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Этот сборник статей посвящён 80-летию молдавского археолога Валентина Дергачева, исследователя древней истории Восточной и Юго-Восточной Европы, автора более 160 работ по неолиту, энеолиту и эпохе бронзы региона, из которых 25 – монографические исследования. Книга неслучайно названа строчкой из Горация, который обескураживает Мельпомену тем, что «памятник себе воздвиг прочнее меди». Хотя что может быть прочнее меди и недолговечнее монументов? В этом смысле судьба памятников, об охране которых заботился Валентин Анисимович, сходна с участью многих научных текстов. Их часто сносят, отправляют на помойку или переплавляют в новые. При этом сама медь, которой так увлечённо занимался всю свою карьеру Дергачев, использовалась в человеческой культуре тысячелетиями. Как и хорошие научные тексты, которые, как правило, надолго переживают своих создателей и становятся фундаментом для открытий следующих поколений. Наш сборник объединяет работы исследователей из Молдовы, Румынии, Болгарии, Украины, России, Грузии, Таджикистана, Азербайджана, Польши, Германии, Италии, Финляндии, Испании, Канады и США.

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HIGH ANTHROPOLOGICAL SCHOOL UNIVERSITY

AERE PERENNIUS. MORE LASTING THAN BRONZE

Essays in honour of Valentin Dergachev on the occasion of his 80th birthday

Edited by
Lilia Dergacheva

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2023

80-летию

Валентина Анисимовича Дергачева

посвящается

This issue to 80th anniversary
of Valentin A. Dergachev

С О Д Е Р Ж А Н И Е

AD GLORIAM

НЕОЛИТИЗАЦИЯ ЕВРОПЫ

О СКИПЕТРАХ, ЛОШАДЯХ И ВОЙНЕ

ОТ БАЛКАН ДО ГИМАЛАЕВ: ВРЕМЯ ЦИВИЛИЗАЦИЙ

МЕТАЛЛИЧЕСКИЕ ИЗДЕЛИЯ И ГЕНЕЗИС КУЛЬТУР

МОЛДАВИЯ И СОСЕДНИЕ ТЕРРИТОРИИ В ЭПОХУ БРОНЗЫ

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P. Biagi, R. Nisbet

Mining Bronze Age Stone Resources: Some examples from the Caucasus (Georgia) and Sindh (Pakistan)

Keywords: Bronze Age, Complex Societies, Mining, Obsidian, Chert, Caucasus, Sindh

Ключевые слова: бронзовый век, сложные сообщества, горное дело, обсидиан, кремень, Кавказ, Синд

P. Biagi, R. Nisbet

Mining Bronze Age Stone Resources: Some examples from the Caucasus (Georgia) and Sindh (Pakistan)

This paper regards the exploitation of knappable stone resources during the 3rd mill. BC in the mountains of the Caucasus and the desert landscapes of Upper Sindh (Pakistan). Here are located two of the most important stone mining fields of the Bronze Age, which started to be exploited when two very different complex societies developed in these regions. The paper examines the reasons why knappable stones, obsidian and chert, were exploited in a period during which metal was already in use in both areas and why stone resources continued to be so important in the economy of greatly developed Bronze age societies. Moreover, comparisons are made with other Bronze Age centres of Eurasia, where the employment and trade of stone material contributed to the development and wealth of complex urban societies.

П. Бьяджи, Р. Нисбет

Выработка залежей камня бронзового века: некоторые примеры с Кавказа (Грузия) и из Синда (Пакистан)

В этой статье рассматривается использование ресурсов камня в III тыс. до н.э. в горах Кавказа и пустынных ландшафтах Верхнего Синда (Пакистан). Здесь находятся два наиболее важных месторождения камня, которые начали эксплуатироваться, когда в этих регионах развивались два очень разных сложных общества бронзового века. В статье поднимается ряд вопросов, а именно: почему пригодные для обработки камни обсидиан и кремень продолжали добываться в то время, когда металл уже использовался в обоих регионах, и почему каменные ресурсы продолжали играть столь важную роль в экономике высокоразвитых обществ бронзового века. Кроме того, проводится сравнение с другими центрами бронзового века Евразии, где использование и торговля камнем способствовала развитию и богатству сложных городских обществ.

1. Introduction (P. B.)

"*… man has learned that certain kinds of stone may be compelled by heating under suitable conditions to yield a substance which, while hot, can be modelled or even run into a mould, but on cooling retains its shape and becomes harder and more durable than stone and takes as good an edge*" (Childe 1930: 1). This statement followed, ca sixty years later "*the Bronze Age, in which bronze was used for arms and cutting instruments of all kinds*" (Lubbock 1865: 23). We know that knappable raw materials were still in use during the metal ages in both Western Europe and the Levant (see Milevski 2013; Lech et al. 2015; Healy et al. 2018; Manclossi et al. 2018), though, as far as we know, only in the central Aegean their exploitation was linked with the development of complex urban societies (Tsampiri 2018: 39).

Why were knappable stones, in our case chert and obsidian, exploited by complex Bronze Age (urban) civilizations (McLaren 2008: 155)? Why were their inhabitants driven to search, mine and trade them, manufacture different types of technologically sophisticated everyday use artefacts, weapons, unique tools employed by artisans and peasants, and also grave goods (Piperno 1973; Carter 1993; Méry 1994; Shanshashvili 2004; van Gijn 2010)? Apart from utilitarian purposes, did chert and obsidian have any other meaning

in those times (Nicolas, Guéret 2014; Horowitz, McCall 2019; Lech, Werra 2019)?

Since the 1950s we know that copper was exploited in the Indus Valley and Pakistani Balochistan already during the Chalcolithic (Gordon 1950), when the Amri culture developed in Sindh (Casal 1964; Fairservis 1975: 175; Biagi 2005). Two charcoal radiocarbon dates from the type-site of Amri attribute it to the second half of the 4th mill. BC (4710 ± 110 BP, 3489 ± 120 BC at 1σ (TF-863); and 4485 ± 110 BP, 3178 ± 158 BC at 1σ (TF-864)) (Agrawal et al. 1971). In this period, chert knapping technology reached its apex in both Sindh and part of Balochistan, and we assisted for the first time in the production of prismatic blades obtained by metal punch pressure technique (Pelegrin 1994; Lechevallier 1979; 2003). According to some authors, technological skill started to decline around the middle of the following millennium (Cleland 1987), although this opinion can be questioned on the basis of more recent evidence (Gadekar et al. 2014). So far, these processes have been poorly investigated in South Asia (Raczek 2010: 233), though we have interesting examples in the Levant (Rosen 1997). We know that also in the Central Mediterranean, quarrying, manufacturing, storing, and trading knapped stone resources, obsidian in this case, played an important role in the development of a wealthy Bronze Age society (Torrence 1986: 99).

This is the case for the island of Melos, where "*the increasing use of bronze implements went hand in hand with an increasing use of obsidian, which yielded razors and knives sharper and cheaper than any that could be made in metal*" (Bosanquet 1904: 230). The surprising discovery of a factory of obsidian implements in the fortified, urban settlement of Phylakopi (Smith 1897: 17) consisted in a "*waste-heap of obsidian cores, chips, and flakes at the W. end of the site in B. C 5. The existence of this great obsidian deposit affords us an important clue, not only as to the probable causes which chiefly contributed to the original settlement of Phylakopi, but also as to the chief source of the prosperity which made Phylakopi afterwards for a time perhaps the most important site in the Cyclades*" (Mackenzie 1904: 244). This discovery led some authors to think that obsidian was a very important material in the economy of the Bronze Age Aegean world. This fact is supported by the discovery of the Malia workshops in Crete (Carter, Kilikoglou 2007), though in the Aegean, as well as in the Indus Valley, we do not have any clear evidence of the presence of hierarchically structured organizations (Rahmstorf 2012: 321). However, this view was questioned after the systematic analysis of the Demenegaki and Sta Nychia extraction areas on the island of Melos (Torrence 1984) (fig. 1).

Given the above premises, in this paper the procurement and exploitation of obsidian in the Lesser Caucasus and chert in the Indus Valley in Pakistan during the Bronze Age are in the focus. In these two regions, important 3rd mill. BC civilizations developed in very contrasting environmental and climatic zones: the Caucasian mountains of Georgia with their cool and continental climate (Kohl 2007), and the semi-desert landscapes of Sindh, crossed by the River Indus (Marshall 1931). Interestingly enough, these two regions fall within the limits of what some authors call "The Bronze Age World System" whose extension "*stretches from the eastern Mediterranean in the west to the Indus Valley in the east*" (Frank 1993: 390).

Knappable stone material was mined in both territories. This activity undoubtedly involved complex exploitation strategies, including planning, testing, preliminary manufacturing, transport, and distribution (Vidale 2000: 36; Miller 2006). One of the main questions is: why, when, and how long did it last? According to the results obtained from the excavations carried out over roughly a century, the evidence for obsidian and chert artefacts yielded by Bronze Age settlements and cemeteries of this age is comparatively scarce (Carter 1993; Davis 2019). Their occurrence can hardly be compared with the number and quantity of cobbles, cores, artefacts, debitage flakes, debris, and fragments one can observe on the surface of every area that shows "*the procedures involved in quarrying* (mining) and *the quantity of rejected material*" (Ericson 1984: 2).

2. The Georgian Caucasus (P. B. & R. N.)

Obsidian sources are numerous in the Caucasus and Anatolia (Badalyan 2010; Karapetyan et al. 2010; Düring, Gratuze 2013; Frahm, Feinberg 2013). However, little is known of the exact origin of the raw material and the techniques employed to extract it in different periods of prehistory. During the Bronze Age a few cultural aspects developed in the Southern Caucasus among which are those of Kura-Araxes (Kushnareva 1997; Rothman 2015; Palumbi 2016), Bedeni (Gobedzhishvili 1980; Bertram 2010; Makharadze 2016a), and Trialeti (Куфтин 1941). According to the available radiocarbon dates, the beginning of the first should fall around the middle of the 4th mill. BC, and continued at least till the first centuries of the 3rd mill. BC (Badalyan 2014; Passerini et al.

Fig. 1. Distribution of the most important sites mentioned in the text: 1 — Mt. Chikiani; 2 — Rohri Hills; 3 — Melos; 4 — Mallia; 5 — Bedeni and Trialeti; 6 — Amri; 7 — Kot Diji; 8 — Mohenjo-Daro; 9 — Lakhueen-jo-Daro; 10 — Harappa (drawing by P. Biagi).

Рис. 1. Распределение наиболее важных памятников, упомянутых в тексте: 1 — Гора Чикиани; 2 — Холмы Рохри; 3 — Мелос; 4 — Маллия; 5 — Бедени и Триалети; 6 — Амри; 7 — Кот Диджи; 8 — Мохенджо-Даро; 9 — Лахуен-джо-Даро; 10 — Хараппа (карта П. Бьяджи).

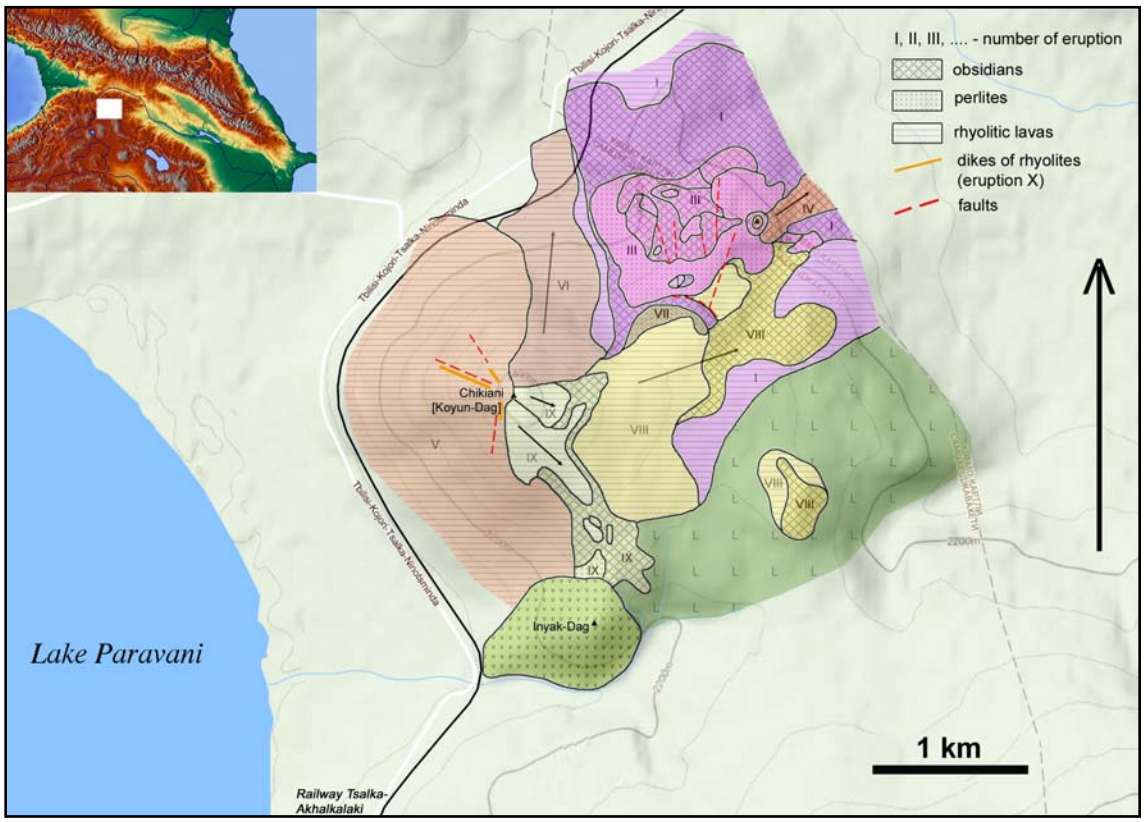

Fig. 2. Mt. Chikiani: I—VIII — obsidian flows and other formations (from Nasedkin et al. 1983: fig. 1).

Рис. 2. Гора Чикиани: I—VIII — обсидиановые потоки и другие образования (по Наседкин и др. 1983: рис. 1).

2016; Alizadeh et al. 2018). A new radiocarbon date from *kurgan* 5 of Bedeni cemetery informs us that this Bedeni culture funerary structure was used around the middle of the 3rd mill. BC (3940±35 BP, 2430±60 BC at 1σ (GrA-69636), on *Cornus mas* stone: $\delta^{13}C$ –27.10). In this period, metallurgy and precious ore mining started to be practised in the Lesser Caucasus, and differentiation in social organization appeared (Stöllner 2016).

Mt. Chikiani (2417 m) is a volcanic dome rising from the north-western edge of the Javakheti Highland, dominating the north-eastern shore of Lake Paravani (Tsalka District, South Georgia). Its gentle morphology, the very easy access to its environmental resources, and its proximity to Trialeti, one of the key sites of the eponymous culture (Куфтин 1941), account for its relevance as a primary obsidian source. By means of different geological (Lebedev, Vashakidze 2015) and geochemical (Biagi, Gratuze 2016) techniques, several obsidian/rhyolite flows, covering the northern and north-eastern side of the cone, from its top to the base (fig. 2) have been located and characterized. At present, the large deposits of perlite outcrops on the upper slope of the mountain are heavily exploited for industrial purposes (Наседкин и др. 1983).

The surveys conducted between 2012 and 2019 along the slopes of Mt. Chikiani and its surroundings led to the discovery of an impressive number of archaeological sites, which provide us with a reliable background in which the local economy developed. Many consist of groups of obsidian mining fields, mine-pits, workshops and test-spots in correspondence with different lava flows that originated between 2.8 and 2.4 Myr (Le Bourdonnec et al. 2012; Nomade et al. 2016). Many other types of sites were also found. They consist of stone-walled villages, andesite/basalt quarries, different types of megalithic monuments and *kurgans*, one fortress constructed on top of a volcanic cone facing Lake Paravani, known as Inyak Dağ, and one *menhir* that marks the south-western boundary of the mining area (Biagi et al. 1917a; Biagi, Nisbet 2018). All these structures seem to be somehow related to obsidian mining that, given the altitude of the highland, was most probably carried out during the summer season.

The analysis of more than 180 obsidian flakes and bombs sampled from different mining areas,

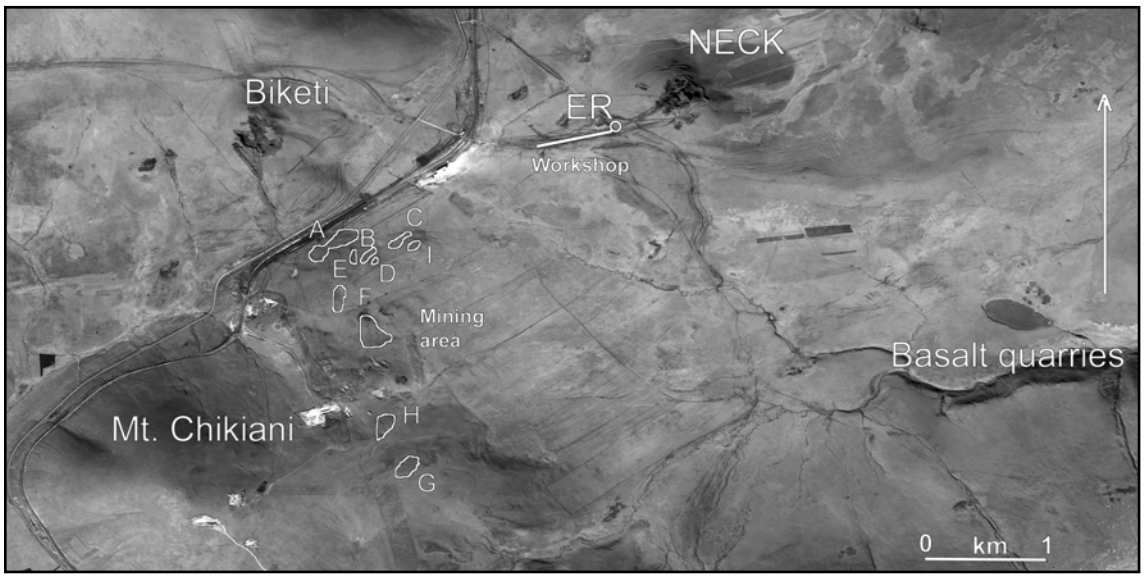

Fig. 3. Mt. Chikiani: A — I — Location of the main groups of obsidian mine-pits and the workshop ER between Mt. Chikiani and the hillock called NECK (drawing by P. Biagi).

Рис. 3. Гора Чикиани: A — I — расположение основных групп обсидиановых карьеров и мастерской ER между горой Чикиани и пригорком под названием NECK (фотография П. Бьяджи).

workshops and other sites located within a radius of ca 10 kms from Mt. Chikiani, shows that three different sources were exploited, characterised by a continuous variation of Ba and Zr concentrations (Biagi et al. 2017b). The technique employed for their analysis is the Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). It is an almost non-destructive method employing elements, such as zirconium, yttrium, niobium, barium, strontium, cerium, lanthanum, and titanium, that seems to be the most powerful to establish a discrimination between different obsidian outcrops (Chataigner, Gratuze 2014a; 2014b; Biagi, Gratuze 2016).

The 2016 season saw the discovery of a few large mining fields along the northern and north-western lower slopes of the volcano (fig. 3), and a few obsidian workshops (Biagi et al. 2017b). Some of the mine pits, barely discernible from the ground, are clearly visible from the air due to the different colour of the grass cover (fig. 4). They were recorded by GPS, taking their maximum and minimum diameters and depth. Many other pits were later discovered by monitoring high-resolution satellite photographs. Almost 250 circular and oval pits were recorded on the ground, though their number is undoubtedly much higher. The smallest is 3—4 m in diameter, and the larger ones are up to 10 m. Their medium depth does not exceed 2 or 3 m, with a few attaining 4 m. Small heaps of obsidian debitage flakes were noticed on the raised lips all around their openings, where also a few blades and polyhedral blade cores were recorded. As far as we know, these structures do not find comparisons from any other obsidian source in the Caucasus and Europe in general, and they strongly resemble the obsidian mines in Hidalgo in Mexico described more than a century ago (Holmes 1900). The extension of the mining area is difficult to assess, though an approximated estimate of 5 square km (500 ha) should not be too far from the truth.

At present, we lack any chronological data to interpret whether the different groups of pits are contemporary or not. However, given the number and extension of the features, we may suggest an activity lasting on a multi-decennial or secular scale. We know from the characterization of artefacts sampled from several sites that Chikiani obsidian was exploited at least since the end of the Middle Palaeolithic up to Historic times (Le Bourdonnec et al. 2012; Tetruashvili 2019). The on-site data retrieved from our surveys show that the area was settled since the Palaeolithic (Kikodze, Koridze 1978; Biagi, Nisbet 2019), though a much larger human presence is attested during the metal ages. Most of the megalithic structures, *kurgans*, mining fields, and obsidian artefacts found along wide erosion canals across the pastures are to be attributed to the latter period.

A circular stone platform ca 5 m in diameter, delimited by large boulders, was accidentally found inside one of the erosions opened along the south-western slope of a nameless hillock called

Fig. 4. Mt. Chikiani: A group of mine pits of area A from which the colour variability is very clear (drone photograph by M. Ferrandi 2017).

Рис. 4. Гора Чикиани: группа шахтерских ям района А, по которым хорошо просматриваются цветовые различия (фотография с дрона, сделанная М. Ферранди 2017).

NECK in our records. The platform was covered with obsidian blocks, and primary and debitage flakes showing that the structure had been used first to heap raw material supplies, and then as a knapping floor (Biagi, Nisbet 2018: fig. 2). This activity resulted in the occurrence of thousands refuse artefacts scattered along a gentle slope ca 800 m long (fig. 5), from which also a few retouched tools were recovered, as well as one proximal segment of a pressure-flaked polyhedral core (Crabtree 1968). This evidence contrasts with the recurrent presence of polyhedral blade cores obtained by indirect percussion recovered from the mining fields located ca 2—2.5 km to the southwest (Biagi et al. 2017b: fig. 8). The presence of one characteristic Bedeni culture winged arrowhead with a concave base of type II —9 of A. Orjonikidze's typological list (Orjonikidze 2004: 53), a few unfinished bifacial spearheads, and two oval rough-outs show that one of the activities performed at the site was the manufacture of different types of bifacial arrows, which took place most probably around the middle of the 3rd mill. BC. Among the other tools are a few long end scrapers, side scrapers, unretouched and retouched blades with a trapezoidal or triangular cross-sections, one medial fragment of a prismatic blade of exogenous flint with very fine lamellar, unifacial flat retouch along one side, and scrape wood traces of wear along the other, fragments of basalt or andesite pestles, and a few ceramic potsherds (fig. 6).

The presence of knapped stone arrowheads is definitely not unusual to the Bronze Age societies of Eurasia (Skakun 2003: 151), and in particular of the north Pontic cultures neighbouring the Caucasus, where they often recur within the same burial complex or *kurgan*, sometimes together with other weapons made of metal (Razumov 2011).

More problematic features are represented by two ca 100 m long parallel rows of stone-walled, well-preserved, apsidal, semi-subterranean rooms discovered near the top of Seyttapa. This lower andesitic cone that elevates some 10 km east of Mt. Chikiani (Biagi, Nisbet 2018: fig. 5). Very similar structures have been described in the Caucasus in Armenia, radiocarbon-dated to different periods of the Bronze and Iron Ages (Badalyan et al. 2008; Reinhold 2016).

3. The Rohri Hills (Sindh, Pakistan) (P. B.)

The Rohri Hills are the earliest chert workshops ever discovered in Sindh (Pakistan) in the 1880s (Biagi 1997). However, H. De Terra and T. T. Paterson were the first to discuss

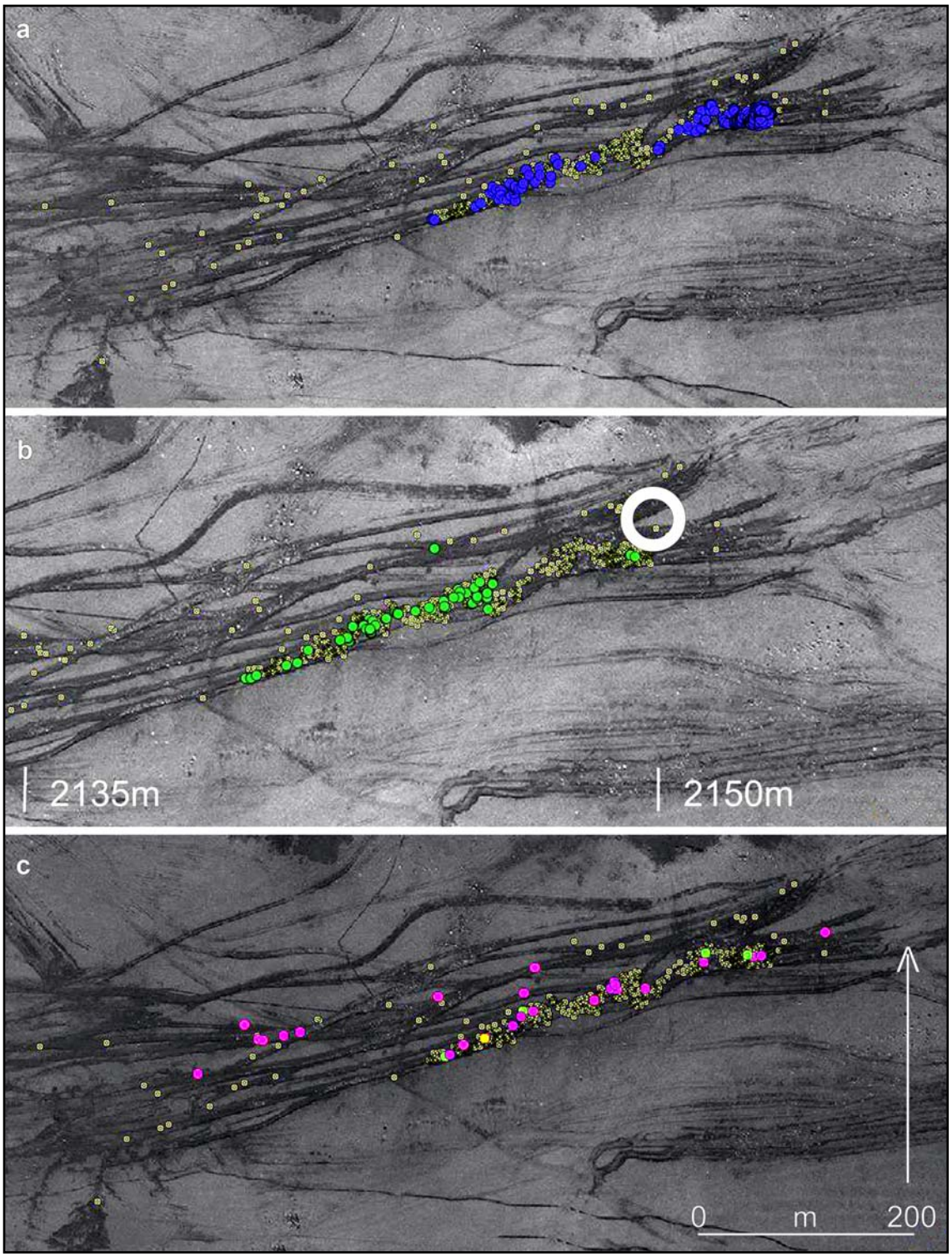

Fig. 5. Mt. Chikiani: Distribution of the mapped artefacts along the ER erosion (small yellow dots). a — Blocks (blue dots), b — Cores (green), c — laminar artefacts: bladelets (violet), microbladelets (green), hypermicrobladelet (orange). The circle shows the approximate location of the circular stone platform (drawing by R. Nisbet and P. Biagi).

Рис. 5. Гора Чикиани: Распределение артефактов вдоль эрозии ER на карте (мелкие желтые точки). a — блоки (синие точки); b — нуклеусы (зеленые точки); c — ламинарные артефакты: пластины (фиолетовые), микропластины (зеленые), гипермикропластины (оранжевые). Кружком обведено примерное расположение концентрической каменной пластины (иллюстрация Р. Нисбет и П. Бьяджи).

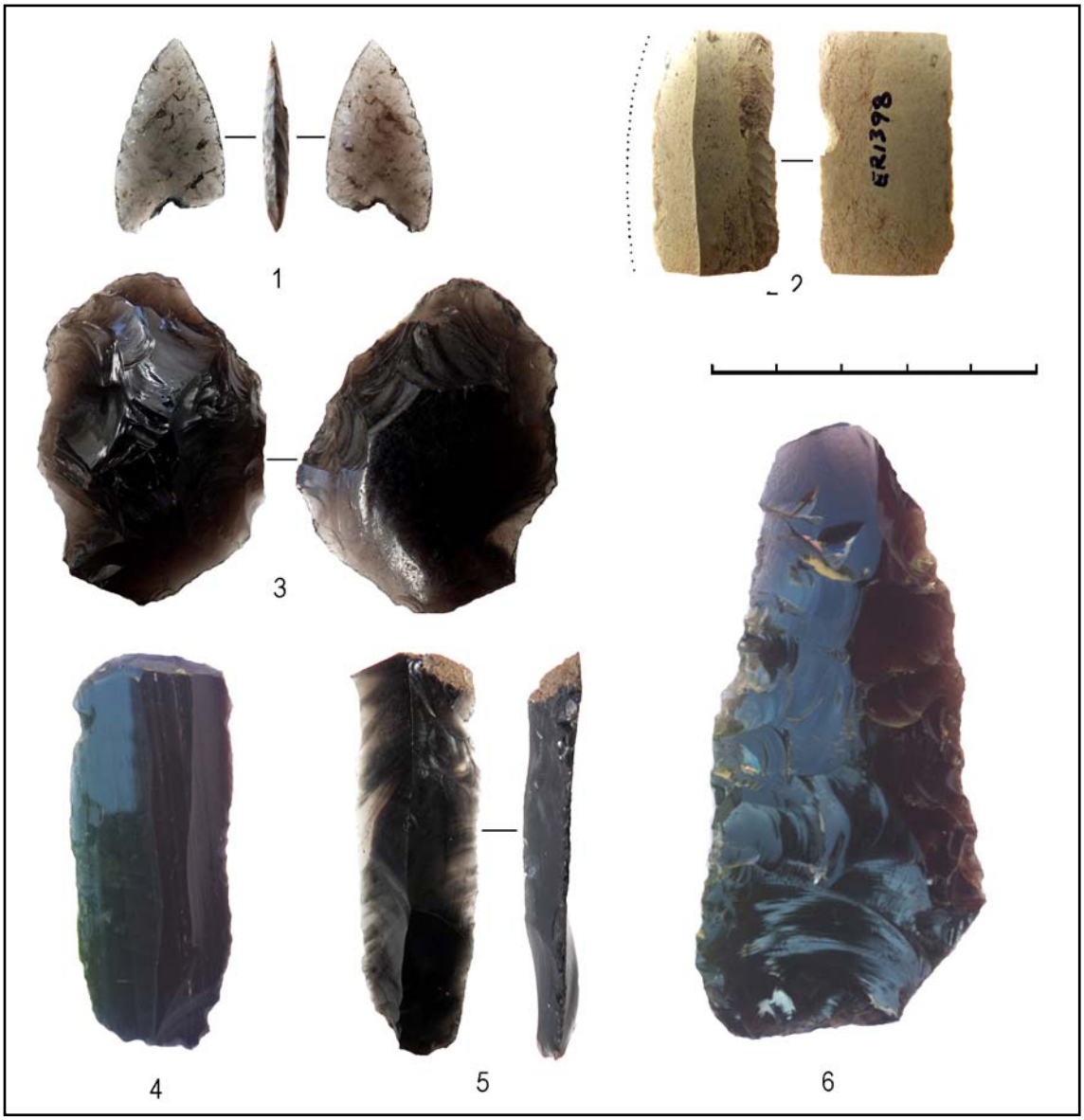

Fig. 6. Mt. Chikiani: Knapped stone artefacts from workshop ER: 1 — obsidian flat retouched Bedeni type arrowhead; 2 — exogenous chert medial fragment of a prismatic blade with traces of wear along one side (dots); 3 — obsidian ogival rough-out arrowhead early stage of manufacture; 4 — obsidian long end scraper; 5 — obsidian retouched bladelet; 6 — obsidian advanced stage of manufacture of a bifacial spearhead (photographs by P. Biagi and E. Starnini).

Рис. 6. Гора Чикиани: каменные изделия из мастерской ER: 1 — обсидиановый плоский ретушированный наконечник стрелы типа Бедени; 2 — экзогенно кремнистый медиальный фрагмент призматической пластины со следами износа с одной стороны (показано точками); 3 — обсидиановый оживальный наконечник стрелы на ранней стадии изготовления; 4 — обсидиановый длинный концевой скребок; 5 — обсидиановая ретушированная пластина; 6 — обсидиановый двусторонний наконечник копья на продвинутой стадии изготовления (иллюстрация П. Бьяджи и Э. Старнини).

their chronological and cultural attribution to the Bronze Age Indus Civilisation some 50 years later (De Terra, Paterson 1939: 336).

The Rohri Hills consist of groups of Eocene-Early Oligocene limestone terraces, or mesas, that elongate in a north-south direction, east of the course of the River Indus, between Rohri and the south-western fringes of the Thar Desert (Blanford 1880) (fig. 7). The surveys carried out between 1993 and 2003 by the Italo-Pakistani Joint Rohri Hills Project in the central-western part of the terraces (Shadee Shaheed Hills) led to the discovery of impressive groups of hundreds chert mines surrounded by workshops composed of thousands knapping by-products including debitage flakes, unretouched arte-

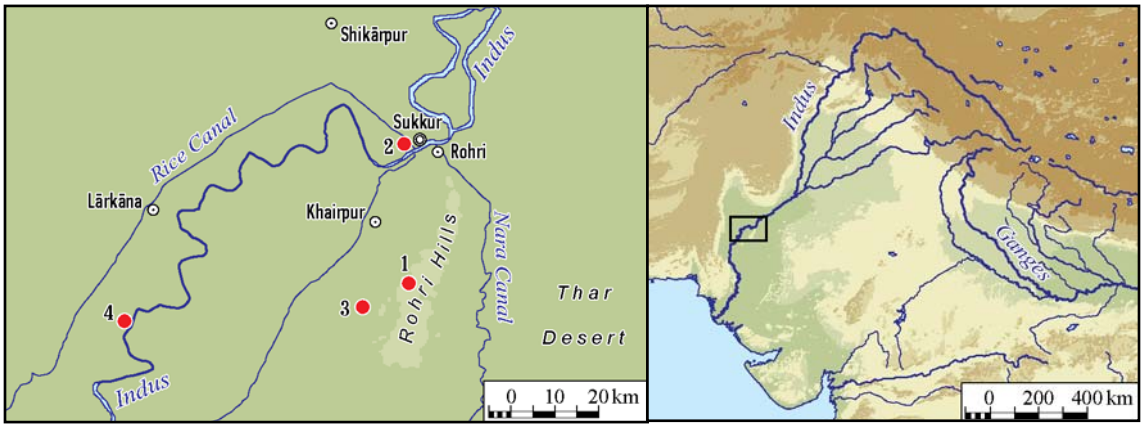

Fig. 7. The Rohri Hills and their surroundings. Distribution map of the sites mentioned in the text: 1 — Shadee Shaheed; 2 — Lakhueen-jo-Daro; 3 — Kot Diji; 4 — Mohenjo-Daro (drawing by P. Biagi).

Рис. 7. Холмы Рохри и их окрестности. Карта распределения упомянутых в тексте памятников: 1 — Шади Шахид; 2 — Лахуен-джо-Даро; 3 — Кот Диджи; 4 — Мохенджо-Даро (иллюстрация П. Бьяджи).

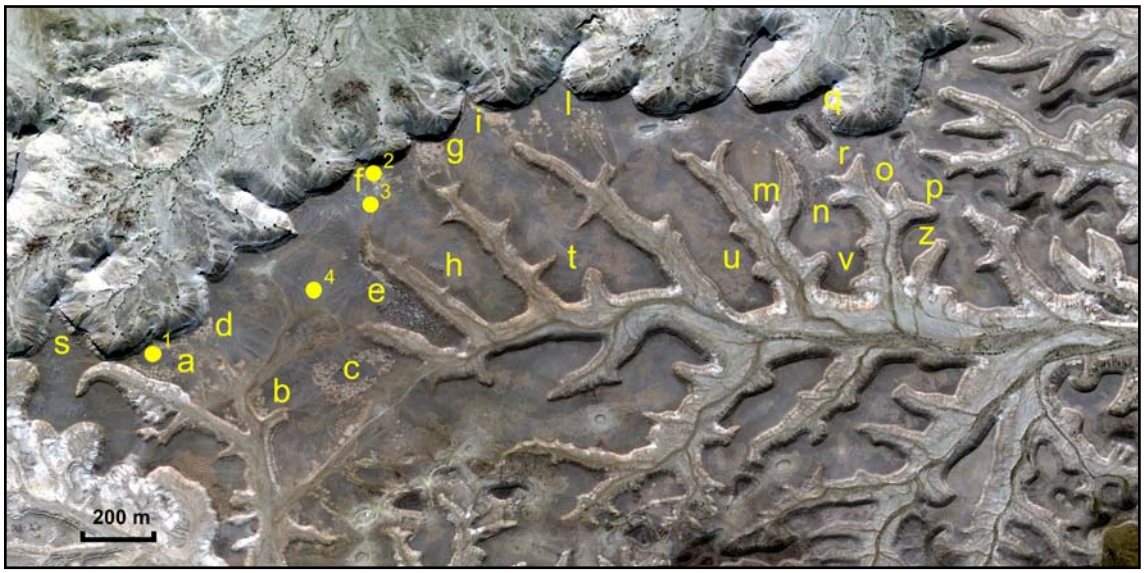

Fig. 8. Shadee Shaheed Hills: Distribution map of the most important mining fields (a — z) with the location of the excavated mine pits RH-862 (1) and RH-59 (2), and workshops RH-58 (3) and RH-480 (4). Note the distribution of groups of mines often at the edge of the mesas and the great difference between the C-shaped group C and the triangular group E that show probable different exploitation strategies. Note also as already 20 years ago the whole area was devastated by stone surface collecting and limestone quarrying. The mining area represented in the satellite image covers ca 80 ha (drawing by P. Biagi).

Рис. 8. Холмы Шади Шахид: карта распределения наиболее важных месторождений полезных ископаемых (a — z) в соотношении с расположением выработанных карьеров RH-862 (1) и RH-59 (2), мастерской RH-58 (3) и RH-480 (4). Стоит обратить внимание на распределение групп залежей, часто на краю столовых гор, и большую разницу между С-образной группой C и треугольно-образной группой E, которые демонстрируют вероятно разные стратегии эксплуатации. Обратите внимание также и на то, что уже 20 лет назад вся территория была опустошена сбором камней с поверхности и добычей известняка. Район добычи, представленный на снимке со спутника, занимает площадь около 80 га (иллюстрация П. Бьяджи).

facts and exhausted cores (Biagi, Pessina 1994; Biagi et al. 2018b: 72). The region covered by chert extraction activities is so wide and intensively exploited that impressive groups of mine-pits are clearly visible even from satellite images (fig. 8). After so many years of work carried out in the area, it can be stated that one of the archaeologically demonstrated phenomena was

the mass-production of thousands of blade and bladelet blanks to supply the request of the artisans workshops of manufacturing centres like those in the neighbouring cities of Mohenjo-Daro, Kot Diji and Lakhueen-jo-Daro at Sukkur (Biagi et al. 2018b).

However, we have to point out once more that the three aforementioned sites yielded just a very small number of knapped stone artefacts. Only 115 items come from the excavations carried out by J. Dales at Mohenjo-Daro (Kenoyer 1984), whose six radiocarbon dates fall within the second half of the 3rd mill. BC (Possehl 1995: 4030±66 BP, 2608±113 BC at 1σ (P-1179), and 3813±65 BP, 2278±111 BC at 1σ (P-1182a)). F.A. Khan reports the presence of chert artefacts from the Kot Dijian (Early Indus) layers of Kot Diji mound, though his description is not very detailed. This author reports the presence of "*cores of flakes from which blades, scrapers, spear-head and sickle like blades had been chipped. Most of them show signs of use on their edges. The well finished leaf-shaped stone arrow heads are worth mention*" (Khan 2002: 48, P-62). A few more artefacts, among which are bullet cores, crested and unretouched bladelets, are illustrated from the Indus occupation layers of the same mound (Khan 2002: P-32; see also Cleland 1987: 106).

It is important to remark that both Kot Dijian and Indus potsherds were retrieved from layer IV of the site. The same layer yielded one charcoal radiocarbon date that is comparable with those obtained from the Rohri Hills mine pits (4043±138 BP, 2595±208 BC at 1σ (P-195)). This result falls into the time span one would expect for the Mature Indus Civilisation (Brunswig 1975: tab. 2) (see Harappan phase of the Integration Era: Shaffer 1991: 448). Moreover, 107 knapped stone artefacts, mainly fragments of unretouched bladelets and crested bladelets, as well as two bladelet cores, come from the excavations carried out at Lakhueen-jo-Daro, a Mature Indus centre located in the industrial area of Sukkur close to the right, western bank of the Indus (Shaikh et al. 2004—2005). The site has been radiocarbon dated from one *Acacia* sp. charcoal sample retrieved from a fireplace ca 3 cm thick at ca 50 cm of depth, where a bronze male figurine was also found. The sample was collected in close relation with a brick platform, and a faience and steatite bead workshop inside one of the first test trenches opened in 1996 in mound C by G.M. Shar of Shah Abdul Latif University, Khairpur (3960±140 BP, 2478±215 BC at 1σ (GrN-23123), δ^{13}C –22.03).

The three cases reported above are from important Indus urban settlements located close (within a radius of ca 50 km) to the Rohri Hills chert sources. A piece of better evidence comes from Harappa in the Punjab (Possehl 1991; Law 2011), more than 550 km north-east of the Rohri Hills sources. Here 8,499 chert artefacts were collected from different areas of the ca 150 ha Mature Indus urban site excavated in 1986 (Davis 2019: tab. 2: 3). In this case, the number of knapped stone artefacts is also quite small. Most consist of fragments of unretouched blades and bladelets, while cores are represented by only eight specimens, three of which are bullet types. These data are important because they confirm the wide distribution of Rohri Hills chert during the Indus period, which extended down to the Arabian Sea coast at least 450—550 km farther south (Law 2011; Biagi et al. 2018: 83; Gadekar, Ajithprasad 2018).

The Rohri Hills mining fields provide an exceptional opportunity to shed light on this aspect of the Indus Civilisation and deeper insights into the role played by the "lithic factor" during the development of this urban civilization when metal was already widely employed for making functional tools, sophisticated products, and art pieces (Shaffer 1982; Yule 1985). The new data show that some of the opinions expressed in the 1980s, when the research in the Rohri Hills mines had not yet begun, are no longer tenable. For example, can we say now "*that production centers for chipped stone existed, but we suspect that stone as a production medium was less conductive to the development of specialization that was copper-bronze*"? Can we now state "*that the introduction of copper-bronze should result in the reduction in the frequency and functional variability of stone tools*" (Cleland 1987: 110)? Moreover, can we consider chert, or obsidian, in the cases presented above, a low-cost material or material employed to produce different types of low-cost items (Vidale, Miller 2000: 120)? What was the real production cost of chert mining also in terms of human lives? What was the social dimension of such an important activity? Was it seasonal, as the local climatic condition would suggest (Seth 1978), or an all-year-round production? Did it imply some kind of authoritative structure (Eltson 2011: 63)?

During the 1990s, test trenches were opened inside a few Shadee Shaheed mine pits (Biagi, Pessina 1994; Negrino, Starnini 1995; Negrino et al. 1996). The most extensively excavated structure is RH-862, that was exploited during the Mature Indus period (fig. 9). This cultural attribution is confirmed by a radiocarbon date obtained from a tiny sample of *Zyziphus nummularia* charcoal (3880±70 BP, 2349±101 BC at 1σ (GrA-3235), δ^{13}C –22.03) (Biagi 1995). Mine-pit RH-59 yield-

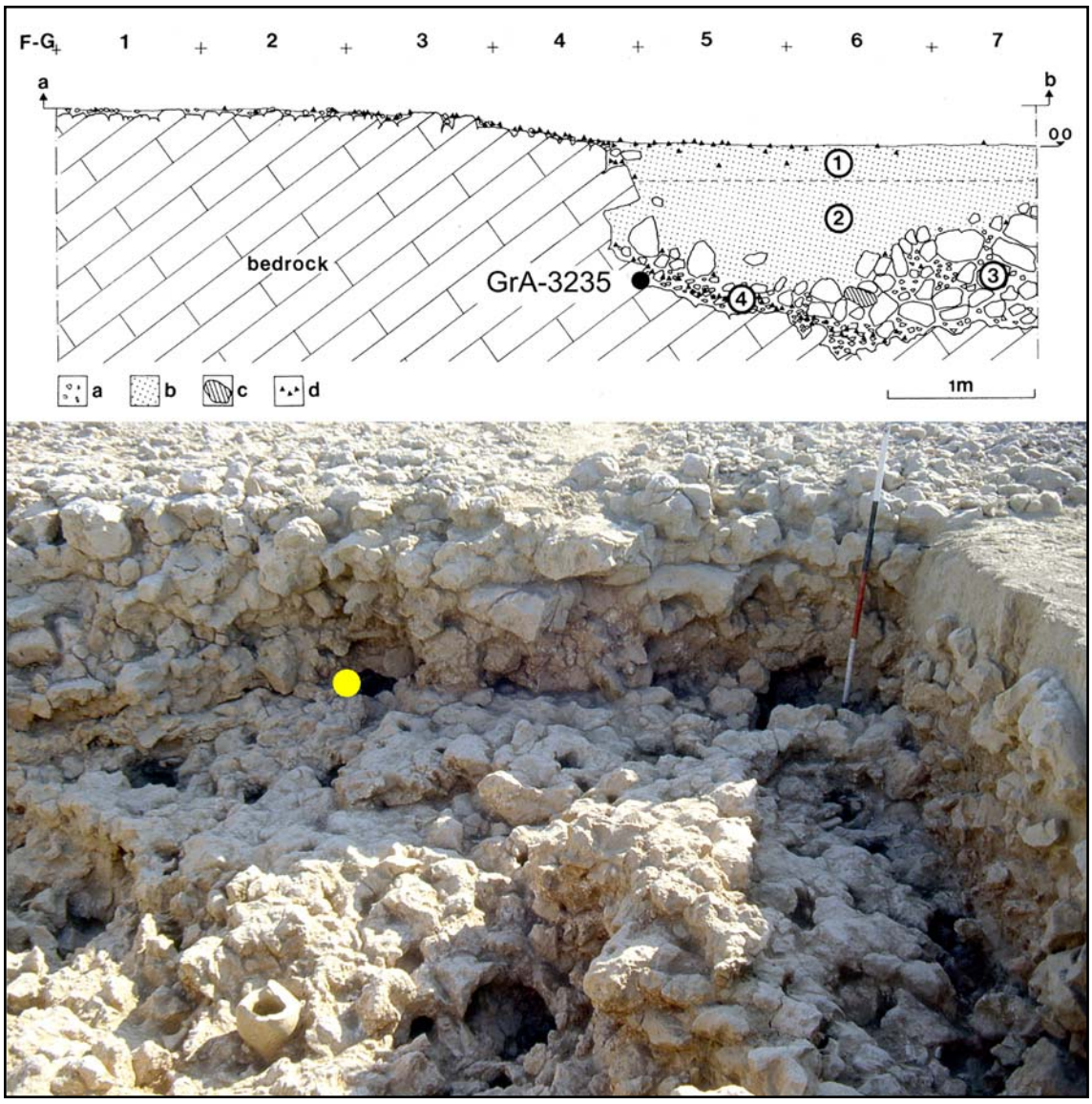

Fig. 9. Shadee Shaheed Hills: Mine-pit RH-862 with the indication of the point from which a *Zyziphus nummularia* charcoal fragment was collected for radiocarbon dating (GrA-3235). a — reddish, sandy clayey soil and rubble; b — aeolian sand; c — chert nodules; d — knapped stone artefacts (photograph by P. Biagi 1995; profile drawing by F. Negrino and E. Starnini, after Biagi et al. 1997: fig. 6).

Рис. 9. Холмы Шади Шахид: шахта RH-862 с указанием места, откуда был взят фрагмент древесного угля *Zyziphus nummularia* для радиоуглеродного датирования (GrA-3235). a — красноватый, супесчано-глинистый грунт и щебень; b — эоловый песок; c — кремнистые конкреции; d — изделия из колотого камня (фотография П. Бьяджи 1995; рисунок профиля Ф. Негрино и Э. Старнини, по Biagi et al. 1997: fig. 6).

ed a slightly older result from a sample of *Zootecus chione* land snails (3999 ± 24 BP, 2525 ± 34 BC at 1σ (GrM-21237), $\delta^{13}C$ –5.67) (fig. 10).

The manufacturing processes employed in the production of blanks (blades and bladelets) detached from polyhedral and bullet cores (fig. 11), the employment of copper-tipped punches, the very probable employment of skilled specialists, and other important topics have already been described in detail in other Rohri Hills papers and are not repeated here (Biagi, Pessina 1994; Negrino, Starnini 1995; Negrino et al. 1996; Briois et al. 2006). However, it is important to remark once more that the Indus urban centres yielded little evidence of the way chert blades were employed. So far our knowledge is limited mainly to a few functions that were most likely processed by a limited number of specialists (Roux 1999: 165), including pottery manufacture (Anderson-Gerfaud et al. 1989), semiprecious stone beads piercing (Bond-

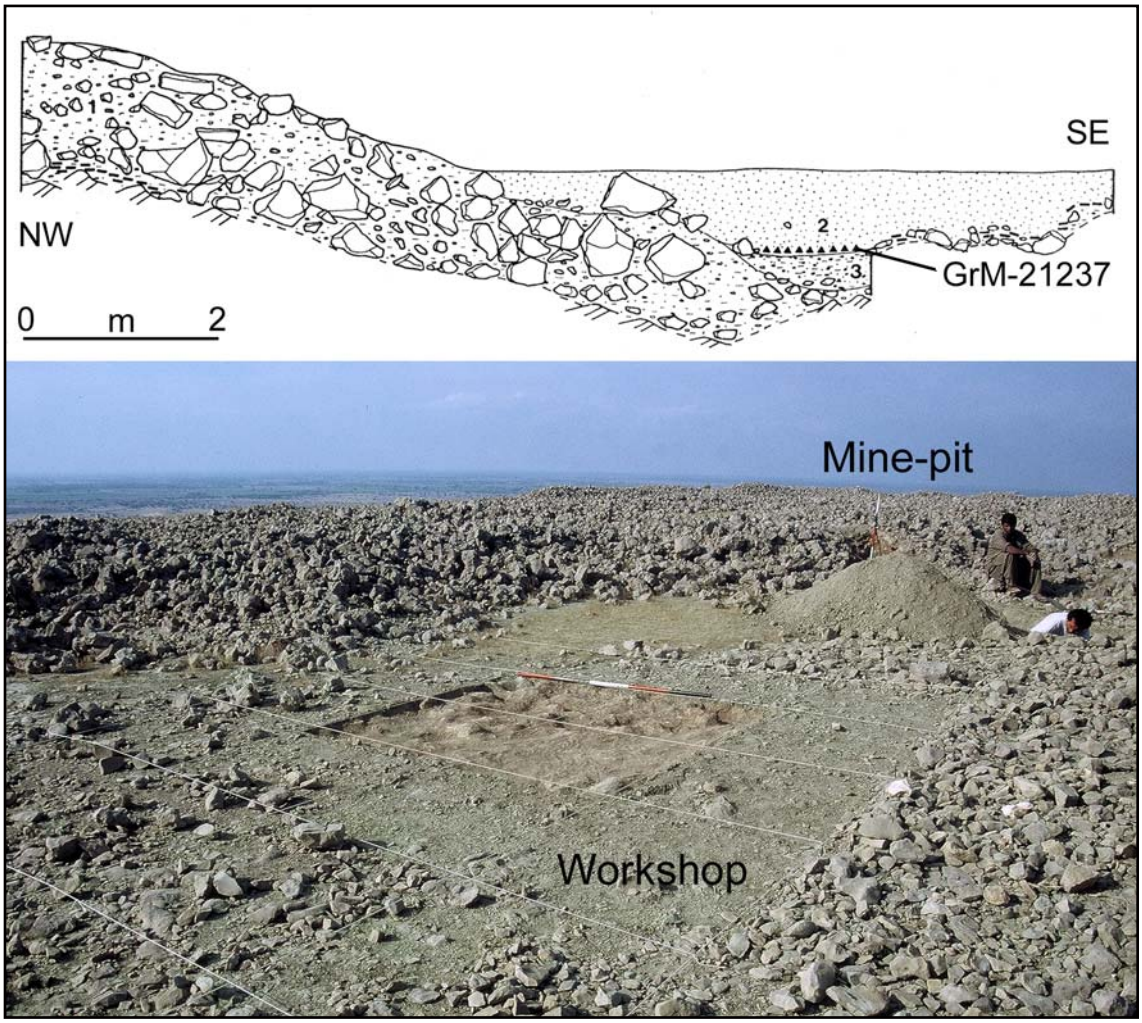

Fig. 10. Shadee Shaheed Hills: Mine-pit RH-59 with adjacent bullet core microbladelet workshop. The profile shows the Zootecus chione horizon (triangles) from which the AMS-MICADAS date GrM-21237 was obtained. 1 — Mine-pit rubbles; 2 — sand cover; 3 — mine-pit deposit (drawing and photograph by P. Biagi).

Рис. 10. Холмы Шади Шахид: шахта RH-59 с примыкающей к ней мастерской микропластинчатых нуклеусов. На профиле показан горизонт Zootecus chione (треугольник), по которому была получена AMS-MICADAS дата GrM-21237. 1 — обломки из карьера; 2 — песчаная крышка; 3 — залежи из карьера (фотография и рисунок профиля П. Бьяджи).

ioli et al. 1984: 24), shell working (Vidale 2000: 72), and agricultural activities as shown by the occurrence of unique types of notched sickle blades that look typical of the Kot Diji aspect (Voytek 1994; Khan 2002: P-62). Probably these data do not reflect all the activities that involved the exploitation, function and efficiency of chert tools (Luedtke 1984).

The extraction methods employed in Mature Indus times to exploit mine RH-862 did not consist of underground or deep shafts with galleries but of trenches and pits that, in some cases, were first opened on the edge of the terrace (Biagi et al. 1997: 31). At present, the mouths of the mine-pits are marked by spots of sand blown from the neighbouring Thar Desert that was trapped into the shallow depression of their openings. The excavations have partly exposed a more or less continuous and roughly horizontal surface where the topmost seam of chert nodules was reached at a depth of ca 1.50 m. Here the consistency of the limestone deposit changed into a harder layer, and a mine front ca 10 m long (see fig. 9). The mine pits are always surrounded by the result of the extraction activity that consists of heaps of limestone rubble visible from a long distance. The presence of workshops where the extracted nodules had been tested was also observed around the edges of the mines (Starnini, Biagi 2006).

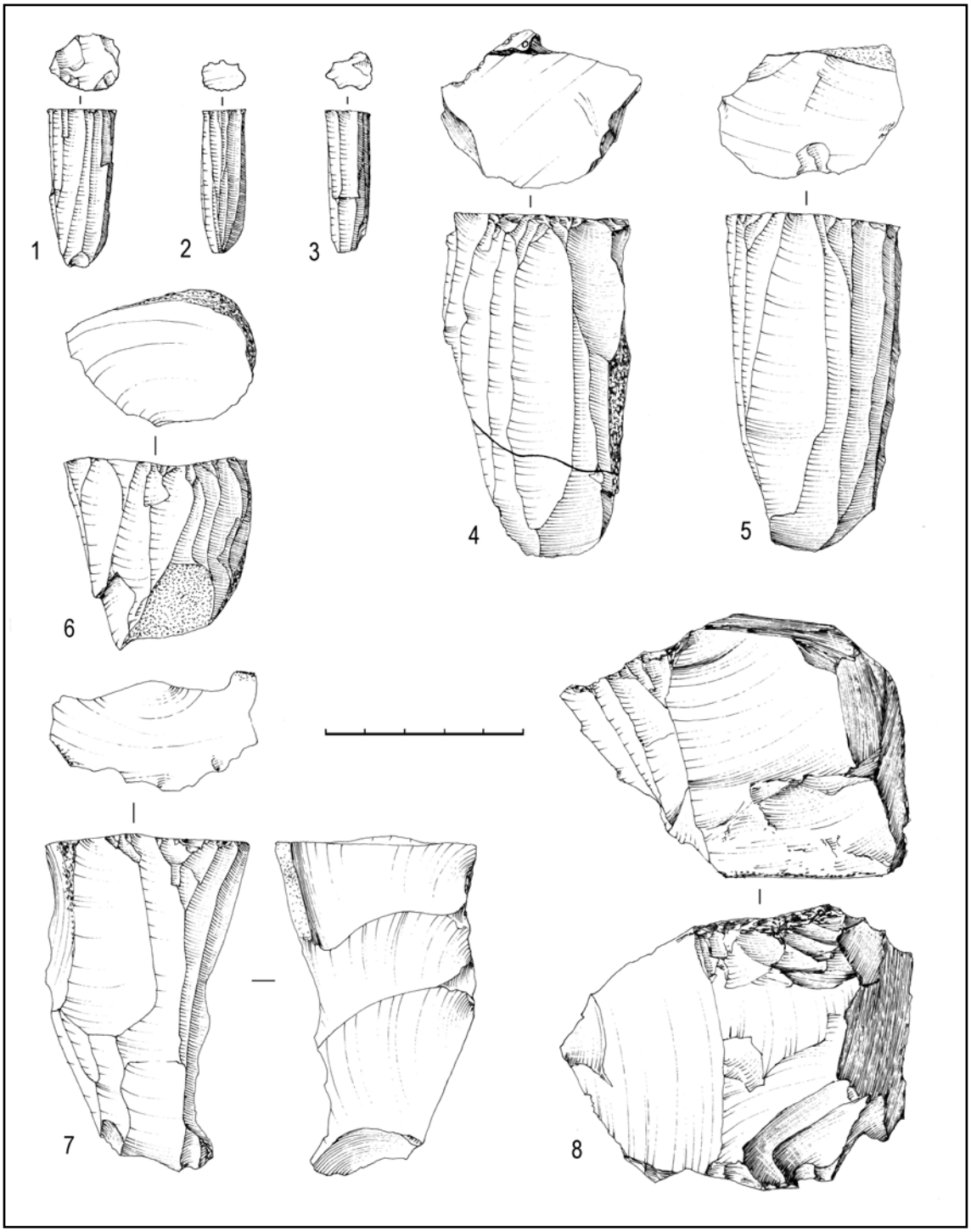

Fig. 11. Shadee Shaheed Hills: Workshop RH-59. Different types of cores: 1—3 — Bullet cores; 4—6 — Polyhedral cores; 7—8 — Pre-cores (drawings by P. Biagi and G. Almerigogna).

Рис. 11. Холмы Шади Шахид: карьер RH-59. Различные типы нуклеусов: 1—3 — Пуле-образные; 4—6 — многогранные стержне-образные; 7—8 — предварительной обработки (рисунки П. Бьяджи и Г. Альмеригогна).

4. Discussion (P.B. & R.N.)

Quarries, mines and workshops are the most important components of an organised lithic production to interpret the context of procurement, exchange and social organisation of a system that involves quite complicated processes not necessarily only functional (Purdy 1984; Topping, Lynott 2005: 186). The two cases discussed in this paper regard complex Bronze Age societies that developed in two very different regions of Eurasia, whose origins are still debated or insufficiently known, as well as is our knowledge of their social structures (Rahmstorf 2012: 318), and the ways they developed. In the case of the Indus Civilization, its periodisation is based on a radiocarbon chronology over 30 years old (Possehl 1995) that has not improved in the last years, with the exception of the north Arabian Sea coast (Biagi et al. 2018a) and Gujarat (Chase et al. 2020). Moreover, the important problem regarding knappable stone resources has often been underestimated by many archaeologists (see *f.i.* Kohl 2007, for the Caucasus; Lahiri 1992, for the Indian Subcontinent). This fact has resulted in an incomplete and probably distorted view of the society that exploited and employed an impressive amount of lithics throughout a long period that lasted more than 1000 years, when metals were largely in use (McLaren 2008).

Regarding the Caucasus, if we consider the impressive and so far unique obsidian mining fields discovered around Mt. Chikiani, which were exploited during the Bronze Age, we can also observe that all the territory around it, within a radius of at least 50 km, is covered with obsidian flakes and artefacts that were undoubtedly detached and transported for reasons we know nothing about. Moreover, they systematically recur also where different types of megalithic structures were constructed. The distribution radius of Mt. Chikiani obsidian was defined a few years ago, without any data considering the different ages of exploitation of this source that are still at present inadequately defined. However, to the best of our present knowledge, the distribution and trade of Chikiani obsidian seem to have spread over an area much wider than all the other south Caucasian sources (Badalyan 2010: fig. 4).

The presence of hundreds of mine pits and very rich workshops discovered ca 2 km from the extractive areas of Mt. Chikiani, provide us with a rough idea of the complexity of the obsidian mining and exploitation activities that took place in a highland zone located above 2000 m of altitude, which is characterised by extreme winter temperatures and lasting snowfalls. For this reason, we suggest that mining was practised on a seasonal basis, as is also known from other countries of Eurasia (Stöllner 2016: 212). The occurrence of obsidian workshops for the production of different types of arrowheads and the recurring displacement of elegant and perfectly refined arrow types as grave goods inside Kura-Araxes and Bedeni *kurgan* burial chambers (see Куфтин 1941; Makharadze 2016b) are not enough to explain the impressive number of obsidian mine-pits opened along the slopes of Mt. Chikani, nor is the presence of a few obsidian notched sickle blades recovered from historical sites. Moreover, we have little idea of the reasons why mine pits were dug out to reach the natural flow since obsidian is very common on the surface, also in the form of large boulders.

Regarding the Indus Valley, the Rohri Hills chert mines show evidence of long-lasting extraction activities in different regions of the terraces. So far, this important aspect has been given little consideration by most archaeologists despite the very important role it plays in the interpretation of the economy of a complex Bronze Age society of which little is known, though much has been written about. In the Indus Valley, most fieldwork was carried out in the 1900s, and most data were collected more than 30 years ago. The basic structural subdivision of the Indus prehistory was suggested by J. Shaffer in the same years (Shaffer 1991). The same can be said of the external trade of the Indus Civilization. Products and items do not seem to have moved in abundance, and "*Harappan contact with the West, via trade or any other kind of cultural interaction, was minimal and sporadic*" (Shaffer 1982: 191). Though our knowledge has undoubtedly improved, especially as regards transoceanic trade and communication, we cannot say that it is very satisfactory (Gupta 1996: 111—136).

The case for chert mining is very indicative in this respect. How can we account for the fact that such an impressive activity that undoubtedly lasted a few hundred years and involved much effort and people, does not find a reasonable counterpart in the Indus settlements, 96 of which, attributed to the Mature period, have been excavated in Pakistan and India (Possehl 1997: 429)? What do we really know about the political/economic/religious system adopted in that period (Hahn 2012; Rahmstorf 2012)? Why is it that our present knowledge is far too poor and many problems have never been solved or have not improved, if not at a very regional scale, at least in the Indus River basin (see *f.i.* Wright et al. 2008)?

5. Conclusion (P.B.)

It has been recently argued that "Bronze Age World System Cycles" can be subdivided into different phases and that "*the frequency of and intensity of contact had reached a peak early in the third millennium B.C.*" (Frank 1993: 392), that is when complex societies started to develop as well as urban settlements, writing or the use of still undeciphered ideograms, sophisticated mortuary practices, and the production of different types of special items manufactured by skilful specialists. Within this picture falls the problem of the exploitation of knappable stone resources over a scale as impressive as it has never been recorded in any other period of prehistory. This fact is even more interesting if we consider that it began to appear and continued throughout most of the Bronze Age, when metal objects were systematically produced even at an industrial scale, as well as pottery though, as described in this paper, little or no attention has ever been paid to lithics by many archaeologists, for many reasons, among which are the recovery techniques adopted in large scale excavations, or the interest that more attractive finds or structures always spark.

Obsidian and chert were undoubtedly exploited on a large scale during the 3rd mill. BC all over the area discussed in this paper and beyond it. Moreover, knapping techniques seem to have followed similar modalities that led to the manufacture of parallel-sided blanks (or prismatic blades) due to the employment of a metal (copper) punch (Pelegrin 2012). Strong similarities can be noticed in the presence of polyhedral blade cores and bullet cores that imply perfect control of the manufacturing process and a precise idea of the final blank to be detached. These products are quite distinctive as are the notched sickle blades whose distribution spread at least from the Caucasus to the Indian Subcontinent during the same period. The presence of long, arched, winged, bifacial arrowheads can be observed all across the region that runs from the Caucasus to the entire north Black Sea coast, and Indus type elongated carnelian beads were manufactured by Indus craftsmen living in Mesopotamia and exported as far as the Aegean (Rahmstorf 2015: 161).

Despite the importance of these archaeological factors, lithics and stone mining often played a secondary role in archaeology. However, obsidian and chert mining fields like those discovered in the Caucasian mountains of Georgia or the desert landscapes of Sindh clearly show that their importance is fundamental for the interpretation of the social structure, economy and trade activities of politically complex Bronze Age societies.

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In this paper, the calendric dates BC have been calibrated according to CalPal online (http://www.calpal-online.de/cgi-bin/quickcal.plprogram quickcal2007 ver.1.5).

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ВопрАнт	— Вопросы антропологии. Москва.
ВПМ	— Вестник Пермского Университета. Серия «История». Пермь.
ВСЕГЕИ	— Всероссийский научно-исследовательский геологический институт имени А. П. Карпинского. Санкт-Петербург.
ВСПУ	— Вестник Санкт-Петербургского университета. Санкт-Петербург.
ГАИМК	— Государственная академия истории материальной культуры. Ленинград.
ГИМ	— Государственный исторический музей. Москва.
ГИМ Южного Урала	— Государственный исторический музей Южного Урала. Челябинск.
ДАО	— Донское археологическое общество. Ростов-на-Дону.
ДАС/ДАЗ	— Донецкий археологический сборник / Донецький археологічний збірник. Донецк.
ДГМІ	— Донбаський гірничо-металургійний інститут. Алчевськ.
ДГРЦ	— Донецкий горнорудный центр.
ДГУ	— Днепропетровский государственный университет. Днепропетровск.

ДДБК — Днепро-Донская бабинская культура.
ДНУ — Донецький національний університет імені Василя Стуса. Донецк; Вінниця.
ДонГТУ — Донбасский государственный технический университет. Алчевск.
ДонГУ — Донецкий государственный университет. Донецк.
ДонДТУ — Донбаський державний технічний університет. Алчевськ.
ЗИИМК — Записки Института истории материальной культуры РАН. Санкт-Петербург.
ЗОРСА — Записки Отделения русской и славянской археологии Русского археологического общества. Санкт-Петербург; Петроград.
ИА АН СССР — Институт археологии Академии наук СССР. Москва.
ИА НАНУ — Інститут археології Національної академії наук України. Київ.
ИА РАН — Институт археологии Российской Академии наук. Москва.
ИАЭ СО РАН — Институт археологии и этнографии Сибирского отделения Российской Академии наук. Новосибирск.
ИАЭК — История, археология и этнография Кавказа. Махачкала.
ИВ РАН — Институт востоковедения Российской Академии наук. Москва.
ИГАИМК — Известия Государственной Академии истории материальной культуры. Ленинград.
Известия СНЦ РАН — Известия Самарского научного центра Российской академии наук. Самара.
ИИМК РАН — Институт истории материальной культуры Российской Академии наук. Санкт-Петербург.
ИНМ Варна — Известия на народния музей. Варна.
ИСНЦ РАН — Известия Самарского научного центра Российской Академии наук. Самара.
ИЭА РАН — Институт этнологии и антропологии имени Н. Н. Миклухо-Маклая Российской Академии наук. Москва.
ІА НАНУ/ИА НАНУ — Інститут археології Національної Академії наук України. Київ.
КГПИ — Куйбышевский государственный педагогический институт. Куйбышев.
КГУ — Куйбышевский государственный университет. Куйбышев.
КДУ — Кам′яна доба України. Київ.
КИАМЗ — Костромской историко-архитектурный и художественный музей-заповедник. Кострома.
КМК — культура многоваликовой керамики.
КН МОН РК — Комитет науки Министерства образования и науки Республики Казахстан. Астана.
КСИА — Краткие сообщения Института археологии АН СССР/РАН. Москва.
КСИИМК — Краткие сообщения о докладах и полевых исследованиях Института истории материальной культуры. Санкт-Петербург.
КСИЭ — Краткие сообщения Института этнографии. Москва; Ленинград.
КЧГУ — Карачаево-Черкесский государственный университет. Нальчик.
ЛГПУ — Липецкий государственный педагогический университет им. П.П. Семенова-Тян-Шанского. Липецк.
ЛГУ — Ленинградский государственный университет. Ленинград.
ЛОИА АН СССР — Ленинградское отделение Института археологии Академии наук СССР. Ленинград.
ЛОИА РАН — Ленинградское отделение Института археологии Российской Академии наук. Санкт-Петербург.
МАИАСП — Материалы по археологии и истории античного средневекового Причерноморья. Москва; Тюмень; Нижний Новгород.
МАСК — Материалы по археологии Северного Кавказа. Армавир.
МАСП — Материалы по археологии Северного Причерноморья. Одесса.
МАЭ РАН — Музей антропологии и этнографии им. Петра Великого «Кунсткамера» Российской академии наук. Санкт-Петербург.
МГУ — Молотовский государственный университет. Молотов.
МДАСУ — Матеріали та дослідження з археології Східної України. Луганськ.
МДУ — Маріупільский державний університет. Маріупіль.
МИА — Материалы и исследования по археологии СССР. Москва; Ленинград.
МИАП — Материалы и исследования по археологии Поволжья. Йошкар-Ола.
МИАР — Материалы по истории и археологии России. Москва.
МИАСК — Материалы и исследования по археологии Северного Кавказа. Армавир.
МИС — Материалы по истории Сибири. Новосибирск.
МИФ — Митология, изкуство, филология. София.
МОН РК — Министерство образования и науки Республики Казахстан. Астана.
МНИЖ — Международный научно-исследовательский журнал. Екатеринбург.
НА ІА НАНУ — Науковий архів Інституту археології Національної Академії наук України. Київ.
НАВ — Нижневолжский археологический вестник. Волгоград.
НАН РК — Национальная Академия Наук Республики Казахстан. Алматы.
НЗЛУ — Наукові записки Львівського університету. Львів.
НИУ «БелГУ» — Национальный исследовательский университет «Белгородский государственный университет». Белгород.
ОГПУ — Оренбургский государственный педагогический университет. Оренбург.
ПА — Поволжская археология. Казань.
ПГГПУ — Пермский государственный гуманитарно-педагогический университет. Пермь.

ПГКМ — Пензенский государственный краеведческий музей. Пенза.
ПГРЭ — Пермская геолого-разведочная экспедиция. Пермь.
ПИФК — Проблемы истории, филологии, культуры. Москва; Магнитогорск.
ПМСК — Покровско-мосоловская срубная культура.
ПРЭ — Проблемы региональной экологии. Москва.
РА — Российская археология. Москва.
РАЕ — Российский археологический ежегодник. Санкт-Петербург.
РАН — Российская Академия наук. Москва.
РАНХиГС — Российская академия народного хозяйства и государственной службы при Президенте Российской Федерации. Москва.
РГНФ — Российский гуманитарный научный фонд. Москва.
РГПУ — Российский государственный педагогический университет им А.И. Герцена. Санкт-Петербург.
РИС — Русский исторический сборник, издаваемый Обществом истории и древностей российских. Москва.
РИС — Русский исторический сборник. Москва.
РП — Разкопки и Проучвания. София.
РЦ РДМИ СПбГУ — Ресурсный центр «Рентгенодифракционные методы исследования» Санкт-Петербургского государственного университета. Санкт-Петербург.
СА — Советская археология. Москва.
САИ — Свод археологических источников. Москва; Санкт-Петербург.
СамГПУ — Самарский государственный педагогический университет. Самара.
САнт — Советская антропология. Москва.
СГАИМК — Сообщения Государственной Академии истории материальной культуры. Ленинград.
СГПИ — Самарский государственный педагогический институт. Самара.
СГПУ — Самарский государственный педагогический университет. Самара.
СГСПУ — Самарский государственный социально-педагогический университет. Самара.
СГУ — Саратовский государственный университет. Саратов.
СКНЦ ВШ ЮФУ — Северо-Кавказский научный центр Высшей школы Южного федерального университета. Ростов-на-Дону.
СКО — Срубная культурная общность.
СНВ — Самарский научный вестник. Самара.
СНУ — Східноукраїнський національний університет імені Володимира Даля. Луганськ.
СНЦ РАН — Самарский научный центр Российской Академии наук. Самара.
СО РАН — Сибирское отделение Российской Академии наук. Новосибирск.
СОИКМ — Самарский областной историко-краеведческий музей им. П.В. Алабина. Самара.
СП — Старожитності Причорномор'я. Одесса.
СПбГУ — Санкт-Петербургский государственный университет. Санкт-Петербург.
ССПіК, ССПК — Старожитності степового Причорномор'я і Криму, Запоріжжя.
СЭ — Советская этнография. Санкт-Петербург.
ТА — Татарская археология. Казань.
ТАС — Тверской археологический сборник. Тверь.
ТИЭ — Труды Института этнографии им. Н. Н. Миклухо-Маклая. Новая серия. Москва.
ТИЭ — Труды Института этнографии. Москва.
ТКЭ — Труды Камского археолого-этнографической экспедиции. Пермь.
ТМАЭ — Труды Марийской археологической экспедиции. Йошкар-Ола.
Труды ГИМ — Труды Государственного исторического музея. Москва.
Труды ИИАЭ АН КазССР — Труды Института истории, археологии и этнографии Академии Наук Казахской ССР. Алма-Ата.
Труды ИЭ АН СССР — Труды Института этнографии Академии наук СССР. Москва.
Труды ХАЭЭ — Труды Хорезмской археолого-этнографической экспедиции. Москва.
ТСА РАНИОН — Труды секции археологии Российской ассоциации научно-исследовательских институтов общественных наук. Москва.
УАВ — Уфимский археологический вестник. Уфа.
УИВ — Уральский исторический вестник. Екатеринбург.
УКСЭ — Уральская комплексная съемочная экспедиция.
УрГУ — Уральский государственный университет им. А. М. Горького. Свердловск / Екатеринбург.
УрО РАН — Уральское отделение Российской Академии Наук. Екатеринбург.
УчЗапМГУ — Ученые записки Молотовского государственного университета. Молотов (Пермь).
ХНУ — Харьковский национальный университет имени В. Н. Каразина. Харьков.
ЧГПИ — Череповецкий государственный педагогический институт. Череповец..
ЮНЦ РАН — Южный научный центр Российской академии наук. Ростов-на-Дону.
ЮУрГГПУ — Южно-Уральский государственный гуманитарно-педагогический университет. Челябинск.
ЮУрГУ — Южно-Уральский государственный университет. Челябинск.
AA — Acta Archaeologica. København.
AAASH — Acta Archaeologica Academiae Scientiarum Hungaricae. Budapest.
AAC — Acta Archaeologica Carpathica. Kraków.

AAL — Acta Archaeologica Lodziensia. Łódź.
AAS — Archaeological and Anthropological Sciences. Berlin.
AASF — Annales Academiae Scientiarum Fennicae. Helsinki.
ABSA — The Annual of the British School at Athens. Cambridge.
ACSS — Ancient Civilizations from Scythia to Siberia. Leiden.
ACR — Accounts of Chemical Research. Washington.
ActaMM — Acta Musei Meridionalis. Vaslui.
ActaMN — Acta Musei Napocensis. Cluj-Napoca.
ActaMP — Acta Musei Porolisensis. Zalău.
AÉ — Archaeolgiai Értesítő. Budapest.
AEAE — Archaeology, Ethnology & Anthropology of Eurasia. Novosibirsk.
AFAS — Annals of the Finnic Academy of Sciences. Helsinki.
AIP Conf Proc — AIP Conference Proceedings. AIP Publishing.
AJA — American Journal of Archaeology. Chicago.
AM — Arheologia Moldovei. Iaşi; Suceava.
AmAnth — American Anthropologist. American Anthropological Association.
American Antiquity — American Antiquity. Cambridge Core.
AMEA Sosial elmlər — Azərbaycan Milli Elmlər Akademiyası Sosial elmlər. Baku.
AMIT — Archäologische Mitteilungen aus Iran und Turan. Berlin.
AMU — Adam Mickiewicz University. Poznań.
AMV — Acta Musei Varnaensis. Varna.
AnalBan — Analele Banatului. Timişoara.
AnatMet — Anatolian metal. Zeitschrift für Kunst und Kultur im Bergbau. Beiheft. Bergbau.
Anatolica — Anatolica. Leiden.
AnatSt — Anatolian Studies. Cambridge.
AncS — Ancient Sindh. Khairpur.
ANES — Ancient Near Eastern Studies. Louvain.
AnthPrae — Anthropologica et praehistorica. Belgium.
Antiquity — Antiquity. Durham.
Apulum — Apulum. Alba-Iulia.
APL — Analecta Praehistorica Leidensia. Leiden..
ARA — Annuaire Roumain d'Anthropologie. Bucureşti.
ArchBulg — Archaeologia Bulgarica. Sofia.
Archeometry — Archeometry. Oxford.
Archéologiques — Archéologiques. Québec.
ArchEu — Archäologie in Eurasien. Mainz.
ArchKbl — Archäologisches Korrespondenzblatt. Urgeschichte Römerzeit Frühmittelalter. Mainz.
ArchMM — Archèologie du Midi Medieval. Languedoc.
ArchPol — Archaeologia Polona. Warszawa.
ASPP — Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia. Pisa.
AU SAV — Archeologický ústav Slovenskej akadémie vied. Nitra.
AUB — Analele Universităţii Bucureşti. Seria istorie. Bucureşti.
AUC, AUDC — Analele Universităţii Creştine „Dimitrie Cantemir". Seria istorie. Bucureşti.
AUO — Acta Universitatis Ouluensis. Finnland.
AzArx — Azərbaycan arxeologiyası. Baku.
BAI — Bibliotheca Archaeologica Iassiensis. Iaşi.
BAI D — Bulletin of the Asia Institute. Detroit.
BAM — Brukenthal Acta Musei. Sibiu.
Banatica — Banatica. Reşiţa.
BAPA — Beiträge zur Archäozoologie und Prähistorischen Anthropologie. Konstanz.
BAR — British Archaeological Reports. Oxford.
BAR IS — British Archaeological Reports, International Series. Oxford.
BASPR — Bulletin of the American School of Prehistorical Research.
BDBG — Berichte der deutschen botanischen Gesellschaft. Berlin.
BDP MV — Jahrbuch Bodendenkmalpflege Mecklenburg-Vorpommern.
BGNAS — Bulletin of the Georgian National Academy of Sciences. Tbilisi.
BGSG — Bulletin of the Geological Society of Greece. Athens.
BiblArh — Biblioteca de Arheologie. Bucureşti.
BiblBruk — Bibliotheca Brukenthal. Sibiu.
BiblIstPont — Biblioteca Istro-Pontică. Brăila.
BiblMAK — Biblioteka Muzeum Archeologicznego w Krakowie. Kraków.
BiblMemAnt — Bibliotheca Memoriae Antiqitatis. Piatra Neamţ.
BiblMo — Biblioteca Mousaios. Buzău.
BiblSep — Bibliotheca Septemcastrensis. Alba-Iulia.
BiblMusMar — Bibliotheca Musei Marisiensis. Bonn.
BiblMuzBist — Biblioteca Muzeului Bistriţa. Bistriţa; Cluj-Napoca.
BiblTh — Biblioteca Thracologica. Bucureşti.
bioRxiv — bioRxiv. The preprint server for Biology. New York.

BMJT	— Buletinul Muzeului Judeţean Teleorman. Seria Arheologie. Alexandria (Teleorman).
BPS	— Baltic-Pontic Studies. Poznań.
BRGK	— Bericht der Römisch Germanischen Kommission, Berlin.
BSAW	— Berlin Studies of the Ancient World. Berlin.
BSPF	— Bulletin de la société préhistorique française. Paris.
CAJ	— Cambridge Archaeological Journal. Cambridge.
CCDJ	— Cultură şi Civilizaţie la Dunărea de Jos. Călăraşi.
CercNum	— Cercetări Numismatice. Muzeul Național de Istorie al României. Bucureşti.
CercNum	— Cercetări Numismatice. Bucureşti.
CNRS	— Centre national de la recherche scientifique. Paris.
Corviniana	— Corviniana. Hunedoara.
ColArchRes	— Collectio Archaeologica Ressoviensis. Rzeszów.
CP	— Camera Praehistorica Journal. Санкт-Петербург.
CRAS	— Comptes Rendus de l'Académie des Sciences. Paris.
CSA	— Current Swedish Archaeology. Stockholm.
Dacia	— Dacia. Recherches et Decouvertes Archeologiques en Roumanie, Bucureşti.
Dacia	— Dacia. Recherches et Découvertes Archéologiques en Roumanie. Bucureşti.
Das Altertum	— Das Altertum. Oldenburg.
DBG	— Berichte der deutschen botanischen Gesellschaft. Berlin.
Der Anschnitt	— Der Anschnitt. Zeitschrift für Kunst und Kultur im Bergbau. Bergbau.
DIA	— Dialogues d'histoire ancienne. Besançon.
Die Kunde	— Die Kunde. Zeitschrift für niedersächsische Archäologie Neue Folge. Oldenburg.
DJA	— Davidson Journal of Anthropology. United Kingdom.
DP	— Documenta Praehistorica. Ljubljana.
DPHK FGM	— Denkschriften der philosophisch-historischen Klasse. Forschungen zur Geschichte des Mittelalters. Wien.
Drobeta	— Drobeta. Seria arheologie-istorie. Drobeta Turnu Severin.
Dziebani	— Dziebani. Tbilisi.
EA	— Eurasia Antiqua. Mainz.
East and West	— East & West. The Istituto Italiano per l'Africa e l'Oriente. Rome.
EC	— Etudes celtiques. Paris.
EJA	— European Journal of Archaeology. Cambridge.
EP	— Eurasian Prehistory. Oxford.
EphNap	— Ephemeris Napocensis. Cluj-Napoca.
EPP	— Folia Praehistorica Posnaniensia. Poznań.
ESA	— Eurasia Septentrionalis Antiqua. Helsinki.
EstJA	— Estonian Journal of Archaeology. Tallinn.
Eurasiatica	— Eurasiatica Journal. Scotland.
FA	— Fennoskandia archaeologica. Helsinki.
FM	— Finskt Museum. Helsinki.
FPP	— Folia Praehistorica Posnaniensia. Poznań.
FUF	— Finnisch-ugrische Forschungen. Helsinki.
Geopolitics	— Geopolitics. Tyalor & Francis Online. S.l.
HAH	— Hereditas Archaeologica Hungariae. Budapest.
HK	— Helsingin Kaiku. Helsinki.
HNM	— Hungarian National Museum. Budapest.
HOM	— Herman Ottó Múzeum. Miskolc.
HUB	— American school of prehistoric research. Harvard University Bulletin. Cambridge.
IA NASU	— Institute of Archaeology, National Academy of Sciences of Ukraine. Kyiv.
IA UMCS	— Instytut archeologii, Uniwersytet Marii Curie-Skłodowskiej. Lublin.
IES	— Institute of Eastern Studies. Poznań.
Iran	— Iran. Taylor and Francis, Ltd. Oxfordshire.
Iraq	— Iraq Journal. Cambridge.
IJA	— International Journal of Archaeology. Science Publishing Group.
İJAS	— İranian Journal of Archaeologıcal Studies. Zahedan.
IJNA	— International Journal of Nautical Archaeology. S.l.
IMB	— Editura Istros Muzeul Brăilei.
IntArch	— Interdisciplinaria Archaeologica. Natural Sciences in Archaeology (online).
iScience	— iScience. United States. S.l.
Istros	— Istros. Revista Muzeului Brăilei. Brăila.
JAA	— Journal of Anthropological Archaeology. Elsevier B.V. S.l.
JAAP	— Journal of Analytical and Applied Pyrolysis. Elsevier Verlag. S.l.
JAMT	— Journal of Archaeological Method and Theory. Springer Nature Switzerland AG. S.l.
JAncS	— Journal of Ancient Sindh. Khairpur.
JAR	— Journal of Archaeological Research. United States.
JAS	— Journal of Archaeological Science. Århus.
JASP	— Jutland Archaeological Society Publications. Moesgaard; Højbjerg.
JFA	— Journal of Field Archaeology. Tyalor & Francis Online. S.l.

JHE — Journal of Human Evolution. Elsevier B.V. S.l.
JHG — Journal of Human Genetic. Spring Nature Ltd. S.l.
JICA — The Journal of Island and Coastal Archaeology. Tyalor & Francis Online. S.l.
JIES — Journal of Indo-European studies.
JIES — Journal of Indo-European studies. Washington; Los Angeles.
JLS — Journal of Lithic Studies. Edinburgh.
JMA — Journal of Mediterranean Archaeology. Equinox Publishing Ltd. S.l.
JMV — Jahrbuch Bodendenkmalpflege Mecklenburg-Vorpommern. Schwerin.
JNES — The Journal of Near Eastern Studies. Chicago.
JRAI — Journal of the Royal Anthropological Institute of Great Britain and Ireland. London.
JRGZ — Jahrbuch des Römisch-Germanischen Zentralmuseums. Mainz.
JWP — Journal of World Prehistory. Springer Nature Switzerland AG. S.l.
KAHVF — Konstanzer althistoriche Vorträge und Forschungen. Konstanz.
L′Anthropologie — L′Anthropologie. Paris.
Lithics — Lithics. Lithic Studies Society. London.
LithTech — Lithic Technology. Tyalor & Francis Online. S.l.
MA — Monumenta archaeologica. Los Angeles.
MAA — Mediterranean Archaeology and Archaeometry. Kaifeng.
MAI — Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften. Budapest.
Magistra Vitae — Magistra Vitae: электронный журнал по историческим наукам и археологии. Челябинск.
MAK — Muzeum Archeologiczne w Krakowie. Kraków.
MCA — Materiale şi cercetări arheologice. Bucureşti.
MemAnt — Memoria Antiquitatis. Piatra-Neamţ.
MemGSI — Memoirs of the Geological Survey of India. Calcutta.
MMJ — Metropolitan Museum Journal. New York.
MNM — Magyar Nemzeti Múzeum. Budapest.
Mousaios — Mousaios. Buzău.
MSROA — Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego. Rzeszów.
MTA — Magyar Tudományos Akadémia. Budapest.
MuzNaţ — Muzeul Naţional. Bucureşti.
NatCommun — Nature Communications. Nature Publishing Group. S.l.
NatEcolEvol — Nature Ecology & Evolution. Springer Nature Ltd.
Nature — Nature. Nature Publishing Group. S.l.
NIM PRS — Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms. ScienceDirect. S.l.
OEA — Oriental and European Archaeology. Wien.
OIP — Oriental Institute Publications. Chicago.
OJA — Oxford Journal of Archaeology. Oxford.
OREA — Oriental and European Archaeology. Wien.
Origini — Origini. Prehistory and protohistory of ancient civilizations. Gangemi Editori. Rome.
OS — Oriental studies. Kalmyk Scientific Center of Russian Academy of Sciences.
Paléorient — Paléorient. CNRS Editions. Paris.
PASOE — Prähistorische Archäologie in Südosteuropa. München.
PBF — Prähistorische Bronzefunde. München; Stuttgart.
Peuce — Peuce. Studii şi Comunicări de istorie veche, arheologie şi numismatică. Tulcea.
Philos Trans R Soc Lond B Biol Sci — Philosophical Transactions of the Royal Society London B: Biological Sciences. London.
Photonics Spectra — Photonics Spectra. Laurin Publishing Company, Inc. S.l.
PloS ONE — PloS ONE. Public Library of Science. San Francisco.
PM MAEŁ — Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Łodz.
PNAS — Proceedings of the National Academy of Sciences of the United States of America. Washington.
Pontica — Pontica. Studii şi materiale de istorie, arheologie şi muzeografie. Constanţa.
PPS — Proceedings of the Prehistoric Society. Cambridge.
PrAlp — Preistoria Alpina. Trentino.
PrEur — Préhistoire Européenne. Liège.
PZ — Praehistorische Zeitschrift. Berlin.
QuatInt — Quaternary International. ScienceDirect. S.l.
QuatScRew — Quaternary Science Reviews. Elsevier Verlag. S.l.
Replika — Replika. Budapest.
ResSq — Research Square (online).
R&A — Radiocarbon and Archaeology.
RA — Revista arheologică. Chişinău.
Radiocarbon — Radiocarbon. An International Journal of Cosmogenic Isotope Research. Arisona.
RCAN — Revista de Cercetări Arheologice şi Numismatice. Bucureşti.
ResSq — Research Square.

RevBis — Revista Bistriţei. Bistriţa-Năsăud.
RGA — Reallexikon der Germanischen Altertumskunde. Strassburg; Berlin; New York.
RGZM — Römisch-Germanisches Zentralmuseum. Mainz.
RJE — Russian Journal of Ecology. Springer Nature Ltd. S.l.
RJP — Romanian Journal of Physics. Bucureşti.
RLE — Routledge Library Edition.
RoczBiesz — Roczniki Bieszczadzkie. Ustrzyki Dolne.
RSP — Rivista di Scienze Preistoriche. Firenze.
S.l. — sino loco (no place of publication is given).
SA — Sprawozdania archeologiczne. Krakow.
Sargeţia — Sargeţia. Deva.
SCA — Studii şi Cercetări de Antropologie. Bucureşti.
Scanning — Scanning. Hindawi Publishing Corporation. S.l.
Science — Science. American Association for the Advancement of Science. S.l.
SCIV(A) — Studii şi cercetări de istorie veche (şi arheologie). Bucureşti.
SCM — Studii şi cercetări maramureşene. Baia Mare.
ScRep — Scientific Reports. London.
SCSM — Studii şi Comunicări Satu Mare. Satu Mare.
SlArch — Slovenská Archeológia. Nitra.
SMASG — Schriften des Museums für Archäologie Schloss Gottorf. München.
SMYA — Suomen Muinaismuistoyhdistyksen aikakauskirja. Helsinki.
SN — Studi Nordici. Roma.
Social Research — Social Research: An International Quarterly.
SpArch — Sprawozdania Archeologiczne. Warszawa.
ST — Szegedi Tudományegyetem. Szeged.
StOr — Studia Orientalia. Finisch Oriental Society. Helsinki.
StP — Studia Praehistorica. Sofia.
Stratum plus — Stratum plus. Археология и культурная антропология. Санкт-Петербург; Кишинев; Одесса; Бухарест.
Subartu — Subartu Journal. Union of Archaeologists of the Kurdistan Region in Iraq. S.l.
SympTh — Symposia Thracologia. Lucrările Simpozionului Anual de Tracologie. Bucureşti.
The Quarry — The Quarry Journal. Sydney.
Thracia — Thracia. Институт за балканистика с Център по тракология — Българска академия на науките. София.
Thraco-Dacica — Thraco-Dacica. Anuarul Institutului Român de Tracologie. Bucureşti.
UPA — Universitätsforschungen zur Prähistorischen Archäologie. Bonn.
VAnt — Vita Antiqua. Kyiv.
VMUFGP — Veröffentlichungen des Museums der Ur- und Frühgeschichte Potsdam. Berlin.
WiadArch — Wiadomości Archeologiczne. Warszawa.
WUR — Wydawnictwo Uniwersytetu Rzeszowskiego. Rzesz’ow.
WUW — Wydawnictwo Uniwesytetu Warszawskiego. Warszawa.
ZAM — Zeitschrift für Archäologie des Mittelalters. Bonn.
ZNO — Zakład Narodowy im. Ossolińskich. Wrocław; Warszawa; Kraków; Gdańsk.