

Literatur

AKKERMANS 1996

P. M. M. G. Akkermans & K. Duistermaat, *Of Storage and Nomads, The Sealings from Late Neolithic Sabi Abyad, Syria*. [Paléorient 22 \(1996\), ii, 17–44](#).

Recent excavations at the late Neolithic site of Tell Sabi Abyad in northern Syria have yielded hundreds of clay settlements in well-defined contexts. It is argued that these settlements facilitated the communal storage at the site of all kinds of products and claims by a nomadic population of considerable size. In this respect, the settlements are indicative of the symbiosis between the sedentary and nomadic populations in the Late Neolithic.

Key-words : Sabi Abyad, Syria, Late Neolithic, Settlements, Storage, Nomads.

ARBuckle 2009

Benjamin S. Arbuckle & Cheryl A. Makarewicz, *The early management of cattle (*Bos taurus*) in Neolithic central Anatolia*. [Antiquity 83 \(2009\), 669–686](#).

The authors use metrical, demographic and body part analyses of animal bone assemblages in Anatolia to demonstrate how cattle were incorporated into early Neolithic subsistence economies. Sheep and goats were domesticated in the eighth millennium BC, while aurochs, wild cattle, were long hunted. The earliest domesticated cattle are not noted until the mid-seventh millennium BC, and derive from imported stock domesticated elsewhere. In Anatolia, meanwhile, the aurochs remains large and wild and retains its charisma as a hunted quarry and a stud animal.

Keywords: Anatolia, Neolithic, faunal analysis, aurochs, cattle, LSI, survivorship, skeletal parts distribution

BALASSE 2002

Marie Balasse & Anne Tresset, *Early Weaning of Neolithic Domestic Cattle (Bercy, France) Revealed by Intra-tooth Variation in Nitrogen Isotope Ratios*. [Journal of Archaeological Science 29 \(2002\), 853–859](#).

Evaluating the role of milk production in prehistoric subsistence economies requires a better estimation of the capacity of a milk-oriented husbandry under prehistoric conditions. Weaning pattern, which is linked to the length of lactation, is an important parameter in this estimation. In this study, weaning pattern is closely examined in Neolithic cattle from the site of Bercy (Paris, France, c. 4000 BC), by a study of intra-tooth (M1, M2) variation in the nitrogen isotope ratios (d15N) of dentine collagen. Collagen 15N is commonly used to trace the change of trophic level at weaning time. The pattern of change in collagen 15N in the first molar of two archaeological bovines is then compared with that observed in modern cattle weaned at known age. Results suggest that the Neolithic calves were weaned early. This could reflect either a shorter lactation for Neolithic cows, or early weaning imposed by the herder in order to reserve a bigger proportion of milk production for human consumption.

Keywords: Milk Production, Weaning, Neolithic, Nitrogen Isotope Ratios, Collagen, Dentine.

BALTER 2010

Michael Balter, *11th International Conference of Archaeozoology. science* **329** (2010), 1464–1465.

Score One for Hunting at Olduvai

Were early humans mighty hunters, or did they scavenge carcasses left behind by other carnivores? At the meeting, the hunting partisans presented evidence from a 1.3-million-year-old Olduvai site called BK that, they say, argues against the scavenging hypothesis.

Burying Man's Best Friend, With Honor

At the meeting, a graduate student suggested that dog burials might be correlated with the use of dogs as hunting partners when the world warmed in the post-Ice Age Holocene period about 10,000 years ago.

In a Cold Snap, Farmers Turned to Milk

About 8200 years ago, a sudden shift of North Atlantic currents plunged the Northern Hemisphere into a short cold and dry spell. At the meeting, an archaeologist presented evidence that at one site in the Middle East, milk products suddenly showed up in the archaeological record then, perhaps to help farmers cope with the climate.

BEJA-PEREIRA 2003

Albano Beja-Pereira et al., *Gene-culture coevolution between cattle milk protein genes and human lactase genes. nature genetics* **35** (2003), 311–313.

Albano Beja-Pereira, Gordon Luikart, Phillip R. England, Daniel G. Bradley, Oliver C. Jann, Giorgio Bertorelle, Andrew T. Chamberlain, Telmo P. Nunes, Stoitcho Metodiev, Nuno Ferrand & Georg Erhardt

Milk from domestic cows has been a valuable food source for over 8,000 years, especially in lactose-tolerant human societies that exploit dairy breeds. We studied geographic patterns of variation in genes encoding the six most important milk proteins in 70 native European cattle breeds. We found substantial geographic coincidence between high diversity in cattle milk genes, locations of the European Neolithic cattle farming sites (>5,000 years ago) and present-day lactose tolerance in Europeans. This suggests a gene-culture coevolution between cattle and humans.

BOGUCKI 1984

Peter I. Bogucki, *Ceramic sieves of the Linear Pottery Culture and their economic implications. Oxford Journal of Archaeology* **3** (1984), 15–30.

Fragments of ceramic sieves constitute a widespread, but little-known element in the ceramic inventories of Linear Pottery sites in temperate Europe. These sieves appear to have functioned as strainers for separating curds from whey in cheese production, on the basis of parallels with later archaeological cultures and ethnographic examples. Archaeozoological data support the hypothesis that dairy production has a greater antiquity than has been hitherto accepted. The sieves played an important role in early dairy production, for the manufacture of cheese was an essential step in the exploitation of milk by populations who possibly had a high level of lactose intolerance.

BOGUCKI 1986

Peter Bogucki, *The Antiquity of Dairying in Temperate Europe. Expedition* **28** (1986), 51–58.

The presence of ceramic sieves on a number of Linear Pottery sites argues that the milking of domestic cattle was practiced by the Early Neolithic peoples of temperate Europe around 4500 b.c. (5400 B.C.). When these data are combined with the zoo-archaeological evidence from Linear Pottery sites, it appears that a system of dairy husbandry developed in Neolithic temperate Europe to supplement the cereal cultivation which formed the mainstay of the subsistence system. Such a diversified economy would have been crucial to the successful establishment of agrarian communities in the forests of temperate Europe. In some areas, such as the lowlands of the North European Plain, dairy husbandry appears to have been the predominant subsistence practice during this period.

The recognition of such an antiquity for dairy production in temperate Europe does not contradict the notion that towards the end of the Neolithic there was a shift towards the maximum utilization of animal resources that Sherratt has termed the “Secondary Products Revolution” (1981, 1983). At this time, particularly in eastern Europe, subsistence systems appear to have emerged which had a primary emphasis on animal husbandry. Legge notes that although any economy which includes cattle will have access to both meat and milk, the exploitation of one or the other will be most efficient if it is developed in a specialized way, as appears to have been the case in this area during the Late Neolithic and Early Bronze Age (1981a:89). The roots of these systems, however, lie several millennia earlier, during the colonization of temperate Europe by the Linear Pottery culture.

BOGUCKI 1993

Peter Bogucki, *Animal traction and household economies in Neolithic Europe*. *Antiquity* **67** (1993), 492–503.

Most archaeological interest in the story of European social evolution has looked to the grand picture, as the bands combine and climb at last to achieve states and empires. What about the structure of European Neolithic as it was experienced at home, when the ox, the pig, the sheep and the goat came to live in the domestic unit of the single household?

BURGER 2007

J. Burger, M. Kirchner, B. Bramanti, W. Haak & M. G. Thomas, *Absence of the lactase-persistence-associated allele in early Neolithic Europeans*. *PNAS* **104** (2007), 3736–3741.

Lactase persistence (LP), the dominant Mendelian trait conferring the ability to digest the milk sugar lactose in adults, has risen to high frequency in central and northern Europeans in the last 20,000 years. This trait is likely to have conferred a selective advantage in individuals who consume appreciable amounts of unfermented milk. Some have argued for the “culture-historical hypothesis,” whereby LP alleles were rare until the advent of dairying early in the Neolithic but then rose rapidly in frequency under natural selection. Others favor the “reverse cause hypothesis,” whereby dairying was adopted in populations with preadaptive high LP allele frequencies. Analysis based on the conservation of lactase gene haplotypes indicates a recent origin and high selection coefficients for LP, although it has not been possible to say whether early Neolithic European populations were lactase persistent at appreciable frequencies. We developed a stepwise strategy for obtaining reliable nuclear ancient DNA from ancient skeletons, based on (i) the selection of skeletons from archaeological sites that showed excellent biomolecular preservation, (ii) obtaining highly reproducible human mitochondrial DNA sequences, and (iii) reliable short tandem repeat (STR) genotypes from the same specimens. By applying this experimental strategy, we have obtained high-confidence LP-associated genotypes from eight Neolithic and one Mesolithic human

remains, using a range of strict criteria for ancient DNA work. We did not observe the allele most commonly associated with LP in Europeans, thus providing evidence for the culture-historical hypothesis, and indicating that LP was rare in early European farmers.

ancient DNA | dairying | selection

CHECK 2006

Erika Check, *How Africa learned to love the cow*. [nature 444 \(2006\), 994](#).

The development of lactose tolerance in sub-Saharan Africa is a fascinating tale of genetic convergence, reports Erika Check.

CHU 2006

Nan-Chin Chu, Gideon M. Henderson, Nick S. Belshaw & Robert E. M. Hedges, *Establishing the potential of Ca isotopes as proxy for consumption of dairy products*. [Applied Geochemistry 21 \(2006\), 1656–1667](#).

AppGeochem21-1656-Supplement.pdf

A procedure has been developed which allows precise determination of Ca isotope ratios in natural and organic samples such as bones, milk and other biological materials. In this study the procedure is used to determine Ca isotope ratios in modern dietary systems and to establish the potential of Ca isotopes as a paleodiet tracer by analysis of bones. Multi-sampling across a 5 cm portion of a red deer jawbone shows invariant Ca isotope ratios and suggests negligible isotopic effect during bone remodelling. The difference between Ca isotopes in red deer diet and bones from one location was 0.65‰, in agreement with a previous study of diet/bone offsets. Similar values for modern deer-bone d44/42Ca from four geographically diverse populations demonstrate that geological/environmental conditions do not cause large variability and suggest that diet is the major cause for variations in bone d44/42Ca. d44/42Ca of herbivore milk is found to be ≈ 0.5 to 0.6 higher than the corresponding diet. Modern human milk has a d44/42Ca of -1.15 ($n = 4$) and is isotopically the lightest material reported in this study. This suggests that, for these samples, a significant portion of Ca intake was from dairy sources, and that human milk has Ca which is, again, ≈ 0.6 ‰ isotopically lighter than dietary Ca intake. Finally, Ca isotope ratios are presented from a variety of samples formed during fermentation processes (e.g., curds, whey, etc.) which indicate that these processes do not fractionate Ca isotopes significantly. Together, the data in this paper indicate that, because milk is an important dietary source of Ca with a distinctive signature, Ca isotope ratios should provide a tracer for past dairy consumption. A simplified model is outlined to demonstrate the ability to quantify dairy consumption by the analysis of Ca isotopes in bones.

CLARE 2008

Lee Clare, Eelco J. Rohling, Bernhard Weninger & Johanna Hilpert, *Warfare in Late Neolithic / Early Chalcolithic Pisidia, southwestern Turkey. Climate induced social unrest in the late 7th millennium calBC*. [Documenta Praehistorica 35 \(2008\), 65–65](#).

This paper proposes an association between climate forcing connected with the 8200 calBP ‘climate event’ and a postulated phase of internecine warfare and population collapse at Late Neolithic/Early Chalcolithic sites in Pisidia, southwestern Turkey. A summary of this evidence is provided and a hypothetical scenario considered in the context of contemporaneous developments in neighbouring regions.

COPLEY 2003

M. S. Copley, R. Berstan, S. N. Dudd, G. Docherty, A. J. Mukherjee, V. Straker, S. Payne, & R. P. Evershed, *Direct chemical evidence for widespread dairying in prehistoric Britain*. [PNAS 100 \(2003\), 1524–1529](#).

Domesticated animals formed an important element of farming practices in prehistoric Britain, a fact revealed through the quantity and variety of animal bone typically found at archaeological sites. However, it is not known whether the ruminant animals were raised purely for their tissues (e.g., meat) or alternatively were exploited principally for their milk. Absorbed organic residues from pottery from 14 British prehistoric sites were investigated for evidence of the processing of dairy products. Our ability to detect dairy fats rests on the observation that the $\delta^{13}\text{C}$ values of the C18:0 fatty acids in ruminant dairy fats are $\approx 2.3\text{‰}$ lower than in ruminant adipose fats. This difference can be ascribed to (i) the inability of the mammary gland to biosynthesize C18:0; (ii) the biohydrogenation of dietary unsaturated fatty acids in the rumen; and (iii) differences (i.e., 8.1‰) in the $\delta^{13}\text{C}$ values of the plant dietary fatty acids and carbohydrates. The lipids from a total of 958 archaeological pottery vessels were extracted, and the compound-specific $\delta^{13}\text{C}$ values of preserved fatty acids (C16:0 and C18:0) were determined via gas chromatography-combustion-isotope ratio mass spectrometry. The results provide direct evidence for the exploitation of domesticated ruminant animals for dairy products at all Neolithic, Bronze Age, and Iron Age settlements in Britain. Most significantly, studies of pottery from a range of key early Neolithic sites confirmed that dairying was a widespread activity in this period and therefore probably well developed when farming was introduced into Britain in the fifth millennium B.C.

COPLEY 2005A

M. S. Copley, R. Berstan, S. N. Dudd, V. Straker, S. Payne & R. P. Evershed, *Dairying in antiquity. I. Evidence from absorbed lipid residues dating to the British Iron Age*. [Journal of Archaeological Science 32 \(2005\), 485–503](#).

The evidence for dairying in antiquity has, until recently, primarily been restricted to the reconstruction of herd structures through the analysis of faunal remains. Using this method alone cannot provide definitive evidence for the presence of dairy herds, due to differences in the recovery of animal bones at sites and the many different farming strategies that can affect herd structures (e.g. dairying, meat production, traction etc.). Absorbed lipid residues have been extracted from 237 pottery vessels from the British Iron Age sites of Maiden Castle, Danebury Hillfort, Yarnton Cresswell Field and Stanwick. The compound-specific stable carbon isotope ($\delta^{13}\text{C}$ values) of the principal fatty acids found in animal fats (C16:0 and C18:0) have allowed the direct detection of dairy fats, thus providing evidence that dairying was an important component of farming practices in the British Iron Age. The results are compared to assessments of the faunal remains at each of the sites, and correlations between morphological characteristics of the vessels (e.g. type, form, use wear and rim diameter) and lipid residue discussed. Keywords: Organic residues; Lipids; Stable carbon isotopes; $\delta^{13}\text{C}$ values; Iron Age; Pottery vessels; Diet; Agriculture; Dairying

COPLEY 2005B

M. S. Copley, R. Berstan, V. Straker, S. Payne & R. P. Evershed, *Dairying in antiquity. II. Evidence from absorbed lipid residues dating*

to the British Bronze Age. [Journal of Archaeological Science](#) **32** (2005), 505–521.

Molecular and isotopic analyses were undertaken of absorbed lipid residues from 256 pottery vessels obtained from four southern British Bronze Age sites (Potterne, Brean Down, Black Patch and Trethellan Farm). The results confirm that not only were ancient Britons utilising dairy products during this period, but also that they were processed in pottery vessels on a large scale. This has been demonstrated through the determination of the compound-specific stable carbon isotope values of the principal fatty acids found in animal fats (C16:0 and C18:0) that allows ruminant dairy and ruminant/non-ruminant adipose fats to be distinguished. The proportion of sherds yielding degraded dairy fats at each of the sites is variable, with the highest occurrence being from Potterne, and the lowest occurrence being from Black Patch. The faunal remains, and vessel characteristics (e.g. rim diameter and vessel type) are compared with the organic residue analyses, and intra-site variability is investigated at Trethellan Farm.

Keywords: Organic residues; Lipids; Fatty acids; Stable carbon isotopes; $\delta^{13}\text{C}$ values; Diet; Bronze Age; Pottery vessels; Agriculture; Dairying

COPLEY 2005C

M. S. Copley, R. Berstan, A. J. Mukherjee, S. N. Dudd, V. Straker, S. Payne & R. P. Evershed, *Dairying in antiquity. III. Evidence from absorbed lipid residues dating to the British Neolithic*. [Journal of Archaeological Science](#) **32** (2005), 523–546.

Absorbed lipid residue analysis has previously demonstrated that dairying was a major component of animal husbandry in Britain during both the Iron Age and Bronze Age. As a continuation of this research into the antiquity of dairying, the incidence of dairy fats associated with pottery vessels from six Neolithic sites from Southern Britain is presented herein. A total of 438 potsherds from Windmill Hill, Abingdon Causewayed Enclosure, Hambledon Hill, Eton Rowing Lake, Runnymede Bridge and Yarnton Floodplain were submitted for organic residue analysis. To date, this constitutes the largest number of sherds investigated from one particular archaeological period. The compound-specific stable carbon isotope values of the major fatty acid components in animal fats, namely C16:0 and C18:0, enable absorbed lipids in pottery vessels to be classified to commodity group, i.e. ruminant adipose, dairy and non-ruminant adipose fats can be distinguished. The lipid extracts were relatively well preserved, and dairy fats were observed in approximately 25 % of all of the sherds, demonstrating that milk was a valued commodity in the British Neolithic. These results confirm that dairying was an established component of the agricultural practices that reached Britain in the 5th Millennium BC.

Keywords: Organic residues; Lipids; Stable carbon isotopes; $\delta^{13}\text{C}$ values; Neolithic; Pottery vessels; Diet; Agriculture; Dairying

CRAIG 2000

Oliver Craig, Jacqui Mulville, Mike Parker Pearson, Robert Sokol, Keith Gelsthorpe, Rebecca Stacey & Matthew Collins, *Detecting milk proteins in ancient pots*. [nature](#) **408** (2000), 312.

Compared with meat production, dairying is a high-input, high-output, high-risk operation indicative of an intensive, sophisticated economy, but this practice is notoriously difficult to demonstrate in the archaeological record. Here we provide evidence for the presence of milk proteins preserved in prehistoric vessels, which to our knowledge have not been detected before.

CRAIG 2003

Oliver E. Craig, *Dairying, dairy products and milk residues: potential studies in European prehistory*. In: MIKE PARKER PEARSON (Hrsg.), *Food, Culture and Identity in the Neolithic and Early Bronze Age*. BAR International Series 1117 (Oxford 2003), 89–96.

CRAIG 2005

Oliver E. Craig et al., *Did the first farmers of central and eastern Europe produce dairy foods?* *Antiquity* **79** (2005), 882–894.

Oliver E. Craig, John Chapman, Carl Heron, Laura H. Willis, Laszlo Bartosiewicz, Gillian Taylor, Alasdair Whittle & Matthew Collins

Although the origins of domestic animals have been well-documented, it is unclear when livestock were first exploited for secondary products, such as milk. The analysis of remnant fats preserved in ceramic vessels from two agricultural sites in central and eastern Europe dating to the Early Neolithic (5900–5500 cal BC) are best explained by the presence of milk residues. On this basis, the authors suggest that dairying featured in early European farming economies. The evidence is evaluated in the light of analysis of faunal remains from this region to determine the scale of dairying. It is suggested that dairying – perhaps of sheep or goats – was initially practised on a small scale and was part of a broad mixed economy.

Keywords: dairying, lipids, stable isotopes, ceramic, faunal remains

CRAIG 2005B

O. E. Craig, G. Taylor, J. Mulville, M. J. Collins & M. Parker Pearson, *The identification of prehistoric dairying activities in the Western Isles of Scotland: an integrated biomolecular approach*. *Journal of Archaeological Science* **32** (2005), 91–103.

The antiquity of dairying in regions considered to be marginal, such as the Western Isles of Scotland, has generated considerable debate. Complementary biomolecular methods are now available for identifying milk residues on ceramic vessels, which provides direct evidence for this practice in the past. A range of late Bronze Age and Iron Age ceramic cooking vessels were selected from two sites on South Uist, an island in the Outer Hebrides. The presence of milk proteins and lipids on a high proportion of potsherds confirms that these vessels were originally used to process dairy products. These data were integrated with evidence from the faunal remains and ethnographic accounts, in order to examine the wider significance and implications of dairy production in the Western Isles of Scotland during the first millennium BC. Further evidence from the pottery typologies and their depositional contexts were considered in order to comment on preparation and consumption practices.

Keywords: Dairying; Scotland; Prehistory; Proteins; Lipids; Food residues; Milk

DUDD 1998

Stephanie N. Dudd & Richard P. Evershed, *Direct Demonstration of Milk as an Element of Archaeological Economies*. *science* **282** (1998), 1478–1481.

The stable carbon isotope (d13C) compositions of individual fatty acid components of remnant fats preserved in archaeological pottery vessels show that dairying was a component of archaeological economies. Characteristic d13C values arise from biases in the biosynthetic origins of the C18:0 fatty acids in milk and adipose fat. Milk and adipose fat from animals raised on similar pastures and fodders have distinct isotopic signatures.

DUERR 2007

Janina Duerr, *Zum Beginn der Milchnutzung in Mitteleuropa. Ethnographisch-Archäologische Zeitschrift* **48** (2007), 335–373.

Nach der Theorie der “Secondary Products Revolution” wurde die Milch der Haustiere erst Jahrtausende nach deren Domestizierung genutzt. Neuere chemische Untersuchungen deuten jedoch auf eine frühere Milchnutzung hin. Im Folgenden sollen zuerst die verschiedenen Forschungsmeinungen und Methoden zum Nachweis von Milchnutzung in der Archäologie und Kulturgeschichte dargestellt werden. Anhand eines Vergleichs von archäozoologischen Daten, Keramik- und Schriftquellen, genetischen Untersuchungen sowie wirtschaftlichen und klimatischen Überlegungen soll anschließend erläutert werden, warum eine Milchnutzung vermutlich schon kurz nach der Domestikation von Schafen und Ziegen im Vorderen Orient begann, allerdings bis zur heutigen Zeit nur eine untergeordnete Rolle in der Ernährung der Menschen spielte. Weiterhin wird dargelegt, warum eine intensive Milchnutzung erst mit der Haltung großer Rinderherden, wie in den mitteleuropäischen Breiten zur Zeit der Bandkeramik, einsetzte. Es wird postuliert, dass Milch aufgrund der geeigneten Umweltbedingungen sowie der kulturellen Tradition zu einem in Mitteleuropa bis heute wichtigen und weithin geschätzten Bestandteil der Ernährung – nicht nur von Kindern, sondern auch von Erwachsenen – wurde, was so in nur wenigen Teilen der Welt geschah.

ENATTAH 2008

Nabil Sabri Enattah et al., *Independent Introduction of Two Lactase-Persistence Alleles into Human Populations Reflects Different History of Adaptation to Milk Culture. American Journal of Human Genetics* **82** (2008), 57–72.

AmJHumGen82-0057-Supplement.pdf

Nabil Sabri Enattah, Tine G.K. Jensen, Mette Nielsen, Rikke Lewinski, Mikko Kuokkanen, Heli Rasinpera, Hatem El-Shanti, Jeong Kee Seo, Michael Alifrangis, Insaf F. Khalil, Abdrazak Natah, Ahmed Ali, Sirajedin Natah, David Comas, S. Qasim Mehdi, Leif Groop, Else Marie Vestergaard, Faiqa Imtiaz, Mohamed S. Rashed, Brian Meyer, Jesper Troelsen and Leena Peltonen

The T-13910 variant located in the enhancer element of the lactase (LCT) gene correlates perfectly with lactase persistence (LP) in Eurasian populations whereas the variant is almost nonexistent among Sub-Saharan African populations, showing high prevalence of LP. Here, we report identification of two new mutations among Saudis, also known for the high prevalence of LP. We confirmed the absence of the European T-13910 and established two new mutations found as a compound allele: T/G-13915 within the -13910 enhancer region and a synonymous SNP in the exon 17 of the MCM6 gene T/C-3712, -3712 bp from the LCT gene. The compound allele is driven to a high prevalence among Middle East population(s). Our functional analyses in vitro showed that both SNPs of the compound allele, located 10 kb apart, are required for the enhancer effect, most probably mediated through the binding of the hepatic nuclear factor 1a (HNF1a). High selection coefficient (s) ≈ 0.04 for LP phenotype was found for both T-13910 and the compound allele. The European T-13910 and the earlier identified East African G-13907 LP allele share the same ancestral background and most likely the same history, probably related to the same cattle domestication event. In contrast, the compound Arab allele shows a different, highly divergent ancestral haplotype, suggesting that these two major global LP alleles have arisen independently, the latter perhaps in response to camel milk consumption. These results support the convergent evolution of the LP in diverse populations, most probably reflecting different histories of adaptation to milk culture.

EVERSHED 2008

Richard P. Evershed et al., *Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding*. [nature](#) **455** (2008), 528–531.

Richard P. Evershed, Sebastian Payne, Andrew G. Sherratt, Mark S. Copley, Jennifer Coolidge, Duska Urem-Kotsu, Kostas Kotsakis, Mehmet Özdoğan, Aslı E. Özdoğan, Olivier Nieuwenhuys, Peter M. M. G. Akkermans, Douglass Bailey, Radian-Romus Andeescu, Stuart Campbell, Shahina Farid, Ian Hodder, Nurcan Yalman, Mihriban Özbaşaran, Erhan Bıçakcı, Yossef Garfinkel, Thomas Levy & Margie M. Burton

The domestication of cattle, sheep and goats had already taken place in the Near East by the eighth millennium BC¹⁻³. Although there would have been considerable economic and nutritional gains from using these animals for their milk and other products from living animals—that is, traction and wool—the first clear evidence for these appears much later, from the late fifth and fourth millennia BC^{4,5}. Hence, the timing and region in which milking was first practised remain unknown. Organic residues preserved in archaeological pottery^{6,7} have provided direct evidence for the use of milk in the fourth millennium in Britain⁷⁻⁹, and in the sixth millennium in eastern Europe¹⁰, based on the $\delta^{13}\text{C}$ values of the major fatty acids of milk fat^{6,7}. Here we apply this approach to more than 2,200 pottery vessels from sites in the Near East and southeastern Europe dating from the fifth to the seventh millennia BC. We show that milk was in use by the seventh millennium; this is the earliest direct evidence to date. Milking was particularly important in northwestern Anatolia, pointing to regional differences linked with conditions more favourable to cattle compared to other regions, where sheep and goats were relatively common and milk use less important. The latter is supported by correlations between the fat type and animal bone evidence.

FALL 2002

Patricia L. Fall, Steven E. Falconer & Lee Lines, *Agricultural Intensification and the Secondary Products Revolution Along the Jordan Rift*. [Human Ecology](#) **30** (2002), 445–482.

The ecological impacts of early agriculture in the Near East remained localized prior to the intensified production of derivative plant and animal products, beginning in the fourth millennium B.C. One aspect of this “secondary products revolution” (Sherratt, 1980a, 1983) involved the adoption of animal traction and increased production of rendered animal commodities (e.g., wool and dairy). However, most of the pervasive regional effects of this revolution followed from the domestication and increasingly intensive cultivation of orchard crops that generated marketable secondary products (e.g., olive oil, wine, and dried fruits) and encouraged widespread deforestation. In the southern Levant this revolution encouraged, and was encouraged by, the rise and fall of Bronze Age towns and their mercantile influences. Botanical and palynological data from the Jordan Rift reveal a complex discontinuous legacy of changes wrought by the secondary products revolution that have molded the agrarian ecology and anthropogenic landscapes characteristic of the region today.

KEY WORDS: agricultural intensification; anthropogenic forests; Middle East; secondary products; urbanism.

GREGG 2009

M. W. Gregg, E. B. Banning, K. Gibbs & G. F. Slater, *Subsistence practices and pottery use in Neolithic Jordan: molecular and isotopic evidence*. [Journal of Archaeological Science](#) **36** (2009), 937–946.

This paper presents direct evidence of subsistence practices and pottery use at a Late Neolithic site at al-Basatīn, northern Jordan. Measurable concentrations of C16:0 and C18:0 were recovered from 8 of 10 archaeological pottery fragments through use of a microwave-assisted silica gel and aminopropyl solvent protocol developed for the isolation and concentration of free fatty acids in marine sediments. Subsequent isotopic analysis of the surviving C16:0 and C18:0 saturated fatty acids revealed $\delta^{13}\text{C}$ ratios consistent with those of adipose fats of ruminant and non-ruminant animals pastured on lands adjacent to the Jordan Valley. The high recovery of diagnostic compounds from the al-Basatīn material is discussed in context of a wider examination of the initial development and use of pottery in the Fertile Crescent, and the emerging debate concerning the efficacy of stable carbon isotope values in characterizing organic residues embedded in pottery fragments recovered from the earliest ceramic horizons in the Middle East and Europe.

Keywords: al-Basatīn | Jordan | Wadi Ziqlab | Neolithic | Archaeological pottery | Organic residues | GC-MS, GCdC-IRMS | $\delta^{13}\text{C}$ values | Microwave-assisted extraction

HOLLOX 2001

Edward J. Hollox et al., *Lactase Haplotype Diversity in the Old World*. [American Journal of Human Genetics](#) **68** (2001), 160–172.

Edward J. Hollox, Mark Poulter, Marek Zvarik, Vladimir Ferak, Amanda Krause, Trefor Jenkins, Nilmani Saha, Andrew I. Kozlov and Dallas M. Swallow

Lactase persistence, the genetic trait in which intestinal lactase activity persists at childhood levels into adulthood, varies in frequency in different human populations, being most frequent in northern Europeans and certain African and Arabian nomadic tribes, who have a history of drinking fresh milk. Selection is likely to have played an important role in establishing these different frequencies since the development of agricultural pastoralism $\approx 9,000$ years ago. We have previously shown that the element responsible for the lactase persistence/nonpersistence polymorphism in humans is cis-acting to the lactase gene and that lactase persistence is associated, in Europeans, with the most common 70-kb lactase haplotype, A. We report here a study of the 11-site haplotype in 1,338 chromosomes from 11 populations that differ in lactase persistence frequency. Our data show that haplotype diversity was generated both by point mutations and recombinations. The four globally common haplotypes (A, B, C, and U) are not closely related and have different distributions; the A haplotype is at high frequencies only in northern Europeans, where lactase persistence is common; and the U haplotype is virtually absent from Indo-European populations. Much more diversity is seen in sub-Saharan Africans than in non-Africans, consistent with an “Out of Africa” model for peopling of the Old World. Analysis of recent recombinant haplotypes by allele-specific PCR, along with deduction of the root haplotype from chimpanzee sequence, allowed construction of a haplotype network that assisted in evaluation of the relative roles of drift and selection in establishing the haplotype frequencies in the different populations. We suggest that genetic drift was important in shaping the general pattern of non-African haplotype diversity, with recent directional selection in northern Europeans for the haplotype associated with lactase persistence.

JÜRGENS 1979

Antonius Jürgens, *Rössener Siebe aus Aldenhoven*. [Kölner Jahrbücher](#) **16** (1979), 17–20.

KAISER 2004

Jocelyn Kaiser, *Ural Farmers Got Milk Gene First?* [science](#) **306** (2004), 1284–1285.

The populations having the greatest DNA sequence diversity around the lactase gene mutations-suggesting that lactose tolerance first appeared in them-include the Udmurts, Mokshas, Ezras, and other groups that originally lived between the Ural mountains and the Volga River. The trait most likely developed 4800 to 6600 years ago, Peltonen says. Her team linked the lactase gene changes to an ancestral variant that these groups apparently got from intermixing with tribes migrating from the Asian steppes.

The findings support the somewhat controversial theory that nomadic herders known as Kurgans expanded into Europe from the southern Urals 4500 to 3500 years ago, bringing Indo-European languages with them, according to Peltonen.

KOEPKE 2008

Nikola Koepke & Joerg Baten, *Agricultural specialization and height in ancient and medieval Europe*. [Explorations in Economic History](#) **45** (2008), 127–146.

Land per capita was one important determinant of height in the Malthusian world 0 to 1800 A.D. A second factor was specialization in milk cattle agriculture. It had two positive effects on human stature: first, proximity to protein production resulted in a very low local shadow price of milk, as this important foodstuff could not be transported easily. Second, this low price resulted in a low inequality of nutritional status, whereas, for example, tradable pork contributed to nutritional inequality. For this study, we used a data set of more than two million animal bones to measure specialization in cattle and its impact on stature.

Keywords: Anthropometrics; Agriculture; Cattle farming; Very long run; Growth; Living standards; Taphonomy; Archaeozoology

MCCORMICK 1992

Finbar McCormick, *Early faunal evidence for dairying*. [Oxford Journal of Archaeology](#) **11** (1992), 201–209.

The high incidence of young calves and mature females in faunal assemblages is often interpreted as being indicative of the practice of specialised dairying. An alternative model is suggested here on the basis of faunal and documentary evidence from the early historical period in Ireland.

MAROM 2009

Nimrod Marom & Guy Bar-Oz, *Culling profiles: the indeterminacy of archaeozoological data to survivorship curve modelling of sheep and goat herd maintenance strategies*. [Journal of Archaeological Science](#) **36** (2009), 1184–1187.

The comparison of survivorship curves derived from seven different models aiming to reconstruct ancient sheep and goat herd maintenance strategies (e.g. optimization of wool, meat, and milk production) shows that many of these models cannot be distinguished statistically. This observation renders the current theoretical framework for reconstructing ancient herd maintenance strategies problematic, due to the possible indeterminacy of model data analysis. In order to assign empirically observed age-at-death data to a model of herd maintenance strategy, it is suggested that a direct fit of observed data to survivorship curves be forgone in favor of a binning procedure highlighting the differences between fewer and more distinguishable models. The incorporation of high-resolution sexing and taxonomic determination to coarse-grained age-at-death models may go a long way towards solving the current problem of indeterminacy.

MILLARD 2000

Andrew R. Millard, *An Evaluation of the Possible Use of Nitrogen Isotopes to Detect Milking in Cattle*. In: GEOFF BAILEY, RUTH CHARLES & NICK WINTER (Hrsg.), *Human Ecodynamics, Proceedings of the Association for Environmental Archaeology conference 1998 held at the University of Newcastle upon Tyne*. (Oxford 2000), 134–140.

MURRAY 2009

T.L. Murray, D.B. Blache & R. Bencini, *The selection of dairy sheep on calm temperament before milking and its effect on management and milk production*. [Small Ruminant Research](#) **87** (2009), 45–49.

We studied the milk production, milk composition and behaviour in the dairy of ewes classified as calm through temperament testing. We hypothesised that calm sheep would not be stressed by milking, and would therefore have complete milk ejections and increased milk yields compared to nervous sheep. The temperaments of 95 experienced dairy ewes were measured in a social challenge 3 weeks before parturition, and their behaviour was observed and milk was sampled during machine milking from approximately 2 to 10 weeks after lambing. Based on their temperament scores, two distinct groups of calm ewes ($n = 16$) and nervous ewes ($n = 16$) were generated. There was no difference between calm and nervous ewes in their frequency of kicks and unloading scores. During the first week of recording, calm ewes were less reluctant to enter the milking parlour and, from approximately week 3 onwards, it took less time to attach the milking cups to calm ewes. There was an interaction between time and temperament on milk production, which provides evidence that the evolution of milk yield differs between temperaments, with calm ewes producing an average of 462 ± 36 g/day while nervous ewes averaged 394 ± 33 g/day. However, there was no effect of temperament or time on the concentration of fat or protein in the milk. Our results suggest that selection for temperament may play a role in moderating milk production by ewes and also contribute to their behaviour on the platform.

Keywords: Sheep | Dairy | Temperament | Behaviour | Milk production

OUTRAM 2009

Alan K. Outram et al., *The Earliest Horse Harnessing and Milking*. [science](#) **323** (2009), 1332–1335.

[s323-1332-Supplement.pdf](#)

Alan K. Outram, Natalie A. Stear, Robin Bendrey, Sandra Olsen, Alexei Kasparov, Victor Zaibert, Nick Thorpe & Richard P. Evershed

Horse domestication revolutionized transport, communications, and warfare in prehistory, yet the identification of early domestication processes has been problematic. Here, we present three independent lines of evidence demonstrating domestication in the Eneolithic Botai Culture of Kazakhstan, dating to about 3500 B.C.E. Metrical analysis of horse metacarpals shows that Botai horses resemble Bronze Age domestic horses rather than Paleolithic wild horses from the same region. Pathological characteristics indicate that some Botai horses were bridled, perhaps ridden. Organic residue analysis, using $\delta^{13}C$ and δD values of fatty acids, reveals processing of mare's milk and carcass products in ceramics, indicating a developed domestic economy encompassing secondary products.

REYNARD 2010

L. M. Reynard, G. M. Henderson & R. E. M. Hedges, *Calcium isotope ratios in animal and human bone*. [Geochimica et Cosmochimica Acta](#) **74** (2010), 3735–3750.

[GeoCosmo74-3735-Supplement.pdf](#)

Calcium isotopes in tissues are thought to be influenced by an individual's diet, reflecting parameters such as trophic level and dairy consumption, but this has not been carefully assessed. We report the calcium isotope ratios ($d_{44}/d_{42}\text{Ca}$) of modern and archaeological animal and human bone ($n = 216$). Modern sheep raised at the same location show $0.14 \pm 0.08\text{‰}$ higher $d_{44}/d_{42}\text{Ca}$ in females than in males, which we attribute to lactation by the ewes. In the archaeological bone samples the calcium isotope ratios of the herbivorous fauna vary by location. At a single site, the archaeological fauna do not show a trophic level effect. Humans have lower $d_{44}/d_{42}\text{Ca}$ than the mean site fauna by $0.22 \pm 0.22\text{‰}$, and the humans have a greater $d_{44}/d_{42}\text{Ca}$ range than the animals. No effect of sex or age on the calcium isotope ratios was found, and intra-individual skeletal $d_{44}/d_{42}\text{Ca}$ variability is negligible. We rule out dairy consumption as the main cause of the lower human $d_{44}/d_{42}\text{Ca}$, based on results from sites pre-dating animal domestication and dairy availability, and suggest instead that individual physiology and calcium intake may be important in determining bone calcium isotope ratios.

REYNARD 2011

L. M. Reynard, G. M. Henderson & R. E. M. Hedges, *Calcium isotopes in archaeological bones and their relationship to dairy consumption*. [Journal of Archaeological Science](#) **38** (2011), 657–664.

The calcium isotope ratios ($d_{44}/d_{42}\text{Ca}$) of bones from humans and fauna from three archaeological sites, Taforalt, Abu Hureyra, and Danebury, are evaluated in order to assess whether calcium isotope ratios of bones can be used to detect dairy consumption by adult humans. At each site the fauna $d_{44}/d_{42}\text{Ca}$ is the same regardless of species, while the humans have lower $d_{44}/d_{42}\text{Ca}$ than the local animals by $0.24 \pm 0.41\text{‰}$ (site means). However we cannot ascribe this difference to dairy consumption, given this human-faunal difference also occurs in Epipalaeolithic and Mesolithic adult humans, where dairy consumption is unlikely. Rather, this difference appears to be a result of differences in metabolic processes or other aspects of diet between humans and fauna. Minimal isotopic change in sequential acid leaches of bone powders and consideration of the high calcium concentration in bone suggest that bone calcium isotope ratios are not substantially affected by diagenetic change.

Keywords: Calcium; Ca; Isotope; Bone; Dairy; Milk; Diet; Taforalt; Abu Hureyra; Danebury

ROTTLÄNDER 1995

Rolf C. A. Rottländer, *Bemerkungen zu einer Abhandlung über Feuerstülpfen*. [Archäologisches Korrespondenzblatt](#) **25** (1995), 169.

In seiner Abhandlung über vorgeschichtliche Feuerstülpfen¹ erwähnt E. Cosack nicht die zu diesem Formenkreis gehörenden Rössener Siebe aus Aldenhoven² und die ebenfalls hierhin gehörenden Siebgefäßscherben aus Zambujal, Portugal. Der Gefäßtypus ist ein Durchläufer und deswegen chronologisch wenig empfindlich. Die Schleifspuren an diesem Gefäßtypus werden von allen Autoren erwähnt, aber niemand beachtet, daß die schleifende Abnutzung nicht in einer Ebene liegt, wie das auch Cosack voraussetzt, wenn er von einer scharrenden Bewegung spricht, sondern daß die Abnutzung (in allen mir bekannt gewordenen Fällen) konisch

ist. Das ist besonders gut an den Schnittzeichnungen der Aldenhovener Gefäße (Jürgens Taf. 1 u. 2) zu sehen.

Die schon von Jazdzewski⁴ vorgebrachte Deutung als Feuerstülpfen muß allerdings falsch sein, weil sich aus 21 Siebgefäßscherben aus Aldenhoven und 46 Siebgefäßscherben aus Zambujal Fett extrahieren ließ, und zwar Fett von ölreichen Samen. Ölreiche Samen schließen den Gebrauch bei der Käsezubereitung aus, die Anwesenheit von Fett widerlegt die Benutzung als Feuerstülpe, weil alles Fett verbrannt, zumindest abgedampft wäre.

RUSSELL 2010

Anna Russell, *Retracing the Steppes – A Zooarchaeological Analysis of Changing Subsistence Patterns in the Late Neolithic at Tell Sabi Abyad, Northern Syria, c. 6900 to 5900 BC*. Dissertation, Universität Leiden ([Leiden 2010](#)).

SALQUE 2013

Mélanie Salque et al., *Earliest evidence for cheese making in the sixth millennium BC in northern Europe*. [nature](#) **493** (2013), 522–525.

[n493-0522-Supplement1.pdf](#)

Mélanie Salque, Peter I. Bogucki, Joanna Pyzel, Iwona Sobkowiak-Tabaka, Ryszard Grygiel, Marzena Szmyt & Richard P. Evershed

The introduction of dairying was a critical step in early agriculture, with milk products being rapidly adopted as a major component of the diets of prehistoric farmers and pottery-using late hunter-gatherers. The processing of milk, particularly the production of cheese, would have been a critical development because it not only allowed the preservation of milk products in a non-perishable and transportable form, but also it made milk a more digestible commodity for early prehistoric farmers. The finding of abundant milk residues in pottery vessels from seventh millennium sites from north-western Anatolia provided the earliest evidence of milk processing, although the exact practice could not be explicitly defined. Notably, the discovery of potsherds pierced with small holes appear at early Neolithic sites in temperate Europe in the sixth millennium BC and have been interpreted typologically as ‘cheese-strainers’, although a direct association with milk processing has not yet been demonstrated. Organic residues preserved in pottery vessels have provided direct evidence for early milk use in the Neolithic period in the Near East and south-eastern Europe, north Africa, Denmark and the British Isles, based on the $d_{13}C$ and $D_{13}C$ values of the major fatty acids in milk. Here we apply the same approach to investigate the function of sieves/strainer vessels, providing direct chemical evidence for their use in milk processing. The presence of abundant milk fat in these specialized vessels, comparable in form to modern cheese strainers, provides compelling evidence for the vessels having being used to separate fat-rich milk curds from the lactose-containing whey. This new evidence emphasizes the importance of pottery vessels in processing dairy products, particularly in the manufacture of reduced-lactose milk products among lactose-intolerant prehistoric farming communities.

SHERATT 1983

Andrew Sherratt, *The Secondary Exploitation of Animals in the Old World*. [World Archaeology](#) **15** (1983), 90–104.

This paper considers the range of evidence for the secondary uses and products of animals: traction, transport, wool and milk. It suggests that early farming populations used livestock mainly for meat, and that other applications were explored

as agriculturalists adapted to new conditions, especially in the semi-arid zone. Innovations in different parts of the Near East were exchanged and disseminated as part of the process leading to urbanisation. Their dispersal affected both the steppe belt, which saw a marked increase in population, and also temperate Europe, where agriculture was revolutionised by more extensive methods of farming and landscape clearance.

SHERATT 1997

ANDREW SHERATT (Hrsg.), *Economy And Society in Prehistoric Europe, Changing Perspectives*. ([Edinburgh 2004](#)).

SOUCI 2009

Deutsche Forschungsanstalt für Lebensmittelchemie, *Lebensmittelta-belle für die Praxis, Der kleine Souci, Fachmann, Kraut*. (Stuttgart⁴2009).

STOJANOWSKI 2011

Christopher M. Stojanowski & Charisse L. Carver, *Inference of emer-gent cattle pastoralism in the southern Sahara desert based on lo-calized hypoplasia of the primary canine*. [International Journal of Paleopathology 1 \(2011\), 89–97](#).

There are limited data on the health effects of the transition to food production in North Africa where Middle Holocene peoples adopted pastoralism to mitigate a deteriorating climate. Unlike other areas of domestication the advent of food production throughout the Sahara, and much of Africa, was decoupled from incre-asing sedentism and population aggregation. Here, we consider the effects of this dietary transition on early childhood health by examining localized hypoplasia of the primary canine (LHPC). We focus on the Gobero region of Niger which pre-serves cemeteries containing skeletal remains from two occupation phases: (1) an Early Holocene/Kiffian fisher-forager phase, and (2) a Middle Holocene/Tenerian cattle pastoralism phase. The fisher-foragers exhibited one of the highest recorded frequencies of LHPC which we interpret as reflecting a diet of aquatic and terre-strial taxa of low fat content. The Middle Holocene population had a significantly lower frequency of LHPC, consistent with cattle providing much needed dietary fat. Because cattle remains were uncommon at Gobero, the most parsimonious interpretation suggests these peoples were incipient cattle pastoralists who had yet to develop into ideological pastoralists. The health benefits of cattle pastora-lism demonstrate the importance of pastoral products for peoples coping with a deteriorating desert climate.

Keywords: Enamel hypoplasia | North Africa | Pastoralism

STONEKING 2006

Mark Stoneking, *Investigating the health of our ancestors: Insights from the evolutionary genetic consequences of prehistoric diseases*.

[International Congress Series 1296 \(2006\), 106–114](#).

Investigations into the health and diseases of prehistoric human populations are traditionally based on various approaches for analyzing skeletal remains. In this paper, I propose that a complementary approach, based on patterns of genetic variation in contemporary populations, can also provide insights into prehistoric health and disease. The idea is that selection for increased reproductive fitness, be-cause of some selective force (such as resistance to a particular disease), will leave

a signature on the gene(s) involved. I describe how modern genomic approaches can identify such genes, and two examples are given of genes that have clearly been influenced by selection. However, while modern genomics is making it relatively straightforward to identify genes that have been subject to selection, the challenge still remains as to how to identify the responsible selective force.

Keywords: Genome scan; Selection; Genetic distance; Lactase persistence; Prion protein

TISHKOFF 2007

Sarah A. Tishkoff et al., *Convergent adaptation of human lactase persistence in Africa and Europe*. [nature genetics](#) **39** (2007), 31–40.

Sarah A. Tishkoff, Floyd A. Reed, Alessia Ranciaro, Benjamin F. Voight, Courtney C. Babbitt, Jesse S. Silverman, Kweli Powell, Holly M. Mortensen, Jibril B. Hirbo, Maha Osman, Muntaser Ibrahim, Sabah A. Omar, Godfrey Lema, Thomas B. Nyambo, Jilur Ghorri, Suzannah Bumpstead, Jonathan K. Pritchard, Gregory A. Wray & Panos Deloukas

A SNP in the gene encoding lactase (LCT) (C/T-13910) is associated with the ability to digest milk as adults (lactase persistence) in Europeans, but the genetic basis of lactase persistence in Africans was previously unknown. We conducted a genotype-phenotype association study in 470 Tanzanians, Kenyans and Sudanese and identified three SNPs (G/C-14010, T/G-13915 and C/G-13907) that are associated with lactase persistence and that have derived alleles that significantly enhance transcription from the LCT promoter in vitro. These SNPs originated on different haplotype backgrounds from the European C/T-13910 SNP and from each other. Genotyping across a 3-Mb region demonstrated haplotype homozygosity extending >2.0 Mb on chromosomes carrying C-14010, consistent with a selective sweep over the past $\approx 7,000$ years. These data provide a marked example of convergent evolution due to strong selective pressure resulting from shared cultural traits—animal domestication and adult milk consumption.

TOWERS 2011

Jacqueline Towers, Mandy Jay, Ingrid Mainland, Olaf Nehlich & Janet Montgomery, *A calf for all seasons? The potential of stable isotope analysis to investigate prehistoric husbandry practices*. [Journal of Archaeological Science](#) **38** (2011), 1858–1868.

The Early Bronze Age barrows at Irthlingborough and Gayhurst in central England are notable for the large number of cattle (*Bos taurus*) remains associated with their human Beaker burials. Previous work using strontium isotope analysis has indicated that most of the cattle analysed, and one aurochs (*Bos primigenius*), were of local origin. In this study, stable isotope analysis of enamel and bone was carried out to investigate whether the mature cattle had experienced similar husbandry practices, climate and environment. Bulk carbon, nitrogen and sulphur isotope analysis of collagen suggested most were consuming similar sources of plant protein from environments probably local to the sites and this was supported by high resolution intra-enamel carbon isotope profiles. Oxygen isotope profiles indicated the aurochs and most of the cattle experienced similar climatic regimes: the only exception being an animal with a non-local strontium isotope ratio. However, a comparison of seasonality profiles of the local animals using estimated tooth formation times showed that there was no consistency in season of birth: the animals appeared to have been born throughout the year. Cattle can breed throughout the year but it requires considerable human effort and intervention to successfully overwinter young stock; it is therefore unlikely to have been carried out without good

reason and benefit if winters were harsh. One reason is to ensure a continuous supply of milk. Measuring oxygen isotope profiles to identify year-round calving may thus be a potential indicator of dairying economies.

Keywords: Stable isotope analysis | Tooth enamel | Bone collagen | Intra-tooth sampling | Cattle husbandry | Dairying

TRAVIS 2008

John Travis, *Trail of Mare's Milk Leads to First Tamed Horses*. [science](#) **322** (2008), 368.

Stear reported at the meeting that she found the isotopic signature of mare's milk on 5500-year-old pottery fragments from Kazakhstan. "It is the smoking gun for horse domestication, since no one would attempt to milk a wild mare." Stear used carbon isotopes to confirm the presence of equine fats on about 50 Botai shards, but the method couldn't distinguish between lipids from milk or meat. So she tested local horse meat and koumiss and confirmed a hypothesis posed by Evershed and Alan Outram of the University of Exeter, U.K.: that horse meat and milk contain different amounts of the hydrogen isotope deuterium. For reasons related to the isotope's heavier weight, summer rains in the region contain much more deuterium than winter precipitation. Because mares are only milked after they foal in the spring, researchers theorized that the isotope would be concentrated in milk, whereas horse meat's deuterium signal would be averaged over the course of each year. Testing the ancient potsherds, Stear found that five had the horsemilk deuterium signature. "The way she did it was quite elegant," says Oliver Craig, a biomolecular archaeologist at the University of York.

WOODING 2009

Stephen P Wooding, *Following the herd*. [nature genetics](#) **39** (2009), 7–8.

The ability to digest lactose into adulthood is a recently evolved trait that has risen to high frequency in some human populations, coincident with the introduction of cattle domestication. A new study shows that variants responsible for this trait arose independently in Europeans and Africans, providing a striking example of convergent evolution.