15 INDO-EUROPEAN AND INDO-IRANIAN WAGON TERMINOLOGY AND THE DATE OF THE INDO-IRANIAN SPLIT*

ALEXANDER LUBOTSKY

15.1 The Indo-European Wheel and Wagon Terminology

In the literature (e.g., Anthony 2007: 35–37), it is often stated that we can reconstruct five words of wheel and wagon terminology for Proto-Indo-European (PIE), viz. the words for 'wheel' (2×), 'axle', 'thill', and the verb 'to convey in a vehicle':

- PIE *k^wek^wlo- 'wheel' (Skt. *cakrá*-, YAv. *caxra*-, ON *hvél*, Gr. κύκλος; Toch. B *kokale* 'wagon');
- PIE **HrotHo*- 'wheel' (Lat. *rota*, OIr. *roth*, OHG *rad*, Lith. *rãtas* 'wheel', *rataĩ* pl. 'chariot'; Skt. *rátha*- and YAv. *raθa*- 'chariot');
- PIE *$h_2e\acute{k}s$- 'axle' (Skt. *ákṣa*-, Gr. ἄξων, Lat. *axis*, OE *eax*);
- PIE *h_2eiHs- 'pole, thill' (Skt. *īṣā́*-, YAv. *aēša*, Hitt. *ḫišša*-, Sln. *ojȇ*, Lith. *íena*; Gr. οἴαξ 'handle');
- PIE *ueg^h- 'to convey in a vehicle' (Skt. *vah*-, Av. *vaz*-, Gr. (Pamph.) ϝεχέτω, Lat. *uehō*, Lith. *vežù*, OCS *vezǫ*; OHG *wegan* 'to move').

This list can be extended with at least five more terms:

- PIE *iug- 'yoke' (Skt. *yugá*-, YAv. *yuua*-, Hitt. *iūk*-, Gr. ζυγόν, Lat. *iugum*, OS *juk*, OCS *igo*);
- PIE *$ieug$- 'to yoke, harness' (Skt. *yuj*-, Av. *yuj*-, Gr. ζεύγνῡμι, Lat. *iungō*, Lith. *jùngti*);
- PIE *d^hur- 'joint, pivot of the chariot pole and the yoke' (Skt. *dhúr*- 'joint of the chariot pole and the yoke, the pole and the yoke together', Hitt. *tūriie/a-^{zi}* 'to harness'), possibly identical with the word for 'door', if it originally meant 'pivot';
- PIE *h_3neb^h- 'wheel hub' (Skt. *nábhya*-, OPr. *nabis*, OHG *naba*);
- PIE *$ḱomieh_2$- 'yoke pin' (Skt. *śámyā*-, YAv. *simā*-, Arm. *samik'* 'pair of yoke sticks', *sametik'* 'yoke band' (unless an Iranian LW), Eng. *hame* 'horse collar', which has replaced the yoke with the pins rather recently).

The list calls for two comments. First, Anatolian attests only the terms for the yoke (Hitt. *iūk*-), for the pole (Hitt. *ḫišša*-), and for the connection of the two (Skt. *dhúr*- 'joint of the pole and the yoke', Hitt. *tūriie/a-^{zi}* 'to harness'). These terms, however, could also refer to the construction of sleighs or plows, which then is compatible with the idea that the Anatolians split off from the rest of the Indo-Europeans before the invention of the wheel.

Secondly, it is important that the other terms have a clear internal Indo-European etymology.

- PIE *k^wek^wlo- 'wheel' ~ PIE *$k^wel(H)$- 'to roam, move'. In the literature, it is often asserted that the verbal root originally meant 'to turn', but this can hardly be the case; cf. the meanings of Skt. *car^{i}*- 'to move, walk, go, wander; to perform', Av. *car*- 'to move, walk', Gr. πέλομαι 'to become, take place, be', and Lat. *colō* 'to live in, inhabit', as well as Gr. βου-κόλος m. and OIr. *bua-chail* m. 'cowherd'. We have to assume that the verbal root meant 'to roam (with cattle), to live a nomadic life', which in some languages developed into 'to live, to be'. The original meaning of *k^wek^wlo- with its reduplication was thus something like 'constantly roaming, moving'. The original four-wheeled wagons were also the mobile homes of the nomads.
- PIE **HrotHo*- 'wheel' ~ PIE **HretH*- 'to run'. Unfortunately, there is only one branch that preserves the verb, viz. OIr. *reithid* 'to run, speed', so we cannot be sure that this is the original meaning. If it was, then it is likely that **HrotHo*- was a 'runner' (cf. Gr. τροχός m. 'wheel', derived from τρέχω 'to run, hurry') and represented a lighter wheel that could be used on a two-wheeled wagon.
- PIE *$h_2e\acute{k}s$- 'axle' = 'armpit' (YAv. *aša*-, Lat. *axilla*, OE *eaxl*). The cognates show that the words for 'axle' and 'armpit' were originally identical; cf., on the one hand, Skt. *ákṣa*- 'axle' = YAv. *aša*- 'armpit' and, on the other, with an *l*-suffix, W. *echel*, ON *ǫxull* 'axle' = Lat. *āla* 'armpit, wing', *axilla*, OIc. *ǫxl*, OE *eaxl*, OHG *ahsala* 'armpit'. This means that the different suffixes in separate languages must be due to later disambiguation.
- PIE *h_3neb^h- 'wheel hub' = 'navel, belly button' (Skt. *nā́bhi*-, YAv. *nāfa*-, OHG *nabalo*, Gr. ὀμφαλός, Lat. *umbilīcus*). The same is true for this pair: the words were originally identical.
- PIE *$ḱomieh_2$- 'yoke pin/peg' ~ PIE *$ḱem$- 'hornless' (Skt. *śáma*- 'hornless'; ON *hind* f. 'hind, doe', Lith. *šmùlas* 'hornless, bald'; Russ. *komólyj* 'hornless'; Gr. κεμάς, -άδος f. 'young deer or dog'). As far as I know, this connection has not been made before, but it looks attractive if we assume that this term was coined by the wagon-makers who saw some resemblance between the yoke with its two pins and the head of an animal with two scurs or nub horns (Figs. 15.1 and 15.2).

* I would like to express my gratitude to David Anthony and Guus Kroonen for many discussions concerning the subject of this paper.

https://doi.org/10.1017/9781009261753.021 Published online by Cambridge University Press

FIGURE 15.1. Plowing oxen in Nepal (Dr. N. Kafle).

FIGURE 15.2. A young buck with nub horns (Buck Manager).

We see that the speakers of PIE tried to find ways to describe these new inventions, either by deriving new words from verbs or by invoking parallels with the bodies of animals or humans. We further often encounter body parts in chariot terminology in the separate IE languages, even though we cannot reconstruct these terms for Proto-Indo-European. For instance, the spoke of the wheel is called a 'shank' in Greek (κνήμη), a 'rib' in Khotan Saka (*pālsu*-); the linchpin of the wheel is called a 'hip' in Sanskrit (*āṇí*-, as the broadest part of the wagon; cf. Toch. B *oñi*- 'hip', and see Pinault 2003: 138–40 for more examples, including Skt. *ratha-mukhá*- 'front part of a chariot', lit. 'mouth of a chariot', and *ratha-śīrṣá*- 'id.', lit. 'head of a chariot').[1] All this seems to prove that the Indo-Europeans had developed these innovations themselves and did not borrow them.

[1] In a paper presented at the conference "The Atharvaveda and its South Asian Contexts. 3rd Zurich International Conference on Indian Literature and Philosophy," September 26–28, 2019, Laura Massetti pointed out that the parallel between the chariot and the human body was even used, in both Vedic and Greek, to compare the work of a physician who cures the body to that of a chariot maker who mends the chariot.

https://doi.org/10.1017/9781009261753.021 Published online by Cambridge University Press

15.2 Proto-Indo-Iranian (PIIr.) Chariot Terminology

Indo-Aryan and Iranian share the same word for 'battle chariot', which can be reconstructed for PIIr. as **HratHa-* (Skt. *rátha-*, YAv. *raθa-*, Khot. *rraha-*, etc.). This word is identical with one of the two IE words for 'wheel' discussed above.

We further have common PIIr. terms for 'charioteer', **HratHiH-* (Skt. *rathī́-*, OAv. *raiθī-*), and for 'chariot fighter', lit. 'standing on the chariot', **HratHai-štaH-* (Skt. *rathe-ṣṭhā́-*, YAv. *raθaē-štā-*). Possibly, the adjective **HratH-iHa-* 'belonging to the chariot' (with further specialization to 'chariot horse' in Vedic and to 'page, servant < groom' in Iranian) is of PIIr. date, but the suffix is productive, and we cannot be sure that this adjective is old. All these terms are derivatives from the word for 'chariot'. We may add here the PIIr. verb for 'to drive a chariot', PIIr. **HiaH-* (Skt. *yā-* 'to drive', Av. *yāman-* 'course') and PIIr. **Haua-saHana-* 'unharnessing of horses, resting place' (Skt. *avasā́na-*, OAv. *auuaŋhāna-*).

Further, there are three terms for (the straps of) the bridle or halter: PIIr. **HraćanaH-* (Skt. *raśanā́-* 'cord, bridle', MP (Pahl.) *lsn /rasan/* 'rope', and Arm. *erasan* 'bridle', an Iranian loanword; cf. also Skt. *raśmí-* 'rope, rein, leash' and *raśmán-* 'bridle', derived from the same root), PIIr. **Hiauktra-* (Skt. *yóktra-* 'thong, yoking cord', YAv. *°yaoxəðra-* 'halter, bridle'), PIIr. **Habʰi-dʰaHana-* (Skt. *abhidhā́nī-* 'horse halter', YAv. *zaraniiō. aiβiδāna-* 'with a golden bridle', Sogd. (Buddh.) *βδ"nh*, *βyδ'n* 'bridle', Khot. *byāna-* 'id.', Khwar.'*βz'n-* 'id.', Pash. *mlúna* 'id.', Yi. *awlān* 'id.', Sariq. *viδun* 'id.', Yazg. *avδén* 'bridle and bit'). The last word is especially interesting, as it seems to refer exclusively to horses, and the verb PIIr. **Habʰi-dʰaH-*, literally 'to put on or against', is specifically used for bridling or haltering horses, which may indicate a new technology.

The status of the chariot makers was very high in the Indo-Iranian society, so high indeed that the poets used to compare their craft to that of the carpenters. Both in Vedic and in Avestan, we often encounter expressions like 'to carpenter a song of praise' (Skt. *mántram takṣ-*, OAv. *mąθrəm tašaŋ*), 'to carpenter the speech' (Skt. *vácas- takṣ-*, YAv. *vacas-tašti-*), and a similar expression is also found in Greek (Pind.) ἐπέων . . . τέκτονες 'the carpenters of words'.

At the same time, it is conspicuous that we cannot reconstruct the PIIr. terminology for certain parts of the chariot, especially for its most essential part, the spoked wheel (including 'spoke', 'felly', 'rim'). This may partly be due to the paucity of Old and Middle Iranian texts, but the fact is that Skt. *ará-* 'spoke of a wheel', *nemí-* 'rim (of a wheel)', and *paví-* 'metal felly (of a wheel)' have no Iranian counterparts.

It follows that the Indo-Iranians knew the chariot and that they coined the names for the charioteer and the warrior/chariot fighter, which means that they were undoubtedly using the chariots for warfare already in PIIr. times.

It is hard to say how we must interpret the absence of detailed PIIr. terminology for the spoked wheel, because this would at any rate be an *argumentum ex silentio*. It is conceivable that the real progress leading to the sophisticated construction of the chariots was only achieved after the split, or that the technical improvements constantly triggered new names for the innovative elements.

Nevertheless, it seems reasonable to conclude that the Indo-Iranians did not stay together for a long time after the discovery of the battle chariot. Since the earliest true chariots known are from around 2000 BCE, the split must have taken place relatively soon after (see below).

15.3 Time Constraints for the Split of Proto-Indo-Iranian (PIIr.) into Two Branches

15.3.1 Proto-Indo-Iranian and the Sintashta–Petrovka Culture

There is growing consensus among both archaeologists and linguists that the Sintashta–Petrovka culture (2100–1900 BCE) in the Southern Trans-Urals was inhabited by the speakers of Proto-Indo-Iranian (cf. Anthony 2007: 408ff.; see also Epimakhov & Lubotsky in Chapter 16 in this volume). Since the first-ever light chariot that could be pulled by horses and used for warfare has been documented exactly in this archaeological culture, the terms for the charioteer and the chariot fighter discussed above cannot obviously be older than 2000 BCE.

The Sintashta–Petrovka culture was very compact in time and space, and it seems likely that its inhabitants spoke one language, but sometime around 1900 BCE, it ceased to exist and was continued by the Andronovo culture, with its huge spread to the south and the east. How can we interpret this linguistically?

15.3.2 Indo-Iranian Loanwords

As I have argued in a 2001 paper (see also Witzel 2003: 25ff.), there is a considerable layer of loanwords in Sanskrit and Iranian that must be of Proto-Indo-Iranian date. The form and the semantics of these loanwords lead to a number of important conclusions:

(a) Borrowed names for animals like camel, donkey, and tortoise show that the Indo-Iranians migrated in a southward direction.
(b) Borrowed terms for irrigation (canals and dug wells) and elaborate architecture (permanent houses with walls of brick and gravel) indicate a rich city culture.
(c) The Sanskrit and Iranian loanwords do not always match phonetically, which points to the dialectal disintegration of Proto-Indo-Iranian.
(d) Since a significant number of loanwords are of a cultic nature (gods or deities: **ćarua-*, **indra-*, **g$^{(h)}$and^{h}aru̯/b^{h}a-*; priests: **at^{h}aru̯an-*, **ućig-*, **r̥ši-* 'seer'; and **ancu-* 'Soma plant'), we must assume that the whole Indo-Iranian Soma/Haoma cult

https://doi.org/10.1017/9781009261753.021 Published online by Cambridge University Press

was borrowed, which could only be possible after a prolonged period of acculturation.[2]

(e) There are hardly any loanwords in the field of agriculture (only the word for 'bread'), which indicates that agriculture did not yet play an important role in the life of Indo-Iranians: presumably, they only used the products of the farmers, hardly tilling the land themselves.

The most likely candidate for the source of borrowing is the Bactria–Margiana Archaeological Complex (BMAC), which is the only rich city culture in the vicinity of Sintashta. It thus follows that a part of the Indo-Iranians, attracted by the riches of the BMAC, moved from Sintashta southward and started to interact with the BMAC people. Archaeologically, we can observe intensive contact between the Andronovans and the BMAC, and a recent genetic study (Narasimhan et al. 2019: 5) states, "We find no evidence of Steppe pastoralist-derived ancestry in groups at BMAC sites before 2100 BCE, but multiple outlier individuals buried at these sites show that by ~2100 to 1700 BCE, BMAC communities were regularly interacting with peoples carrying such ancestry."

Some of the Indo-Iranian borrowed terms may be directly compared with the BMAC artifacts. It is tempting to assume that the PIIr. word **gadā-* 'club, mace' refers to the characteristic mace-heads of stone and bronze abundantly found in BMAC towns, while PIIr. **u̯āćī-* 'ax, adze' may be identified with shaft-hole axes and ax-adzes of this culture (cf. also Parpola 2015).

Since it was the Indo-Aryans[3] who later moved further south, it seems attractive to assume that they were the first to establish contact with the BMAC, and developed and maintained this until the decline of the BMAC, which started in the seventeenth century BCE (for a recent discussion, see Luneau 2019). In those cases where Sanskrit and Iranian loanwords do not match phonetically (point (c) above), it is probable that the speakers of Sanskrit borrowed the word first and then transmitted it to the Iranians.

The next question is when the Indo-Aryans left Central Asia, and in order to answer this, let us look at where they went.

15.3.3 The Mitanni Aryans

The military elite of the Mitanni kingdom (of Aryan descent) was present in Syria and northern Iraq in the fourteenth century BCE and probably arrived there a few generations earlier, in the sixteenth to fifteenth century BCE. The language has a clear Indo-Aryan (rather than PIIr.) character, the most important argument being the word for 'one', Mitanni *a-i-ka-* (Sanskrit *eka-*) vs Iranian **ai-ua-* (for more details on this word, see now Lubotsky & Kloekhorst 2022). The point is that the formation with the suffix *-ka-* is found nowhere else and must be due to a typically Indo-Aryan innovation, whereas the Iranian suffix *-ua-* is also found in Greek οἶος < **Hoiuo-* (and in the Sanskrit particle *evá* 'thus', most probably of the same origin as Iranian **ai-ua-*).

15.3.4 The Arrival of Indo-Aryans in India

Archaeologically, Indo-Aryans have often been connected with the Gandhara Grave Culture in the Swat Valley (from 1600 BCE onwards), and this theory has now been corroborated by genetic evidence (Narasimhan et al. 2019). Interestingly, this evidence shows that "the source of this [= Steppe] ancestry is primarily from females in Late Bronze Age and Iron Age individuals from the Swat District" (p. 9), which is an indication of a large-scale migration, including women. As to the arrival of Steppe ancestry in the region, geneticists "estimate the date of admixture into the Late Bronze Age and Iron Age individuals from the Swat District of northernmost South Asia to be, on average, twenty-six generations before the date that they lived, corresponding to a 95% confidence interval of ~1900 to 1500 BCE" (p. 10).

Finally, it follows from the genetic studies that the Kalash, a group in northwest South Asia, speakers of a Dardic language, has the highest proportion of Steppe ancestry. It thus seems likely that they just stayed there when other Indo-Aryans moved further south, and the same was probably true for the Nuristani people, if we combine these findings with the linguistic evidence that the Nuristani languages are closely related to Indo-Aryan (I refer especially to the important 2016 article of Chlodwig Werba).

15.3.5 The Oldest Texts

We see that the Indo-Aryans move southward around the sixteenth century BCE and arrive in the Near East and in the Swat Valley almost simultaneously. It is probably not accidental that this date coincides with the decline of the BMAC: the profound changes in the economy of the BMAC forced the Indo-Aryan pastoralists to look for new markets.

The definitive split in Proto-Indo-Iranian language unity can thus be dated to the sixteenth century BCE, although dialectal differentiation must have begun earlier. This date is further compatible with the chronology of the oldest Indo-Iranian texts, the Rigveda and the Avesta.

The Rigveda is usually dated between 1200 and 1000 BCE, which seems a reasonable estimate to me, although it must be said that we can only rely on the internal chronology of the Vedic texts and some indirect evidence. For instance, as argued by Parpola in a recent article (2019), the Sanskrit word for 'mirror', *ādarśa-*, only appears in the texts since the Upaniṣads. It is likely that the mirror was introduced into India by the Persians, during the conquest of the Indus Valley by Darius in 519 to 518 BCE, which would mean that the early fifth century BCE is a *terminus post quem* for the Upaniṣads. The Upaniṣads are relatively young Vedic texts (the internal

[2] This is the reason why the route of Indo-Aryans through the Altai, as indicated on the map in Narasimhan 2019, is improbable.

[3] I use the term "Indo-Aryan" for the Indo-Iranian dialect that shows typical traits of the later Indo-Aryan languages, even though the term is unfortunate, because the "Indo-Aryans" of Central Asia and of the Mitanni kingdom were most probably never in India. The same is true, mutatis mutandis, for Iranian.

https://doi.org/10.1017/9781009261753.021 Published online by Cambridge University Press

chronology being: Upaniṣads < Śrauta-Sūtras < Āraṇyakas < Brāhmaṇas < Yajurveda mantras < Atharvaveda mantras and book X of the Rigveda < the Family Books of the Rigveda), and if they were indeed composed in the fifth century BCE, the Family Books of the Rigveda must have been at least five centuries older. On the basis of geographical names mentioned in the Rigveda, we can be sure that the bulk of the hymns were composed in the Punjab.

I do not see sufficient reason for dating the Rigveda much older than 1200 BCE, although this cannot be excluded either. It is sometimes assumed (cf. Witzel 2001: 5–6) that the Atharvaveda, the second oldest Sanskrit text, must be dated between 1200 and 1000 BCE, because we there find a mention of *śyāmám áyas* 'dark metal' (presumably, iron), while the Iron Age starts in India around this time. Even if *śyāmám áyas* indeed refers to iron (it could, for instance, also be bronze), the occurrence of iron in the Atharvaveda would set only a *terminus post quem* for this text. It is therefore perfectly feasible that the Atharvaveda was, for instance, created between 900 and 800 BCE, and the Rigveda between 1200 and 1000 BCE.

It must be stressed, however, that both the Rigveda and Atharvaveda are collections of texts from various periods, with a possible difference of up to several centuries, so it is not very useful to talk about *the* date of these collections: we can only try to establish the date of their final redaction. It is thus imaginable that some of the Rigvedic hymns were composed earlier than 1200 BCE, and not yet even in the Punjab, but in Central Asia.

The oldest text in an Iranian language is the Avesta, in particular the Gāthās of Zarathuštra, which can also be dated approximately to 1000 BCE. The language of the Rigveda and that of the Avesta are quite similar, and it is even conceivable that at the time of the creation of their oldest parts, the two languages were still mutually intelligible. This means that the separation must have taken place not very long before, and the sixteenth century BCE would be quite fitting.

15.3.6 Indo-Iranian Loanwords in Uralic

Uralic has borrowed – rather extensively – from Proto-Indo-Iranian and, later, from Iranian. To my mind, the arguments in favor of Uralic loanwords from Indo-Aryan (rather than from Proto-Indo-Iranian or Iranian) presented by Asko Parpola in recent publications (most recently, Parpola 2017) are not convincing. When Indo-Aryans separated from the Iranians, they were already at the south of the BMAC and could not have had any contact with Uralic.

15.3.7 The Language of the BMAC and the Language of the Punjab

If we look at the loanwords that are found in the language of the Rigveda (for which see Kuiper 1991), we see a considerable number of agricultural terms: *lā́ṅgala-* 'plow', *sī́rā-* 'plowshare', *kīnā́ra-* and *kīnā́śa-* 'plowman', *ū́rdara-* 'granary', *khārī́-* 'measure of grain', *khála-* 'threshing floor', *odaná-* 'rice dish', and *tílvila-* 'fertile', as well as *ɻbī́sa-* 'oven', *ulū́khala-* 'mortar', *kārotará-* 'sieve', *mū́la-* 'root', *phála-* 'fruit', *púṣpa-* 'flower', *píppala-* 'sweet fruit', *urvāruká-* 'cucumber', etc. This layer signals a change in the lifestyle of the Indo-Aryans and the growing importance of agriculture in their subsistence.

A remarkable feature of the Rigvedic loanwords is that they are structurally very close to those found in Proto-Indo-Iranian, which we have discussed above, §15.3.2. This means that the language spoken in the BMAC and the language spoken in the Swat Valley and the Punjab were quite similar, if not identical (cf. Lubotsky 2001: 305). The similarity of the two languages is all the more surprising as the BMAC and the Indus Valley Culture do not have much in common either archaeologically or genetically, and it seems unlikely that their inhabitants spoke the same language.

It therefore seems worthwhile to seriously consider another scenario.[4] As already mentioned in §15.3.5, the southward movement of the Indo-Aryans was simultaneous with the decline of the BMAC and was probably triggered by it. In the situation of an economic and political crisis, it is only to be expected that in their movement, the Indo-Aryans were joined by a sizable group of BMAC people, who would bring their culture and agricultural lifestyle with them.

This scenario may account for the prolonged contact between the Indo-Aryans and the BMAC people in the Swat Valley and the Punjab and, consequently, for a large number of loanwords when the Indo-Aryans started to get settled and to learn agriculture. At the same time, it perfectly explains the fact that "intrusive BMAC material is subsequently found further to the south in Iran, Afghanistan and Pakistan" (Mallory & Adams 1997: 73), without the improbable assumption that the Indo-Aryans had adopted the culture of the BMAC in Central Asia, which led Mallory to postulate his famous *Kulturkugel* (Mallory 1998: 192–3). As we know from major people movements of the past, they were often multiethnic, and a joint movement of Indo-Aryans and BMAC people would not be surprising at all.

15.4 Conclusions

On the basis of linguistic evidence, we can make the following chronological inferences:

(a) Proto-Indo-European wagon terminology, shared by the Anatolians, can refer to the construction of sleighs or plows and can thus predate the invention of the wheel. All other terms have a clear internal Indo-European etymology, which is a strong indication that the Indo-Europeans had developed these innovations themselves and did not borrow them.
(b) Indo-Aryan and Iranian share not only the same word for 'battle chariot', but also the terms for 'charioteer' and for

[4] This scenario has been suggested to me by my colleague Maarten Kossmann.

https://doi.org/10.1017/9781009261753.021 Published online by Cambridge University Press

'chariot fighter' (lit. 'standing on the chariot'), which means that they were already using the chariots for warfare in PIIr. times and that the split of Proto-Indo-Iranian must necessarily postdate 2000 BCE (the earliest known battle chariots of the Sintashta–Petrovka culture).

(c) Proto-Indo-Iranian loanwords show that a part of the Indo-Iranians, attracted by the riches of the BMAC, moved from Sintashta southward and started to interact with the BMAC people. At a later stage, when the BMAC started to decline (17–16th century BCE), the Indo-Aryans moved further south: both to the southwest (Mitanni) and to the southeast (the Swat Valley). It seems probable that in the latter movement, they were joined by a part of the BMAC population.

References

Anthony, David. 2007. *The horse, the wheel, and language: How Bronze-Age riders from the Eurasian steppes shaped the modern world*. Princeton: Princeton University Press.

Kuiper, F. B. J. 1991. *Aryans in the Rigveda*. Amsterdam: Rodopi.

Lubotsky, Alexander. 2001. The Indo-Iranian substratum. In: Christian Carpelan, Asko Parpola, & Petteri Koskikallio (ed.), *Early contacts between Uralic and Indo-European: Linguistic and archaeological considerations. Papers presented at an international symposium held at the Tvärminne Research Station of the University of Helsinki 8–10 January 1999* (Mémoires de la Société Finno-Ougrienne 242), 301–317. Helsinki: Suomalais-Ugrilainen Seura.

Lubotsky, Alexander, & Alwin Kloekhorst. 2022. Indo-Aryan °*(a)ṷartanna* in the Kikkuli-treatise. In: H. Fellner, M. Malzahn, M. Peyrot (ed.), *lyuke wmer ra. Indo-European Studies in honor of Georges-Jean Pinault*, 331–336. Ann Arbor, New York: Beech Stave Press.

Luneau, Élise. 2019. Climate change and the rise and fall of the Oxus Civilization in Southern Central Asia. In: L. E. Yang et al. (ed.), *Socio-environmental dynamics along the historical Silk Road*, 275–299. Heidelberg: Springer.

Mallory, James P. 1998. A European perspective on Indo-Europeans in Asia. In: Victor Mair (ed.), *The Bronze Age and Early Iron Age peoples of Eastern and Central Asia*, 175–201. Washington, DC: Institute for the Study of Man.

Mallory, James P., & Douglas Q. Adams. 1997. *Encyclopedia of Indo-European culture*. London: Fitzroy Dearborn.

Narasimhan, Vagheesh M. et al. 2019. The formation of human populations in South and Central Asia. *Science* 365: eaat7487.

Parpola, Asko. 2015. The Mohenjo-daro axe-adze, a vestige of Aryan migration into the Indus Valley? *Current World Archaeology* 74: 14–5.

2017. Finnish *vatsa* ~ Sanskrit *vatsá-* and the formation of Indo-Iranian and Uralic languages. *SUSA/JSFOu* 96: 245–286.

2019. The mirror in Vedic India: Its ancient use and its present relevance in dating texts. *Studia Orientalia Electronica* 7: 1–29.

Pinault, Georges-Jean. 2003. Sanskrit *kalyāṇa-* interprété à la lumière des contacts en Asie centrale. *Bulletin de la Société Linguistique de Paris* 98(1): 123–161.

Werba, Chlodwig. 2016. Ur(indo)arisches im Nūristānī: Zur historischen Phonologie des Indoiranischen. In: Andrew M. Byrd, Jessica DeLisi, & Mark Wenthe (ed.), *Tavet Tat Satyam: Studies in honor of Jared S. Klein on the occasion of his seventieth birthday*, 341–359. Ann Arbor & New York: Beech Stave Press.

Witzel, Michael. 2001. Autochthonous Aryans? The evidence from Old Indian and Iranian texts. *Electronic Journal of Vedic Studies* 7(3): 1–115.

2003. Linguistic evidence for cultural exchange in prehistoric Western Central Asia. *Sino-Platonic Papers* 129: 1–70.