# Modelling Modes of Production: European 3rd and 2nd Millennium BC Economies


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## Introduction

Dramatic new evidence from ancient DNA and strontium isotopes allows for more detailed social reconstructions of prehistoric societies both at the level of individual kinship systems and of large-scale migrations that establishes a new level of documentation of prehistory. However, such new evidence demands new interpretations. We revisit therefore Marx's concept of Modes of Production (MP) to expand its relevance in light of present archaeological knowledge so as to model changes in Bronze Age economies (3rd to 2nd millennium BC) in temperate Europe.[1] We and others believe that theoretical benefits can be harvested by employing Modes as a cornerstone in materialist theory for history, in which political economy theories form a central part (Earle and Spriggs 2015; Rosenswig and Cunningham 2017a).[2] To begin, we have in front of us Europe's prehistoric economies, by which we consider key relations that allow us to model specific MP and their articulations. Among these

[1] In doing so we respond to recent critiques of a lack of contextualized archaeological interpretations of the new science based evidence, especially aDNA (Fuhrholt 2017; Sørensen 2017, both with comments).

[2] Circulation, consumption, as well as production are essential elements of all economies such that economic modes might be a more accurate characterization, or perhaps modes of exchange (Karatin 2014) or modes of reproduction (Rowlands 2019), but we retain Modes of Production because of its historically effective uses by Marx and later Marxist archaeologists. The recent upsurge of Marxist theory in archaeology (Rosenswig and Cunningham 2017a, b; Hansen and Müller 2011; Müller 2017; Ott 2017; Rowlands 2019) is part of a broad revival of materialist theories in the historical and social sciences, including the concepts of materialization and materiality (Patterson 2003) and with that also a return to the thinking of Marx as its intellectual foundation.

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M. Frangipane et al. (eds.), *Ancient Economies in Comparative Perspective*,
Frontiers in Economic History, https://doi.org/10.1007/978-3-031-08763-9_8

we consider the articulation between production, circulation, and consumption as most important, as presented originally in Marx's introduction to *Grundrisse* (Marx 1974).

Marx's writings are often complicated and offer room for interpretation. He never defines Modes of Production, but uses them to examine historical examples, such as Asiatic, Feudal, or Germanic Modes of Production. His conception of Modes is inherent, however, in the following quotation: '*Production creates the objects which correspond to the given needs; distribution divides them up according to social laws; exchange further parcels out the already divided shares in accord with individual needs; and finally, in consumption, the products steps outside this social movement and becomes a direct object and servant of individual need, and satisfies it in being consumed*' (Marx 1974: 89). Fundamental to his understanding is to combine means of production and relations of production to formulate governing processes of Modes. This unity of economic, social, and political is foundational to our approach to political economies as dynamic human systems. For simplification, we combine his consideration of distribution and exchange into circulation as the cover term. Here, we seek to update Marx's original conception of Modes according to advances in theoretical understanding and the richly expanded evidence of the prehistoric record.

Central to our venture is Marx's observation that several Modes of Production may co-exist in any socio-economic system, but that one will dominate. In his *Introduction* to *Grundrisse*, he states that '*in all forms of society there is one specific kind of production, which predominates over the rest, whose relations thus assign rank and influence to the others*' (Marx 1974: 106). Thus, in our conception of the Maritime Mode of Production (Ling et al. 2018), a pre-existing Germanic Mode of Production was transformed by channelling neighbouring maritime economies to control flows of special goods in a new Mode. Hegemonic or administrative dominance of outside polities with existing Modes creates new Modes from constituent parts. Marx further develops the dialectic relationship between production, circulation, and consumption as a basis for his analysis of capital. His observations introduce a historical dynamic, and for us it implies a focus on historical transformations; seeds of new dominant MP are always to be found in preceding ones and the parts continue as an afterlife in subordinate positions. This perspective of interacting MP, in conjunction with the articulation of production, circulation, and consumption adds a spatial dynamic and implies a focus upon large-scale geographical interactions of Modes in ancient World Systems. We turn now to a definition of MP and discuss its usefulness in archaeology and anthropology.

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It is important, however, that like Darwinism in the biological sciences, the measure of truth is its applicability to the real world and not to the original statements of the master. Our theoretical foundations also include the elaboration of Marxist theory to embrace World System theories and its application to pre-capitalist societies (Friedman and Rowlands 1977; Kristiansen 1998; Spriggs 1984 for a summary), as well as the historical period (Wolf 1982). We do not include the so-called 'New Materialism' in our study (Coole and Frost 2010; Witmore 2014), as we consider it to be embedded in a theoretical illusion of object fetishism (Hornborg 2017).

## Modes of Production

Modes of Production are the labour processes that extract, transform, and distribute resources to meet needs and to create power relationships (Fig. 1). Following from this, Modes are always to be understood as exploitive, whether of environments or humans; they are deeply embedded in the contested social relationships of production. Fundamental is developing property rights, the social relationships of people to productive resources. Property is central to understanding relations of production, and it can be studied archaeologically (Earle 2017). A crucial theoretical concern is to describe how surplus labour and surplus wealth are generated and distributed. Labour processes involve tools, skills, organization, and knowledge and so are always socially constituted, involving relationships between working individuals and groups. Controlling flows and employing goods provide the material infrastructure for social formations with degrees of stratification and power differentials. 'Modes are manifest in social formations—i.e., societies and cultures in the process of becoming and dissolving' (Patterson 2014: 41). The aim is, therefore, to understand what Modes of Production do rather than what they are.

Modes of Production should never be thought of as a new typology; rather, resulting in a range of political outcomes, Modes represent specific relations of production as processes grounded in material conditions (Rosenswig and Cunningham 2017a). Modes are in constant flux and reformulation. Although modelled in terms of specific relations of production, these relationships are to be understood as systems constant changing and creating novel relationships of power and inequality. MP specify how individuals access the economy to mobilize revenues to support and institutionalize political power. Institutions thus organize production, circulation, and consumption, which form relations of production (Kristiansen and Larsson 2005: Chapter 1.2 and 1.3; Earle et al. 2015). Social systems must be considered regulated (institutionalized) and open at the same time, such that the connections between them create articulated Modes as in World Systems (Friedman and Rowlands 1977; Wolf 1982), and agency must be recognized for all people positioned with

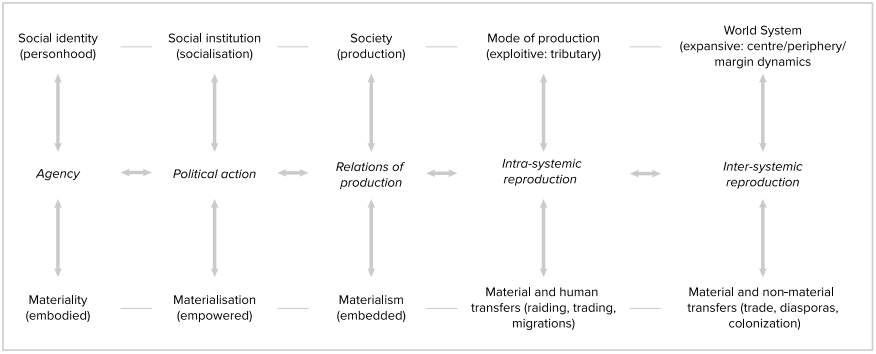


**Fig. 1** Materialist model of forces of history from individual agency to World Systems

differing relationships to production, even if agency change according to changing historical conditions (Blanton and Fargher 2008; DeMarrais and Earle 2017; Kristiansen and Larsson 2005: Fig. 169–170). At any point in time, a social formation is formulated by MP that are linked together among different spheres and scalar dimensions that determine power relations of cooperation and co-optation. Contradictions may arise over time between both different Modes and different institutions within an MP. This may lead to a redefinition of institutions and of relations of production through increased agency on a large geographical scale, whose end result is social transformations of one or several Modes.

While a social formation is historically defined in time and space, a Mode of Production is the material relationships that can be employed to characterize historically different social formations and polities. Modes thus represent abstractions of material relationships that model economic strategies in ways that can be compared across prehistory and historic cases (Earle and Spriggs 2015; Earle 2017). As we discuss with our summary of Bronze Age Europe, relations of production are framed by the institutional character of property as it opens or limits access to resources and results in particular relationships of power. Wolf's (1982) tributary mode of production, for example, is a generalized concept based on elite property relations that can be applied to various historically independent cases of complex social formations without well-developed market systems. Thus, the mode of production concept 'provides the potential for archaeologists to comparatively investigate changing human organizations' (Rosenswig and Cunningham 2017a).

Modes of Production can perhaps best be understood within a multi-scalar model of agency and interaction, as presented in Fig. 1. It raises the question of the internal articulation of scales. In our model, different levels are dialectically intersected into each other. We consider a Mode of Production to dominate until the build-up of contradictions activates agency and leads to a redefinition of relations of production that releases a transformation.

We now discuss how different Modes of Production during the European Bronze Age help understand political change. We recognize two general Modes: Kin-ordered and Tributary (Wolf 1982) that we divide into historically specific variants representing alternative pathways towards and away from complexity. In all cases, most economic activities, such as subsistence production and tool manufacture, were primarily local (within the household or local community), but we envision specific relations of production and circulation that were critical for political formations.

## *Kin-Ordered Modes of Production*

A Kin-Ordered Mode implies that no regionally centralized control exists over large numbers of households. It remains decentralized with an emphasis on horizontal kin relations. Communities retain political autonomy even when they take part in expansive networks of trade and alliances. Competition and contradictions within communities often drive demographic expansion and migrations. Corporate, Pastoral

Segmentary, and Germanic Modes are variants with differing subsistence, levels of intensification, and property relations.

***Corporate Mode of Production (CMP1)*** models moderately dense populations living in villages dependent typically on farming and its *landesque capital* (see Hayden and Cannon 1982; Häkannson and Widgren 2016; Johnson and Earle 2000). Clan and lineage kin groups owned and defended land. Village headmen or chiefs led independent village-sized polities. Property relations were materialized by fortified villages, permanent household arrangements, and/or group cemeteries. Village-based polities could either bud off to form new village polities or expand by conquest to form regional polities with Tributary Modes of Production.

***Pastoral Mode of Production (PMP1)*** models decentralized, low-density societies based on free and highly mobile pastoral herders organized by ego-centric kin networks (Barfield 1993; Irons 1979; Kradin et al. 2003; Sahlins 1961). The economy was extensive and low intensity, as required to manage individually owned animals. All males were warriors, raiding for and defending moveable wealth in animals. Mechanisms of expansion included population growth causing expansion into 'open' lands or intensification with agriculture that could establish the Germanic Mode of Production.

***Germanic Mode of Production (GMP1)*** models settled and largely self-sufficient households that individually own improved agricultural fields and many animals (Marx 1974: 79; Gilman 1995). The animals required ample territory across lands often marginal to intensive agriculture. Males were warriors raiding for moveable wealth in animals. Specialization and trade established decentralized networks between regions. By controlling wealth circulation, the GMP could expand spatially to form regional chieftaincies and confederacies as part of the GMP2 or Maritime Mode of Production.

## *Tributary Modes of Production (TMP)*

Embodied in Tributary Modes of Production were extractions of surpluses in labour, staples, and/or wealth to finance political expansion and regional power (Earle 1997; Wolf 1982). Competition created strongly growth-oriented political economies, whether centrally or decentrally organized. Variants of the TMP included the CMP2 and GMP2 and the Maritime Mode of Production.

***CMP2*** models settlement hierarchy within regional, staple-financed polities (D'Altroy and Earle 1985; Earle 1997). Hillforts offered hard-point control over productive lands and/or transport routes and defined specific property rights. Construction of agricultural facilities included terracing, drainage, and irrigation. Overarching chiefly ownership of productive lands and trade routes was based on conquest or financed construction of facilities. Burials were typically in cemeteries, sometimes with marked elite burials. Specialized warriors, eventually organized as armies, were armed with superior weapons and mobility was provided,

for example, by horses and chariots. Mechanisms for expansion included conquest warfare, domination of trade bottlenecks, and eventually encouraging markets.

***GMP2*** models the formation of regional polities involving warrior chiefs, who coordinated raiding bands recruited from free farmers to seize and trade objects of wealth including animals, slaves, and high-status objects. Mechanisms for expansion involved elite individuals seeking to channel wealth circulation in higher volume trade especially of metals that provided means to form regional chieftaincy networks.

***Maritime Mode of Production (MMP)*** models political strategies employed by chiefs owning productive farms to produce surpluses to support acquisition of boats owned by chiefs (Ling et al. 2018). This Mode is an expansion of GMP (see Bell Beaker discussion below); however, the particular property of the MMP was the spatial fusion of agropastoral and maritime systems. By financing raiding and trading parties geared to metals, slaves, and other objects of exchange value, chiefs channelled wealth flows and thus expanded chieftaincies and their confederacies. Mechanisms of expansion typically involved access to a world economy in an arc around agrarian states or city-states.

We describe below the historical dynamics and transformations in the political economy during the European 3rd and 2nd millennia BC, concluding with a brief outline of how these patterns can illuminate the transformative potentials of historical processes. We wish to stress that our interpretations are sketches for further discussion, and thus biased by our priority of what constitutes the most convincing explanation of the data at hand. In other words, they are interpretative narratives where we privilege some data at the expense of others in order to create coherent social and economic explanations of historical processes.

## Third Millennium BC: Age of Migrations

Archaeology is undergoing a third scientific revolution that is transforming our understanding of Eurasian prehistory (Kristiansen 2014). With rapidly developing DNA and strontium techniques, 3rd Millennium migrations, for example, are now well documented at the onset of the Bronze Age, and they demand a new understanding of historical changes (cf. Furholt 2017, 2018). Setting the stage for these changes earlier Neolithic farmers had spread broadly across Europe forming scattered local groups with small villages and cemeteries indicative of CMP1. Some argue that changes started earlier among these early farming groups, but the changes were limited (Heyd 2017). No comprehensive explanations are readily at hand for the 3rd Millennium's changes that are now documented; we need to re-theorize migrations, mobility and their relation to genetic, cultural, and language change, and other key economic changes (Kristiansen et al. 2017, for a first attempt). The economic and social transformations of western Eurasia during this period were due, we argue, to major migrations, genetic replacement, and what amounted to genocide. We now discuss and re-theorize these changes, understanding them in part by MP models and their associated economic changes. In simple terms, we suggest that a dynamic

existed between population growth, subsistence shifts, new property relationships, expanding warfare, and emerging trading networks, all of which underlay large-scale migrations and population replacements.[3]

## *The Pastoral Mode of Production and the Replacement of Neolithic Farmers*

The 4th millennium BC witnessed the origins of new technologies (Hansen 2014), which transformed Late Neolithic/Late Copper Age societies, created a new pastoral economy in the Pontic steppe, and undergirded its expansion into Europe. Using oxen as draft animals, the traction complex of wheels and wagons spread rapidly from the Caucasus into much of Europe during the mid to later 4th millennium BC (Johannsen and Laursen 2010; Maran 2004; Leppek 2017). Although it probably lowered transport costs from farm to table in existing Neolithic economies and so allowed for larger settlements, evidently more importantly for future historical trajectories, the traction complex transformed steppe economies by lowering costs of seasonable herd movements (Anthony 2007). Suddenly, the steppes became highly productive for people and their animals. As known ethnographically (Irons 1979), the warrior basis of pastoral societies was enhanced by horse domestication that increased mobility of warrior bands employed in swift raiding (compare Hämäläinen 2008 for the adoption of horses by American Plains Indians).

In the steppe, the traction complex and the role of cattle permitted rapid expansion of the Yamnaya Culture. By 3000–2900 BC, it stretched westward from the southern Urals into Romania and the Carpathian (Kaiser and Winger 2015: Fig. 1). This 'cattlization' greatly increased the ratio of cattle (typically 80%) to sheep compared with Copper Age settlements in Pontic steppe when cattle were of little importance (Kaiser 2011: Fig. 1b vs. Figure 2b). Wagons—or mobile homes really—appeared in elite burials, and, for the first time, male warriors received institutional identity in burials, sometimes marked with stone menhirs depicting warriors. Monumental barrows (kurgans) represented a new kin-ordered family structure with inheritance of animals and pasture rights, and their burial ritual symbolized the new institution of warrior leaders originating in the Maykop Culture of northern Caucasus (Korenevskiy 2017). Yamnaya encapsulated a new social formation that embodied rapidly expanding populations with Pastoral MP.

[3] By large scale we primarily refer to their effects in terms of genetic and cultural turnover, inlcuding major openings of landscapes (Kristiansen et al. 2017). We realize, however, that rapid demographic growth also played a role in these processes. At present it is difficult to estimate group sizes; however, we believe that their organisation was perhaps more important. The best proxi for the estimation of impact are pollen diagrams, which for northwestern and western Jutland testify to extensive deforestation within one to two generations (Andersen 1993). Similar processes were reconstructed for the southern Cimbrean Peninsula (Feeser et al. 2012; Feeser and Furholt 2014) The evidence suggests a widespread, large-scale event signifying the arrival of substantial numbers of people across northwestern Europe.

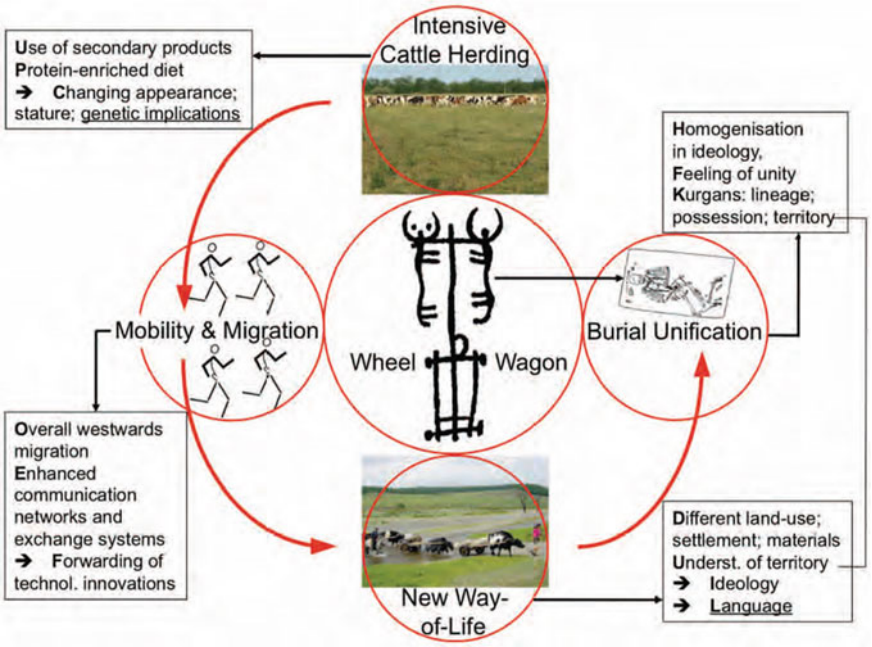


**Fig. 2** Model of the Yamnaya pastoral Mode of Production (after Frînculeasa et al. 2015)

The PMP of the Yamnaya Culture (Fig. 2) can be modelled as follows: Subsistence was based on meat and dairy products (Shislina 2008) with some wild products (Schulting & Richards 2016). No agriculture is documented, except to the west, where some cereal was cultivated (Pashkevych 2012). Genetic selection existed for lactose tolerance (Mathieson et al. 2015), and, compared to Neolithic populations, people were taller with a healthier, protein-rich diet, which meant that more children could survive, and population could grow. Spatially, demographic expansion was rapid, increased by the required low population densities and highly mobile economy of pastoralists. Under the prevailing climatic conditions of the early 3rd millennium BC for grassland productivity animals and populations would rapidly outgrow local carrying capacity. Settlements were impermanent, not anchored to permanent, owned places. Property was first and foremost in animals, especially cattle, the most important subsistence product and the primary form of moveable wealth.[4] An element of

[4] The following citation catches the dynamics of cattle ownership and raiding: "The importance of cattle as a medium of exchange and as the main object of raiding parties meant that cattle circulated in society much more intensively than is generally assumed. The practice of raiding need not result in accumulation of cattle on the homesteads of successful warrior elites. In Northeast Africa as well as in ancient Ireland the cattle captured in raiding was often directly redistributed by elites to their followers or clients. Especially in Ireland, clientship networks were closely connected with a system of cattle loans. The existence of such redistributive practices makes it almost impossible to reconstruct the cattle ownership of tribal leaders on the basis of archaeological evidence" (Roymans 1999: 298).

permanence was, however, established by barrow cemeteries, aligned in the landscape probably to mark ownership of pastoral lands along established seasonal routes (compare Johnson and Earle 2000).

From 2850 BC onwards, Yamnaya populations expanded rapidly into central and northern Europe leading to the formation of Corded Ware Culture (Allentoft et al. 2015; Haak et al. 2015; Mittnik et al. 2018). Genetically, they originated from Yamnaya populations, but they also added some farmers' DNA, apparently from capture or marriage of women from existing Neolithic groups (Sjögren et al. 2016). These captive women would, of course, have brought with them specific cultural behaviours and knowledge that influence the formation of the Corded Ware complex (see Cameron 2016: chapter 6). Numbers of farmers declined substantially, but coexisted for a few hundred years with pastoral groups, until being extirpated in much of Europe by the later 3rd millennium BC. Corded Ware Culture, composed of a genetically distinctive group, spread over vast areas carrying common burial rituals (Furholt 2014: Fig. 7, 2018) similar to the steppe Yamnaya Culture. Across Northern Europe tens of thousands of small, single-grave barrows exist, forming visible lines of communication in vast, open anthropogenic environments (Hübner 2005; Bourgeois 2013). These barrows suggest segmentary groups with territorial ownership of pasturelands and routes of movement.

## *Dynamics of the Growing Pastoral Mode of Production*

The 3rd millennium BC witnessed radical transformations in European societies. Already Neolithic farmers appear to have declined significantly in number during the late 4th millennium in northern Europe (Hinz et al. 2012), probably devastated by the plague (Rasmussen et al. 2015; Rascovan et al. 2019); overall, population densities were quite low, and pastoralists spread into relatively open land, first in areas unoccupied by Neolithic farmers and progressively replacing them across much of Europe. How was this possible? Pastoral societies are universally warrior-based and organized along male lines of warrior sodalities.[5]

Corded Ware migrations apparently constituted up to 80–90% males, in all probability young warriors, as supported by genetic evidence from the earliest Corded Ware burials (Goldberg et al. 2017). Mobile pastoral warrior groups would have been in search of animals, new pastureland, and of course women; males in Neolithic communities were killed, and women were taken as captives and mates. Ample

[5] Based on ethnographic analogy to pastoral societies like the Nuer (Evans-Pritchard 1940), individuals owned animals. Each male was a warrior, required to establish his manhood characteristically by capture of animals. Then they had to defend their animals and animals of their close kin against constant threats of outside raids. These warriors were individual predatory agents seeking to seize what was useful to them but could unify along kinship lines to form larger predatory warrior groups according to the model of predatory segmentary societies, as articulated by Sahlins (1961). There existed fundamental similarities between African pastoral societies and Indo-European pastoral societies (Lincoln 1981).

evidence exists of massacres of Neolithic communities probably by Corded Ware groups (Schroeder et al. 2019) and in reverse by Neolithic groups (Muhl et al. 2010). Abduction of Neolithic women by Corded Ware males was probably customary, while the killing of males represented ethnic cleansing.[6] This would explain the extraordinary genetic fact that only two dominant male lines are documented from Yamnaya to Bell Beaker communities, and these lines still dominate today's male population in Europe, while Neolithic male lines vanished. In contrast, multiple female lines existed, many of which show Neolithic origins. As the evidence stands, we can envisage a rather massive, if long-drawn-out, genocide of Neolithic males that eliminated their reproduction contributions throughout temperate Europe,[7] even if such processes might have been intersected with periods of more peaceful interaction.

The practice of exogamy and abduction of Neolithic women helped introduce new cultural and economic practices that created both a new pottery style, as well as introduced certain agricultural practices though on a limited scale (Kristiansen et al. 2017). Also new vocabulary for crops was introduced that were non-Indo-European in origin (Iversen and Kroonen 2017). A cultural hybridity led to small-scale changes in material culture, language, and economy among Corded Ware groups.[8] The PMP remained dominantly, but we can suppose that as territorial limits for expansion were approached, a need to intensify subsistence probably transformed the PMP. In one place or another across Europe, the selective addition of agricultural practices and regional trading specialization formed a foundation of what was later to become the Germanic Mode of Production, perhaps first unfolding in rapid migrations of Bell Beaker groups.

## *Water-Based Technology, Continued Expansion, Colonization, and New Trading Networks*

From around 2500 BC, the Beaker complex spread in ribbons and patches across western and central Europe where pastoral and agricultural groups were already well established (Heyd et al. 2018). Many new settlements were positioned close

[6] There is evidence of horse domestication, and thus horse riding, in the 4th millennium BC (Damgårdet al. 2018). This practice would have spread with the Yamnaya and later Corded Ware migrations. The use of horses in raiding would have provided an advantage to these groups compared to Neolithic communities. We find small amounts of domesticated horse bones in relation to Corded Ware and Bell Beaker settlements (Becker 2008).

[7] A dramatic bottleneck in male genetic lineages took place globally between 5000–7000 BP, while not the case for female haplo groups (Karmin et al. 2015). A recent attempt has been made to explain this as a results of increasing competition between patrilineal male lineages leading to new more expansive pastoral formations (Zeng et al. 2018).

[8] We are aware that these processes unfolded according to local conditions and created local variations, not least in areas where Neolithic populations were still holding their positions. Thus, in Poland, we witness the formation of several cultural variants (Wlodarczak 2017); however, to understand such processes demand more localized samples that combine aDNA and the evidence from strontium isotopic tracing.

to the sea and along rivers. Settlements typically held boat-shaped houses that were found in small clusters of farms and/or small hamlets with house structures replacing each other through time, suggesting individual ownership of farmland. A particular cultural package, typically found in burials under barrows, included such items as the characteristic beaker (probably a drinking vessel), a flint dagger, finely crafted arrowheads, and distinctive double-drilled buttons. Genetically, many Bell Beaker groups came out of Corded Ware populations, but an apparently earlier Bell Beaker group in Iberia belonged genetically to Neolithic populations of Anatolian descent (Olalde et al. 2018). Around 2600 BC, they expanded into the Mediterranean Sea to colonize and probably to tie into existing populations (based on continuing house traditions), but they also expanded to the north along the Atlantic seaboard, identified by Maritime Beakers, and inland into central Europe. Here, they would have encountered Corded Ware populations, which apparently adopted the Beaker package, including metallurgical skills and advanced archery of warriors (Grossman 2015). Little genetic admixture, however, took place between the Iberian Bell Beaker and Beaker-transformed Corded Ware populations, which had varying admixture with other existing Neolithic groups.[9]

What are we to make of the dynamic development of this new phenomenon across Europe? These two genetic populations, with distinctive historical backgrounds, adopted a shared cultural and technological complex that formed a network of traders, craft specialists, and miners that was expanded by rapid colonization and conversion. We envision the Bell Beaker complex as created by rapid migrations characterized by the PMP of Corded Ware people, who represented genetically much of the Bell Beaker populations. The dynamic population expansion was typical of those pastoralists, and the distribution of barrows suggests the same pattern of ownership over pasturelands and cattle that was so widespread. But the new settlement pattern of permanent farmsteads that suggests a stable farm-based property system anticipates the Germanic Mode of Production. We suggest that the addition of farming, evidently related to their linkage to Neolithic populations, would have created an anchored productive base that supported mobility across water with a new boat technology of seagoing plank-build boats, as documented by slightly later evidence of boats that must represent a protracted maritime tradition (van de Noort 2011). Setting out from the Netherlands, these boats enabled them to cross the British Channel in large numbers, and they spread rapidly across the British Isles in much the same way as Corded Ware had spread into central and northern Europe. Again, we witness a rapid and nearly full genetic replacement of the existing Neolithic populations (Olalde et al. 2018).

We propose that, with new boat technology, Bell Beaker people took to the waters of Europe to colonize areas with special resources for trade within an

[9] Discussing these variations: "We observed differences in ancestry not only at a pan-European scale, but also within regions and even within sites. …. Although the steppe-related ancestry in Beaker-complex-associated individuals had a recent origin in the east, the other ancestry component—from previously established European populations— could potentially be derived from several parts of Europe, because groups that were genetically closely related were widely distributed during the Neolithic and Copper Age" (Olalde et al. 2018).

extended network of culturally identified people. We imagine people with the same creative drive for expansion and innovation, as characterized by Corded Ware groups, expanding to colonize areas offering opportunities to produce goods with regional comparative advantages that could then be traded inter-regionally among a group with common identity. They colonized the Netherlands and coastal England with its pivotal location joining the maritime coasts and the river systems of central Europe, moving across the British Isles to mine rich metal deposits, colonizing western Jutland with cattle useful for hiding production, flint for the specialty warrior equipment (daggers and arrowhead), and, of course, in amber, into Norway where standing forests could be used for boat construction, and along the rivers into the heart of Europe where many metal sources were available, horse breeding was optimal, and the web of rivers provided networks for efficient movement to consumers of their many products. Evidence is building for emerging regional specialization and major inter-regional trading systems: the rapid abandonment of amber for local use in Denmark (Shennan 1982), new mines on the British Isles (O'Brien 2015), and horse breeding for trade in Bell Beaker settlements on the Danube in Hungary (Endrödi and Reményi 2016).

## *The Transformative Potential of the 3rd Millennium MP*

By the end of the 3rd Millennium, temperate Europe from the Urals to Ireland exhibited basically similar social formations, probably with rather similar spoken Indo-European dialects, as well as shared ideologies, which then began to diverge (Heyd 2016). They originated in the steppe PMP, which gradually transformed into a GMP once the migrants settled and adopted agricultural practices, as was already underway during the later Corded Ware settlement complex of Central Europe (Müller 2009). The rapid expansion of a common Corded Ware Culture across much of Europe erased many of the ethnic divisions and allowed for freer movements across vast stretches of land, the establishment of broad networks of relationships, and distant exchanges in some special objects, especially the stone used for battle axes and later many special goods.

Systematically, the adoption of a GMP appears linked to the emerging trading complex of the Bell Beaker Complex. Broadly spread social and linguistic compatibility held a transformative potential when linked to an expanding trading economy. Already during the 5th Millennium, metal had come into use, especially for objects of distinction, but expansion in metal use and trade stalled due in part to localized Neolithic lives with CMP1 that apparently limited trading volume and extent. As the new farm-based Germanic Mode of Production, based on independent households, developed, its economic base apparently supported new water-based trading and related export production within broad networks of relations of production materialized in the Bell Beaker complex. This was, we believe, the synthesis that allowed for extensive trading networks that interconnected Europe and allowed for the eventual articulation with an expanding World Economy. The interstitial connections of the Beaker Complex would lead to the onset of a new and lasting Bronze Age trading

economy that transformed 3rd millennium MP into new tributary forms that we now describe.

## Second Millennium BC: Age of International Trade

Across Europe, the Bronze Age of the 2nd millennium BC witnessed dramatic changes in social formations and their articulations regionally and trans-regionally based on an integrated, metal-driven trade (Kristiansen and Larsson 2005; Kristiansen and Earle 2015; Vandkilde 2016). Of course, much in everyday life remained largely unchanged, geared to subsistence practices linked to local histories of resource use. Everyday lives were essentially still based on CMP and GMP. Changes were, however, dramatic in a new sphere of exchange in wealth that supported the emergence of tributary modes of production. Some contributing factors behind this development are considered below. Between 2000 and 1500 BC, European population rose more than 50% perhaps to 13 million, which was comparable to the Near East at that time, although admittedly across a much larger area (Müller 2015a: Fig. 17.9). Bronze Age populations document a genetic continuity from the 3rd millennium; probably some migrations involved population expansions and colonization. Although genetic changes from the Mediterranean are yet to be determined, new evidence from strontium and isotopic analyses show that in the 2nd Millennium individuals, both males and females travelled regularly over long distances (Frei et al. 2015, 2017a, b). Increased individual mobility is probably connected to various factors (such as chiefly exploratory travels, marriage alliances, free-agent warriors, and slaving), but certainly all connected ultimately to the expanding, well-organized commodity trade in copper and tin for bronze weapons, luxury and utilitarian objects. The metal trade and the associated commodity flows helped establish broad trans-regional networks across Europe. For the first time, the societies of Europe and even into the steppes became bound into expanding socio-economic networks.

### *From Kin-Ordered to Tributary Modes of Production: Transforming and Linking Local Economies with Expanding Trading Systems*

Starting around 2000 BC, a transformation took place, with tin bronzes becoming dominant in a wide range of goods and with concomitantly increased volumes of trade across Europe (Vandkilde 2017). The change was completed by 1600 BC, when metal trade took another jump in scale and volumes (Vandkilde et al. 2015; Meller and Risch 2015). As a result of these changes, the Kin-ordered Modes of Production from the 3rd millennium BC were often transformed into Tributary Modes of Production, as emergent leaders and groups were able to control bottlenecks in resource flows.

Although most subsistence goods and other items like ceramics were obtained locally and market systems were under-developed, communities often became dependent on surplus production for trade in order to gain access to metals and increasingly to textiles. In turn, the demand for surplus labour increasingly required tributary work and slaves.

At this time, the PMP largely ended across Europe, because increasing population densities demanded expanding food production. Subsistence intensification with investments in buildings for storage and animals created a new landscape of farmsteads and hamlets. The Germanic Mode of Production became the dominant MP across northern and middle Europe and along its Atlantic fringe from 2000 BC onwards. Wealth was based upon land and cattle, stalled for protection and increased production, and each farm would provide warriors to form retinues for local and often chiefly agency (Horn and Kristiansen 2018). A characteristic settlement pattern of permanent farms and fields with individually owned ancestral barrows marking the landscape emerged extensively over temperate Europe (Artursson 2009; Earle 2002; Earle and Kristiansen 2010; Kristiansen 2015). Along the coasts of Scandinavia and western Europe, as the extension of the GMP1 and its Bell Beaker manifestation, a new Maritime Mode of Production formed from 1600 BC onwards (Ling et al. 2018). This new maritime economy boosted the GMP1 into a more expansive variety, as intensive landholding economies could finance boat construction and their crew engaged in international trading and raiding on scales not seen before. It was the circulation of wealth by chieftains that bound warriors into dynamic regional chieftaincies and their confederacies.

The CMP1 became dominant in much of Central and Southern Europe, where Neolithic precedents for settled village life existed. Focused on rich soils, permanent settlements were positioned above good farming lands, often with a reliance on intensive agricultural investments. These lands must have been corporate property materialized by densely settled and stable villages and their associated group cemeteries. Settlements were often fortified tells or hillforts, which, we argue, materialized ownership and defense of land (Earle 2002, 2017). A vivid example of the CMP is the tell settlements and cemeteries in the alluvial soils of Hungary (Jaeger et al. 2018a, b; Kienlin 2015). Quite similar to earlier Neolithic settlements, these were largely self-sufficient communities of arranged houses within fortified walls that could form tell deposits over hundreds of years of continuous occupation (Jaeger 2017). From around 1700/1800 BC, metal trade and production intensified, in tandem with a new wool-based economy (Bergerbrandt and Sabatini in press), and societies across Central Europe entered a CMP2, as represented in the settlement hierarchies of the Benta Valley (Earle and Kolb 2010). Other dramatic examples of CMP2 at this time include the irrigation-based hillfort Argaric culture of southern Spain (Gilman 2013) and the fortified, irrigation-based villages of the Terramare culture of the Po Valley, in northern Italy (Cardarelli 2015).

On the steppe, the PMP of the 3rd millennium BC gave way to more settled herding economies (Anthony et al. 2016). With the invention of swift two-wheeled war chariots the balance of power changed dramatically, and a PMP2 with significant stratification formed on the steppes. New power institutions demanded surplus

production to maintain specialists linked to the breeding and training of horses and the construction and driving of the new war machine, the chariot. We can locate this innovation in the Sintashata Culture of the Trans-Urals, a society organized around regularly laid out fortified settlements, led by a new warrior elite that controlled copper production in the Urals (Chechushkov and Epimakhov 2018). From around 1800 BC, these groups expanded east and west in a series of conquest migrations that took them through central Asia into Pakistan and northern India (Allentoft et al. 2015; Damgård et al. 2018). In the west, they reached Mycenae, and to the south the invention changed the character of warfare in Near Eastern city-states.

With the formation of fully developed BA Tributary Modes of Production, the societies of western Eurasia entered into commercial and political relations with states and city-states in the eastern Mediterranean, Anatolia, and the Near East (Kristiansen and Larsson 2005). We now describe these dramatically expanded trade networks that boosted local economies and vice versa.

## *The Growth of Trans-Regional Metal Trade in the 2nd Millennium BC*

We believe that the circulation of metals, especially copper and tin to produce bronze, was the primary driver of the expanding political economies of Bronze Age Europe. Although metallurgy and related trade expanded from 2500 BC onward with Bell Beaker networks, a full-blown bronze economy emerged in south and central Europe only after 2000 BC, extending into the steppe as well. The demand for tin-bronze objects required a supply of copper and tin, two metals smelted from ores that typically derived from different regions, often quite distant from each other. Captured by Vandkilde with the term 'bronzization' (Vandkilde 2017), the 2000 BC turning point reflects the integration of Europe into a larger world system, which unfolded and expanded to encompass all European regions after 1700/1600 BC (Vandkilde 2014). Copper became widely distributed throughout Europe from a few major mining areas (O'Brien 2015; Melheim et al. 2018; Radivojevic et al. 2018). The magnitude of the Bronze Age metal trade was quite extraordinary, according to the rates of consumption, especially knowing that most regions imported metals from long distances. This in turn led to the rapid development of new institutions, such as warrior retinues linked to powerful chiefs and, in the steppe, to the invention of the two-wheeled war chariots. New institutions like these demand innovative forms of economic support, often some measure of control over laborers, whose surplus could be extracted as tribute.[10] A good example is the regional fortified metal production centre of Bruszsewo near Poznan, which controlled both supra-regional metal- and

[10] An increasing number of local and regional in depth studies testify to these European wide transformations. Selectively we refer for Northern Europe to Vandkilde (2017), Bech et al. (2018), Yates (2007); for the steppe to Anthony et al. (2016), Krause and Koryakova (2013 and 2014), and for tell societies of east-central Europe to Jaeger et al. (2018a, b).

amber trade, and the nearby hamlets. The wealth was displayed in the burial mounds of the nearby Leki Male (Müller and Kneisel 2010; Czebreszuk et al. 2015). This transformation was not uniform, however, as some regions, peripheral to the Bronze Age trading networks, retained a CMP1 way of life (Kienlin 2017).

How and why did the new trading economy come to dominate European societies? Metal provided new weapons, personal adornments, and working tools that were broadly advantageous. Once appropriated to provide for many social, ritual, and economic demands, regular supplies of metal became indispensable to social and economic reproduction. The flows of metal were not unlike the modern dependency on oil that transformed international relations so fundamentally. In Denmark alone, the annual demand for copper to replace loss and reduction through use-wear and sharpening of axes, sickles, and weapons amounted to 1–2 tons (Radivojevic et al. 2018). Scaling this up to all of Europe, the production and circulation of copper must have been hundreds of tons per year. By now, every farmstead, village, warrior, and chief were depending on regular deliveries (Marciniak and Greenfield 2013: Table 1 and Fig. 11). We can imagine that long-distance political confederacies were formed to secure trade routes by providing protection and provisions during travels, and that they were likely based on old Indo-European institutions of guest-friendship (Kristiansen and Larsson 2005: 236ff.). A continuation and institutionalization of exogamy probably structured the support for these political confederacies of long-distance alliances and trade, as evidenced in Fig. 3, as millennia-old traditions. The institutional character of trade routes was also highly dependent on population densities and social stratification (Müller, 2015a, b). The establishment of such integrated, high volume trade across Europe was further facilitated by lowered transport costs using more advanced maritime technologies, which included large (11 m) seagoing plank-build boats that could carry cargoes up to 6–700 kilos, as did the famous Hjortspring boat from Denmark (Kaul 2003; Vinner 2003).

Highly desirable foreign metals were the product of regionally specialized economies. Each region's population had to be involved in some critical step in metal commodity chains or produce alternative highly valued exports for trade that provided an inter-regional comparative advantage (i.e. lower costs in procurement and production) (Rowlands and Ling 2013). These could include the mining and refining of copper, tin, silver, or gold ores, different stages of textile production, the collection and manufacture of amber, of glass and other items of personal adornment, and the production/extraction of salt and other commodities (Ling et al. 2017: Fig. 9.1; Kristiansen and Suchowska-Ducke 2015). Each regional specialization pattern, geared internally by the acquisition of metal, transformed local labour processes. Thus, the broadly new metal economy transformed the regions of Europe in quite different ways depending on local opportunities. Some examples are well known, while others are just becoming recognized.

Denmark's amber provides broadly known examples of export production. In the Thy, for example, households near the coast became engaged routinely in raw amber collection, sorting, and storage, for export purposes (Earle 2018). A new industry of salt extraction was established in Hallstatt and the Carpathians with large-scale mining and related activities, probably including children for such jobs as lighting

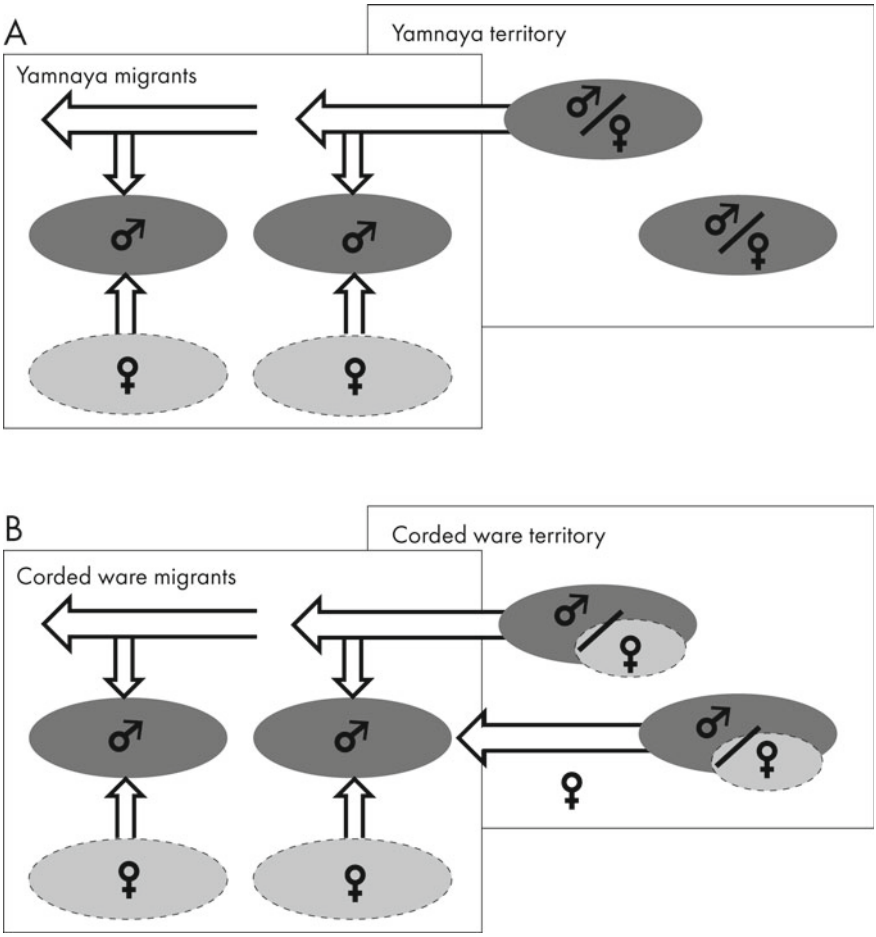


**Fig. 3** Model of the Yamnaya and Corded Ware expansion strategy (after Kristiansen et al. 2017: Fig. 1)

the large galleries (Harding 2013; Kern et al. 2009). The increased trans-regional availability of salt then expanded its uses and enhanced demand, for example, to produce salt meat, so useful to support trading and military campaigns.

Beyond specialization in metal mining and crafting, perhaps the most dramatic economic change was the emergence of a trans-regional textile industry, which began during the 3rd Millennium in western Asia and expanded into southern and central Europe in the 2nd Millennium (Sabatini and Bergerbrant 2019). During the Middle Bronze Age, in the Po Valley of northern Italy, for example, a village specialized in spinning as has recently been documented by an extraordinary concentration of spindle whorls (Sabatini et al. 2018); spinning specialization here must then have been linked closely to specialized sheep herding to produce the required volume of

wool. Thanks to its specialization, the village gained access to metal and could further specialize in the metal production and trade, allowing the subsequent emergence of regional political hierarchies. At the same time, along the Danube in Hungary, sheep production shifted from generalized culling practices towards one geared to wool production (Vretemark 2010). Here, too, a regional settlement hierarchy emerged that suggests a chiefdom-like political structure characteristic of the CMP2.

By the Middle Bronze Age and into the beginning of the Iron Age, following lowered costs in production and transport and increased population densities, the new export industry of southern and central Europe appears to have provided northern Europe with woollen garments (Sabatini and Bergerbrant 2019). Several thousand woollen textiles, in the form of large 2 × 3 m pieces of cloth, were then exported north. We estimate that 1500 to 5000 textile pieces reached Denmark alone (Bergerbrant 2019; Kristiansen and Sørensen 2019). In south Scandinavia, these large pieces were cut up to create male and female garments. At this time in Denmark 80% of woollen textiles were imported, and only 20% were locally made (Frei et al. 2017a). After 500 BC, however, new breeds of sheep with full fleece made it possible for villages and individual households to produce their own woollen textiles, thus leading to a decline in textile trade. Many regions of Europe participated in different ways in the emerging wool economy providing textiles, which were historically one of the mainstays of World Systems. All in all, the development of regional specializations both met existing demands and created new demands as unexpected efficiencies and uses became evident, so that progressively integrated economies of special commodities emerged.

## *Competing Tributary Modes of Production and the Bronze Age World System*

After 1700/1600 BC, a privileged class of consumers from expanding palaces and city-states of the eastern Mediterranean boosted the demand for high-value goods, such as amber from the northland, tin from Cornwall, and probably other specialties like slaves acquired by northern raiders and horses from Carpathian breeders. As a result of these inter-regional flows, we observe cyclical swings in trade routes linking transport technologies and the political strategies to concentrate and circulate wealth. Between 1900–1600/1500 BC, central and south-eastern Europe flourished with regional polities financed strategically with CMP2 that secured ownership over trade routes and key exports (Vandkilde 2014). As rapidly as they formed to dominate trade, their dominance collapsed. A newly dominant trade route took over that linked Denmark and south Scandinavia more directly into the trade networks that connected the Mediterranean to the amber trade, perhaps also moving slaves (Kristiansen and Suchowska-Ducke 2015). The Maritime Mode of Production was formed to link formally independent communities into more integrated political economies, by which highly productive chiefly farms could finance trading-raiding ventures that

passed wealth through the hands of chiefs for the building of extensive networks of warriors (Ling et al. 2018). After 1300 BC, the Carpathian ECMP recovered, forming huge fortified proto-urban settlements, while the Atlantic sea trade connected Iberia, British Isles, and Denmark and stoked the continuing MMP.

What were the main drivers and constraints of the Tributary Mode of Production? The primary driver behind the formation of Tributary Modes of Production during the 2nd millennium was the potential for control of warriors and producers through the centralized circulation of the metal required for new professional weapons (swords, lances) that armed semi-professional warrior bands and retinues. These, in turn, helped to protect trade and to control local export producers. The ideological driver, especially of the GMP2 and MMP, was a prestige good system of wealth finance, which allowed chiefs to tie warriors and clients to them and thus expand alliances and incoming tribute. But this would not have been possible without the surplus generated from trade/plunder from faraway places through warrior force (Horn 2016), and the subsequent local expansion of property rights of the more successful chiefs. Throughout Europe, this competitive tributary, trade/raid-based MP resulted in settlement hierarchies between farms and villages (Sørensen 2010), and by the Late Bronze Age it led to the formation of regional centres corresponding to large and rich chief settlements, exploiting the produce of farmers reduced to commoners and slaves (Holst et al. 2013).

Warriors, however, were disruptive in centralized power systems (Earle 1997). Only control over the circulation of metal weapons appears to have been the way to effectively bind them to their chieftains. The rise of semi-autonomous warrior aristocracies, who could be hired by the highest bidder,[11] could tip local and regional power balances and lead to rapidly changing trade routes and opportunities for wealth accumulation. Conquest migrations, such as documented by the Tollense battle in 1250BC, sought to colonize and control fertile lands as at Mecklenburg and major trade routes like the Oder. When considering the scale of warfare documented at Tollense, conflict, conquest, and colonization could take place at regional scale to assert ownership over key land and trade routes, from which tributes could be extracted. The Tollense battle happened at a time when trade between Jutland and south Germany had collapsed after 150–200 flourishing years and had to be forcefully replaced by another trade route from the Carpathians to south Scandinavia (Kristiansen and Suchowska-Ducke 2015). At the same time, an expanded maritime trade towards the Iberian Peninsula appears to have compensated for the temporary collapse of the Weser trade route to South Germany.

The only stability in such systems was constant change as competing forces, emphasizing alternative TMP, sought to direct flows of metals to their advantage. Competition over the metal trade and the resulting opportunities of circulation were inherent to reproduction of the system; they did not lead to systemic collapse, but

[11] There is increasing evidence from strontium isotopic analyses that many warriors of retinues and larger armies had diverse, non-local origins (Wahl and Price 2013; Price et al. 2017). Similar patterns are known from Viking Age warrior cemeteries (Price et al. 2011). This is a characteristic pattern of retinues formed by mercenaries.

rather to continuing shifts in regional centres of wealth. These shifts were often between different MP, the GMP2 and CMP2 of east-central Europe, dominated by the CMP2, and middle and north-western Europe dominated by the MMP and GMP2 dynamics, which persisted independently of the observed shifts in ascendancy to the south. The historical trajectories of Europe and the eastern Mediterranean became increasingly intertwined.[12]

Towards the end of the Bronze Age, the transformative potential of 2nd millennium MP unfolded, ultimately separating the historical trajectories of temperate Europe and the Mediterranean (Kristiansen 1998). In temperate Europe, the metal trade ceased to be critical because of the replacement of bronze, which required large-scale trade, with iron, which was locally available. The Maritime Mode of Production and its control over metal circulation ended, to be replaced by hillfort societies across much of Europe and fortified villages in Scandinavia. These settlement forms were characteristic of CMP1. Eventually, in the world of hillforts large urban-like settlements formed. The oppida (Fernández-Götz 2014) were likely loci for new markets and full-time specialists including merchants.

In the Mediterranean, in the twelfth century BC, the so-called 'Sea Peoples,' apparently originating from northern Italy and other places, flooded the Mediterranean Sea region to prey on and ultimately disrupt trade, causing the collapse of the Late Bronze Age states of the Mycenaeans and the Hittites (Fischer and Bürge 2017; Kristiansen 2016: Fig. 10.5 and 10.7). Perhaps the loss in control over metal circulation and warrior weapons created a dynamic, highly decentralized piratic network of warriors that could prey on established trade, on which the late BA civilizations had been based. Then, during the 1st Millennium BC, throughout the Mediterranean, the Phoenicians (Monroe 2018), then the Greeks, and eventually the Romans, via colonizing, created a new trans-regional economic integration, suppressed warrior raiders (pirates), and established supportive administrative and mercantile structures for trade to support a new social order. The global interdependency that ceased with changes in metal and textile technologies made northern Europe into a periphery, but one linked economically by increasing trade relations to support resource demands of Mediterranean empires. The north–south divergence was finally established and consolidated with the gradual formation of the Roman empire towards the end of the millennium that established a continuingly strong core-periphery relationship until the collapse of the Roman empire in the 6th Century AD (Brun 1994).

[12] We suggest that similar dynamics between competing MP characterized larger regions of western Eurasia, perhaps most clearly demonstrated in the Caucasus (Smith 2015). But also in the steppe do we see an increasing settleling down of the pastoral groups after 2000 BC (Anthony et al. 2016).

## Concluding Discussion

### *Formation and Dissolution of Modes of Production: Expansion and Constraints*

Migrating societies tend to support forces of social equality, in part due to the inherent conditions of risks and collaboration needed to overcome these conditions and the lack of circumscription (Kristinsson 2010). A rule of patrilineal residence and exogamy helped to secure male dominance over property, first in animals and then in farmsteads created by improvement or seizure. As described well in Indo-European sources (Falk 1986), and archaeologically documented (Anthony and Brown 2017), male primogeniture would lead to an institution of training young teenage males as warriors responsible for themselves. Since the pastoral system inherently produced demographic surpluses of young warriors, they had to move out or become dependent labourers at home. Seeking to establish their status, these warriors were the first agents of expansion (Sergent 2003). As operated in many pastoral societies, the young warriors would have been responsible for the defence of their group, but their personal ties based on kin-relationships and friendship would have created the ideal collaborative bonds to seize new opportunities. Sahlins (1961) based on his analysis of Nuer and Tiv ethnographies from Africa called this an organization of predatory expansion. This model is presented in Fig. 3.

Constraints can also act as drivers, depending on outcomes. Demographic and ecological restrictions undoubtedly existed in the PMP. Ecological borders of the steppe became limits to Yamnaya expansion to the west. To the east, they were constrained by well-organized horse herders and hunters of the Botai Culture. Turning constraints into drivers for expansion, however, the Corded Ware people adapted their pastoral economy to forested Europe, and they did so by choosing to occupy first the lighter soils where forests were easily transformed by burning into steppe-like grasslands. Demographic constraints on Corded Ware populations were linked to the carrying capacity of their animals that varied with climate and precipitation. The early 3rd millennium was in this respect good for pastoral practices, but the onset of a dry, warm period around 2300 BC affected productivity and gradually favoured more stable agricultural activities.

In areas of heavier and more fertile soils, Neolithic populations still persisted with settled village life, structured by the CMP1. In less fertile soils occupied by pastoralists, however, the transition to the GMP1 was driven by a continuing growth dynamic, but with definite limits to expansion. While retaining a strong herding component, groups adopted cereal farming, starting an economic transformation that included settlements of scattered farms and the continuous search for new opportunities for colonization. Interacting with Iberian Bell Beaker groups, which had new metal technologies and perhaps maritime boats, Bell Beaker people, who were genetically Corded Ware populations, were able to rapidly recolonize northern and western Europe with a new farming-trading-export economic mix. This Bell Beaker complex

continued to expand towards the British Isles through a broad network of communities that developed specialized products for exchange and/or means of transport. Europe became divided: in areas of heavier soils, villages with cemeteries existed with the CMP and across lighter soils isolated farms and barrows associated with the GMP and MMP (Harding 2000: Fig. 3.1; Earle and Kristiansen 2010: Fig. 8.8 and 8.9).

## *The Role of Cultural, Linguistic, and Ethnic Identities*

Fundamentally, common identities appear in burial rituals, often an individual under a barrow, that express the relations of production that gave individual rights to property. Strict rules of how to position males and females and how to accompany them with particular packages of goods probably reflect shared institutions of ownership transferred at death.

Across broad areas of Eurasia, correspondences existed between migratory expansions and colonisations of the Yamnaya, Corded Ware, and Bell Beaker groups. Structured by an emergent Pastoral to Germanic Mode of Production, these cultural groups stood in sharp contrast to the Corporate Mode of Production of Neolithic farmers, who kept, improved, and defended rich soil areas cut out of the forest, and its cultural localism. Neolithic farms were the target of continuous raids to capture women by Corded Ware and later Bell Beaker warrior groups. As a result of these tensions sharp cultural and ethnic borders were sustained, as well documented from ethnohistorical sources (Cameron 2016: chapter 5). The emergent GMP was supported by warrior sodalities materialized in widespread similarities in male burials (Bourgeois 2017), and perhaps linked to the practice of raising foster sons from distant families networked by kinship and marriage (Knipper et al. 2017). Martin Furholt (2017) has proposed that the fluidity of social groups was behind the formation and maintenance of a homogenous material culture, at least for a few hundred years, which represented strong spatial mobility despite being settled. Later migrations during the La Tene and Migration periods documented that migrating groups often shared symbolic elements fundamental to their identity, while exhibiting local cultural variation (Hedeager 2010).

The symbolic and ritual world, reinforced by language, provided a cultural and ethnic identity in periods of mobility and social tensions. When confronting hostile groups, such collective identities were crucial to form alliances in a segmentary system. Others outside these groups were despised and exterminated; defeat meant death or slavery. Archaeology documents massacred bodies thrown into pits like garbage, as at Pömmelte (2300–2000 BC) where 27 individuals, mostly juvenile and adult males, were thrown into pits around a circular ritual structure (Spatzier 2017).

Language change and continuity has been broadly studied in processes of migration and political economies (Hornborg 2014). In comparative ethnographic cases (Lansing et al. 2017), the dominant language is the one spoken by the social groups into which spouses found residence after marriage. Thus, whether matrilineal or

patrilineal, the language of the receiving group dominates. That these BA societies were typically patrilineal with patrilocal residence following marriage and language adoption, we believe, is in line with the dominance of IE languages across western Eurasia. We can thus propose that the expansive patrilineal, patrilocal warrior based on Pastoral Modes of Production supported the global expansion of Indo-European languages. Should the Neolithic Corporate Mode of Production have been dominant, we would in all probability have seen a much more diverse linguistic history across Europe.

During the 2nd millennium BC, the formation of new regional identities, in part linked to trans-regional networks of trade routes, raiding, and confederation, probably led to the formation of regional dialects and later languages, such as Germanic, and Celtic, Italic and Greek. They could well have their roots in the regional identities, political economies, and networks of mobility and trade formed during the 2nd millennium BC (Kristiansen 1998: Fig. 26).

## *Ideology and Modes of Production*

The dialectic of ideology and relations of production suggests how culture, language, and social relations are modelling on core values and life worlds. Ideology and myth provide a blueprint for social action, e.g. how young warriors must raid cattle and bring them back as bridewealth payments, core personal wealth, and obligations to priests and sacrificial gift to gods (Roymans 1999: Fig. 9). Warrior behaviour unfolded according to social rules that were organized following heavenly rules expressed in myths, rituals, and martial behaviour (Lincoln 1981). This behavioural complex was rooted in principles of primogeniture that led to the formation of the institution of young male training and initiation camps, where they learned the mythical and ritual codex of martial behaviour (Falk 1986). Indoctrination assigns rewards from the gods when warriors sought to take new territories. Inscribed in myths and rituals were Indo-European tales of warrior heroes (Miller 2000). The virility of the warrior hero became a universal language from burial rituals to rock art sceneries (Horn 2013). But these same warriors could become dangerous and dysfunctional after battle; their enhanced aggressive personalities would have been difficult to restrain. Not being able to adjust to normal social life, Bronze Age warriors may represent the first documentation of post-traumatic stress, encoded in the mythologies (Woodard 2013). As documented by Woodard, mythic stories of dysfunctional warriors were shared throughout the Indo-European world from India and Rome to Celtic Ireland, and so probably originated in a shared past, no later than the 2nd millennium BC.

We observe a homology between ideology and social organization, where kinship functioned as relations of production, legitimized by religion. What comes first? This is an old discussion where Godelier (1977) and Friedman (1975) proposed that, as part of modes of production in traditional, small-scale societies, religion organized relations of production and kinship. Rather than seeking arrows of causality,

they appear to merge in the formation of PMP. Modes entail all of these relations, including economic appropriation and distribution of surplus wealth and labour within a larger spatial framework where these mechanisms are unfolding until they reach their constraints. With the international metal economy also came 'modern' weapons, which lead to the formation of a new social institution—the warrior retinue (Kristiansen 2018). But it also became a prerequisite for securing protection to trade expeditions, as well as granting tribute from clients in some varieties of the TMP.

## *The Dialectic of Transformations and Traditions*

Our analysis has come to an end, and even if we can point to specific drivers and constraints in the formation and dissolution of Modes of Production, we note certain commonalities crosscutting such changes, most clearly rules of patrilineality and patrilocality, regionally generalized subsistence economies, and the importance of status in defining objects. These traditions seem to be core of the Indo-European speaking societies that expanded through migratory movements during the 3rd millennium BC, and consolidated and expanded their political economies and hierarchies through the metal trade during the 2nd millennium BC. We note that different MPs co-existed during both millennia, the CMP1 of Neolithic origin was gradually incorporated into a new dominant MP of steppe origin, only to reappear in the 2nd and then 1st millennia BC.

From this, we may deduce that cultural and ethnic/linguistic traditions were indeed strong, especially if linked to rules of ownership, as they usually would have been. Cultural and ethnic traditions, we propose, were carried by institutions that defined basic rules of ownership and political dominance. Every MP, therefore, not only had dominant relations of production characterizing a political economy, but also dominant ideological relations that defined rules of conduct instrumental in maintaining the MP, which also included blueprints for warfare and genocide. The different sources of power represented by economic relations, warrior might, and ideology were always part of a single whole that we can divide only for analytical purposes (Earle 1997).

Among the agents of change were technological innovations that changed both the means and the relations of production. Twice, they paved the way for the formation of new Modes and the subsequent downfall of previous Modes: firstly, with the introduction of the traction complex which led to the formation of the Pastoral Mode of Production around 3000 BC, and secondly, with the introduction of the war chariot around 2000 BC, in combination with effective, personal weapons as represented by the bronze sword and spear paving the way for the Tributary Mode of Production. In both cases, the complexity and materiality of the technologies created new relations of production, and institutions that allowed for the emergence of a warrior elite and their control in part by their aristocratic chiefs. New technologies can drive social transformations, if they are appropriated to form new relations of production, new supporting ideologies/institutions, and thus a new MP.

The forces of history discussed here are more dramatic and violent than scholars have been used to[13]; however, it brings prehistory more in line with recent ethnographic and historical evidence, such as the taking of captives and the killing of the defeated males (Cameron 2016). History happened, not always to ways of our liking. The expansive forces of the 3rd millennium BC established a new and more unified economy, and social formations of Modes of Production that facilitated the integration of western Eurasia into a larger globalized Bronze Age world during the 2nd millennium BC (Kristiansen and Larsson 2005; Vandkilde 2016, 2017), from which there was no way back.

**Acknowledgments** We wish to thank Matthew Spriggs, Johannes Müller, Johan Ling and Antonio Gilman for constructive comments to the manuscript before submission.

## References

Allentoft, M.E. et al. (2015), Population Genomics of Bronze Age Eurasia, *Nature*, 522: 167–172.

Andersen, S.T. (1993), History of Vegetation and Agriculture at Hassing Huse Mose, Thy, Northwest Denmark, Since the Ice Age, *Journal of Danish Archaeology*, 11: 57–79.

Anthony, D.W. (1990), Migration in Archaeology: The Baby and the Bathwater, *American Anthropologist* 92: 895–914.

Anthony, D. (2007), *The Horse, The Wheel and Language. How Bronze-Age Riders from the Eurasian Steppes Shaped the Modern World*, Princeton, Princeton University Press.

Anthony, D.W., and Brown, D. (2017), The Dogs of War: A Bronze Age Initiation Ritual in the Russian Steppes, *Journal of Anthropological Archaeology*, 48: 134–148.

Anthony, D.W., Brown, D.R., Khokhlov, A.A., Kuznetsov, P.F., and Mochalow, O.D. (ed.) (2016), *A Bronze Age Landscape in the Russian Steppes. The Samara Valley Project*, Los Angeles (CA), Cotsen Institute of Archaeology, 373–85.

Artursson, M. (2009), *Bebyggelse och samhällsstruktur. Södra och mellersta Skandinavien under senneolitikum och bronsa˚lder 2300-500 f. Kr.* Stockholm & Göteborg, Riksantikvarieämbetet

[13] In many respects our new models echo Maria Gimbutas dramatic scenario of the downfall of a Neolithic matrilineal Old Europe due to migrating warlike patrilineal Indo-Europen speaking societies (Gimbutas 1997a, b), even if she was wrong about the three successive waves as representing Indo-European speaking societies, starting in the 4th millennium BC. We now know that that main migrations took place during the 3rd millennium BC, and those that were eventually earlier, such as Globular Amphora, were Neolithic populations, and not Indo-European speaking. While Gimbutas had a vast archaeological knowledge that allowed her to present impressive, large scale archaeological narratives, she lacked a comparative theoretical and methodological framework to support her interpretations, which made them subject to critique (discussion in Anthony 1990; Kristiansen 1991). Thus, while her interpretations, like those of Gordon Childe and an earlier generation of archaeologists, have become verified, at least in part, it is only now that we are able to provide detailed evidence of the complex interplay of genetic, demographic, economic and social forces of change, including the kinship system, which holds a key to understand much of these dynamics. Thus, the outline of the Crow-Omaha kinship system and its application to the Germanic Mode of Production by Morgen and Engels (Engels 1972), and later to Bronze Age (Rowlands 1980), is still valid. However, we have some way to go before we fully understand Neolithic Modes of Production and their underlying kinship systems.

(Arkeologiska undersökningar. Skrifter No. 73) & Göteborg university, (GOTARC Serie B. Gothenburg Archaeological Thesis 52).
Barfield, T. (1993), *The Nomadic Alternative*, Englewood Cliffs, NJ, Pearson.
Bech, J.-H., Eriksen, B.V., and Kristiansen, K. (eds.) (2018), *Bronze Age Settlement and Land Use in Thy, Northwest Denmark.* Volume I–II, Højbjerg, Jutland Archaeological Society, Aarhus University Press.
Becker, C. (2008), Tierknochen aus der schnurkeramischen Siedlung Wattendorf-Motzenstein (Franken). Ein kritischer Blick auf Daten zu Ernährung und Wirtschaftsweise, in: Dörfler W. and Müller J. (eds.), *Umwelt - Wirtschaft - Siedlungen im dritten vorchristlichen Jahrtausend Mitteleuropas und Südskandinaviens*, Kiel, Wacholtz, 287–300.
Bergerbrant, S. (2019), Local or Traded. Wool Textiles in the Éarly Nordic Bronze Age, in: Bergerbrant S. and Sabatini S. (eds.), *The Textile Revolution in the Bronze Age*, Cambridge, Cambridge University Press.
Blanton, R., and Fargher, L. (2008), *Collective Action in the Formation of Pre-modern States*. New York, Springer.
Bourgeois, Q. (2013), *Monuments on the Horizon: The Formation of the Barrow Landscape Throughout the 3rd and the 2nd Millennium BC*. Leiden, Sidestone.
Bourgeois, Q., and Kroon, E. (2017), The Impact of Male Burials on the Construction of Corded Ware Identity: Reconstructing Networks of Information in the 3rd Millennium BC, *PLoS ONE*, 12(10): e0185971, https://doi.org/10.1371/journal.pone.0185971.
Brun, P. (1994), From Hallstatt to La Tene Period in the Perspective of the Mediterranean World Economy, in: Kristiansen K. and Jensen J. (eds.), *Europe in the First Millennium* B.C., Sheffield, Collis Publications, 57–65.
Cameron, C. (2016), *Captives: How Stolen People Changed the World*, Lincoln, University of Nebraska Press.
Cardarelli, A. (2015), Different Forms of Social Inequality in Bronze Age Italy, *Origini*, XXXVIII: 151–200.
Chechushkov, I.V., and Epimakhov, A. (2018), Eurasian Steppe Chariots and Social Complexity During the Bronze Age, *Journal of World Prehistory*, https://doi.org/10.1007/s10963-018-9124-0.
Coole, D.H., and Frost, S. (2010), *New Materialisms: Ontology, Agency, and Politics*, Durham, NC, Duke University Press, http://dx.doi. org/https://doi.org/10.1215/9780822392996.
Czebreszuk, J., Müller, J., Jaeger, M., and Kneisel, J. (eds.) (2015), *Brusczewo IV. Natural Resources and Economic Activities of the Bronze Age people*, Habelt, Bonn.
D'Altroy, T., and Earle, T. (1985), Staple Finance, Wealth Finance, and Storage in the Inka Political Economy, *Current Anthropology*, 26: 187–206.
Damgård et al. (2018), The First Horse Herders and the Impact of Early Bronze Age Steppe Expansions into Asia, *Science*, 360 :6396.
DeMarrais, E., and Earle, T. (2017), Collective Action Theory and the Dynamics of Complex Societies, *Annual Review of Anthropology,* 46 (1): 183–201.
Earle, T. (1997), *How Chiefs Come to Power: The Political Economy in Prehistory*. Stanford, CA, Stanford University Press.
Earle, T. (2002). *Bronze Age Economics*. Boulder, Westview.
Earle, T. (2017), *An Essay on Political Economies in Prehistory*, Bonn, Habelt.
Earle, T. (2018). Amber Finds From the Bronze Age of Thy. In: Bech, J.-H., Eriksen, B.V. and Kristiansen, K. (eds.), *Bronze Age Settlement and Land-Use in Thy, Northwest Denmark*: chapter 24, Højbjerg: Jutland Archaeological Society, Aarhus University Press.
Earle, T., and Kolb, M. (2010), Regional Settlement Patterns, in: Earle T. and Kristiansen K., *Organizing Bronze Age Societies*, Cambridge, Cambridge University Press, 57–86.
Earle, T., and Kristiansen, K. (2010), *Organizing Bronze Age Societies*, Cambridge, Cambridge University Press.
Earle, T., and Spriggs, M. (2015), Political Economy in Prehistory: A Marxist Approach to Pacific Sequences, *Current Anthropology*, 56 (4): 515–544.

Earle, T. et al. (2015), The Political Economy and Metal Trade in Bronze Age Europe, *European Journal of Archaeology*, 18: 633–657.
Endrődi, A., and Reményi, L. (2016), *A Bell Beaker Settlement in Albertfalva, Hungary (2470–1950 BC)*, Budapest, Budapest History Museum.
Engels, F. (1972), *The Origin of the Family, Private Property, and the State: In the Light of Lewis H. Morgan*, New York, International Publishers.
Evans-Pritchard, E.E. (1940), *The Nuer: A Description of the Modes of Livelihood and Political Institutions of a Nilotic People*, Oxford, Clarendon Press.
Falk, H. (1986), *Bruderschaft und Würfelspiel*, Freiburg, Hedwig Falk.
Feeser, I., Dörfler, W., Averdieck, F.-R., and Wiethold, J., (2012), New Insight into Regional and Local Land-Use and Vegetation Patterns in Eastern Schleswig-Holstein During the Neolithic, in: Hinz M. and Müller J. (eds.), *Siedlung, Grabenwerk, Grosssteingrab*, Habelt, Bonn, 159–191.
Feeser, I., and Furholt, M., (2014), Ritual and Economic Activity During the Neolithic in Schleswig-Holstein, Northern Germany: An Approach to Combine Archaeological and Palynological Evidence, *Journal of Archaeological Science*, 51: 126–134.
Fernandez-Götz, M. (2014), *Identity and Power: The Transformation of Iron Age Societies in Northeast Gaul*, Amsterdam, Amsterdam University Press.
Fischer, P.M., and Bürge, T. (eds.) (2017), *"Sea Peoples" Up-to-date*, Vienna, Verlag der Österreichischen Akademie der Wissenschaften.
Frei, K.M., Mannering, U., Kristiansen, K., Allentoft, M.E., Wilson, A.S., Skals, I., Tridico, S., Nosch, M.L, Willerslev, E., Clarke, L., and Frei, R. (2015), Tracing the Dynamic Life Story of a Bronze Age Female, *Scientific Reports*, 5, 10431.
Frei, K.M., Mannering, U., Vanden Berghe, I., and Kristiansen, K. (2017a), Bronze Age Wool: Provenance and Dye Investigations of Danish Textiles, *Antiquity,* 91: 640–654.
Frei, K.M., Villa, C., Jørkov, M.-L., Allentoft, M.E., Kaul, F., Ethelberg, P, Reiter, S.S., Wilson, A.S., Taube, M., Olsen, J., Lynnerup, N., Willerslev, E., Kristiansen, K., and Frei, R. (2017b), A Matter of Months: High Precision Migration Chronology of a Bronze Age Female, *PLoS One*, 12, 6, e0178834.
Friedman, J. (1975), Religion as Economy and Economy as Religion, *Ethnos*, 40: 46–63.
Friedman, J., and Rowlands, M.J. (1977), Notes Towards an Epigenetic Model of the Evolution of "Civilisation", in: Friedman J. and Rowlands M.J. (eds.), *The Evolution of Social Systems*, London, Duckworth, 201–276.
Frînculeasa, A., Preda, B., and Heyd, V. (2015), Pit-graves, Yamnaya and Kurgans Along the Lower Danube, *Praehistorische Zeitschrift*, 90: 45–113. https://doi.org/10.1515/pz-2015-0002.
Furholt, M. (2017), Translocal Communities—Exploring Mobility and Migration in Sedentary Societies of the European Neolithic and Early Bronze Age, *Praehistorische Zeitschrift*, 92, 2: 304–321.
Fuhrholt, M. (2018), Massive Migrations? The Impact of Recent aDNA Studies on our View of Third Millennium Europe, *European Journal of Archaeology*, 21: 1–33.
Gilman, A. (1995), Prehistoric European Chiefdoms: Rethinking "Germanic" Societies, in: Price T.D. and Feinman G. (eds.), *Foundations of Social Inequality*, New York, Plenum, 235–251.
Gilman, A. (2013), Where There States During the Later Prehistory of Southern Iberia?, in: Cruz M., García L., Gilman A., *The Prehistory of Iberia: Debating Early Social Stratification and the State*, New York, Routledge, 10–28.
Gimbutas, M. (1997a), The Fall and Transformation of Old Europe, in: Dexter M. and Bley K. (eds.), *The Kurgan Culture and the Indo-Europeanization of Europe*, Washington, DC, Institute for the Study of Man, 351–372.
Gimbutas, M. (1997b), The Three Waves of the Kurgan People into Old Europe, 4500–2500 B.C., in: Dexter M. and Bley K. (eds.), *The Kurgan Culture and the Indo-Europeanization of Europe*, Washington, DC, Institute for the Study of Man, 240–265.
Godelier, M. (1977), *Perspectives in Marxist Anthropology*, New York, Cambridge.

Goldberg, A., Günther, T., Rosenberg, N.A., and Jacobsson, M. (2017), Ancient X-Chromosomes Reveal Contrasting Sex Bias in Neolithic and Bronze Age Eurasian Migrations, *PNAS*, 114 (10): 2657–2662, https://doi.org/10.1073/pnas.1616392114/-/DCSupplemental

Grossmann, R. (2015), *Das dialektische Verhältnis von Schnurkeramik und Glockenbecher zwischen Rhein und Saale*, Habelt, Bonn.

Haak, W. et al. (2015), Massive Migration from the Steppe Was a Source for Indo-European Languages in Europe, *Nature*, 522: 207–211.

Häkannson, T., and Widgren, M. (2016), *Landesque Capital: The Historical Ecology of Enduring Landscape Modifications*, Walnut Creek CA, Left Coast Press.

Hansen, S. (2014), The 4th Millennium: A Watershed in European Prehistory, in: Horejs B. and Mehofer M. (eds.), *Western Anatolia Before Troy. Proto-urbanisation in the 4th Millennium BC?*, Vienna, Austrian Academy of Sciences, 243–260.

Hansen, S., and Müller, J., (2011), Sozialarchäologische Perspektiven prähistorischer Gesellschaften: die Entstehung von sozialer Ungleichheit. Einführung in die Thematik der Tagung, in: Hansen S. and Müller J. (eds.), *Sozialarchäologische Perspektiven: Gesellschaftlicher Wandel 5000–1500 v. Chr. zwischen Atlantik und Kaukasus,* Mainz, Zabern, 3–12.

Harding, A. (2000), *European Societies in the Bronze Age*, Cambridge, Cambridge University Press.

Harding, A. (2013), *Salt in Prehistoric Europe*, Leiden, Sidetone Press.

Hayden, B., and Cannon, A. (1982), The Corporate Group as an Archaeological Unit, *Journal of Anthropological Archaeology*, 1: 132–158.

Hedeager, L. (2010), *Iron Age Myth and Materiality*, London, Routledge.

Heyd, V. (2016), Das Zeitalter der Ideologien: Migration, Interaktion und Expansion im prähistorischen Europa des 4.und 3.Jahrtausends v.Chr., in: Furholt M., Großmann R. and Szmyt M. (eds.), *Transitional Landscapes? The 3rd Millennium BC in Europe*, Bonn, Habelt, 53–84.

Heyd, V. (2017), Kossina's Smile, *Antiquity*, 91, 356: 348–359.

Heyd, V., Fokkens, H., Sjögren, K.-G., and Kristiansen, K. (2018), Archaeological Supplementary to Olalde et al., The Beaker Phenomenon and the Genomic Transformation of Northwest Europe, *Nature*, 555, 7695: 190–196, doi:https://doi.org/10.1038/nature25738

Hinz, M., Feeser, I. Sjögren, K.-G. and Müller, J. (2012), Demography and the Intensity of Cultural Activities: An Evaluation of Funnel Beaker Societies (4200–2800 cal BC), *Journal of Archaeological Science*, 39: 3331–340. https://doi.org/10.1016/j.jas.2012.05.028

Holst, M.K., Rasmussen, M., Bech, J.-H. and Kristiansen, K. (2013), Bronze Age 'Herostrats': Ritual, Political, and Domestic Economies in Early Bronze Age Denmark, *Proceedings of the Prehistoric Society*, 79: 1–32.

Horn, C. (2013), Violence and Virility, in: Bergerbrant S. and Sabatini S. (eds.), *Counterpoint: Eassys in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*, Oxford, Archaeopress, 235–241.

Horn, C. (2016), Nothing to Lose: Waterborne Raiding in Southern Scandinavia, in: Glørstad H., Tsigaridas Glørstad A.Z. and Melheim L. (eds.), *Interdisciplinary Perspectives on Past Colonisation, Maritime Interaction and Cultural Integration*, Sheffield, Equinox, 109–127.

Hornborg, A. (2014), Political Economy, Ethnogenesis, and Language Dispersals in the Prehispanic Andes: A World-System Perspective, *American Anthropologist*, 116, 4: 810–823.

Hornborg, A. (2017), *Global Magic. Technologies of Appropriation from Ancient Rome to Wall Street*, New York, Palgrave Macmillan.

Hübner, E. (2005), *Jungneolithische Gräber auf der Jütischen Halbinsel*, København, Det Kgl. Nordiske Oldskriftselskab.

Iron, W. (1979), Political Stratification Among Pastoral Nomads, in: Equipe Ecologie et Anthropologie des Sociétés Pastorales (ed.), *Pastoral Production and Society*, Cambridge, Cambridge University Press, 361–374.

Iversen, R. and Kroonen, G. (2017), Talking Neolithic. Linguistic and Archaeological Perspectives on How Indo-European Was Implemented in Southern Scandinavia, *American Journal of Archaeology*, 121, 4: 511-525.

Jaeger, M. (2017), Bronze Age Defensive Settlement in the Context of Long-Range Relationships: How Far Is It from Fortified Villages to Citadels?, in: Hansen S. and Müller J. (eds.), *Rebellion and Inequality in Archaeology*, Bonn, Habelt, 186–205.

Jaeger, M., Kulcsár, G., Taylor, N., and Staniuk, R. (eds.) (2018a), *Kakucs-Turján—A Middle Bronze Age Multi-Layered Fortifed Settlement in Central Hungary*, Habelt, Bonn.

Jaeger, M., Kirleis, W., Kiss, V., Kulcsár, G., Müller, J., Staniuk, R., and Taylor, N. (2018b), Kakucs Archaeological Expedition, in: Jaeger M., Kulcsár G., Taylor N. and Staniuk, R. (eds.), *Kakucs-Turján—A Middle Bronze Age Multi-Layered Fortifed Settlement in Central Hungary*, Habelt, Bonn, 13–25.

Johannsen, N., and Laursen, S. (2010), Routes and Wheeled Transport in late 4th- to Early 3rd-Millennium Funerary Customs of the Jutland Peninsula: Regional Evidence and European context, *Praehistorische Zeitschrift*, 88: 15–58.

Johnson, A., and Earle, T. (2000), *The Evolution of Human Societies* (2nd Edition), Stanford, CA, Stanford University Press.

Kaiser, E. (2011), Der Übergang zur Rinderzucht im nördlichen Schwarzmeerraum, *Godisnjak*, 39: 23–34.

Kaiser, E., and Winger, K. (2015), Pit graves in Bulgaria and the Yamnaya Culture, *Praehistorische Zeitschrift*, 90: 114–40.https://doi.org/10.1515/pz-2015-0001.

Karatani, K. (2014), *The Structure of World History. From Modes of Production to Modes of Exchange*, Durham and London, Duke University Press.

Karmin, M. et al. (2015), A Recent Bottleneck of Y Chromosome Diversity Coincides with a Global Change in Culture, *Genome Research*, 1: 1–8.

Kaul, F. (2003), The Hjortspring Boat and Ship Iconography of the Bronze Age and Early Pre-Roman Iron Age, in: Crumlin-Petersen O. and Trakadas A. (eds.), *Hjortspring. A Pre-Roman Warship in Context*, Roskilde, Vikingeskibshallen, 187–208.

Kern, A., Kowarik, K., Rausch, A.W., and Reschreiter, H. (eds.) (2009), *Kingdom of Salt. 7000 Years of Hallstatt*, Vienna, Natural History Museum.

Kienlin, T. (2015), *Bronze Age Tell Communities in Context*, Oxford, Archaeopress.

Kienlin, T.L. (2017), World Systems and the Structuring Potential of Foreign-Derived (Prestige) Goods. On Modelling Bronze Age Economy and Society. in: Scholz, A.K., Bartelheim, M., Hardenberg, R. and Staecker J. (eds.), *ResourceCultures: Sociocultural Dynamics and the Use of Resources—Theories, Methods, Perspectives*, Tübingen, University of Tübingen Press,143–158.

Korenevskiy, S.N. (2017), The Emergence of the Burial Mound Ritual in the Caucasus, 5th-4th Millennium BC (Common Aspects of the Problem), in: Avetisyan P.V. and Grekyan Y.H. (eds.), *Bridging Times and Spaces*, Oxford, Archeopress, 231–247.

Knipper, C., Mittnik, A., Massy, K., Kociumaka, C., Kucukkalipci, I., Maus, M., Wittenborn, F., Metz, S.E., Staskiewicz, A., Krause, J., and Stockhammer, P.W. (2017), Female Exogamy and Gene Pool Diversification at the Transition from the Final Neolithic to the Early Bronze Age in central Europe, *PNAS*, 114, 38: 10083–10088.

Kradin, Nikolay N., Bondarenko, D., and Barfield, T., (eds.) (2003), *Nomadic Pathways in Social Evolution*, Moscow, Center for Civilizational and Regional Studies of the Russian Academy of Sciences.

Krause, R., and Koryakova, L.N. (eds.) (2013), *Multidisciplinary Investigations of the Bronze Age Settlements in Southern Trans-Urals*, Bonn, Habelt.

Krause, R., and Koryakova, L.N. (eds.) (2014), *Zwischen Tradition und Innovation*, Bonn, Habelt.

Kristiansen, K. (1991), Prehistoric Migrations-the Case of the Single Grave and Corded Ware Cultures, *Journal of Danish Archaeology*, 8: 211–226.

Kristiansen, K. (1998), *Europé Before History*, Cambridge, Cambridge University Press.

Kristiansen, K. (2014), Towards a New Paradigm? The Third Science Revolution and Its Possible Consequences in Archaeology, *Current Swedish Archaeology*, 22: 11–34.

Kristiansen, K. (2015), The Decline of the Neolithic and the Rise of Bronze Age Society, in: Fowler C., Harding J. and Hofmann D., (eds.), *The Oxford Handbook of Neolithic Europe*, Oxford, Oxford University Press, 1093–1117.

Kristiansen, K. (2016), Interpreting Bronze Age Trade and Migration, in: Kariatzi E. and Knappett C. (eds.), *Human Mobility and Technological Transfer in the Prehistoric Meditearranean*, Cambridge, British School at Athens and Cambridge University Press, 154–180.

Kristiansen, K. (2018), Warfare and the Political Economy: Bronze Age Europe1500−1100 BC, in: Horn C. and Kristiansen K. (eds.), *Warfare in Bronze Age Society*, Cambridge, Cambridge University Press, 23–46.

Kristiansen, K., and Larsson, T.B. (2005), *The Rise of Bronze Age society. Travels, Transmissions and Transformations*, Cambridge, Cambridge University Press.

Kristiansen, K., and Suchowska-Ducke, P. (2015), Connected Histories: The Dynamics of Bronze Age Interaction and Trade 1500–1100 BC, *Proceedings of the Prehistoric Society,* 81: 361–392.

Kristiansen, K., and Sørensen, M.-L.S. (2019), Wool in the Bronze Age. Concluding reflections, in: Sabatini S. and Bergerbrant S. (eds.), *The Textile Revolution in The Bronze Age*, Cambridge: Cambridge University Press, 317–332.

Kristiansen, K., Allentoft, M.E., Frei, K.M., Iversen, R., Johannsen, N., Kroonen, G., Pospieszny, Ł., Price, T.D., Rasmussen, S., Sjögren, K.-G., Sikora, M., and Willerslev, E. (2017), Re-theorising Mobility and the Formation of Culture and Language Among the Corded Ware Culture in Europe, *Antiquity*, 91, 356: 334–347.

Kristinsson, A. (2010), *Expansions: Competition and Conquest in Europe Since the Bronze Age*, Reykjavík, Reykjavíkurakademían.

Lansing, J.S. et al. (2017), Kinship Structures Create Persistent Channels for Language Transmission, *PNAS,* 114, 49:12910–12915. https://doi.org/10.1073/pnas.1706416114

Leppek, M. (2017), Innovation, Interaction and Society in Europe in the 4th Millennium BCE: The 'Traction Complex' as Innovation and 'Technology Cluster', in: Stockhammer P. and Maran J. (eds.), *Appropriating Innovations. Entangled Knowledge in Eurasia, 5000–1500 BCE*, Oxford, Oxbow Books, 98–108.

Lincoln, B. (1981), *Priests, Warriors and Cattle, A Study in the Ecology of Religion*, Los Angeles and London, Berkeley.

Ling, J., Cornell, P., and Kristiansen, K. (2017), Bronze Economy and Mode of Production. The Role of Comparative Advantages in Temperate Europe during the Bronze Age, in: Rosenswig R., Cunningham J. (eds.), *Modes of Production and Archaeology*, Gainesville, FL, University Press of Florida, 207–233.

Ling, J., Earle, T., and Kristiansen, K. (2018), Maritime Mode of Production: Raiding and Trading in Seafaring Chiefdoms, *Current Anthropology*, 59: 488–524.

Maran, J. (2004), Kulturkontakte und Wege der Ausbreitung der Wagentechnologie im 4. Jahrtausend v. Chr., in: Fansa M. and Burmeister, S. (eds.), *Rad und Wagen. Der Ursprung einer Innovation. Wagen im Vorderen Orient und Europa*, Mainz, Zabern, 429–442.

Marciniak, A., and Greenfield, H.J. (2013), A Zooarchaeological Persepctive on the Origins of Metallurgy in the North European Plain: Butchering Marks on Bones from Central Poland, in: Bergerbrant S. and Sabatini S. (eds.), *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*, Oxford, British Archaeological Reports, 457–468.

Marx, K. (1974), *Grundrisse. Foundations of the Critique of Political Economy (Rough Draft)*, London, Penguin Books.

Mathieson, I. et al. (2015), Genome-Wide Patterns of Selection in 230 Ancient Eurasians, *Nature*, 528: 499–503.

Melheim, L., Gradin, L., Persson, P.-O., Billström, K., Stos-Gale, Z., Ling, J., Williams, A., Angelini, I., Canovaro, C., Hjärthner-Holdar, E., and Kristiansen, K. (2018), Moving Metals III. Possible Origins for Copper in Bronze Age Denmark Based on Lead Isotopes and Geochemistry, *Journal of Archaeological Science*, 96: 86–105.

Meller, H., and Risch, R. (2015), Change and Continuity in Europe and the Mediterranean around 1600 BC. *Proceedings of the Prehistoric Society*, 81: 239–264, © The Prehistoric Society https://doi.org/10.1017/ppr.2015.10.

Miller, D.A. (2000), *The Epic Hero*, Baltimore and London, The John Hopkins University Press.

Mittnik, A., Wang, C.-C., Pfrengle, S., Daubaras, M., Zarina, G., Hallgren, F., Allmäe, R., Khartanovich, V., Moiseyev, V., Furtwängler, A., Valtueña, A.A., Feldman, M., Economou, C., Oinonen, M., Vasks, A., Tõrv, M., Balanovsky, O., Reich, D., Jankauskas, R., Haak, W., Schiffels, S., Krause, J. (2018), The Genetic Prehistory of the Baltic Sea Region, *Nature Communications*, 9, 442, https://doi.org/10.1038/s41467-018-02825-9.

Monroe, C.M. (2018), Marginalizing Civilization: The Phoenician Redefinition of Power ca. 1300-800 BC., in: Kristiansen K., Lindkvist T. and Myrdal J. (eds.), *Trade and Civilisation. Economic Networks and Cultural Ties from Prehistory to the Early Modern Period*, Cambridge, Cambridge University Press, 195–241.

Muhl, A., Meller, H., and Heckenhahn, K. (2010), *Tatort Eulau. Ein 4500 Jahre altes Verbrechen wird Aufgeklärt*, Stuttgart, Theiss.

Müller, J. (2009), A Revision of Corded Ware Settlement Pattern—New Results from the Central European Low Mountain Range, *Proceedings of the Prehistoric Society,* 75: 125–142.

Müller, J. (2015a), Eight Million Neolithic Europeans: Social Demography and Social Archaeology on the Scope of Change—From the Near East to Scandinavia, in: Kristiansen K., Smedja L. and Turek J. (eds.), *Paradigm Found, Archaeological Theory Present, Past and Future: Essays in Honour of Evzen Neustupny*, Oxford, Oxbow Books, 200–215.

Müller, J. (2015b), Bronze Age Social Practices: Demography and Economy Forging Long-Distance Exchange, in: Suchowska-Ducke P., Reiter S.S. and Vandkilde H. (eds.), *Mobility of Culture in Bronze Age Europe*, Oxford, Oxbow, 225–230.

Müller, J. (2017), Rebellion and Inequality: Hierarchy and Balance, in: Hansen, S. and Müller, J. (eds.), *Rebellion and Inequality in Archaeology*, Bonn, Habelt, 23–32.

Müller, J., and Kneisel, J. (2010), Bruszczewo 5: Production, Distribution, Consumption, and the Formation of Social Differences, in: Müller J., Czebreszcuk J. and Kneisel J. (eds.), *Bruszczewo II. Ausgrabungen und Forschungen in einer prähistorischen Siedlungskammer Großpolens*, Bonn, Habelt, 756–783.

O'Brien, W. (2015), *Prehistoric Copper Mining in Europe, 5500–500 BC*, Oxford, Oxford University Press.

Olalde et al., (2018), The Beaker Phenomenon and the Genomic Transformation of Northwest Europe, *Nature*, 555, 7695: 190–196, https://doi.org/10.1038/nature25738.

Ott, K. (2017), Philosophical Problems of How to Think Revolutions, in: Hansen S. and Müller J. (eds.), *Rebellion and Inequality in Archaeology*, Bonn, Habelt, 59–78.

Pashkevych, G. (2012), Environment and Economic Activities of Neolithic and Bronze Age Populations of the Northern Pontic Area, *Quaternary International*, 261: 176–82. https://doi.org/10.1016/j.quaint.2011.01.024.

Patterson, T.C. (2003), *Marx's Ghost*. *Conversations with Archaeologists*, Berg, Oxford and New York.

Patterson, T.C. (2014), *From Acorns to Warehouses: Historical Political Economy of Southern California's Inland Empire*, Walnut Creek, CA, Left Coast.

Price, T.D. et al. (2011), Who Was in Harold Bluetooth's Army? Strontium Isotope Investigation of the Cemetery at the Viking Age Fortress at Trelleborg, Denmark, *Antiquity,* 85: 476–489.

Price, T.D. et al. (2017), Multi-Isotope Proveniencing of Human Remains from a Bronze Age Battlefield in the Tollense Valley in Northeast Germany, *Archaeological and Anthropological Sciences*, 11: 33–49, https://doi.org/10.1007/s12520-017-0529-y.

Radivojevic, M., Roberts, B.J., Pernicka, E., Stos-Gale, Z., Martinon-Torres, M., Rehren, T., Bray, P., Brandherm, D., Ling, J., Mai, J., Vandkilde, H., Kristiansen, K., Shennan, S.J., and Broodbank, C. (2018), The Provenance, Use and Circulation of Metals in the European Bronze Age: The State of the Debate, *Journal of Archaeological Research,* 27, 2: 1–55, https://doi.org/10.1007/s10814-018-9123-9.

Rascovan, N., Sjögren, K.-G., Kristiansen, K., Nielsen, R., Willerslev, E., Desnues, C., and Rasmussen, S. (2019), Emergence and Spread of Basal Lineages of Y. Pestis During the Neolithic Decline. *Cell,* 176, 1–2: 295–305.

Rasmussen, S. et al. (2015), Early Divergent Strains of Yersinia pestis in Eurasia 5,000 Years Ago. *Cell*, 163, 3: 571–582.

Rosenswig, R.M., and Cunningham, J.J. (2017a), Introducing Modes of Production in Archaeology, in: Rosenswig R.M. and Cunningham J.J. (eds.), *Modes of Production and Archaeology*, Gainesville, University Press of Florida, 1–28.

Rosenswig, R.M., and Cunningham, J.J. (eds.) (2017b), *Modes of Production and Archaeology*, Gainesville, University Press of Florida.

Rowlands, M. (1980), Kinship, Alliance and Exchange in the European Bronze Age, in: Barrett J. and Bradley R. (eds.), *Settlement and Society in the British Later Bronze Age*, Oxford, British Archaeological Reports, 15–55.

Rowlands, M. (2019), Unequal Exchange and the Articulation of Modes of Re-Production, in: Armada, X.-L., Murillo-Barosso, M. and Charlton, M. (eds.), *Metals, Minds and Mobility. Integrating Scientific Data with Archaeological Theory*, Oxford, Oxbow Books,.

Rowlands, M., and Ling, J. (2013), Boundaries, Flows and Connectivities: Mobility and Stasis in the Bronze Age, in: Bergerbrant S. and Sabatini S. (eds.), *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*, Oxford, Archaeopress, 517–529.

Roymans, N. (1999), Man, Cattle and the Supernatural in the Northwest European Plain, in: Fabech C. and Ringtved J. (eds.), *Settlement and Landscape*, Aarhus, Jutland Archaeological Society and Aarhus University Press, 291–300.

Sabatini, S., and Bergerbrant, S. (eds.) (2019), *The Textile Revolution in the Bronze Age*, Cambridge, Cambridge University Press.

Sabatini, S., Earle, T., and Cardarelli, A. (2018), Bronze Age Textile and Wool Economy: The Case of the Terramare Site of Montale, Italy, *Proceeding of the Prehistoric Society*, 84: 1–27, https://doi.org/10.1017/ppr.2018.11

Sahlins, M.D. (1961), The Segmentary Lineage: An Organisation of Predator Expansion, *American Anthropologist*, 63, 2: 332–345.

Schroeder, H., Margaryan, A., Szmyt, M., Theulot, B., Włodarczak, P., Rasmussen, S., Gopalakrishnan, S., Szczepanek, A., Konopka, T., Jensen, T.Z., Witkowska, B., Wilk, S., Przybyła, M.M., Pospieszny, Ł., Sjögren, K.-G., Belka, Z., Olsen, J., Kristiansen, K., Willerslev, E., Frei, K.M., Sikora, M., Johannsen, N.N., and Allentoft, M. E. (2019), Blood Ties: Unravelling Ancestry and Kinship in a Late Neolithic Mass Grave, *PNAS*, 116, 22: 10705–10710, https://doi.org/10.1073/pnas.1820210116.

Schulting, R.J., and Richards, M.P. (2016), Stable Isotope Analysis of Neolithic to Late Bronze Age Populations in the Samara Valley, in: Anthony D.W., Brown D.R., Khokhlov A.A., Kuznetsov P.F. and Mochalov O.D. (eds.), *A Bronze Age Landscape in the Russian Steppes. The Samara Valley Project*, Los Angeles CA, Cotsen Institute of Archaeology, 127–149.

Sergent, B. (2003), Les troupes de jeunes homes et l'expansion indo-europenne, *Dialogues d'histoire ancienne*, 29: 9–27.

Shennan, S. (1982), Exchange and Ranking: The Role of Amber in the Earlier Bronze Age of Europe. In: Renfrew C. and Shennan S. (eds.), *Ranking, Ressource and Exchange*, Cambridge, Cambridge University Press, 33–45.

Shishlina, N. (2008), *Reconstruction of the Bronze Age of the Caspian Steppes. Life Styles and Lifeways of Pastoral Nomads*, Oxford, Archaeopress.

Sjögren, K.-G., Price, T.D., and Kristiansen, K. (2016), Diet and Mobility in the Corded Ware of Central Europe, *PLoS One*, 11, 5, e0155083.

Smith, A. (2015), *The Political Machine. Assembling Sovereignity in the Bronze Age Caucasus*, Princeton and Oxford, Princeton University Press.

Sørensen, M.L.S. (2010), Households, in: Earle T. and Kristiansen K. (eds.), *Organizing Bronze Age Societies. The Mediterranean, Central Europe & Scandinavia Compared*, Cambridge, Cambridge University Press, 122–154.

Sørensen, T.F. (2017), The Two Cultures and a World Apart: Archaeology and Science at a New Crossroads, *Norwegian Archaeological Review*, 50, 2: 101–115, https://doi.org/10.1080/00293652.2017.1367031.

Spatzier, A. (2017), The Honoured and the Sacrificed? Gender and Violence at a Sanctuary of the Late 3rd Millennium BC in Central Germany, in: Mattic U. and Jensen B. (eds.), *Archaeologies of Gender Violence*, Oxford, Oxbow, 45–76.

Spriggs, M. (1984), Another Way of Telling: Marxist Perspectives in Archaeology, in: Spriggs M. (ed.), *Marxist Perspectives in Archaeology*, Cambridge, Cambridge University Press, 1–9.

Van deNoort, R. (2011), *North Sea Archaeologies: A Maritime Biography, 10,000 BC–AD 1500*. Oxford, Oxford University Press.

Vandkilde, H. (2014), Breakthrough of the Nordic Bronze Age: Transcultural Warriorhood and a Carpathian Crossroad in the Sixteenth Century BC, *European Journal of Archaeology*, 17, 4: 602–633.

Vandkilde, H. (2016), Bronzization: The Bronze Age as Pre-modern Globalization, *Praehistorische Zeitschrift*, 91: 103–223.

Vandkilde, H. (2017), *The Metal Hoard from Pile in Scania, Sweden: Place, Things, Time, Metals, and Worlds Around 2000 BCE*, Aarhus: Aarhus University Press.

Vandkilde, H., Hansen, S., Kotsakis, K., Kristiansen, K., Müller, J., Sofaer, J., and Sørensen, M.L.S. (2015), Cultural Mobility in Bronze Age Europe, in: Suchowska-Ducke P., Reiter S.S. and Vandkilde H. (eds.), *Forging Identities. The Mobility of Culture in Bronze Age Europe*, Oxford, Archaeopress, 5–37.

Vinner, M. (2003), Sea Trials, in: Crumlin-Petersen O. and Trakadas A. (eds.), *Hjortpring. A Pre-Roman Warship in Context*, Roskilde, Vikingeskibshallen, 103–118.

Vretemark, M. (2010), Subsistence Strategies, in: Earle T. and Kristiansen K. (eds.), *Organizing Bronze Age Societies. The Mediterranean, Central Europe & Scandinavia Compared*, Cambridge, Cambridge University Press, 155–184.

Wahl, J., and Price, T.D. (2013), Local and Foreign Males in a late Bronze Age Cemetery at Neckarsulm, South-Western Germany: Strontium Isotope Investigations, *Anthrop. Anz.*, 70, 3: 289–307.

Witmore, T. (2014), Archaeology and the New Materialisms, *Journal of Contemporary Archaeology*, 1, 2: 203–246.

Wlodarczak, P. (2017), Battle Axes and Beakers. The Final Eneolithic Societies, in: Urbanczyk, P. (ed.), *The Past Societies. Polish Lands from the First Evidence of Human Presence to the Early Middle Ages.* 5500–2000 BC, Warszawa: Institute of Archaeology and Ethnology, Polish Academy of Sciences, 275–336.

Wolf, E. (1982), *Europe and the People Without History*, Berkeley, CA, University of California Press.

Woodard, R.D. (2013), *Myth, Ritual, and the Warrior in Roman and Indo-European Antiquity*, Cambridge, Cambridge University Press.

Yates, D.T. (2007), *Land, Power and Prestige. Bronze Age Field Systems in Southern England*, Oxford, Oxbow Books.

Zeng, T.C. Aw, A.J., and Feldman, M.W. (2018), Cultural Hitchhiking and Competition Between Patrilineal Kin Groups Explain the Post-Neolithic y-Chromosome Bottleneck, *Nature Communications*, 9: 2077, https://doi.org/10.1038/s41467-018-04375-6