

Dairy Queen

Churns and milk products in the Aegean Bronze Age

Abstract*

This article assembles examples of an unusual vessel found in domestic contexts of the Early Bronze Age around the Aegean and in the Eastern Mediterranean. Identified as a “barrel vessel” by the excavators of Troy, Lesbos (Thermi), Lemnos (Poliochni), and various sites in the Chalkidike, the shape finds its best parallels in containers identified as churns in the Chalcolithic Levant, and related vessels from the Eneolithic Balkans. Levantine parallels also exist in miniature form, as in the Aegean at Troy, Thermi, and Poliochni, and appear as part of votive figures in the Near East. My interpretation of their use and development will consider how they compare to similar shapes in the archaeological record, especially in Aegean prehistory, and what possible transregional relationships they may express along with their specific function as household processing vessels for dairy products during the third millennium BC.

Keywords: Barrel vessel, churn, dairy product, Early Bronze Age, Ghasulian churn, milk fat lipid, residue analysis

My investigation of an unusual ceramic shape begins in the north Aegean (*Fig. 1*), where the first examples of this vessel stem from Heinrich Schliemann’s excavations at Troy. Schliemann first published a barrel-shaped vessel from what he termed the third or “burnt” city at Troy (now recognized as the later third millennium BC), and suggested it could have functioned as a kind of cask, noting similar shapes from Cy-

prus in European collections.¹ Carl Blegen recognized a parallel in a shape found in excavations of the 1930s at Troy, dating to the later Troy I period (first settlement), but it still stayed a “barrel vessel” (*Fig. 2*), and in fact it has retained this name in ceramic studies of this period in the Aegean.²

Beyond the Troad, the shape appeared in Early Bronze Age settlements on the north Aegean islands of Lemnos and Lesbos (*Fig. 1*). Among the prehistoric pottery discovered and published by Winifred Lamb at Thermi on Lesbos were two miniature vessels, shaped like small barrels or oval containers with flattened ends and an opening with short neck on one side.³ They stem from phase V of the settlement, with the larger one found in House E, the smaller from an unspecified context. Lamb identified them as containers perhaps intended for oil, but did not compare them with the pottery of the neighboring Troad. Meanwhile, these curiosities were soon joined by discoveries on the nearby island of Lemnos, where examples from Poliochni were published as “*barilotti*”.⁴ Here they appear during the Red and Yellow phases of the prehistoric settlement, or the middle and later centuries of the third

¹ Schliemann 1880, 404–405, nos. 439–440; Easton 2000 on this phase as Blegen’s Troy IIG.

² Blegen 1950, 76, 179, figs. 223b, 231 a, b: shape D28 (#37.980), Troy I (late).

³ Lamb 1936, 121, fig. 37, inv. 186 = No. 367 (11.5 cm long, from Town IV) and 601 (8 cm long; unstratified), Pl. XXIII; Kouka 2002, 222, 235 (“*Tönnchen*”), Table 66, Plan 31 for location of no. 367 in House E3 (Town V).

⁴ Bernabò-Brea 1964, 642, “*barilotti*”, pl. CXLVIII: a, b (two miniatures): from *vano* 518, *isolato* VII; ends of a third were found in surface levels by Giorgio Monaco in 1934; Bernabò-Brea 1976, 276: “*barilotto decorato con teste di ariete*”; from first trenches made by Ricci in 1930, east of *Strada* 105, at the level of *isolato* VII: from House 401, *isolato* VI. Pl. CCXXa. Inv. 3983: height 35.5 cm, length 48 cm (color illustration: Benvenuti 2000, 24, fig. 33 = *Fig. 3*); Dumas & Angelopoulou 1997, 543–554, fig. 1 (shape N1), “barrel-shaped vessels”.

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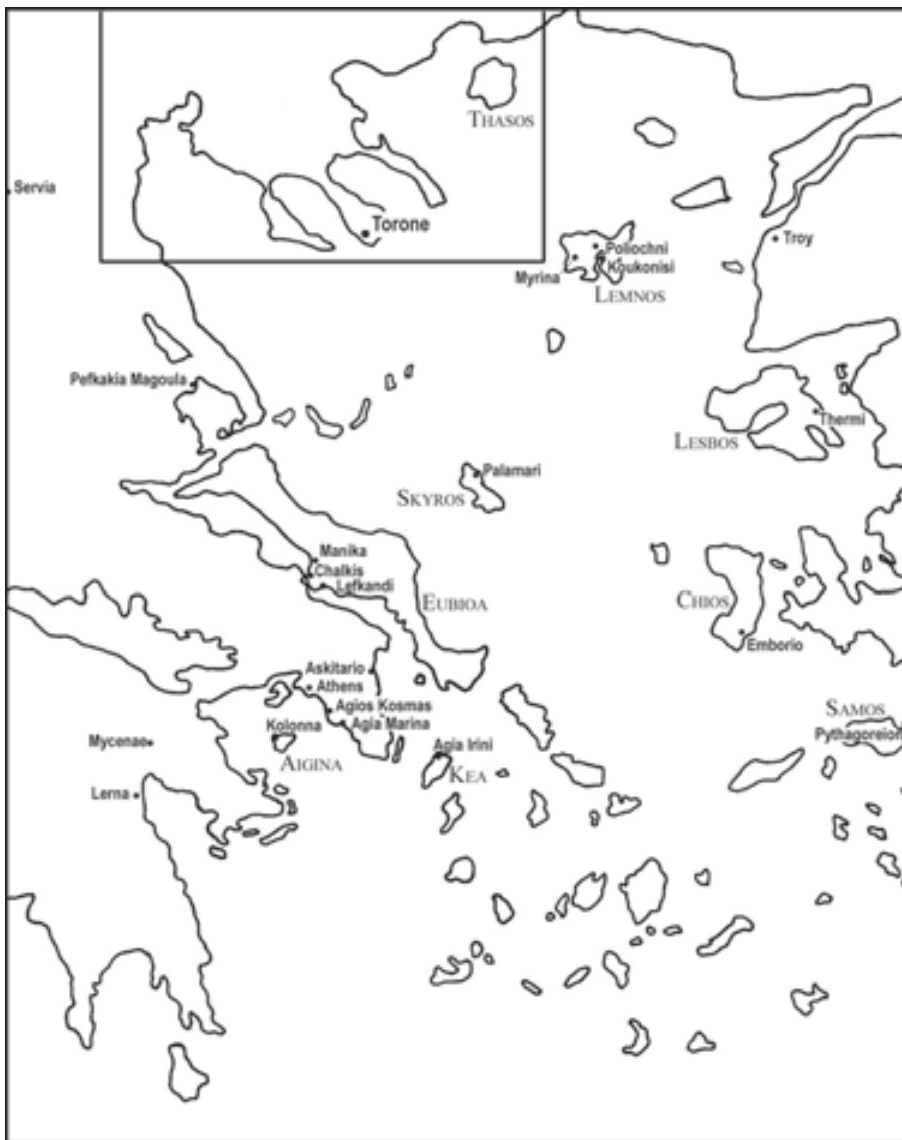


Fig. 1. Central and North Aegean sites in the Early Bronze Age (Morris 2009/2010, fig. 2).

millennium (2400–2000 BC), with the example from the later phase decorated with ram’s heads (Fig. 3). Thus the shape, including miniature versions, was recognized as a constant if unusual “barrel” vessel characterizing the Early Bronze Age (the Troy I–III “Maritime Culture”) in the northern Aegean islands and northwest Anatolia.⁵ Nearly three decades ago, in his discussion of the ceramic repertoire of Troy I, Michel S  feriad  s summarized well both the features of this Trojan type and its relationship to those from Lemnos, Lesbos, and

the Baden culture of the Copper Age Balkans.⁶ In a footnote, he also suggested their function, by comparing them to modern examples in Turkey suspended horizontally for producing butter by agitating soured milk, a container and a process that he illustrated in his publication.

My own engagement with this shape was inspired by the opportunity to study the prehistoric pottery from Torone in coastal Macedonia of the northern Aegean, located near the southern tip of the central promontory of the Chalkidike (Fig. 4). A Classical city famous for its role in Thucydides’ account of a battle waged on the site by the Spartan general Brasi-

⁵ Podzuweit 1979, 231–232, “Sonderform E: T  nchen” (pl. 24,1); Huot 1982, 125, 557–559, E7; Vol. II, Pl. 254–255, “vase-tonneau”; S  feriad  s 1985, 217–218, Pl. XIV.

⁶ S  feriad  s 1985, 218–219, Pl. XIV.



Fig. 2. Barrel vessel from Troy I (late): Istanbul Archaeological Museum (photo S. Morris).



Fig. 3. Barrel vessel from Room 401, Poliochni, Lemnos (Yellow period): Benvenuti 2000, fig. 33 (photo I. Georgouleas).

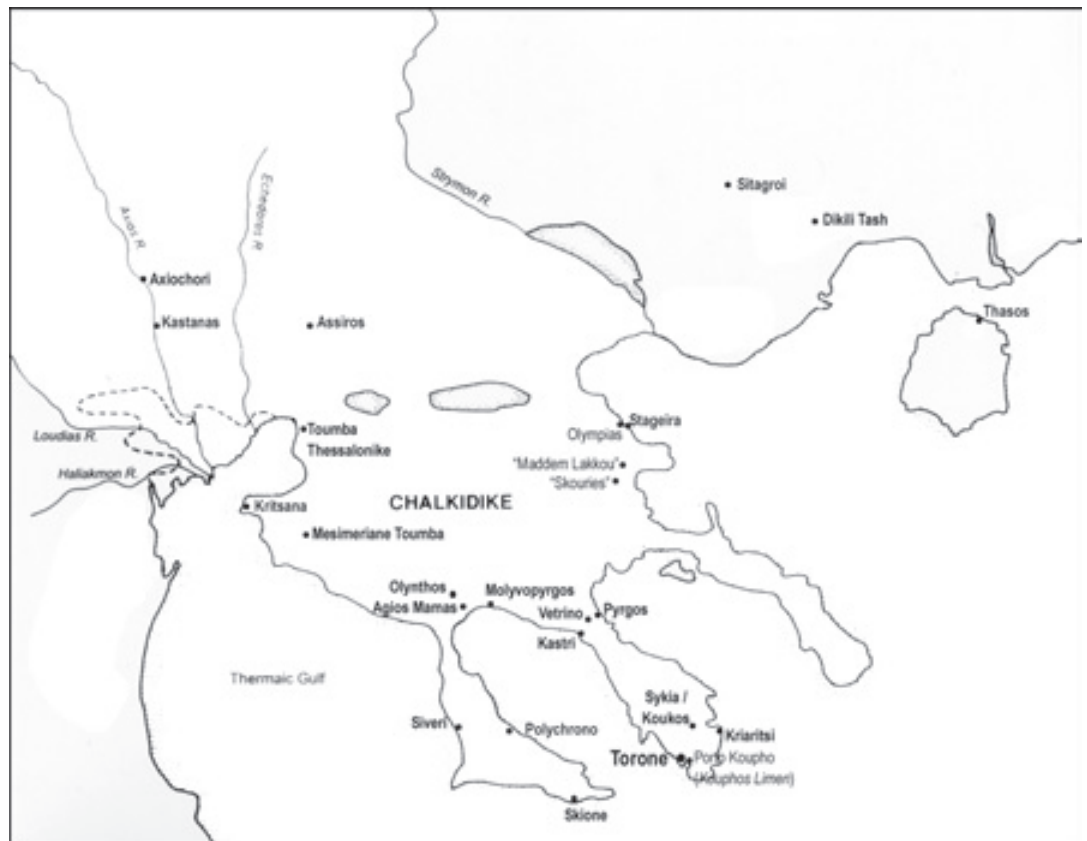


Fig. 4. Chalkidike and Central Macedonia in the Bronze Age (Morris 2009/2010, fig. 1).

das against the Athenians during the Peloponnesian War, it was excavated since 1975.⁷ The chief promontory of the settlement, called “Lekythos” in Thucydides for its distinctive shape, was the seat of a temple of Athena (a landmark in the battle narrative), followed by a Macedonian garrison, then Roman, Byzantine, and Ottoman forts. Beneath these levels lay a prehistoric settlement (explored in 1986 and 1988–1990), occupied from the onset of the Early Bronze Age, around 3000 BC, through the Early Iron Age, with significant phases in the second millennium BC, including Middle Bronze Age and Early Mycenaean (LH I–II).⁸

Among the household vessels of the Early Bronze Age, fragments of heavy fabric with burnished exterior surfaces and deeply scored interior faces mended up, after many seasons spent in puzzlement over them, into the barrel shape known at Thermi, Troy and Lemnos (*Figs. 5–7*). Examples were found in fragments above a series of Early Bronze Age floors in Trench 67/68, possibly from a single shape (restored in *Figs. 5–6*), as well as from Trenches 72, 74, and 69: in other words, in every context dating to the Early Bronze Age II phase, or approximately 2600–2400 BC. They range in size from 12 cm to over 23 cm in end diameter, with the maximum diameter of the body reaching ca 25 cm, a projecting “neck” measuring 10–12 cm in height and 12–15 cm in diameter, and the body is estimated to reach 50 cm in length. Fabric inside the break of most fragments (up to 1 cm thick) shows a grey or red core, coarse to semi-coarse in texture with visible inclusions (white grit, chips, grit, or even pebbles, with gold mica), inside lighter grey or red surface layers;



Fig. 5. Fragments of barrel vessel from Torone, Chalkidike (photo S. Morris).

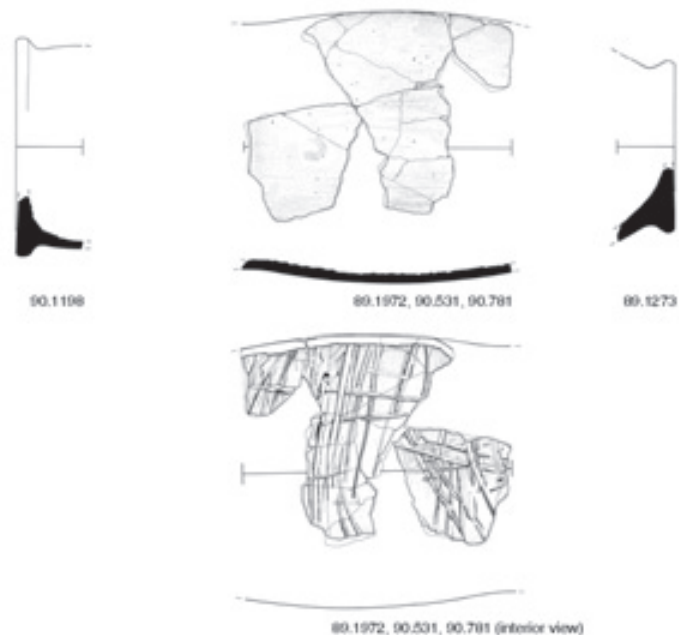


Fig. 6. Exterior, interior of barrel vessel from Torone, Chalkidike reconstructed from end, body fragments (Morris 2009/2010, 37, fig. 28).

⁷ Cambitoglou *et al.* 2001, for testimonia and full report on excavations of 1975–1978.

⁸ Papadopoulos 2001, 273–291; preliminary report on the Bronze Age phases of the Lekythos (1986–1990); Morris 2009–2010, 25–26, 37–38, figs. 28–29 for barrel vessel.

the surface is well burnished and shows the same mottled colors (red, brown and black) of other household pottery of the same phase. Distinctive is the deep, irregular scoring inside the surface of the “barrel” portion of the container (Fig. 7), the way both ends are burnished (i.e. could not serve as resting surfaces), and its heavy, weighty fabric.

Like those at other North Aegean sites, the fragments from Torone form an ovoid cylinder tapering towards the ends, then flaring out to form two broad flat terminals (round in section), which would allow a rope to be fastened at the narrowed section of each end to suspend the vessel. In parallels from Lemnos, loop handles attached to each end serve for suspension, as in the example from Poliochni with ram’s heads decorating the terminals (Fig. 3). A neck projects at 90° degrees to the main longitudinal axis of the body (Fig. 5) and may have been fitted with a vertical strap handle and carried a lid, according to non-joining fragments from Torone. The fabric is identical to other Early Bronze Age pottery, with a mottled surface (red-brown-black) burnished smooth, including on the ends, and a rougher surface visible inside the “neck”. Unique is the treatment inside the belly of the barrel, whose interior walls have been deliberately roughened or scored with deep grooves that criss-cross each other (Figs. 6–7). This treatment easily distinguished fragments in deposits at Torone, which allowed examples of this vessel to be identified from every household of the Early Bronze Age exposed in excavations on the Lekythos.

Similar examples can be recognized at sites explored long ago in the Chalkidike by Heurtley at Kritsana and Agios Mamas, from the same periods, and others may even lurk in assemblies at Sitagroi.⁹ The closest parallel stems from rescue excavations south of Thessaloniki at Mesimeriani Toumba, in an example identical in fabric and shape to the Torone “barrels”, now on display in the Thessaloniki museum (Fig. 8).¹⁰ Its peculiar position upon discovery in excavation indicates reuse: it was broken (or cut) nearly in half along (with) its neck and set on end vertically, near a hearth inside an Early Bronze Age house, but the excavators recognized its original horizontal form in their typology, along with its possible functions.

⁹ For possible candidates, see Aslanis 1985, Kritsana IV–V: pl. 101, 14; pl. 104, 14; Agios Mamas (Pit D 28): pl. 110, 8; Sitagroi (Thrace): Sherratt in Renfrew *et al.* 1986, “possible lids”, 486 fig. 13.22, #7 (“inverted lid”), #8 (“protruding base”).

¹⁰ Grammenos and Kostos 2002, 29 (Type 28), 47; 227, Pl. XLI, no. 28, Pl. 5a, b, A(γγείο)1. The vessel preserves 2/3 of its original shape, with a maximum length of 26.5 (doubled, it would yield ca 50 cm, as estimated for the Torone examples); it measures 20.3 cm at mid point, and weighs 4 kg. Fabric is not described but the vessel is classified in the “burnished red-brown” class (Grammenos & Kostos 2002, 26–27), whose surface is described as medium to well-burnished, dark reddish to dark brown in color.



Fig. 7. Interior wall of barrel vessel from Torone, Chalkidike (inv. 90.781: 10 × 10 cm) (photo S. Morris).



Fig. 8. Barrel vessel (upended) from Mesimeriani Toumba, Chalkidike. Archaeological Museum, Thessaloniki, Π 2377 (photo S. Morris).

We shall return to it, to consider the death as well as life of this important prehistoric household instrument.

The assembly of vessels from the North Aegean (Troad and islands), to which we add the new or newly recognized examples from the Chalkidike peninsula, have long been compared and classified for their function as containers for dairy products, specifically for processing raw milk by agitating the cylinder in a horizontal, suspended position. This essay will consider more closely the relation of this Aegean shape to related vessels in the Balkans, the Levant, and Crete, as well as evaluate its significance within the domestic economy of the Bronze Age North Aegean.



Fig. 9. Chalcolithic churn from Gilat, as found in situ (Grigson 1995, 266, pl. 2.2).

The Chalcolithic Levant: churns and cult

The closest parallels, in form and function, for these distinctive vessels appear north, south, and east of the north Aegean region, many of them during cultural phases that predate the Early Bronze Age (third millennium BC). In the Near East, such shapes first turned up at Teleilat Ghassul in Jordan in the 1930s, and soon were a common discovery at Chalcolithic sites in the Negev (for an example from Gilat: Fig. 9). Jacob Kaplan first identified them as vessels for processing milk, based on prototypes of goat-skin and modern parallels still used by pastoralists like the Fellahin and Bedouin in today's Negev desert (Fig. 10).¹¹ Today they are known as “Ghassulian churns” and are a characteristic feature of the Late Chalcolithic Levant, both at seasonal herding stations in the Negev, as well as in more permanent settlements.¹² In addition to the many functional churns at Chalcolithic sites, striking and memorable in the Levant are versions made in miniature as a small votive type, found at settlements but also in burial caves (Azor, Ben-Shemen) and shrines where “functional” ex-

amples are absent.¹³ As with the Aegean miniature versions (from Lemnos and Lesbos), one speculates whether they were designed for preparing “individual” servings of soured milk (for which one would expect a small, portable skin bag; hence these may be votive?), or, more likely in the Near East, associate churns with some form of cult. A memorable version of the Ghassulian churn reinforces a ritual role, for it appears as part of a terracotta figure of a female from a shrine at Gilat carrying such a vessel on her head (Fig. 11), and on a bovine figure from a shrine near a spring at En-Gedi (Fig. 12), bearing a pair of such churns.¹⁴ Evidently the shape and/or its contents inspired some form of cult attention in the Chalcolithic period, both in the form of miniature vessels and as part of cult figurines, celebrating the products of animal herds in an era and an environment where milk and its byproducts played a major role.

However, a major gap in chronology leaves the Chalcolithic period in the Levant, whose terminus has recently been raised by new C¹⁴ dates to ca 3900–3700 BC, separated from the earliest examples of churns in the Aegean by as much as a thousand years.¹⁵ This means that Chalcolithic churns and contexts from the Levant offer, at best, remote parallels for

¹¹ Kaplan 1954, 1965; Amiram 1969, 33–34, Photo 18, Pl. 7, fig. 39. A related shape with elongated, perforated ends flattened into two “wings” was first called a “bird-vase” at Teleilat Ghassul, now identified as a smaller suspended churn.

¹² Garfinkel 1999, 254–258, “Ghassulian Ware” (Late Chalcolithic), “churns”, figs. 142–160, Ph. 100; Levy 2006, 424–426, 492–495; pp. 110, 112, 187, 191, Pl. 5:33, 5:34, 5:41.

¹³ Ussishkin 1980, Epstein 1985, Tadmor 1990, Gilead 1995, 165–171.

¹⁴ Gilat: Treasures 64, no. 16 (Fig. 11); En Gedi: Ussishkin 1980, fig. 11 (= Fig. 12).

¹⁵ Bourke *et al.* 2004. The onset of the Early Bronze Age, both in terms of its absolute date and its urbanizing innovations, is also currently under revision in the Levant. I am grateful to Stephen Bourke for enlightening me on these complications in chronology.



Fig. 10. Modern Bedouin churn in use (photo courtesy of Osnat Misch-Brandl).



Fig. 11. Chalcolithic female figurine with churn, from Gilat, Negev (Israel) *Treasures* 64, no. 16; IDAM 76–54. H. 30 cm.



Fig. 12. Bovine figurine (milk cow?) with churns, from En Gedi (Ussishkin 1980, fig. 11).

the Aegean, along with the most likely explanation for their function, based on modern analogies. What, if any, intermediate stages and phases would link the Chalcolithic Levant with the Bronze Age Aegean? While one might expect to find examples of the clay churn in the northern Levant, for example, none have appeared despite intensive work in the Chalcolithic Golan, beyond a single example re-used as a burial container at Chalcolithic Byblos in Syria.¹⁶ Examples from Predynastic Egypt (Minshat Abu Omar, Abydos) are probably imports from Palestine during a period of intense relations between the two areas, in the fourth and third millennia BC.¹⁷ This leaves Anatolia or Cyprus as possible areas for exploring any migration of this vessel.

¹⁶ Byblos: Dunand 1973, 251, 292 fig. 170, Pl. CLI T[ombe] 1735 #32258: “Énéolithique récent” [3700–3300 BC]: “baratte”; 301 (fragment of second churn). Golan: Epstein 1998. A container from Jebel Aruba (<http://www.rmo.nl/english/current/exhibitions/archive/jebel-aruda>) dating to the Late Chalcolithic (Uruk) period may be an import from Mesopotamia.

¹⁷ Kroeper 1989, 416, fig. 8a, “spouted vessel”; Kroeper & Wildung 2000 (Minshat Abu Omar) 10–11: Grave 787, Pl. 4 (placed near head [mouth] of adult male; 13 cm long, 12 high, 11 cm in diameter, imported fabric; Hartung 2001, 2002 (Abydos). I am grateful to Robert Schiestl for directing my attention to these examples.



Fig. 13. Churn (“Fischbutte?”) from Baden culture, Hungary (Banner 1956, pl. LIII:1).

Anatolia: Bridges across prehistory?

Given the large number of Chalcolithic sites (over 50) well explored in Anatolia, one might expect links between the Aegean and the Levant to lie here. There are a few isolated candidates in small barrel-vessels, some (including miniatures) from excavations at Demircihüyük, another from Karataş-Semayük (Elmalı) in Lycia.¹⁸ Other Chalcolithic sites in Anatolia offer related containers, including one acquired by the Louvre Museum and published many years ago. Claire Epstein recognized its anthropomorphic shape as a “churn-goddess”, a broad jar with vertical neck, shaped into a face and even furnished with obsidian eyes, in fact closely resembling the “bird-jar” variant of the Ghassulian churn in the Levant. Close parallels in Anatolia soon turned up in excavations at Hacilar by James Mellaart in the Early Chalcolithic phase (Hacilar I), classified among other “ovoid jars:” broad in profile with tapering ends, little or no resting surface, and a small opening on the top or side.¹⁹ This might give Chalcolithic Anatolia a form

of churn equivalent to the Levantine “bird-vase”, but nothing resembling the Ghassulian churn. Finally, Late Chalcolithic levels (LMT VII.2) at Limantepe or prehistoric Klazomenai in coastal Ionia have produced a suggestive shape, albeit a miniature one (ca 15 cm in length) made in fine ware and found with other special objects, which has been identified as a biconical rhyton, but it resembles in profile very closely the Baden vessels (Fig. 13) firmly identified as churns.²⁰

More recently, explorations close to Hacilar in southwest Anatolia have produced examples that resemble barrel vessels from Höyücek, a small mound of the Neolithic through Chalcolithic eras.²¹ Refik Duru describes these shapes as “a kidney-like flat and elongated body with a cylindrical neck attached to the middle”, and classifies them along with other “unusual” vessels or “fantastic” forms, possibly designed for ritual use.²² With four vertical lugs for suspension and no resting surface underneath, where a raised decorative motif implies it was viewed from below (while the vessel was suspended?), these shapes are likely to have been using for processing dairy products. While they stem from a level of the site characterized by abundant (ca 100) figurines and termed a “Shrine Phase”,

¹⁸ Schoop 2005; Demircihüyük: Bittel & Otto 1939, 13, Taf. 10:7; Efe 1988, 77–78, fig. 94, pl. 48:10 (end fragment: miniature? diameter of end ca 4 cm); Elmalı: Mellink 1965, 250 n. 17, Pl. 64, fig. 32, compared Ghassulian churns, but rejected them as parallels, followed by Eslick 2009, 79, KA 122 (MCI), Pls. 28, 72. I am grateful to Christine Eslick for her views on this vessel, and an advance copy of her publication.

¹⁹ Epstein 1985, 54, fig. 1 = Mellaart 1970, Vol. 1, 137. These appear at Hacilar in both monochrome wares (Level I, 1.6, 362–363, fig. 111:19; 158, pl. CV: 4 and Vol. I, color plate IV) and painted assemblages (Vol. II, 422–425, figs. 146–148; I, 42, #27, from P.IIA.1.3, plan on p. 52).

²⁰ Kouka 2009, 143, 145 fig. 6. I am grateful to Vasif Şahoğlu and Ourania Kouka for advice on this shape, to be published by Riza Tuncel with the Late Chalcolithic levels.

²¹ Duru 1999, 146, fig. 18; 2008, p. 63, fig. 119, p. 64, fig. 120.

²² Duru 2008, 63, fig. 119.

this does not preclude a practical function for these containers.²³ As the Shrine Phase has been dated by C¹⁴ analysis to the seventh millennium BC, or Early Neolithic, these “kidney-shaped” vessels, if correctly identified, would count among our earliest churns thus recognized in the ceramic record. They would also mark the first appearance of dairy-producing vessels in a cult context even earlier than the Chalcolithic shrines with churns and miniatures in the Levant, or the Proto-Elamite temple texts, given their association with the Shrine Phase of the Höyücek settlement.

With the exception of these isolated Neolithic vessels from the Burdur region, and possible shapes from the Chalcolithic and Early Bronze Age in western regions, the horizontal churn makes no appearance in prehistoric Anatolia. Instead, a different type of standing vessel, closely comparable to the modern tall jar called *taş yanyık*, a butter churn, became a standard element of the ceramic repertoire since the Chalcolithic period.²⁴ During an era of small-scale pastoralism (small herds, probably predominantly goats, raised largely for secondary products rather than for meat) across the central highlands of Anatolia, milk products were processed in tall jars with a spout for drawing off the lowest levels of liquid, while perforations in the high neck of the jar released gases during the souring process. Possibly these vessels were designed for the important process of separating butter or clarifying it into butter-oil, later an important product for Hittite culture in Central Anatolia during the second millennium BC. Developing a dependable means of storing protein and fat could have assisted the rise of small, independent communities prior to large-scale centralization and urbanization in the Early Bronze Age. Elsewhere, primarily in northwest Anatolia and the Marmara region, perforated strainers indicate an alternative means of boiling and straining milk, comparable to the “cheese pots” of the Final Neolithic phase in the Aegean and Europe.²⁵ In neither case did an elongated horizontal barrel-shape join the ceramic repertoire, although it could have existed in a form made of skin or wood. Thus prehistoric Anatolia, despite its rich post-Selcuk record in dairying practices and containers, provides no link from East to Aegean.

One possibility involving the south Aegean is suggested by the curious case of Crete, where striking examples of “suspension” vessels, perhaps for processing dairy products, show up in the Early Minoan I period, as noted long ago for their resem-

blance to Ghassulian churns.²⁶ Recently, a number of scholars have returned to this shape and in fact revived the notion of a whole-scale migration from the Chalcolithic Levant to Crete, to account for a diverse set of innovations such as the introduction of olive cultivation, the appearance of new shapes and decorative techniques (light-on-dark) in ceramics, new types of figurines in ivory, novel burial customs, and perhaps an interest in metallurgy. Tracing this connection requires close control over chronology, revising significant Early Minoan deposits and phases upward into the Final Neolithic, and coordinating an entire suite of innovations.²⁷ While this connection remains a fascinating possibility for contact between the southern Aegean and the Near East, the “churn” candidates found on Crete (primarily from Lebena) are different enough in shape and surface treatment to keep them remote from the examples in the North Aegean. Those from Lebena include a short, squat cylinder with “neck” and end panels that end in feet, forming a resting surface; they are made of fine ware and decorated in light on dark (cream on red) patterns typical of the Early Minoan I style. Another candidate is offered in an eccentric convex-concave profiled vessel with high-swung handles that are pierced for suspension. Neither resembles in fabric or form the heavy and coarse containers found in the north Aegean.

Northern roots, northern routes: From the Danube to the Aegean?

Without a direct connection to Chalcolithic predecessors for Aegean churns (except perhaps for the southern Aegean, in Crete), or any visible links via prehistoric Anatolia, what other possible origins could explain the appearance in the third millennium BC of those in the north Aegean? Independent inventions by different groups raising herds for milk could account for diverse examples, but circumstances suggest other pathways.

²³ Duru 1999, 178; 2008, 36–40, figs. 62–74.

²⁴ Schoop 1998; 2005, 57–58 [churns?], 86–87, fig. 2.19:3, 597; Pl. 28 [butter jars], for which compare the Ubaid temple frieze jars (*Fig. 14*). Residue analysis has confirmed the presence of fatty acids in these sherds, along with a high probability of dairy fats: Sauter, Puchiner & Schoop 2005.

²⁵ Bogucki 1984; Takaoglu 2006.

²⁶ First to note this link was Jirku 1948, before Kaplan 1954 identified the vessels as churns; cf. Weinberg 1954, 94–96, 103, fig. 1.17; 1965, 302; Kalicz 1963, 36 n. 219; Hood 1990. Vessels from Lebena: Alexiou & Warren 2004, 62–63, “barrel vases”, Tomb II:4 = Herakleion 15385/II 273 (2) fig. 18, Pl. 31B. H. 10.3 cm, L. 8.9 cm, W (end) 8.4 cm; Tomb II:5 = Herakleion 15447/II 200 (1). H. 10.8 cm, L. 10.6 cm; Vlassaki *et al.* 2008, 24 #3 (color photo).

²⁷ I am grateful to Sharon Zuckerman for drawing my attention to this connection, to Harriet Blitzer for helpful discussions, and to Robert Koehl for a copy of his paper, “The Role of Ghassulian Culture in the Development of Early Bronze Age Crete”, delivered at the Onassis Center conference on the exhibition published as Vlassaki *et al.* 2008. A special panel of the Archaeological Institute of America (held in Seattle in January 2013), convened by Robert Koehl and devoted to this topic, is said to be headed for publication.

Following recent arguments for the origins of metallurgy in the Aegean, my own conclusions point north, rather than to the East. As noted by earlier observers of these shapes in the north Aegean, possible parallels for the distinctively shaped “dairy bottles” exist in the so-called Baden (Pécelér) culture of the Carpathian basin, or the later Eneolithic (Copper Age, Chalcolithic, or Final Neolithic period) in Hungary.²⁸ Labeled a “*Fischbutte*” or fish-trap (Fig. 13), for its resemblance to traditional oblong leather (animal skin) shapes or baskets submerged to trap fish in rivers, it is considered one of the most distinctive and characteristic shapes of this prehistoric culture.²⁹ Primarily common in the Carpathian basin of Hungary, examples have also been identified in the southern Balkans, in Croatia and FYROM–Macedonia (Bubanj near Nis), and even in Romania.³⁰ Parallels with Ghassulian churns have long been noted, and indeed the function of the Carpathian vessels was recognized as a container for liquids, and probably for storage of milk, in connection with dairying. However, the chronology of the shapes in the north implied that they spread to the Balkans from Anatolia, without intermediate discoveries to prove this connection. The examples now found in Chalkidike provide a link in both time and space between those of the fourth-millennium Carpathian cultures and their later relatives on Lemnos, Lesbos and Troy. Rather than assuming this innovation began in the Levant and “traveled” north and west (possibly stopping at Crete?), the lack of precise parallels, especially in the intervening cultures of Anatolia, suggests that the north Aegean vessels belong to the southern-most appearance of a set of forms and practices at home in the Final Neolithic Balkans.

Aegean archaeologists are long accustomed to turning north, for example to consider the origins of copper metallurgy and types of ceramic, lithic and metal artifacts, in prehistory. In recent years, striking correspondences between the Central Balkans (Karanovo culture) and Central Anatolia point to intensive traffic across the Hellespont since the early Neolithic, with scattered signs of these links in coastal Thrace.³¹ As Joseph Maran has argued, the important shift from copper-based metallurgy in the Neolithic Balkans south towards the exploitation of silver, gold and lead, put the Aegean in the path of innovation and opened up new coastal sites around the eastern Mediterranean, during the Final Neolith-

ic.³² While he has focused on vessels he calls “Bratislava bowls” (now found in Epirus, Thessaly, Macedonia, Attica and the Cyclades) and other artifacts, humbler shapes that express a dependence on dairy products, and are associated with the same cultures originating in the Balkans, may be just as significant as markers of cultural and economic innovation in the emergent Early Bronze Age. If we can pinpoint any of these transformations in time, it is here suggested that the northern Aegean, yet to reveal a clearly defined, stratified Final Neolithic (Chalcolithic) phase of the kind recognized in southern Greece and the islands, may harbor in its Early Bronze Age phases these vessels as epiphenomena of the metallurgical revolution that made the third millennium BC in the Aegean so different from the earlier Copper Age in the Balkans. The latter’s early phase ended abruptly, whether through dramatic events in climate change, anthropogenic exhaustion of soils and forests, or disruption by new mobile populations from Central Asia. More than one of these explanations for abandonment might mark an increase in reliance on pastoral products, either from the failure of agriculture, the effects of deforestation from the quest for fuels to (s)melt copper, or the incursion of Asian populations more dependent on dairy subsistence than on crops.³³ Did the transformation of the Early Bronze Age in the North Aegean, with the advent of copper-alloy technology typified in the Petralona hoard, include a migration of craft specialists and their families from the Balkans, who processed and/or consumed milk in a new way?

Clay and milk

Linking these shapes with dairy processing is but the first step in understanding their use.

The prehistory of dairying is at the forefront of current research on European prehistory, thanks to recent work in residue analysis, which has succeeded in isolating milk fat lipids in several thousand Neolithic vessels from southeastern Europe, Anatolia and the Levant.³⁴ These results point to milk processing as early as the 9th–7th millennium BC in north-west Anatolia, and the sixth millennium in Neolithic Europe. More recently, milk strainers (sieves) or boilers specific to Eu-

²⁸ Bernabo Brea 1976, 276; Huot 1982, 558; Sherratt 1981, 281, fig. 10.15 (4th row).

²⁹ Schmidt 1945, 64, 123, fig. 71:8; Banner 1956, 144, fig. 43 (distribution map), 146–147, pls. VI:1, XXI:23, XXIII:42, XXIX:13, XLIV:6, LIII:1, CXIII:12–17 (typology of shapes); Kalicz 1963, 35–37.

³⁰ *CVA* Yugoslavia 2, Zagreb, Musée National, VI c, pl. 2:2 (Sarvas); Garasanin 1958, pl. 5:2.

³¹ Özdoğan 2004, with earlier literature.

³² Maran 1998, 2000; Parzinger 1993, 347–352 (Horizons 10–12, ca 3400–2900 BC).

³³ For a summary of recent data and its possible causes, see Anthony 2010, 45–54.

³⁴ Evershed *et al.* 2008. Without details of shapes represented among the 2,200 sherds sampled, links from form to use/function are not yet available, and some doubts exist. Low levels of myristic acid (C14:0) and lack of evidence to date for alpha casein undermine the certainty of milk fats in the containers analyzed (according to oral communication from zooarchaeologist Lachlan Mairs of the University of Sydney).

ropean prehistory tested positive for such fats and point to the production of cheese as a primary activity of early herders and farmers, with important implications for the transition from the Mesolithic to Neolithic in Europe.³⁵ Independent faunal studies suggest upgrading the results of dairy processing to a “primary” rather than “secondary” product of the so-called Neolithic revolution, based on age profiles of sheep and goats in the northern Levant and Cyprus, as early as the PPNB (Pre-Pottery Neolithic B), or well before the use of ceramics.³⁶ Thus the early history of human dairy consumption lies well beyond the study of ceramic containers, alone, and depends critically on interdisciplinary methods and evidence.

The most important link in this chain of investigation remains residue analysis. However, the percentage or concentration of butter/fat in any deposit or residue cannot always easily be determined, thus the likelihood of determining the precise product and its fat content, much less whether it derives from cow’s milk, or that of sheep, goat, or water buffalo. In some contexts, a preponderance of bovine fauna raised beyond the usual age of slaughter for meat would point to cattle being raised for milk. Moreover, distinguishing butter from other dairy products such as soured milk, curds, cream, yogurt, buttermilk or cheese still requires more assistance from ethnography than residue analysis, to understand the “foodways” of secondary dairy products. Thus although we can now mark the advent of milk as regular contents of ceramic vessels since the seventh millennium BC, was it processed, consumed or stored as a fresh, boiled, soured, salted, or fermented product? Complementary stable isotope analysis of human skeletons can determine sources of animal protein by species, but cannot distinguish whether such proteins were consumed as meat or milk. Other ancillary techniques for linking dairy products to human consumers enlist bioarchaeology, to identify diseases like brucellosis carried by un-pasteurized (under-boiled) dairy products, or zoonotic diseases linked to cattle (such as bovine tuberculosis). Thus residue analysis remains but one of several techniques to be enlisted for a conjoined analytic quest for the early human use of dairy products.

Since the Neolithic period, humans have had to process milk from domesticated animals—cattle, sheep and goat—both as a storage solution and as a means of making lactose products easier to digest.³⁷ Indeed, recent arguments support the notion that genetic adaptation to digesting lactose became a strong and selective biological advantage in early Europe,

while for those who lacked the enzyme (lactase) to digest raw milk, processing was crucially important for health purposes.³⁸ Boiling milk also kills bacteria (lactobacilli) and helps prevent diseases such as brucellosis, thus processing techniques introduce safety and health to a primary food product: indeed, dairy herds have been described as man’s best water purifying agent. Finally, milk processed into yogurt, cheese, and butter represents a secondary product of immense value to early (and modern) pastoralists. Processing and preserving raw milk expands the shelf-life of a valuable food-stuff, providing portable, long-life protein as cheese and yogurt, or fat in long-life butter-oil, and develops its potential for profitable distribution, turning raw milk into a longer-term cash crop. Even earlier, it may have provided portable protein for mobile pastoralists (as it does today) or even for hunter-gatherers.

In the Near East, archaeological evidence, both faunal and ceramic, finds support in the oldest readable texts, which offer confirmation of early dairy specialization. For the Chalcolithic period, or fourth-to-early third millennium BC, also marks the era of the earliest written texts from the Near East that indicate specialized and controlled dairy products, in Proto-Elamite tablets from various sites in Mesopotamia recording targets and sub-categories of milk by-products. Studies of the Archaic Uruk texts and their Proto-Elamite predecessors by Robert Englund and Jacob Dahl are enlightening on this subject and perhaps underappreciated by archaeologists and faunal specialists. Texts from Susa offer signs identified as marking specialized dairy products contributed annually by herders (keepers of flocks belonging to the temple where the texts are found). Special symbols differentiate dairy products from goat’s or sheep’s milk, and those in the form of butter/oil (fat) from cheese (dried product); other signs point to cattle, primarily in later (Uruk) versions of this sign that correspond to the Sumerogram KISIM, Babylonian *kisimmu*, etc. Moreover, the sign itself resembles the shape of a “dairy-bottle”, which is how Assyriologists first identified it (*Fig. 14*). A visual record of the sequence of dairy processing, much analyzed by archaeologists, also exists in the form of a sculpted frieze from a temple at El Ubaid in Iraq, dating to the Early Dynastic III period (2600–2500 BC) (*Fig. 14*). Some zooarchaeologists have denied that dairy products can be preserved, or that production of them was controlled, in the Uruk period.³⁹ This may reflect how dairying is simply not prominent in later texts, while it figures more visibly in texts from a period just after the Chalcolithic (Ghassulian), when pastoralism and

³⁵ Salque *et al.* 2013.

³⁶ Vigne & Helmer 2007; Conolly *et al.* 2011.

³⁷ Sherratt 1981, 1983 on secondary dairy products; Martin 1980, 24–25; Englund 1995, 377–380, fig. 1; Schoop 1998, 29, fig. 3; Kapetanios 2003, 285, fig. 31.1, for various flow-charts for processing raw milk into cheese, yogurt, butter (oil) and other products (cf. Katz 2012, 181–210 on fermentation of milk products); Greenfield 2010.

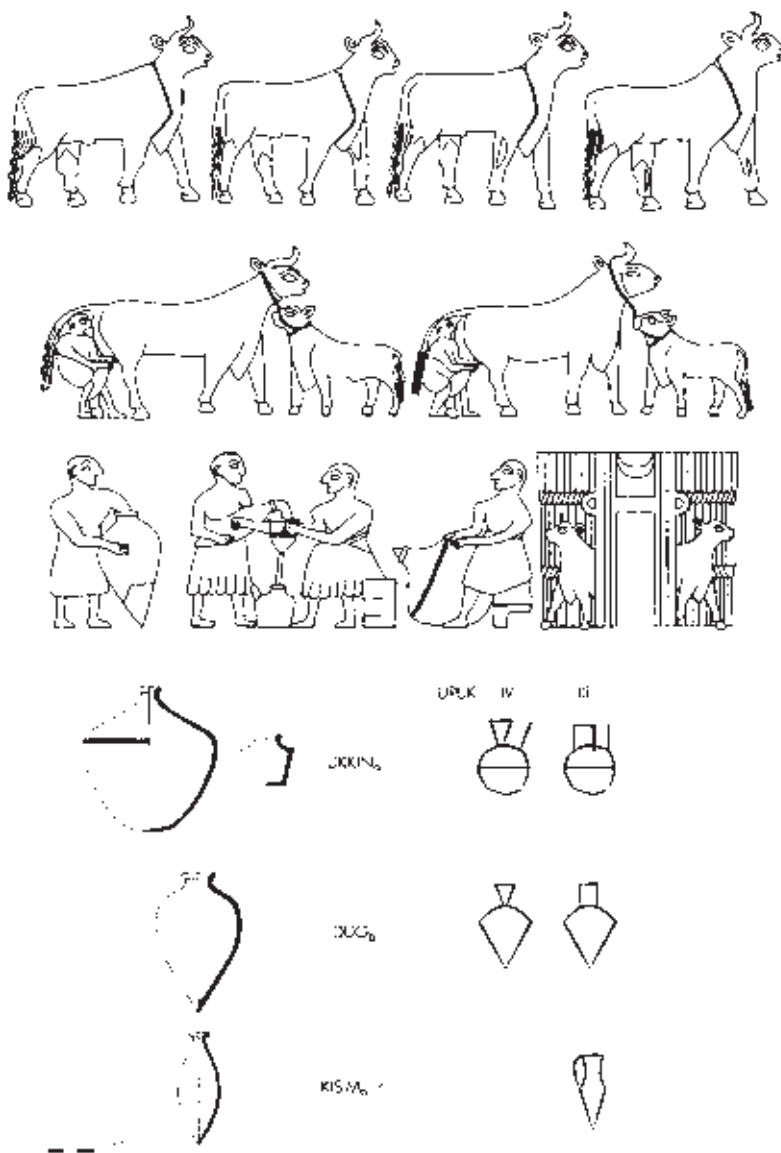
³⁸ Itan *et al.* 2009; Leonardi *et al.* 2012; Leonardi 2013 (for further research, see results of the LeCHE project (Lactase Persistence in the Early Cultural History of Europe, a Marie Curie International Training Project, 2009–2013).

³⁹ Zeder 1993; Dahl 2005.

Fig. 14. Depiction of dairy herds (cattle), milking and processing from a temple frieze at Al-Ubaid, Iraq, with “dairy bottle” signs in the Archaic Uruk texts (Bauer et al. 1998, fig. 54).

its products dominated local economies. Moreover, Proto-Elamite texts and their products stem from a temple (like the Ubaid frieze) as records of annual yields from sacred herds (temple property), providing a contemporary context for the ritual link to dairy vessels in the miniature churns and figurine versions in the Chalcolithic Levant and (possibly) Anatolia. While faunal specialists have kept us focused on meat (especially during recent popularity of the study of feasting in archaeology), Assyriology thus helps restore the prominence of dairy products, which leaves it up to us as archaeologists to trace the material components of this domestic and ritual economy. Literature of Egypt and the Near East continued to celebrate the role of dairy products, from the Middle Kingdom Song of Sinuhe (where a traveler is welcomed by “Asiatic” pastoralists with a drink of boiled milk) to Sumerian poems and Biblical passages that celebrate pastoral products.⁴⁰

At present, none of the Early Bronze Age containers from the North Aegean identified as dairy bottles has been subjected to residue analysis, nor are they suitable for such a study (some were excavated in the 19th century, others are immobilized in museum displays, and many have been washed under conditions that preclude later residue analysis). While some Neolithic sherds from Northern Greece (Makrygialos) were included in the study published in 2008, they tested negative for the presence of milk fats.⁴¹ Thus this essay represents more of a manifesto for future research, as well as a summary of those containers published (if not all identified) as possible churns, than a definitive analysis.



Form and function: “Shaken, not stirred?”

In several locales where the “dairy bottle” appears in the archaeological record, scholars have also been greatly assisted in their quest for explanations of its function by the existence of contemporary, traditional herding communities, both sedentary and mobile. This is particularly true in the Near East, home to Bedouin and other pastoralists, but also in Turkey and the Balkans, where ethnohistory and modern studies have preserved ways of life not always still practiced in more developed areas. How can these communities inform archae-

⁴⁰ Song of Sinuhe: Papyrus Berlin 3022.15–25 (translated Lichtheim); Jacobsen 1983, Kramer 1989, Grottanelli 1994, Homan 2002, and Saidel 2008 for the symbolism of milk, pastoralism and the nomadic lifestyle in the ancient (and modern) Levant.

⁴¹ Urem-Kotsou & Kotsakis 2007, 257; Kotsakis 2008.

ologists about the use of ceramic containers to process dairy products? In particular, what kind of foodways or food preferences guided the processing of milk?

While prehistoric Anatolia failed to produce definite ceramic examples of the churn adopted by its neighbors, its rich ethnography reveals many examples of skin and wood containers still in use today, probably introduced by Turkic tribes from Central Asia. A typical Yörük nomadic household includes an animal-skin bag suspended from a triangular framework of inclined wooden supports, perhaps simply a container for food or water hung safely above reach of predators and insects, but more likely a vessel for dairy products to be soured (in the sun?) and/or agitated, i.e. a churn for turning milk into byproducts.⁴² Yakar's intensive study of traditional societies in Anatolia captured scenes of both a vertical wooden churn and a suspended one of skin outside a Yörük tent, and describes women as "using different types of churn to make dairy products such as butter, cheese and yogurt".⁴³ The "black-tent" culture of mobile pastoralists he studies is widely distributed not only among the Bedouin in the Levant, and Yörük in Anatolia, but across the modern Middle East from the Aegean to the Indus, and especially among Iranian tribes south of the Caspian Sea as well as in Central Asia.⁴⁴ Even non-mobile pastoralists, or those who move their flocks to richer pastures in the summer, devote considerable time to milking and processing, as in contemporary Turkish villages.⁴⁵

In one of the most detailed studies of these pastoralists and their methods of processing milk products, a project focused on the Turan region of Iran produced precise modern terminology and timing of different processing of goat and sheep milk, where smooth-skinned (tanned) leather containers are used for keeping milk and yogurt cool, while shaggy animal skins are for cheese.⁴⁶ Versions of these animal-skin containers for dairy products are still common in Turkey in the form of a goatskin in which *tulum peynir*, or full-fat milk pressed into a dry, crumbly cheese (also known as *Erzincan peynir*) is manufactured, served or sold. The Greek equivalent of this cheese is still known as "*touloumo-tyri*", named for the goatskin, and traditional pastoralists in northern Greece (the Sarakatsanoi)



Fig. 15. Modern wooden barrel-vessel for making ayran, Turkey, 2008 (photo Charles Steinmetz).

but also in the Cycladic islands use skins to make and store cheese.⁴⁷

Finally, last but not least, traditional wooden vessels for making *ayran*, or buttermilk (a soured milk drink of salt and water added to yogurt, then agitated, called *dala* in northern Greece among the Vlachs, *dhallë* in Albania, *dogh* in Farsi, and *lassi* in India), are still in use or on display throughout modern Turkey (Fig. 15). The product is also now marketed in Greece as "*ariáni*," in plastic bottles illustrated with a vertical wooden churn to suggest how it is made. Clearly modern Anatolia offers us both ethnographic examples of this constant pastoral shape and a continued taste for its products. Its early modern history also helps explain why these shapes do not appear in the ethnographic record of northern Greece, even among transhumant pastoralists of the Balkans. The Sarakatsanoi and Vlach tribes active over a large area of the southern Balkans in the Late Ottoman empire use(d) wooden buckets and churns for processing dairy products, often on a large scale in a specialized dairy hut or tent (*bantzós*), during high season for dairy herds, as they specialized in mass production of cheeses and yogurt for sale in urban markets.⁴⁸ But the skin or wooden barrel-shapes used as churns in Anatolia and the Levant (*tourban* in Turkish, *drouvani*, or *dourvani* in Greek) serve as occa-

⁴² See display in Antalya Museum: Özgen & Özgen 1988, 156, 227, fig. 188.

⁴³ Yakar 2000, 211, figs. 87–88 (does not specify which container used for which product).

⁴⁴ For cautionary remarks on the comparative use of modern nomads to understand and explain prehistoric ones: Saidal 2008 and other essays in Barnard & Wendrich 2008.

⁴⁵ Gürsan-Salzmänn 2001, for a helpful account of just how much time women spend on milking and processing on a daily basis, and producing (e.g.) cheeses for sale in markets.

⁴⁶ Martin 1980; cf. Kapetanios 2003, 285, fig. 31.1.

⁴⁷ Sarakatsanoi: Hatzimichali 2010, 141–142, 147; Naxos: Zeugoli 1953, 96, 100–101.

⁴⁸ Sarakatsanoi: Hatzimichali 1957, II: 22, 111 fig. 55; 72–112; Kavadias 1965, 36–38, figs. 20–22, 110–111, figs. 91–93. According to Wace and Thompson (1914, 78–80), among the Vlachs butter (*umtu*) "is rarely made" (79), but *dala* (soured milk, *dhallë* in Albanian) is common. Vertical churns for butter (*boutnaioi*) are far more common among traditional ceramic containers of Greece: Korre-Zoographou 1995, 184, fig. 335 (from Karditsa, Thessaly), although occasional shapes like *tsotres* (ibid. 209, fig. 394, from Euboea) with two flat ends, two handles and a short neck resemble suspended churns.

sional water-containers, not as dairy processors. Either a taste for butter eluded Greece, or these areas already depended on olive oil for cooking and calories, or on goats whose milk produces less butter fat than sheep or cattle (rarer in the Aegean). Instead, milk was processed directly (by boiling, not agitation) into full-fat cheese (for protein) rather than separating the butter (fat) first. Even in Chalkidike, whose Toronean cows were praised for their rich yield of milk (Aristotle *HA* 523a), such containers may have been used for souring milk, not separating butter.

To sum up arguments so far, it appears that in several different prehistoric locales around the eastern Mediterranean, milk products were processed in suspended containers of skin, wood, or clay, to assist agitation of the contents, presumably after being soured, fermented or cultured as part of the production process. The earliest containers, like their current ethnographic counterparts, are made from the skins of animals raised for their milk, thus in both material and function these vessels epitomize pastoralism and its by-products. Archaeology captures these vessels when turned into more permanent, durable artifacts of clay or wood, but they enjoyed a relatively short shelf-life in ceramic prehistory, making their debut in the Neolithic or Chalcolithic era, depending on locale, and lasting through the end of the Early Bronze Age. Their origin in goatskins means they could have been invented independently in any of these locales, and there are no means to press for priority in any one area. I suspect that many other examples of such vessels lie unpublished, mid-identified, or variously classified as “miscellaneous” or ritual vessels, among prehistoric ceramics around the Eastern Mediterranean (as I have suggested for several sites in Turkey). For example, one puzzle from Urartu, on display in the Istanbul Archaeological Museum of the Ancient Orient, may represent a revival of the shape in the Early Iron Age, but pastoralism at any period may have inspired such a container and its multiple lives.

But I can offer some thoughts, however simplistic, on the demise of these vessels in solid form. As Jacob Kaplan recognized, the portable churn of perishable materials outlasted its brief life in clay. While still used by some modern nomads, ceramic versions marked a fleeting moment in Old World prehistory, as they disappear from the Levant after the Chalcolithic, and do not outlast the Early Bronze Age in the Aegean. Two archaeological contexts capture a precise moment in this process of abandonment, in both regions. The version found at Mesimeriani Tomba (*Fig. 8*) had been broken in half on one side of its neck, then turned ninety degrees and set into an earthen floor near a hearth, in a domestic context of the Early Bronze Age. This placement left its erstwhile neck now projecting horizontally, forming a spout attached to a vertical cylinder. How precisely it was used remains a matter of speculation: the display in the prehistoric collection of the Archae-

ological Museum of Thessaloniki calls it “an unusual cooking vessel” (with an improbable explanation of how it could have been used over a fire), then admits that “some archaeologists believe that this device was used for making butter”. But its position makes the vessel even more unusual, and its secondary placement, near a hearth, complicates interpretation. One doubts it worked very well for cooking, instead of for something to be stirred or prepared, perhaps near heat, then drawn off or poured out by the lateral spout. Alternatively, it was still used as a churn (with neck/spout plugged?), but this time in a vertical position, perhaps placed near a hearth to allow the milk to warm, rise and separate, before being processed into butter with a wooden paddle. Nor is this example unique: in an identical case at Gilat in the Chalcolithic Negev, a barrel-churn was found truncated and repositioned in a secondary context, where it was fixed with mud plaster and (according to the excavator) used as a storage container.⁴⁹

The truth is that a churn made of pliable animal skin, or even light-weight wood rather than heavy, scored clay, is much easier to manipulate than the ceramic version of this container, but as Kaplan pointed out, a vessel with hard sides works better to break up an emulsion of fat suspended in liquid, and force the molecules to separate into butter and milk, or, alternatively, to mix yogurt, water and butter-milk thoroughly for a soured milk drink. Here is where the interior treatment of the vessels deserves careful attention, for they appear deliberately roughened (*Figs. 6–7*). A translation into clay may have led to its expiration, as households (women?) realized other vessels and methods made more sense as containers for processing soured milk into butter. The transformation of a horizontal (suspended) churn into a vertical (fixed) container turned an early pastoral vessel, appropriate for outdoor use in a desert environment with abundant sunshine, into a permanently fixed vertical version used indoors near the warmth of a hearth, just as it was over time, eventually. These unique archaeological contexts replicate the gradual replacement, over time, of the pastoralist churn by the tall, wooden churn more widely in use in households of the world, as the chief receptacle for making butter. As it vanished from the archaeological repertoire, it may have multiplied in wood and reverted to skin in most societies. Alternately, the debut and restricted life of these shapes in the Balkans, Levant, or Anatolia, may be tied to the advent of nomadic pastoralists from Asia, whether in the fourth millennium BC into the Balkans or in early modern migration of Turkic tribes to Anatolia, and to their tastes for butter or soured milk. Meanwhile, the curious existence of miniature or votive versions, in the Near East, Anato-

⁴⁹ Levy 2006, 101, Pl. 5.41.

lia, and the Aegean, argues for some more symbolic as well as functional significance of these shapes.

While the “churns” in the north Aegean stem entirely from household deposits, and so far none stem from ritual contexts of the Early Bronze Age, the existence of miniatures (from Thermi, Troy, etc.) point to the transformation of a functional vessel. The example from Torone was found in the same context with a small clay female figurine, as well as miniature versions of household pottery (ladles), a genre recently analyzed as a phenomenon contemporary with figurine-making and other cult industries.⁵⁰ In the Chalcolithic Levant, by contrast, archaeological churns may have expressed stronger ties to pastoralism in ideology as well as subsistence—hence the proliferation of miniature churns and figurines—just as they represent a lifestyle still visible among the Bedouin. This ideology survives in the poetics of the Hebrew Bible, which envisions a land flowing with milk and honey, compares one’s beloved’s hair to “a flock of goats moving down Gilead”, and the imagery of the tent dominates emerging political ideology as well.⁵¹ With that, the archaeology of Chalcolithic Palestine perhaps had a special claim on the long history of pastoralism and its by-products, and the humble churn plays a special role in the evolution of this paradigm. In contrast, the later appearance of the churn in the archaeological record of the Aegean may have inspired some miniature versions, but was dominated by an emergent culture based on metallurgy and long-distance exchange.

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⁵⁰ Torone “goddess:” Marangou 1992, 64, 209, 231–32, 272, fig. 29d.

⁵¹ See Jacobsen 1983, Kramer 1989, Grottanelli 1994, Homan 2002 on the ideology of milk, pastoralism and the nomadic lifestyle in the ancient Levant.

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