The Horse, the Wheel, and Language

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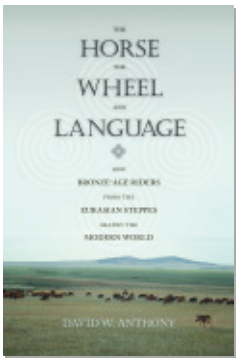

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NOTES

Chapter 1. The Promise and Politics of the Mother Tongue

1. Bloch 1998:109.
2. See Sapir 1912:228.
3. Cannon 1995:28–29.
4. Poliakov 1974:188–214.
5. Veit 1989:38.
6. Grant 1916.
7. For "external origin" passages in the *Rig Veda*, see Witzel 1995. For "indigenous origin" arguments, see N. Kazanas's discussions in the *Journal of Indo-European Studies* 30, nos. 3–4 (2002); and 31, nos. 1–2 (2003).
8. For the Nazi pursuit of Aryan archaeology, see Arnold 1990.
9. For goddesses and Indo-Europeans, see Anthony 1995b; Eisler 1987, 1990; and Gimbutas 1989, 1991. For Aryan-identity politics in Russia, see Shnirelman 1998, 1999.
10. Heidegger 1959:37–51, contrasted to Boaz 1911. For the non-Aryan element in the *Rig Veda*, see Kuiper 1948, 1991.
11. Harding and Sokal 1988.
12. The *American Heritage Dictionary* has thirteen hundred unique Proto-Indo-European roots listed in its appendix. But multiple reconstructed words are derived from the same root morphemes. The number of reconstructed words with distinct meanings is much greater than the number of unique roots.
13. For doubts about proto-languages and tree diagrams, see Lincoln 1991; and Hall 1997. For a more nuanced view of tree diagrams, see Stewart 1976. For "creolization" and convergence creating Proto–Indo–European, see Renfrew 1987:78–86; Robb 1991; and Sherratt and Sherratt 1988.
14. For framing, see Lakoff 1987:328–37.

Chapter 2. How to Reconstruct a Dead Language

1. Here is the text of the tale:

A sheep, shorn of its wool, saw some horses, one moving a heavy cart, another carrying a big load, a third carrying a human speedily. The sheep said to the horses: "It pains me [literally, "the heart narrows itself for me"] to see human driving horses." The horses said: "Listen sheep, it pains us to see that human, the master, makes the wool of the sheep into a warm garment for himself and the sheep no longer has any wool!" On hearing that the sheep ran off into the fields.

It is impossible to construct whole sentences like this with confidence in a language known only in fragments. Proto-Indo-European tense markers in the verbs are debated, the form of the relative pronoun is uncertain, and the exact construction of a Proto-Indo-European complement (sheep saw horse carrying load) is unknown. Linguists still see it as a classic challenge. See Bynon 1977:73–74; and Mallory 1989:16–17.

2. This chapter is generally based on four basic textbooks (Bynon 1977; Beekes 1995; Hock and Joseph 1996; and Fortson 2004), and on various encyclopedia entries in Mallory and Adams 1997.

3. Embleton 1991.

4. Pinker 1994.

5. An example of a change in phonology, or pronunciation, that caused shifts in morphology, or grammar, can be seen in English. German has a complex system of noun and pronoun case endings to identify subjects, objects, and other agents, and verb endings that English lacks. English has lost these features because a particular dialect of Middle English, Old Northumbrian, lost them, and people who spoke the Old Northumbrian dialect, probably rich wool merchants, had a powerful effect on the speech of Medieval London, which happened to give us Modern English. The speakers of Old Northumbrian dropped the Germanic word-final *n* and *m* in most suffixes (*esse'*, not *essen*, for "to eat"). In late Old English the pronunciation of many short vowels (like the final *-e* that resulted here) was already merging into one vowel (the [uh] in so*a*, called *schwa* by linguists). These two shifts in pronunciation meant that many nouns no longer had distinctive endings, and neither the infinitive nor the subjunctive plural verb had a distinct ending. Later, between 1250 and 1300, the word-final *schwa* began to be dropped from most English speech, which wiped out the distinction between two more grammatical categories. Word order became fixed, as few other guides indicated the difference between subject and object, and auxiliary particles like *to*, *of*, or *by* were employed to distinguish infinitives and other forms. Three shifts in pronunciation were responsible for much of the grammatical simplification of modern English. See Thomason and Kaufman 1988:265–275.

6. For Grimm's Law, see Fortson 2004:300–304.

7. Some linguists argue that the Proto-Indo-European root did not begin with *k* but rather with a palato-velar, a *kh*-type sound, which would require that the first consonant was moved back in the *centum* languages rather than forward in the *satem* languages. See Melchert 1994:251–252. Thanks to Bill Darden for pointing this out.

8. Hock and Joseph 1996:38.

9. For pessimistic views on the "reality" of reconstructed Proto-Indo-European, see Bynon 1977; and Zimmer 1990. For optimistic views, see Hock and Joseph 1996:532–534; and Fortson 2004:12–14.

10. Hall 1950, 1976.

11. Bynon 1977:72. Mycenaean was in a transitional state in 1350 BC, when it was recorded. Some Proto-Indo-European words with k^w had already shifted to *k* in Mycenaean. The alternation between $*k^w$ and $*p$ probably was already present in some dialects of Proto-Indo-European.

12. For doubts on reconstructed meanings, see Renfrew 1987:80, 82, 260. For the argument that comparing cognates requires that the meanings of the compared terms are subjected to fairly strict limits, see Nichols 1997b.

Chapter 3. Language and Time 1

1. See Swadesh 1952, 1955; and Lees 1953.

2. The replacement rate cited here compares the core vocabulary in Modern English to the core vocabulary in Old English, or Anglo-Saxon. Much of the Old English core vocabulary was replaced by Norse, but, since Norse was another Germanic language, most of the core vocabulary remains Germanic. That is why we can say that 96% of the core vocabulary remains Germanic, and at the same time say that the replacement rate in the core vocabulary was a high 26%.

3. Much of the information in this section came from Embleton 1991, 1986. See also McMahon and McMahon 2003; and Dyen, Kruskal, and Black 1992. Many linguists are hostile to any claim that a cross-cultural core vocabulary can be identified. The Australian aboriginal languages, for example, do not seem to have a core vocabulary—all vocabulary items are equally vulnerable to replacement. We do not understand why. Both sides of the debate are represented in Renfrew, McMahon, and Trask 2000.

4. Meid 1975; Winfred 1989; and Gamkrelidze and Ivanov 1984:267–319.

5. Ivanov derived Hittite (Northern Anatolian) and Luwian (Southern Anatolian) separately and directly from Proto-Indo-European, without an intervening proto-language, making them as different as Celtic and Greek. Most other linguists derive all the Anatolian languages from a common source, Proto-Anatolian; see Melchert 2001 and Diakonoff 1985. Lydian, spoken on the western coast of Anatolia in the Classical era, might have descended from the same dialect group as Hittite. Lycian, spoken on the southwestern coast, probably descended from the same dialects as Luwian. Both became extinct in the Classical era. For all these topics, see Drews 2001.

6. For the Anatolian languages, see Fortson 2004:154–179; Houwink Ten Cate 1995; Veenhof 1995; and Puhvel 1991, 1994. For the glottalic perspective, see Gamkrelidze and Ivanov 1995.

7. Wiluša was a city west of the Hittite realm. It is very possible that Wilusa was Troy and that the Trojans spoke Luwian. See Watkins 1995:145–150; and Latacz 2004.

8. The non–Indo-European substrate effect on Luwian was described by Jaan Puhvel (1994:261–262) as "agglutinative creolization . . . What has happened to Anatolian here is reminiscent of what became of French in places like Haiti." Hittite showed similar non–Indo-European substrate effects and had few speakers, causing Zimmer (1990:325) to note that, "on the whole, the Indo-Europeanization of Anatolia failed."

9. Melchert 2001.

10. Forster 2004; Baldi 1983:156–159.

11. Lehrman 2001. The ten innovations that Lehrman identified as distinctive of Proto-Indo-European included two phonological traits (e.g., loss of the laryngeals), three morphological traits in nouns (e.g., addition of the feminine gender), and five morphological traits in verbs.

12. See Sturtevant 1962 for the Indo-Hittite hypothesis. For Anatolian as a daughter of very early Proto-Indo-European, see Puhvel 1991. Lehrman (2001) pointed out that Anatolian had a different word from Proto-Indo-European for *man*, usually considered part of the core vocabulary. The Anatolian term (**pāsna-*) used a root that also meant "penis," and the Proto-Indo-European term (**wĭro-*) used a root that also meant "strength." Proto-Anatolian and Proto-Indo-European did, however, share cognate terms for *grandfather* and *daughter*, so their kinship vocabularies overlapped. Classic Proto-Indo-European and Anatolian probably emerged from different places and different times in the Pre-Proto-Indo-European dialect chain.

13. For Pre-Greek language(s) of Greece, see Hainsworth 1972; and Francis 1992.

14. For the oldest language in the Indic branch I use the term *Old Indic* instead of *Indo-Aryan*. The standard nomenclature today is *Indo-Iranian* for the parent, *Avestan Iranian* for the oldest Iranian daughter, and *Indo-Aryan* for the oldest Indic daughter. But the designation *Aryan* for Indic is unnecessary; they were all Aryan. For the language and history of the *Rig-Veda*, see Erdosy 1995.

15. For Old Indic terms among the Mitanni, see Thieme 1960; Burrow 1973; and Wilhelm 1995. I thank Michael Witzel for his comments on Mitanni names. Any errors are my own.

16. For a date for Zarathustra before 1000 BCE, see Boyce 1975; and Skjærvø 1995. For the "traditional" date promulgated by ancient Greek sources, five hundred years later, see Malandra 1983.

17. Clackson (1994) and Hamp (1998) argued that Pre-Armenian was linked to the Greek-Indo-Iranian block. See also the isogloss map in Antilla 1972, figure 15.2. Many of the shared lexical items are discussed and described in Mallory and Adams 1997. I am grateful to Richard Diebold for his analysis of Greek/Indo-Iranian relations in a long letter of October 1994, where he pointed out that the shared innovations link Greek and Iranian closely, and Greek and Indic somewhat less.

18. See Rijksbaron 1988 and Drinka 1995 for the shared poetic functions of the imperfect. Poetics, shared phrases, and weapon terms are reviewed in Watkins 1995, chap. 2, 435–436.

19. See Ringe et al. 1998; and also Ringe, Warnow, and Taylor 2002. Similar cladistic methods were applied to a purely lexical data set in Rexová, Frynta, and Zrzavý 2003.

Chapter 4. Language and Time 2

1. See Darden 2001, esp. 201–204, for the etymology of the term *wool*. For the actual textiles, see Barber 2001, 1991; and Good 1998.

2. The "unspinnable" quotation is from Barber 2001:2. The mitochondrial DNA in modern domesticated sheep indicates that all are descended from two ancient episodes of domestication. One cluster (B), including all European and Near Eastern sheep, is descended from the wild *Ovis orientalis* of eastern Anatolia or western Iran. The other cluster (A) is descended from another *Ovis orientalis* population, probably in north-central Iran. Other wild Old World ovicaprids, *Ovis ammon* and *Ovis vignei,* did not contribute to the genes of domesticated sheep. See Hiendleder et al. 2002. For a general discussion of sheep domestication, see Davis 1987; and Harris 1996.

3. In the Ianna temple of Uruk IV (3400–3100 BCE) artists depicted women making textiles. The later Sumerian names for some months incorporated the term for plucking sheep. The zoological evidence suggests that the months were named this way during the Late Uruk period or afterward, not before.

4. Zoological evidence for wool production in the Near East is reviewed by Pollack (1999:140–147). For Arslantepe, see Bökönyi 1983. An earlier date for wool sheep could be indicated by a couple of isolated pieces of evidence. The phase A occupation at Hacinebi on the Euphrates, dated 4100–3800 BCE, had spindle-whorls that seemed the right weight for spinning wool, which requires a light spindle; see Keith 1998. A clay sheep figurine from Tepe Sarab in western Iran (Kermanshah) seems to show a wooly fleece, from a level dated about 5000 BCE. For a broader discussion, see Good 2001.

5. For the caprids (sheep and/or goats) at Khvalynsk, see Petrenko 1984. Petrenko did not report the age at death for all the caprids in the Khvalynsk graves, but six of the twelve with reported ages were adults. Sacrificial deposit #11 contained 139 bones of caprids representing four adults and five sub-adults, and the *average* adult withers height was 78 cm, almost 15 cm taller than other European Neolithic caprids. For Svobodnoe sheep, see Nekhaev 1992:81. For sheep in Hungary, see Bökönyi 1979:101–116. For sheep in Poland, see Milisauskas 2002:202.

6. For wool at Novosvobodnaya, see Shishlina, Orfinskaya, and Golikov 2003. For evidence of Catacomb-period wool (dated ca. 2800–2200 BCE) in the North Caucasian steppes, see Shishlina 1999. Sherratt's updated comments on wool are included in the revised text of an older article in Sherratt 1997a.

7. The term for hub or nave, which is often included in other lists, also meant "navel" in Proto-Indo-European, so its exact meaning is unclear. For the wheel-wagon vocabulary, see Specht 1944. Three influential updates were Gamkrelidze and Ivanov 1984:718–738; Meid 1994; and Häusler 1994. I first published on the topic in Anthony and Wailes 1988; and also in Anthony 1991a, 1995a. As with most of the topics covered in this book, there is an excellent review of the Indo-European wheel vocabulary in Mallory and Adams 1997.

8. Don Ringe communicated the argument against *hurki-* to me in a letter in 1997. Bill Darden discussed the Anatolian terms in Darden 2001.

9. I am indebted to Mary Littauer for alerting me to draft experiments carried out in 1838–40 with wagons and carts on different road surfaces, where it was determined that the draft of a wagon was 1.6 times greater than that of a cart of the same weight. See Ryder 1987.

10. For the earliest wheeled vehicles, see Bakker et al. 1999; and Piggott 1983. For European wheels, see Häusler 1992; and Hayen 1989. For Mesopotamia, see Littauer and Crouwel 1979; and Oates 2001. The most comprehensive anlysis of the steppe vehicle burials, still unpublished, is by Izbitser 1993, a thesis for the Institute of the History of Material Culture in

St. Petersburg. Izbitser is working on an English-language update from her post in the New York Metropolitan Museum. Other key steppe accounts are in Mel'nik and Serdiukova 1988, and the section on wagons in Gei 2000:175–192.

11. Sherratt's essays were compiled and amended in Sherratt 1997. He continued to suggest that horseback riding in the steppes was inspired by Near Eastern donkey riding; see 1997:217. An early critical response to the SPR is Chapman 1983.

12. For Neolithic sleds in Russia, see Burov 1997. Most of them were joined with mortice-and-tenon joints, and equipped with bent-wood curved runners. These are the same carpentry skills needed to make wheels and wooden-slat tires.

13. The version of the Renfrew hypothesis I use here was published as Renfrew 2001. For assenting views among archaeologists, see Zvelebil and Zvelebil 1988; Zvelebil 1995; and Robb 1991, 1993. Robert Drews (2001) began in a different place but ended up supporting Renfrew.

14. For the north Syrian origin of the Anatolian Neolithic population, see Bar-Yosef 2002; for the likely Afro-Asiatic linguistic affiliation of these first farmers, see Militarev 2002.

15. See Gray and Atkinson 2003, reviewed by Balter 2003. The linguist L. Trask criticized Gray and Atkinson's methods, and Gray responded on his homepage, updated March 2004, at http:// www.psych.auckland.ac.nz/psych/research/Evolution/GrayRes.htm.

16. Buck 1949:664, with Indo-European terms for *turn*, *turn around*, *wind*, and *roll*. Gray's argument for a natural independent development of the term *wheel* from *to turn* (wheel = the turner) is further complicated by the fact that there are two reconstructed Proto-Indo-European terms for *wheel,* and the other one was based on the Proto-Indo-European verb **reth-* 'run' (wheel = the runner), a different semantic development.

17. Renfrew 2001:40–45; 2000. Renfrew's hypothesis of a very long-lived Proto-Indo-European phase, surviving for many millennia, is supported by some linguists. For a view that Proto-Indo-European was spoken from the Mesolithic through the end of the Corded Ware period, or about 6000–2200 BCE, see Kitson 1997, esp. 198–202.

18. Childe 1957:394.

19. Mallory 1989:145–146; and Anthony 1991a. For Africa, see Nettles 1996.

Chapter 5. Language and Place

1. For homeland theories, see Mallory 1989, chap. 6. For political uses of the past in the Soviet Union, see Shnirelman 1995, 1999; Chernykh 1995; and Kohl and Tsetskhladze 1995. For the belief in an Aryan-European "race," see Kühl 1994; and Poliakov 1974.

2. The Pontic-Caspian steppe homeland hypothesis was defended in English most clearly by Gimbutas 1970, 1977, 1991; and Mallory 1989, updated in Mallory and Mair 2000. Although I agree with Gimbutas's homeland solution, I disagree with her chronology, her suggested causes for the expansion, and her concept of Kurgan-culture migrations, as I explained in detail in Anthony 1986.

3. See Dixon 1997:43–45. Similarly for Zimmer 1990:312–313, "reconstructions are pure abstracts incapable of being located or dated . . . no philological interpretation of the reconstructed items is possible."

4. The tree model does not exclude or deny some areal convergence. All languages contain elements based on both branching structures and convergence with neighbors. On areal borrowing, see Nichols 1992.

5. See Thomason and Kaufman 1992; Nichols 1992; and Dixon 1997. All support the derivation of the Indo-European languages from Proto-Indo-European. Dixon (1997:31), although a critic of the criteria used to create some family tree models, stated: "The genetic relatedness of the Indo-European languages, in a family tree model, has of course been eminently proved." A good brief review of various approaches to convergence can be found in Hock and Joseph 1996:388–445.

6. Gradual convergence between neighboring languages can result in several different kinds of similarities, depending on the social circumstances. The range of possibilities includes *trade jargons*, crude combinations of words from neighboring languages barely sufficient to communicate for purposes of trade or barter; *pidgins,* which evolve from trade jargons or from a multitude of partially known languages in a colonial encounter where a colonial target language supplies much of the content of the pidgin; and *creoles,* which can evolve from pidgins or can arise abruptly in multiethnic forced labor communities where again a colonial target language supplies much of the content. Unlike pidgins, creoles contain the essential grammatical structures of a natural language, but in a reduced and simple form. They can, of course, be as expressive in song, poetry, and metaphor as any natural language, so the fact that they are grammatically simple is not a value statement. All these ways of speaking pass through a bottleneck of great grammatical simplification. Indo-European grammar is not at all like a creole grammar. See Bickerton 1988; and Thomason and Kaufman 1988.

7. Pulgram, in 1959, suggested that the comparative method, applied to the modern Romance words for *coffee*, would produce a false Latin root for *coffee* in Classical Latin. But Pulgram's claim was rebutted by Hall (1960, 1976). Pulgram's argument was cited in Renfrew (1987:84–86) but corrected in Diakonov (1988: n. 2).

8. For Pre–Indo-European substrate terms in Balto-Slavic, see Andersen 2003. For Greek and pre-Greek place-names, see Hester 1957; Hainsworth 1972; and Renfrew 1998. In northern Europe, at least three different extinct non–Indo-European languages have been identified: (1) the "language of Old European hydronomy," preserved principally in non–Indo-European river names; (2) the "language of bird names," preserved in the names of several kinds of birds, including the blackbird, lark, and heron, and also in other terms borrowed into early Germanic, Celtic, and Latin, including the terms for *ore* and *lightning*; and (3) the "language of geminates," which survives only in a few odd sounds quite atypical for Indo-European, borrowed principally into Germanic but also into a few Celtic words, including doubled final consonants and the word-initial [kn-], as in *knob*. See Schrijver 2001; Venneman 1994; Huld 1990; Polomé 1990; and Krahe 1954.

≠ 9. For *beech* and *salmon* as terms that limited Proto-Indo-European to northern Europe, see Thieme 1958. Friedrich 1970 showed that the *beech* root referred variously to beech, oak, and elder trees in several branches, and that in any case the common beech grew in the Caucasus Mountains, making it useless as a diagnostic northern European tree word. Diebold 1985 summarized the evidence against salmon as a limiting geographic term. For the honeybee argument, see the excellent study by Carpelan and Parpola 2001. See also the articles on salmon and beech in Mallory and Adams 1997.

10. This interpretation of Proto-Indo-European **peku* is that of Benveniste 1973:40–51.

11. This reconstruction of Proto-Indo-European society is based on Benveniste 1973, numerous entries in Mallory and Adams 1997, and Gamkrelidze and Ivanov 1995.

12. For Proto-Uralic linkages with Proto-Indo-European, see Carpelan, Parpola, and Koskikallio 2001, particularly the articles by Koivulehto and Kallio. See also Janhunen 2000; Sinor 1988; and Ringe 1997.

13. For a Yeniseian homeland, see Napol'skikh 1997.

14. Koivulehto 2001.

15. Janhunen (2000) has somewhat different forms for some of the pronouns. Nichols pointed out in a note to me that the *-m* and *-n* shared inflections are not very telling; only a whole paradigm of shared inflections is diagnostic. Also, nasal consonants occur in high frequencies and apparently are prone to occur in grammatical endings, and so it is the pronouns that are really important here.

16. Nichols 1997a.

17. For the glotallic theory, see Gamkrelidze and Ivanov 1973; see also Hopper 1973. For their current views, see Gamkrelidze and Ivanov 1995.

18. For discussions of the glottalic theory, see Diakonov 1985; Salmons 1993; and Szemerényi 1989.

19. For critical discussions of the Semitic-Proto-Indo-European and Kartvelian-Semitic-Proto-Indo-European loan words, see Diakonov 1985:122–140; and Nichols 1997a appendix. On the chronology of the Proto-Kartvelian dispersal or breakup, see Harris 1991.

Chapter 6. The Archaeology of Language

1. My definitions are adapted from Prescott 1987. A different set of definitions was suggested by Parker 2006. He suggested *boundary* as the general term (what I am calling borders) and *border* as a specific term for a political or military boundary (more or less what I am calling a boundary). Parker tried to base his definitions partly on vernacular understandings of how these words are normally used, a noble goal; but I disagree that there is any consistency of usage in the vernacular, and prefer to use established definitions. In their review of the borderland literature, Donnan and Wilson (1999:45–46) followed Prescott in using *border* as the general or unspecialized term. The classic work to which I owe a great deal of my thinking is Barth 1969. For archaeological treatments of ethnic borders, see Shennan 1989, and Stark 1998.

2. For the growth of Medieval European regional identities, see Russell 1972; and Bartlett 1993. For the anthropological deconstruction of tribes and bounded cultures, see Fried 1975; and Wolf 1982, 1984. See also Hill 1992; and Moore 2001. For good archaeological uses of this border-deconstructing approach to ethnicity see Wells 2001; Florin 2001; MacEachern 2000; and James 1999.

3. See Hobsbawm 1990; Giddens 1985; and Gellner 1973. Giddens (1985:120) famously referred to the nation-state as a "bordered power-container." For a different interpretation of ancient tribes and borders, see Smith 1998. He is accused of being a "primordialist"; see his defense in chapter 7. Also see Armstrong 1982.

4. For projectile points and language families in South Africa, see Weissner 1983. For a good review of material culture and ethnicity, see Jones 1997, esp. chap. 6.

5. For New Guineau, see Terrell 2001; see also Terrell, Hunt, and Godsen 1997. For the original argument that biology, culture, and language were separate and independent, see the introduction to Boaz 1911. For California, see Jordan and Shennan 2003. For the other examples, see Silver and Miller 1997:79–98.

6. Persistent frontiers were the subject of a flurry of studies in the 1970s; see Spicer 1971 and a volume dedicated to Spicer by Castile and Kushner 1981. The focus in these papers was the maintenance of stigmatized minority identities. In archaeology, the long-term persistence of prehistoric "culture areas" was discussed long ago in Ehrich 1961. The subject was revisited by Kuna 1991; and Neustupny 1991. My first paper on the subject was Anthony 2001.

7. For the persistence of the Hudson-Valley Iroquoian/Algonkian frontier, see Chilton 1998. For the Linear Pottery frontier, see Zvelebil 2002. For the Jastorf/Halstatt frontier, see Wells 1999.

8. Emberling (1997) used the term *redundant* rather than *robust* for material-culture borders that were marked in multiple categories of material culture, and he recognized that this redundancy suggested that these borders were particularly important socially.

9. For Wales, see Mytum 1994; and John 1972. For the genetic border at the Welsh/English frontier, see Weale et al. 2002. For the border near Basle, see Gallusser 1991. On Breton culture, see Jackson 1994; and Segalen 1991. For the German/Romansh frontier in Italy, see Cole and Wolf 1974.

10. For the Ucayali quotation, see DeBoer 1990:102. For language and genetic correlations, see Jones 2003.

11. For the Iroquois, see Wolf 1982:167; 1984:394; and, in contrast, see Tuck 1978; Snow 1994; and Richter 1992. Moore (2001:43) also used intermarriages between Amerindian tribes as an index of *general* cultural and linguistic mixing: "These [marriage] data show a continual movement of people, and hence their genes, *language, and culture*, from society to society" (emphasis mine).

12. For the borders of functional zones, see Labov 1994. For functional zones, see Chambers and Trudgill 1998; and Britain 2002.

13. See Cole and Wolf 1974:81–282; see also Barth 1969. Cole and Wolf wrote a perceptive analysis of a persistent frontier in Italy, and then in 1982 Wolf published his best-known book, which suggested that tribal borders outside Europe were much more porous and changeable. In making this argument he seems, in my view, to have made some statements contradicted by his own earlier field work.

14. For the billiard-ball analogy, see Wolf 1982:6, 14. On migration processes generally, see Anthony 1990, 1997. Archaeologists of the American Southwest have pushed migration theory further than those of any other region. For a sampling see Spielmann 1998. For migration theory in Iroquoian archaeology, see Sutton 1996.

15. For the four Colonial cultural provinces, see Fischer 1989; Glassie 1965; and Zelinsky 1973. Although anthropology veered away from cultural geography in the 1980s and 1990s, historians and folklorists continued to study it. See Upton and Vlach 1986; and Noble 1992. For a review of the historians' interest in cultural geography in North America, see Nash 1984.

16. Clark 1994.

17. Kopytoff 1987.

18. For the Nuer, see Kelley 1985. For the effect of changes in bride-price currencies on basic subsistence economies, see Cronk 1989.

19. On dialect leveling among colonists, see Siegel 1985; Trudgill 1986; and Britain 2004. The degree of leveling depends on a number of social, economic, and linguistic factors; see Mufwene 2001. For Spanish leveling in the Americas, see Penny 2000. On the history of American English dialects, see Fischer 1989.

20. For charter groups, see Porter 1965; and Breen 1984. On German immigrants in Ohio, see Wilhelm 1992. On Puritan charter groups in new England, see Fischer 1989:57–68. On the Maya, see Fox 1987, although now there are criticisms of Fox's migration-based history; on apex families, see Alvarez 1987; and on the Pueblo, see Schlegel 1992.

21. On leveling and simplification in material culture among colonists, see Noble 1992; and Upton and Vlach 1986. Burmeister (2000) noted that the external form of residential architecture tends to conform to broad norms, whereas ethnicity is expressed in internal details of decoration and ornament.

22. The Boasian approach to borders is reviewed in Bashkow 2004.

23. On the provinces of France, see Chambers and Trudgill 1998:109–123; on the Maasai, see Spear and Waller 1993; on Burma, see Leach 1968, 1960; and for a different interpretation of Burma, see Lehman 1989.

24. On language and ecology, see Hill 1996; and Nettles 1996. Hill's paper was published later in Terrell 2001:257–282. Also see Milroy 1992.

25. The concept of ecologically determined "spread zones" for languages came from Nichols 1992. Similar ideas about arid zones and language expansion can be found in Silver and Miller 1997:79–83. Renfrew (2002) applied the term *spread zone* to any region of rapid language spread, particularly any expansion of pioneer farmers, regardless of ecology. Campbell (2002), however, warned against mixing these definitions.

26. For China, see DiCosmo 2002; and Lattimore 1940.

27. For Acholi origins, see Atkinson 1989, 1994.

28. A similar model for the growth of Bronze Age chiefdoms, described long before Atkinson's case study was published, was by Gilman 1981.

29. For the Pathan-Baluch shift, see Mallory 1992; Barth 1972; and Noelle 1997.

Chapter 7. How to Reconstruct a Dead Culture

1. For the history of Christian J. Thomsen's Three-Age System, see Bibby 1956.

2. I generally follow the Eneolithic and Bronze Age chronology of Victor Trifonov at the Institute of the History of Material Culture in St. Petersburg; see Trifonov 2001.

3. For the impact of radiocarbon dating on our understanding of European prehistory, see Renfrew 1973.

4. The old carbon problem in freshwater fish is explained in Cook et al. 2002; and in Bonsall et al. 2004. I used their method to create the correction scale that appears in the appendix.

5. A good historical review of radiocarbon dating in Russian archaeology is in Zaitseva, Timofeev, and Sementsov 1999.

6. For a good example of cultural identity shifting in response to changing historical situations, see Haley and Wilcoxon 2005. For Eric Wolf's and Anthony Smith's comments on situational politics alone being insufficient to explain emotional ties to a cultural identity see Cole and Wolf 1974:281–282; and Smith 1998, chap. 7.

7. For technological style and cultural borders, see Stark 1998.

Chapter 8. First Farmers and Herders

1. The three sky gods named here almost certainly can be ascribed to Proto-Indo-European. *Dyeus Pater*, or Sky/Heaven Father, is the most certain. The Thunder/War god was named differently in different dialects but in each branch was associated with the thunderbolt, the hammer or club, and war. The Divine Twins likewise were named differently in the different branches—the Nāsatyas in Indic, Kastōr and Polydeukēs in Greek, and the Dieva Dēli in Baltic. They were associated with good luck, and often were represented as twin horses, the offspring of a divine mare. For Trita, see Watkins 1995; and Lincoln 1981:103–124. More recently, see Lincoln 1991, chap. 1. For the twins, see Puhvel 1975; and Mallory and Adams 1997:161–165.

2. For the tripartition of Indo-European society, see Dumezil 1958; and Littleton 1982. There is a good review in Mallory 1989:128–142. For an impressive example of the interweaving of three's and two's in Indo-European poetry, see Calvert Watkin's analysis of a traditional Latin poem preserved by Cato in 160 BCE, the "Lustration of the Fields." The structure is tripartite, expressed in a series of doubles. See Watkins 1995:202–204.

3. Przewalkski horses are named after the Polish colonel who first formally described them in 1881. A Russian noble, Frederic von Falz-fein, and a German animal collector, Carl Hagenbeck, captured dozens of them in Mongolia, in 1899 and 1901. All modern Przewalski's are descended from about 15 of these animals. Their wild cousins were hunted to extinction after World War II; the last ones were sighted in Mongolia in 1969. Zoo-bred populations were reintroduced to two preserves in Mongolia in 1992, where once again they are thriving.

4. For differences between east-Ural and west-Ural Upper Paleolithic cultures, see Boriskovskii 1993, and Lisitsyn 1996.

5. For a wide-ranging study of the Ice Age Caspian, the Khvalynian Sea, and the Black Sea, including the "Noah's Flood" hypothesis, see Yanko-Hombach et al. 2006.

6. For the decline of matriliny among cattle herders, see Holden and Mace 2003.

7. For Y-chromosome data on early European cattle, see Gotherstrom et al. 2005. For MtDNA, see Troy et al. 2001; and Bradley et al. 1996.

8. For agricultural frontier demography, see Lefferts 1977; and Simkins and Wernstedt 1971.

9. For the oldest Criş site in the lower Danube valley, see Nica 1977. For a Starcevo settlement in the plains north of Belgrade, see Greenfield 1994.

10. For Criş immigrants in the East Carpathians, see Dergachev, Sherratt, and Larina 1991; Kuzminova, Dergachev, and Larina 1998; Telegin 1996; and Ursulescu 1984. The count of thirty sites refers to excavated sites. Criş pottery is known in unexcavated surface exposures at many more sites listed in Ursulescu 1984. For the Criş economy in eastern Hungary, see Vörös 1980.

11. For Neolithic bread, see Währen 1989. Criş people cultivated gardens containing four varieties of domesticated wheat: *Triticum monococcum, T. dicoccum* Shrank, *T. spelta, T. aestivo-compactum* Schieman; as well as barley (*Hordeum*), millet (*Panicum miliaceum*), and peas (*Pisum*)—all foreign to eastern Europe. On the plant evidence, see Yanushevich 1989; and Pashkevich 1992.

12. Markevich 1974:14.

13. For the possible role of acculturated foragers in the origin of the East Carpathian Criş culture, see Dergachev, Sherratt, and Larina 1991; and, more emphatically, Zvelebil and Lillie 2000.

14. On pioneer farmers and language dispersal, see Bellwood and Renfrew 2002; Bellwood 2001; Renfrew 1996; and Nichols 1994. On the symbolic opposition of wild and domesticated animals, see Hodder 1990.

15. Most archaeologists have accepted the argument made by Perles (2001) that the Greek Neolithic began with a migration of farmers from Anatolia. For the initial spread from Greece into the Balkans, see Fiedel and Anthony 2003. Also see Zvelebil and Lillie 2000; and van Andel and Runnels 1995. The practical logistics of a Neolithic open-boat crossing of the Aegean are discussed in Broodbank and Strasser 1991.

16. For **tawro-s*, see Nichols 1997a: appendixes. For the association of Afro-Asiatic with the initial Neolithic, see Militarev 2003.

17. The classic Russian-language works on the Bug-Dniester culture are in Markevich 1974; and Danilenko 1971; the classic discussion in English is in Tringham 1971. More recently, see Telegin 1977, 1982, and 1996; and Wechler, Dergachev, and Larina 1998.

18. For the Mesolithic groups around the Black Sea, see Telegin 1982; and Kol'tsov 1989. On the Dobrujan Mesolithic, see Paunescu 1987. For zoological analyses, see Benecke 1997.

19. Most of the dates for the earliest Elshanka sites are on shell, which might need correction for old carbon. Corrected, Elshanka dates might come down as low as 6500–6200 BCE. See Mamonov 1995, and other articles in the same edited volume. For radiocarbon dates, see Timofeev and Zaitseva 1997. For the technology and manufacture of this silt/mud/clay pottery, see Bobrinskii and Vasilieva 1998.

20. For the dates from Rakushechni Yar, see Zaitseva, Timofeev, and Sementsov 1999. For the excavations at Rakushechni Yar, see Belanovskaya 1995. Rakushechni Yar was a deeply stratified dune site. Telegin (1981) described sedimentary stratum 14 as the oldest cultural occupation. A series of new radiocarbon dates, which I ignore here, have been taken from organic residues that adhered to pottery vessels said to derive from levels 9 to 20. Levels 15 to 20 would have been beneath the oldest cultural level, so I am unsure about the context of the pottery. These dates were in the calibrated range of 7200–5800 BCE (7930±130 to 6825±100 BP). If they are correct, then this pottery is fifteen hundred years older than the other pottery like it, *and* domesticated sheep appeared in the lower Don valley by 7000 BCE. All domesticated sheep are genetically proven to have come from a maternal gene pool in the mountains of eastern Turkey, northern Syria, and Iraq about 8000–7500 BCE, and no domesticated sheep appeared in the Caucasus, northwestern Anatolia, or anywhere else in Europe in any site dated as early as 7000 BCE. The earliest dates *on charcoal* from Rakushechni Yar (6070+100 BP, 5890+105 BP for level 8) come out about 5200–4800 BCE, in agreement with other dates for the earliest domesticated animals in the steppes. If the dated organic residue was full of boiled fish, it could need a correction of five hundred radiocarbon years, which would bring the earliest dates down to about 6400–6200 BCE—somewhat more reasonable. I think the dates are probably contaminated and the sheep are mixed down from upper levels.

21. For 155 Late Mesolithic and Neolithic radiocarbon dates from Ukraine, see Telegin et al. 2002, 2003.

22. On Bug-Dniester plant foods, see Yanushevich1989; and Kuzminova, Dergachev, and Larina 1998. A report of millet and barley impressions from the middle-phase site of Soroki I/level 1a is contained in Markevich 1965. Yanushevich did not include this site in her 1989 list of Bug-Dniester sites with domesticated seed imprints; it is the only Bug-Dniester site I have seen with reports of barley and millet impressions.

23. The dates here are not on human bones, so they need no correction. The bone percentages are extracted from Table 7 in Markevich 1974; and Benecke 1997. Benecke dismissed the Soviet-era claims that pigs or cattle or both were domesticated independently in the North Pontic region. Telegin (1996:44) agreed. Mullino in the southern Urals produced domesticated sheep bones supposedly dated to 7000 BCE, cited by Matiushin (1986) as evidence for migrations from Central Asia; but like the claimed sheep in deep levels at Rakushechni Yar, these sheep would have been *earlier* than their proposed parent herds at Djeitun, and the wild species was not native to Russia. The sheep bones probably came from later Eneolithic levels. Matiushin's report was criticized for stratigraphic inconsistencies. See Matiushin 1986; and, for his critics, Vasiliev, Vybornov, and Morgunova 1985; and Shorin 1993.

24. Zvelebil and Rowley-Conwy 1984.

25. For captured women and their hyper-correct stylistic behavior, see DeBoer 1986. The archaeological literature on technological style is vast, but a good introduction is in Stark 1998.

26. The Linear Pottery culture in the East Carpathian piedmont overlapped with the Criş culture around 5500–5400 BCE. This is shown at late Criş sites like Grumazeşti and Sakarovka that contained a few Linear Pottery sherds. Sakarovka also had Bug-Dniester sherds, so it shows the brief contemporaneity of all three groups.

27. There is, of course, generosity and sharing among farmers, but farmers also understand that certain potential foods are not food at all but investments. Generosity with food has practical limits in bad times among farmers; these are generally absent among foragers. See Peterson 1993; and Rosenberg 1994.

28. The classic text on the Dnieper-Donets culture is Telegin 1968. For an English-language monograph see Telegin and Potekhina. In this chapter I only discuss the first phase, Dnieper-Donets I.

29. For DDI chipped axes, see Neprina 1970; and Telegin 1968:51–54.

30. Vasilievka V was published as a Dnieper-Donets II cemetery, but its radiocarbon dates suggest that it should have dated to DD I. Vasilievka I and III were published as Late Mesolithic, broadly around 7000–6000 BCE, but have radiocarbon dates of the very Early Mesolithic, closer to 8000 BCE. Vasilievka II and Marievka were published as Neolithic but have no ceramics and Late Mesolithic radiocarbon dates, 6500–6000 BCE, and so are probably Late Mesolithic. Changes in human skeletal morphology that were thought to have occurred between the Late Mesolithic and Neolithic (Jacobs 1993) now appear to have occurred between the Early and Late Mesolithic. These revisions in chronology have not generally been acknowledged. For radiocarbon dates, see Telegin et al. 2002, 2003. See also Jacobs 1993, and my reply in Anthony 1994.

31. For Varfolomievka, see Yudin 1998, 1988.

32. The zoologist Bibikova identified domesticated animals—sheep, cattle, and horses—at Matveev Kurgan in levels dated 6400–6000 BCE. Today neither the German zoologist Benecke nor the Ukrainian archaeologist Telegin give credit to Bibikova's claims for an independent local domestication of animals in Ukraine. Matveev Kurgan (a settlement, not a kurgan) is located in the Mius River valley north of the Sea of Azov, near Mariupol. Two sites were excavated between 1968 and 1973, numbered 1 and 2. Both contained Grebenikov-type microlithic flint tools and were thought to be contemporary. Two radiocarbon dates from MK 1 average about 6400–6000 BCE, but the single date (on bone) from MK 2 was about 4400–4000 BCE.

In the latter period domesticated animals including sheep were common in the region. The artifacts from all depths were analyzed and reported as a single cultural deposit. But at MK 1 the maximum number of flint tools and animal bones was found at a depth of 40–70 cm (Krizhevskaya 1991:8), and the dwelling floor and hearths were at 80–110 cm (Krizhevskaya 1991:16). Most of the animal bones from MK 1 and 2 were from wild animals, principally horses, onagers, and wild pigs, and these probably were associated with the older dates. But the bones identified as domesticated horses, cattle, and sheep probably came from later levels associated with the later date. See Krizhevskaya 1991. Stratigraphic inconsistencies mar the reporting of all three Pontic-Ural sites with claimed very early domesticated animals—Rakushechni Yar, Mullino, and Matveev Kurgan.

Chapter 9. Cows, Copper, and Chiefs

1. Benveniste 1973:61–63 for feasts; also see the entry for GIVE in Mallory and Adams 1997:224–225; and the brief recent review by Fortson 2004:19–21.

2. The dates defining the beginning of the Eneolithic in the steppes are principally from human bone, whereas the dates from Old Europe are not. The date of 5200–5000 BCE for the beginning of the Eneolithic Dnieper-Donets II culture incorporates a reduction of –228±30 radiocarbon years prior to recalibration. There is a discussion of this below in note 16.

3. "Old Europe" was a term revived by Marija Gimbutas, perhaps originally to distinguish Neolithic European farming cultures from Near Eastern civilizations, but she also used the term to separate southeastern Europe from all other European Neolithic regions. See Gimbutas 1991, 1974. For chronologies, economy, environment, and site descriptions, see Bailey and Panayotov 1995; and Lichardus 1991. For the origin of the term *Alteuropa* see Schuchhardt 1919.

4. Most of these dates are on charcoal or animal bone and so need no correction. The earliest copper on the Volga is at Khvalynsk, which is dated by human bone that tested high in ^{15}N (mean 14.8%) and also seemed too old, from about 5200–4700 BCE, older than most of the copper in southeastern Europe, which was the apparent source of the Khvalynsk copper. I have subtracted four hundred radiocarbon years from the original radiocarbon dates to account for reservoir effects, making the Khvalynsk cemetery date 4600–4200 BCE, which accords better with the florescence of the Old European copper age and therefore makes more sense.

5. For the pathologies on cattle bones indicating they were used regularly for heavy draft, see Ghetie and Mateesco 1973; and Marinescu-Bîlcu et al. 1984.

6. For signs and notation, see Gimbutas 1989; and Winn 1981. The best book on female figurines is Pogozheva 1983.

7. Copper tools were found in Early Eneolithic Slatina in southwestern Bulgaria, and copper ornaments and pieces of copper ore (malachite) were found in Late Neolithic Hamangia IIB on the Black Sea coast in the Dobruja hills south of the Danube delta, both probably dated about 5000 BCE. For Old European metals in Bulgaria, see Pernicka et al. 1997. For the middle Danube, see Glumac and Todd 1991. For general overviews of Eneolithic metallurgy, see Chernykh 1992; and Ryndina 1998.

8. For vegetation changes during the Eneolithic, see Willis 1994; Marinescu-Bîlcu, Cârciumaru, and Muraru 1981; and Bailey et al. 2002.

9. Kremenetski et al. 1999; see also Kremenetskii 1997. For those who follow the "beech line" argument in Indo-European origin debates, these pollen studies indicate that Atlantic-period beech forests grew in the Dniester uplands and probably spread as far west as the Dnieper.

10. For the ceramic sequence, see Ellis 1984:48 and n. 3. The Pre-Cucuteni I phase was defined initially on the basis of ceramics from one site, Traian-Dealul Viei; small amounts of

similar ceramics were found later at four other sites, and so the phase probably is valid. For an overview of the Tripolye culture, see Zbenovich 1996.

11. Marinescu-Bîlcu et al. 1984.

12. Some Tripolye A settlements in the South Bug valley (Lugach, Gard 3) contained sherds of Bug-Dniester pottery, and others had a few flint microlithic blades like Bug-Dniester forms. These traces suggest that some late Bug-Dniester people were absorbed into Tripolye A villages in the South Bug valley. But late Bug-Dniester pottery was quite different in paste, temper, firing, shape, and decoration from Tripolye pottery, so the shift to using Tripolye wares would have been an obvious and meaningful act. For the absence of Bug-Dniester traits in Tripolye material culture, see Zbenovich 1980:164–167; and for Lugach and Gard 3, see Tovkailo 1990.

13. For Bernashevka, see Zbenovich 1980. For the Tripolye A settlement of Luka-Vrublevetskaya, see Bibikov 1953.

14. For the Karbuna hoard, see Dergachev 1998.

15. The Early Eneolithic cultures I describe in this section are also called Late Neolithic or Neo-Eneolithic. Telegin (1987) called the DDII cemeteries of the Mariupol-Nikol'skoe type Late Neolithic, and Yudin (1988) identified Varfolomievka levels 1 and 2 as Late Neolithic. But in the 1990s Telegin began to use the term "Neo-Eneolithic" for DDII sites, and Yudin (1993) started calling Varfolomievka an Eneolithic site. I have to accept these changes, so sites of Mariupol-Nikol'skoe (DDII) type and all sites contemporary with them, including Khvalynsk and Varfolomievka, are called Early Eneolithic. The Late Neolithic apparently has disappeared. The terminological sequence in this book is Early Neolithic (Surskii), Middle Neolithic (Bug-Dniester–DDI), Early Eneolithic (Tripolye A–DDII–Khvalynsk), and Late Eneolithic (Tripolye B, C1-Sredni Stog-Repin). For key sites in the Dnieper-Azov region, see Telegin and Potekhina 1987; and Telegin 1991. For sites on the middle Volga, see Vasiliev 1981; and Agapov, Vasiliev, and Pestrikova 1990. In the Caspian Depression, see Yudin 1988, 1993.

16. The average level of ^{15}N in DDII human bones is 11.8 percent, which suggests an average offset of about –228±30 BP, according to the method described in the appendix. I subtracted 228 radiocarbon years from the BP dates for the DDII culture and calibrated them again. The unmodified dates from the earliest DDII cemeteries (Dereivka, Yasinovatka) suggested a calibrated earliest range of 5500–5300 BCE (see Table 9.1), but these dates always seemed too early. They would equate DDII with the middle Bug-Dniester and Criş cultures. But DDII came for the most part *after* Bug-Dniester, during the Tripolye A period. The modified radiocarbon dates for Dnieper-Donets II fit better with the stratigraphic data and with the Tripolye A sherds found in Dnieper-Donets II sites. For lists of dates, see Trifonov 2001; Rassamakin 1999; and Telegin et al. 2002, 2003.

17. For lists of fauna, see Benecke 1997:637–638; see also Telegin 1968:205–208. For ^{15}N in the bones, see Lillie and Richards 2000. Western readers might be confused by statements in English that the DDII economy was based on hunting and fishing (Zvelebil and Lillie 2000:77; Telegin, et al. 2003:465; and Levine 1999:33). The DDII people ate cattle and sheep in percentages between 30% and 78% of the animal bones in their garbage pits. Benecke (1997:637), a German zoologist, examined many of the North Pontic bone collections himself and concluded that domesticated animals "first became evident in faunal assemblages that are synchronized with level II of the Dnieper-Donets culture." People who kept domesticated animals were no longer hunter-gatherers.

18. Flint blades 5–14 cm long with sickle gloss are described by Telegin (1968:144). The northwestern DDII settlements with seed impressions are listed in Pashkevich 1992, and Okhrimenko and Telegin 1982. DDII dental caries are described in Lillie 1996.

19. Telegin 1968:87.

20. The Vasilievka II cemetery was recently dated by radiocarbon to the Late Mesolithic, about 7000 BCE. The cemetery was originally assigned to the DDII culture on the basis of

a few details of grave construction and burial pose. Telegin et al. 2002 extended the label "Mariupol culture" back to include Vasilievka II, but it lacks all the artifact types and many of the grave features that define DDII-Mariupol graves. The DDII cemeteries are securely dated to a period after 5400–5200 BCE. Vasilievka II is Late Mesolithic.

21. For funeral feasts, see Telegin and Potekhina 1987:35–37, 113, 130.

22. I have modified Khvalynsk dates on human bone to account for the very high average ^{15}N in human bone from Khvalynsk, which we measured at 14.8%, suggesting that an average −408±52 radiocarbon years should be subtracted from these dates before calibrating them (see Authors Note on Dating, and chapter 7). After doing this I came up with dates for the Khvalynsk cemetery of 4700/4600–4200/4100 BCE, which makes it overlap with Sredni Stog, as many Ukrainian and Russian archaeologists thought it should on stylistic and typological grounds. It also narrows the gap between late Khvalynsk on the lower Volga (now 3600–3400 BCE) and earliest Yamnaya. See Agapov, Vasiliev, and Pestrikova 1990; and Rassamakin 1999.

23. Until Khvalynsk II is published, the figure of forty three graves is conditional. I was given this figure in conversation.

24. For the enhancement of male status with herding economies, see Holden and Mace 2003.

25. In Anthony and Brown (2000) we reported a smaller number of horses, cattle, and sheep from the cemetery at Khvalynsk, based on only the twelve "ritual deposits" placed above the graves. I later compiled the complete animal bone reports from two sources: Petrenko 1984; and Agapov, Vasiliev, and Pestrikova 1990, tables 1, 2. They presented conflicting descriptions of the numbers of sheep in ritual deposits 10 and 11, and this discrepancy resulted in a total count of either fifty-two or seventy sheep MNI.

26. See Ryndina 1998:151–159, for Khvalynsk I and II metals.

27. For ornaments see Vasiliev 2003.

28. For the possibility that the first domesticated animals came across the North Caucasus from the Near East, see Shnirelman 1992; and Jacobs 1993; and, in opposition, see Anthony1994.

29. Yanushevich 1989.

30. Nalchik is described in Gimbutas 1956:51–53.

31. I found this grave referenced in Gei 2000:193.

32. The bones at Dzhangar were originally reported to contain domesticated cattle, but the zoologist Pavel Kosintsev told me, in 2001, that they were all onager and horse, with no obvious domesticates.

33. The Neolithic cultures of the North Caspian Depression, east of the Volga, were first called the Seroglazivka culture by Melent'ev (1975). Seroglazivka included some Neolithic forager camps similar to Dzhangar and later sites with domesticated animal bones like Varfolomievka. Yudin suggested in 1998 that a new label, "Orlovka culture," should be applied to the Early Eneolithic sites with domesticated animals. On Varfolomievka, see Yudin 1998, 1988. Razdorskoe was described by Kiyashko 1987. Older but still informative is Telegin 1981.

34. The Orlovka site was first described by Mamontov 1974.

35. The Samara Neolithic culture, with the cemetery of S'yezzhe, usually is placed earlier than Khvalynsk, as one S'yezzhe grave contained a boars-tusk plaque exactly like a DDII type. Radiocarbon dates now indicate that early Khvalynsk overlapped with the late Samara Neolithic (and late DDII). The Samara Neolithic settlement of Gundurovka contained Khvalynsk pottery. The Samara culture might have begun before Khvalynsk; see Vasiliev and Ovchinnikova 2000. For S'yezzhe, see Vasiliev and Matveeva 1979. For animal bones, see Petrenko 1984:149; and Kuzmina 2003.

Chapter 10. The Domestication of the Horse and the Origins of Riding

1. See Clayton and Lee 1984; and Clayton 1985. For a recent update, see Manfredi, Clayton, and Rosenstein 2005.

2. For early descriptions of bit wear, see Clutton-Brock 1974; and Azzaroli 1980. Doubts about the causes of this kind of wear had been expressed by Payne (1995) in a study published after long delays.

3. We were provided with horse teeth by Mindy Zeder at the Smithsonian Institution; the Large Mammal Veterinary Facility at Cornell University; the University of Pennsylvania's New Bolton Veterinary Center; the Bureau of Land Management, Winnemucca, Nevada; and Ron Keiper of Pennsylvania State University. We learned mold-making and casting procedures from Sandi Olsen and Pat Shipman, then at Johns Hopkins University. Mary Littauer gave us invaluable advice and the use of her unparalleled library. Our first steps were supported by grants from the Wenner-Gren Foundation and the American Philosophical Society.

4. On horse MtDNA, see Jansen et al. 2002; and Vilà et al. 2001. For horse Y-chromosomes, see Lindgren et al. 2004.

5. For equids in Anatolia, see Summers 2001; and online reports on the Catal Höyuk project. For horses in Europe, see Benecke 1994; and Peške 1986.

6. For Mesolithic and Neolithic Pontic-Caspian horses, see Benecke 1997; Vasiliev, Vybornov, and Komarov 1996; and Vasilev 1998. For horse bones at Ivanovskaya in the Samara Neolithic, see Morgunova 1988. In the same volume, see I. Kuzmina 1988.

7. For Mongol horse keeping, see Sinor 1972; and Smith 1984. For horses and cattle in the blizzard of 1886, see Ryden 1978:160–162. For feral horses see also Berger 1986.

8. For a review of these methods, see Davis 1987. For riding-related pathologies in vertebrae, see Levine 1999b. For crib-biting, see Bahn 1980; and the critique in White 1989.

9. The graphs from Benecke and von den Driesch (2003) are combined and reprinted as figure 10.3 here. See also Bökönyi 1974. For a critical view of Dereivka, see Uerpmann 1990.

10. The ratio of females to males in a harem band, counting immature horses, should be about 2:1, but the *skeletons* of immature males cannot be assigned a sex as the canine teeth do not erupt until about four to five years of age, and the presence of erupted canines is the principal way to identify males. From the bones, a harem band would contain just one *identifiable* male.

11. A horse's age at death can be estimated from a loose molar by measuring the molar crown height, the length of the tooth from the bifurcation between the roots to the occlusal surface. This measurement decreases with age as the tooth wears down. Spinage (1972) was the first to publish crown height-versus-age statistics for equids, based on zebras; Levine (1982) published statistics for a small sample of horses using measurements from X-rays. We largely confirmed Levine's numbers with direct measurements on our larger sample. But we found that estimates based *only* on crown heights have *at best* a±1.5 year degree of uncertainty (a three-year span). The crown height on the right and left P_2s of the same horse can vary by as much as 5 mm, which would normally be interpreted as indicating a difference in age of more than three years. See note 18, below.

12. Bibikova (1967, 1969) noted that fifteen of seventeen sexable mandibles were male. I subtracted the cult stallion, an Iron Age intrusion, making fourteen of sixteen males. Bibikova never published a complete description of the Dereivka horse bones, but she did note that the MNI was fifty-two individuals; 23% of the population was aged one to two years (probably looking at long bone fusion); fifteen of seventeen sexable jaw fragments were from males older than five, as this is when the canine teeth emerge; and there were no very old individuals.

Levine's age-at-death statistics were based on the crown heights of all the teeth kept in 1998, with an MNI of only sixteen—about two-thirds of the original collection had been lost. Only 7% of this remnant population was one to two years of age based on long-bone fusion (1999b:34) and about one-third of the surviving teeth were from the Iron-Age cult stallion. For Levine's age-at-death graphs, see Levine 1990, 1999a, 1999b.

13. The analysis of the equid P_2s from Leisey was conducted by Christian George as part of his MA Thesis in Geosciences at the University of Florida. The 1.5-million-year-old Leisey equids were *Equus "leidyi,"* possibly an eastern variant of *Equus scotti*, a common member of the Rancholabrean fauna, very similar in dentition, diet and stature to true horses. Of the 113 P2s from this site, 39 were eliminated because of age, damage, or pathologies, leaving 74 measurable P_2s from mature equids. See George 2002; Anthony, Brown, and George 2006; and Hulbert, Morgan, and Webb 1995. Our collection of P_2s was assembled through the generosity of the New Bolton Center at the University of Pennsylvania, the Cornell University College of Veterinary Medicine, the Bureau of Land Management in Winnemucca, NE; and Ron Keiper, then at Pennsylvania State University.

14. We are grateful to the National Science Foundation for supporting the riding experiment, and to the State University of New York at Cobleskill for hosting and managing it. Dr. Steve MacKenzie supervised the project, and the riding and recording was done by two students in the Horse Training and Behavior Program, Stephanie Skargensky and Michelle Beleyea. The bone bit and antler cheekpieces were made with flint tools by Paul Trotta. The hemp rope was supplied by Vagn Noeddlund of Randers Ropeworks. Mary Littauer and Sandra Olsen provided valuable suggestions on bits and mold-making. All errors were our own.

15. The pre-experiment, never-bitted mean bevel measurement for the three horses bitted with soft bits was 1.1 mm, the same as the never-bitted Pleistocene Leisey equids. The standard deviation for the three was 0.42 mm. The post-experiment mean was 2.04 mm, more than two standard deviations greater than the pre-experiment mean. Another 300 hours of riding might have created a bevel of 3 mm, our threshold for archaeological specimens.

16. The 74 never-bitted equid teeth from Leisey exhibited a greater range of variation than the 31 never-bitted modern P_2s we collected, not surprising with a larger sample. The distribution of measurements was normal, and a t-Test of the difference between the means for our bitted sample and the Leisey sample showed a significant difference. The threshold of 3 mm for identifying bit wear in archaeological specimens is supported by the Leisey data.

17. Levine outlined six problems with our bit wear studies in 1999b:11–12 and 2004:117–120. She placed it in a category she termed "false direct evidence," with so-called bridle cheekpieces whose forms vary wildly and whose function is entirely speculative. We believe Levine's criticisms are based on factual errors, distortions, and misunderstandings. For our reply to each of her six criticisms, see Anthony, Brown, and George 2006. We remain confident in our analysis of bit wear.

18. Permanent horse P2s become flattened or "tabled" by occlusion with the opposing tooth gradually between two and three years of age. Brown determined that a P_2 with a crown height greater than 5.0 mm *and* an occlusal length-to-width ratio greater than 2.1 is probably from a horse three years old or younger, so should be excluded from studies of bit wear (Brown and Anthony 1998:338–40). Brown was the first to combine the crown height and the occlusal length-width ratio to produce an age-at-death estimate this precise. If she had not done this we would have been forced to discard half of our sample to avoid using 2-3-year-old teeth. Christian George also used Brown's method to eliminate young teeth ($\leq$ 3 yr) from the Leisey sample. It should be noted that George found one P_2 with a bevel of 3.05 mm, but it was probably from a horse less than three years old.

19. Bendrey (2007), as this book went to press, reported new bevel measurements on never-bitted Przewalski horses, from zoos in England and Prague. Bendrey measured 29 P_2s from 15 Przewalksi horses of acceptable age (>3 and <21), and found 3mm bevels on three, or 10%. We found one bevel of *almost* 3mm in 105 never-bitted P_2s, less than 1%. The Przewalski bevels all

were caused by malocclusion with the opposing upper P^2; one 3mm bevel was filed down as a veterinary treatment for underbite. Malocclusion occurred among zoo-kept Przewalskis more frequently than among Pleistocene equids or Nevada mustangs. All zoo Przewalskis are descended from about 15 captured in the wild, and these founders might have had unusually bad occlusion. Also domestic horses were bred with the founders, perhaps mixing genes for different tooth and jaw sizes.

20. Raulwing 2000:61, with references.

21. For Dereivka, see Telegin 1986. For the horse bones, see Bibikova 1967, 1970; Bökönyi 1974, 1978, 1979; and Nobis 1971.

22. For criticisms of the traditional evidence for horse domestication at Dereivka, see Anthony 1986, 1991b; and Levine 1990.

23. Our research at the Institute of Zoology in Kiev was hosted by a generous and thoughtful Natalya Belan; in Samara, Russia, by Igor Vasiliev; and in Petropavlovsk, Kazakhstan, by Victor Zaibert. In Budapest Sandor Bökönyi made us welcome in the gracious manner for which he was widely known and is widely missed. The project was supported by a grant from the National Science Foundation. For reports, see Anthony and Brown 1991; and Anthony, Telegin, and Brown 1991.

24. See Häusler 1994.

25. For the redating of the Dereivka cult stallion, see Anthony and Brown 2000; reiterated in Anthony and Brown 2003.

26. Both Botai and Tersek showed some influence in their ceramics from forager cultures of the forest-steppe zone in the southeastern Urals, known as Ayatskii, Lipchin, and Surtanda. Botai-Tersek might have originated as a southern, steppe-zone offshoot of these cultures. For a description of Botai and Tersek in English, see Kislenko and Tatarintseva 1999; in Russian, see Zaibert 1993. For discussions of the horse remains at Botai and related sites, see Olsen 2003; and Brown and Anthony 1998.

27. Our initial measurements of the horse teeth from Kozhai 1 (made in a hotel room in Petropavlovsk, Kazakhstan) produced one tooth with a 3 mm bevel. This is how we described the Kozhai results before 2006. We remeasured the twelve Kozhai 1 casts for Anthony, Brown, and George 2006, and agreed that a borderline 2.9+ measurement was actually 3 mm, resulting in two teeth with bit wear. Two other P_2s from Kozhai 1 measured 2 mm or more, an unusually high measurement among wild horses.

28. Describing the Botai horses as wild were Levine 1999a, 1999b; Benecke and von den Dreisch 2003; and Ermolova, in Akhinzhalov, Makarova, and Nurumov 1992.

29. See Olsen 2003:98–101.

30. French and Kousoulakou 2003:113.

31. The Atbasar Neolithic preceded Botai in the northern Kazakh steppes; see Kislenko and Tatarintseva 1999. Benecke and von den Dreisch (2003: table 6.3) reported that domesticated sheep and cattle bones were found in Atbasar sites in the Kazakh steppes, dated before Botai. This is true, *but* the Russian and Kazakh authors they cite described the bones of domesticated sheep and cattle as later intrusions in the Neolithic levels; they were less weathered than the bones of the wild animals. The animal bones from Atbasar sites are interpreted by Akhinzhalov, Makarova, and Nurumov as indicating a foraging economy based on wild horses, short-horned bison, saiga antelope, gazelle, red deer, and fish. Domesticated animals appeared at the end of the Botai era. For their comments on differential bone weathering in Atbasar sites, see Akhinzhalov, Makarova, and Nurumov 1992:28–29, 39.

32. Logvin (1992) and Gaiduchenko (1995) interpreted some animal bones in sites of the Eneolithic Tersek culture, centered in the Tugai steppes near Kustenai, Kazakhstan, and dated to the same period as Botai, as domesticated cattle, particularly from Kumkeshu I. Another zoologist, Makarova, had identified the Tersek bovid bones as those of wild bison (Akhinzhalov, Makarova, and Nurumov 1992:38). Some domesticated cattle might have been kept in Tersek sites, which were closer to the Pontic-Caspian herders. None appeared at Botai. For Kumkeshu I, see Logvin, Kalieva, and Gaiduchenko 1989.

33. For horses in the Caucasus I relied on the text of a conference paper by Mezhlumian (1990). A few horses might have passed through the Caucasus into northern Iran before 3000 BCE, indicated by a few probable horse teeth at the site of Qabrestan, west of Teheran (see Mashkour 2003) and a possible horse tooth at Godin Tepe (see Gilbert 1991). No definite horse remains have been identified in eastern Iran, Central Asia, or the Indian subcontinent in deposits dated earlier than 2000 BCE, claims to the contrary notwithstanding. For a review of this debate, see Meadow and Patel 1997.

34. For central European horses, see See Benecke 1994; Bökönyi 1979; and Peške 1986.

35. Khazanov 1994:32.

36. For war and the prestige trade, see Vehik 2002.

37. The American Indian analogy is described in Anthony 1986. The most detailed analysis of the effects of horseback riding and horse keeping on Plains Indian cultures is Ewers 1955.

38. One argument against riding before 1500 BCE was that steppe horses were too small to ride. This is not true. More than 70% of the horses at Dereivka and Botai stood 136–144 cm at the withers, or about 13–14 hands high, and some were 15 hands high. They were the same size as Roman cavalry horses. Another argument is that rope and leather bits were inadequate for controlling horses in battle. This is also not true, as the American Indians demonstrated. Our SUNY students at Cobleskill also had "no problem" controlling horses with rope bits. The third is that riders in the steppes rode sitting back on the rump of the horse, a manner suited only to riding donkeys, which did not exist in the steppes. We have rebutted these doubts about Eneolithic riding in Anthony, Brown, and George 2006. For the arguments against Eneolithic riding, see Sherratt 1997a:217; Drews 2004:42–50; Renfrew 2002; and E. Kuzmina 2003:213.

39. The remains of a bow found in Berezovka kurgan 3, grave 2, on the Volga, in a grave of Pokrovka type probably dated about 1900–1750 BCE, had bone plates reinforcing the shaft and bone tips at the ends—a composite bow. The surviving pieces suggest a length of 1.4–1.5 m, almost five feet from tip to tip. See Shishlina 1990; and Malov 2002. For an overview of early archery and bows, see Zutterman 2003.

40. I am indebted to Dr. Muscarella for some of these ideas about arrow points. For a discussion of the initial appearance and usage of socketed bronze arrowheads, see Derin and Muscarella 2001. For a catalogue and discussion of the early Iron Age socketed arrowheads of the Aral Sea region, see Itina and Yablonskii 1997. Socketed bronze spear points were made in the steppes as early as 2000 BCE, and smaller socketed points began to appear occasionally in steppe sites about the middle of the Late Bronze Age, around 1500 BCE, but their potential was not immediately exploited. The ideal bows, arrows, and arrowheads for mounted archery evolved slowly.

41. For tribal warfare, see Keeley 1996.

Chapter 11. The End of Old Europe and the Rise of the Steppe

1. For the gold at Varna, see Bailey 2000:203–224; Lafontaine and Jordanov 1988; and Eleure 1989.

2. Chapman 1989.

3. For off-tell settlement at Bereket, see Kalchev 1996; at Podgoritsa, see Bailey et al. 1998.

4. The decrease in solar insolation that bottomed out at 4000–3800 BCE is documented in Perry and Hsu 2000; and Bond et al. 2001. For the Piora Oscillation in the Swiss Alps, see Zöller 1977. For indicators of cooling in about 4000 BCE in the Greenland ice cores, see O'Brien et al. 1995. For climate change in Central Europe in the German oak tree rings, see Leuschner et al. 2002. For the Pontic steppes, see Kremenetski, Chichagova, and Shishlina 1999.

5. For the flooding and agricultural shifts, see Bailey et al. 2002. For overgrazing and soil erosion, see Dennell and Webley 1975.

6. For Jilava, see Comsa 1976.

7. The pollen changes are described in Marinova 2003.

8. Cast copper objects began to appear regularly in western Hungary with the Lasinja-Balaton culture at about 4000 BCE; see Bánffy 1995; also Parzinger 1992.

9. Todorova 1995:90; Chernykh 1992:52. The burning of houses might have been an intentional ritual act during the Eneolithic; see Stevanovic 1997. But the final fires that consumed the Eneolithic towns of the lower Danube valley and the Balkans about 4000 BCE were followed by region-wide abandonment and abrupt culture change. Region-wide abandonments of large settlements in the North American Southwest (1100–1400 CE) and in Late Classic Maya sites (700–900 CE) in Mesoamerica were associated with intense warfare; see Cameron and Tomka 1993. The kind of climate shift that struck the lower Danube valley about 4100–3800 BCE would not have made tell settlements uninhabitable. Warfare therefore seems a likely explanation.

10. For evidence of overgrazing and soil erosion at the end of the Karanovo VI period, see Dennell and Webley 1975; for the destruction of Eneolithic Yunatsite, see Merpert 1995; and Nikolova 2000.

11. Todorova 1995.

12. See Ellis 1984 for ceramic workshops, and Popov 1979 for flint workshops. I use the Russian spelling (Tripolye, Tomashovka) rather than the Ukrainian (Tripil'ye, Tomashivka), because many site names such as Tripolye are established in the literature outside Ukraine in their Russian spelling.

13. On the demographics, see Dergachev 2003; and Masson 1979. On the flight of Bolgrad-Aldeni refugees, see Sorokin 1989.

14. On Tripolye B1 warfare generally, see Dergachev 2003, 1998b; and Chapman 1999. On Drutsy 1, see Ryndina and Engovatova 1990. For much of the other information in this section I have relied on the review article by Chernysh 1982.

15. The Cucuteni C designation refers only to a type of shell-tempered pottery. The Cucuteni chronology ends with Cucuteni B_2. Cucuteni C ware appeared first in sites dated to the Cucuteni A_3/Tripolye B1 period and ultimately dominated ceramic assemblages. See Ellis 1984:40–48.

16. The source of the steppe influence on Cucuteni C pottery is usually identified as the early Sredni Stog culture, phase Ib, for Telegin; or the Skelya culture, for Rassamakin.

17. Shell-temper adds to the durability and impact resistance of vessels that are regularly submitted to thermal shock through reheating, and also increases the cooling effect of evaporation, making a shell-tempered pot good for cooking or storing cool drinking water. Cucuteni C ware and fine painted wares were found together both in pit-houses and large two-storied surface houses. Contextual differences in the distribution of Cucuteni C ware and fine ware in settlements have not been described. At some sites the appearance of Cucuteni C wares seems abrupt: Polivanov Yar had traditional grog-tempered coarse wares in the Tripolye B2 occupation but switched to shell-tempered C wares of different shapes and designs in Tripolye C1, whereas the fine painted wares showed clear continuity between the two phases. See Bronitsky and Hamer 1986; Gimbutas 1977; and Marinescu-Bilcu 1981.

18. For the horse-head maces see Telegin et al. 2001; Dergachev 1999; Gheorgiu 1994; and Govedarica and Kaiser 1996.

19. For the skull shapes, see Necrasov 1985; and Marcsik 1971. Gracile "Mediterranean" Tripolye skulls have been found in ritual foundation deposits at Traian (Tripolye B2).

20. For Mirnoe, see Burdo and Stanko 1981.

21. For the eastern migration, see Kruts and Rizhkov 1985.

22. The Iron Age stereotype of nomadic cavalry seems to lie behind some of the writings of Merpert (1974, 1980) and Gimbutas (1977), who were enormously influential.

23. The "awkward seat" hypothesis is based on Near Eastern images that show riders sitting awkwardly on the horse's rump, a seat more suited to donkey riding. Donkeys have low withers

and a high, broad rump. If you sit forward on a donkey and the animal lowers its head, you can easily fall forward to the ground. Donkey riders, therefore, usually sit back on the rump. Horses have high withers, so horse riders sit forward, which also permits them to hang onto the mane. You have to push and lift to get yourself onto a horse's rump, and then there's nothing to hold on to. Artistic images that show riders on horseback sitting back on the rump probably indicate only that many Near Eastern artists before 1000 BCE, particularly in Egypt, were more familiar with riding donkeys than horses. The suggestion that riders in the steppes would adopt and maintain a donkey seat on horses is inherently implausible. See Drews 2004:40–55, for this argument.

24. For mutualism and economic exchanges between Old Europe and the Eneolithic cultures of the Pontic steppe, see Rassamakin 1999:112; see also Manzura, Savva, and Bogotaya 1995; and Nikolova 2005:200. Nikolova has argued that transhumant pastoralism was already part of the Old European economy in Bulgaria, but the Yagodinska cave sites she cited are radiocarbon dated about 3900 BCE, during or just after the collapse. Upland pastoral settlements were a small and comparatively insignificant aspect of the tell economies, and only a serious crisis made them the basis for a new economy.

25. Ewers 1955:10.

26. See Benveniste 1973:53–70, for *Give* and *Take*, esp. 66–67 for the Hittite terms; for the quotation, see 53. Hittite *pai* was derived from the preverb *pe-* with **ai-*, with reflexes meaning "give" in Tocharian *ai-*. Also see the entry for *Give* in Mallory and Adams 1997:224–225.

27. See Keeley 1996. For mutualist models of the Linear Pottery frontier, see Bogucki 1988. An ethnographic case frequently cited in discussions of mutualist food exchange is that of the horticultural Pueblo Indians and the pedestrian buffalo hunters of the Plains. But a recent study by Susan Vehik suggested that the Pueblo Indians and the Plains bison hunters traded prestige commodities—flint arrowheads, painted pottery, and turquoise—not food. And during a period of increasing conflict in the Plains after 1250 CE, trade actually greatly increased; see Vehik 2002.

28. See Kershaw 2000.

29. See "bride-price" in Mallory and Adams 1997:82–83.

30. In East Africa a group of foragers and beekeepers, the Mukogodo, were forced to obtain livestock after they began to interact and intermarry with stock-raising tribes, because it became impossible for Mukogodo men to obtain wives by offering beehives when non-Mukogodo suitors offered cattle. Cattle were just more valuable. The Mukogodo became pastoralists so that they could continue to have children. See Cronk 1989, 1993.

31. Ewers 1955:185–187.

32. The Sredni Stog site had two levels, Sredni Stog 1 and 2. The lower level (Sredni Stog 1) was an Early Eneolithic DDII occupation, and the upper was the type site for the Late Eneolithic Sredni Stog culture. In older publications the Sredni Stog culture is sometimes called Sredni Stog 2 (or II) to differentiate it from Sredni Stog 1 (or I).

33. The Sredni Stog culture is defined in Telegin 1973. The principal settlement site of the Sredni Stog cultre, Dereivka, is described in English in Telegin 1986; for the Sredni Stog origin of Cucuteni C ware, see 111–112. Telegin's chronological outline is described in English in Telegin 1987.

34. The longest and most detailed version of Rassamakin's new model in English is the 123-page article, Rassamakin 1999. Telegin's four phases (Ia, Ib, IIa, IIb) of the Sredni Stog culture represented, for Rassamakin, at least three separate and successive cultures: (1) the Skelya culture, 4500–4000 BCE (named for Strilcha Skelya, a phase Ib Sredni Stog site for Telegin); (2) the Kvityana culture, 3600–3200 BCE (Kvityana was a phase Ia site for Telegin, but Rassamakin moved it to the equivalent of Telegin's *latest* phase IIb); and (3) the Dereivka culture, 3200–3000 BCE (a phase IIa site for Telegin, dated 4200–3700 BCE by radiocarbon). Telegin seemed to stick to the stratigraphy, grave associations, and radiocarbon dates, whereas Rassamakin relied on stylistic arguments.

35. For Sredni Stog ceramics, see Telegin 1986:45–63; 1973:81–101. For skeletal studies, see Potekhina 1999:149–158.

36. For the seeds at Moliukhor Bugor, see Pashkevich 1992:185. For the tools at Dereivka, see Telegin 1973:69, 43. Bibikova actually reported 2,412 horse bones and 52 horse MNI. I have edited out the mandible, skull, and two metacarpals of the "cult stallion."

37. Only four settlement animal bone samples are reported for Sredni Stog. Most of them are worryingly small (a few hundred bones) and screens were not used in excavations (still are not), so bone recovery varied between excavations. For these reasons, the published animal bone percentages can be taken only as rough guides. For an English translation of the faunal reports, see Telegin 1986.

38. Rassamakin (1999:128) assigned the Dereivka cemetery, which he called Dereivka 2, to the Skelya period, before 4000 BCE, and assigned the Dereivka settlement to the Late Eneolithic, around 3300–3000 BCE. Telegin, following the radiocarbon dates from the settlement and the Tripolye B2 bowl found in the cemetery, assigned both to the same period.

39. See Dietz 1992 for the varied interpretations of antler "cheekpieces."

40. For the Suvorovo-Novodanilovka group, see Nechitailo 1996; and Telegin et al. 2001. The metals are analyzed in Ryndina 1998:159–170; for an English summary, see 194–195. English-language discussions of the Suvorovo-Novodanilovka group are few. In addition to Rassamakin's description of the Skelya culture, which incorporates Suvorovo-Novodanilovka, see Dergachev 1999; and Manzura, Savva, and Bogotaya 1995. And there is a useful entry under "Suvorovo" in Mallory and Adams 1997.

41. Telegin 2002, 2001.

42. The physical type in Novodanilovka graves is discussed in Potekhina 1999:149–154. The types of the lower Danube valley are described by Potekhina in Telegin et al. 2001; and in Necrasov and Cristescu 1973.

43. Ryndina (1998:159–170) examined copper objects from graves at Giugiurleşti, Suvorovo, Novodanilovka, Petro-Svistunovo, and Chapli. For the copper of Varna and Gumelnitsa, see Pernicka et al. 1997. They document the end of the Balkan mines and the switch to Carpathian ores at about 4000 BCE.

44. The horse-head examples in the Volga steppes were found at Novoorsk near Orenburg and at Lebyazhinka near Samara. For the polished stone mace heads, see Kriukova 2003.

45. For Old European weapons, see Chapman 1999.

46. *Equus hydruntinus* had a special ritual status in the cemeteries of Varna and Durankulak, but was unimportant in the diet and was on the brink of extinction. Horses (*Equus caballus*) were rare or absent in the Eneolithic settlements and cemeteries of the Danube valley before the Cernavoda I period, except for sites of the Bolgrad variant. The Gumelnița-related Bolgrad sites had about 8% horse bones. Other Old European sites in the Danube valley had few or no horses. For the Varna and Durankulak equids, see Manhart 1998.

47. See Vehik 2002 on increased warfare and long-distance trade in the Southwest. DiCosmo (1999) observed that increased warfare in the steppes encouraged organizational changes in preexisting institutions, and these changes later made large nomadic armies possible.

48. Contacts between late Tripolye A/early B1 settlements and the Bolgrad culture are summarized in Burdo 2003. Most of the contact is dated to late Tripolye A—Tripolye AIII2 and III3.

49. For Bolgrad sites, see Subbotin 1978, 1990.

50. For the intrusive cemeteries, see Dodd-Opriţescu 1978. For the gold and copper hoards, see Makkay 1976.

51. For the Suvorovo kurgan group, see Alekseeva 1976. The Kopchak kurgan is described in Beilekchi 1985.

52. Giurgiuleşti is described briefly in Haheu and Kurciatov 1993. One radiocarbon date is published from Giurgiuleşti: Ki-7037, 5380 ± 70 BP, or about 4340–4040 BCE, calibrated; I have been told that the date is misprinted in Telegin et al. 2001, 128.

53. The Novodanilovka grave, which was isolated and not in a cemetery, is described in Telegin 1973:113; for Petro-Svistunovo and Chapli, see Bodyans'kii 1968; and Dobrovol'ski 1958.

54. The region-wide abandonment of tells in about 4000–3500 BCE is observed in Coleman 2000. I do not see how this could have been the event that brought Greek speakers into Greece, because Greek shared many traits with the Indo-Iranian language branch (see the end of chapter 3), and Indo-Iranian emerged much later. The crisis of 4000 BCE probably brought Pre-Anatolian speakers into southeastern Europe.

55. See Madgearu 2001 on de-urbanization in post–Roman Bulgaria. Mace (1993) notes that if grain production falls, cattle are insurance against starvation. Cattle can be moved into a protected area during a period of conflict. Under conditions of declining agricultural yields and increasing conflict, a shift to a greater reliance on herding would make good economic sense.

56. For loot, lucre, and booty in Proto-Indo-European, see Benveniste 1973:131–137; for language shift among the Pathan, see Barth 1972.

57. For Cernavoda I, see Morintz and Roman 1968; and Roman 1978; see also Georgieva 1990; Todorova 1995; and Ilčeva 1993. A good recent summary is in Manzura 1999. For the cemetery of Ostrovul Corbului, see Nikolova 2002, 2000.

58. Sherratt 1997b, 1997c. Sherratt suggested that the drinking vessels of the period from 4000 to 2500 BCE were used to serve a beverage that included honey (the basis of mead) and grain (the source of beer), both directly attested in Early Bronze Age Bell Beaker cups. Honey, he suggested, would have been available only in small quantities, and might have been under the control of an elite who apportioned the fermented drink in ceremonies and closed gatherings open to just their inner circle. Proto-Indo-European contained a word for honey (**melit-*) and a derivative term for a honey drink (**medhu-*).

59. For Cernavoda I-Late Lengyel horses, see Peške 1986; and Bökönyi 1979.

60. For pastoralism, see Greenfield 1999; Bökönyi 1979; and Milisauskas 2002:202.

61. For the prayer to Sius, see Puhvel 1991.

Chapter 12. Seeds of Change on the Steppe Borders

1. Ryndina (1998:170–171) counted 79 copper objects from steppe graves for the Post-Suvorovo period, compared to 362 for Suvorovo-Novodanilovka graves.

2. See Telegin 2002, 1988, 1987; see also Nikolova and Rassamakin 1985; and Rassamakin 1999. Early reports on Mikhailovka are Lagodovskaya, Shaposhnikova, and Makarevich 1959; Shaposhnikova 1961 (this was the article where the division between lower and upper stratum 2 was noticed); and Shevchenko 1957. For the stratigraphic position of Lower Mikhailovka graves, see Cherniakov and Toshchev 1985. Radiocarbon dates for graves with Mikhailovka I pottery are reported in Videiko and Petrenko 2003. Early Mikhailovka II begins about 3500 BCE, in Kotova and Spitsyna 2003.

3. For the Maikop sherd at Mikhailovka I, see Nechitailo 1991:22. For the other pottery exchanges, see Rassamakin 1999:92; and Telegin 2002:36.

4. Pashkevich 2003.

5. The sheep of the Early Bronze Age in southeastern Europe were significantly larger than Eneolithic sheep, which Bökönyi (1987) attributed to a new breed of wool sheep that appeared after about 3500 BCE.

6. At the Cernavoda site three excavation areas yielded three successive archaeological cultures, of which the oldest was Cernavoda I, about 4000–3600 BCE; next was Cernavoda III, about 3600–3000 BCE, contemporary with Baden; and the youngest was Cernavoda II, 3000–2800 BCE. Mikhailovka I probably was contemporary with the end of Cernavoda I and the first half of Cernavoda III. See Manzura, Savva, and Bogatoya 1995.

7. For Mikhailovka I graves at Olaneshti, see Kovapenko and Fomenko 1986; and for Sokolovka, see Sharafutdinova 1980.

8. Potekhina 1999:150–151.

9. "Post-Mariupol" was the label first assigned by Kovaleva in the 1970s. See Nikolova and Rassamakin 1985; Telegin 1987; and Kovaleva 2001.

10. See Ryndina 1998:170–179, for Post-Mariupol metal types.

11. The two graves were Verkhnaya Maevka XII k. 2, gr. 10; and Samarska k.1, gr. 6 in the Orel-Samara region. See Ryndina 1998:172–173.

12. For Razdorske, see Kiyashko 1987, 1994.

13. The percentage of horse bones at Repin is often said to be 80%. Shilov (1985b) reviewed the numbers and came up with 55% horse bones, still a very high number.

14. For Repin/Yamnaya at Cherkasskaya, see Vasiliev and Siniuk 1984:124–125.

15. For Kara Khuduk and Kyzyl-Khak, see Barynkin and Vasiliev 1988; for the fauna, see I. Kuzmina 1988. Also see Ivanov and Vasiliev 1995; and Barynkin, Vasiliev, and Vybornov 1998. For the radiocarbon dates for Kyzyl Khak, see Lavrushin, Spiridonova, and Sulerzhitskii 1998:58–59. For late Khvalynsk graves on the lower Volga, see Dremov and Yudin 1992; and Klepikov 1994.

16. Kruts typed the Chapaevka ceramics as late Tripolye C1, whereas Videiko described Chapaevka as a late Tripolye B2 settlement. See Kruts 1977; and Videiko 2003. Videiko argued that ceramic craft traditions changed at different rates in different settlement groups. Tripolye B2 stylistic habits lingered longer, he suggested, in the Dnieper group (Chapaevka) than they did in the super-settlements of the South Bug group, which shifted to Tripolye C1 styles earlier. Tripolye C2 styles began on the Dniester at Usatovo about 3400–3300 BCE, but Tripolye C2 styles appeared on the Dnieper about 3100 BCE.

17. Kruts 1977:48.

18. For the super-sites, see Videiko 1990, and other articles in the same volume; also see Shmagli and Videiko 1987 and Kohl 2007.

19. At Maidanets'ke, emmer and spelt wheats were the most common cereals recovered; barley and peas also were found in one house. Cattle (35% of domesticates, MNI) were the most important source of meat, with pig (27%) and sheep (26%) as secondary sources; the remaining 11% was equally divided between dogs and horses. About 15% of the animals were red deer, wild boar, bison, hare, and birds. The cattle, pigs, and abundant wild animals indicate substantial forest near the settlement. A forest of about 20 <km^2 would have provided sufficient firewood for the town, figuring about 2.2 ha of hardwood forest per family of five for a sustainable woodlot. Since ecological degradation is not obvious, the abandonment of the town perhaps was caused by warfare. See Shmagli and Videiko 1987:69, and several articles on economy in the volume cited above as Videiko 1990.

20. The Tripolye B1 settlement of Polivanov Yar on the Dniester overlooked outcrops of high-quality flint. One house was engaged heavily in flint working, with all stages of the tool-making process. In the later Tripolye C1 settlement, all six excavated structures were engaged in flint working, the initial shaping occurred elsewhere, and new products were made (heavy flint axes and chisels about 10 cm long). The Tripolye C1 settlement had become a specialized village of flint workers. Maidanets'ke imported finished flint tools of Dniester flint, probably from Polivanov Yar. At Veseli Kut (150 ha), a Tripolye B2 town east of the South Bug valley, two structures were identified as ceramic workshops. Eight buildings dedicated to ceramic production were found at Varvarovka VIII (40 ha and 200 houses—the largest town in its region), and a similar ceramic factory appeared at Petreni on the Dniester, again the largest town in its area. At Maidanets'ke, eight houses in a row contained looms (indicated by clusters of up to seventy ceramic loom weights) and some had two looms, perhaps a specialized weaver's quarter. For Polivanov Yar, see Popova 1979; for ceramic workshops, see Ellis 1984.

21. For the Uruk expansion, see Algaze 1989; Stein 1999; and Rothman 2001. For copper production at Hacinebi, see Özbal, Adriaens, and Earl 2000; for the copper of Iran, see Matthews and Fazeli 2004. For the wool sheep, see Bökönyi 1983; and Pollack 1999.

22. For Sos and Berikldeebi, see Kiguradze and Sagona 2003; and Rothman 2003.

23. The Maikop-like pottery was found in pre-Kura-Araxes levels at Berikldeebi. Early Maikop began before the Early Transcaucasian Culture. See Glonti and Dzhavakhishvili 1987.

24. For pre-Maikop Svobodnoe, see Nekhaev 1992; and Trifonov 1991. For steppe-Svobodnoe exchanges, see Nekhaev 1992; and Rassamakin 2002.

25. The poses of those buried in the Maikop chieftain's grave were not clear. For an English-language description of the Maikop culture, see Chernykh 1992:67–83. Quite dated accounts are Childe 1936; and Gimbutas 1956:56–62. A long, detailed description in Russian is in Munchaev 1994. For the Novosvobodnaya graves, see Rezepkin 2000. For the archaeological culture history in the North Caucasus, see Trifonov 1991.

26. For the silver and gold staff casings with bulls, see Chernopitskii 1987. The 47-cm length of the riveted copper blade is emphasized in Munchaev 1994:199.

27. Rostovtseff (1922:18–32) argued that Maikop was a Copper Age or, in Anatolian terms, a Late Chalcolithic culture. But Maikop became established as a North Caucasian Bronze Age culture, so it begins somewhat earlier than the Anatolian Bronze Age to which it was originally linked. Some Russian archaeologists now suggest an early Maikop phase that would be Late Eneolithic, whereas later Maikop would remain Early Bronze Age. For Maikop chronology, see Trifonov 1991, 2001. For my own mistaken chronology, see Glumac and Anthony 1992. I should have believed Rostovtseff.

28. For the east Anatolian seal, see Nekhaev 1986; and Munchaev 1994:169, table 49:1–4.

29. For Galugai, see Korenevskii 1993, 1995; the fauna is described in 1995:82. Korenevskii considered Galugai a pioneer settlement by migrants from Arslantepe VIA. For Maikop horses, see Chernykh 1992:59.

30. Rezepkin (1991, 2000) argued that Maikop and Novosvobodnaya were separate and contemporary cultures. Similar radiocarbon dates from Galugai (Maikop) and Klady (Novosvobodnaya) suggested this. But the radiocarbon dates for Galugai are on charcoal and those from Klady are on human bone, which might be affected by old carbon in fish if the Klady people ate a lot of fish. Adjusted for a ^{15}N content of 11%, which would be at the low end of the levels known in the steppes, the *oldest* Klady dates might drop from about 3700–3500 to about 3500–3350 BCE. I follow the traditional view and represent Novosvobodnaya as an outgrowth of Maikop. Rezepkin compared Novosvobodnaya pottery to TRB or Funnel Beaker pottery from Poland, and megalithic porthole graves at Klady to TRB dolmen porthole graves. He suggested that Novosvobodnaya began with a migration from Poland. Sergei Korenevskii (1993) tried to bring the two phases back into a single culture. Black burnished pottery is found in central Anatolia at Late Chalcolithic and at EBI sites such as Kösk Höyük and Pinarbişi, a closer alternative source.

31. Shishlina, Orfinskaya, and Golikov 2003.

32. See Kiguradze and Sagona 2003:89, for the beads at Alikemek Tepesi.

33. The Maikop-Novosvobodnaya connections of the Sé Girdan kurgans were noticed by A. D. Rezepkin and B. A. Trifonov; both published Russian-language articles describing these connections in 2000. These were brought to Muscarella's attention in 2002 by Elena Izbitser at the Metropolitan Museum of Art in New York. Muscarella (2003) reviewed this history.

34. For the symbolic power of long-distance trade, see Helms 1992. For primitive valuables, see Dalton 1977; and Appadurai 1986.

35. For the Novosvobodnaya wagon grave, see Rezepkin and Kondrashov 1988:52.

36. Shilov and Bagautdinov 1998.

37. See Nechitailo 1991, for Maikop-steppe contacts. Rassamakin (2002) suggested that Late Tripolye migrants of the Kasperovka type influenced the formation of the Novosvobodnaya culture.

38. Cannabis might have been traded from the steppes to Mesopotamia. Greek *kánnabis* and Proto-Germanic **hanipiz* seem related to Sumerian *kunibu*. Sumerian was dead as a widely

spoken language by about 1700 BCE, so the connection must have been a very ancient one, and the international trade of the Late Uruk period provides a suitable context; see Sherratt 2003, 1997c. Wine could have been a linked commodity; the Greek, Latin, Armenian, and Hittite roots for "wine" are cognates, and some linguists feel that the root was of Semitic or Afro-Asiatic origin. See Hock and Joseph 1996:513.

39. For Caucasian horses, see Munchaev 1982; Mezhlumian 1990; and Chernykh 1992:59. For Norşuntepe and Anatolia, see Bökönyi 1991.

Chapter 13. Wagon Dwellers of the Steppe

1. For climate change at the beginning of the Yamnaya period, see Kremenetski 1997b, 2002.

2. The **ghos-ti-* root survived only in Italic, Germanic, and Slavic, but the institution was more widespread. See Benveniste 1973:273–288 on *Phílos*, and entries in Mallory and Adams 1997 on *guest* and *friend*. Ivanov suggested that Luwian *kaši-* 'visit' might possibly be cognate with Proto-Indo-European **ghos-ti-*, but the relationship was unclear. See Gamkrelidze and Ivanov 1995:657–658, for their discussion of *hospitality*. In later Indo-European societies, this institution was critical for the protection of merchants and visiting elites or nobles; see Kristiansen and Larsson 2005:236–240. See also Rowlands 1980.

3. As Mallory has noted, the eastern Indo-European branches did have some agricultural vocabulary. The eastern Indo-Europeans talked about plowed fields, grain, and chaff. The archaeological contrast between east and west is more extreme than the linguistic one, which perhaps reflects the difference between what people knew and could talk about (language) and how they actually behaved most of the time (archaeology). See entries on *agriculture*, *field*, and *plow* in Mallory and Adams 1997.

4. For the feminine gender as one of the ten innovations distinguishing classic Proto-Indo-European from the archaic form preserved in Anatolian, see Lehrman 2001. For the Afro-Asiatic loans in western Indo-European, see Hock and Joseph 1996:513. For Rudra's female consorts, see Kershaw 2000:212

5. Gimbutas 1956:70ff. I would never have thought it possible to penetrate the archaeology of Eastern Europe had it not been for this pioneering English-language synthesis, which opened the door. Nevertheless, I soon began to disagree with her; see Anthony 1986. I was very pleased to spend a few days with her in 1991 at a the National Endowment for the Humanities conference in Austin, Texas, organized by Edgar Polomé.

6. The hundred-year anniversary of Gorodtsov's 1903 archaeological expedition on the Northern Donets River was celebrated by three conferences on the Bronze Age (or at least three were planned). The first conference was in Samara in 2001, and the proceedings make a valuable primer on the Bronze Age cultures of the steppes. See Kolev et al. 2001.

7. See Merpert 1974:123–146, for the Yamnaya "cultural-historical community."

8. This steppe-pine-forest vegetation community is designated number 19 in the Atlas SSSR, 1962, edited by S. N. Teplova, 88–89. It occurs both in the lowland and mountain steppe environments.

9. Afanasievo radiocarbon dates are listed in table 13.3. Most of the Afanasievo dates appear to be on wood from the graves, but some are on human bone. Although I have not seen ^{15}N measurements for Afanasievo individuals, later skeletons from graves in the Altai had ^{15}N levels of 10.2 to 14.3%. Applying the correction scale I am using in this book, the Afanasievo dates taken on bone might be too old by 130 to 375 radiocarbon years. I have not corrected them, because, as I said, most appear to have been measured on samples of wood taken from graves, not human bone.

10. V. N. Logvin (1995) noted that some undated flat-grave cemeteries in northern Kazakhstan might represent a short-lived mixture of early Yamnaya or Repin and Botai-Tersek people. For the Karagash kurgan, see Evdokimov and Loman 1989.

11. The pottery in the earliest Yamnaya graves in the Volga-Ural region (Pokrovka cemetery I, k. 15, gr. 2; Lopatino k. 1, gr. 31; Gerasimovka II, k. 4, gr. 2) was Repin-influenced; and the pottery in the earliest Afanasievo kurgans (Bertek 33, Karakol) in the Gorny-Altai region also looks Repin-influenced.

12. For Afanasievo, see Molodin 1997; and Kubarev 1988. On the craniometrics, see Hemphill and Mallory 2003; and Hemphill, Christensen, and Mustafakulov 1997. For the faunal remains from Balyktyul, see Alekhin and Gal'chenko 1995.

13. On the local cultures, see Weber, Link, and Katzenberg 2002; also Bobrov 1988.

14. Chernykh 1992:88; Chernykh, Kuz'minykh, and Orlovskaya 2004.

15. For Tocharian linkages to Afanasievo, see Mallory and Mair 2000.

16. See Gei 2000:176, for the count of all steppe vehicle graves, and for the wagons of the Novotitorovskaya culture. For the Yamnaya wagon grave at Balki kurgan, see Lyashko and Otroshchenko 1988. For the Yamnaya vehicle at Lukyanovka, see Mel'nik and Serdyukova 1988. For the Yamnaya vehicle graves north of the Danube delta, see Gudkova and Chernyakov 1981. The Yamnaya vehicle graves at Shumaevo cemetery II, kurgans 2 and 6, were the first wagon graves found in the Volga-Ural region in decades, excavated by M. A. Turetskii and N. L. Morgunova in 2001–2002. One wheel was recognized in kurgans 6 and three in kurgan 2; see Morgunova and Turetskii 2003. For early wheeled vehicles in general, see Bakker, et al. 1999.

17. Mel'nik and Serdiukova (1988:123) suggested that Yamnaya wagons had no practical use but were purely ritual imitations of vehicles used in the cults of Near Eastern kings. This ascribes to the Yamnaya people more veneration of distant Near Eastern symbols and less practical sense than seems likely to me. It also leaves unexplained the Yamnaya shift to an economy based on mobility. Even if some of the wagons placed in graves *were* lightly built funeral objects, that does not mean that sturdier originals did not exist.

18. Izbitser (1993) asserted that all these steppe vehicles, including those in graves where only two wheels were found, were four-wheeled wagons. Her opinion has been cited in arguments over the origin of the chariot to suggest that the steppe cultures perhaps had no experience making two-wheeled vehicles; see Littauer and Crouwel 1996:936. But many graves contain just two wheels, including Bal'ki kurgan, grave 57. The image on the Novosvobodnaya cauldron at Evdik looks like a cart. Ceramic cart models associated with the Catacomb culture (2800–2200 BCE) and in the North Caucasus at the Badaani site of the ETC or Kura-Araxes culture (3500–2500 BCE) are interpreted by Izbitser as portraying something other than vehicles. Gei, on the other hand, sees evidence for both carts and wagons, as do I. See Gei 2000:186.

19. The Dnieper region of Merpret 1974 was divided into no fewer than six microregions by Syvolap 2001.

20. Telegin, Pustalov, and Kovalyukh 2003.

21. See Sinitsyn 1959; Merpert 1974; and Mallory 1977. For reconsiderations of Merpert's scheme in the light of the discovery of the Khvalynsk culture, see Dremov and Yudin 1992; and Klepikov 1994. For a review of all the early Yamnaya variants in the Volga-Don-Caucasus region, and their chronology, see Vasiliev, Kuznetsov, and Turetskii 2000.

22. Whereas Mikhailovka I produced 1,166 animal bones, Mikhailovka II and III together yielded 52,540 bones.

23. For Yamnaya seed imprints, see Pashkevich 2003. Pashkevich identifies Mikhailovka II as a settlement of the Repin culture, reflecting the debate about its ceramic affiliation referred to in the text; see also Kotova and Spitsyna 2003.

24. For Yamnaya and Catacomb chronology, see Trifonov 2001; Gei 2000; and Telegin, Pustalov, and Kovalyukh 2003. For western Yamnaya and Catacomb dates, see Kośko and Klochko 2003.

25. These views were well stated by Khazanov (1994) and Barfield (1989).

26. For grain cultivation by steppe nomads, see Vainshtein 1980; and DiCosmo 1994. For modern nomads who ate very little grain, see Shakhanova 1989. For the growth of bodyguards into armies, see DiCosmo 1999, 2002.

27. See Shilov 1985b.

28. For a study of seasonal indicators in kurgans in the Kalmyk steppes, see Shishlina 2000. For comments on the Yamnaya herding pattern in the Dnieper steppes, see Bunyatyan 2003.

29. For Samsonova, see Gei 1979. For Liventsovka, see Bratchenko 1969. The predominance of cattle at these places is mentioned in Shilov 1985b:30.

30. Surface scatters of Yamnaya lithics and ceramics in the Manych Depression in Kalmykia are mentioned by Shishlina and Bulatov 2000; and in the lower Volga and North Caspian steppes by Sinitsyn 1959:184. Desert or semi-desert conditions in these places make surface sites more visible than they are in the northern steppes, where the sod hides the ground. In the Samara oblast we found LBA occupations 20–30 cm beneath the modern ground surface; see Anthony et al. 2006. The winter camps of the Blackfeet are described in Ewers 1955:124–126: "Green Grass Bull said that bands whose members owned large horse herds had to move camp several times each winter. . . . However, a short journey of less than a day's march might bring them to a new site possessing adequate resources for another winter camp . . . Demands on fuel and grass were too great to allow all the members of a tribe to winter in one large village." This kind of behavior might make Yamnaya camps hard to find.

31. The Tsa-Tsa grave is described in Shilov 1985a.

32. Yamnaya dental pathologies in the middle Volga region with comparative data from Hsiung-Nu and other cemeteries were studied by Eileen Murphy at Queen's University Belfast as part of the Samara Valley Project. The unpublished internal report is in Murphy and Khokhlov 2004; see also Anthony et al. 2006. For caries in different populations, see Lukacs 1989.

33. For phytoliths in Yamnaya graves, see Shishlina 2000. The yields of *Chenopodium* and einkorn wheat were compared by Smith 1989. *Amaranthus* has 22% more protein (g/kg) than bread wheat, and *Chenopodium* has 34% more; wheat is higher in carbohydrates than either. For nutrient comparisons, see Gremillion 2004.

34. For the high incidence of curbitra orbitalis among Yamnaya skeletons, see Murphy and Khokhlov 2004; and Anthony et al. 2006.

35. For lactose tolerance, see Enattah 2005.

36. See Vainshtein 1980:59, 72, for comments on cows, milk foods, and poverty.

37. Mallory 1990.

38. On genders in Yamnaya graves, see Murphy and Khokhlov 2004; Gei 1990; Häusler 1974; and Mallory 1990.

39. On "Amazon" graves, see Davis-Kimball 1997; and Guliaev 2003.

40. Alexander Gei (1990) estimated a population density of 8–12 people per 100 km^2 in the EBA Novotitorovskaya and 12–14 per 100 km^2 in the MBA Catacomb periods in the Kuban steppes. But kurgans were erected only for a small percentage of those who died, so Gei's figures undercount the actual population density by an order of magnitude. At ten times his grave-based estimate, or about 120 people per 100 km^2, the population density would have been like that of modern Mongolia, where pastoralism is the dominant element in the economy.

41. Golyeva 2000.

42. For the equation between the status and man-days invested in the funeral, see Binford 1971. See also Dovchenko and Rychkov 1988; Mallory's analysis of their study in Mallory 1990; and Morgunova 1995.

43. The granulated decoration on the two golden rings from Utyevka I, kurgan 1, grave 1, is surprising, since the technique of making and applying golden granulation requires very specific skills that first appeared about 2500 BCE (Troy II, Early Dynastic III). The middle Volga was apparently connected with the Troad through some kind of network at this time. The axe in the Utyevka grave is an early type, similar to the axes of Novosvobodnaya and Yamnaya, and that implies a very early Poltavka date. The grave form and artifact assemblage taken together suggested to Vasiliev a date at the late Yamnaya–early Poltavka transition, so probably about 2800 BCE. The grave has not been dated by radiocarbon. For Utyevka I and its analogies, see

Vasiliev 1980. For the Kutuluk grave with the mace, see Kuznetsov 1991, 2005. For an overview, see Chernykh 1992:83–92.

44. Chernykh 1992:83–92.

45. For the Yamnaya grave at Pershin, see Chernykh; and Isto 2002. For the "clean" copper on the Volga, see Korenevskii 1980.

46. For the Post-Mariupol graves, see Ryndina 1998:170–179; for Lebedi, see Chernykh 1992:79–83; and for Voroshilovgrad, see Berezanskaya 1979.

47. For the iron blade, see Shramko and Mashkarov 1993.

48. Oared longboats are not actually portrayed in surviving art until Early Cycladic II, after 2900–2800 BCE, but the number of settled Cycladic Islands jumped from 10% to 90% for the first time in Early Cycladic I, beginning about 3300 BCE. This was possible only with a reliable form of seagoing transport. Longboats capable of holding twenty to forty oarsmen probably appeared earlier than ECII. See Broodbank 1989.

49. For Kemi-Oba graves in the Odessa oblast, see Subbotin 1995. For stone stelae in the North Pontic steppes generally, see Telegin and Mallory 1994.

Chapter 14. The Western Indo-European Languages

1. For a good essay on the subject of language shift, see the introduction in Kulick 1992. For Scots Gaelic, see Dorian 1981; see also Gal 1978.

2. For the Galgenberg site of the Cham culture, see Ottaway 1999. Bökönyi saw the statistical source of the larger horses that appeared in Central Europe in the horse population at Dereivka; Benecke suggested that the horses of Late Mesolithic Mirnoe in the steppes north of the Danube delta were a closer match. But both agreed that the source of the new larger breeds was in the steppes. See Benecke 1994:73–74; and Bökönyi 1974.

3. For the Bukhara horse trade, see Levi 2002. I am indebted to Peter Golden and Ranabir Chakravarti for calling my attention to it.

4. Polomé 1991. For the translation of the *Rig Veda* passage, see O'Flaherty 1981:92.

5. See Kristiansen and Larsson 2005:238.

6. See Benveniste 1973:61–63 for feasts; also see the entry for GIVE in Mallory and Adams 1997:224–225; and Markey 1990. For poets, see Watkins 1995:73–84. For the general importance of feasting in tribal societies, see Dietler and Hayden 2001. For an ethnographic parallel where chiefs and poets were mutually dependent, see Lehman 1989.

7. Mallory (1998) referred to this process using the wry metaphor of the *Kulturkugel*, a bullet of language and culture that acquired a new cultural skin after penetrating a target culture, but retained its linguistic core.

8. A broad scatter of kurgan graves in the steppes contained imported Tripolye C2 pots (among other imported pot types) and a few, like Serezlievka, also contained Tripolye-like schematic rod-headed figurines. The Serezlievka-type graves in the South Bug valley probably were contemporary with Yamnaya graves of the Zhivotilovka-Volchansk group in the Dnieper-Azov steppes that also contained imported Tripolye C2 pots, dated by radiocarbon about 2900–2800 BCE. Rassamakin (1999, 2002) thought that Zhivotilovka-Volchansk graves represented a migration of Tripolye C2 people from the forested upper Dniester deep into the steppes east of the Dnieper. But a Tripolye pot in a Yamnaya grave is most simply interpreted as a souvenir, gift, or acquisition rather than as a migrant Tripolye person. Yamnaya graves rarely contained any pots. Cotsofeni pots filled that customary void in the Yamnaya graves of the Danube valley, just as pottery of the Tripolye C2, late Maikop, and Globular Amphorae types did in the Ukrainian steppes.

9. For the Usatovo culture see Zbenovich 1974; Dergachev 1980; Chernysh 1982; and Patovka et al. 1989. For a history of excavations at Usatovo, see Patovka 1976. The Cernavoda I affiliations of pre-Usatovo coastal steppe kurgans are discussed in Manzura, Savva and Boga-

toya 1995. A Cernavoda I feature in Usatovo is described in Boltenko 1957:42. Recent radiocarbon dates are discussed in Videiko 1999.

10. For Usatovo fauna see Zbenovich 1974: 111–115.

11. For spindle whorls, see Dergachev 1980:106.

12. See Kuz'minova 1990, for Usatovo paleobotany.

13. For Usatovo ceramics, see Zbenovich 1968, with a brief notice of the orange-slipped grey wares on page 54.

14. For trade between Usatovo, late Cernavoda III, and late Maikop, see Zbenovich 1974:103, 141. The single glass bead at Usatovo was colored white by the inclusion of phosphorus. It was in a grave pit covered by a stone lid, a stone cairn, and then by the kurgan. The pear-shaped bead measured 9 mm in diameter, had a hole 5 mm in diameter, and had slightly darker spiraling on its surface. Two cylindrical glass beads, colored with copper (green-blue) were recovered from the Tripolye C2 grave 125 at Sofievka on the Dnieper near Kiev, dated a century or two later, about 3000–2800 BCE (4320+70 BP, 4270+90 BP, 4300+45 BP, from three other graves at Sofievka). Two other glass beads were found on the surface near this grave but certainly were not from it. The glass in both Sofievka and Usatovo was made with ash as an alkali, not soda. An ash recipe was used in the Near East. For analyses, see Ostroverkhov 1985. For the radiocarbon dates from Sofievka and the amber beads from Zavalovka, see Videiko 1999.

15. For the daggers, see Anthony 1996. For oared longboats, see the end of the last chapter of this volume, and Broodbank 1989.

16. For the ochre-painted skulls, see Zin'kovskii and Petrenko 1987.

17. For Zimnea, see Bronicki, Kadrow, and Zakościelna 2003; see also Movsha 1985; and Kośko 1999.

18. For fortifications, see Chernysh 1982:222.

19. See Boyadziev 1995, for the dating of the migration.

20. For the large cluster in Hungary, see Ecsedy 1979, 1994. For the cluster in Oltenia, see Dumitrescu 1980. For the cluster in northern Serbia, see Jovanovich 1975. For Bulgaria, see Panayotov 1989. For overviews see, Nikolova 2000, 1994. For relative chronologies at the time of the migration event in southeastern Europe generally, see Parzinger 1993. For the wagon grave at Plachidol, see Sherratt 1986. For the stone stelae, see Telegin and Mallory 1994. Ecsedy mentions that undecorated stone stelae were found near Yamnaya kurgans in Hungary.

21. The graves in Hungary could possibly have been the result of a separate migration stream that passed directly over the Carpathians through Late Tripolye territory rather than being a continuation of the lower Danube valley stream.

22. Most of the radiocarbon dates for Yamnaya graves in the Odessa oblast, the heart of the Dniester steppes, are quite late, beginning about 2800–2600 BCE, by which time the Usatovo culture was gone. There are a few earlier radiocarbon dates (Semenovskii, k.11, 14; Liman, k.2; Novoseltsy, k.19), but in both of the Semenovskii kurgans the primary grave for which the kurgan was raised was an Usatovo grave, and all the Yamnaya graves were secondary. The stratigraphy makes me wonder about the early radiocarbon dates. Yamnaya seems to have taken over the Odessa oblast steppes after the Usatovo culture. See Gudkova and Chernyakov 1981; and Subbotin 1985.

23. Kershaw 2000; see also entries on *korios* and warfare in Mallory and Adams 1997. The cattle raid, a related institution, is discussed in Walcot 1979.

24. For Yamnaya dog-tooth ornaments on the Ingul, see Bondar and Nechitailo 1980.

25. For the stelae of the steppes, see Telegin and Mallory 1994. For the symbolic importance of belts, see Kershaw 2000:202–203; and Falk 1986:22–23.

26. Kalchev 1996.

27. Nikolova 1996.

28. Alexandrov 1995.

29. Panayotov 1989:84–93.

30. Barth 1965:69.

31. Bell Beaker decorated cup styles, domestic pot types, and grave and dagger types from the middle Danube were adopted about 2600 BCE in Moravia and Southern Germany. This material network could have been the bridge through which pre-Celtic dialects spread into Germany. See Heyd, Husty, and Kreiner 2004, especially the final section by Volker Heyd.

32. See Hamp 1998; and Schmidt 1991, for connections between Italic and Celtic.

33. For the effects of wheeled vehicles, see Maran 2001.

34. See Szmyt 1999, esp. 178–188.

35. On the Slavic homeland, see Darden 2004.

36. Coleman (2000) argued that Greek speakers entered Greece during the Final Neolithic/Bronze Age transition, about 3200 BCE. If an Indo-European language spread into Greece this early I think it was more likely an Anatolian-type language. For a northern steppe origin for Greek, but in a later era more amenable to my scenario, see Lichardus and Vladar 1996; and Penner 1998. The same evidence is marshaled for another purpose in Makkay 2000, and in detail by Kristiansen and Larsson 2005. Another argument for a northern connection of the Shaft Grave princes is presented in Davis 1983. Connections between southeastern Europe and Greece are outlined in Hänsel 1982. Robert Drews (1988) also argued that the Shaft Grave princes were an immigrant dynasty from the north, although he derived them from Anatolia.

37. Mallory 1998:180.

Chapter 15. Chariot Warriors of the Northern Steppes

1. See Gening, Zdanovich, and Gening 1992, for the original report on Sintashta.

2. The Sintashta culture remained unrecognized as recently as 1992. Chernykh (1992:210–234) discussed Sintashta-type metals as part of the "Andronovo historico-cultural community," assigning it to about 1600–1500 BCE. Dorcas Brown and I visited Nikolai Vinogradov in 1992, and I was permitted to take bone samples from the chariot grave at Krivoe Ozero for radiocarbon dating. This resulted in two articles: Anthony 1995a; and Anthony and Vinogradov 1995. See Vinogradov 2003, for the complete report on the Krivoe Ozero cemetery. For the settlement and cemeteries at Arkaim, see Zdanovich 1995; and Kovaleva and Zdanovich 2002. For the Sintashta cemetery at Kammeny Ambar, see Epimakhov 2002. For a wide-ranging overview, see Grigoriev 2002, marred by the assumption that the Sintashta culture and many other steppe cultures originated from a series of south-to-north folk migrations from Anatolia and Syria, where he argued that the Indo-European homeland was located. See Lamberg-Karlovsky 2002, for connections to Central Asia. For conference proceedings, see Jones-Bley and Zdanovich 2002; Boyle, Renfrew, and Levine 2002; and Levine, Renfrew, and Boyle 2003.

3. I use the term *Aryan* here as it is defined it in chapter 1, as the self-designation of the people who composed the hymns and poems of the *Rig Veda* and *Avesta* and their immediate Indo-Iranian ancestors.

4. For the contact zone between Corded Ware, Globular Amphorae, and Yamnaya at about 2800–2600 BCE, see Szmyt 1999, esp. pp. 178–188. Also see Machnik 1999; and Klochko, Kośko, and Szmyt 2003. A classic review of the archaeological evidence for mixed Yamnaya, late Tripolye (Chapaevka), and Corded Ware elements in Middle Dnieper origins is Bondar 1974. A recent review emphasizes the Yamnaya influence on the Middle Dnieper culture, in Telegin 2005.

5. For Middle Dnieper chronology, see Kryvaltsevich and Kovalyukh 1999; and Yazepenka and Kośko 2003.

6. Machnik 1999.

7. Before the Middle Dnieper culture appeared, the east side of the river near Kiev had been occupied between about 3000 and 2800 BCE by the mixed-origin late Tripolye C2 Sofievka group, which cremated its dead, used riveted daggers like those at Usatovo, and made

pottery that showed both cord-impressed steppe elements and late Tripolye elements. For the Sofievka settlement, see Kruts 1977:109–138; for radiocarbon dates, see Videiko 1999.

8. See Carpelan and Parpola 2001. This almost monograph-length article covers much of the subject matter discussed in this chapter. For Corded Ware migrations from the genetic point of view, see Kasperavičiūtė, Kučinskas, and Stoneking 2004.

9. For Balanovo, Abashevo, and Volosovo, see Bol'shov 1995. For Abashevo ceramics, see Kuzmina 1999. The classic work on Abashevo is Pryakhin 1976, updated in Pryakhin 1980. For an English account, in addition to Carpelan and Parpola 2001, see Chernykh 1992:200–204 and Koryakova and Epimakhov 2007.

10. For the Volosovo culture, see Korolev 1999; Vybornov and Tretyakov 1991; and Bakharev and Obchinnikova 1991.

11. For Abashevo and Indo-Iranian linkages, see Carpelan and Parpola 2001; and Pryakhin 1980.

12. For the headbands, see Bol'shov 1995.

13. See Keeley 1996, on tribal war.

14. See Koivulehto 2001; and Carpelan and Parpola 2001.

15. See Ivanova 1995:175–176, for the Aleksandrovska IV kurgan cemetery.

16. For Kuisak settlement, see Maliutina and Zdanovich 1995.

17. In Table 1, sample AA 47803, dated ca. 2900–2600 BCE, was from a human skeleton of the Poltavka period that was later cut through and decapitated by a much deeper Potapovka grave pit. A horse sacrifice above the Potapovka grave is dated by sample AA 47802 to about 1900–1800 BCE. Although they were almost a thousand years apart, they looked, on excavation, like they were deposited together, with the Potapovka horse skull lying above the shoulders of the decapitated Poltavka human. Before dates were obtained on both the horse and the skeleton this deposit was interpreted as a "centaur"—a decapitated human with his head replaced by the head of a horse, an important combination in Indo-Iranian mythology. But Nerissa Russell and Eileen Murphy found that both the horse and the human were female, and the dates show that they were buried a thousand years apart. Similarly sample AA-12569 was from an older Poltavka-period dog sacrifice found on the ancient ground surface at the edge of Potapovka grave 6 under kurgan 5 at the same cemetery. Older Poltavka sacrifices and graves were discovered under both kurgans 3 and 5 at Potapovka cemetery I. The Poltavka funeral deposits were so disturbed by the Potapovka grave diggers that they remained unrecognized until the radiocarbon dates made us take a second look. The "centaur" possibility was mentioned in Anthony and Vinogradov 1995, five or six years before the two pieces were dated. Of course, it now must be abandoned.

18. For Sarazm, see Isakov 1994.

19. For Kelteminar, see Dolukhanov 1986; and Kohl, Francfort, and Gardin 1984. The classic work on Kelteminar is Vinogradov 1981.

20. For a radiocarbon date from Sergeivka, see Levine and Kislenko 2002, but note that their discussion mistakenly assigns it to the Andronovo period, 1900–1700 BCE. See also Kislenko and Tatarintseva 1990. Another transitional forager-herder group influenced by Poltavka was the Vishnevka 1 pottery group in the forest-steppe on the northern Ishim; see Tatarintseva 1984. For Sergeivka sherds at the Poltavka cemetery of Aleksandrovka, see Maliutina and Zdanovich 1995:105.

21. For climate deterioration, see Blyakharchuk et al. 2004; and Kremenetski 2002, 1997a, 1997b.

22. Rosenberg 1998.

23. For the Mesopotamian metal trade, see Muhly 1995; Potts 1999:168–171, 186.

24. For metals and mining, see Grigoriev 2002:84; and Zaikov, Zdanovich, and Yuminov 1995. See also Kovaleva and Zdanovich 2002. Grigoriev suggested that the amount of slag found in each house was so small that it could represent household production. However, slag is often found in small amounts even at industrial sites, and that all houses contained slag and

production facilities (ovens with attached wells that aided in the updraft) shows an intensity of metal production that was unprecedented in the steppes.

25. See DiCosmo 1999, 2002; and Vehik 2002.

26. Ust'e, like Chernorech'e III, was excavated by Nikolai Vinogrado. Vinogradov was kind enough to show me his plans and photographs from Ust'e, where Sintashta houses are clearly stratified beneath a Petrovka occupation.

27. See Epimakhov 2002:124–132 for the artifact catalogue.

28. For the ballistics of flint projectile points, see Knecht 1997; and Van Buren 1974. For javelins in Greek chariot warfare, see Littauer 1972; and Littauer and Crouwel 1983.

29. For the chariot petroglyphs, see Littauer 1977; Samashev 1993; and Jacobsen-Tepfer 1993. On the derivation of steppe cheekpieces from Mycenaean cheekpieces, see E. Kuzmina 1980. For a review of European cheekpieces, see Hüttel 1992. Littauer and Crouwel (1979) argued persuasively for the Near Eastern origin of the chariot, overthrowing pre-World War II suggestions that the chariot was a super-weapon of the steppe Aryans. Piggott (1983, 1992) began to challenge the Near Eastern origin hypothesis almost immediately. Moorey (1986) also supported a multiregional invention of the various elements combined in the chariot.

30. See Epimakhov 2002:124–132 for a grave inventory that totals sixteen chariot graves; see Kuzmina 2001:12 for an estimate of twenty. The sites Kuzmina lists include Sintashta (seven chariot graves), Kamenny Ambar (two), Solntse II (three), Krivoe Ozero (three), and, in northern Kazakhstan, in Petrovka graves, Ulybai (one), Kenes (one), Berlyk II (two), and Satan (one).

31. For arguments against the functionality of steppe chariots, see Littauer and Crouwel 1996; Jones-Bley 2000; and Vinogradov 2003:264, 274. For arguments in favor of the steppe chariots as effective instruments of war, see Anthony and Vinogradov 1995; and Nefedkin 2001.

32. For English descriptions of the narrow-gauge chariots, see Gening 1979; Anthony and Vinogradov 1995; and Anthony 1995a. For two critical replies, see Littauer and Crouwel 1996; and Jones-Bley 2000. For the limitations of the chariot in battle, see Littauer 1972; and Littauer and Crouwel 1983.

33. For Bronze Age steppe bows, see Grigoriev 2002:59–60; Shishlina 1990; Malov 2002; and Bratchenko 2003:199. For ancient bows of the Near East and Iran, see Zutterman 2003.

34. See Littauer 1968.

35. For the disk cheekpieces, see Priakhin and Besedin 1999; Usachuk 2002; and Kuzmina 2003, 1980. For left and right side differences, see Priakhin and Besedin 1999:43–44. For chariots in the *Rig Veda*, see Sparreboom 1985. For the metal examples in the Levant, see Littauer and Crouwel 1986, 2001. This type of cheekpiece probably spread into Mycenaean Greece from southeastern Europe, where it appeared in Otomani, Monteoru, and Vatin contexts. For radiocarbon dates for these cultures, see Forenbaher 1993, and for disk-shaped cheekpieces in those contexts, see Boroffka 1998, and Hüttel 1994. The European origin of Mycenaean chariotry might explain why Mycenaean chariot warriors, like the early charioteers of the northern steppes, sometimes carried spears or javelins. For chariots in Greece, see Crouwel 1981.

36. For a review of the Near Eastern evidence for chariots, see Oates 2003; for older studies, see Moorey 1986, and Littauer and Crouwel 1979. For vehicles at Tell Brak, see Oates 2001:141–154. If we were to accept the "low" chronology, which seems increasingly likely, the date for the end of Ur III and the earliest proto-chariots would shift down from 2000 to 1900 BCE. See Reade 2001.

37. See Stillman and Tallis 1984:25 for Mitanni chariot squadrons; for Chinese chariot squadrons, see Sawyer 1993:5.

38. See Appuradai 1986:21 for the "tournament of values."

39. For human pathologies, see Lindstrom 2002, who notes the complete absence of dental caries, even in the oldest individuals (161). Lindstrom was the first Western archaeologist to participate in excavations at a Sintashta site.

40. Igor Ivanov, a geomorphologist at Arkaim, told me in 2000 that the reports of irrigation channels at Arkaim were mistaken, that these were natural features.

41. See Gening, Zdanovich, and Gening 1992:234–235 for Sacrificial Complex 1, and page 370 for the man-days for the SB kurgan.

42. For feasting in tribal societies, see Hayden 2001.

43. For the fauna, see Kosintsev 2001; and Gaiduchenko 1995. For $^{N}15$ isotopes in human and animal bones, see Privat 2002.

44. For doubts about social hierarchy in Sintashta society, see Epimakhov 2000:57–60.

45. Witzel 1995:109, citing Kuiper 1991.

46. For various theories on how to link Sintashta and the Indo-Iranians, see Parpola 1988, 2004–2005; E. Kuzmina 1994, 2001; and Witzel 2003.

47. All quotations are from O'Flaherty 1981.

48. For the Indo-European dog sacrifice and New Year initiation ceremony, see Kershaw 2000; and Kuiper 1991, 1960.

49. Epimakhov 2002; and Anthony et al. 2005.

Chapter 16. The Opening of the Eurasian Steppes

1. For exotic knowledge and power, see Helms 1992.

2. For Indic terms among the Mitanni, see chapter 3; Thieme 1960; and Burrow 1973.

3. Elamite was a non–Indo-European language of uncertain affiliations. As Dan Potts stressed, the people of the western Iranian highlands never used this or any other common term as a blanket ethnic designation for themselves. They did not even all speak Elamite. See Potts 1999:2–4. For the appearance of horses, see Oates 2003.

4. See Weiss 2000; also Perry and Hsu 2000.

5. At Godin Tepe, onagers were 94% of the equid bones. A cheektooth and a metacarpal from Godin IV, dated about 3000–2800 BCE, might be horse. The first clear and unambiguous horse bones at Godin appeared in period III, dated 2100–1900 BCE; see Gilbert 1991. On horses and mules at Malyan, see Zeder 1986. The bit wear at Malyan is the earliest unambiguous bit wear in the Near East. Copper stains reported on the P_2s of asses from Tell Brak, dated 2300–2000 BCE, might have had another cause (perhaps corroded lip rings). See Clutton-Brock 2003.

6. Owen 1991.

7. The phrase *Fahren und Reiten*, or "To drive and to ride," appeared between 1939 and 1968 in the titles of three influential publications by Joseph Weisner, and the order of terms in this phrase—driving *before* riding—has become a form of shorthand referring to the historical priority of the chariot over the ridden horse in the Bronze Age civilizations of the Near East. Certainly wheeled vehicles preceded horseback riding in the Near East, and horse-drawn chariots dominated Near Eastern warfare long before cavalry, but this was not because riding was invented after chariotry (see chapter 10). If images of horseback riding can now be dated before 1800 BCE, as seems to be the case, they preceded the appearance of horses with chariots in Near Eastern art. See Weisner 1939, 1968; Drews 2004:33–41, 52; and Oates 2003.

8. For Zimri-Lim's adviser's advice, see Owen 1991; n. 12.

9. For tin sources, see Muhly 1995:1501–1519; Yener 1995; and Potts 1999:168–171, 186. For Eneolithic Serbian tin-copper alloys, see Glumac and Todd 1991. For the possible mistranslation of the Gudea inscription I am indebted to Chris Thornton, and, through him, to Greg Possehl and Steven Tinney. For the seaborne tin trade in the Arabian Gulf, see Weeks 1999; and for the Bactrian comb at Umm-al-Nar, see Potts 2000:126. For Harappan metals, see Agrawal 1984.

10. The polymetallic ores of the Zeravshan probably produced the metals of Ilgynly-Depe, near Anau, during the fourth millennium BCE. At Ilgynly, among sixty-two copper artifacts, primarly tanged knives, one object contained traces of tin; see Solovyova et al. 1994. For tin

bronzes in early third-millennium Namazga IV, see Salvatori et al. 2002. For Sarazm, see Isakov 1994; for its radiocarbon dates and metals, see Isakov, et al. 1987.

11. For the tin mines of the Zeravshan, see Boroffka et al. 2002; and Parzinger and Boroffka 2003.

12. Zaman Baba graves have been seen as a hybrid between Kelteminar and Namazga V/VI-type cultures, see Vinogradov 1960:80–81; and as a hybrid with Catacomb cultures on the supposition that Catacomb-culture people migrated to Central Asia, see Klejn 1984. I support the former. For recent debates over Zaman Baba, see E. Kuzmina 2003:215–216.

13. Lyonnet (1996) sees Sarazm IV ending during Namazga IV, or during the middle of the third millennium BCE. I see Sarazm ending in late Namazga V/early VI, based on the co-occurrence of Petrovka and late Sarazm pottery at Tugai, and on radiocarbon dates indicating that Sarazm III was occupied in 2400–2000 BCE, so Sarazm IV had to be later.

14. For skull type affiliations, see Christensen, Hemphill, and Mustafakulov 1996.

15. For BMAC, see Hiebert 1994, 2002. Salvatori (2000) disagreed with Hiebert, suggesting that BMAC began much earlier than 2100 BCE, and grew from local roots, not from an intrusion from the south, making the growth of BMAC more gradual. For the BMAC graves at Mehrgarh VIII, see Jarrige 1994. For BMAC materials in the Arabian Gulf, see Potts 2000, During Caspers 1998; and Winckelmann 2000.

16. For tin-bronzes in Bactria and lead-copper alloys in Margiana, see Chernykh 1992:176–182; and Salvatori et al. 2002. For the lead ingot at Sarazm, see Isakov 1994:8. For the Iranian background, see Thornton and Lamberg-Karlovsky 2004.

17. For horse bones in BMAC, see Salvatori 2003; and Sarianidi 2002. For the BMAC seal with the rider, see Sarianidi 1986. A few horses might have passed through the Caucasus into western Iran before 3000 BCE, indicated by a few probable horse teeth at the site of Qabrestan, west of Teheran; see Mashkour 2003. No definite horse remains have been identified in eastern Iran or the Indian subcontinent dated earlier than 2000 BCE. See Meadow and Patel 1997.

18. For the steppe sherds in BMAC sites, see Hiebert 2002. For the "Abashevo-like"sherds at Karnab, see Parzinger and Boroffka 2003:72, and Figure 49.

19. For Tugai, see Hiebert 2002; E. Kuzmina 2003; and the original report, Avanessova 1996. The talc temper in two pots, an indication that they were made in the South Ural steppes, is described in Avanessova 1996:122.

20. For Zardcha Khalifa, see Bobomulloev 1997; and E. Kuzmina 2001, 2003:224–225.

21. For the lead wires at Kuisak, see Maliutina and Zdanovich 1995:103. For the lapis bead and the grave at Krasnoe Znamya, see E. Kuzmina 2001:20.

22. For Srubnaya subsistence, see Bunyatyan 2003; and Ostroshchenko 2003.

23. For Chenopodium yields, see Smith 1989:1569.

24. For the Samara Valley Project, see Anthony et al. 2006. The results obtained here were replicated at Kibit, another Srubnaya settlement in Samara Oblast, excavated by L. Popova and D. Peterson, where there was no cultivated grain and many seeds of *Chenopodium*.

25. For the enormous Srubnaya mining center at Kargaly, see Chernykh 1997, 2004. For the mining center in Kazakhstan near Atasu, see Kadyrbaev and Kurmankulov 1992.

26. For stratigraphic relationships between Sintashta and Petrovka, see Vinogradov 2003; and Kuzmina 2001:9. The Petrovka culture was a transitional culture marking the beginning of the LBA. For Petrovka and its stratigraphic relationships to Alakul and Federovo, see Maliutina 1991. I would like to acknowledge the difficulty of keeping all these P-k cultures straight: on the middle Volga the MBA Poltavka culture evolved into final MBA Potapovka and then into early LBA Pokrovka, which was contemporary with early LBA Petrovka in Kazakhstan.

27. For the north-south movements of nomads in Kazakhstan, see Gorbunova 1993/94.

28. See Grigoriev 2002:78–84, for Petrovka metals.

29. For the Rostovka cemetery, see Matiushchenko and Sinitsyna 1988. For general discussions in English, see Chernykh 1992:215–234; and Grigoriev 2002:192–205.

30. For Seima-Turbino hollow-cast bronze casting and its influence on early China through the Qijia culture of Gansu province, see Mei 2003a, 2003b; and Li 2002. See also Fitzgerald-Huber 1995 and Linduff, Han, and Sun 2000.

31. See Epimakhov, Hanks, and Renfrew 2005 for dates. Seima-Turbino might possibly have begun west of the Urals and spread eastward. Sintashta fortifications might then be seen as a reaction to the emergence of Seima-Turbino warrior bands in the forest zone, but this is a minority position; see Kuznetsov 2001.

32. For Alakul and Federovo elements on the same pot, see Maliutina 1984; for the stratigraphic relations between the two, see Maliutina 1991. For radiocarbon dates, see Parzinger and Boroffka 2003:228.

33. E. Kuzmina 1994:207–208.

34. For Andronovo mines near Karaganda, see Kadyrbaev and Kurmankulov 1992; for mines near Dzhezkazgan, see Zhauymbaev 1984. For the estimate of copper production, see Chernykh 1992:212

35. For the Namazga VI pottery at Pavlovka, see Maliutina 1991:151–159.

36. For Andronovo sites in the Zeravshan, see Boroffka et al. 2002. For Tazabagyab sites on the former Amu-Darya delta, see Tolstov and Kes' 1960:89–132.

37. Hiebert 2002.

38. For the post-BMAC pastoral groups who made coarse incised ware, see Salvatori 2003:13; also Salvatori 2002. For the Vaksh and Bishkent groups, see Litvinsky and P'yankova 1992.

39. See Witzel 1995.

40. Books 2 and 4 of the *Rig Veda* referred to places in eastern Iran and Afghanistan. Book 6 described two clans who claimed they had come from far away, crossed many rivers, and gone through narrow passages, fighting indigenous people referred to as *Dasyus*. These details suggest that the Aryans fought their way into the Indian subcontinent from eastern Iran and Afghanistan. Although some new elements such as horses can be seen moving from Central Asia into the Indian subcontinent at this time, and intrusive pottery styles can be identified here or there, no single material culture spread with the Old Indic languages. For discussions, see Parpola 2002; Mallory 1998; and Witzel 1995:315–319.

41. For *Indra* and *Soma* as loan words, see Lubotsky 2001. Indra combined attributes that originally were separate: the mace was Mithra's; some of his epithets, his martial power, and perhaps his ability to change form were Verethraghna's; and the slaying of the serpent was the feat of the hero Thrataona, the Third One. The Old Indic poets gave these Indo-Iranian traits to Indra. The most prominent aspect of Indo-Iranian Verethraghna, the god of might/victory, was his shape-shifting ability, especially his form as the Boar. See Malandra 1983:80–81.

42. V. Sarianidi proposed that the people of the BMAC spoke Iranian. Sarianidi suggested that "white rooms" inside the walled buildings at Togolok 21, Togolok 1, and Gonur were fire temples like those of the Zoroastrians, with vessels containing *Ephedra*, *Cannabis*, and poppy seeds, which he equated with *Soma* (RV) or *Haoma* (AV). But examinations of the seed and stem impressions from the "white rooms" at Gonur and Togolok 21 by paleobotanists at Helsinki and Leiden Universities proved that the vessels contained no *Cannabis* or *Ephedra*. Instead the impressions probably were made by millet seeds and stems (*Panicum miliaceum*); see Bakels 2003. The BMAC culture makes a poor match with Indo-Iranian. The BMAC people lived in brick-built fortified walled towns, depended on irrigation agriculture, worshiped a female deity who was prominent in their iconography (a goddess with a flounced skirt), had few horses, no chariots, did not build kurgan cemeteries, and did not place carefully cut horse limbs in their graves.

43. Li 2002; and Mei 2003a.

Chapter 17. Words and Deeds

1. See Diamond 1997.

2. Hobsbawm 1997:5–6: "For history is the raw material for nationalist or ethnic or fundamentalist ideologies, as poppies are the raw material for heroin addiction. . . . This state of affairs affects us in two ways. We have a responsibility for historical facts in general and for criticizing the politico-ideological abuse of history in particular."

3. O'Flaherty 1981:69.