *Proceedings of the 8th International Congress of Anthropological and Ethnological Sciences* 3, 327–30

Grønnow, B., Applet, M. & Odgaard, U. 2014. In the light of blubber: the earliest stone lamps in Greenland and beyond. In H.C. Gulløv (ed.), *Northern Worlds: landscapes, interactions and dynamics*, 403–22. Odense: University Press of Southern Denmark

Grygiel, R. 2008. *Neolit i początki epoki brązu w rejonie Brześcia Kujawskiego i Osłonek, vol. II. Środkowy neolit. Grupa brzesko-kujawska kultury lendzielskiej*. Łódź: Wydawnictwo Fundacji Badań Archeologicznych Imienia Profesora Konrada Jażdżewskiego

Gumiński, W. 2011. Importy i naśladownictwa ceramiki kultury brzesko-kujawskiej i kultury pucharów lejkowatych na paraneolitycznym stanowisku kultury Zedmar – Szczepanki na Mazurach. In U. Stankiewicz & A. Wawrusiewicz (eds), *Na rubieży kultur. Badania nad okresem neolitu i wczesną epoką brązu*, 149–60. Białystok: Muzeum Podlaskie w Białymstoku.

Gumiński, W. 2020. The oldest pottery of the Para-Neolithic Zedmar culture at the site Szczepanki, Masuria, NE-Poland. *Documenta Praehistorica* 47, 126–54.

Hallgren, F. 2004. The introduction of ceramic technology around the Baltic sea in the 6th millennium. In H. Knutsson (ed.), *Coast to Coast: arrival, results and reflections*, 123–42. Uppsala: Wikströms

Hansel, F.A., Copley, M.S., Madureira, L.A.S. & Evershed, R.P. 2004. Thermally produced ω-(*o*-alkylphenyl)alkanoic acids provide evidence for the processing of marine products in archaeological pottery vessels. *Tetrahedron Letters* 45, 2999–3002

Hartz, S. 2011. From pointed bottom to round and flat bottom – tracking early pottery from Schleswig-Holstein. In Hartz *et al.* (eds) 2011, 241–76

Hartz, S., Lüth, F. & Terberger, T. (eds). 2011. *Early Pottery in the Baltic – Dating, Origin and Social Context*. Frankfurt: Bericht der Römish-Germanischen Kommission Band 89

Heron, C., Andersen, S., Fischer, A., Glykou, A., Hartz, S., Saul, H., Steele, V. & Craig, O. 2013. Illuminating the Late Mesolithic: residue analysis of 'blubber' lamps from Northern Europe. *Antiquity* 87, 178–88

Heron, C., Craig, O.E., Lucquin, A.J.A., Steele, V.J., Thompson, A. & Piličiauskas, G. 2015. Cooking fish and drinking milk? Patterns in pottery use in the southeastern Baltic, 3300–2400 cal BC. *Journal of Archaeological Science* 63, 33–43

Holland, K.M. 1992. In the wake of prehistoric North Pacific sea mammal hunters. *Arctic Anthropology* 29(2), 63–72

Hough, W. 1898. The origin and range of the Eskimo lamp. *American Anthropologist* 11(4), 116–22

Hulthén, B. 1977. *On Ceramic Technology During the Scanian Neolithic and Bronze Age*. Stockholm: Theses and Papers in North-European Archaeology 6

Hulthén, B. 1980. Ertebøllekulturens lampor. *Ale Historisk tidskrift för Skåneland* 4, 1–5

Ingold, T. 1993. The temporality of the landscape. *World Archaeology* 25(2), 152–74

Jaanits, L. 1965. On results of the Stone Age investigations in Soviet Estonia. *Finskt Museum* 72, 5–46

Jochelson, W. 1905. The Jesup North Pacific Expedition. *Memoirs of the American Museum of Natural History* 6(1), 565–7

Kabaciński, J., Król, D. & Terberger, T. 2011. Early pottery from the coastal site Rzucewo, Gulf of Gdańsk (Poland). In Hartz *et al.* (eds) 2011, 393–407.

Kabaciński, J., Hartz, S., Raemaekers, D.C.M. & Terberger, T. (eds). 2015. *The Dąbki Site in Pomerania and the Neolithisation of the North European Lowlands (c. 5000–3000 calbc)*. Leidorf: Archäologie und Geschichte im Ostseeraum Band 8

Kaplan, S.A., Jordan, R.H. & Sheehan, G. W. 1984. An Eskimo whaling outfit from Sledge Island, Alaska. *Expedition Magazine* 26(2), 16–23

Kilian, L. 1955. *Haffküstenkultur und Ursprung der Balten*. Bonn: Rudolf von Habelt.

Klinge, M. 1932. De store Lerkar i Stenalderens Affaldsdynger. *Naturens verden* 16(1), 1–18

Klinge, M. 1934. Stenalderens Affaldsdynger. Hvilke Forhold tyder paa, at de store Lerkar er blevet anvendt til Saltkogning? *Naturens verden* 18(2), 60–70

Koch, E. 1998. *Neolithic Bog pots from Zealand, Møn, Lolland and Falster*. København: Nordiske Fortidsminder Serie B

Kotula, A. 2015. Contact and adaptation – the early local pottery at Dąbki and its relations to neighbouring hunter-gatherer ceramics. In Kabaciński *et al.* (eds) 2015, 175–202

Kotula, A., Piezonka, H. & Terberger, T. 2015. New pottery dates on the Mesolithic-Neolithic transition in the north-central European lowlands. In Kabaciński *et al.* (eds) 2015, 489–509

Kriiska, A. 1996. The Neolithic pottery manufacturing technique of the lower course of the Narva River. In T. Hackens, S. Hicks & V. Lang (eds), *Coastal Estonia: recent advances in environmental and cultural history*, 373–84. Strasbourg: Council of Europe, Rixensart

Kriiska, A., Oras, E., Lõugas, L., Meadows, J., Lucquin, A. & Craig, O.E. 2017. Late Mesolithic Narva stage in Estonia: pottery, settlement types and chronology. *Estonian Journal of Archaeology* 21(1), 52–86

Laguna, F. de. 1940. Eskimo lamps and pots. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* 70(1), 53–76

Liiva, A. & Loze, I. 1993. Mesolithic and Neolithic habitation of the eastern Baltic. *Radiocarbon* 35, 503–6

Loze, I.A. 1988. *Poselenija kamennogo veka Lubanskoj niziny. Mezolit, rannij i srednij neolit*. Riga: Zinatne

Loze, I. 1992. The Early Neolithic in Latvia. *Acta Archaeologica* 63, 119–40

Lucier, C.V. & Vanstone, J.W. 1991. The traditional oil lamp among Kangigmiut and neighboring Iñupiat of Kotzebue Sound, Alaska. *Arctic Anthropology* 28(2), 1–14

Lucquin, A., Colonese, A.C., Farrell, T.F.G. & Craig, O.E. 2016. Utilising phytanic acid diastereomers for the characterisation of archaeological lipid residues in pottery samples. *Tetrahedron Letters* 57(6), 703–7

Mathiassen, T. 1935. Blubber lamps in the Ertebølle culture? *Acta Archaeologica* 6, 139–52

Mattingly, D.J. 1996. First fruit? The olive in the Roman world. In G. Shipley & J. Salmon (eds), *Human Landscapes in Classical Antiquity. Environment and Culture*, 213–253. London: Routledge

McCartney, A.P. & Veltre, D.W. 1996. Anangula core and blade site. In F.H. West (ed.), *American Beginnings: the prehistory and palaeoecology of Beringia*, 443–50. London: University of Chicago Press

Medina-Alcaide, M.Á., Cabalín, L.M., Laserna, J., Sanchidrián, J., Torres, A.J., Intxaurbe, I., Cosano, S. & Romero, A. 2019. Multianalytical and multiproxy approach to the characterization of a Paleolithic lamp. An example in Nerja cave (southern Iberian Peninsula). *Journal of Archaeological Science: Reports* 28, 102021 [https://doi.org/10.1016/j.jasrep.2019.102021]

Menne, J. & Brunner, M. 2021. Transition from Swifterbant to Funnelbeaker: a Bayesian chronological model. *Open Archaeology* 7(1), 1235–43

Meurers-Balke, J. 1983. *Siggeneben-Süd. Ein Fundplatz der frühen Trichterbecherkultur an der holsleinischen Ostseeküste*. Neumünster: Offa-Bücher 50

Monteith, F., Yu, C., Cai, L. & Zhao, Y. 2022. Perceived space: demonstrating a quantified approach to illumination in archaeological sites based on Asian Buddhist cave temples 5th–8th century CE. *Archaeological and Anthropological Sciences* 14, 191

Oras, E., Lucquin, A., Lembi, L., Tõrv, M., Kriiska, A. & Craig, O.E. 2017. The adoption of pottery by north-east European hunter gatherers: evidence from lipid residue analysis. *Journal of Archaeological Science* 78, 112–19.

Papadopoulos, C. & Moyes, H. (eds). 2022. *The Oxford Handbook of Light in Archaeology*. Oxford: Oxford University Press

Papakosta, V., Oras, E. & Isaksson, S. 2019. Early pottery use across the Baltic – a comparative lipid residue study on Ertebølle and Narva ceramics from coastal hunter-gatherer sites in southern Scandinavia, northern Germany and Estonia. *Journal of Archaeological Science: Reports* 24, 142–151 [https://doi.org/10.1016/j.jasrep.2019.01.003]

Paurman, D. 1940. *Etnograafilised kirjeldused Iisakust ja Narvatagusest*. Tartu: Estonian National Museum, Ethnographic Archives, ERM EAp 162 EA 41:2/465–734

Pettitt, P., Leluschko, S. & Sakamoto, T. 2022. Light, human evolution, and the Palaeolithic. In Papadopoulos & Moyes (eds) 2022, 19–41

Piezonka, H. 2012. Stone Age hunter-gatherer ceramics of north-eastern Europe: new insights into the dispersal of an essential innovation. *Documenta Praehistorica* 39, 23–51

Piezonka H. 2015. *Jäger, Fischer, Töpfer: Wildbeutergruppen mit früher Keramik in Nordosteuropa im 6. und 5. Jahrtausend v. Chr.* Bonn: Hebert-Verlag.

Piezonka, H., Meadows, J., Hartz, S., Kostyleva, E., Nedomolkina, N., Ivanishcheva, M., Kosorukova, N. & Terberger, T. 2016. Stone Age pottery chronology in the Northeast European forest zone: new AMS and EA-IRMS results on foodcrusts. *Radiocarbon* 58(2), 267–89

Piličiauskas, G. & Heron, C. 2015. Aquatic radiocarbon reservoir offsets in the southeastern Baltic. *Radiocarbon* 57(4), 539–56

Piličiauskas, G., Skipitytė, R. & Heron, C. 2018. Mityba Lietuvoje 4500–1500 cal BC maisto liekanų keramikoje izotopinių tyrimų duomenimis. *Lietuvos archeologija* 44, 9–41

Piličiauskas, G., Kisieliene, D., Piličiauskienė, G., Gaižauskas, L. & Kalinauskas, A. 2019. Comb Ware culture in Lithuania: new evidence from Šventoji 43. *Lietuvos archeologija* 45, 67–103

Povlsen, K. 2014. The introduction of ceramics in the Ertebølle culture. *Danish Journal of Archaeology* 2(2), 146–63

Prangsgaard, K. 1997[1992]. Introduktion af keramik i den yngre ertebøllekultur i sydskandinavien. In M.B. Henriksen, J. Martens & A. Tubæk Naamansen (eds), *Lag* (3 edn), 29–52. Højbjerg: Kulturlaget

Prangsgaard, K. 2013. Pottery. In Andersen (ed.) 2013, 277–92.

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

Rimantienė, R. 1989. *Nida: senųjų baltų gyvenvietė*. Vilnius: Mokslas

Rimantienė, R. 2005. *Die Steinzeitfischer an der Ostseelagune in Litauen*. Vilnius: National Museum of Lithuania

Rimantienė, R. 2016. *Nida: a Bay Coast culture settlement on the Curonian Lagoon*. Vilnius: National Museum of Lithuania

Robson, H.K. 2015. *Evaluating the Change of Consumption and Culinary Practices at the Transition to Agriculture: a multi-disciplinary approach from a Danish kitchen midden*. Unpublished PhD Thesis, University of York

Robson, H.K. & Ritchie, K. 2019. The Early Mesolithic fisheries of Southern Scandinavia. In D. Groß, H. Lübke, J. Meadows & D. Jantzen (eds), *Working at the Sharp End: from bone and antler to Early Mesolithic life in Northern Europe*, 289–303. Kiel: Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum 10

Robson, H.K., Boethius, A. & Ritchie, K. forthcoming. Fishing. In L. Nilsson Stutz, R. Peyroteo Stjerna & M. Tõrv (eds), *The Oxford Handbook of Mesolithic Europe*. Oxford: Oxford University Press

Robson, H.K., Andersen, S.H., Clarke, L., Craig, O.E., Gron, K.J., Jones, A.K.G., Karsten, P., Milner, N., Price, T.D., Ritchie, K., Zabilska-Kunek, M. & Heron, C. 2016. Carbon and nitrogen stable isotope values in freshwater, brackish and marine fish bone collagen from Mesolithic and Neolithic sites in central and northern Europe. *Environmental Archaeology* 21(2), 105–18

Robson, H.K., Skipitytė, R., Piličiauskienė, G., Lucquin, A., Craig, O E., Heron, C.P. & Piličiauskas, G. 2019. Diet, cuisine and consumption practices of the first farmers in the south-eastern Baltic. *Archaeological and Anthropological Sciences* 11, 4011–24

Robson, H.K., Saul, H., Steele, V.J., Meadows, J., Nielsen, P.O., Fischer, A., Heron, C.P. & Craig, O. E. 2021. Organic residue analysis of Early Neolithic 'bog pots' from Denmark demonstrates the processing of wild and domestic foodstuffs. *Journal of Archaeological Science: Reports* 36, 102829 [https://doi.org/10.1016/j.jasrep.2021.102829]

Roebroeks, W. & Villa, P. 2011. On the earliest evidence for habitual use of fire in Europe. *Proceedings of the National Academy of Sciences of the United States of America* 108(13), 5209–14

Saltsman, E.B. 2013. Dwelling construction materials from Pribrezhnoye in the context of the formation of Primorskaya culture. *Archaeologia Baltica* 19, 12–29

Saltsman, E.B. 2016. The origin of the Primorskaya Culture (an analysis of the Pribrezhnoe and Ushakovo-3 dig sites). *IKBFU's Vestnik. SER. The Humanities and Social Science* 2016(1), 6–38

Sherriff, B.L., Tisdale, M.A., Sayer, B.G., Schwarcz, H.P. & Knyf, M. 1995. Nuclear magnetic resonance spectroscopic and isotopic analysis of carbonized residues from subarctic Canadian prehistoric pottery. *Archaeometry* 37(1), 95–111

Solazzo, C. & Erhardt, D. 2007. Analysis of lipid residues in archaeological artifacts: marine mammal oil and cooking practices in the Arctic. In H. Barnard & J.W. Eerkens (eds), *Theory and Practice of Archaeological Residues Analysis*, 161–78. Oxford: British Archaeological Report S1650

Spencer, R.F. 1959. *The North Alaskan Eskimo: a study in ecology and society*. Washington DC: US Government Printing Office

Thielen, L. 2020. *Die Neolithisierung auf den Fundplätzen Hamburg-Boberg. Kontakte und Interaktionen*. Hamburg: Veröffentlichung des Archäologischen Museums Hamburg und Stadtmuseums Harburg

Thielen, L. & Ramminger, B. 2015. Mesolithic and Neolithic pottery from the inland-site Hamburg-Boberg in northern Germany. In Kabaciński *et al.* (eds) 2015, 479–88.

Timofeev, V.I. 1998. The beginning of the Neolithic in the Eastern Baltic. In M. Zvelebil, L. Domańska & R. Dennell (eds), *Harvesting the Sea, Farming the Forest*, 225–36. Sheffield: Sheffield Academic Press

Tisdale, M.A. 1987. Late Woodland settlement dynamics in the Central Boreal Forest: clues from pottery technology. In W. Cowan (ed,), *Papers of the Eighteenth Algonquian Conference*, 363–75. Ottawa: Carleton University Press

Vankina, L.V. 1970. *Torfânikovaâ stoânka Sarnate*. Riga: Zinatne

Vanmontfort, B., Louwe Kooijmans, L., Amkreutz, L. & Verhart, L. (eds). 2010. *Pots, Farmers and Foragers: pottery traditions and social interaction in the earliest Neolithic of the Lower Rhine Area*. Leiden: Archaeological Studies Leiden University 20

Wetzel, G. 2015. Frühneolithische Funde von Friesack 4, Lkr. Havelland (Land Brandenburg) und Uhyst 13, Lkr. Görlitz (Freistaat Sachsen) und ihr Umfeld. In Kabaciński *et al.* (eds) 2015, 511–36

Wetzel, G. 2021. Frühe Keramik in Brandenburg und den Lausitzen – zwischen Bandkeramik und Trichterbecherkultur. In W. Schier, J. Orschiedt, H. Stäuble & C. Liebermann (eds), *Mesolithikum oder Neolithikum? Auf den spuren später wildbeuter*, 151–203. Berlin: Universität Berlin und der Humboldt-Universität zu Druckerei/Kühne & Partner

Wetzel, G. & Beran, J. forthcoming. Friesack 4, Lkr. Havelland – die endmesolithische, neolithische und metallzeitliche Keramik und die Friesack-Boberger Gruppe/Kultur. *Arbeitsberichte zur Bodendenkmalpflege in Brandenburg* 36

Żurek, J. 1954. Osada z młodszej epoki kamiennej w Rzucewie, pow. wejherowski i kultura rzucewska. *Fontes Archaeologici Posnanienses* 4, 8–41

RÉSUMÉ

Production de lumière par les chasseurs-cueilleurs-pêcheurs à céramique de la région circum-baltique, par Harry K. Robson, Alexandre Lucquin, Marjolein Admiraal, Ekaterina Dolbunova, Kamil Adamczak, Agnieszka Czekaj-Zastawny, William W. Fitzhugh, Witold Gumiński, Jacek Kabaciński, Andreas Kotula, Stanisław Kukawka, Ester Oras, Henny Piezonka, Gytis Piličiauskas, Søren A. Sørensen, Laura Thielen, Günter Wetzel, John Meadows, Sönke Hartz, Oliver E. Craig et Carl P. Heron

L'éclairage artificiel est un besoin fondamental de l'Homme. La combustion de bois et d'autres matériaux dans les foyers et les cheminées prolongeait la durée du jour, tandis que l'utilisation de substances inflammables dans les torches offrait de la lumière lors des déplacements. On comprend de plus en plus que la poterie jouait un rôle dans la production de lumière. Dans cette étude, nous nous concentrons sur les bols ovales en céramique, fabriqués et utilisés principalement par les chasseurs-cueilleurs-pêcheurs de la région circum-baltique sur une période d'environ 2 000 ans commençant au milieu du VI^{e} millénaire avant J.-C. Les bols ovales se trouvent souvent à côté de récipients (de cuisson) plus grands. Leur fonction de « lampes à huile » pour l'éclairage a été proposée à plusieurs reprises, mais peu de preuves directes ont été obtenues pour vérifier cette association fonctionnelle. Cette étude présente les résultats de l'analyse moléculaire et isotopique des résidus organiques préservés obtenus à partir de 115 bols ovales provenant de 25 sites archéologiques représentant un large éventail de milieux environnementaux. Nos résultats confirment que les bols ovales de la région circum-baltique étaient principalement utilisés pour brûler des graisses et des huiles, surtout à des fins d'éclairage. Les graisses proviennent des tissus d'organismes marins, d'eau douce et terrestres. Les données isotopiques de masse des dépôts de surface carbonisés montrent un modèle d'utilisation systématiquement différent lorsque les bols ovales sont comparés à d'autres récipients en poterie du même assemblage. Il est suggéré que les chasseurs-cueilleurs-pêcheurs autour du 55^{e} parallèle ont couramment déployé une culture matérielle pour la production de lumière artificielle, mais les preuves sont limitées aux périodes et aux lieux où des technologies plus durables ont été employées, y compris dans la région circum-baltique.

ZUSAMMENFASSUNG

Die Erzeugung von Licht mithilfe von Keramik durch Jäger-Sammler-Fischer des zirkumbaltischen Raums, von Harry K. Robson, Alexandre Lucquin, Marjolein Admiraal, Ekaterina Dolbunova, Kamil Adamczak, Agnieszka Czekaj-Zastawny, William W. Fitzhugh, Witold Gumiński, Jacek Kabaciński, Andreas Kotula, Stanisław Kukawka, Ester Oras, Henny Piezonka, Gytis Piličiauskas, Søren A. Sørensen, Laura Thielen, Günter Wetzel, John Meadows, Sönke Hartz, Oliver E. Craig und Carl P. Heron

Künstliche Beleuchtung ist ein Grundbedürfnis des Menschen. Holz und andere Materialien in Herden und Feuerstellen zu verbrennen verlängerte die Tageslichtdauer, während die Verwendung von brennbaren Stoffen in Fackeln Licht für unterwegs bot. Es wird zunehmend verstanden, dass Keramik eine Rolle bei der Lichterzeugung spielte. In dieser Studie konzentrieren wir uns auf ovale Keramikschalen, die vor allem von Jäger-Sammler-Fischern im zirkumbaltischen Raum über einen Zeitraum von etwa 2000 Jahren, beginnend in der Mitte des sechsten Jahrtausends v. Chr., hergestellt und verwendet wurden. Ovale Schalen kommen häufig zusammen mit größeren (Koch-)Gefäßen vor. Ihre Funktion als "Öllampen" für die Beleuchtung wurde vielfach vorgeschlagen, aber nur eingeschränkte direkte Nachweise konnten dokumentiert werden, die es ermöglichen diese funktionelle Verbindung zu prüfen. In dieser Studie werden die Ergebnisse molekularer und isotopischer Analysen der erhaltenen organischen Rückstände von 115 ovalen Schalen aus 25 archäologischen Fundplätzen vorgestellt, die ein breites Spektrum von Umweltbedingungen repräsentieren. Unsere Ergebnisse bestätigen, dass die ovalen Schalen des zirkumbaltischen Raums in erster Linie zur Verbrennung von Fetten und Ölen verwendet wurden, vor allem zu Beleuchtungszwecken. Die Fette stammen aus dem Gewebe von Meeres-, Süßwasser- und Landlebewesen. Isotopendaten von verkohlten Oberflächenablagerungen zeigen ein durchgängig anderes Verwendungsmuster, wenn ovale Schalen mit anderen Keramikgefäßen aus dem selben Fundensemble verglichen werden. Es wird angenommen, dass Jäger-Sammler-Fischer um den 55. Breitengrad herum häufig materielle Kultur für die künstliche

https://doi.org/10.1017/ppr.2022.12 Published online by Cambridge University Press

Lichterzeugung einsetzten, aber die Nachweise beschränken sich auf Zeiten und Orte, an denen langlebigere Technologien eingesetzt wurden, einschließlich des baltischen Raums.

RESUMEN

Producción de luz por parte de las sociedades de cazadores-recolectores- pescadores con cerámica del arco circum-báltico, por Harry K. Robson, Alexandre Lucquin, Marjolein Admiraal, Ekaterina Dolbunova, Kamil Adamczak, Agnieszka Czekaj-Zastawny, William W. Fitzhugh, Witold Gumiński, Jacek Kabaciński, Andreas Kotula, Stanisław Kukawka, Ester Oras, Henny Piezonka, Gytis Piličiauskas, Søren A. Sørensen, Laura Thielen, Günter Wetzel, John Meadows, Sönke Hartz, Oliver E. Craig, y Carl P. Heron

La iluminación artificial es una necesidad humana fundamental. La combustión de madera y otros materiales generalmente en hogares u otro tipo de estructuras se extendió a las horas diurnas, mientras que el uso de sustancias inflamables como antorchas ofrecían luz durante los desplazamientos. Cada vez está más extendida la idea de que la cerámica jugó un importante papel en la producción de luz. En este estudio, nos centramos en las cerámicas de morfología de cuenco oval, realizadas y usadas fundamentalmente por las sociedades de cazadores-recolectores-pescadores en el círculo báltico durante un período de ca. 2000 años comenzando a mediados del VI milenio cal BC. Los cuencos ovales generalmente se documentan junto a grandes recipientes de cocina. Su función como “lámparas de aceite” para iluminación se ha propuesto en numerosas ocasiones pero existe una limitada evidencia que permite evaluar esta asociación funcional. Este estudio presenta los resultados de los análisis moleculares e isotópicos de los residuos orgánicos preservados en 115 cuencos ovales de 25 yacimientos arqueológicos representando un amplio rango de entornos medioambientales. Nuestros descubrimientos confirman que estos cuencos ovales de la zona circum-báltica fueron empleados fundamentalmente para la combustión de grasas y aceites, predominantemente en relación con la iluminación. Estas grasas derivan de organismos marinos, de agua dulce y terrestres. El análisis isotópico de los depósitos carbonizados muestra de forma consistente un patrón de uso diferente de estos cuencos ovales en comparación con otros recipientes cerámicos dentro de los mismos conjuntos. Se sugiere que los grupos de cazadores-recolectores-pescadores en torno al paralelo 55 comúnmente utilizaban esta cultura material para la producción de luz artificial, pero la evidencia se restringe a los tiempos y lugares en las que estas tecnologías duraderas eran empleadas, incluyendo el círculo báltico.