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# Between Valleys and Mountains. The Dzedzvebi Plateau as an Intermediate Settlement Site of Late Chalcolithic and Early Bronze Age Communities in the Lesser Caucasus

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**Abstract**
The question of how societies have appropriated the resource-rich montane landscapes of the South Caucasus since the 5th millennium BCE and in which temporal rhythms this development took place is linked with regional mobility as well as the social and economic negotiation of the participating communities. Intermontane settlement areas like the large Dzedzvebi Plateau near Kazreti in southeast Georgia probably played an important role as intermediate centres of exchange within the South Caucasian mountain corridors. That role is illuminated here, based on the findings of archaeological investigations that started in 2007. In the valley area of Kazreti, this function was closely linked with the exploitation of ore and the processing of metals, especially the gold of Sakdrisi. The establishment of permanent settlements on the Dzedzvebi Plateau exemplifies the social and economic developments that led to the settlement and integration of mountain corridors, connecting valleys and plateaus to the cultural activities of Kura-Araxes-period communities in the South Caucasus in the period around 3000 BCE.

**Keywords**
Late Chalcolithic, Early Bronze Age, metallurgy, husbandry, subsistence, obsidian, aDNA, burial practices, social integration

**Zusammenfassung** – *Zwischen Bergen und Tälern. Das Dzedzvebi Plateau als Zwischenstation spätchalkolithischer und frühbronzezeitlicher Gesellschaften im Kleinen Kaukasus*

Die Frage, wie sich Gesellschaften seit dem 5. Jahrtausend v. u. Z. die ressourcenreichen montanen Landschaftsräume des Südkaukasus angeeignet haben und in welchen zeitlichen Rhythmen diese Erschließung geschah, ist mit der regionalen Mobilität sowie den sozialen wie auch wirtschaftlichen Aushandlungen der involvierten Gemeinschaften verknüpft. Gebirgsnahe bzw. gebirgsumschlossene Plätze wie das große Siedlungsplateau von Dzedzvebi bei Kazreti in Südostgeorgien spielten dabei wohl als intermediäre Orte des Austausches eine wichtige Rolle innerhalb der südkaukasischen Gebirgskorridore. Diese Rolle wird vor dem Hintergrund der seit 2007 durchgeführten archäologischen Untersuchungen und ihrer zahlreichen Ergebnisse beleuchtet, die im Talraum von Kazreti eng mit der Erzausbeute und der Verarbeitung von Metallen, allen voran des Goldes von Sakdrissi, verbunden war. Die Etablierung der Dauersiedlung auf dem Dzedzvebi-Plateau lässt jene sozialen und wirtschaftlichen Entwicklungen erkennen, die im Südkaukasus zu einer Besiedlung und Integration von Gebirgskorridoren führten, die Täler und Hochplateaus mit den kulturellen Aktivitäten der Kura-Araxes-zeitlichen Gemeinschaften im Südkaukasus in der Zeit um 3000 v. u. Z. verbanden.

**Schlüsselbegriffe**
Spätchalkolithikum, Frühbronzezeit, Metallurgie, Herdenhaltung, Subsistenz, Obsidian, aDNA, Bestattungspraktiken, soziale Integration


Fig. 1. The Early Transcaucasian Culture (Kura-Araxes) in West Asia in its early stages of development (after 3500 BCE and before 3200/3000 BCE) and during its expansion (after 3200/3000 BCE till 2600/2400 BCE). – Red dot: Balichi-Dzedzvebi site. – Black dots: other important archaeological sites (Deutsches Bergbau-Museum Bochum [DBM] / Ruhr-University Bochum [RUB]; T. Stöllner, after Rothman 2015).

### 1. Introduction. Appropriating Valleys and Mountains: The Georgian-German Caucasus Project and its Research Questions

The Transcaucasian areas saw dramatic changes in the 5th and 4th millennia BCE. In the 5th millennium BCE, the Late Neolithic communities of the Shulaveri-Shomutepe Culture transformed into communities of the Sioni tradition, a cultural complex that remains poorly understood. Especially little is known about its early phase;[1] the social and economic developments of the Late Chalcolithic (LC), which occurred in the late 5th millennium BCE at the latest, are better understood. The connections between the Kura and Araxes river basins and the intermediate areas of the Armenian Plateau and the surrounding west Asian regions, especially the Syrian-Mesopotamian lowlands, developed in this period and were further strengthened in the late phases of the Late Chalcolithic, as can be observed in the material culture and architecture.[2] The Transcaucasian Sioni tradition shaped the cultural development from the late 5th millennium until the early 4th millennium BCE, particularly in the great valleys of the Kura and the Araxes. The area also experienced the social development of distinctly regionally oriented elites.[3] The southern Caucasus became a major source of attraction for communities living in Iran, Mesopotamia and beyond; hence its development into an important component of the dynamics that progressively shaped southwest Asia at the dawn of urban civilisation

1 Sagona 2017. – Iserlis 2018.

2 Already Lyonnet 2007. – Lyonnet 2009. – Marro 2010. – Lyonnet 2018. – Marro 2022.

3 E.g. Lyonnet et al. 2008.

(the Ubeid and Uruk complexes).[4] The subsequent changes to the Kura-Araxes communities therefore seems all the more striking, especially the representation of social status in burials and the clear focus on domestic cults and rituals.[5] Their activities around the mining complex of Sakdrisi[6] – as well as the metallurgical tradition of the Transcaucasian communities of the Early Bronze Age (EBA) – illustrate the increasing importance of metal extraction and other uses of raw materials and resources that started in the 5th millennium BCE.[7] Some of these groups (e.g. Sioni groups in eastern Georgia and Leilatepe communities in western Azerbaijan) mastered elaborate techniques, such as metallurgy, and favoured specific biotopes on the mountain slopes of the Lesser Caucasus. One could therefore raise the question of whether the increasing economic and social complexity of Kura-Araxes cultural manifestations also marked the transition to more specialised economic and social practices in the second half of the 4th millennium BCE.[8] Economic reorganisation and the production of new goods may, in return, have been the force that propelled Kura-Araxes groups towards eastern Anatolia and southwestern Iran at the beginning of the Early Bronze Age (Fig. 1).

Examination of the settlement pattern, especially between the 5th and the early 3rd millennium in the Kura Valley system (Mtchvari),[9] makes it clear that Late Chalcolithic sites in particular (henceforth Late Chalcolithic 3[10] and the latest stage, Late Chalcolithic 4[11]) tended to spread along the main courses of the Kura and the lower reaches of its tributaries (e.g. Aragvi, Chramis, Mashavera). In a few cases, settlements extended to the middle courses of the main tributaries during this phase (e.g. Dzedzvebi, Abanoskhevi).[12] These early permanent settlements were situated in an intermediary position between the lower valleys and the high mountain pastures. They were important supply posts or rest areas for groups driving their herds up to the summer pastures. Evidence of seasonal presence on the plateaus of the Lesser Caucasus mountains (e.g. Areni Cave, Bavra Alavari) since the Neolithic is particularly interesting here, because it indicates the appropriation of the highland plateaus long before the development of permanent settlement there.[13] These settlements coincide with the continuous but sporadic and seasonal mining of obsidian sources at Mount Chikiani and many other locations on the Armenian Plateau.[14] Only in the second half of the 4th and in the 3rd millennium BCE did the high altitudes around the valleys of the North Caucasus or the Javakheti Mountains and the Trialeti Plateau become more permanently developed.[15] A similar development has been observed in the Araxes Valley, where permanent settlements and camps were established in the piedmont of the South Caucasus, but rarely in the upper valleys.[16] This pattern appears to have changed in the first half of the 4th millennium. The site of Godedzor in the Vorotan Valley represents a semi-permanent or seasonal settlement with evidence of crop planting.[17] These sites likely reflect special resource conditions; the more inhospitable higher-lying regions could thus be settled more easily. In the area of Godedzor, the earliest evidence of cereal cultivation dates to the middle of the 4th millennium BCE; the settlement, which is located above 1800 m asl, is probably connected to the nearby obsidian sources.[18]

This new evidence makes it clear that research should focus on the relationships between the mountain corridors between the Greater and the Lesser Caucasus mountain ranges. Intra-montane sites are of special interest, as they appear to have facilitated access and connectivity between the lower valleys and larger main valleys (e.g. the Kura and the Araxes valleys) and the plateaus and the highlands. One of these fascinating sites is the Dzedzvebi Plateau near Balichi/Kazreti, where a series of Chalcolithic and Early Bronze Age settlements has been discovered; excavation of these sites started in 2007 and is ongoing (see below). The present study sheds light on social and economic dynamics and practices

4 In general, for the chaff-faced pottery ware communities or the LC-Leilatepe/Berikldeebi tradition, see e.g. Munchaev 1975. – Makharadze 2007. – Kavtaradze 2014. – Museibli 2021. – Marro 2022.

5 Recently Batiuk 2013. – Palumbi, Chataigner 2014.

6 E.g. Gambashidze, Stöllner 2016. – Stöllner et al. 2014. – Stöllner et al. 2021. – Marro, Stöllner 2021.

7 Stöllner 2021a, 449–453.

8 Stöllner 2016. – Stöllner 2021a.

9 See also Helwing et al. 2017.

10 After the chronological system established in Lyonnet 2007. – Tsopi/Sioni group in a somewhat broad and unspecific definition, see Nebieridze 2010. – Iserlis 2018.

11 Leilatepe/Berikldeebi phase: Museibli 2021.

12 Ramishvili et al. 1987.

13 Wilkinson et al. 2012. – Varoutsikos et al. 2018.

14 Chataignier, Gratuze 2014a. – Chataignier, Gratuze 2014b. – See the comments in Stöllner 2021a. – For Chikiani, see recently Biagi, Nisbet 2023.

15 Stöllner 2016, 223–224 and Fig. 10.

16 Berthon et al. 2021. – Gailhard et al. 2021. – Marro 2022.

17 Palumbi et al. 2021.

18 Satanakar, Sevkar: Palumbi et al. 2021, 302–306 (C. Chataigner).

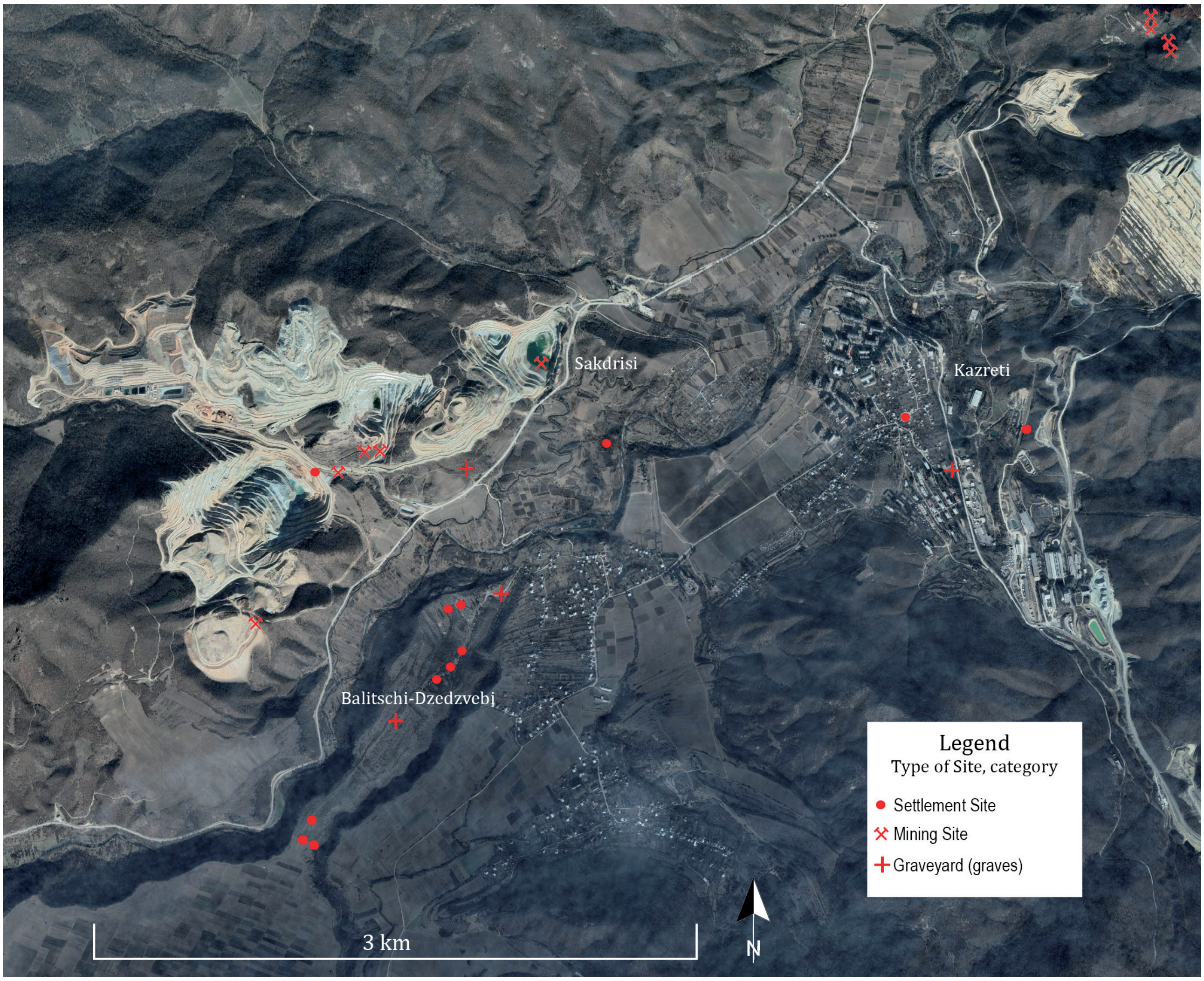



Fig. 2. Mashavera Valley around Kazreti and Balichi: potential ancient mining sites, prehistoric settlements and graveyards and those for which evidence has been found (Draft: DBM; S. Senczek).

based on recent research results from this site.[19] Dzedzvebi's topographical situation not only raises the question of when and on which economic basis the stable settlement of higher mountain plateaus was achieved, but also if preludes of intensification occurred earlier, for instance continuous usage of summer pastures and certain transhumance strategies. Intermediate sites may also have served as winter camps for people who used the higher pastures, for those who travelled up the stream to acquire secondary products such as wool, metal, or dairy products and those who brought up their stock to be managed by individuals who were better acquainted with the higher mountainous regions.

## 2. Dzedzvebi Plateau and its Settlements: Topography, Chronology and Fieldwork

The Dzedzvebi Plateau is situated south of the village of Balichi and the small town of Kazreti in southeast Georgia. The basaltic plateau stretches 1730 m, from 708 m asl to 768 m asl (between Area I [latitude: 41,3718488, longitude: 44,3915731] and Area IV.3 [latitude: 41,3643273, longitude: 44,38397]). The elongated plateau lies between the Mashavera and the Ukangorula (Dampludka) rivers, dominating the intra-montane valleys south of Kazreti (Fig. 2). At its widest point, the plateau is approximately 400 m wide, while at its narrowest it is just over 100 m wide. Due to its location,

19 DFG STO 458/27-1. We are especially grateful to the boards of the Deutsche Forschungsgemeinschaft (DFG) and their referees. Dr. Christoph Kümmel, Bonn, helped realise many aspects of the project. This article is based on long-term stratigraphical and chronological investigations and excavations, surveys and further analyses by archaeometallurgical, archaeometric and archaeobiological (archaeobotany, archaeo-genetics, archaeozoological and stable isotopes) methods, which are described in their subchapters.

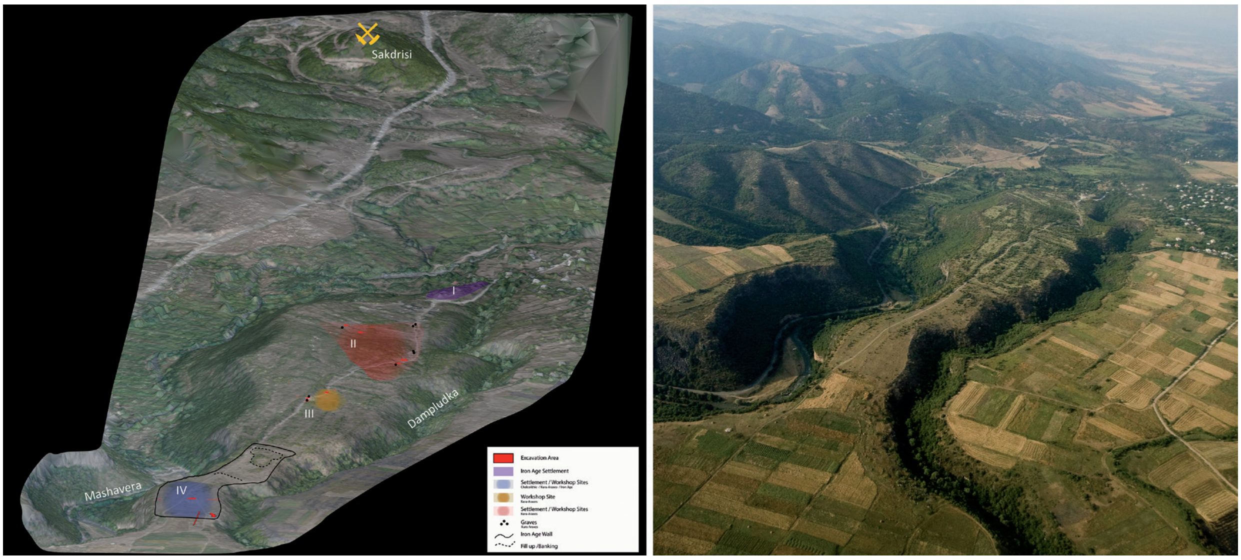



Fig. 3. Left: The settlement plateau of Balichi-Dzedzvebi and its archaeological sites on the northern hilltop (Dzedzvebi, Area I, Iron Age), northern slope (Dzedzvebi, Area II, Early Bronze Age), on the northern part of the central plateau (Dzedzvebi, Area III, Early Bronze Age) and on the southern plateau (Dzedzvebi, Area IV, Chalcolithic, Early Bronze Age and Iron Age) (Plan processing/3D visualisation: DBM/RUB/Georgian National Museum [GNM]; A. Hornschuch, F. Klein). – Right: Aerial photograph of the intra-montane position of Dzedzvebi Plateau according to the fluvial systems and the accessibility to pastures and plateaus of the Lesser Caucasus (RUB/DBM; T. Stöllner).

it also cordons off the north-south connection of the valley area. On its northern side, the small Dampludka River flows into the Mashavera, naturally protecting access to the northern plateau. To the south, the plateau between Mashavera and Ukangorula (Dampludka) narrows considerably.

The terrain gently rises towards the south, where it has been protected by a fortification rampart since the Iron Age at the latest. The earliest occupation layers appear to belong to the Middle Bronze Age (MBA) Trialeti period (see below), but it is unclear if a fortification has stood there since that time. The plateau thus encloses a settlement area of approximately 60 ha and can be divided into four distinct areas. In the north, the plateau ends in a spur-like plain (Area I) with an Iron Age settlement and an access road on its eastern slope, which continues to provide access from the northeast to this day. Whether this area was fortified during the Iron Age is not clear at present as detailed excavations have not yet been carried out in Area I. Also enclosed is a relatively broad slope area that rises slightly to the south (Area II), towards the almost flat, narrower Area III, which eventually merges into the southern plateau (Area IV) after a first plateau constriction from both river valleys in the west and the east. An additional, larger Iron Age settlement core has been found there.[20] The occupation of the plateau therefore provides insight into the developments of the beginning and end of the 5th millennium (the Early Chalcolithic and Late Chalcolithic 3 stages) and during the earlier phases of the Kura-Araxes period, between the 2nd half of the 4th and the beginning of the 3rd millennium BCE.

The area constitutes an intermediate location, between the lower parts of the Kura Valley and its tributaries and the mountainous highlands of the Shirak, Tsalka and Samtskhe-Javakheti plateaus. The Kazreti and Balichi area lies within a one- or two-day walk from the Bolnisi zone and the lower Mashavera and its confluence with the Chramis River, south of present-day Marneuli. From Dzedzvebi Plateau, the Transcaucasian plateaus can be reached via Didi Dmanissi within a two- or three-day journey as well (Fig. 3, below).

The Dzedzvebi Plateau is not the only site known in the middle Mashavera Valley. On the flanks of the Dzedzvebi Plateau near the Mashavera River, early Holocene abri use has been recorded, although little is known about the material culture remains found there and their chronology (Fig. 3).[21] Older studies have also documented finds from the wider valley area. Iron Age settlements are known in Kazreti, while medieval settlements are spread across the left, western bank of the Mashavera Valley; the latter include the Late Antique Christian village of Orsakdrebi and

20 Already summarising Gambashidze, Stöllner 2016.

21 Berdzenishvili 2006.

the Muslim village of Abulmulg, located near the exit of a side valley of Abanoskhevi.[22] The toponym Orsakdrebi was later used to designate the geological deposits of Sakdrisi I to V. Excavations conducted in 2012 (led by Irina Gambashidze) and again in 2013, documented prehistoric sites, mainly Late Chalcolithic ones; unfortunately, the 2013 rescue excavations led by Vakhtang Licheli have not been published, but it seems their documentation was done rather randomly. However, the site of the Early Bronze Age gold mine of Sakdrisi (Sakdrisi II, Kachagiani Hill), which was excavated by a Georgian-German team between 2004 and 2013 but opened to commercial mining in 2014 despite national and international protests, has attracted some attention.[23]

From the start, the research at the Sakdrisi gold mine was concerned with locating a settlement and evidence of the labour-intensive gold ore processing. Such evidence was found when a complete Kura-Araxes vessel was discovered by a gravedigger in the cemetery of Balichi, on the Dzedzvebi Plateau (Area II, Grave 1). Excavations started in 2007 and have yielded ample results since then.[24] It is now clear that several settlement nuclei were established at different locations on the plateau during different chronological phases. Chalcolithic settlement of the 5$^{th}$ millennium BCE has only been found on the southern plateau, an area that is easily accessible, especially from the south (Area IV.3) (see radiocarbon dates, Tab. 1 and Fig. 4). So far, evidence of Chalcolithic settlement has not been found in other excavation areas (areas IV.1–2, IV.4–6) on the southern plateau; this suggests that settlement was certainly smaller than the Iron Age occupation in the same area. The next chronological focus is the Kura-Araxes occupation, which can be dated between the 36$^{th}$/35$^{th}$ century and the 27$^{th}$ century BCE (see radiocarbon dates, Tab. 1 and Fig. 4). These settlements are mainly distributed on the southern plateau (Area IV) and along the slopes of Dzedzvebi II and the northern part of Dzedzvebi III. This area can be characterised as a settlement dominated by crafting activities with smaller, interspersed burial groups (see below). Its temporal overlap with mining activity at Sakdrisi and additional evidence of artefact and metallurgical features (e.g. stone tools, see below)[25] indicates that this settlement is related to the copper and gold exploitation of the Madneuli-Sakdrisi deposit district (see below). Isolated Middle Bronze Age occupations have also been found in the same area, mainly represented by Trialeti burials and ritual deposits. In contrast to the settlement in areas II and III, the Kura-Araxes occupation of the southern plateau is difficult to assess. Like in Dzedzvebi II and III, evidence of occupation during the oldest Kura-Araxes period, dating to the early 3$^{rd}$ millennium, has been found on the southern plateau, represented by late Kura-Araxes pottery in the style of Shengavit ware and two AMS (Accelerator Mass Spectrometry) $^{14}$C dates (MAMS 20637, MAMS 20640, Tab. 1). A few indications of Middle Bronze Age occupation have been found there as well, but no regular pits or architectural features from this period have been identified thus far. The third major period began with settlements in the Early and Middle Iron Age, from the 11$^{th}$ century BCE onwards. The Iron Age occupation of the northern plateau has not yet been investigated, but its pottery spectrum is typologically identical to that of the southern plateau, where it has been found in all excavation areas (IV.1–6). The Iron Age layers reach thicknesses of up to 1.5 to 2 m, completely covering the older occupation horizons. The Iron Age settlement on the southern plateau significantly disturbed the older Chalcolithic and Early Bronze Age settlement features, mainly due to its deep storage pits. The Iron Age settlement, approximately 5 to 6 ha in size, was surrounded by a fortification of rubble stone walls (Fig. 3) with gateways to the south and probably also to the north and the area of Dzedzvebi III.

Archaeological fieldwork on the Dzedzvebi Plateau is difficult because the area is covered by whitethorn bushes (Dzedzvi bushes) and is subject to erosion, especially in Area II, where medieval field cropping took place and terraces were constructed. The plateaus consist of Mashavera basalt, which has been dated by Argon/Argon to 1.85 million years ago.[26] Therefore, it is difficult to carry out large-scale magnetic surveys; an extensive georadar survey is planned for the near future. Because of these conditions, surveys consisted of traditional field survey and small-scale soundings. The construction of a dirt road by bulldozer in 2008 across the full length of the plateau also provided important insights about pottery scatter and the distribution of features. During the 2007–2021 field campaign, the team investigated a series of trenches between Dzedzvebi II and the southern plateau (Dzedzvebi IV). A firm chronological frame was established based on stratigraphical sequences, typological studies of ceramics and other artefacts, and a series of 59 AMS $^{14}$C dates,

22 Muskhelishvili 1941. – Sinauridze 1985.

23 Stöllner et al. 2014. – Gambashidze, Stöllner 2016. – Stöllner et al. 2021.

24 Stöllner et al. 2010. – Stöllner, Gambashidze 2011. – Stöllner et al. 2014. – Gambashidze, Stöllner 2016. – Stöllner, Gambashidze 2018.

25 Stöllner et al. 2014. – Gambashidze, Stöllner 2016. – Stöllner et al. 2021.

26 Ferring et al. 2011.

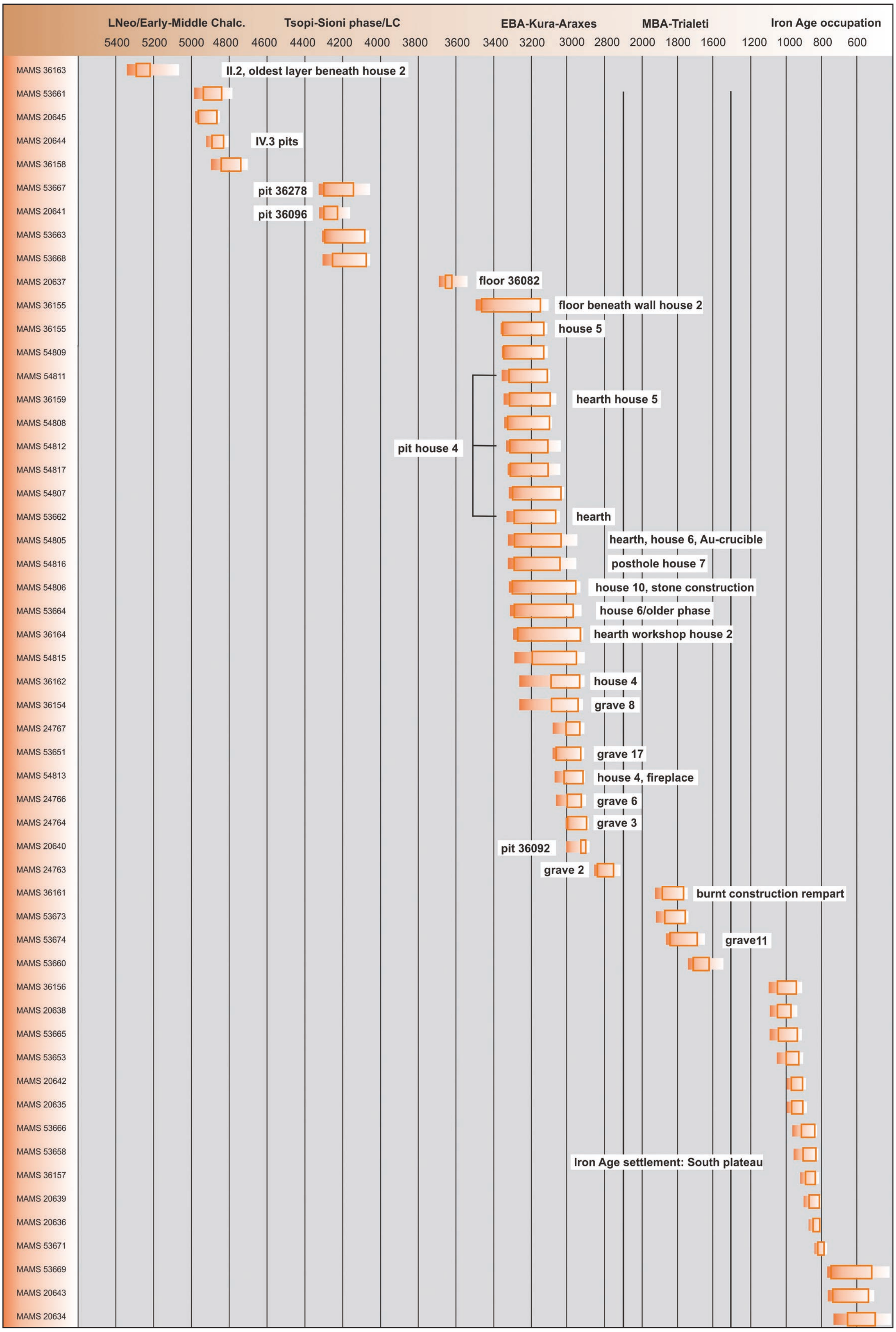



Fig. 4. Calibrated AMS $^{14}$C datings (OxCal v4.4.4) from the Early Bronze Age Sakdrisi and Dzedzvebi mining and settlement complex according to the 1$\sigma$- and 2$\sigma$-confidence interval (Draft: DBM/RUB; T. Stöllner; see Tab. 1).

| Lab. No. | Feature | Feature description | Material | Delta $^{13}$C %0 | | | $^{14}$C BC 1 | $^{14}$C BC 2 | $^{14}$C Age BP | C:N | C [%] | Colla-gen [%] | Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAMS 36163 | 34029 | Neolithic layer | Bone | ± | 46 | –14.1 | calBC 5306–5222 | calBC5363–5078 | 6282 | 3.3 | 35.5 | 6.3 | Late Neo-lithic/Early-Middle Chalcolithic |
| MAMS 20645 | 36131 | Early Chalco-lithic Layer | Charcoal | ± | 18 | –32 | calBC 4945–4851 | calBC4982–4846 | 6020 | | 32.0 | | |
| MAMS 53661 | 36533 | Pit 79 | Seed fragment | ± | 31 | –22.4 | calBC 4934–4841 | calBC 4987–4795 | 5996 | | 66.7 | | |
| MAMS 20644 | 36128 | Chalcolithic Layer | Charcoal | ± | 18 | –25.7 | calBC 4907–4839 | calBC4935–4801 | 5985 | | 25.7 | | |
| MAMS 36158 | 36323 | Filling of Pit 11 | Charred plant remains | ± | 29 | –27.4 | calBC 4841–4748 | calBC4894–4723 | 5930 | | 49.4 | | |
| MAMS 20641 | 36094 | Disturbace of Pit 27 | Charcoal | ± | 17 | –27.5 | calBC 4318–4237 | calBC4327–4175 | 5383 | | 27.5 | | Tsopi-Sioni phase/LC |
| MAMS 53667 | 36278 | Pit 4 | Cereal fragments | ± | 30 | –30.8 | calBC 4321–4071 | calBC 4328–4055 | 5363 | | 81.5 | | |
| MAMS 53663 | 36540-1 | Filling of Pit 84 | Seed fragment | ± | 29 | –13.4 | calBC 4306–4062 | calBC 4320–4053 | 5343 | | 64.5 | | |
| MAMS 53668 | 36311-1 | Filling of Pit 1 | Cereal fragments | ± | 25 | –20.4 | calBC 4239–4061 | calBC 4311–4051 | 5329 | | 60.0 | | |
| MAMS 20637 | 36082 | Cultural layer | Cereal fragments | ± | 21 | –20.7 | calBC 3651–3639 | calBC 3692–3540 | 4848 | | 20.7 | | EBA-Kura-Araxes |
| MAMS 36155 | 34029 | Slope colluvium | Charcoal | ± | 26 | –27.2 | calBC 3483–3146 | calBC 3493–3123 | 4578 | | 46.3 | | |
| MAMS 54809 | 38107 | Floor | Charcoal | ± | 28 | –16.2 | calBC 3360–3111 | calBC 3366–3102 | 4536 | | 61.9 | | |
| MAMS 36160 | 37042 | Backfilling of Grave 8 | Charcoal | ± | 26 | –23.8 | calBC 3352–3119 | calBC3357–3104 | 4527 | | 36.0 | | |
| MAMS 54811 | 38134 | Deepest filling of Pit 6 | Charred cereal grain fragments | ± | 29 | -18.7 | calBC 3356–3109 | calBC 3362–3102 | 4527 | | 68.6 | | |
| MAMS 54808 | 38114 | Floor | Charcoal | ± | 29 | –22.7 | calBC 3344–3105 | calBC 3355–3099 | 4510 | | 65.1 | | |
| MAMS 54812 | 38133 | Middle filling of Pit 6 | Charcoal | ± | 28 | –17.2 | calBC 3331–3101 | calBC 3346–3037 | 4488 | | 64.9 | | |
| MAMS 54817 | 37118 | Filling of Pit 5 | Charred cereal grain fragments | ± | 24 | –18.4 | calBC 3331–3100 | calBC 3341–3041 | 4485 | | 64.4 | | |
| MAMS 36159 | 37017 | Filing of Pit 37006 | Charred plant remains | ± | 26 | –23.4 | calBC 3328–3099 | calBC 3340–3039 | 4484 | | 53.1 | | |
| MAMS 53662 | 38046-1 | Upper filling of Pit 6 | Seed fragment | ± | 28 | –15.2 | calBC 3325–3032 | calBC 3335–3025 | 4463 | | 58.5 | | |
| MAMS 54807 | 37155 | Filling of Pit 11 | Charred cereal grain fragments | ± | 30 | –18.6 | calBC 3322–3028 | calBC 3338–3012 | 4454 | | 68.5 | | |
| MAMS 54816 | 40047 | Posthole | Charred fruitstone | ± | 24 | –20 | calBC 3314–3026 | calBC 3332–2939 | 4446 | | 69.1 | | |
| MAMS 54805 | 40034 | Hearth in House 9 | Charred particles | ± | 29 | –19.2 | calBC 3316–3023 | calBC 3332–2935 | 4444 | | 64.2 | | |
| MAMS 54806 | 37161 | Grave 21 | Charred particles | ± | 29 | –21.6 | calBC 3312–2940 | calBC 3328–2925 | 4431 | | 61.5 | | |
| MAMS 53664 | 40012 | Waste dump area | Charcoal fragment | ± | 28 | –20.1 | calBC 3307–2939 | calBC 3326–2926 | 4430 | | 65.4 | | |
| MAMS 36164 | 34053 | Hearth in House 1 | Charcoal | ± | 25 | –21.3 | calBC 3261–3013 | calBC 3310–2925 | 4423 | | 57.2 | | |
| MAMS 36154 | 37023 | Grave 8 | Bone | ± | 24 | –20.8 | calBC 3093–2944 | calBC 3261–2925 | 4413 | 3.2 | 42.7 | 9.0 | |
| MAMS 54815 | 37159 | Pit 9 | Charcoal (branch wood?) | ± | 24 | –23.6 | calBC 3094–2937 | calBC 3307–2920 | 4413 | | 69.2 | | |
| MAMS 36162 | 38017 | Deposit of stones and pottery | Charcoal | ± | 29 | –27 | calBC 3089–2939 | calBC3262–2919 | 4406 | | 61.6 | | |
| MAMS 24767 | 34809/ 34810 | Grave 6 | Bone | ± | 22 | –20.8 | calBC 3086–2934 | calBC 3090–2926 | 4401 | | No data | 5.1 | |
| MAMS 53651 | 40027 | Grave 17 | Bone fragment | ± | 18 | –20.1 | calBC 3078–2932 | calBC 3091–2922 | 4397 | | 20.1 | | |
| MAMS 24766 | 34809/ 34810 | Grave 6 | Bone | ± | 23 | –22.2 | calBC 3016–2928 | calBC 3085–2915 | 4378 | 3.0 | 25.6 | 3.4 | |
| MAMS 54813 | 38117 | Hearth in Trench 2 | Charred cereal grain and seed fragments | ± | 24 | –16.2 | calBC 3011–2916 | calBC 3076–2907 | 4361 | | 65.5 | | |
| MAMS 24764 | 33026 | Grave 3 | Bone | ± | 22 | –19.6 | calBC 3008–2902 | calBC 3012–2899 | 4333 | 3.1 | 28.2 | 6.1 | |
| MAMS 20640 | 36092 | Cultural layer | Charcoal | ± | 21 | –28.5 | calBC 2925–2899 | calBC 3010–2893 | 4321 | | 28.5 | | |
| MAMS 24763 | 34801 | Grave 2 | Bone | ± | 21 | –18.8 | calBC 2833–2579 | calBC 2852–2506 | 4091 | 3.0 | 23.1 | 1.7 | |

Tab. 1. List of AMS $^{14}$C datings of Dzedzvebi excavations (DBM/RUB; T. Stöllner, A. Belošić).

| Lab. No. | Feature | Feature description | Material | Delta $^{13}$C %0 | | | $^{14}$C BC 1 | $^{14}$C BC 2 | $^{14}$C Age BP | C:N | C [%] | Colla-gen [%] | Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAMS 36161 | 39029 | Burned layer | Charcoal | ± | 25 | –24.4 | calBC 1911–1779 | calBC1934–1770 | 3529 | | 57.2 | | MBA-Trialeti |
| MAMS 53673 | 36432 | Pit 71 | Charred annual plant material | ± | 24 | –23.5 | calBC 1893–1775 | calBC 1931–1750 | 3523 | | 65.4 | | |
| MAMS 53674 | 38062 | Grave 11 | Bone fragments | ± | 21 | –17.9 | calBC 1867–1694 | calBC 1876–1646 | 3444 | 3.2 | 43.6 | 2.1 | |
| MAMS 53660 | 36557 | Pit 91 | Seed fragment | ± | 26 | –15.6 | calBC 1732–1628 | calBC 1747–1567 | 3388 | | 61.7 | | |

Tab. 1. Continued.

of which 39 date from the 6th to the 2nd millennium BCE and are published here (Fig. 4 and Tab. 1).

### 3. Late Chalcolithic and Early Bronze Age Settlement: Results of the Archaeological Excavation

#### 3.1. Late Chalcolithic and Early Bronze Age Settlement on the Southern Plateau (Area IV)

As early as 2010, fundamental insights into the settlement stratigraphy of the southern plateau were brought to light when a test trench was dug in Dzedzvebi IV.3 (trenches 4/5), where a Chalcolithic phase with Sioni-period pottery had been documented. The first $^{14}$C dates confirmed an early and late 5th millennium BCE occupation (Fig. 4 and Tab. 1), significantly older than the Kura-Araxes-period occupation of the plateau, which in turn was followed stratigraphically by Middle Bronze Age and Iron Age layers and features. This exceptional discovery was confirmed by a larger-scale excavation, conducted in 2014–2015 and 2019. A total of 17 pits with Sioni-period pottery were discovered and at least partially excavated. Chalcolithic features are represented by six pits in Trench 2 and another ten to eleven features in Trench 4 (Fig. 5).[27] It is evident that some of these features were disturbed by later Early Bronze Age and especially Iron Age features. These disturbances are the reason the assignment of some pit features is not certain, as Chalcolithic pottery could be intrusive in younger features (pits 5, 39 and 84). A series of AMS $^{14}$C dates allows a chronological estimation of both Chalcolithic phases. The older phase clearly spans from the 49th to the 47th century BCE (Early Chalcolithic), while a second, Late Chalcolithic, phase has been dated to the 44th–40th centuries BCE. This was unexpected, as the pit inventories did not initially reveal any significant differences between the certainly Late Chalcolithic pits 1, 3, 4, 24, 91 and 93 and the older Early Chalcolithic features (pits 7, 11 and 79). Based on their pottery characteristics, Pit 2 and Pit 89 can also be assigned to the latter phase.[28] Other pits cannot be more precisely dated without $^{14}$C dating (pits 5–6, 39, 78 and 80–81). The pits, which are often cauldron shaped, were originally used as storage pits and most of them contained pottery, obsidian and animal bone deposits. Particularly striking is the pottery found in some of the Late Chalcolithic pits, such as pits 1 and 4, which contain large pieces, indicating the intentional storage of vessel sets. The pottery forms and types cannot be described as chaff-faced ware *sensu strictu*.[29] Since the older Sioni pottery also included organic temper (in combination with mineral temper), it instead appears to reflect a regional pottery tradition that involves hand-building techniques. Obsidian debitage flakes and debris were also recovered; some of these point to core modification, the production of blades and other tools near the pits, and the disposal of larger quantities of obsidian (as in pits 1, 4 or 11, which together contained 611 flakes and blades). The find variation observed in the disposal of bones also suggests that the waste that was discarded in the pits relates to specific practices. The same is true for the Late Chalcolithic pits that contain significant amounts of pottery (pits 1, 4, 7 and 91). The interpretation of special food consumption and food storage practices is supported by additional evidence, for example the composition of the vessel inventories, which include stretched storage vessels, bowls and so-called mangals (flat, pan-like vessels with perforations on the rim) (Fig. 6). That certain activities are reflected in the pit contents can also be supposed for Pit 4, where, in addition to metallurgical equipment, uncommon obsidian flakes from the deposits of Sarikamis (eastern Turkey) were found (almost all the other obsidian artefacts originate from Mount Chikiani near Paravani Lake; see section 4.3). The smelted copper also originates from a foreign copper-ore deposit, which can be assumed to be on the Armenian Plateau.[30] The presence of these artefacts indicates exchange relations over great distances, involving the inhabitants of the Dzedzvebi Plateau.

27 Baldus 2022.

28 Stöllner in press.

29 In the sense of Marro 2010 of the Late Chalcolithic (Leilatepe/Amuq F horizon). – See also Lyonnet 2018. – Marro 2022.

30 Stöllner 2021b.

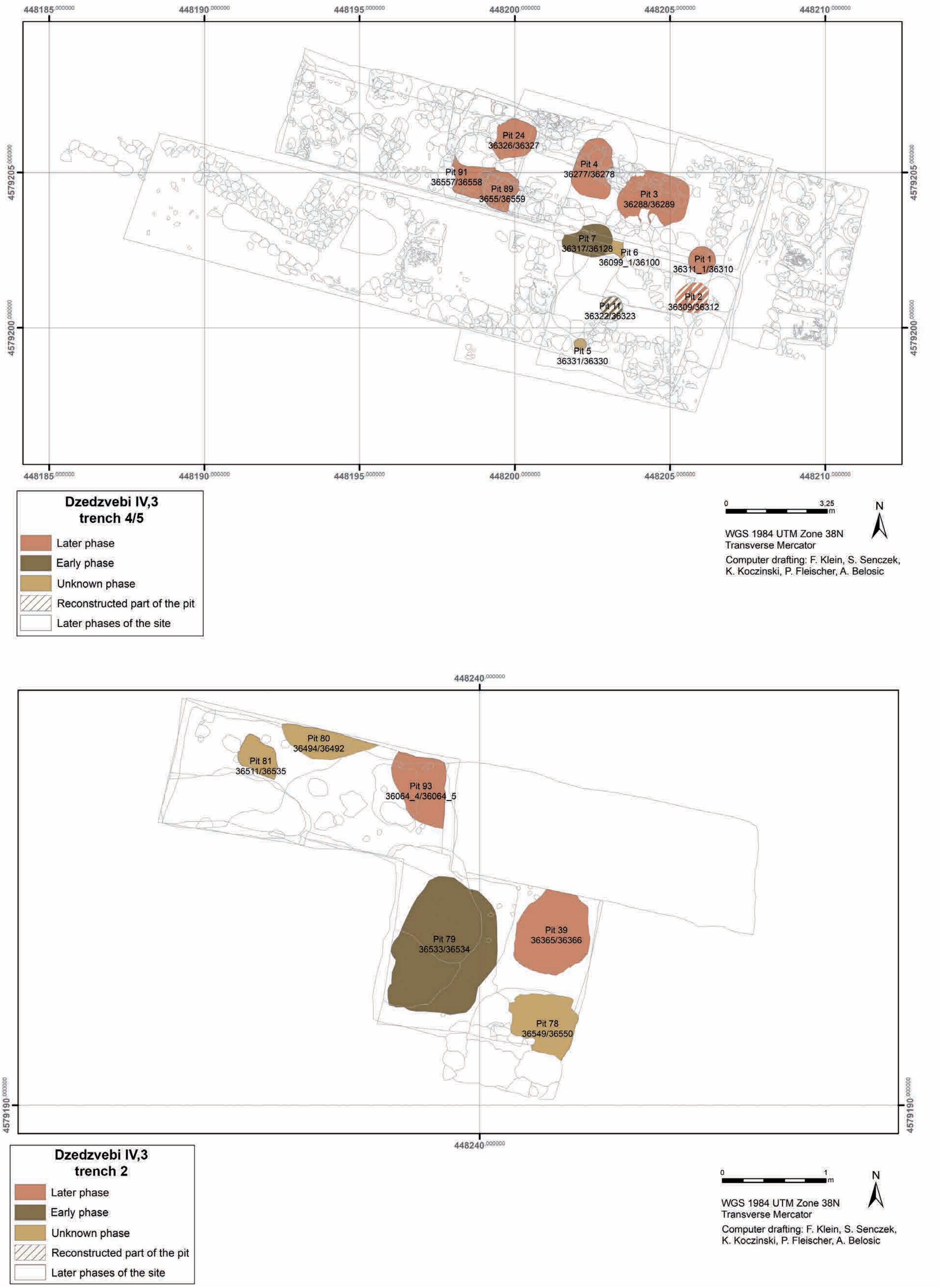



Fig. 5. Chalcolithic pits from the southern plateau settlement at Balichi-Dzedzvebi Plateau, according to their Early Chalcolithic, Late Chalcolithic, classic Sioni and general Chalcolithic dating (Draft: DBM; S. Senczek, A. Belošić).

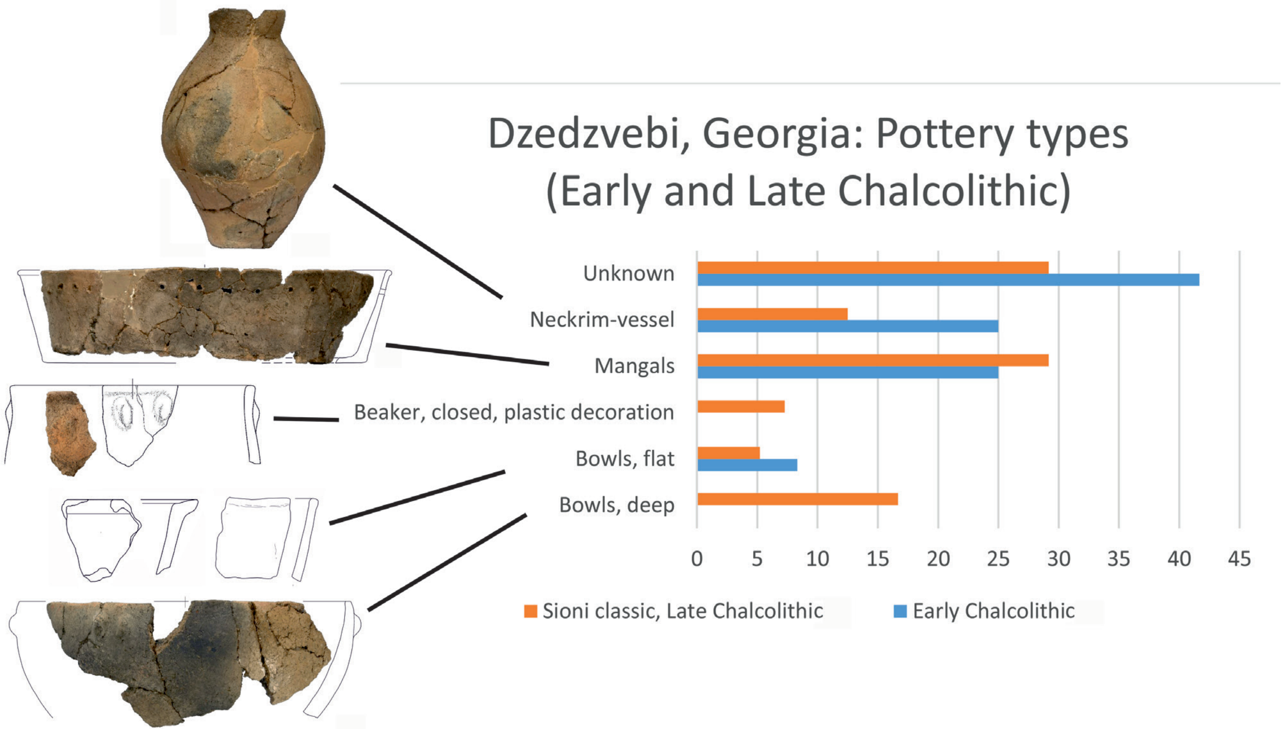



Fig. 6. Pottery types according to their dating in various pits of the southern plateau settlement at Balichi-Dzedzvebi Plateau (Draft: DBM/RUB; T. Stöllner).

Kura-Araxes-period layers are more difficult to assess than the numerous Chalcolithic pits. It is clear that during the early phase of the Kura-Araxes period (36th to 35th century BCE), a flat levelling of sandy-silty material occurred (observable in trenches 2 and 4/5 of IV.3). Some of these deposits are nearly 50 cm thick (36082). These features also contained remarkable domestic debris (see section 4.4), representing a dwelling horizon. A few pit features and, most importantly, most of the find assemblages, can be attributed to the fully developed Kura-Araxes period (around 3000 BCE and even later), which indicates a longer occupation period. However, little can be said about the structure of this settlement. The younger layers of the Middle Bronze Age (Trialeti Culture) are more informative; these are represented by a layer on top of a Chalcolithic pit (Pit 91), a burnt feature on the southern rampart (39029) and a posthole structure (36434). These features indicate that the plateau was used and settled at least sporadically during this period.

### 3.2. Early Bronze Age Settlement and Metallurgical Activities on Dzedzvebi's North Slope (Areas II and III)

#### 3.2.1. Workshops and Houses in Dzedzvebi, Area II.2

Area II.2 has been under investigation since 2007, when a hearth was incidentally discovered during construction of the Dzedzvebi dirt road (the hearth of what was later labelled House 1). In 2008, the excavation focused on the southwest, where House 2 was discovered (Fig. 7). Excavations were resumed in 2013 and were finally completed in 2014. Multiphase occupation and metallurgical activities can be observed across the area. As early as 2008, it became clear that the double-shelled wall of House 2, on its southwest side, had been added to the older house wall of House 1. Further excavations confirmed these findings. However, the features were disturbed by the old dirt road running through the middle of houses 1 and 2. The 2014 excavations further to the southwest, along the newer dirt road, also showed that the preservation condition of the features would likely make further archaeological observations difficult, due to erosion. The excavation of an area (II.6) to the north and adjacent to excavation Area II.2 unexpectedly did not reveal any relevant features aside from medieval rubble stone wall terraces. Nevertheless, these findings are significant, because they make it clear that scattered settlement activity can be expected in various areas of the Early Bronze Age occupation.

House 1 is a circular house feature, c. 8 m in diameter, with a single-shelled outer wall and central hearth. An attempt to record an older soil layer in the north of the feature failed to reveal any clear features but showed that numerous Kura-Araxes-period pottery fragments were embedded in

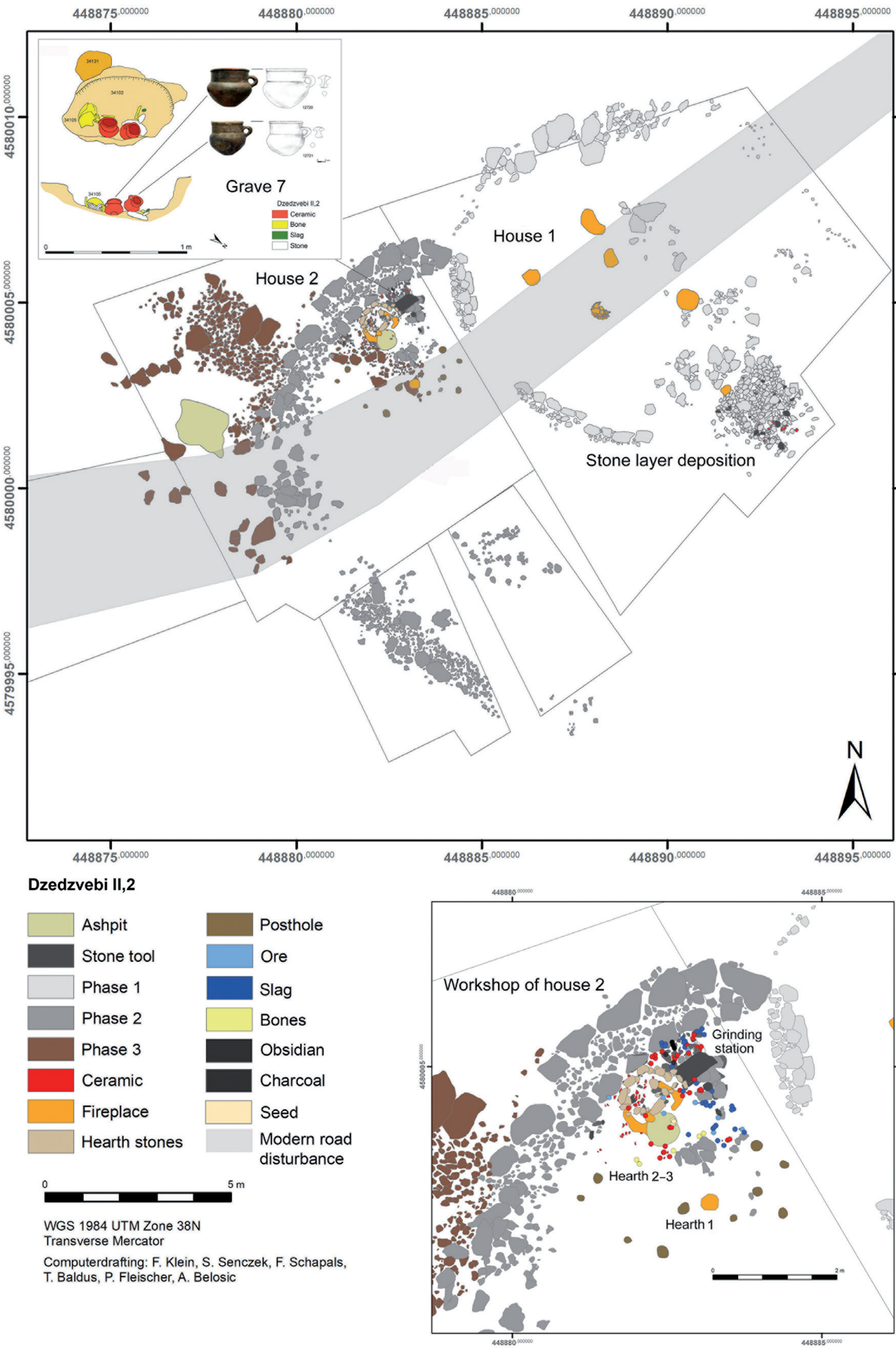



Fig. 7. Dzedzvebi, Area II.2, features of the Kura-Araxes building phases 1–3 (House 1, House 2, stone layer deposition, workshop and Grave 7) and an older ash pit in the west (Draft: DBM/RUB; A. Belošić, S. Senczek).

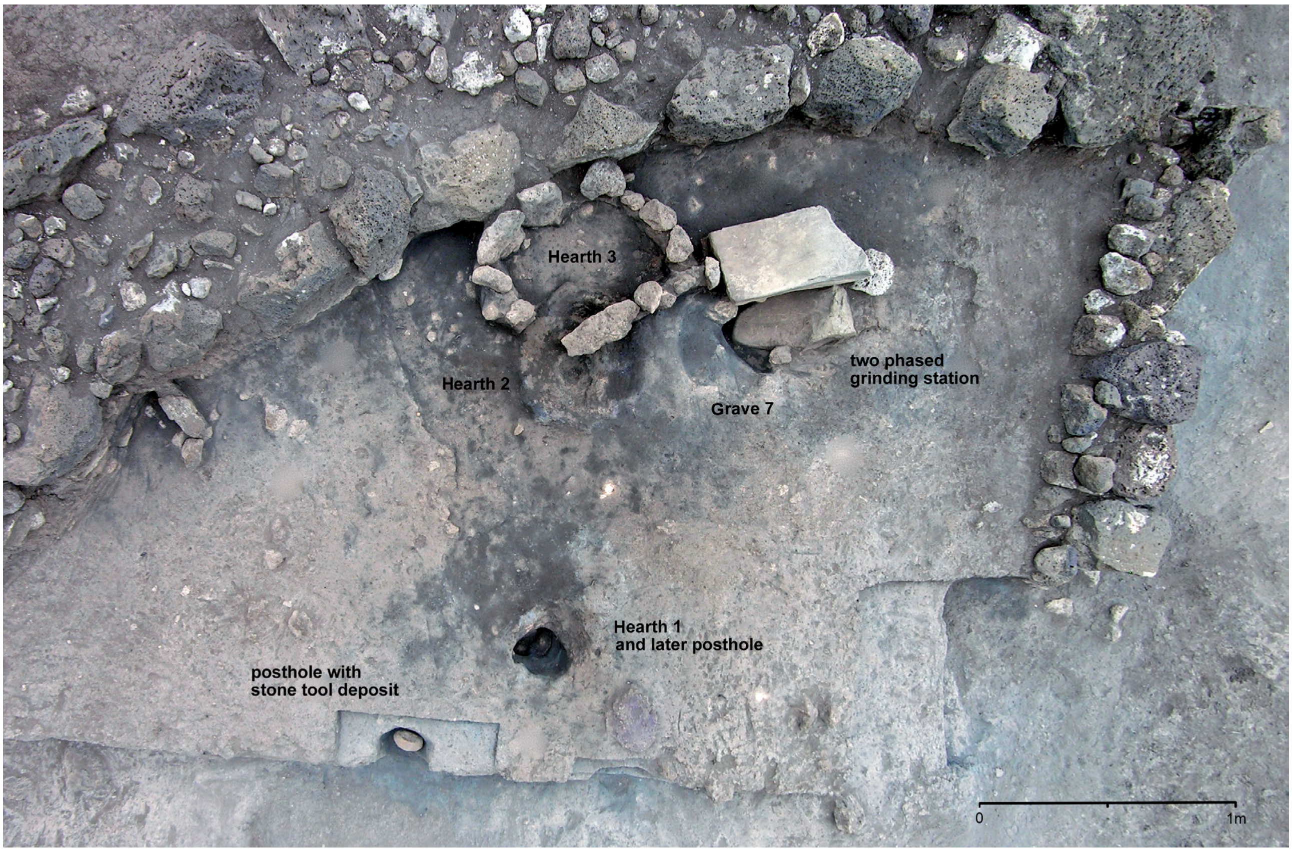



Fig. 8. Dzedzvebi, Area II.2, bird's-eye view of the workshop area of House 2 in its younger phases with grinding station (beneath the pit of Grave 7 is visible), hearths 1–3 and postholes (Photo: DBM/GNM/RUB; T. Rabsilber).

the floor loam, indicating the presence of older feature layers in the surrounding area. In 2008, an extension of the excavation to the southeast of House 1 finally yielded a layer consisting of quarry stones and macrolithic tools that had been placed on an old surface (Feature 34014) (Fig. 7). A similar find was documented in II.8 (Feature 38022). A comparable quarry stone deposit (Feature 34024) was also discovered in the workshop area of House 2, to the north of House 1, in the spandrel of the double-shelled wall (34026). This area turned out to be the location of a metallurgical workshop, which seems more than a sheer coincidence, as it seems that such layers covered places of important practices in the Dzedzvebi EBA settlement (e.g. areas II.2, II.3, II.8). The double-shelled wall was only partially preserved, due to the old dirt route, which curved to the southeast. Interior structures cannot be clearly distinguished in the eastern part, but a waste area outside Wall 34026 was documented in Feature 34051. The multiphase workshop finds investigated in the northwestern area of House 2 are significant (Figs. 7–8). One of the *in situ* features consisted of two superimposed hearths (hearths 2 and 3) from the Kura-Araxes period (34053: MAMS 36164, calBC 2$\sigma$ BC3310–2925, Tab. 1). This sequence corresponded to an arrangement of two superimposed grinding bases found above a pit (34067). Another, smaller, hearth, was found in the surrounding area, along with slag and ore heaps. An area of waste mixed with crucible remains was located to the north of House 2 (under an originally transverse wall) and investigated in 2014. Surprisingly, during the 2014 excavation, Pit 34067 was discovered to be a burial pit for a skull burial of a juvenile with two accessory vessels (then 34105) (Fig. 7, top left). Two large grinding plates were later placed on each other and on top of the fill, indicating a two-phase grinding station and attesting to the ritual nature of the metallurgical practice.[31] Another, older, hearth was located to the south (Feature 34074). Numerous slag deposits on the reddened subsoil attest to metallurgical use. This hearth feature (Hearth 1; the oldest hearth feature) was cut by a posthole (34076) from a later workshop phase, again indicating the multiphase nature of the site (Fig. 8). The hearth was found in the subsoil close to a stone setting (36131) and is therefore likely one of the oldest metallurgical installations at the workshop. Two

31 Stöllner 2017, 124–125 and Fig. 2,2; 127–128.

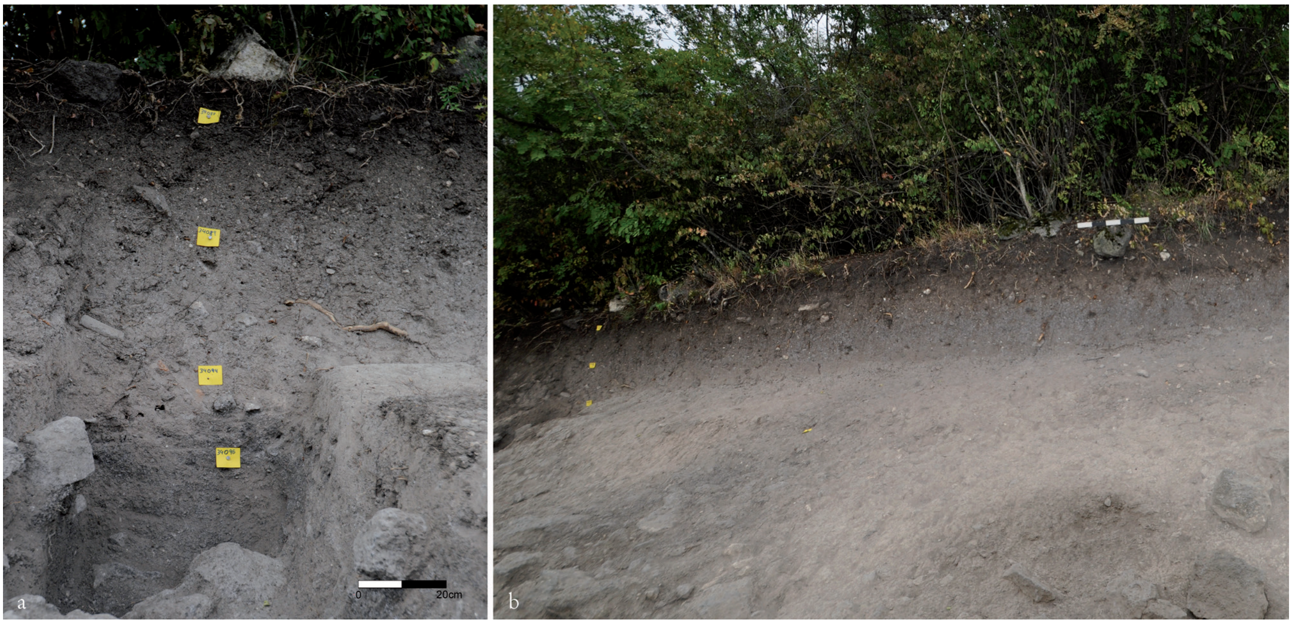


Fig. 9. Dzedzvebi, Area II.2, east profile alongside the old dirt road, showing soil colluvium on top of Kura-Araxes layers. – a. Colluvium layer 34096 on top of ancient topsoil; view towards a sounding/E-profile. – b. E-profile from NW (Photos: GNM/RUB; F. Schapals).

large postholes to the east of the feature also indicate that the hearth was covered with some kind of roofing. Thus, after the removal of a massive building post (34070), a rubbing stone fragment was deposited in the posthole, again suggesting ritual activities in the vicinity of the metallurgical activities. The workshop's use during multiple phases is also confirmed by stratigraphic analysis and construction finds.

House 2 and its workshop were probably not the oldest Kura-Araxes features at this site. The 2013 and 2014 investigations to the northwest and west of Wall 34026 yielded stratigraphically older features: a hearth (34051, in the old dirt road), an ash pit (34096, Fig. 7) and an ash-filled hearth (34106). These features probably lay under a slope colluvium (34029/34098) and indicate the presence of older house features from the Kura-Araxes period there. In the northwestern corner of the excavation area, a stone pack with wall features (34097 and 34099) was also documented; however, any association with the aforementioned features cannot be determined. Parallel to the later wall alignment of House 2, a downhill erosion channel was also documented, which was filled by the slope colluvium and contained some random stone and crucible material. The dating of the slope colluvium thus provides evidence of older metallurgical activity at this site, predating the activity that took place in the workshop of House 2 (see above, 34029: MAMS 36155, calBC 2$\sigma$ 3493–3123, see Tab. 1). Whether an animal bone fragment also found in this Late Neolithic layer (late 6$^{th}$ millennium BCE) points to a distinctly older date (Find 6481: MAMS 36163, calBC 2$\sigma$ 5363–5078, see Tab. 1), however, cannot be determined at present, as no corresponding features have been identified to date. A suspicious stone packing (34097) in the northwest corner of the excavation may also be Kura-Araxes-period terracing, which has been documented in two places during the excavations along the old dirt road. Its east profile also shows the various slope colluvia (34094) that developed along the terraces and clearly had a damming effect (Fig. 9).

### 3.2.2. Workshops, Houses and Graves in Dzedzvebi, Area II.3

The investigation of settlement sections further downhill revealed a similar multiphase stratigraphy. The first features were documented there in the vicinity of House 3 as early as 2009 (Fig. 10).[32] Excavations resumed in 2019 and house complexes 6, 7 and 8 were also investigated in 2021. The current settlement plan shows three honeycomb-like ground plans with massive, double-shelled foundation walls. These ground plans have different interior dimensions: House 6 measures approximately 60 to 70 m$^2$ (depending on the construction phase), while House 3 is considerably larger, at 110 m$^2$ and House 7 is larger still, measuring approximately 180 m$^2$ (Fig. 10). The preservation conditions of the architectural remains vary, as the slope has led to erosion-related damage, especially in the downhill sections.

32 Stöllner et al. 2014, 97–99.

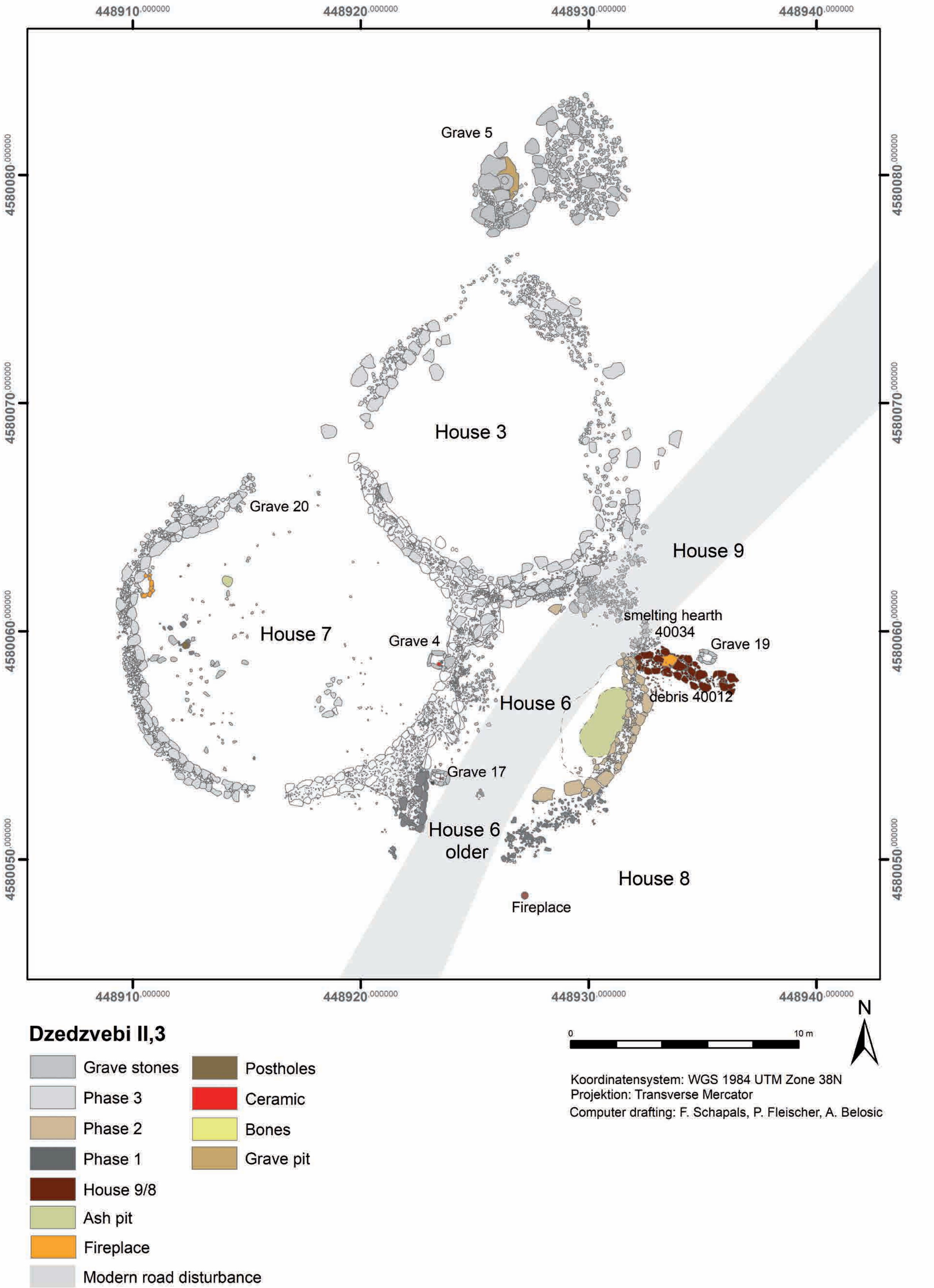



Fig. 10. Dzedzvebi, Area II.3, features of the Kura-Araxes building phases 1–3 (houses 3, 6–9) (Draft: DBM/GNM/RUB; F. Schapals, P. Fleischer, A. Belošić).

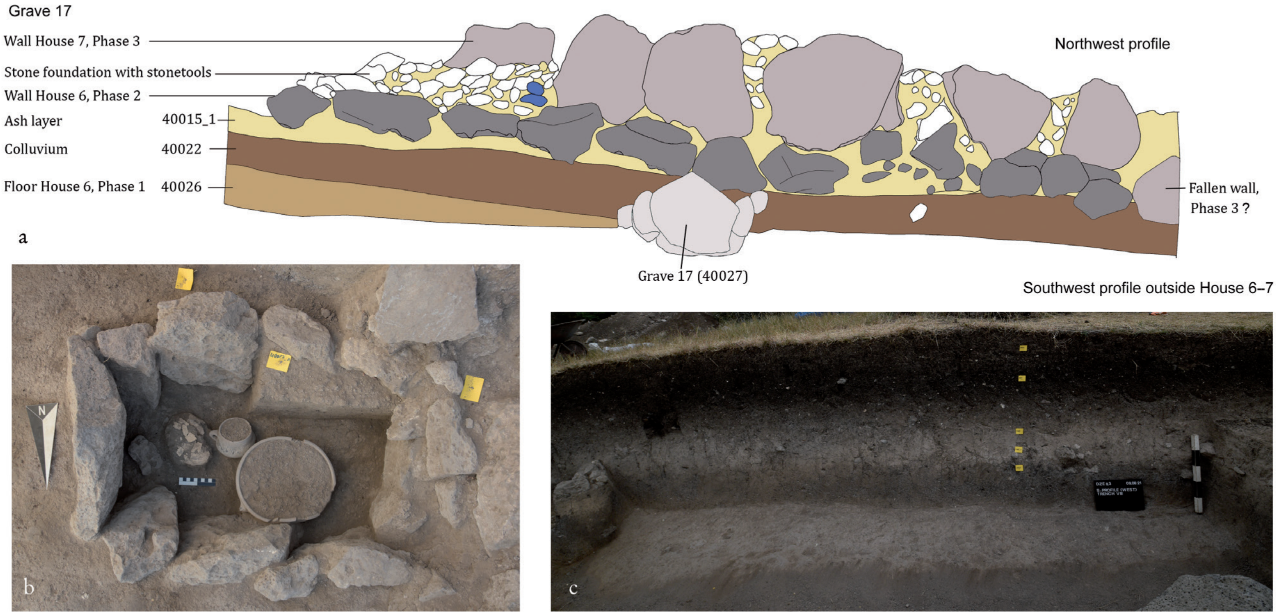



Fig. 11. Dzedzvebi, Area II.3, stratigraphic sequence around houses 6 and 7 and Grave 17 as well as the Early Bronze Age slope colluviums 40022. – a. W-profiles of house walls of houses 6 and 7. – b. Grave 17 with juvenile skull, jug and bowl. – c. S-profile south of houses 6 and 7 with stratigraphical sequence (the ancient topsoil is visible below) (Draft/photos: DBM/GNM/RUB; S. Senczek, F. Schapals, T. Stöllner).

House 6 was also disturbed in the central areas by the old dirt road. Nevertheless, certain common building principles can be observed: the outer sections of the double walls are constructed with large blocks of basalt, filled with smaller rocks. Postholes were not observed in the house walls; only House 7 includes individual, apparently randomly scattered postholes in its interior. These findings suggest light wick constructions for walls and roofs, probably wattle-and-daub structures consisting of light poles with mud or other organic coverings and a single supporting post inside the large buildings. Central hearths – typical for Kura-Araxes house features (e.g. in Shida Kartli or on the Armenian Plateau) – are also absent here.[33] While no hearths were discovered in the houses themselves, one was found south of House 6, which suggests another house was located to the southwest (House 8?). All the features investigated so far are associated with stone cist graves. For example, a skull burial of a juvenile was discovered in Grave 4 in 2009; it can now be assigned to the interior of House 7. Another stone deposition site with a vessel was discovered in the northwestern part of the building (Grave 20). It has been identified as a possible cenotaph. The oldest construction phase of House 6 also included a stone cist, Grave 17 (MAMS 53651, calBC 2$\sigma$ 3091–2922), while to the north of House 6, another stone cist, without burial (Grave 19) was discovered (another house interior, tentatively identified as House 9, likely adjoins here) (Fig. 11). Finally, as early as 2009, House 3 yielded a roundish stone set in the northwest, in the centre of which a Middle Bronze Age burial (Grave 5) was discovered. Vessel deposits from the Trialeti Culture indicate that ritual activities continued well beyond the actual use of the house. It is likely the house construction was still visible in the first half of the 2nd millennium BCE. The stratigraphic position of the stone cist, Grave 17, is interesting, as it clearly belongs to the oldest construction phase of House 6 and was covered by its younger western stone wall (second phase) (Fig. 11). Nevertheless, the grave likely remained accessible, and it cannot be ruled out that ritual activity continued at the cist. The features in the south of houses 6 and 7 provide insights into the multiphase use of the site: House 6 was built in a first phase with a stone cist, before the area was covered by colluvium (40022) with relatively few finds and renewed humus formation (Fig. 11, bottom right). House 6 was then rebuilt with a new wall that extends further to the south and corresponds with a find-rich ash layer (Layer 40015-1), on the surface of which a distinct find-rich surface (40015) was found, probably a waste layer from the third phase in this area. That third phase consists of the construction of House 7, which was partly set on the western outer walls of House 6. Since the radiocarbon dating of ashy posthole fill from within House 7 (40047: MAMS 54816, calBC 2$\sigma$ 3332–2939) is roughly contemporaneous with the presumed most recent occupation of Grave 17 (House 6), it

33 Sagona 2017, 230–234.


Fig. 12. Dzedzvebi, Area II.3, ash-filled metallurgical hearth 40034 and debris area at the spandrel of houses 6 and 9 (Feature 40012) (Photo: DBM/GNM/RUB; F. Schapals).

is unlikely that much time passed between the reconstruction of House 6 and the occupational activities of House 7. A metallurgically used hearth (40034) of a house feature to the north (House 9?) has also been dated to this time range (MAMS 54805, calBC 2$\sigma$ 3332–2935), along with a waste area (40012) in the house spandrel outside House 6 and the presumed House 9 (MAMS 53664, calBC 2$\sigma$ 3326–2926) (Fig. 12). These features probably correspond to the second phase (House 3, House 7 and House 6, younger building phase). They indicate the repeated use of the house areas, accompanied by reconstruction work, for which light and easily renewable roof constructions were probably well suited.

The evidence of craft activities in II.3 is significant. The high number of ore crushing and rubbing tools, crucible fragments, slags and pieces of ore found in House 3 in 2009 was striking.[34] The excavations in 2019 and 2021 confirmed these findings, documenting rubbing implements in the younger settlement features distributed around House 7 (south and east) and east of House 6, indicating the presence of specific waste areas outside the house features. The processing of gold-bearing ores was demonstrated by sediment analyses from soil samples;[35] further evidence was found in a hearth pit to the northeast of House 6 (probably House 9?). A pit filled with ash (40034, built into an outer wall) yielded crucible fragments near light slag crusts that also included molten gold remains (see section 4.2). This evidence is significant not only because it confirms gold extraction took place here, but also because, as an analysis of the ore remains has already shown, it links the area to gold ore mining activities at Kachagiani (Sakdrisi).[36]

### 3.2.3. Workshops, Graves, Pits and Houses in Areas II.7–8

Trenches in this area were excavated in 2014–2015, 2019 and 2021. Here, too, initial prospection was based on test trenches made across the terraced terrain. Three exploratory

34 Stöllner et al. 2014, Fig. 24.

35 Stöllner et al. 2021. – Stöllner 2021b.

36 Jansen, Stöllner, Courcier 2014, 105 and Fig. 31.

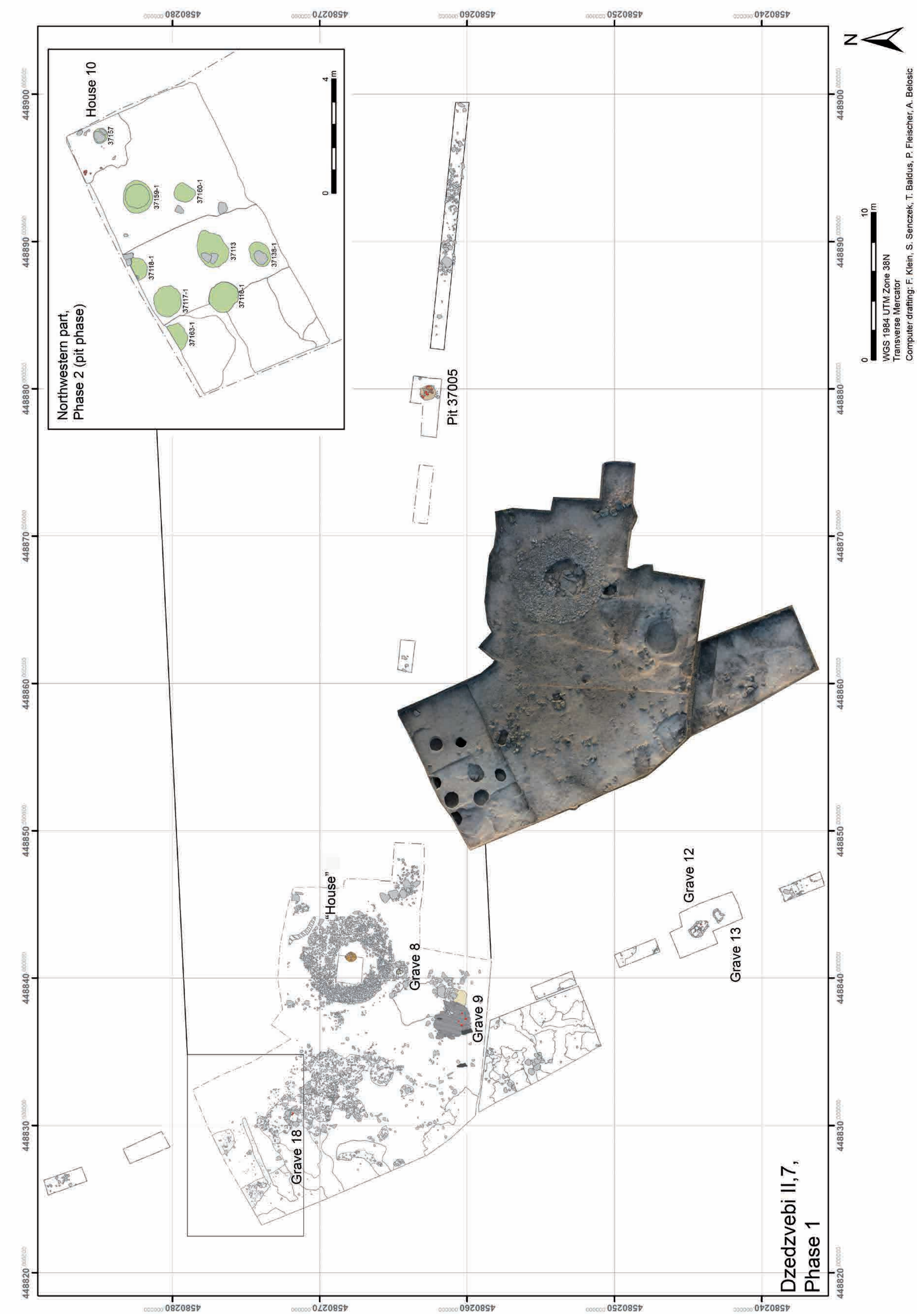



Fig. 13. Dzedzvebi, Area II.7, features around the platform 'House 5' and the graves 8–9, 12–13 and 18 according to the phases (Draft/photos: DBM/GNM/RUB; F. Klein, T. Baldus, S. Senczek, P. Fleischer, A. Belošić).

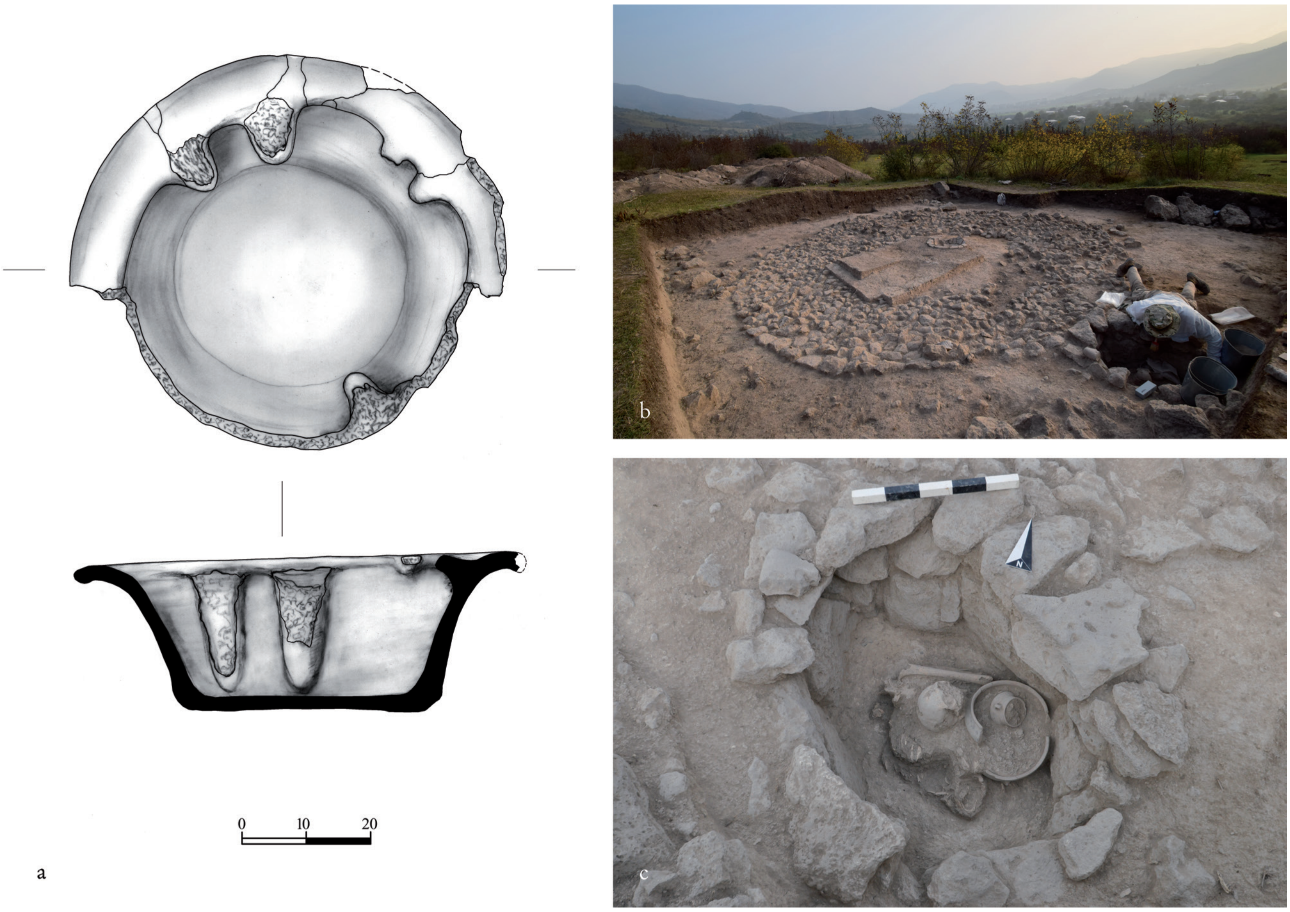



Fig. 14. Dzedzvebi, Area II.7, 'House 5' and Grave 8: Multi-tongued clay hearth (a), view from the southeast to 'platform' House 5 and Grave 8 during excavation 2014 (b) and view to Grave 8 (c) (Photo/drawing: DBM/GNM/RUB; T. Sachvadze, F. Klein).

trenches running approximately E–W were opened along the surface excavation of II.8, while in II.7, five search trenches were initially laid out over a length of 38 m that covered both terraces (Fig. 13). As Kura-Araxes-period stone settings and pit features were encountered everywhere, individual areas were investigated and documented in detail. In Trench 2, a shallow, cauldron-shaped pit was documented (Feature 37006) and the deposit of four vessels (an amphora-like large vessel, a deep bowl, a handle jug and a calotte-shaped bowl), a rubbing stone and hearth remains were discovered there, clearly the remains of a commensal activity that were later deposited here.[37] Like the pottery, the pit dates to the 34th to 31st century BCE (MAMS 36159, calBC 2$\sigma$ 3340–3039). Results from testing on the upper terrace were more significant (initially II.7, Trench 5) (Fig. 13): Most notable were a roundish stone platform with a large, central hearth (House 5), an adjacent stone cist burial (Grave 8), and the conspicuously elaborate tholos-shaped Grave 9. The hearth is embedded in a central clay level of c. 3 m diameter, but a follow-up investigation did not reveal any underlying features, only larger basalt slabs embedded in the loess soil. The hearth itself, with at least five inwardly turned tongue-shaped prolongations, resembles a particular Transcaucasian type and suggests that extensive (commensal?) activities took place in this structure; this interpretation is supported by the presence of an animal bone deposit on the eastern edge of the platform.[38] Grave 8, which contained the skull and long bones of a mature male, was probably added to the burrow later (MAMS 36154, calBC 2$\sigma$ 3261–2925) (Fig. 14). It was backfilled with material that indicates the presence of older layers near the platform (MAMS 36160, calBC 2$\sigma$ 3357–3104). Finally, in the southern part of the 2015 excavation areas, one of the most remarkable grave finds of the Dzedzvebi Plateau was discovered (Grave 9: Fig. 15). The

37 Stöllner 2017, 123 and Figs. 2, 4–5.

38 In general Sagona 2017, 250–252 and Fig. 5.7.5 (Tsikhiagora B2).

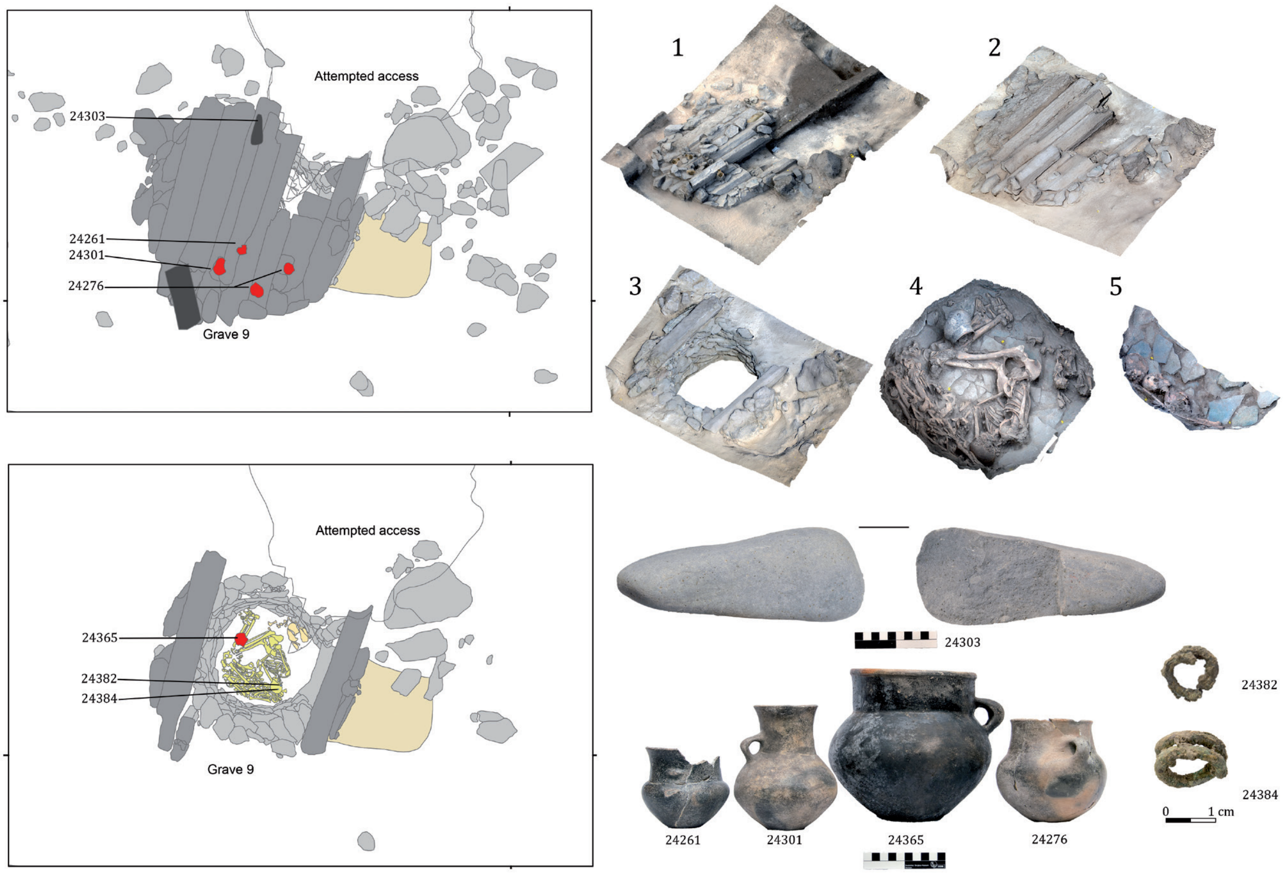



Fig. 15. Dzedzvebi, Area II.7, Grave 9, maps of basalt needle covering and deposits, interior part of the grave and SFM (Structure from Motion)-3D-modelling (DBM/GNM/RUB; A. Belošić, H.-J. Lauffer, F. Klein, S. Senczek).

roundish burial pit, measuring 2 m in diameter, was lined on the inside with a dry-stone wall and a floor made of platy stones; it was accessible via a c. 80 cm-wide entrance with a 1.2 m-long *dromos* on the south side. The *dromos* was closed by two larger basalt slabs, covered with eight needle-shaped basalt rocks, each approximately 2 to 2.5 m long, and finally encircled with basalt quarry stones. A disturbance from the north corresponded with a 4 × 3 m pit and destroyed a small section of the basalt needle cover on the northeast side, but without penetrating the grave. Stratigraphic observations suggest that the disturbance occurred not long after the burial itself. The deposition of a piece of basalt needle, chipped by the disturbance near the surface of the grave cover, also suggests that the grave was not covered by additional sediment at the time, but was still at least partly visible. Three vessels and a stone implement, on the other hand, were found directly on top of the grave covering and probably indicate ritual deposits after construction of the grave (Fig. 15). Why the burial chamber was disturbed by a pit from the north remains unknown, but an intention to rob must not necessarily be assumed. The grave itself shows multiple reuses: the presence of a bone package with the remains of three male individuals on the southwest side, which likely represents older burials, in addition to the last of the crouched burials, probably indicates this was a burial place for male individuals. The last crouched burial, which included one lamb and two adult sheep skulls, an amphora-like shoulder vessel and a copper spiral ring, was a physically tall man (see section 4.6). Not only the location of this burial, but also the different isotopic origins of the ewes (see section 4.5) suggests this last addition to the collective burial played an important role, as the ewes might have been grave goods from persons from different regional backgrounds.

New insights were obtained during the 2019 and 2021 excavations. Individual medieval intrusions (the younger intrusions in Feature 37138: MAMS 54814, calAD 2 $\sigma$ 1215–1271; Feature 37090: MAMS 53670, calAD 2$\sigma$ 1168–1264) became visible; they disturbed strata that included ashy cultural layers and stone layers over a large area, indicating the agricultural use of the site in later periods (Fig. 13). These Kura-Araxes-period features, as the 2021 excavation in particular has made clear, represent a younger phase. The stone

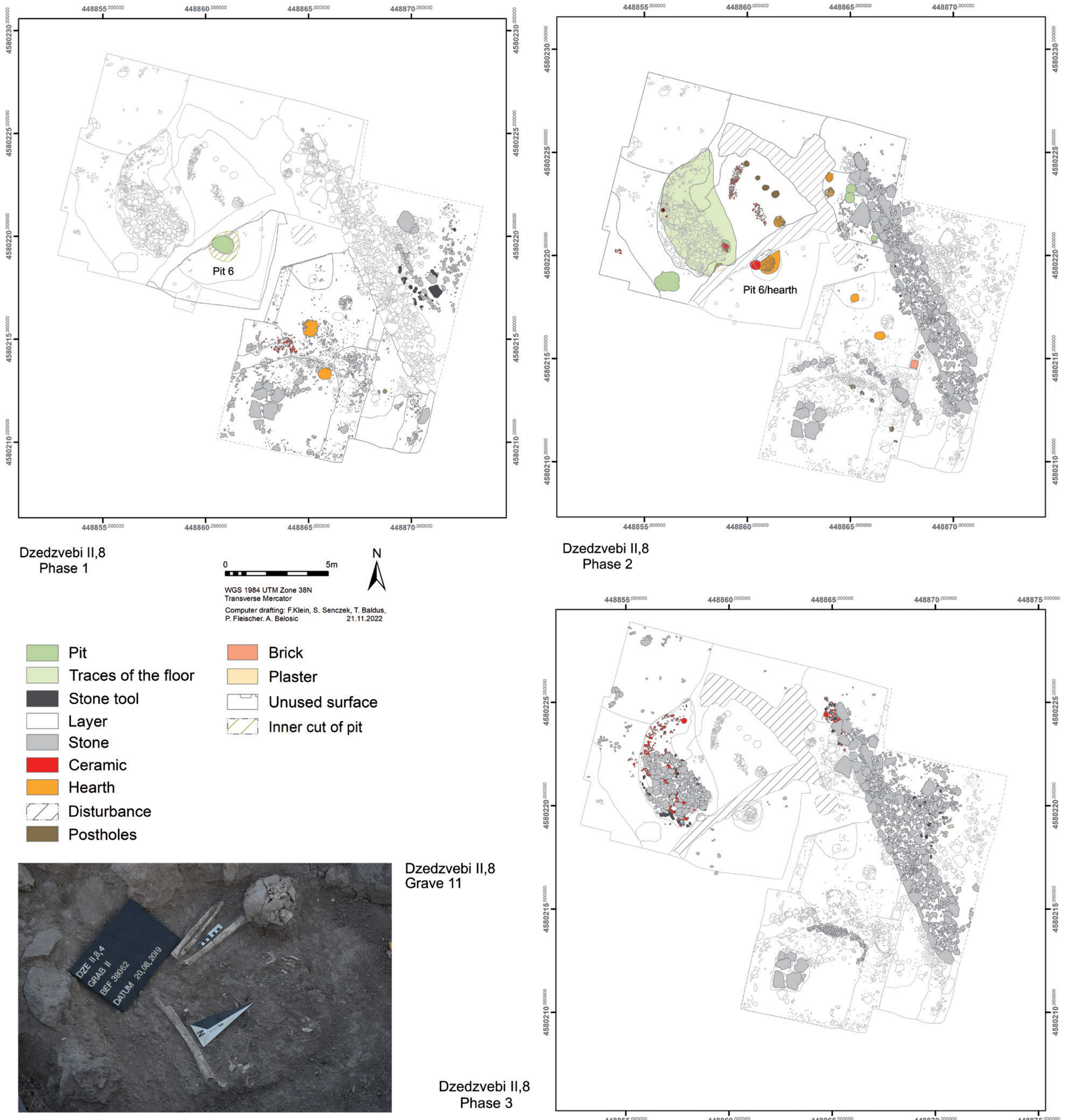



Fig. 16. Dzedzvebi, Area II.8, features according to the stratigraphic sequence (DBM/GNM/RUB; A. Belošić, M. Büyükyaka).

cist grave Grave 18 is of particular interest here; its grave rim was partially fitted with millstones and rubbing stones and it contained the cranium of a juvenile individual and two accessory vessels. This feature can be compared with similar ritual activities documented in the workshop areas of II.2 and II.3. Most importantly, the 2021 excavation in the northern part of Trench 11 provided insight into the older features that were located under the younger overburden of grave features, stone rolling and cultural layer remains. No fewer than eight cauldron-shaped pits were discovered there. The dating of Pit 5 and Pit 11 reflects a slightly older calibration range (Pit 5: MAMS 54817, calBC 2$\sigma$ 3341–3041, base of Pit 11: MAMS 54807, calBC 2$\sigma$ 3338–3012) than the nearby Pit 9 (MAMS 54815, calBC 2$\sigma$ 3307–2920) and the adjacent clay platform. A stone cist was erected underneath this platform, designated as Grave 21; it did not contain a burial deposit (MAMS 54806, calBC 2$\sigma$ 3328–2925). This indicates that the lower stratigraphic horizon in II.7 represents a settlement feature that was in use during the 34th and the beginning of the 30th centuries BCE and that ritual features and graves were probably added towards the end of this period, before the central features were covered with settlement waste, ash and stone rubble. Further investigations are needed not only to more closely examine these older settlement features, but also to understand their connection to the ritual appropriation of the site. It is clear, however, that the scattered grave features 12 and 13 (which do not include dumping), uncovered in the south, should also be seen in this context.

A similarly complex development can be observed in the adjacent Area II.8, where a complicated stratigraphic sequence was excavated in 2014 and 2021, initially starting from three search trenches (Fig. 16). In 2015, the area where settlement features were recorded in 2014 was extended by a large trench and a multiphase house area was discovered (House 4). To the east, the feature is delimited by a massive wall. This stone block wall, nearly 2 m wide, runs NNW–SSE and most likely represents a terracing wall, as it could still be observed in the east of the central Cut 5 in II.7 (38020). If this is the case, the feature would have extended approximately 50 m along the edge of the terrace, which is still visible today. Unlike the house features in areas II.2 and II.3, House 4 is not framed with double-shelled quarry stone walls, but with a semicircular clay bank (38035), which formed the edge of a possible interior room in the west.[39] In the east, four shallow post pits were discovered in 2019, which may belong to a roof construction (Fig. 16, Phase 2). However, since the feature as a whole was disturbed by a large animal burrow, it is difficult to determine the exact extent of a possible house interior. Some of the features suggest activity zones, such as three hearths, the outstanding feature 'gold washing hearth' (38046) built over a pit (No. 6), and a central dump consisting of quarry stones, grinding tools and pottery (38011, 38017). In the latter, stone layer 38011 covered the ceramic deposit 38017, consisting of storage vessels, bowls, jugs with handles and aniconic stands, as well as an *in situ* arrangement of two stands and a three-handled vessel with haematite filling on the semicircular clay bank (38037) (Fig. 16, phases 2–3). The stone layer covered the crockery layer as well as the stand-vessel deposit and thus probably represents the remains of a specific activity.[40] Particularly striking was the hearth discovered in the south of the feature; on its central, indented inner surface, a pan-like bowl was discovered, still *in situ*. Based on its relatively high gold content, this particular find could be interpreted as a washing hearth (Fig. 17).[41] The adjacent lower part of a storage vessel may have contained ground material that was processed further here. However, follow-up investigations revealed that the feature only covered the upper part of Pit 6, partially excavated in 2019 and further investigated in 2021. Further excavation revealed three additional hearths under Hearth 38046, which closed the rather narrow mouth of a pit that widened into a cauldron shape to a depth of approximately 1.1 m and a diameter of approximately 1.4 m (Fig. 17). Three $^{14}$C dates indicate that the oldest fill (Feature 38134: MAMS 54811 calBC 2$\sigma$ 3362–3102) is slightly older than the fill found above it (Feature 38133: MAMS 54812, calBC 2$\sigma$ 3346–3037) as well as the washing hearth at the top of the pit (Feature 38046-1: MAMS 53662, calBC 2$\sigma$ 3335–3025). This suggests that the pit initially served as a storage pit and was later transformed into a feature with a ritual-technical use. Significantly, Deposit 38017 (pottery, utensil and stone deposits to the northwest of the pit) is younger and thus marks the conclusion of the events in House 4 (MAMS 36162, calBC 2$\sigma$ 3262–2919).

Pit 6 clearly suggests the presence of an older settlement feature in the vicinity of House 4 but also demonstrates the continuous social and ritual practice that took place in older parts of the settlement that were remembered through deliberate actions (Fig. 16, Phase 1). The 2019 and 2021 investigations finally recorded older settlement activities parallel to Storage Pit 6 by extending the excavation area to the east and southeast. These findings suggest that the above-mentioned Wall 38020 most likely represents a younger phase of settlement activity in this area. This phase also includes the stone tools (rubbing stones and underlying grinding plates) found to the east of the wall, which may have been placed there intentionally with quarry rocks. At the end of the chronological sequence, a much younger burial, Grave 11, was placed on the surface of the features there. Next to the skeletal remains of the crouched inhumation burial, a Middle Bronze Age bowl was set down upside down (Fig. 16, bottom left). Like in II.3, these findings indicate later ritual activities (collagen from Grave 11 bones: MAMS 53674, calBC 2$\sigma$ 1876–1646). In contrast, rows of stones found in the same area (38077-1, 38096) appear to be older, with

39 Stöllner 2017, 124–126 and Fig. 3. – See also Gambashidze, Stöllner 2016.

40 Sagona 2017, 230–234.

41 Skowronek, Courcier, Stöllner 2017, 132–133. – The hearth type is also known from Abanoshevi: Ramishvili et al. 1987, 74 and Tab. 135.

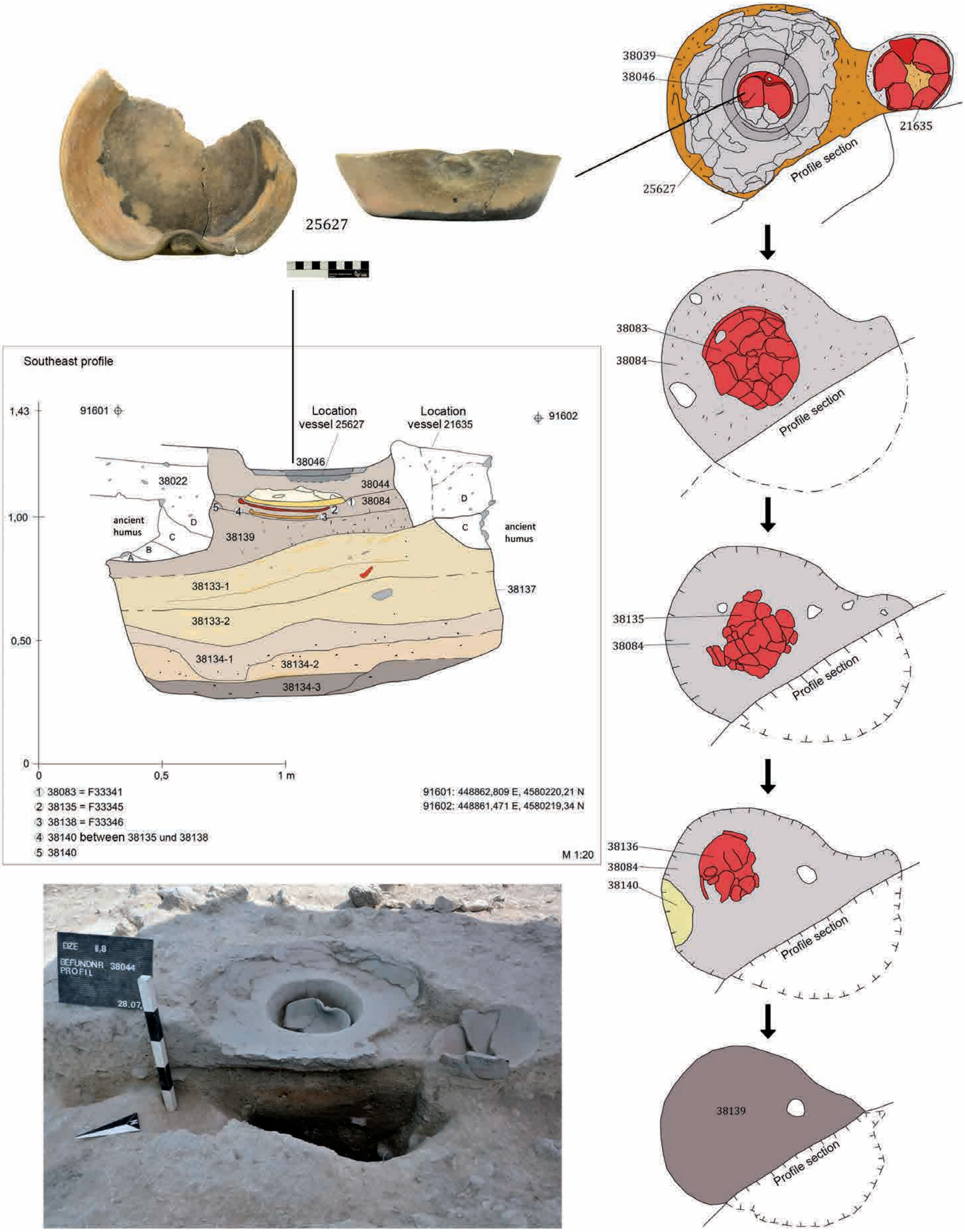



Fig. 17. Dzedzvebi, Area II.8, Pit 6 and hearths in their stratigraphic sequence (DBM/GNM/RUB; S. Senczek, P. Fleischer).

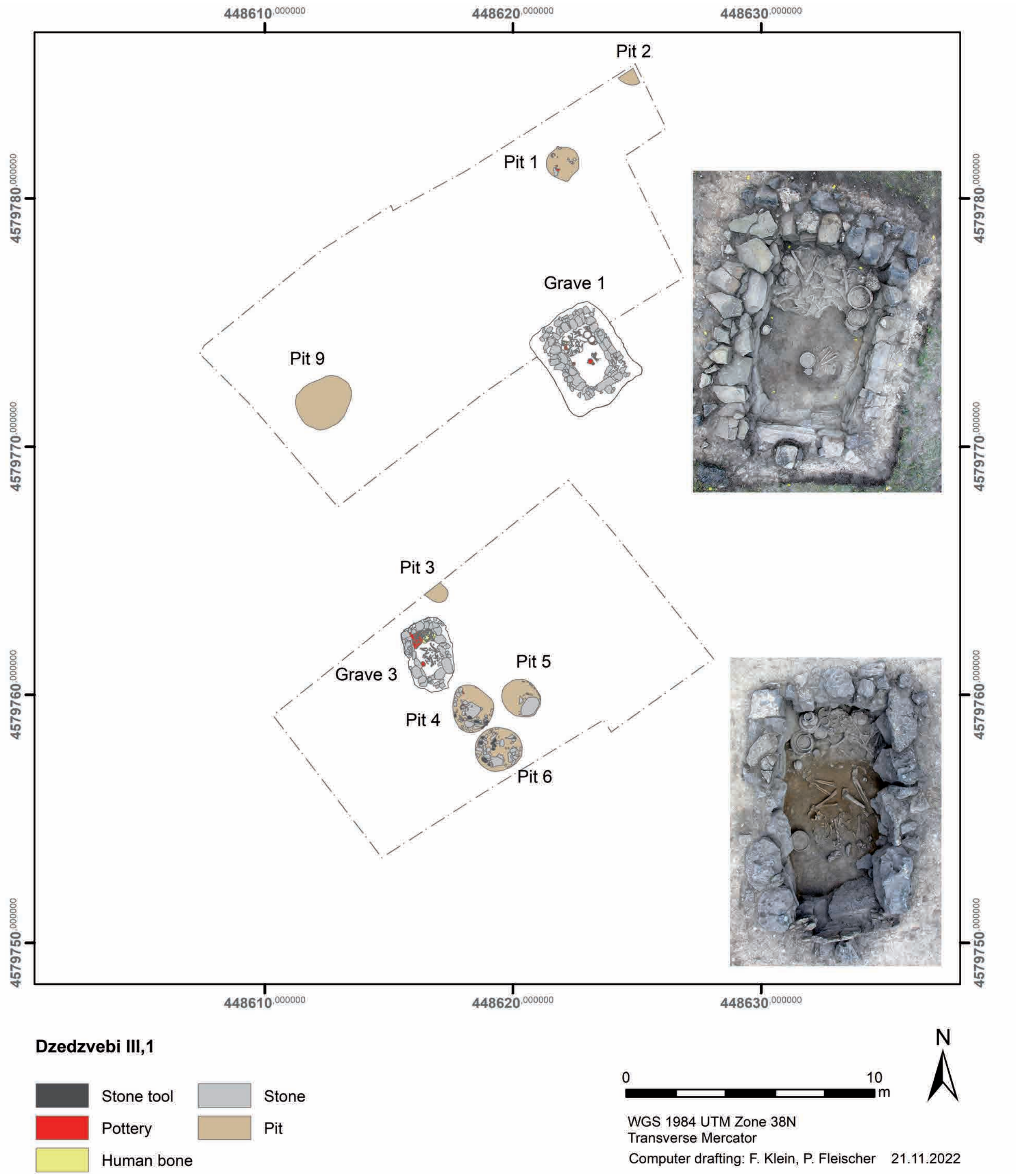



Fig. 18. Dzedzvebi, Area III.1, graves 1 and 3 and accompanying pits (DBM/GNM/RUB; F. Klein, P. Fleischer).

evidence of soil levelling under Wall 38020. Investigations in trenches 5 and 6 produced clearer evidence of these older settlement activities, which included the presence of older soils that appear to have been levelled (including 38114, 38112, 38107), a row of post pits (38111-1 to 38112-6) and at least two hearths (38117/118; 38115/116) and smaller pits. Two dates from these features indicate they were created between the 34th and late 32nd centuries BCE (38114: MAMS 54808, calBC 2$\sigma$ 3355–3099; 38107: MAMS 54809, calBC 2$\sigma$ 3366–3102). These dates appear to correspond to the storage phase of Pit 6. One hearth (38117/118: MAMS 54813, calBC 2$\sigma$ 3076–2907), however, is associated with the more recent activities documented in House 4. The results so far clearly show that Area II.8 was occupied over a longer period of time. Like in Area II.7, the activities that took place here were increasingly influenced by ritual activities, probably associated with gold processing.

### 3.2.4. Workshop, Pits and Graves in Areas III.1 and III.5

The workshop area on the north slope was bordered by two relatively loosely occupied areas to the north and the south (Area III and areas II.1 and II.4). In Area III.1 (Fig. 18), a burial chamber constructed of stone blocks, measuring 3.3 × 2 m (interior: 2.2 × 1.5 m, depth 0.7 m) was discovered in 2007. When the excavation area was extended north of the dirt road in 2009, additional features were unearthed in an area measuring 22 × 17 m, including several shallow pits (pits 1, 2 and 9). These yielded vessel deposits with calcined bones, indicating ritual activities in the vicinity of Grave 1. Grave 1 itself produced a bone and vessel deposit in the northwestern part of the chamber (at least three individuals with eleven vessels), probably three adult individuals (at least one male and one female burial), as well as a subadult burial still *in situ* in the southeastern part of the burial (with two accompanying vessels and another vessel lying further away). The layout of the burial suggests that access was gained from the southeast and that burials and later ritual activities were carried out in that area. It is clear that skeletal parts were moved to the northwest. Grave 1 was the first location where typical Kura-Araxes collective burials were documented on the Dzedzvebi Plateau; other burials of this type were found in graves 3 and 6 (Dzedzvebi II.4). The excavation was also extended to the south of the dirt road in 2009, after a chamber burial (Grave 3) was discovered there as well. Here, too, additional features were found in the vicinity of the burial in the 15 × 7–9 m excavation area, including a shallow pit (Pit 3) and three shallow cauldron pits to the southeast of the burial. Chamber Grave 3, measuring 2.3 × 1.4 m (interior: 1.9 × 0.9–1 m, depth 0.7–9 m), includes features similar to Grave 1 and dates to a calibration period between the 31st and the beginning of the 29th century BCE (MAMS 24764, calBC 2$\sigma$ 3012–2899). At least six individuals (at least one female, one male and one subadult) have been identified, accompanied by a total of 16 accessory vessels and a few limestone beads. Again, one individual, the youngest burial, was laid down in a crouched position in the southeastern part of the grave. Another individual was moved to the eastern wall of the chamber, while others lay with stacked vessel deposits and a bone package in the northwest of the chamber. Like in Grave 1, the absence of vertebral columns and pelvic parts is conspicuous; aside from skulls and rib arches, mainly the long bones of the postcranial skeleton were found.

To the southeast of the grave, the three pits, c. 0.7–0.9 m deep, were examined in more detail. No organic remains that could indicate a possible grain storage function were found, but the pits had been filled in with quarry stones as well as grinding and rubbing implements (including typical rubbing stones used in gold processing). Pits 4 and 5 each contained 10 implements, while Pit 6 produced only five.[42] These deposits indicate a link between the persons in the nearby burial and gold production. Researchers suggested in 2009 that a related site may have been located in the immediate vicinity. In 2014, such a site was finally discovered in Area III.5, after several test trenches had been laid out in the surrounding area in 2010, in which Kura-Araxes-period artefacts were found (areas III.2 to III.4), but no definite features. By contrast, the Kura-Araxes-period ore-beneficiation site discovered on the surface of the Dzedzvebi dirt road was highly interesting. An oval find accumulation was discovered in the centre of the find area, measuring c. 2.3 × 2.4 m, in a dark cultural layer (33038), containing a total of 36 ore-dressing tools (mainly rubbing stones) on top of a shallow pit. In the northwest corner of the feature was a pit (33042) measuring 1 × 0.7 m and approximately 0.5 m deep, which was backfilled with an ash-rich cultural layer and an ash bed, in which several crucible fragments were found, including several larger pieces (Fig. 19). The backfill of the pit (Feature 33039, Samples 18204 and 18205) yielded gold contents between 3.3 ppm and 12 ppm, indicating the infill of gold-bearing sands formed during processing adjacent to the probable smelting pit.[43] The other three shallow pits (33043–45) found in the vicinity cannot be connected to metallurgical activities. They may represent traces of posts that were part of a light flying roof construction. In no case, however, can the feature be described as a stable workshop. It was most likely a short-term processing station, probably operated for a single season. This illustrates the temporary character of the gold processing on the Dzedzvebi Plateau, which is also evident in the multiphase nature of the house features and workshops in II.2 and II.3.

### 3.2.5. Graves in Areas II.1 and II.4

In 2007, the gravedigger of the cemetery of Dzedzvebi found an amphora-shaped vessel and a lid while digging a fresh grave.[44] The completeness of the vessels suggested it was a grave good. Further finds, such as hearth fragments, were

42 Stöllner et al. 2014, 100–101 and Figs. 26–27.

43 Skowronek, Courcier, Stöllner 2017, 131–133 and Fig. 5/2, Tab. 2.

44 Stöllner et al. 2010, 6000–6001 and Fig. 12.

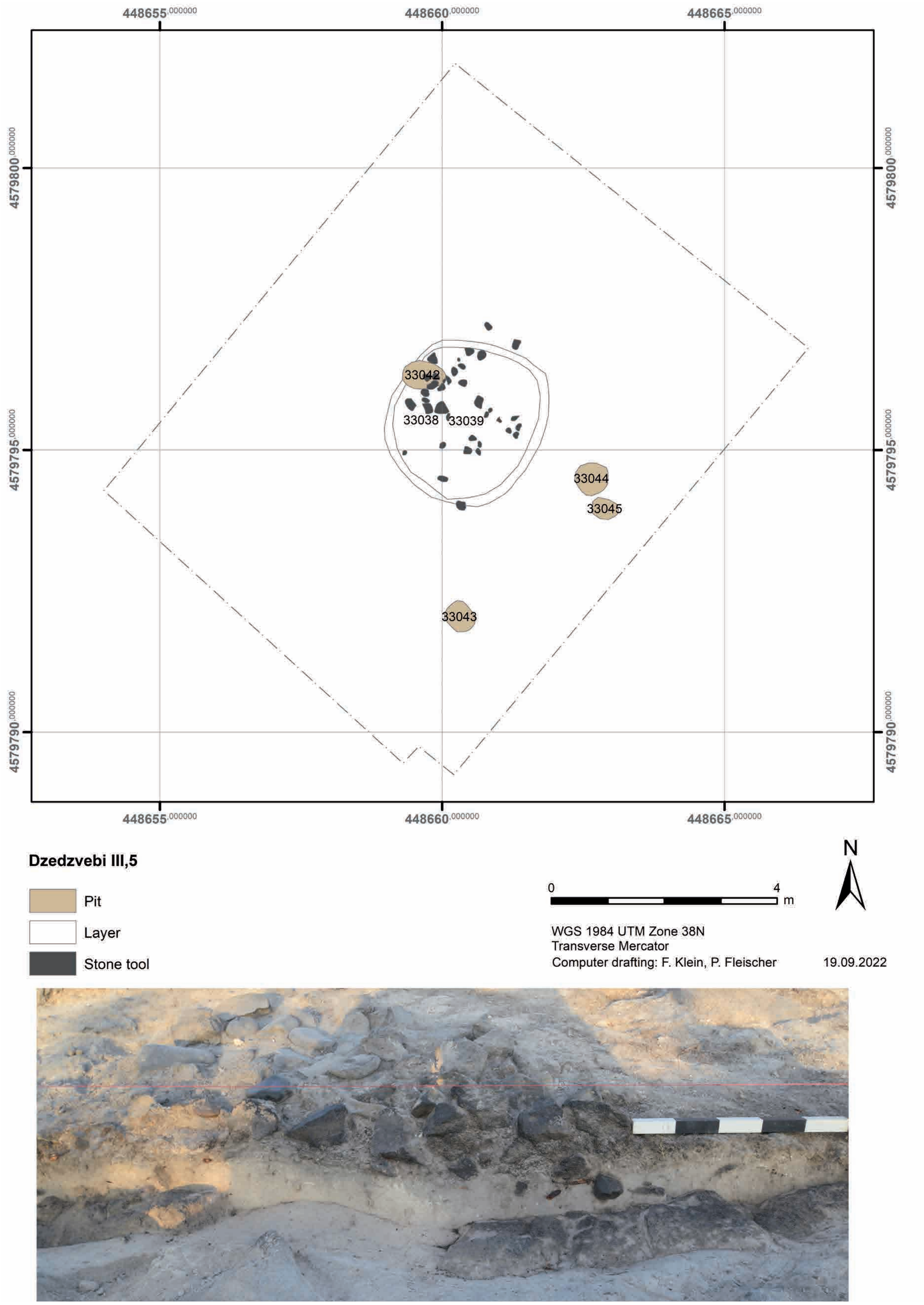



Fig. 19. Dzedzvebi, Area III.5, open-air beneficiation area. – Top: Dump with work tools and pitspits. – Bottom: Northwest profile cutting the dump features 33038 to 38040 (DBM/GNM/RUB; F. Klein, P. Fleischer, I. Luther).

later recovered in the current graveyard, but only during the 2008 excavations was a closed grave discovered near the Dzedzvebi dirt road (Grave 2). The neighbouring Grave 6 was discovered some years later, approximately 30 m to the north. These finds suggest that this, like Area III.1, is the location of a cemetery. How densely occupied this cemetery is cannot be assessed because larger and more comprehensive excavations have not yet been undertaken in this area (Fig. 20). Grave 6, which was investigated in 2011, is similar in its construction and orientation as well as its dating to graves 1 and 3 (MAMS 24766, calBC 2$\sigma$ 3085–2915; MAMS 24768, calBC 2$\sigma$ 3090–2926). It is a collective grave, including the remains of a male in a crouched position; a bone package consisting of a further four individuals, three females and one subadult, was found near the feet of the first individual, in the northwestern part of the grave. Again, vertebral columns and pelvic areas were missing from the bone package. Four vessels were included as grave goods, which had clearly been moved from their original position to their final position. A good ancient DNA profile could be obtained from the adult male individual due to its good preservation (see section 4.7); again, the vertebral column was missing, but parts of the pelvis were preserved *in situ*. Pollen analysis on several samples yielded interesting results about plant remains.[45] Honey was found in the vessel deposited with Individual 1, particularly near the bottom of the vessel. Honey-related pollen were discovered under the head and the right heel; this location suggests the possible use of a balm or healing agent. In the bent right hand, a dark, possibly plant-enriched soil material was discovered, which has not yet been identified more precisely. The pollen found in this location could not be associated with a specific plant species. The observation is interesting, as microscopic analysis indicates low numbers of insects and ticks, suggesting a burial in the cold season, which, in combination with the pollen spectra (e.g. grain pollen), points to an overall agro-pastoral cultivated environment during the Kura-Araxes period.

Another grave (Grave 2) was located c. 30 m to the south, but it is not as well preserved as Grave 6 (Fig. 20).[46] Grave 2 is younger than the other burials, as evidenced by its furniture and $^{14}$C dating, which indicate it was created during a late Kura-Araxes phase, at the transition to the Martkopi-Bedeni phase (MAMS 24763, calBC 2$\sigma$ 2852–2506) (Fig. 21). The burial customs observed here differ from the older collective graves 1, 3 and 6. Two adult individuals were possibly ritually disturbed, and a total of four vessels was added. Finally, a juvenile individual was added to the clearly manipulated burial. Adding a juvenile can be considered a ritual constant of Dzedzvebi communities. The presence of a necklace that was added to the grave also illustrates this ritual context. The necklace was made of limestone beads and two pendants, which can be interpreted as miniature votive items of shaft-hole implements (Fig. 21). This may indicate a connection to metal production but is more certainly an indicator of social status. The question of whether this change in the custom of burial gifts (and the appearance of metal, which was previously rarely included in burials) also indicates changes in the social structure must, however, remain unanswered for the time being. Later Kura-Araxes burials in general contain a higher amount of precious metal items, indicating the growing importance of status displays in burials.[47]

## 4. Analytical Investigations

### 4.1. Copper Metallurgy in the Late Chalcolithic and Early Bronze Age: Metallurgical and Provenance Studies[48]

Previous investigations on copper metallurgy have focused on the workshop of House 2 in Dzedzvebi II.2 and the Late Chalcolithic copper crucible from IV.3. In more recent investigations, numerous other finds from the excavations in areas II.8 and II.3 have come to light, which are currently being investigated. The number of finds relating to metallurgy, such as crucibles, ores and slags, distributed across the entire settlement, is significant (Fig. 22): Numerous crucibles were found in areas II.3, II.8 and III.5, but very few were found in the vicinity of the workshop of House 2 (II.2). The location of the two crucible fragments at this site probably indicates a relocated or undated context. Many of the slags and crucibles found in House 3 may have been displaced by downslope erosion processes. In contrast to the *in situ* find north of House 6 (40034), no metallurgical installations were found in houses 3, 6 and 7 of Area II.3. More significant, however, is the relocation of crucible fragments in the waste area of House 4 (II.8), south of the large wall of Feature 38022. These crucible fragments are likely related to metallurgical processes with hearth features in House 4. As previously mentioned, no crucible fragments were found in the workshop area of House 2, but there is a slagged hearth in Feature 34074, which suggests that crucibles may not have been the only equipment used for the reduction of copper during the Kura-Araxes

45 We are grateful to Dr. E. Kvavadze from the Georgian National Museum, who provided us with a scientific report about the palynological features of the graves and the vessel contents.

46 Stöllner, Gambashidze 2011, 195 and Fig. 10. – Gambashidze, Stöllner 2016, 84–95.

47 Poulmarc'h, Pecqueur, Jalilov 2014. – Stöllner 2016.

48 This section is based on work that was carried out by Dr. A. Courcier and this section's author during a DFG/ANR (Agence Nationale de la Recherche, France) project between 2013 and 2018.

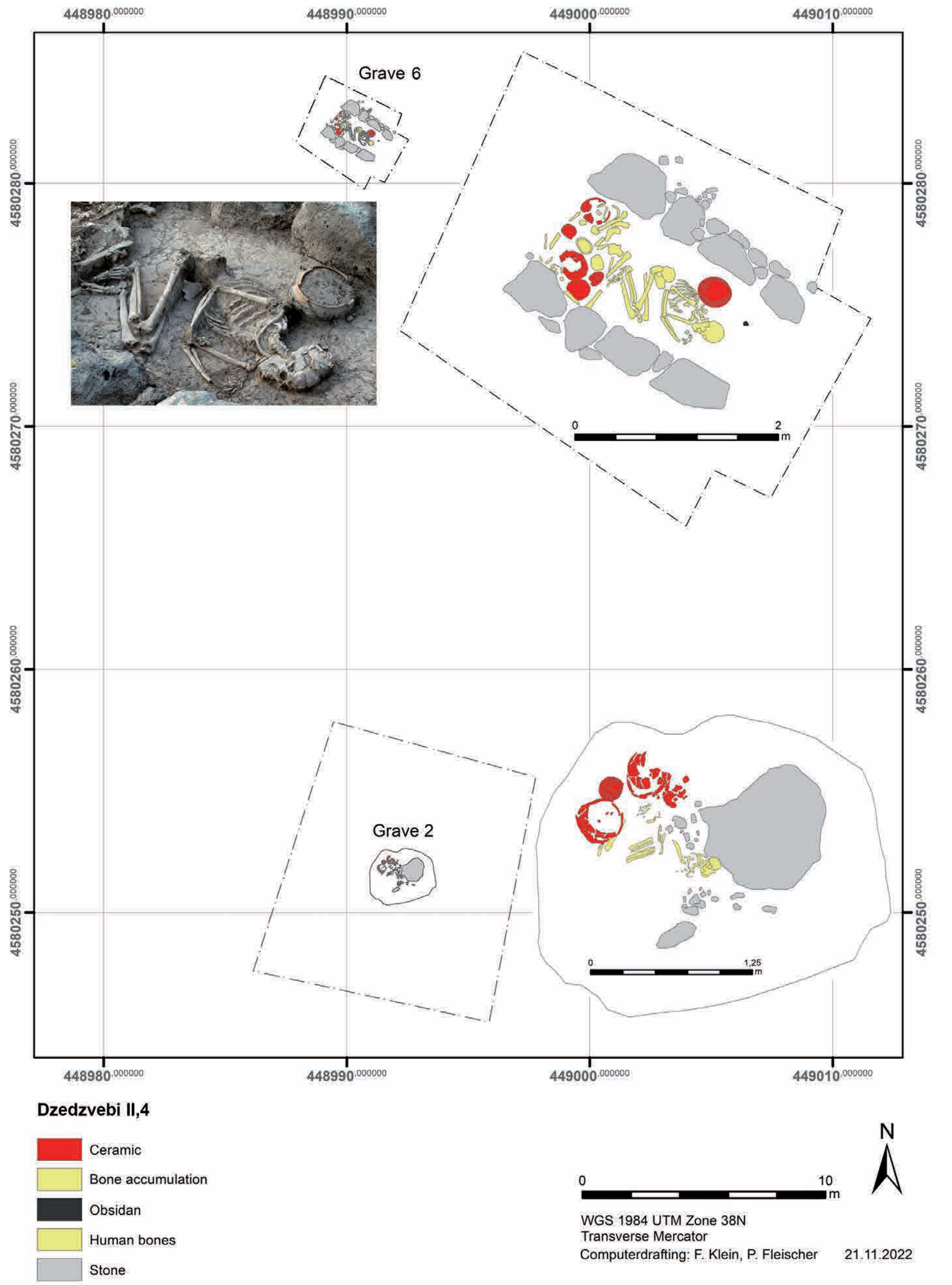



Fig. 20. Dzedzvebi, Area II.4, graves 2 and 6 according to their position and details (DBM/GNM/RUB; P. Fleischer, F. Klein, T. Rabsilber).


Fig. 21. Dzedzvebi, Area II.4, selection of the inventory of Grave 2 (Drafts/photos: DBM/GNM/RUB; T. Sachvadze, T. Rabsilber).

period (Fig. 8). Ores and slags found in this area have been studied more extensively and were found to occur in small concentrations in the floor layers of the workshop (38029, 34059). These findings, in combination with the large rubbing stones found on top of Pit 34067, indicate the processing and crushing of slag and ore in this location. In contrast, the find contexts of the Late Chalcolithic metallurgical tools from Pit 4 (Feature 36278) on the southern plateau (Area IV.3) are less informative. Casting crucible 27905 and the heavy equipment casting mould 27906 were found in a pottery-rich pit (Fig. 23). A further metallurgical context is missing. This also applies to slag from the neighbouring Chalcolithic Pit 7, which may even constitute the oldest slag evidence from the early 5th millennium BCE (29241).

The archaeometallurgical investigation of crucibles, crucible fragments, slags and ores associated with copper metallurgy was based on the examination of 29 samples in the Deutsches Bergbau-Museum (DBM) research laboratory (Tab. 3). For the purpose of studying slags and crucibles, a cross-section of each sample was mounted in resin. Microscopic studies were carried out with a Zeiss Axioplot microscope to distinguish the microstructure of metal objects. Two different etching solutions were used for the copper samples: 1) hydrogenate ammonium peroxide, and 2) a combination of aqueous ammonium persulfate with acidified thiosulphate/acetate.[49] In addition, we examined the slags via scanning electron microscopy (SEM), using a Zeiss Supra 40VP SEM, equipped with a Noran System Seven Thermo UltraDry Silicon Drift X-ray detector (SDD) for energy dispersive X-ray spectrometry analyses (EDS). We normalised the results of these micro analyses. Some of the slags and ores were crushed and milled. In some cases, we were able to separate metallic prills from the milled slags, particularly from the slag crust of the Chalcolithic crucible 27905 (Fig. 23). This allowed a geochemical characterisation.[50] Therefore, chemical analyses of prills and slag crusts were carried out separately. Powdered slags were analysed for their mineralogical composition by X-ray diffraction analysis, using Panalytical X'pert Pro. We carried out X-ray fluorescence (XRF) using an XL3T Nitron portable XRF analyser on the three metal objects and crucible 22434 to examine the major elements. All the artefacts were quantitatively analysed for trace and major element composition by inductively coupled plasma mass spectrometry (ICP-MS), using an Element XR high resolution single collector

49 Scott 2012, 282–283.

50 Stöllner 2021b, 105–106 and Figs. 5–6.

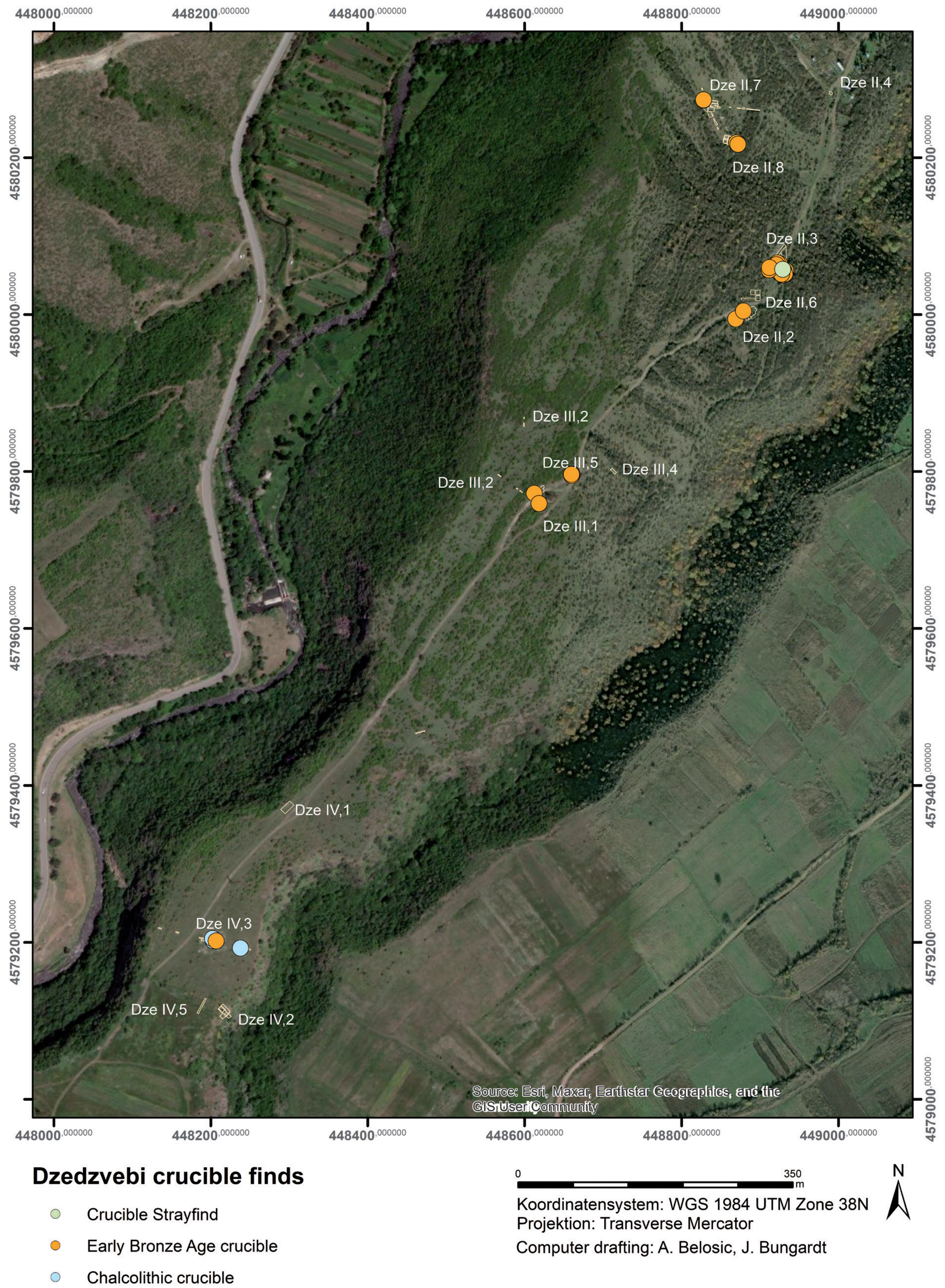



Fig. 22. Dzedzvebi, distribution of crucibles from the Chalcolithic and the Early Bronze Age in excavated areas II, III and IV (DBM/GNM/RUB; J. Bungardt, A. Belošić).

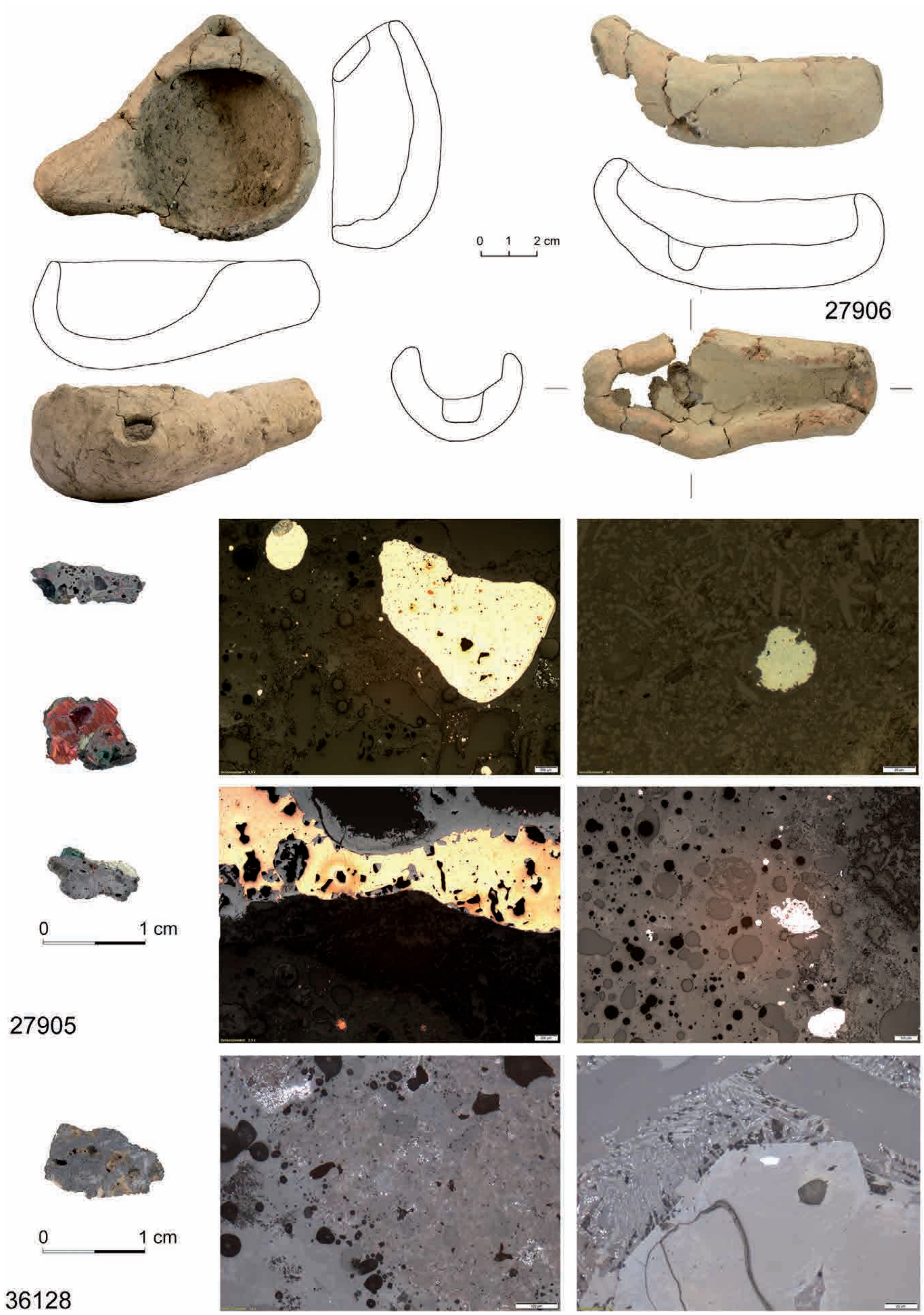



Fig. 23. Dzedzvebi, Area IV.3, crucible 27905 and casting mould 27906 from the Chalcolithic Pit 4 and slags/dross from the crucible with trapped copper prills in thin sections (polarisation microscope) (DBM/GNM/RUB; A. Courcier, H.-J. Lauffer, T. Sachvadze).

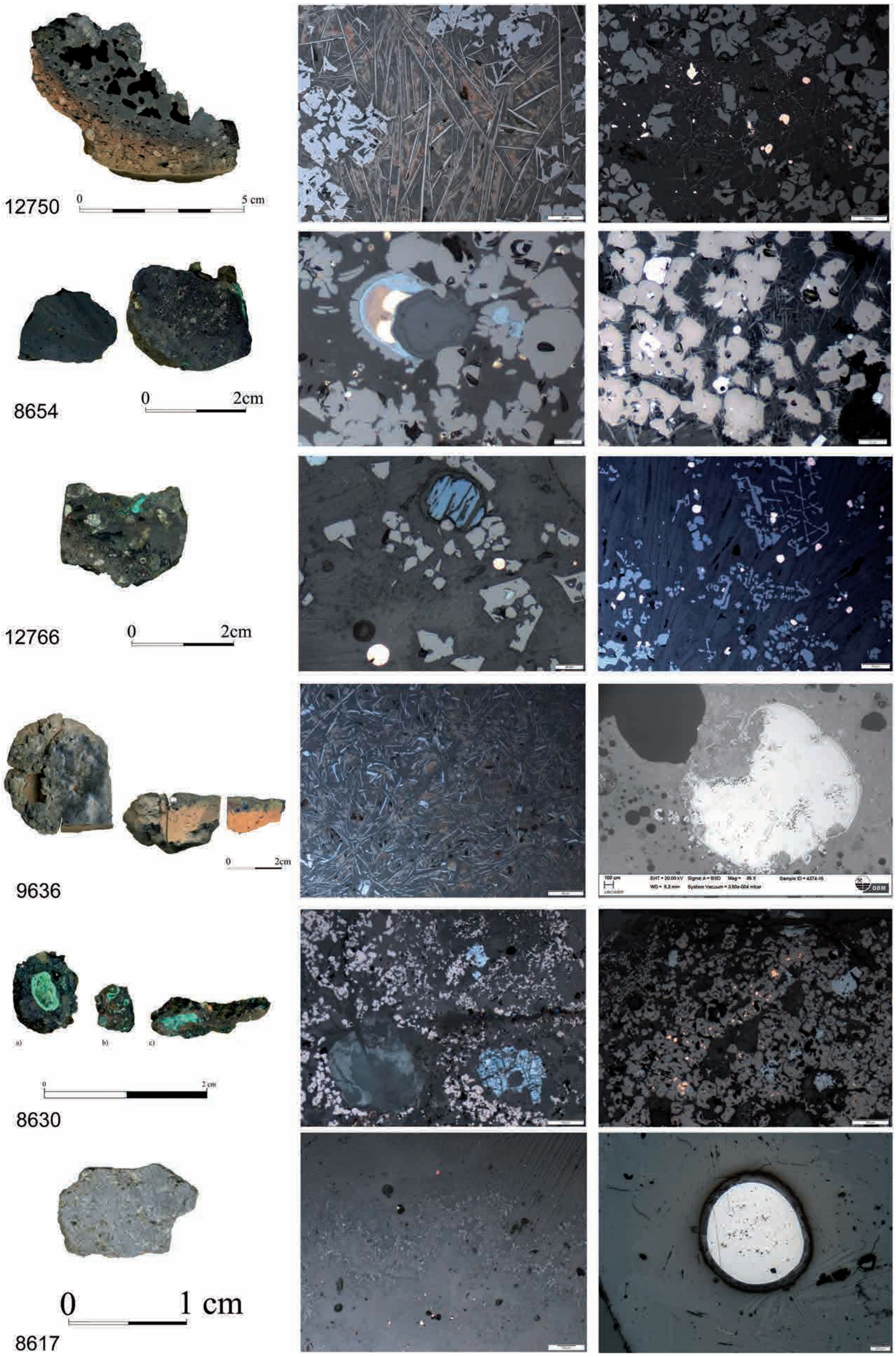



Fig. 24. Early Bronze Age slags/crucible dross from excavation areas II.2 and II.3, thin sections in SEM and polarisation microscope (DBM/GNM/RUB; A. Courcier).


Fig. 25. Early Bronze Age metals from areas IV.3 and II.2, metallographic investigations, thin sections under the polarisation microscope (DBM/GNM/RUB; A. Courcier, H.-J. Lauffer).

ICP-MS. Lead isotopic analyses (LIA) were also carried out on these artefacts, using a Thermo Scientific Neptune XT equipped with a multi-collector platform Thermo Scientific Triton.[51]

Slags and slaggy encrusting from crucibles found in the workshop area of House 2 and some other relocated find spots illustrate attempts at smelting hydrocarbonates (azurite, malachite, e.g. crucible 12750, slags 8654, 12766), sulphur copper ores (chalcopyrite, chalcocite, bornite, slags 6200, 6416, 6431, 6437, 12756) and indeed even co-smelting hydrocarbonates and sulphur copper ores (crucible 8617, slag 8630). In one case, the arsenic and antimony levels indicate the usage of fahlores (6418). Samples from the workshop occupation level 34059 demonstrate

51 This analysis was undertaken in the Department of Petrology and Geochemistry at the Goethe University in Frankfurt am Main under the direction of apl. Professor Dr. Sabine Klein, to whom we are grateful.

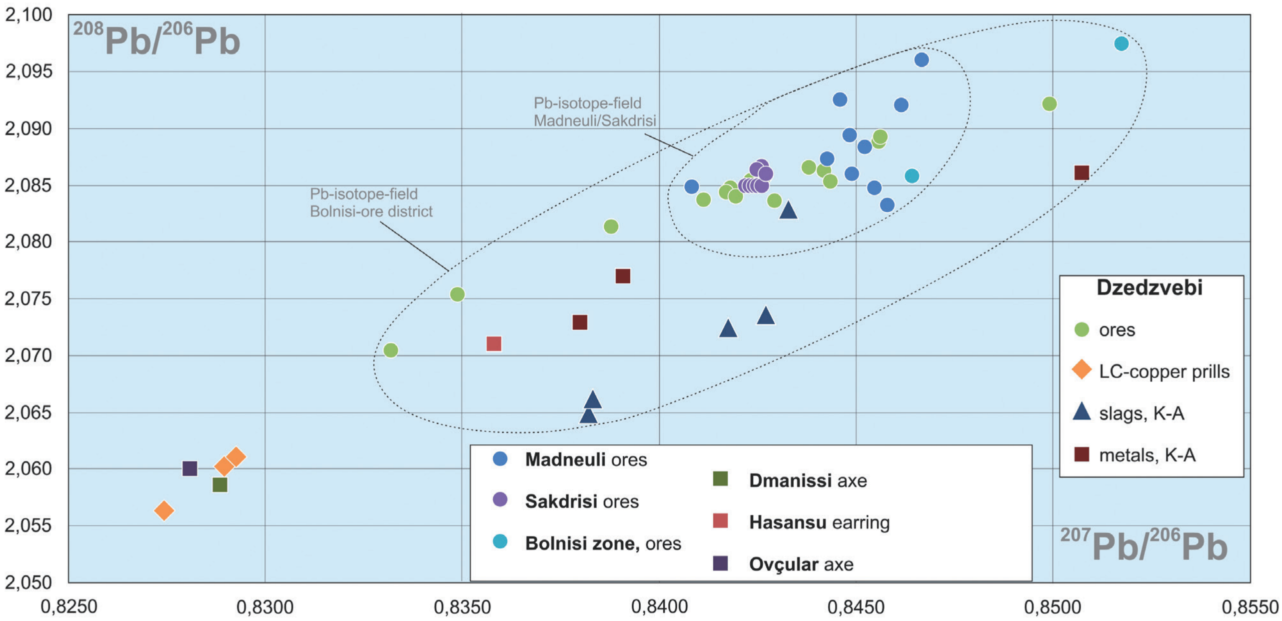



Fig. 26. Madneuli/Bolnisi zone, Pb isotope ratios $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$, ores, Sakdrisi gold flakes, slags and metals from Dzedzvebi settlement, copper prills from a LC crucible, and from two shaft-hole axes from Dmanisi and Ovçular as well as from the spiral rings of Hasansu (Data: DBM. – Hauptmann et al. 2010. – Gailhard et al. 2017. – Jansen 2019).

the coexistence of the different ore combinations during the smelting activities (Fig. 24). These ores are not typical for the haematite-free gold deposits of the Kachagiani hillock but are present in the Madneuli/Bolnisi ore district. All the slags studied are manganese free, heterogeneous, largely glassy (alkaline aluminium silicates) and porous. They contain large inclusions of gangue minerals, ore fragments, metal prills and sometimes charcoal fragments. The phases consist of magnetite, wüstite, delafossite, Fe-rich diopsite, glass, akermanite, albite and calcite. A fayalite phase was also detected in numerous slags, suggesting smelting under reduction conditions. The Cu phases consist of cuprite and copper, mainly in tiny prills trapped in the slag. Very occasionally, large copper prills or flakes were formed close to the slag surface. The significant amounts of lead, zinc and antimony detected in some slags or slaggy encrusting suggest the use of polymetallic ores. One crucible and some slags (8617, 9636 and 9645) suggest a voluntary production of arsenical copper (1–9.5 % As); their higher sulphide and iron contents suggest this is most likely the result of co-smelting with arseno-pyrites, although a speiss alloy has not been found so far.[52]

The study of three metal objects from Dzedzvebi II.2 and IV.3 completes these observations (27918, 12761 and 12707) (Fig. 25). The trace elements from copper prills isolated from a slag and a crucible of Area II.3 (9636, 9645) and of these three copper artefacts are similar in their Ag, Pb and Sb ratio, indicating they may derive from polymetallic ores with some accessory fahlores. Two objects (12761, 12707) are rich in arsenical copper (4.3–4.5 % As), while the last one (27918) consists of unalloyed copper. As the LIA results may also be related to regional deposits (Fig. 26 and Tabs. 2–3), it is likely that those ores were derived from nearby ore deposits of the Madneuli-Bolnisi ore zone.

A different picture can be derived from Late Chalcolithic crucible 27905 (Pit 5) and from Early Chalcolithic slags from Pit 7 (29141). Additional crucible fragments found in Pit 91, of which one is covered by a dross with copper prills, have not yet been studied (Find 32137). The bullous heterogenous slaggy dross of crucible 27905 included corrosion of copper ores, numerous small copper metal prills surrounded by a rim of cuprite trapped in it and the occasional file inclusions of gangue host rock such as digenite/bornite copper sulphurs and some haematite (Fig. 23). The chemical and LIA investigations, especially of the metal prills from the crucible, show a different ore composition with higher levels of Sb/Ag and Pb traces (Tab. 2 and Fig. 27). The different compositions, shown in Figure 27, indicate different smelting charges may have been used, suggesting a multifunctional use of the crucible or a high variety in copper-ore concentrates smelted

52 Rehren, Boscher, Pernicka 2012. – Boscher 2016.

| Sample/ Find-No. | Sample character | Location | $^{208}Pb/^{206}Pb$ | $^{207}Pb/^{206}Pb$ | $^{204}Pb/^{206}Pb$ | $^{208}Pb/^{204}Pb$ | $^{207}Pb/^{204}Pb$ | $^{206}Pb/^{204}Pb$ | Bibliography |
|---|---|---|---|---|---|---|---|---|---|
| Geo-32/1 | Ore | Madneuli | 2.087 | 0.8443 | 0.05409 | 38,592 | 15.609 | 18.488 | Hauptmann et al. 2010 |
| Geo-32/2 | Ore | Madneuli | 2.093 | 0.8446 | 0.05395 | 38.785 | 15.655 | 18.535 | Hauptmann et al. 2010 |
| Geo-32/3 | Cu-Pb-Zn Sulfide | Madneuli | 2.092 | 0.8461 | 0.05418 | 38.614 | 15.618 | 18.458 | Hauptmann et al. 2010 |
| Geo-32/4 | Ore | Madneuli | 2.088 | 0.8452 | 0.05420 | 38.528 | 15.593 | 18.449 | Hauptmann et al. 2010 |
| Geo-32/5 | Ore | Madneuli | 2.089 | 0.8448 | 0.05416 | 38.578 | 15.599 | 18. 464 | Hauptmann et al. 2010 |
| Geo-32/6 | Ore | Madneuli | 2.086 | 0.8449 | 0.05412 | 38.541 | 15.610 | 18.476 | Hauptmann et al. 2010 |
| Geo-32/7 | Ore | Madneuli | 2.085 | 0.8455 | 0.05411 | 38.528 | 15.625 | 18.480 | Hauptmann et al. 2010 |
| Geo-32/8 | Ore | Madneuli | 2.083 | 0.8458 | 0.05411 | 38.502 | 15.632 | 18.482 | Hauptmann et al. 2010 |
| Geo-32/9 | Ore | Madneuli | 2.096 | 0.8467 | 0.05401 | 38.810 | 15.676 | 18.515 | Hauptmann et al. 2010 |
| Geo-24/031 | Cu-Fe ore | Madneuli | 2.089 | 0.8456 | 0.05412 | 38.605 | 15.625 | 18.477 | Hauptmann et al. 2010 |
| Geo-32/1 | Ores | Madneuli | 2.085 | 0.8408 | 0.05370 | 38.825 | 15.659 | 18.623 | Jansen 2019 |
| Geo-32/1 | Ores | Madneuli | 2.08483 | 0.84083 | 0.05370 | 38.82521 | 15.65860 | 18.62272 | Jansen 2019 |
| Geo-5/314 | Ores | Bolnissi | 2.08583 | 0.84642 | 0.05422 | 38.46927 | 15.61061 | 18.44312 | Hauptmann et al. 2010 |
| Geo-29/II | Fe-Cu ore | Mamulo/ Gomareti | 2.09747 | 0.85173 | 0.05451 | 38.48058 | 15.62605 | 18.34657 | Hauptmann et al. 2010 |
| Geo-28/15b1 | Ore | Sakdrisi, Mine A | 2.0566 | 0.8312 | 0.0532 | 38.6432 | 15.6176 | 18.7899 | Hauptmann et al. 2010 |
| Geo-28/15b2 | Ore | Sakdrisi, Mine A | 2.0865 | 0.8425 | 0.0540 | 38.6406 | 15.6022 | 18.5193 | Hauptmann et al. 2010 |
| Geo-28/15 | Fe-Cu ore | Sakdrisi, Mine A | 2.08660 | 0.84260 | 0.05398 | 38.65280 | 15.60850 | 18.52400 | Hauptmann et al. 2010 |
| Geo-28/P-1 | Ore | Sakdrisi, Mine 1/3 | 2.0850 | 0.8423 | 0.0540 | 38.6100 | 15.6000 | 18.5200 | Jansen 2019 |
| Geo-28/P-5 | Ore | Sakdrisi, Mine 1/3 | 2.0850 | 0.8425 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-6 | Ore | Sakdrisi, Mine 1/3 | 2.0850 | 0.8424 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-6_2 | Ore | Sakdrisi, Mine 1/3 | 2.0860 | 0.8427 | 0.0540 | 38.5900 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-10 | Ore | Sakdrisi, Mine 1/2 | 2.0850 | 0.8426 | 0.0541 | 38.5800 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-12 | Ore | Sakdrisi, Mine 1/2 | 2.0850 | 0.8424 | 0.0540 | 38.5900 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-16 | Ore | Sakdrisi, Mine 1/1 | 2.0860 | 0.8427 | 0.0540 | 38.5900 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-19 | Ore | Sakdrisi, Mine 2 | 2.0850 | 0.8423 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-20 | Ore | Sakdrisi, Mine 2 | 2.0850 | 0.8423 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-21 | Ore | Sakdrisi, Mine A3 | 2.0850 | 0.8426 | 0.0541 | 38.5700 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-22 | Ore | Sakdrisi, Mine A3 | 2.0850 | 0.8426 | 0.0540 | 38.5900 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-24 | Ore | Sakdrisi, Mine 2 | 2.0850 | 0.8422 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-32 | Ore | Sakdrisi, Mine B3 | 2.0850 | 0.8422 | 0.0540 | 38.5900 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-33 | Ore | Sakdrisi, Mine B3 | 2.0850 | 0.8425 | 0.0540 | 38.5900 | 15.5900 | 18.5000 | Jansen 2019 |
| Geo-28/P-34 | Ore | Sakdrisi, Mine B3 | 2.0850 | 0.8422 | 0.0540 | 38.6000 | 15.5900 | 18.5100 | Jansen 2019 |
| Geo-28/P-37 | Ore | Sakdrisi, Mine 1/1 | 2.0850 | 0.8424 | 0.0540 | 38.5900 | 15.5900 | 18.5100 | Jansen 2019 |
| 25524 | Cerussite/Haema-tite, concentrate, found in a vessel | Dzedzvebi | 2.09222 | 0.84992 | 0.05432 | 38.51563 | 15.64557 | 18.40810 | Data DBM |
| 6418b | Ore | Dzedzvebi | 2.08658 | 0.84380 | 0.05407 | 38.59038 | 15.60589 | 18.49518 | Jansen 2019 |
| 8617a | Ore | Dzedzvebi | 2.08584 | 0.84268 | 0.05402 | 38.61428 | 15.59868 | 18.51090 | Jansen 2019 |
| 9721d | Ore | Dzedzvebi | 2.08140 | 0.83877 | 0.05369 | 38.76596 | 15.62246 | 18.62643 | Data DBM |
| 9721e | Ore | Dzedzvebi | 2.08630 | 0.84419 | 0.05413 | 38.53935 | 15.59485 | 18.47325 | Jansen 2019 |
| 9721f | Ore | Dzedzvebi | 2.08545 | 0.84234 | 0.05399 | 38.62946 | 15.60266 | 18.52338 | Jansen 2019 |
| 12764 | Ore | Dzedzvebi | 2.08376 | 0.84112 | 0.05390 | 38.65575 | 15.60373 | 18.55136 | Jansen 2019 |
| 18034 | Ore | Dzedzvebi | 2.08480 | 0.84180 | 0.05397 | 38.62970 | 15.59732 | 18.52820 | Jansen 2019 |
| 18042_1 | Ore | Dzedzvebi | 2.07046 | 0.83320 | 0.05331 | 38.83697 | 15.62902 | 18.75804 | Data DBM |
| 18172 | Ore | Dzedzvebi | 2.08441 | 0.84170 | 0.05394 | 38.64609 | 15.60537 | 18.54075 | Jansen 2019 |
| 24042_1 | Ore | Dzedzvebi | 2.07536 | 0.83487 | 0.05338 | 38.86958 | 15.63749 | 18.73211 | Data DBM |
| 24042_3 | Ore | Dzedzvebi | 2.08912 | 0.84562 | 0.05414 | 38.58807 | 15.61948 | 18.47120 | Data DBM |
| 25108-1 | Ore | Dzedzvebi | 2.08889 | 0.84556 | 0.05414 | 38.58190 | 15.61727 | 18.46944 | Data DBM |
| 25291 | Ore | Dzedzvebi | 2.08536 | 0.84433 | 0.05405 | 38.58063 | 15.62083 | 18.50147 | Data DBM |
| 25433-6 | Ore | Dzedzvebi | 2.08401 | 0.84195 | 0.05401 | 38.58758 | 15.58983 | 18.51536 | Data DBM |
| 6450/34029 | Ore | Dzedzvebi II.2 | 2.08363 | 0.84292 | 0.05400 | 38.58797 | 15.61033 | 18.51950 | Data DBM |
| Geo-118/28 | Ore | Dzedzvebi | 2.0850 | 0.8422 | 0.0540 | 38.5900 | 15.5900 | 18.5100 | Data DBM |
| Feat. 36278 / FNo 27905 | Slag, prill, LC | Dzedzvebi | 2.05631 | 0.82744 | 0.05285 | 38.90959 | 15.65740 | 18.92204 | Data DBM |

Tab. 2. List of Pb isotope ratios of regional Madneuli/Bolnisi ores, ores from Dzedzvebi settlement and LC and EBA metals, according to the published data and recent investigation.

| Sample/ Find-No. | Sample character | Location | $^{208}Pb/^{206}Pb$ | $^{207}Pb/^{206}Pb$ | $^{204}Pb/^{206}Pb$ | $^{208}Pb/^{204}Pb$ | $^{207}Pb/^{204}Pb$ | $^{206}Pb/^{204}Pb$ | Bibliography |
|---|---|---|---|---|---|---|---|---|---|
| Feat. 36278 / FNo 27905 | Slag, prill, LC | Dzedzvebi | 2.06027 | 0.82897 | 0.05295 | 38.91187 | 15.65648 | 18.88677 | Data DBM |
| Feat. 36278 / FNo 27905 | Slag, prill, LC | Dzedzvebi | 2.06109 | 0.82925 | 0.05297 | 38.90800 | 15.65412 | 18.87761 | Data DBM |
| Feat. 34506/ FNo 9636 | Slag, Kura-Araxes | Dzedzvebi II.2 | 2.06587 | 0.83831 | 0.05353 | 38.59621 | 15.66210 | 18.68284 | Data DBM |
| Feat. 34029/ FNo 6416 | Slag, Kura-Araxes | Dzedzvebi II.2 | 2.07330 | 0.84272 | 0.05381 | 38.53288 | 15.66210 | 18.58542 | Data DBM |
| Feat. 34029/6431 | Slag, Kura-Araxes | Dzedzvebi II.2 | 2.07221 | 0.84175 | 0.05375 | 38.55236 | 15.66037 | 18.60446 | Data DBM |
| Feat. 34059/8630 | Slag, Kura-Araxes | Dzedzvebi II.2 | 2.08259 | 0.84327 | 0.05396 | 38.59765 | 15.62885 | 18.53332 | Data DBM |
| Feat. 34522/9645 | Slag, Kura-Araxes | Dzedzvebi II.2 | 2.06462 | 0.83822 | 0.05350 | 38.58806 | 15.66657 | 18.69026 | Data DBM |
| FNo. 27918 | Cu metal | Dzedzvebi IV.5 | 2.08611 | 0.85073 | 0.05434 | 38.38769 | 15.65477 | 18.40160 | Data DBM |
| FNo. 12707 | Cu metal | Dzedzvebi II.2 | 2.07701 | 0.83909 | 0.05371 | 38.67290 | 15.62342 | 18.61928 | Data DBM |
| FNo 12761 | Cu metal | Dzedzvebi II.2 | 2.07290 | 0.83799 | 0.05357 | 38.69230 | 15.64160 | 18.66548 | Data DBM |
| Lab Nr 4243/13 | Pick-axe, LC | Ovçular | 2.06 | 0.8281 | | 38.91 | 15.644 | 18.892 | Gailhard et al. 2017 |
| Lab Nr 4871/13 | Pick-axe, LC | Dmanisi | 2.05859 | 0.82884 | 0.05292 | 38.89942 | 15.66200 | 18.89617 | Data DBM |
| Aze-160a | Au spiral, Kura-Araxes | Hasansu | 2.0710 | 0.8358 | 0.0533 | 38.8200 | 15.6700 | 18.7500 | Jansen 2019 |

Tab. 2. Continued.

| Artefact | Provenance | Period | Archaeo n° | | DBM Lab n° |
|---|---|---|---|---|---|
| | Place | | Find | Feature | |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 8654 | 34059 | 4038/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 12766 | 34098 | 4039/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 12756 | 34097 | 4040/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 6200 | 34012 | 4367/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 6416 | 34029 | 4368/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 6418 | 34029 | 4369/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 6437 | 34029 | 4370/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 6431 | 34029 | 4371/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 8617 | 34059 | 4378/15 |
| Slag | DZ II.2 | EBA (Kura-Araxes) | 8630 | 34059 | 4373/15 |
| Crucible + slag | DZ II.2 | EBA (Kura-Araxes) | 12561 | 34088 | 4375/15 |
| Crucible + slag | DZ II.2 | EBA (Kura-Araxes) | 12750 | 34097 | 4035/15 |
| Small tool? object | DZ II.2 | EBA (Kura-Araxes) | 12707 | 34090 | 4032/15 |
| Awl fragment | DZ II.2 | EBA (Kura-Araxes) | 12761 | 34097 | 4033/15 |
| Crucible + slag | DZ II.3 | EBA (Kura-Araxes) | 9636 | 34506 | 4374/15 |
| Slag | DZ II.3 | EBA (Kura-Araxes) | 9645 | 34522 | 4376/15 |
| Ore | DZ II.3 | EBA (Kura-Araxes) | 9721 | 34513 | 4377/15 |
| Slag | DZ II.8 | EBA (Kura-Araxes) | 25473 | 38017 | 3140/16 |
| Crucible | DZ III.5 | EBA (Kura-Araxes) | 18209 | 33046 | 4034/15 |
| Crucible + slag | DZ III.5 | EBA (Kura-Araxes) | 18185 | 33039 | 4036/15 |
| Awl | DZ IV.3 | EBA (Kura-Araxes) | 27918 | 36082 | 4031/15 |
| Slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3134/16 |
| Slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3135/16 |
| Slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3136/16 |
| Slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3137/16 |
| Prill trapped in slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3138/16 |
| Slag | DZ IV.3 | Late Chalcolithic (Sioni) | 36278 | 27905 | 3139/16 |
| Slag | DZ IV.3 | Early Chalcolithic | 36128 | 29141 | 3141/16 |
| Slag | DZ IV.3 | Early Chalcolithic | 36128 | 29141 | 3142/16 |
| Surface | DZ IV.3 | Late Chalcolithic (Sioni) | 36100 | 22434 | No number |

Tab. 3. List of copper metallurgical artefacts and educts from LC and Kura-Araxes copper metallurgy at Dzedzvebi (DZ) studied in the laboratory.

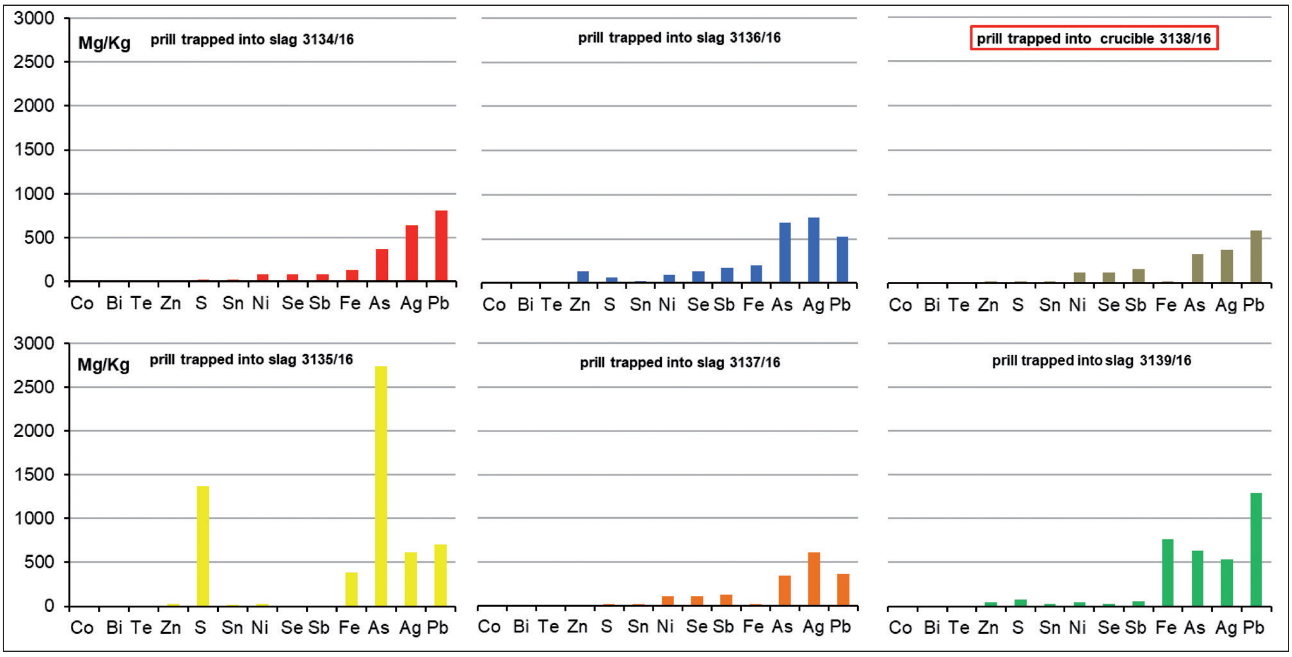



Fig. 27. Composition of trace elements of Chalcolithic slag/dross trapped in the Chalcolithic crucible 27905 (DBM/GNM/RUB; A. Courcier).

in one charge. As the Pb isotope ratios also differ from regional LIA spectra, it seems likely that the copper ore (concentrate) came from a different deposit, possibly the Armenian Plateau.[53] The Early Chalcolithic slag, which constitutes one of the oldest examples of pyrometallurgy in the Lesser Caucasus, is different: These are dense slags with large host-rock Fe-rich inclusions and numerous magnetite clusters in fayalite formation, with cuprite precipitation between fayalite needles. A few tiny metal prills are also embedded into an anamorphous glassy matrix. However, as we do not know more about the metallurgical process, further comments cannot be made at present.

### 4.2. Gold Metallurgy of the Early Bronze Age: Metallurgical and Provenance Studies

Compared to copper metallurgy, the issue of gold metallurgy is significantly more complex. This is mainly because – in contrast to copper – the melting of a heavy metal concentrate in a crucible, presumably produced by gold panning, leads to the sintering together of gold prills into reguli.[54] These prills were usually removed from the slag crusts of the crucibles; therefore, they are rarely found. The crucible from Dzedzvebi II.3, the last one identified with gold adhesions, illustrates this problem especially clearly (see below). In principle, however, gold metallurgy can be approximated by various findings. The most common ones are grinding devices with characteristic grooves that point to the grinding of harder material (characteristic grooves have also been proven for rotary mills used in gold processing since antiquity)[55] and speak to the processing of metal-bearing ores. Thus, milling devices of the type series 6a–c as well as the grinders of type 7b1–g can be traced in certain focal points, especially in the workshop areas of the Kura-Araxes settlement.[56] Type 6a (grinding slabs) may also be related to grain grinding and is therefore less definitive (Fig. 28). A comparison of the tools found during the excavations at the Kachagiani mound (Sakdrisi) and those in Dzedzvebi has shown that the same tools were used at both sites; the only difference is that in Sakdrisi, mining tools are more numerous, while in Dzedzvebi, processing tools are more numerous.[57] However, they are the same type of equipment, usually made of dense basalt rocks and andesites. It is striking that the depositional practices led to the accumulation of implements in rock layers apparently laid down at specific locations, which

53 See also Stöllner 2021b, 105–106 and Fig. 4.
54 Timberlake 2017. – Stöllner et al. 2021, esp. 104–110.
55 Weisgerber 2001. – Cauuet 2004.
56 For types, see Stöllner et al. 2014, 93 and Fig. 18.
57 Stöllner et al. 2014, 93 and Fig. 18.

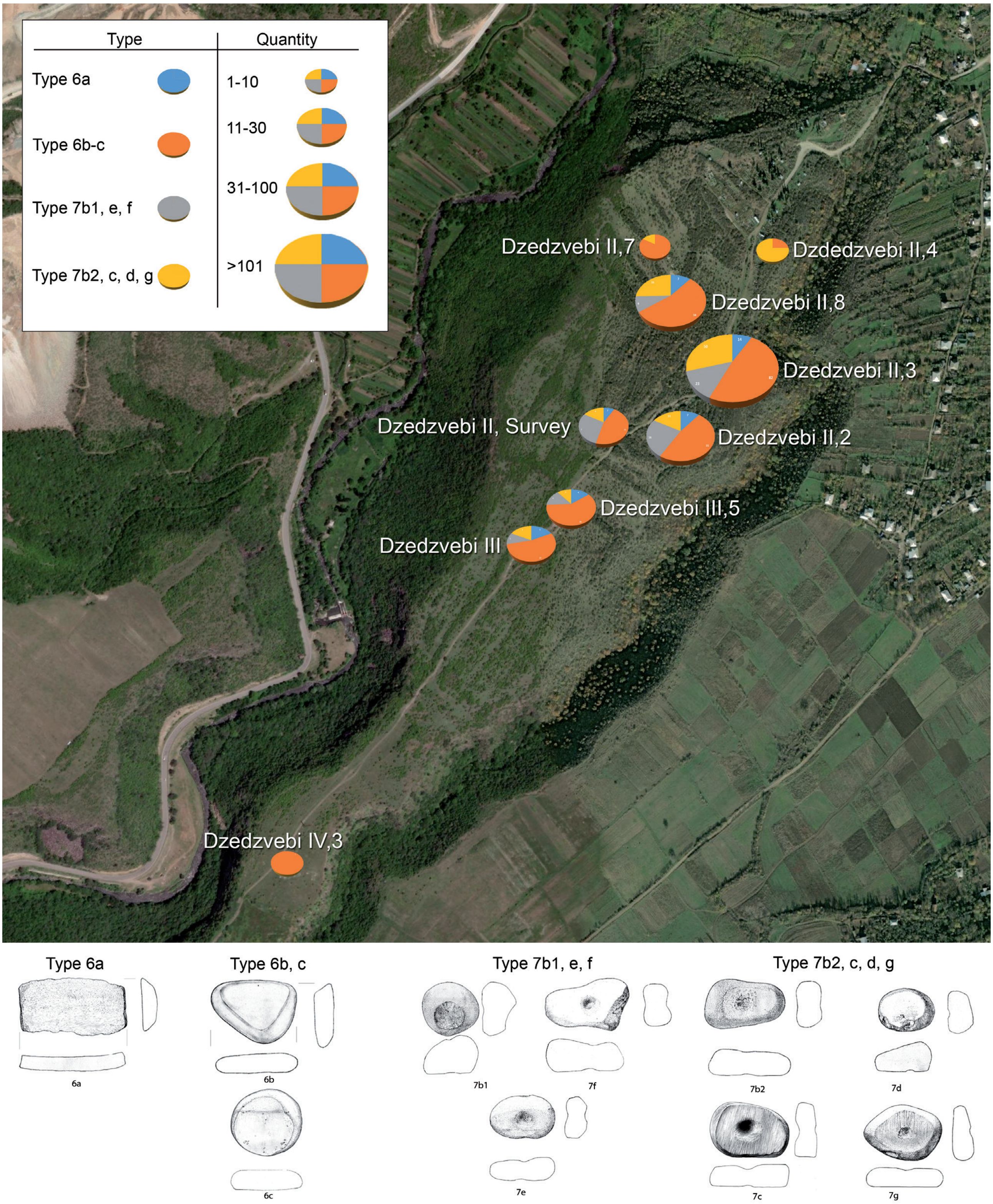



Fig. 28. Dzedzvebi Plateau, distribution of ore-beneficiation stone implements (grinders and grinding slabs) according to their typology and their numbers (DBM/GNM/RUB; S. Senczek).

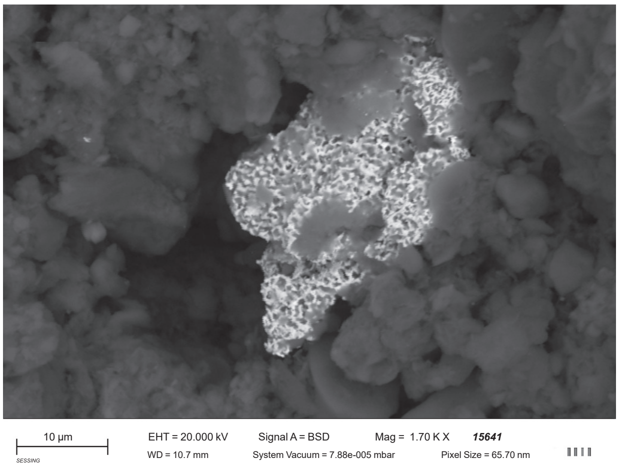



Fig. 29. Scanning electron micrograph (BSD) of crucible 15641 showing a bright gold alloy particle on the inner surface. The chemical analysis reveals 66 wt.-% Au, 32 wt.-% Cu and 1.5 wt.-% Ag (SEM-EDS).

probably represents part of a practice of ore beneficiation associated with ritual acts.[58]

This clear connection to mining on the Kachagiani Hill is also illustrated in the distribution of ore pieces in the Kura-Araxes settlement of Dzedzvebi II/III: Haematite and quartz-rich ores are not expected from the geological subsoil of the Dzedzvebi Plateau; they must have come from the mineralisation of the Sakdrisi I–V deposits.[59] The mineralogical examination of the ores indicates a similarity to ores from the Kachagiani Hill; this finding was confirmed by a consistency in their lead isotope signatures compared to samples from the original ore lodes.[60] The intercalation of free-gold flakes in the ore matrix is especially striking.[61] That this presumably gold-bearing quartz-haematite ore was also ground in Dzedzvebi is demonstrated by the gold content of sediments found in the vicinity of House 3 (Dzedzvebi II.3), the open processing and smelting site (III.5) and the area of House 4 (II.8), at a presumed washing site.[62] This evidence shows relatively conclusively that gold-bearing ores were processed at Dzedzvebi II/III, and that these activities mainly included preparation tasks such as grinding and pounding. It is likely that the separation of the ores was carried out at Sakdrisi by coarse crushing. There, the discovery of a processing site in front of Pit 1/Pinge A provides evidence of testing of the gold content by assaying,[63] but the majority of the ores may have been worked at the Dzedzvebi settlement. In this respect, the discovery of a hearth site with crucibles at the edge of House Complex 6 (40034) was significant, as it was possible to recover some crucible remains from an ashy backfill. An initial microscopic examination of the crucible 15641 at the Georgian National Museum confirmed the initial suspicion that it could be a gold-melting crucible. The follow-up investigation, using scanning electron microscopy (SEM) at the Deutsches Bergbau-Museum in 2021–2022 has shown an adhering gold particle. The chemical analysis with an energy dispersive spectroscope of the SEM revealed a composition high in copper, at approximately 30 % (Fig. 29). This composition is unusual for gold extracted from ore lodes and alluvial sources and was not encountered among the other materials from Sakdrisi, where all of the approximately 250 free-gold particles extracted from the ore lodes showed Cu contents of less than 0.2 wt.%.[64] However, taking into account the ore-beneficiation process, including the washing process, it seems highly likely that the amount of copper, ten times higher than the gold in bulk analyses of the ores,[65] would have led to copper-rich heavy mineral concentrates.[66] Smelting of such concentrates would have led not only to the sintering of gold prills, but also to an enrichment of Cu in the smelting dross.[67] The composition of the crucible gold therefore may indicate a metallurgical processing leading to an enrichment of copper by – possibly coincidental – co-smelting with copper minerals present in the same heavy mineral concentrate from panning. Two polished cross-sections did not reveal any additional gold prills trapped in the slagged portion at random cuts of the crucible's inner surface; instead, particles of lead and silver were observed. They were probably removed mechanically by the ancient smelters. The crucible may have been used for different purposes in the production of artefacts made of various precious metals. Testing of additional fragments of crucibles from House Complex 6 is currently underway and will improve our understanding of the technical processes performed at this important site.

58 Stöllner 2017.

59 Gugushvili et al. 2002. – Hauptmann et al. 2010.

60 Jansen 2019, 260–262.

61 See Jansen, Stöllner, Courcier 2014, 105–106 and Fig. 31.

62 See on this already Stöllner 2017, 132–133 and Tab. 2.

63 Dump 10042 and cistern in Stöllner et al. 2014, 86–91 and Fig. 17. – See also Timberlake 2017.

64 Jansen 2019, 156.

65 See Jansen, Stöllner, Courcier 2014, 106 and Tab. 4.

66 Timberlake 2017, 128–130.

67 See Jansen 2019, 173–174 for melting of gold concentrates from Sakdrisi leading to a higher copper content even under oxidising conditions.

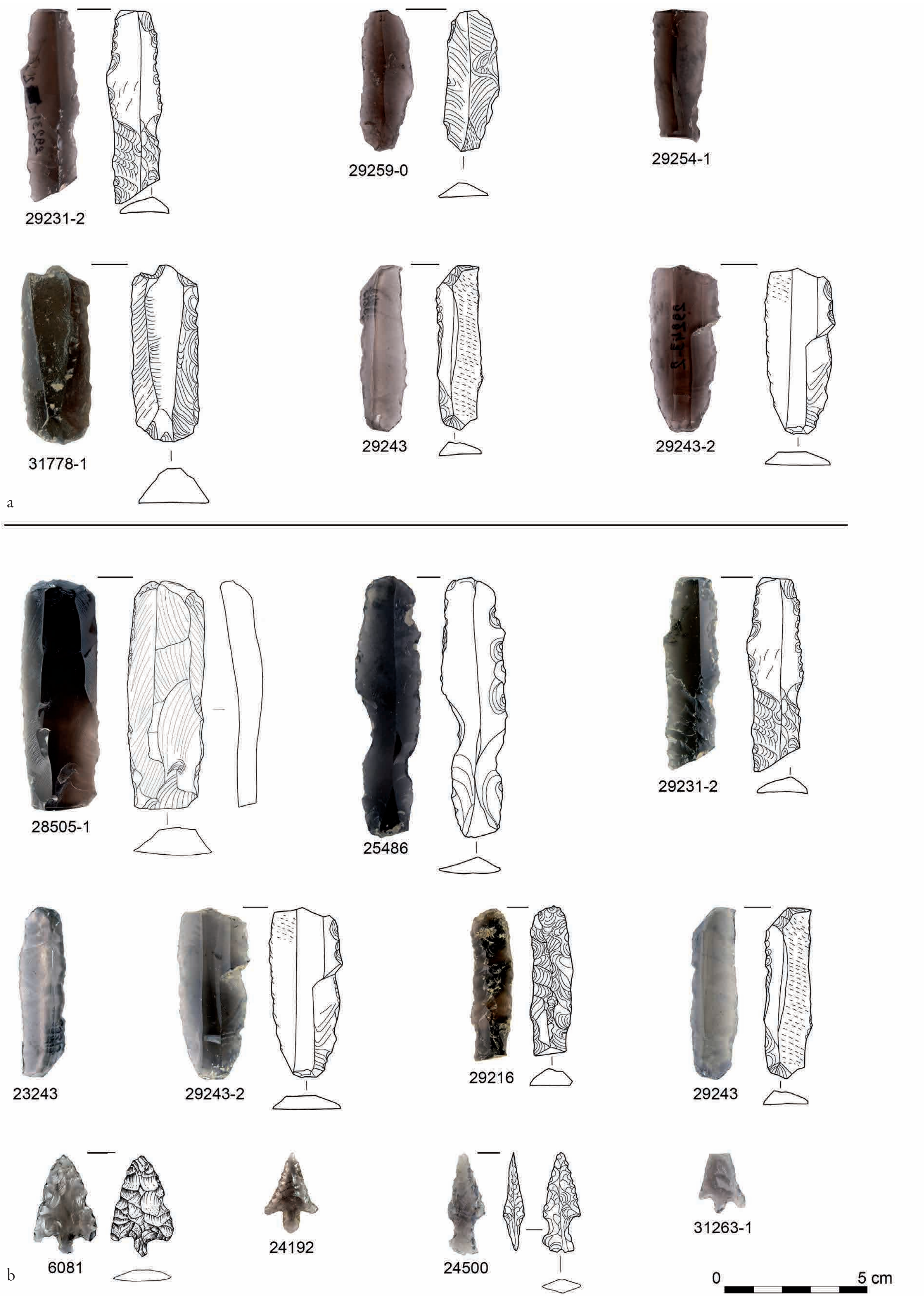
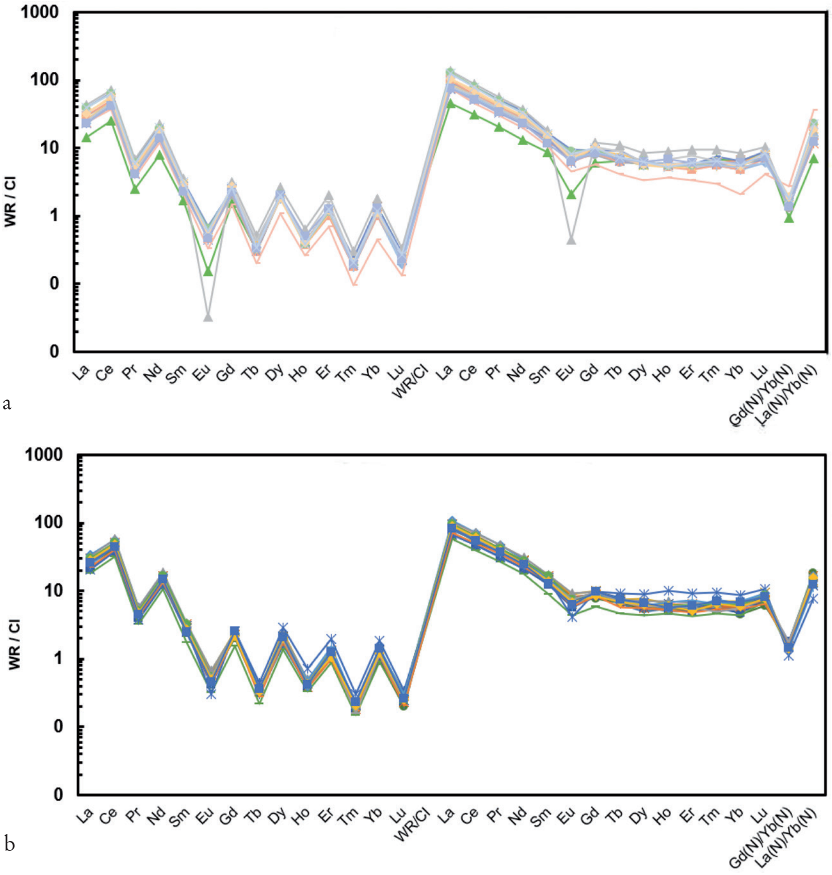



Fig. 30. Obsidian artefacts from Dzedzvebi. – a. Late Chalcolithic. – b. Early Bronze Age (DBM/GNM/RUB; S. Senczek, H.-J. Lauffer, T. Sachvadze).




a

b

Fig. 31. Spider diagrams of the rare earths of the obsidian finds analysed with mass spectrometry. – a. Late Chalcolithic. – b. Early Bronze Age. – The thick lines show the Chikiani samples (DBM/RUB; J. Bungardt).

### 4.3. Obsidian from the Late Chalcolithic and Early Bronze Age

Since the Chalcolithic, the highland regions of the Caucasus have been exploited more intensively due to livestock farming; this exploitation opened up numerous new trade routes.[68] Examination of these new connections raises new questions, including ones about the procurement of obsidian in the Caucasus. These questions can be addressed at the Dzedzvebi site. The technological aspects of 429 obsidian artefacts from Dzedzvebi were studied, based on a study by Judith Thomalsky (Fig. 30 a–b).[69] The aim was to identify any signs of on-site production. Provenance studies were also undertaken to investigate possible exchange routes. To study the provenance of the obsidian from Dzedzvebi, 289 finds were analysed by pXRF, 50 of which were analysed by mass spectrometry in the research laboratory of the Deutsches Bergbau-Museum to determine their rare earth trace elements. A discussion on trace elements as indications of provenance follows older studies,[70] which already emphasised the importance of the Chikiani sources for communities from the upper Kura Valley and its tributaries during the later Chalcolithic and Early Bronze Age.[71]

An examination of the Chalcolithic material from the Dzedzvebi site (n=115) makes it clear that this material is of high quality and includes a wide range of colours. The material mainly consists of flakes and a few modified (retouched) basic forms. Workplace activities through the *chaîne opératoire* can be detected via examination of the composition of debris assemblages from various pit fillings from Dzedzvebi IV.3. The phases of production and disposal can be established with certainty. Core preparation has not been

68 Stöllner 2021a, 445–448.

69 Thomalsky 2021.

70 Badalyan 2010. – Chataigner, Gratuze 2014a. – Chataigner, Gratuze 2014b.

71 Biagi, Nisbet, Gratuze 2017.

identified. The modification and the utilisation phase cannot be proven with certainty, but it is likely that these also took place on-site (see a selection of bladelets including a crested bladelet [29216], an elongated end scraper [28505-1] and one flat, retouched bladelet [29231-2], illustrated in Fig. 30b).

Geochemically, the Chalcolithic assemblage shows basic agreement, but some samples deviate from the average in terms of their element concentrations. However, the majority of the samples agree with the values of the Chikiani deposit (mainly assigned to Chikiani 2 and 3, based on the Ba/Zr variation).[72] Even some of the samples with deviating values agree with a formation of this type. However, two samples do not match the values of the Chikiani complex. In some cases, samples match the Sarikamis deposit (east Turkey), while other samples do not match any of the deposits used as comparisons for this study (Fig. 31a). A basic supply of obsidian thus most likely came from the Chikiani obsidian flows, but a seasonal supply from the Sarikamis region cannot be excluded. It is interesting to note that this evidence derives from the Late Chalcolithic Pit 4, in which metallurgical debris (crucibles, mould) were also found. The copper ore smelted there also appears to have a foreign provenance, most likely the Armenian Plateau (see above, section 4.1).

Although the Early Bronze Age finds (n=237) are similar to those of the Chalcolithic, some differences can be observed. The quality remains very good on average, but the material shows more frequent inclusions. The colour variety is the same as in the Chalcolithic. Here, too, the majority of the pieces are flakes, which again suggests a predominant production of primary basic forms. Workplace activities can therefore also be demonstrated for this period. The phases of production and disposal can again be reliably determined. Core preparation is conceivable, but difficult to prove. The modification and use phases cannot be proven with certainty here either, but it is likely that these also took place on-site (Fig. 31b).

In terms of geochemistry, the Early Bronze Age samples are more uniform than those of the Chalcolithic. The element concentrations here predominantly match a formation of the Chikiani complex (Koyun Dağ). Some samples also match the Chikiani deposit, and thus the majority of the Chalcolithic samples (Fig. 31a–b). A basic supply of obsidian from the Chikiani mining complex can thus also be assumed for the Early Bronze Age. It was possibly extracted from a different formation than during the Late Chalcolithic period, as the Ba/Zr variation appears more concentrated around the Chikiani 2 volcanic flow.

The supply of obsidian was most likely discovered by pastoralists, who increasingly used the highland regions for their livestock, starting in the Chalcolithic. During the Chalcolithic, however, other, presumably seasonal routes, such as those to the Sarikamis region, were also used. The predominant use of the Chikiani source during the Early Bronze Age points to directional access to raw material sources and thus to territorial concepts (possibly in combination with pastoral activities, see below).

#### 4.4. Subsistence During the Late Chalcolithic and Early Bronze Age 1: Archaeobotany

Despite the rich archaeological legacy of Georgia, relatively few archaeobotanical publications focused on Georgian sites are available.[73] At Dzedzvebi, over 300 soil samples have been collected so far, of which 16 belong to the Chalcolithic period and 115 to the Kura-Araxes Early Bronze Age. Due to the multi-period nature of the site, the archaeobotanical evaluation is not clear in all cases, as botanical remains generally cannot be dated by their appearance. Therefore, the number of samples used for this evaluation was reduced. The following arguments are based on 16 Chalcolithic and 47 Kura-Araxes samples derived from 63 unequivocally single-phased fillings of structures, several of which were dated by AMS radiocarbon dating.

The samples represent the archaeobotanical evidence of the excavations at Dzedzvebi from 2013 to 2021. Several of the soil samples were significantly disturbed by roots, as evidenced by the high percentage of root debris found in them. In particular, near-surface or bioturbation-influenced soil contained recent seeds and fruits, vegetative remains, wood, insect remains and mouse faeces (Fig. 32).

The soil samples were processed by wet sieving using 1 mm, 0.5 mm and – at the start – 0.25 mm mesh. More recently, only 1 mm and 0.5 mm mesh were used, because the smaller sizes contained only severely fragmented remains and did not provide any useful information. During the sieving process, the light organic fraction was also separated from the heavy mineral fraction to improve sorting efficiency. The material was sorted and examined at 6x to 40x magnification. Identification was based on common

72 See Biagi, Nisbet, Gratuze 2017, Fig. 14.

73 Lisitsina 1984. – A relatively recent compilation of old and new findings is provided in Hovsepyan 2015. – See also Longford, Sagona 2022.

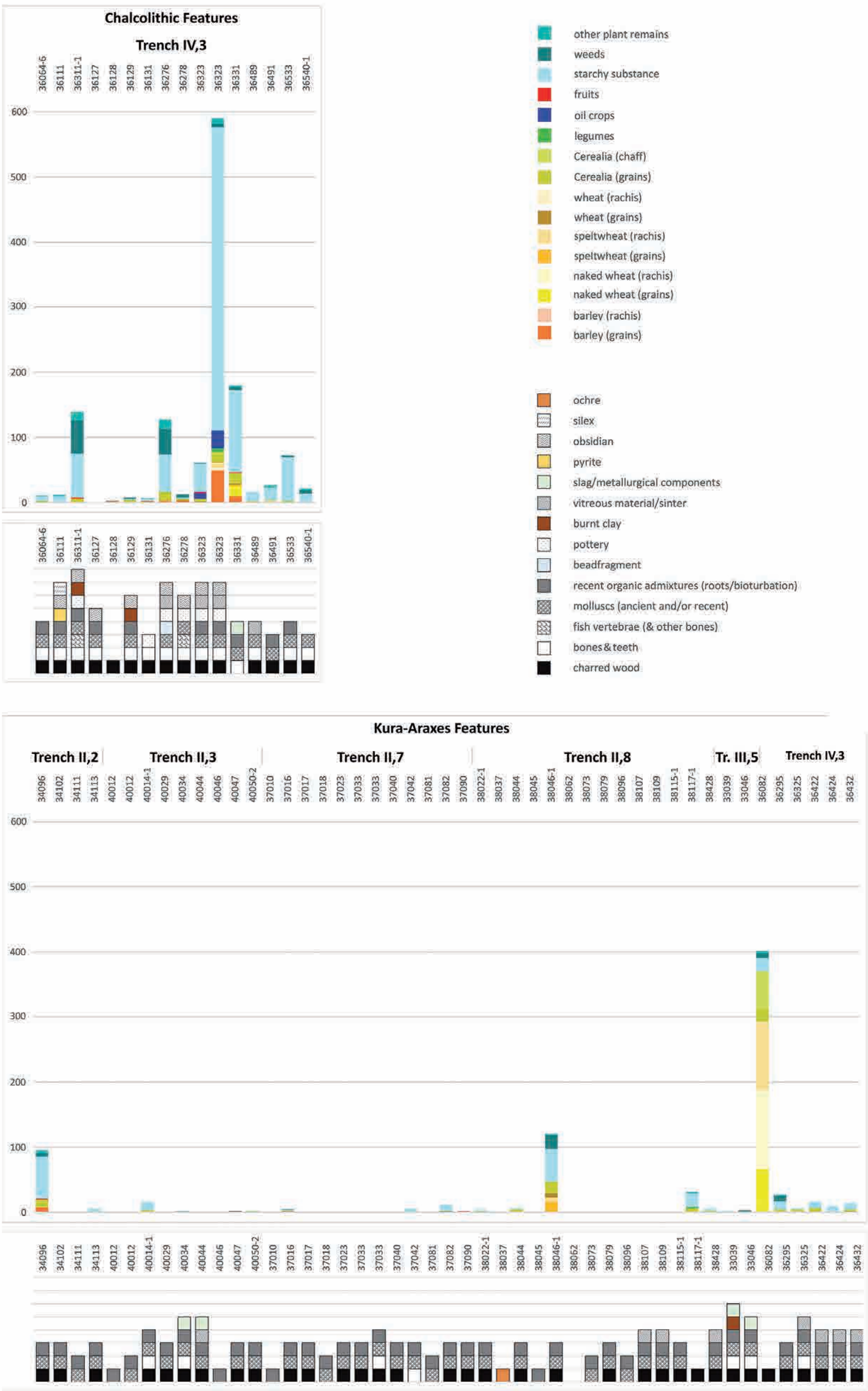



Fig. 32. Presence of plant remains and other material inside the samples of Dzedzvebi (Draft: RUB; N. Boenke).

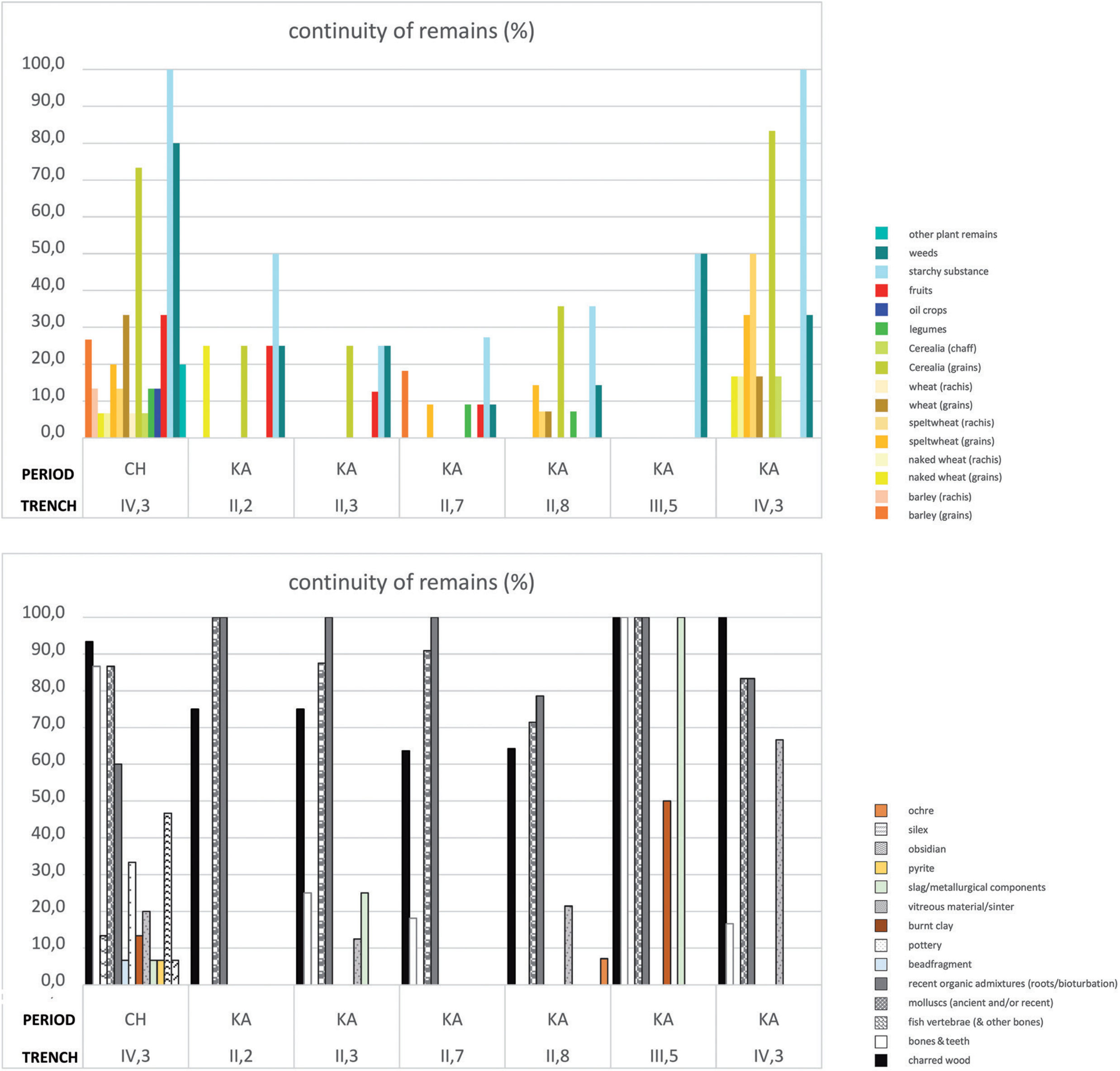



Fig. 33. Continuity of plant remains and other materials inside the features. The continuity is given as the percentage of presence in the features available for each section and period. The underlying feature/sample relation for the single groups is as follows: Chalcolithic (CH) Trench IV,3: 15/16; Kura-Araxes (KA) Trench II,2: 4/4; Trench II,3: 8/9; Trench II,7: 11/12; Trench II,8: 14/14; Trench III,5: 2/2; Trench IV,3: 6/6 (Draft: RUB; N. Boenke).

identification literature,[74] a guide to the recent flora of Georgia,[75] and additional available literature. The plant remains are mainly preserved charred, but some are mineralised. For wild plants from near-surface strata, it is not clear when mineralisation occurred. For others, a prehistoric origin is plausible, because some species are preserved both mineralised and charred.

The total number of plant remains is relatively small. The samples contain 2082 seeds, fruits, vegetative remains and charred fragments of starchy substances (Tabs. 4a–c). Although 75 percent of the samples are from the Kura-Araxes period, these samples contain just 40 percent of the residues. Outside of Trench IV.3, the continuity of seeds and fruits is relatively low (Fig. 33). Chalcolithic pits were found exclusively in Trench IV.3. The final

74 Brouwer, Stählin 1975. – Bergren 1981. – Cappers, Bekker, Jans 2006. – Jacomet et al. 2006. – Nesbitt 2006. – Cappers, Neef, Bekker 2009.

75 Fischer, Gröger, Lobin 2018.

interpretation of this result must be left to the comparison with the archaeological finds and features.[76] Either different areas of use existed within the settlement, or a generally different waste behaviour occurred in the Kura-Araxes period, which is reflected taphonomically. It is conceivable that the investigated areas were deliberately kept clean, or that the organic remains were burned in a blazing fire. The latter does not lead to charring, but to the nearly complete ashing of organic substances. The powdery, ashy consistency of the Dzedzvebi soil samples may be indicative of this. Additionally, the proportion of very fine, non-determinable charcoal fragments smaller than 1 mm appears normal in comparison with typical archaeobotanical samples. In contrast, the number of charcoal pieces larger than 1 mm is often very low.

In addition to the archaeobotanical remains, the wet-sieved samples provide evidence of the presence of other basics of subsistence. A correlation between crops, charred starchy substances as a sign of food production and bone fragments can be noted in distinct areas (Fig. 32). Two Chalcolithic samples also contained fish vertebrae (most likely from the Mashavera and Dampludka rivers). Residues of metallurgical activities like slag or tiny pieces of malachite were found in the Late Chalcolithic as well as the Early Bronze Age samples, while tiny obsidian and silex flake fragments were found only in the Chalcolithic samples from Trench IV.3. This may illustrate the difference between the production and (re)use of stone tools.

Most of the botanical finds that are not charcoal fragments are charred cultivated plants (Figs. 32–33). The archaeobotanical evidence is dominated by cereals. The species found in samples from the Chalcolithic and Kura-Araxes periods at Dzedzvebi do not show a larger variation compared to what is known from the Neolithic Shulaveri-Shomutepe Culture (6th millennium BCE).[77] Unlike what has been documented regarding early agriculture in other regions outside the so-called 'Fertile Crescent' (e.g. the Linear Pottery Culture), we did not find a limited set of species dominated by emmer and einkorn, but a much larger variety.[78] Gorislava N. Lisitsina, like other authors before, already emphasised the great natural diversity and the variety of grain cultivation in the Caucasus region, which regionally gave rise to the cultivation of different types of wheat.[79]

The documented crops (Fig. 34) are einkorn (*Triticum monococcum* L.), naked as well as hulled barley (*Hordeum vulgare*), and naked wheat, with clear evidence of common wheat (*Triticum aestivum* s.l. hexaploid). Emmer (*Triticum dicoccum* Schrank) can exclusively be reported in three features from the Kura-Araxes period. Other Kura-Araxes features included small amounts of naked wheat, einkorn and/or barley. This range is comparable to that found in other places in the South Caucasus.[80] As residues, both grains and chaff were documented. Most of the material appears to consist of charred grains from food preparation, but evidence of cereal processing by glume bases or rachis fragments and even of free-threshing cereals has also been found for both periods; therefore, local production is likely. The different cereals can be interpreted either as species used for various purposes or as plants used for different needs and locations. Common wheat is generally used as bread wheat, while barley grains can also be used as pearl barley or for brewing beer. In addition, barley also has lower demands on soil and climate and grows at higher altitudes as well as in the lowlands. Its vegetation period is shorter; therefore, it can be grown as a summer crop. Summer crops can also be an alternative if a winter crop is failing. The same applies to emmer and einkorn, while growing common wheat as a winter crop is the better choice. Common wheat also has higher demands in terms of soil moisture and nutrients than einkorn and emmer.

Very little evidence of other crops has been found. Two poorly preserved lentils (cf. *Lens culinaris* Med.) were found in Chalcolithic samples, as well as fragments of large legumes that may have been cultivated. Lallemantia seeds (*Lallemantia* spec. e.g. *Lallemantia* cf. *iberica*) were found in Kura-Araxes samples; these plants may have been cultivated as oil crops.

Preserved fruits were much rarer. Compared to cooked food, taphonomically, they have a much lower chance of being charred. Some fruit stone fragments indicate the use of collected wild fruits like hackberry (*Celtis* spec.). Grape (*Vitis* spec.) was documented twice in the Chalcolithic features. Evidence of viticulture in Georgia since the Epipalaeolithic and Neolithic periods has recently been revisited by Reinder Neef, who also discusses the range of the moisture- and

76 Stöllner, Gambashidze 2011, 196 already suggested that the different record of domestic debris suggested a different interpretation of the settlement areas II and IV.

77 Compared to Lisitsina 1984, 288 and Tab. 1.

78 Neef, Decaix, Tengberg 2017, 371–377.

79 Lisitsina 1984, 285.

80 Longford, Sagona 2022, 347–374. – Manoukian et al. 2022, 4.


Fig. 34. Dzedzvebi, figures of selected plant remains. – A. *Triticum aestivum* s.l. hexaploid/6n-naked wheat (rachis fragments, charred, feature B36082/sample F23284). – B. *Triticum aestivum/durum/turgidum*/naked wheat (compactum type, grain, charred, feature B36082/sample F23284). – C. *Hordeum vulgare* L., naked barley (grains, charred, feature B36331/sample F29315). – D. *Celtis* spec. (stone core, mineralised, feature B36128/sample F23282). – E. *Vitis* spec. (pip fragment, mineralised, feature B36311-1/sample F29256). – F. *Vitis* spec. (pip fragment, charred, feature B36331/sample F29315). – G. *Lallemantia* spec. (seeds, charred, feature B36323/sample F29336). – H. *Neslia paniculata* (L.) Desv. (seeds, charred, feature B36295/sample F28641) (Photos: RUB; N. Boenke).

heat-loving wild form.[81] The lower altitudes of the Caucasus region offer excellent conditions, and occurrences of wild grape can still be observed today around Dzedzvebi, in the valleys of the small rivers Mashavera and Dampludka. However, it remains unclear if the residue inside the vessel is wine or a different form of fruit preparation.[82] No evidence of domesticated grapes or of cultivation from that period has

81 See Olmo 1995. – Zohary 1995. – Mcgovern et al. 2017, e10313–e10315. – Neef 2018, esp. 88–89.

82 Neef 2018, 95.

been found in the region. An overview of the archaeobotanical record of the Transcaucasus area by Patrick McGovern and others mentioned only pips with metric attributes that correspond to the wild from of grape.[83] Unfortunately, neither of the Dzedzvebi grape pips from the late 5th millennium are well preserved. For this reason, a simple assignment based on their metric characteristics is not possible; however, morphologically the seeds appear closer to the metric characteristics of wild grape. Three charred barley fragments from the same sample as one mineralised grape pip date to the late 5th millennium; this date would make that pip the earliest evidence of grapes in the area.[84]

Finally, a small number of weeds have also been identified. Unfortunately, most of the identified weeds grow as well in fields as they do on paths or rubble. There is no clear indication of whether these weeds represent the settlement's vegetation or field weeds. Only rubbish pepperwort (*Lepidium ruderale* L.) could be identified as a ruderal plant. Both rubbish pepperwort and black bindweed (*Fallopia convolvulus* (L.) A. Löve) are nitrogen indicators; their presence thus may indicate settled areas, although these plants are also associated with melioration or grazing on harvested fields and fallow land. Neither unambiguous growing conditions nor harvesting techniques are readable since any such statements can only be made on the basis of individual findings in each case due to the small number of positive samples. Only certain tendencies are ascertainable. Most of the weeds are annual plants but they can also/occasionally be perennial. Some of the plants grow close to the ground, while others can grow over 80 cm tall. None of the identified species exclusively flower high on the plant, making ear harvesting unlikely. Deep-rooting species like black bindweed, corn gromwell (*Lithospermum arvense* L.), ball mustard (*Neslia paniculata* (L.) Desv.) and lamb's quarters (*Chenopodium album* L.) indicate favourable soils, which is a requirement for the cultivation of common wheat, among other crops. Due to the small number of finds, neither those weeds that can be associated with winter crops, like corn gromwell and ball mustard, nor those that are more typically associated with summer crops, like lamb's quarters or wild millet (e.g. green foxtail, *Setaria* cf. *viridis* (L.) P.B.), correlate clearly with distinct species of cereals.

However, in conclusion, the occurrence of cereal residues alongside weeds may indicate an interpretation as field weeds (Fig. 32). Arable farming, especially the more demanding cultivation of common wheat can be seen as an indicator of the sedentariness of (groups of) people. In addition to the orientation towards the metallurgical resources in the vicinity (see sections 4.1–2) and the keeping of animals (see section 4.5), a focus on agricultural production can also be observed.

### 4.5. Subsistence During the Late Chalcolithic and Early Bronze Age 2: Archaeozoology and Isotope Studies

Analyses of faunal remains were carried out in 2016 and 2021 at the excavation house.[85] Over 4300 bone remains were recorded from the Chalcolithic and Early Bronze Age periods (1812 remains from Chalcolithic contexts and 2521 remains from EBA ones) (Tab. 5). Approximately 20 % of the remains in the Chalcolithic assemblage were identified, while 17 % of the identified specimens belong to the EBA (Tab. 5). The exploitation of animal resources mainly consisted of the breeding of domestic species: caprines (*Caprinae*), including sheep (*Ovis aries*) and goats (*Capra hircus*), have been identified, as well as cattle (*Bos taurus*) (for both periods, approximately 90 % of the identified specimens). Although the share of caprines and cattle is similar for both periods, we found some remains of pigs (*Sus domesticus*) in the EBA (Fig. 35). Wild mammals represent only c. 5 % of the identified specimens (n=21 in both periods) (Fig. 36). We identified remains of foxes (*Vulpes vulpes*), wild boars (*Sus scrofa*), cervids (red deer [*Cervus elaphus*] and roe deer [*Capreolus capreolus*]), hares (*Lepus sp.*) and equids (*Equus sp.*). Although the assemblages are small, we can distinguish a greater importance of wild boar in the EBA. Carnivores are less represented in this period.

In order to define husbandry practices more precisely, we created kill-off patterns expressed in number of teeth (number of identified dental specimens [NISPd]=36) for caprines, according to the method established by Sebastian Payne (Figs. 37–38).[86] Harvest profiles were created by using a correction of each age group to figure in the histogram. This method is linked to the various lengths of the age classes.[87] In contrast to the relatively large number of bone remains from the Chalcolithic and EBA, very few dental remains could be studied. The profiles are therefore not statistically robust. However, we note for both periods the absence of age classes A and B (young lamb up to 6 months), which may reflect an economic choice by herders not to slaughter young animals, off-site slaughter or an absence of

83 McGovern et al. 2017, e10315.

84 Feature 36311-1: MAMS 53668, calBC 4311–4051. – Compare section 3.1.

85 See Berthon et al. 2021 for a list of methodological references used.

86 Payne 1973.

87 Ducos 1968. – Vigne, Helmer 2007.

| Period | Trench | Feature No. | Find No. | CEREALS | *Hordeum* spec./barley (grains) | cf. *Hordeum* spec./barley (rachis) | *Hordeum vulgare* L./barley (grains) | *Hordeum vulgare* L. (naked barley, grains) | *Hordeum vulgare* L. (hulled barley, grains) | *Hordeum vulgare* L. (hulled barley, rachis) | *Triticum aestivum/durum/turgidum*/ naked wheat (compactum-type, grains) | cf. *Triticum aestivum/durum/turgidum*/ naked wheat (compactum-type, grains) | *Triticum aestivum/durum/turgidum*/ naked wheat (rachis) | cf. *Triticum aestivum/durum/turgidum*/ naked wheat (grains) | *Triticum aestivum* s.l. hexaploid/6n-naked wheat (rachis) | *Triticum* cf. *aestivum* s.l. hexaploid/6n-naked wheat (rachis) | *Triticum dicoccum* Schrank/emmer (grains) | *Triticum dicoccum* Schrank/emmer (spikelet forks/glume base) | *Triticum monococcum* L./einkorn (grains) | *Triticum monococcum* L./einkorn (spikelet forks/glume base) | *Triticum cf. monococcum* L./einkorn (spikelet forks/glume base) | *Triticum monococcum/dicoccum* /einkorn or emmer (grains) | *Triticum monococcum/dicoccum* /einkorn or emmer (spikelet forks/glume base) | *Triticum* spec./spelt wheat (spikelet forks/glume base) | *Triticum* spec./wheat (grains) | *Triticum* spec./wheat (rachis) | *Panicum miliaceum* L./broomcorn millet | cf. *Panicum miliaceum* L./broomcorn millet | Panicoideae/millets | Cerealia (grains) | Cerealia (glumes) | Cerealia (earfragment, lower part) | Cerealia (awns) | LEGUMES | cf. *Lens culinaris* Med./lentil | Fabaceae/Legumes (large) | OIL CROP | *Lallemantia* spec. | FRUITS | *Celtis* spec./Hackberry min. | cf. *Celtis* spec./Hackberry | *Vitis* spec./grape | *Vitis* spec./grape min | fruit stone fragment indet. | pericarp/kernel case fragments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH | IV,3 | 36064-6 | 31701 | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| | | 36111 | 29237 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36127 | 23283 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36128 | 23282 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | | | | | |
| | | 36129 | 29213 | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | |
| | | 36131 | 23281 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | 1 |
| | | 36276 | 28586 | | | | | 1 | | | | | | | | | | | | | | 2 | | | 1 | | | | | 12 | | | | | | | | | | | | | | | |
| | | 36278 | 27997 | | | | | 2 | | | | | | | | | | | | | | | | | 2 | | | | | 1 | | | | | | | | | | | | | | | |
| | | 36311-1 | 29256 | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | 1 | 1 | |
| | | 36323 | 29312 | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 4 | | | | | | | | 10 | | 1 | | | | | |
| | | 36323 | 29336 | | | 2 | | 48 | | | | | | | | 3 | | | | | | | | 8 | 1 | | | | | 12 | | 3 | | | 1 | 5 | | 27 | | | | | | | |
| | | 36331 | 29315 | | 1 | | 2 | 6 | | | 9 | 6 | | | | | | | | | | 3 | | | 2 | | | | | 16 | | | | | | | | | | | | 1 | | | |
| | | 36489 | 31591 | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36491 | 31921 | | | | | | | 1 | | | | | | | | | | | 1 | | | | | 1 | | | | | | | | | 1 | | | | | | | | | | |
| | | 36533 | 31951 | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| | | 36540-1 | 32052 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KA | II,2 | 34096 | 12680 | | | | 4 | | 3 | | 1 | | | | | | | | | | | | | | | | | | | 11 | | | | | | | | | | | | | | | 2 |
| | | 34102 | 12720-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 34111 | 12785 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 34113 | 12786 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | II,3 | 40012 | 15196 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40012 | 15252 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40014-1 | 15317-5 | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | |
| | | 40029 | 15822 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40034 | 15698 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40044 | 15829 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40046 | 15832 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40047 | 15831 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| | | 40050-2 | 15864 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| | II,7 | 37010 | 24095 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37016 | 24106 | | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37017 | 24123-3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37018 | 24114 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37023 | 24193 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37033 | 24338 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37033 | 24338 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37040 | 24301-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37042 | 24345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37081 | 24702 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37082 | 24551 | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | |
| | | 37090 | 24475 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | II,8 | 38022-1 | 25762 | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| | | 38037 | 25524-2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38044 | 25913 | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | 3 | | | | | | | | | | | | | | | |
| | | 38045 | 25538 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38046-1 | 25915 | | | | | | | | | | | | | | 12 | 4 | | | | 4 | | 2 | 7 | | | | | 18 | | | | | | | | | | | | | | | |
| | | 38062 | 25842 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38073 | 33136 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38079 | 33069 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38096 | 33063 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38107 | 33129 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38109 | 33171 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38115-1 | 33195 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38117-1 | 33209 | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | 3 | | | | | | | | | |
| | | 38428 | 31319 | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| | III,5 | 33039 | 18204 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 33046 | 18214 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IV,3 | 36082 | 23284 | | | | | | | | 2 | | 64 | | 121 | | | | | 1 | | | 3 | 102 | | | | | | 18 | 56 | | 3 | | | | | | | | | | | | |
| | | 36295 | 28641 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 3 | | | | | | | | | | | | | | | |
| | | 36325 | 29307 | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| | | 36422 | 32136 | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | | | | 4 | | | | | | | | | | | | | | | |
| | | 36424 | 31290 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36432 | 31289 | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 3 | | | | | | | | | | | | | | | |

Tab. 4a. List of Chalcolithic (CH) and Kura-Araxes (KA) plants cultivated and gathered at Dzedzvebi (Data: RUB; N. Boenke).

| Period | Trench | Feature No. | Find No. | BORAGINACEAE | *Lithospermum arvense* L./Corn-Gromwell min. | cf. *Lithospermum arvense* L./Corn-Gromwell (inner fruit) | cf. *Lithospermum arvense* L./Corn-Gromwell (inner fruit) min. | BRASSICACEAE | cf. *Lepidium ruderale* L./Rubbish pepperword | *Neslia paniculata* (L.) Desv./Ball-mustard | CARYOPHYLLACEAE | *Silene* cf. *dichotoma* Ehrh. (Forking-Catchfly) | CHENOPODIACEAE | *Chenopodium album* L./lamb's quarters | cf. *Chenopodium album* L./lamb's quarters | *Chenopodium* spec. | Chenopodiaceae min. | FABACEAE | *Trifolium* spec./clover | MALVACEAE | Malvaceae (inner fruit) | POACEAE | *Bromus* spec./brome grasses | Festuca-/Lolium-Type/fescue-/ryegrass-type | cf. *Poa annua* L./annual bluegrass | *Setaria* cf. *viridis* /green foxtail | Poaceae large | Poaceae | Poaceae (culm fragments) | POLYGONACEAE | *Fallopia convolvulus* (L.) A. Löve/black bindweed | cf. *Fallopia convolvulus* (L.) A. Löve/black bindweed | Polygonaceae | RUBIACEAE | *Galium* cf. *aparine* L./cleavers | *Galium spurium* L./false cleavers | Galium spurium/aparine/cleavers/false-cleavers | *Galium* spec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH | IV,3 | 36064-6 | 31701 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36111 | 29237 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36127 | 23283 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36128 | 23282 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36129 | 29213 | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| | | 36131 | 23281 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36276 | 28586 | | 15 | 1 | 5 | | 5 | 2 | | | | | | 2 | 1 | | | | | | | | | | | | | | | | | | | 2 | 7 | |
| | | 36278 | 27997 | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | 1 |
| | | 36311-1 | 29256 | | 47 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| | | 36323 | 29312 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36323 | 29336 | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | | 1 | | 1 | | | | | |
| | | 36331 | 29315 | | | | | | | 1 | | | | | 1 | | | | | | | | | 1 | | | | | | | | | | | | | 2 | |
| | | 36489 | 31591 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36491 | 31921 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36533 | 31951 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| | | 36540-1 | 32052 | | 2 | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | 2 | |
| KA | II,2 | 34096 | 12680 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | 1 | |
| | | 34102 | 12720-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 34111 | 12785 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 34113 | 12786 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | II,3 | 40012 | 15196 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40012 | 15252 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40014-1 | 15317-5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40029 | 15822 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40034 | 15698 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40044 | 15829 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40046 | 15832 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40047 | 15831 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 40050-2 | 15864 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | II,7 | 37010 | 24095 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37016 | 24106 | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| | | 37017 | 24123-3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37018 | 24114 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37023 | 24193 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37033 | 24338 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37033 | 24338 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37040 | 24301-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37042 | 24345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37081 | 24702 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37082 | 24551 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 37090 | 24475 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | II,8 | 38022-1 | 25762 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38037 | 25524-2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38044 | 25913 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38045 | 25538 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38046-1 | 25915 | | | | | | | | | 3 | | | | | | | | | 1 | | | 1 | 4 | 2 | 7 | | 2 | | | | 1 | | | | | |
| | | 38062 | 25842 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38073 | 33136 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38079 | 33069 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38096 | 33063 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38107 | 33129 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38109 | 33171 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38115-1 | 33195 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 38117-1 | 33209 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | 38428 | 31319 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | III,5 | 33039 | 18204 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 33046 | 18214 | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | IV,3 | 36082 | 23284 | | | | | | | 1 | | | | | | | | | 1 | | | | | | | | 1 | | | | 1 | 1 | | | | | 3 | |
| | | 36295 | 28641 | | | | | | | 3 | | | | | | | | | | | | | 1 | 1 | | | | | 1 | | | | | | | | 2 | |
| | | 36325 | 29307 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36422 | 32136 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36424 | 31290 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 36432 | 31289 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Tab. 4b. List of Chalcolithic (CH) and Kura-Araxes (KA) weeds at Dzedzvebi (Data: RUB; N. Boenke).

| Period | Trench | Feature No. | Find No. | OTHER PLANT REMAINS | seed/fruit indet. | seed/fruit indet. (inner fruit) min. | stalk fragments | vegetative remains | WOOD | charcoal fragments | mineralized wood | charred roots | charred bark | OTHER ORGANICS | starchy substance | bones&teeth | fish vertebrae (& other bones) | molluscs (ancient and/or recent) | RECENT ADMIXTURES (Bioturbation/roots) | recent seeds/fruits | recent vegetative plant remains | recent wood | recent roots | recent insects | recent mice faeces | OTHERS | beadfragment | pottery | burnt clay | vitreous material | vitreous material/sinter | sinter with plant imprint | ash lumps | slag/metallurgical components | pyrite | obsidian | silex | ochre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH | IV,3 | 36064-6 | 31701 |  |  |  |  | 1 |  | x |  |  |  |  | 7 | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36111 | 29237 |  | 2 |  |  |  |  | x |  |  |  |  | 9 | x |  | x |  |  | x |  | x | x |  |  |  |  |  |  |  |  |  |  | x | x | x |  |
|  |  | 36127 | 23283 |  |  |  |  |  |  | x |  |  |  |  | x | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |
|  |  | 36128 | 23282 |  |  |  |  |  |  | x |  |  |  |  | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36129 | 29213 |  |  |  |  |  |  | x |  |  |  |  | 1 | x |  | x |  |  |  |  | x |  |  |  |  |  | x |  |  |  |  |  |  | x |  |  |
|  |  | 36131 | 23281 |  | 1 |  |  |  |  | x | x |  |  |  | 3 | x |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |
|  |  | 36276 | 28586 |  | 6 | 8 |  |  |  | x |  |  |  |  | 57 | x |  | x |  |  |  |  |  |  |  |  | x | x |  | x |  | x |  |  |  | x |  |  |
|  |  | 36278 | 27997 |  |  |  |  |  |  | x | x |  |  |  | 2 | x | x | x |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |
|  |  | 36311-1 | 29256 |  | 1 | 12 |  |  |  | x | x |  |  |  | 68 | x | x | x |  |  |  |  | x |  |  |  |  | x | x |  |  |  |  |  |  | x |  |  |
|  |  | 36323 | 29312 |  | 1 |  |  |  |  | x |  |  |  |  | 43 | x |  | x |  |  |  |  | x |  |  |  |  | x |  |  | x |  |  |  |  | x |  |  |
|  |  | 36323 | 29336 |  | 9 |  |  |  |  | x |  |  |  |  | 466 | x |  | x |  | x |  |  | x |  |  |  |  | x |  | x |  |  |  |  |  | x |  |  |
|  |  | 36331 | 29315 |  |  |  |  | 2 |  |  |  |  |  |  | 126 | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |
|  |  | 36489 | 31591 |  |  |  |  |  |  | x |  |  |  |  | 15 | x |  | x |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |  |  |
|  |  | 36491 | 31921 |  | 4 |  |  |  |  | x |  |  |  |  | 18 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36533 | 31951 |  |  |  | 1 |  |  | x |  |  |  |  | 67 | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36540-1 | 32052 |  | 2 |  |  |  |  | x |  |  |  |  | 13 | x |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| KA | II,2 | 34096 | 12680 |  | 4 | 1 |  |  |  | x |  |  |  |  | 64 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |
|  |  | 34102 | 12720-1 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 34111 | 12785 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 34113 | 12786 |  |  |  |  |  |  | x |  |  |  |  | 5 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | II,3 | 40012 | 15196 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40012 | 15252 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40014-1 | 15317-5 |  |  |  |  |  |  | x |  |  | x |  | 13 | x |  | x |  |  | x |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40029 | 15822 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40034 | 15698 |  | 1 |  |  |  |  | x |  |  |  |  |  | x |  | x |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |
|  |  | 40044 | 15829 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  | x |  |  |  |  |
|  |  | 40046 | 15832 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40047 | 15831 |  | 1 |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 40050-2 | 15864 |  |  |  |  |  |  | x |  |  |  |  | 1 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | II,7 | 37010 | 24095 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37016 | 24106 |  |  |  |  |  |  | x |  |  |  |  | 1 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37017 | 24123-3 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37018 | 24114 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  | x |  | x | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37023 | 24193 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37033 | 24338 |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  | x |  | x |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37033 | 24338 |  |  |  |  |  |  | x |  |  |  |  |  | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37040 | 24301-1 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37042 | 24345 |  |  |  |  |  |  |  |  |  |  |  | 5 | x |  | x |  |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37081 | 24702 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  | x |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37082 | 24551 |  |  |  |  |  |  | x |  |  |  |  | 9 |  |  | x |  |  |  | x | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 37090 | 24475 |  |  |  |  |  |  | x |  | x |  |  |  |  |  | x |  |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | II,8 | 38022-1 | 25762 |  |  |  |  |  |  | x |  |  |  |  | 3 |  |  | x |  |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38037 | 25524-2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |
|  |  | 38044 | 25913 |  |  |  |  |  |  | x |  |  |  |  | 2 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38045 | 25538 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38046-1 | 25915 |  | 2 |  |  |  |  | x |  |  |  |  | 50 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38062 | 25842 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38073 | 33136 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38079 | 33069 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38096 | 33063 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38107 | 33129 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  |  | 38109 | 33171 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  |  | 38115-1 | 33195 |  |  |  |  |  |  | x |  |  |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38117-1 | 33209 |  | 2 |  |  |  |  | x |  |  | x |  | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 38428 | 31319 |  |  |  |  |  |  | x |  |  |  |  | 3 |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  | III,5 | 33039 | 18204 |  |  |  |  |  |  | x |  |  |  |  | 2 | x |  | x |  |  |  | x | x |  |  |  |  |  | x |  |  |  |  | x |  |  |  |  |
|  |  | 33046 | 18214 |  | 1 |  |  |  |  | x |  |  |  |  |  | x |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  | x |  |  |  |  |
|  | IV,3 | 36082 | 23284 |  | 3 |  |  |  |  | x |  |  |  |  | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36295 | 28641 |  | 2 |  |  |  |  | x |  |  |  |  | 13 |  |  | x |  |  |  |  | x |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 36325 | 29307 |  |  |  |  |  |  | x |  |  |  |  | 2 | x |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  |  | 36422 | 32136 |  |  |  |  |  |  | x |  |  |  |  | 10 |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  |  | 36424 | 31290 |  |  |  |  |  |  | x |  |  |  |  | 9 |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |
|  |  | 36432 | 31289 |  |  |  |  |  |  | x |  |  |  |  | 9 |  |  | x |  |  |  |  | x |  |  |  |  |  |  | x |  |  |  |  |  |  |  |  |

Tab. 4c. List of unspecified Chalcolithic (CH) and Kura-Araxes (KA) plant remains and other materials at Dzedzvebi (Data: RUB; N. Boenke).

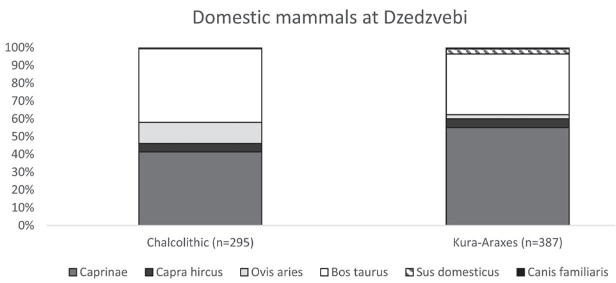



Fig. 35. Relative representation of domestic mammals from Chalcolithic and EBA levels at Dzedzvebi (in % of the domestic mammals NISP) (Draft/data: MNHN; A. Vautrin, R. Berthon).

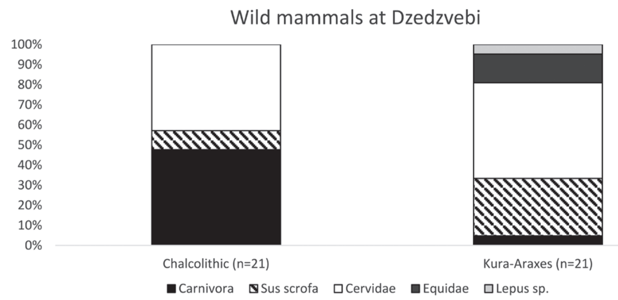



Fig. 36. Relative representation of wild mammals from Chalcolithic and EBA levels at Dzedzvebi (in % of the wild mammals NISP) (Draft/data: MNHN; A. Vautrin, R. Berthon).

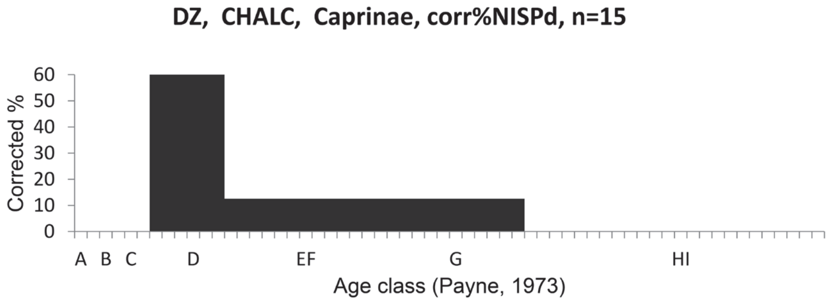



Fig. 37. Kill-off pattern of *Caprinae* (sheep and goats), Chalcolithic (Draft/data: MNHN; A. Vautrin, R. Berthon).

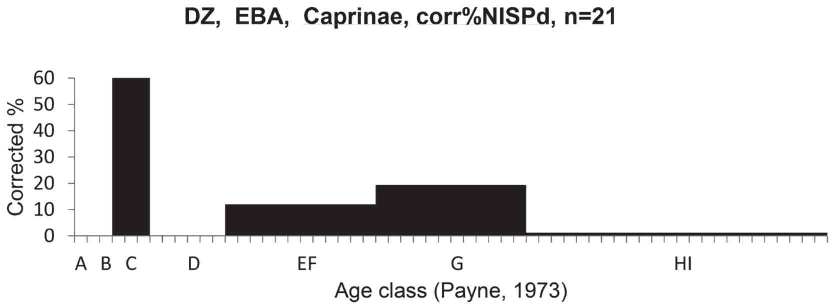



Fig. 38. Kill-off pattern of *Caprinae* (sheep and goats), EBA (Draft/data: MNHN; A. Vautrin, R. Berthon).

herds, suggesting pastoral mobility.[88] Most of the slaughtered caprines had reached their optimal meat weight (age classes C and D). Older animals that may have been kept for their fleece or for reproduction purposes represent a smaller percentage of the slaughtered caprines.

Husbandry strategies such as feeding, lambing seasonality and mobility were also investigated using an isotopic approach. We measured the variation of carbon and oxygen isotope ratios ($\delta^{13}C$ and $\delta^{18}O$) in sequentially sampled enamel from Dzedzvebi Chalcolithic and EBA caprine and cattle teeth. These analyses were performed at the Service de Spectrométrie de Masse Isotopique du Muséum National d'Histoire Naturelle (MNHN) in Paris. The results show a difference in diet between caprines and cattle, with a higher consumption of $C_4$ plants in summer for cattle than for caprines (Fig. 39). This could be explained in several ways: (1) these two species were raised in different areas and eventually slaughtered in Dzedzvebi, (2) Dzedzvebi herds were pastured in different territories, (3) different species

88 Arnold, Greenfield 2006.

| Taxon | Common name | Chalcolithic | Kura-Araxes | % Chalcolithic | % Kura-Araxes | % id. Chalcolithic | % id. Kura-Araxes |
|---|---|---|---|---|---|---|---|
| *Lepus* sp. | Hare | 0 | 1 | 0.0 | 0.0 | 0.0 | 0.2 |
| Carnivora | Carnivore | 1 | 1 | 0.1 | 0.0 | 0.3 | 0.2 |
| Felidae | Felid | 1 | 0 | 0.1 | 0.0 | 0.3 | 0.0 |
| Canidae | Canid | 1 | 0 | 0.1 | 0.0 | 0.3 | 0.0 |
| *Canis familiaris* | Domestic dog | 2 | 3 | 0.1 | 0.1 | 0.6 | 0.7 |
| *Vulpes vulpes* | Red fox | 6 | 0 | 0.3 | 0.0 | 1.7 | 0.0 |
| *Meles meles* | European badger | 1 | 0 | 0.1 | 0.0 | 0.3 | 0.0 |
| *Equus* spp. | Horse/Donkey | 0 | 3 | 0.0 | 0.1 | 0.0 | 0.7 |
| *Sus* spp. | Pig/Boar | 1 | 0 | 0.1 | 0.0 | 0.3 | 0.0 |
| *Sus domesticus* | Pig | 0 | 11 | 0.0 | 0.4 | 0.0 | 2.7 |
| *Sus scrofa* | Wild boar | 2 | 6 | 0.1 | 0.2 | 0.6 | 1.4 |
| Cervidae | Cervid | 2 | 0 | 0.1 | 0.0 | 0.6 | 0.0 |
| *Cervus elaphus* | Red deer | 6 | 9 | 0.3 | 0.4 | 1.7 | 2.2 |
| *Capreolus capreolus* | Roe deer | 1 | 1 | 0.1 | 0.0 | 0.3 | 0.2 |
| Bovinae | Cow/Auroch | 0 | 1 | 0.0 | 0.0 | 0.0 | 0.2 |
| *Bos taurus* | Domestic cow | 122 | 132 | 6.7 | 5.2 | 34.1 | 31.8 |
| Caprinae | Goat/Sheep | 162 | 213 | 8.9 | 8.4 | 45.3 | 51.3 |
| *Capra hircus* | Goat | 14 | 19 | 0.8 | 0.8 | 3.9 | 4.6 |
| *Ovis aries* | Sheep | 35 | 9 | 1.9 | 0.4 | 9.8 | 2.2 |
| Aves | Bird | 1 | 5 | 0.1 | 0.2 | 0.3 | 1.2 |
| Mollusca | Molluscs | 0 | 1 | 0.0 | 0.0 | 0.0 | 0.2 |
| **Total identified** | | **358** | **415** | **19.8** | **16.5** | **100.0** | **100.0** |
| Unidentified large | | 192 | 127 | 10.6 | 5.0 | | |
| Unidentified medium | | 0 | 5 | 0.0 | 0.2 | | |
| Unidentified small | | 0 | 4 | 0.0 | 0.2 | | |
| Large mammals | | 300 | 282 | 16.6 | 11.2 | | |
| Medium mammals | | 511 | 618 | 28.2 | 24.5 | | |
| Small mammals | | 1 | 5 | 0.1 | 0.2 | | |
| Unidentified size category | | 450 | 1065 | 24.8 | 42.2 | | |
| **Total unidentified** | | **1454** | **2106** | **80.2** | **83.5** | | |
| **Total** | | **1812** | **2521** | **100.0** | **100.0** | | |

Tab. 5. Faunal spectrum at Dzedzvebi (Data: MNHN; R. Berthon, A. Vautrin).

had different plant preferences in the same environment, or (4) farmers chose to keep cattle and caprines in different pastures. In order to understand better the preliminary results of the carbon- and oxygen-isotope studies, a complementary study of strontium, also recorded in dental enamel, is in progress at the DBM research laboratory. This analysis will allow us to investigate whether cattle display a different carbon isotope ratio in summer when pastured in the same area as the other cattle and caprines. The results for EBA specimens are different, especially for caprines, since three ewes from Grave 9 had access to a diet containing a significant $C_4$ plant component. Two ewes display higher $\delta^{13}C$ values in summer, while the third ewe consumed $C_4$ plants in winter (Fig. 39). Strontium analyses will allow us to determine if the $C_4$-plant-rich grasslands were located in the same area for the three ewes from Grave 9 as well as the two Chalcolithic cattle. As $C_4$ plants are not expected in the vicinity of Dzedzvebi in winter, we will use strontium isotope ratio values to discuss potential foddering.

### 4.6. Physical Anthropology of Early Bronze Age Graves

Modern anthropological studies concerning Caucasian Late Chalcolithic and Kura-Araxes populations are rare, and none exist that focus on mining populations. During the recent excavations, we conducted a study of 31 individuals from twelve Early Bronze Age graves from the Dzedzvebi settlement. The state of preservation of the bones can be described as very poor, which also suggests that the actual

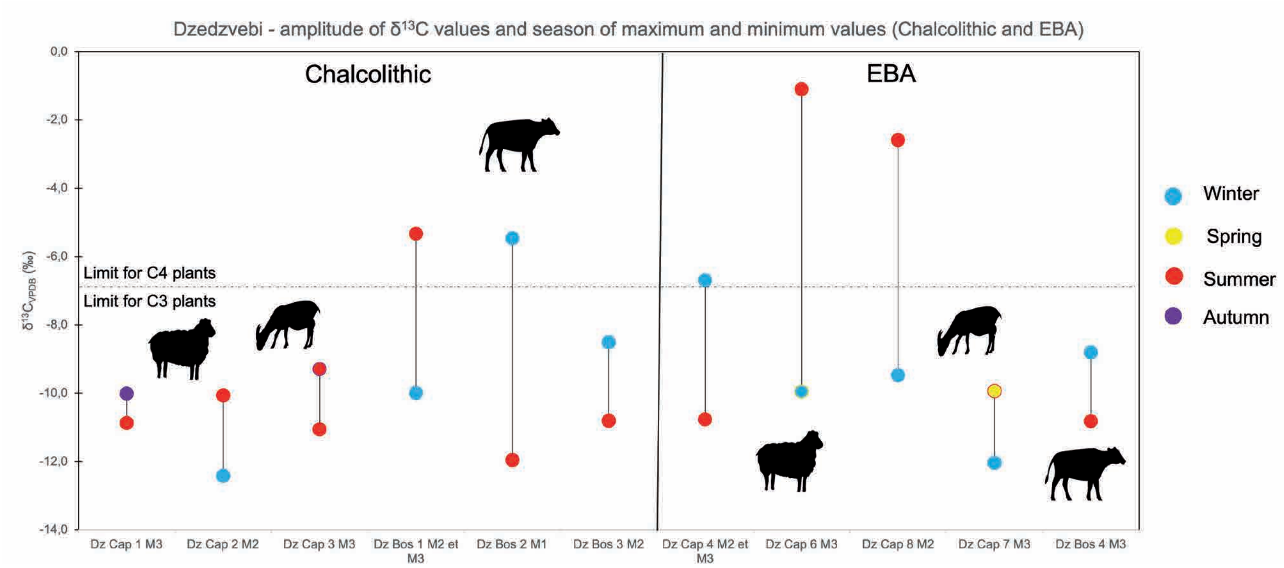



Fig. 39. Amplitude of $\delta^{13}C$ values during Chalcolithic and EBA. The colours designate the season for which the minimum/maximum of $\delta^{13}C$ is reached (blue = winter, yellow = spring, red = summer, purple = autumn, when mixed colours = late season / early season, e.g.: red/purple = late summer–early autumn). The season was determined according to the $\delta^{18}O$ value of the sample (Draft/data: MNHN; A. Vautrin).

number of individuals buried in these grave contexts may have been higher (Tab. 6). These graves were associated with the mining and metallurgical complex of Settlement Area II, based on partial overlap. In one case, the connection to mining activities was even clearer, as a unique broken stone tool, most likely a mining hammer, was deposited on top of the outer stone slabs that covered the chamber construction (Grave 9). Some of the graves were collective burials (graves 1, 2, 3, 6, 9), which may correspond to kinship structures within the mining community. Single burials (graves 8, 12, 15) of a child, a juvenile and a mature male were also found. Some graves were located in special connection to the workshop installations, as was the case for skull graves of juveniles and children that had been integrated into the workshops of houses 2 and 3, as well as the younger debris layer in Trench 11 of II.7 (graves 4, 7, 17–18).[89] Some grave constructions did not contain any preserved human bones and can be interpreted as cenotaphs (graves 13, 19, 20–21).

The collective graves 1, 2, 3 and 6 represent a special funerary context. The bones found there suggest a minimum number of individuals (MNI) of three to six, with one subadult and several adults represented in each context. For Grave 6, analyses of sex-determining skeletal markers resulted in the identification of one male (the main burial) and three female adult individuals. For one adult individual, the preservation was too poor to determine the sex. The main male individual died at the age of 35 to 45 years. For Grave 3, the success rate for sex determination was much lower. One male and one female could be identified there, while for the other three adult individuals, no discriminating traits were preserved. For graves 1 and 2, the MNI is four and three, respectively. For each of the graves, again one subadult individual was identified, while the rest of the bones derived from adult individuals. For Grave 1, one of those individuals was determined to be male and another female. The subadults found in graves 1 and 2 show a skeletal development status suggesting an age at death of 10–13 years and 5–9 years, respectively. The subadult bones found in a ceramic vessel in Grave 6 also belong to a 5–9-year-old individual. For the subadult found in Grave 3, the preserved skeletal elements did not allow a more detailed age-at-death determination. Another collective burial was discovered in the impressive tholos-shaped burial (Grave 9), which contained three males and two females. Only the youngest set of remains, that of a crouched male, was an adult, while the others reached mature and even senile ages. Interesting is an adult-to-mature male found in a redeposited position in Grave 8 nearby. A healed trauma was observed in the skull of this individual, above the right orbital arch, possibly related to an accident or interpersonal violence.

Another group of graves comprises children's graves, which include skull burials of younger children (infants I, graves 4, 7, 17–18) and that of an almost juvenile in Grave 12. All of these graves were clearly reopened to

89 Stöllner 2017.

| | | | | Age | | Sex | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Grave | Date | MNI | Subadult | Adult | Male | Female | Undetermined | Burials |
| Dzedzvebi | 1 | EBA | 4 | 1 | 3 | 1 | 1 | 2 | Age of adults not analysed; subadult, 10–13 years |
| Dzedzvebi | 2 | calBC 2852–2506 | 3 | 1 | 2 | 0 | 0 | 3 | Age of adults not analysed; subadult, 5–9 years |
| Dzedzvebi | 3 | calBC 3012–2899 | 6 | 1 | 5 | 1 | 1 | 4 | Age of adults not analysed; subadult, age unclear |
| Dzedzvebi | 4 | EBA | 1 | 1 | | | | 1 | Age of adults and child not determined |
| Dzedzvebi | 6 | calBC 3085–2915<br>calBC 3090–2926 | 6 | 1 | 5 | 1 | 3 | 2 | Male, 35–45 years; age of further adults mostly unclear, one female approximately 18–19 years; subadult, 5–9 years |
| Dzedzvebi | 7 | EBA | 1 | 1 | | | | 1 | Child, 4 years |
| Dzedzvebi | 8 | calBC 3261–2925 | 1 | | 1 | 1 | | | Male, 30–40 years |
| Dzedzvebi | 9 | EBA | 5 | | 5 | 3 | 2 | | Male, 30 years; male skull, 50 years; male skull, 33–42 years; female skull, 60 years; pelvis, 45 years |
| Dzedzvebi | 11 | calBC 1876–1646 | 1 | | | 1? | | | Male?, adult, 25 years |
| Dzedzvebi | 12 | EBA | 1 | 1 | | | | 1 | Child, 9–11 years |
| Dzedzvebi | 15 | EBA | 1 | 1 | | | | 1 | Child, 5–6 years (teeth) |
| Dzedzvebi | 17 | calBC 3091–2922 | 1 | 1 | | | | 1 | Child skull, 4–5 years |
| Dzedzvebi | 18 | EBA | 1 | 1 | | | | 1 | Child skull, 3–4 years |

Tab. 6. Main results of the morphological analyses of the human remains found at Dzedzvebi. – MNI = minimum number of individuals (Data: RUB/University College Santa Cruz [UCSC]; I. Al-Oumaoui, L. Fehren-Schmitz).

remove parts of the bodies (graves 1–3, 6, 9, 12), to rearrange the grave by including new individuals (graves 1–3, 6, 9) or to redeposit the bodies (for instance Grave 8). The infant skulls were likely rearranged, as virtually no parts of postcranial skeletons or even complete skulls have been found in their stone cists. The absence of vertebrae in many graves (especially in those that were rearranged: 1–3, 6, 8, 9, 12) is especially notable, as it demonstrates multilevel ritual practices involving the dead. Only the most recent burial, the *in situ* positioned crouched inhumation burial of an adult male, included a spine and pelvis bones. Two dates could be obtained from Grave 6, from the main individual and one of the others. Both dates fall into the same range (main individual: calBC 3090–2926, other individual: calBC 3085–2915), which suggests that these individuals were buried at the same time or shortly after each other.

No remarkable signs of pathological alterations were observed in most of the available bones from the various graves, for instance from the six individuals placed in Grave 3. In Grave 2, a degree of dental wear can be seen in a decidual first molar belonging to the child aged 5–9 years old; this wear pattern is normal for an individual of that age, due to the mixed teeth. No signs of pathology or stress could be detected in this individual. Grave 6 shows a different pattern of pathology than the other graves. A female of approximately 18–19 years old shows a moderate degree of dental wear in the upper first molar and a slight degree in the second, both from the right upper quadrant. The two individuals, one male between 35–45 years and one of unknown age and sex, show muscular development in the upper and lower extremities. The upper extremities show more one-sided muscular development, in both cases on the right side. In brief, one side was used more in activities than the other, while the development in the lower extremities is related to locomotion.

This pattern of an intensified right-hand-sided muscular development was also observed in the mature male in Grave 8 and the *in situ* crouched adult male in Grave 9. The physical activity level of the individual in Grave 8 was estimated to not have been intensive, in contrast with the adult male in Grave 9: the upper extremities of the latter individual show considerable muscle development. Again, the right side is more developed than the left; this can be observed in the activity markers at the attachment site of the flexors and the extensors, like the *biceps brachii* in the humerus, while the ulna shows a kind of *myositis ossificans* in the region of the *pronator quadratus* muscle, which indicates a healed traumatic injury. These findings suggest a pattern of physical activity that is consistent with the nature of the environment and the work that likely took place there (possibly mining). The lower extremities also show more robusticity on the right side than on the left side. The vertebral column shows several lesions; these are not severe, but likely impactful for a person of that age. These findings provide insight into the considerable stress this individual experienced in his life: the development of schmorl's nodes was detected in the cervicals $C_3$ and $C_4$, with sharp edging and exostosis from the atlas to $C_4$, which reduced gradually beyond that point. The thoracic vertebrae show slight to moderate exostosis and ossification of the *ligamentum flavum*; the lumbar is in a similar condition. The development of schmorl's nodes was noticed in L2, while depressions were noted in the rest of the vertebral bodies, developing into schmorl's nodes. It seems likely that the schmorl's nodes and lesions in the vertebrae, as well as the particular muscular development of the right extremities are all related to physical stress. A possible explanation is that the mining work may have led to one-sided physical stress, especially when it took place in narrow galleries. Further comparison among this population and others from the same period is needed to understand better the lifestyle and the type of activity.

### 4.7. Genome-Wide Data of Ancient Human Individuals from Dzedzvebi

We screened twelve samples from human skeletal remains from two different archaeological sites in Georgia (Dzedzvebi and Sakdrisi) for ancient DNA preservation. Two Late Antique individuals from Sakdrisi mine are not discussed further here. All processing steps were carried out at dedicated ancient DNA facilities in Santa Cruz, USA, and Leipzig, Germany. All of the samples underwent initial screening steps via shotgun sequencing and passed the standard quality thresholds with respect to the amount of endogenous DNA content (in %) and ancient DNA authenticity criteria; they were thus subsequently enriched for ~1.24 million ancestry-informative SNPs (Single Nucleotide Polymorphisms) (1240k SNP panel, Tab. 7). The total number of SNPs across this panel ranged from 22,937 to 782,932 SNPs. After capture, the genome-wide SNP data were subjected to additional series of quality checks, also applying a minimum cut-off of 30,000 SNPs. Only one individual (A19277) did not pass and was therefore removed from downstream analysis. The remainder of the data were subjected to chromosomal sex determination, assignment of uniparentally inherited haplogroups, and estimation of biological relatedness. In-depth, comparative analyses of genome-wide data in conjunction with relevant published ancient and modern-day data are the subject of ongoing studies.

#### 4.7.1. Chromosomal Sex Determination

We calculated the mean number of reads mapping to the autosomes and to each sex chromosome and used the ratio of the sex chromosome to the autosomes to estimate the chromosomal (i.e. genetic) sex of individuals. Under the assumption of contamination-free data, we expect an X-ratio of ~0.8 and a Y-ratio of 0 for females, while the expected ratios of X and Y chromosomes to autosomes for males are ~0.4. Genetic sex could be determined for all individuals: four were females and eight were males (Fig. 40 and Tab. 7). We detected no sign of sex chromosome contamination.

#### 4.7.2. X-Contamination Estimates

Since males only have one copy of the X chromosome, we used the ANGSD (Analysis of Next Generation Sequencing Data) method, which estimates contamination based on observed levels of heterozygosity at the known polymorphic sites of the X chromosome of the male individuals.[90] To assess contamination with confidence, we used a minimum of 100 SNPs on the X chromosome that had to be covered at least twice. Only three male individuals (A19269, A19277, A19279) did not reach this quality threshold, although all had estimated levels of background contamination that were considerably lower than 5 % (Tab. 7).

#### 4.7.3. Uniparentally Inherited Haplogroups

Mitochondrial haplogroups were determined by extracting the sequencing reads from the 1240k data that exclusively mapped to the human mitochondrial reference genome. Using the software Geneious Primer, we generated consensus sequences for each individual, which had over 3000 reads mapped to the human mitochondrial reference genome.[91] The assignment of mitochondrial haplotypes from the consensus sequences was done using Haplogrep 2.0.[92]

To assign Y-chromosome haplogroups for all genetically male individuals, we called the Y-chromosome SNPs of the 1240k SNP panel using pileup from the Rsamtools package[93] (base quality ≥ 30 and mapping quality ≥ 30). On the basis of these calls, Y-chromosome haplogroups were then assigned manually using the Y-SNPs pileup included in the ISOGG (International Society of Genetic Genealogy) SNP index v.14.07.

#### 4.7.4. Biological Relatedness

To estimate biological relatedness within our dataset, we calculated the pairwise mismatch rate between all pairs of samples using READ software. We detected two sets of samples, (XXX001.A19269, XXX001.A19273 and XXX001.A19274) and (XXX001.A19271 and XXX001.

90 Korneliussen, Albrechtsen, Nielsen 2014.

91 Kearse et al. 2012.

92 Kloss-Brandstätter et al. 2011.

93 Bioconductor/Rsamtools: Binary Alignment (BAM), FASTA, https://github.com/Bioconductor/Rsamtools (last access 12.10.2023).

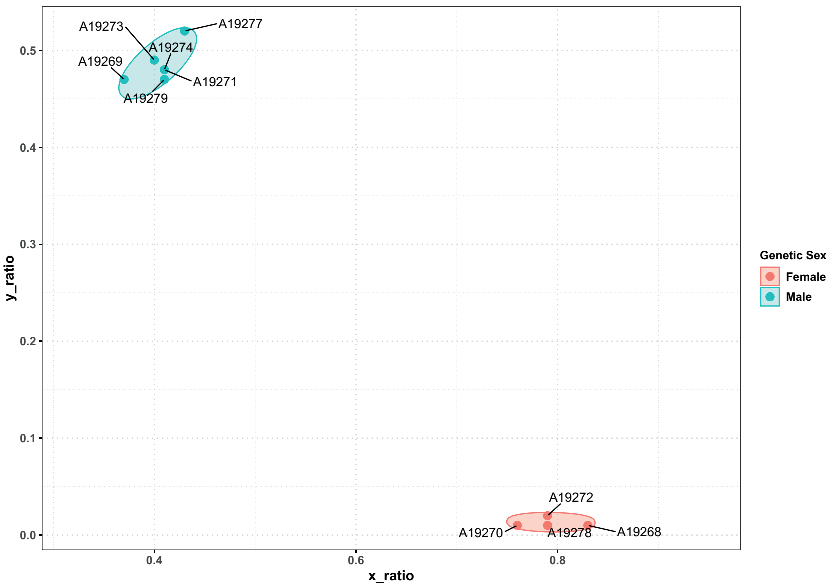



Fig. 40. X-ratio to Y-ratio scatterplot showing the mapping clusters according to chromosomal sex of all individuals under study (Max Planck Institute for Evolutionary Anthropology [MPI] Leipzig; W. Haak and research group).

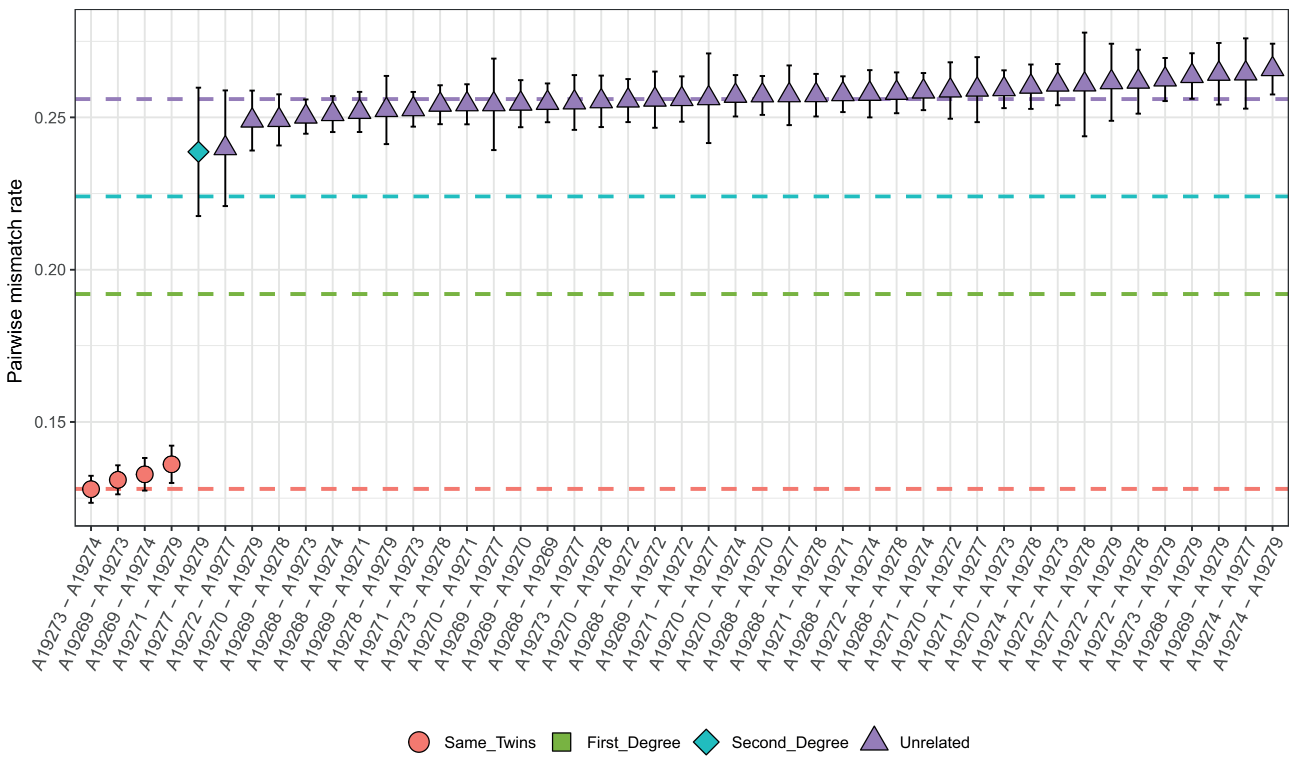



Fig. 41. READ estimates for the genetic relatedness among the individuals (MPI Leipzig; W. Haak and research group).

| Sample ID | Area | Ind. ID | Archaeo ID | Endogenous DNA (%) | Genetic Sex | X-con-tam. | 1240k SNPs covered | Y chrom. hg | mtDNA hg | Relatedness estimate | Further analyses |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A19268 | III.1 | 1 | DZ_G3_5 | 10.83 | F | – | 529.679 | | I | | Yes |
| A19269 | II.4 | 2 | DZ_G6_15 | 1.111 | M | 0.048 | 164.344 | J | K1a | Identical with /73 and /74 | Yes |
| A19270 | II.4 | 3 | DZ_G6_19 | 1.764 | F | – | 164.188 | | U4c1 | | Yes |
| A19271 | II.4 | 4 | DZ_G6_21 | 6.294 | M | 0.004 | 400.117 | J | U3b1a1 | Identical with /79 | Yes |
| A19272 | III.1 | 5 | DZ_G3_11 | 0.592 | F | – | 81.010 | T | | | Yes |
| A19273 | II.4 | 2 | DZ_G6_32 | 56.92 | M | 0.007 | 744.902 | J1a | K1a1 | Identical with /69 and /74 | Yes |
| A19274 | II.4 | 2 | DZ_G6_14 | 3.261 | M | 0.004 | 332.228 | J | K1a | Identical with /69 and /73 | Yes |
| A19277 | III.1 | 6 | DZ_G1_M6 | 0.1376 | M | – | 22.937 | BT | | | No |
| A19278 | II.4 | 7 | DZ_G6_24 | 2.51 | F | – | 116.809 | | T2a1b2b | | Yes |
| A19279 | II.4 | 4 | DZ_G6_31 | 0.7105 | M | – | 64.973 | J | U3b1a1 | Identical with /71 | Yes |

Tab. 7. Overview of genetic results, including quantity and quality of DNA content, contamination estimates, genetic relatedness, and Y chromosomal and mitochondrial haplogroups (MPI Leipzig; W. Haak and research group).

A19279), all skeletal elements that either originated from the same individual or from an identical twin. Since the samples in each set also shared the same sex and uniparentally inherited markers, we merged the data of the identical samples as belonging to one individual each and used these for downstream analysis (Fig. 41). The remainder of the samples/individuals were not closely related.

#### 4.7.5. Results and Discussion

We report preliminary results from eight out of nine successfully genotyped individuals from twelve samples from two sites in Georgia, dating to the Bronze Age and medieval periods. Results include genetic sex determination, contamination estimation, uniparentally inherited haplogroup assignments and estimation of biological relatedness. It should be noted that the individuals from three collective burials do not show any close biological relation (graves 1, 3 and 6). Mitochondrial DNA analyses were successful for six samples from Dzedzvebi, which most likely belong to six distinct individuals. Two of the individuals carried HVR (hypervariable region) I polymorphisms characteristic of mitochondrial haplogroup J, while another two could be assigned to haplogroup K, and one each to I and C. All of these haplogroups are also represented in modern Georgian populations, with the exception of the East Asian/Siberian haplogroup C, which is also found in European and Anatolian populations at a very low frequency. For four of the individuals, it was also possible to amplify genetic markers associated with Lactase Persistence (LP), eye colour and hair colour (the crouched male in Grave 6). These results were obtained using Next Generation Sequencing (NGS) protocols that provide insight not only into the study of maternal genetic patterns, but also into genome-wide information. The genotypes suggest dark hair and brown eyes for all individuals. Recent ancient DNA studies conducted on Bronze Age individuals from the Pontic-Caspian steppe also exclusively found these phenotypes.[94] Additional, in-depth population genetic analyses are currently being conducted and will be included in a large-scale time transect study based on comparative data from Mesolithic to Late Bronze Age individuals across the wider Caucasus region.

## 5. Discussion: Dzedzvebi as a Site of Interconnectivity

### 5.1. Sedentarism and Mobility in the Late Chalcolithic and Early Bronze Age Settlement

The investigation into the rhythms that shaped the communities in the middle Maschavera Valley aims at an overall understanding of their social and economic activities. In the second half of the 4th millennium and in the early 3rd millennium BCE, the extraction of raw materials in the vicinity of the rich gold deposit of the Kachagiani Hill probably played an important role. Previous investigations have not only shown that the extraction of free gold took place in close connection with the processing activities in Dzedzvebi (see also below), but also raised questions about the permanence of the gold exploitation activities in general (Fig. 42).[95] The Paravani model was developed to integrate various data into an operational model, showing how much gold could be won in what amount of time. The model made it apparent that the gold deposit did not need to be mined permanently, based on the results of experimental archaeological investigations.[96]

94 Allentoft et al. 2015.

95 $^{14}$C dates from Sakdrisi published by Stöllner et al. 2014.

96 Most recently summarised by Stöllner et al. 2021.

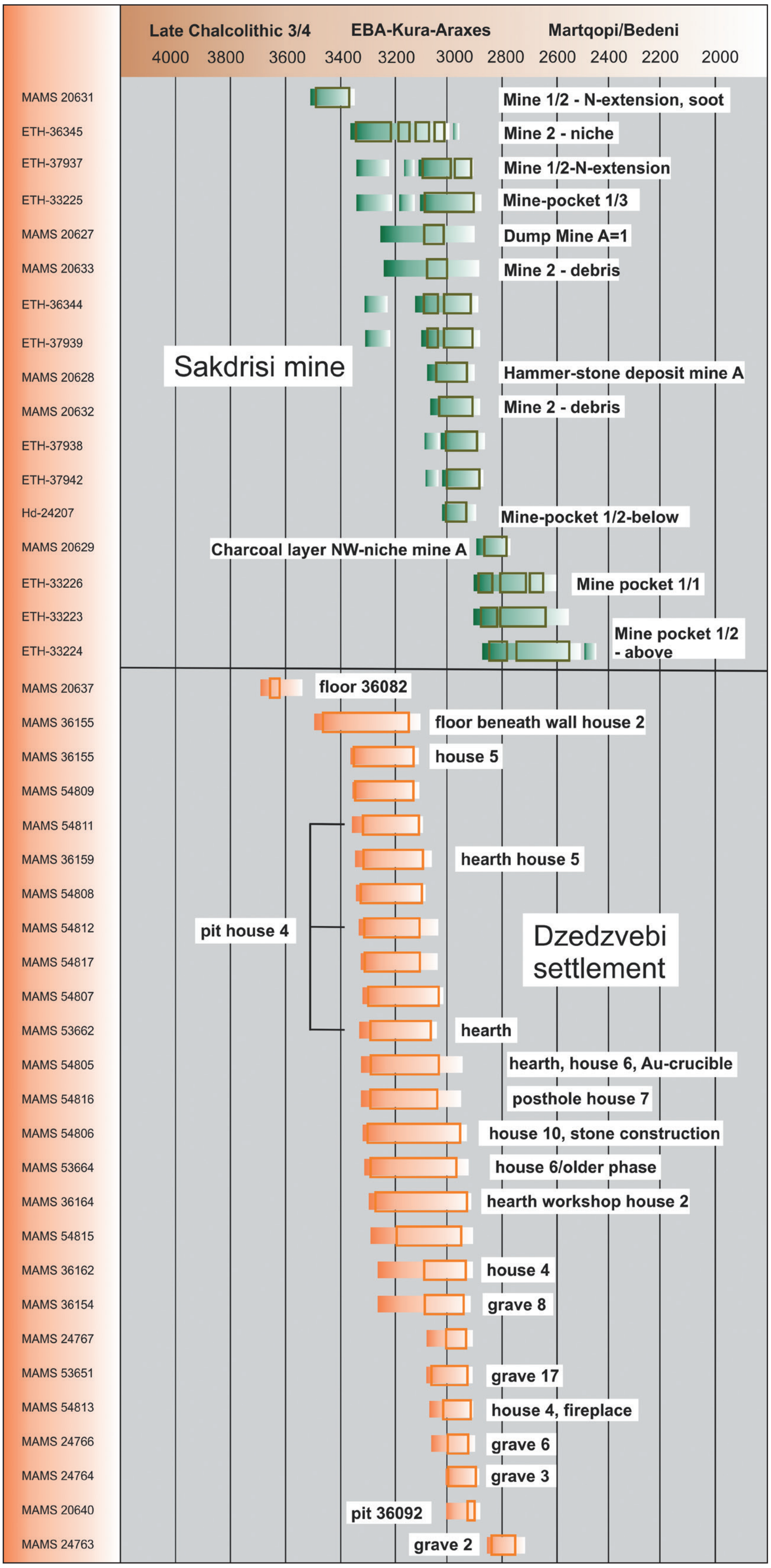



Fig. 42. Comparison of AMS $^{14}$C datings from the Kura-Araxes mining of Sakdrisi and the Kura-Araxes features of Dzedzvebi Plateau (DBM/RUB; T. Stöllner).

The deposit may have been visited repeatedly by groups who extracted ores there for a few days and processed the concentrates later on the Dzedzvebi Plateau. Is there evidence for this hypothesis? On the one hand, the analysis of the Sakdrisi pottery assemblage revealed a close connection with the finds from the Dzedzvebi Plateau. On the other hand, mineralogical analysis revealed the presence of different mineralogical compositions, which suggests that the extraction of gold ore was not undertaken by a single group, but that several communities from the lowlands of the Mashavera and the Kura Valley system were involved.[97] As no evidence of pottery workshops has been discovered in Balichi-Dzedzvebi to date, it can be assumed that these communities brought ceramic vessels to the mining fields. This indicates a certain level of mobility among the communities in Dzedzvebi and Sakdrisi. Can this picture be corroborated by further findings? The settlement finds of the Kura-Araxes period initially suggested largely sedentary populations, but even then, the small amount of domestic waste (animal bones) found at the workshop settlement was conspicuous. The pottery is highly fragmented, and no large-format pottery waste is known, aside from special ritual deposits.[98] The same applies to complete non-mining and beneficiation implements made out of metal and obsidian (e.g. awls, sickle knives, bladelets, see e.g. Fig. 30). This could indicate that usable objects were taken away and only rarely discarded. The house architecture is not as durable as it appears at first glance, despite the large floor areas, especially of the milling houses in Area II.3. Evidence of more durable roof constructions is lacking, and no clay plaster has been found, which may be another indication of the impermanence of the structures. These findings suggest lighter roof constructions were used, made of yurt-like rod frames with skin and textile coverings.[99] This could indicate that the houses were repeatedly repaired. In addition, ore beneficiation and smelting activities were not only carried out inside more solid house features, as evidenced by the open-air ore beneficiation and smelting area, Area III.5. The stratigraphic sequences are also interesting: Thin colluvium layers in Area II.2 and especially Area II.3 show that these partial coverings and destructions led to maintenance and repairs. This is particularly clear in houses 6 and 7 in Area II.3. The radiocarbon chronology demonstrates that the renovation most likely took place a short time after the erosion event and the destruction of the older house features (see above; MAMS 53651, MAMS 53664, MAMS 54805). It is remarkable that the older, already known sites were clearly resettled and reused, even though the large open spaces in the settlement areas would have allowed the construction of buildings elsewhere (see section 5.4).

The study of the isotope patterns of domestic animals reveals that some animals (e.g. caprids) consumed seasonally different $C_3$/$C_4$ plants. This suggests that some exchange of animals took place between the lower valleys (lower Mashavera/Kura Valley/Chrami Valley) and the area surrounding the middle Mashavera Valley (the possible location of $C_3$ plants), assuming that fodder was not supplied from the lowlands (see Fig. 43). During the Kura-Araxes period, the caprids in Grave 9 may have grazed in a specific lower-valley context, while other caprids and cattle appear to have grazed in the vicinity of $C_3$ plant sites (which includes the high pastures of the Transcaucasus). The latter coincides with the main use of the Chikiani obsidian, which points to regular exchange or access to the resources of the Javakheti and Trialeti plateaus (pastures, raw materials) of the Dzedzvebi communities. Further and indirect evidence on the question of sedentarism can also be seen in the lack of close kinship relations within the graves that have been genetically investigated so far (graves 1, 3 and 6). These investigations make it clear that biological kinship did not play a decisive role in the formation of burial communities. This suggests that several biologically unrelated communities gathered at Dzedzvebi, but that no longer-settled community emerged, with higher proportions of biological kinship, as genetic evidence of such a community would have been observed among the buried people.

It is more difficult to assess the permanency aspect of the Chalcolithic settlement. Only pit complexes have been found, some of which, like those with a cauldron-shaped structure, can be interpreted as storage pits. However, certain shallower features also suggest other uses, such as shallowly deepened housing pits. In contrast to the mud-brick architecture documented in the lower Kura Valley (e.g. from contemporaneous Mentesh III),[100] clear architectural features in Sioni settlements are relatively rare.[101] The closest settlement is at Grmakhevistavi, near Vardisubani; it has yielded numerous pit complexes as well as soil and hearth remains from the Late Chalcolithic 4 stage (first half of the 4$^{th}$ millennium BCE).[102] However, the site should probably be assigned to a younger chronological stage (LC3/4) than the Dzedzvebi Chalcolithic settlement in the first half of

97 Otkhvani et al. 2015. – Otkhvani et al. 2021.

98 Such as Pit 37006: Stöllner 2017, Figs. 2, 4–5.

99 Such constructions can possibly also be assumed for other sites with similar architectural constructions, e.g. the site of Godedzor in Palumbi et al. 2021.

100 Lyonnet 2017. – Lyonnet, Guliyev 2017.

101 Nebieridze 2010. – Sagona 2017. – Shapardon 2020.

102 Abramishvili, Giguashvili, Kakhiani 1980.

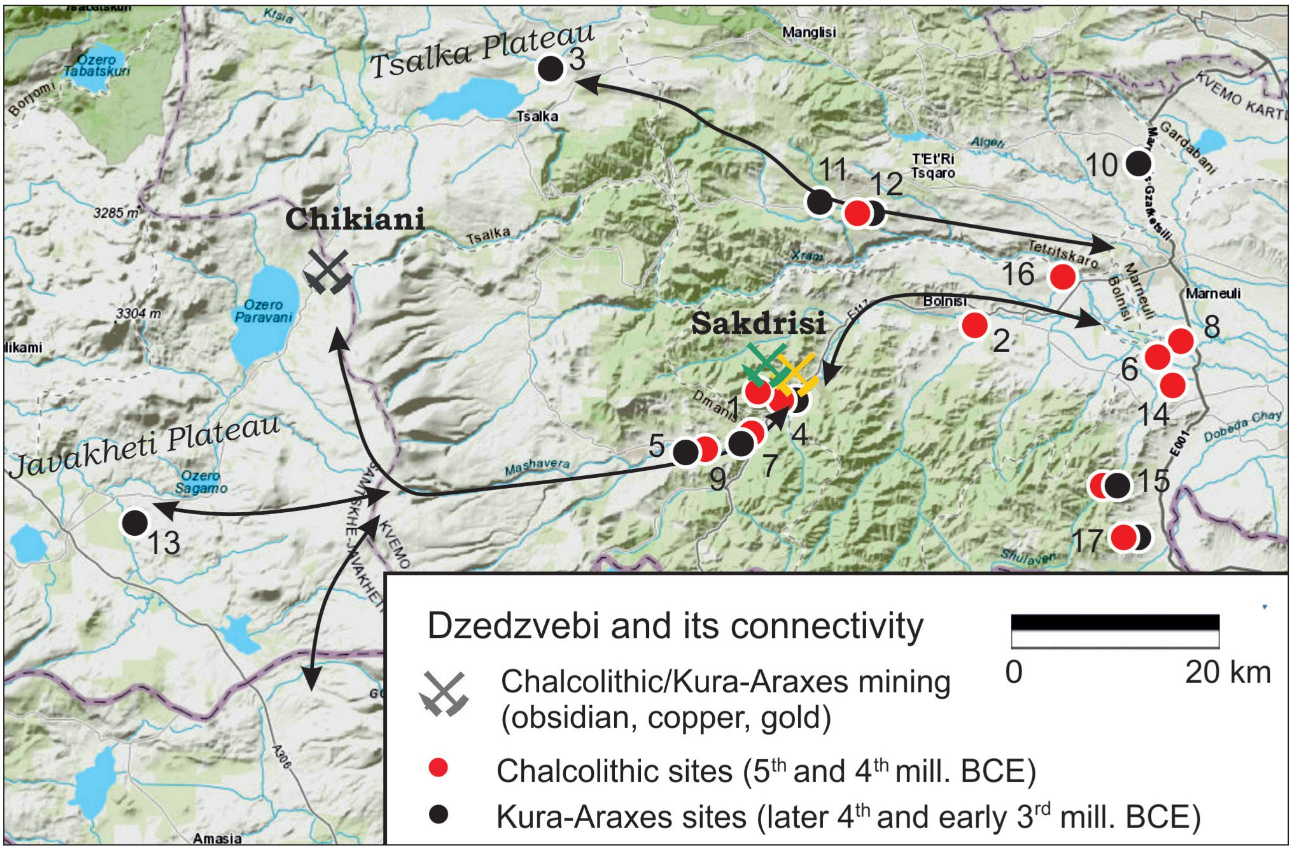



Fig. 43. Mountain corridors and connectivity of the Dzedzvebi/Sakdrisi complex during the $5^{\text{th}}$ to the early $3^{\text{rd}}$ millennia BCE. – 1. Abulmulg, Abanoshevi Valley; Chalcolithic. – 2. Arukhlo VI; Chalcolithic. – 3. Bestasheni, Tsalka Plateau; Kura-Araxes. – 4. Dzedzvebi; Chalcolithic/Kura-Araxes. – 5. Gantiadi/Dmanisi, various sites; Kura-Araxes. – 6. Gadachrili Gora; Chalcolithic. – 7. Grmakhevistavi; Chalcolithic/Kura-Araxes. – 8. Imiris gora, Marneuli; Chalcolithic. – 9. Javakhi; Chalcolithic. – 10. Koda; Kura-Araxes. – 11. Nachivchavebi; Chalcolithic/Proto-Kura-Araxes. – 12. Samshvilde, Tetriskaro; Chalcolithic/Kura-Araxes. – 13. Satkhe; Kura-Araxes. – 14. Shulaveris Gora; Chalcolithic. – 15. Sioni; Chalcolithic/Kura-Araxes. – 16. Tsiteli Sopeli; Chalcolithic. – 17. Tsopi; Chalcolithic/Kura-Araxes (DBM/RUB; T. Stöllner, after Isaac et al. 1994. – Nebieridze 2010. – Stöllner 2016. – Stöllner in press).

the $4^{\text{th}}$ millennium BCE. Thus, very little can be said with certainty about the degree of sedentarism. In Dzedzvebi, however, the presence of obsidian objects (Chikiani and Sarikamis volcanoes) and the presumed supply of copper-ore concentrates or scrap metal[103] indicate that close relations with the Armenian Plateau (Shirak Plain) and the Javakheti/Baraleti Plateau were most likely maintained (see Fig. 43).[104] This connection is probably related to pastoral activities involving flocks of sheep and goats, which were most likely driven into these areas for grazing. That parts of the herd may have been absent is suggested by the slaughter pattern (see section 4.5).[105] Animals aged up to 6 to 9 months do not appear to have been slaughtered at Dzedzvebi, which could indicate that these animals were absent (although other explanations are also possible). The evidence of later LC sites in the upper Mashavera Valley (Abulmulg:[106] Javakhi, Grmakhevistavi) is interesting, as it suggests a pathway connection to high-altitude summer pastures.

### 5.2. Subsistence Practices and Storage Activities in the Late Chalcolithic and Early Bronze Age: Herding and Crop Planting

Closely related to the question of mobility is the question of herding. As mentioned above, herding has been an essential component of the subsistence economy. Sheep/goat and

103 Stöllner 2021b.

104 According to the research results of A. Vautrin concerning $^{87}Sr/^{86}Sr$ values of Meskhetian (Orchosani, Rabati, Chobareti) and Dzedzvebi bovid samples, there is a common pasturage zone with values around 0.7070. Further isotope studies of the highland pastures and their variation of $^{87}Sr/^{86}Sr$ values is needed.

105 Berthon et al. 2021, 272–273.

106 Stöllner in press.

cattle can be described as the most important meat suppliers in both periods. However, concrete slaughtering techniques cannot be reconstructed due to the poor preservation of the animal bones and their high fragmentation. Hunting played only a subordinate role. It should be noted that domestic pigs were kept in the Kura-Araxes period, indicating a proportionate stationary domestic animal husbandry. However, the share of pigs is very small, at 0.4 % of the total share of domestic animals. The examination of the weed communities and ruderal plants is also interesting, as they are probably connected to cereal cultivation, especially naked wheat, einkorn, emmer and millet. Like in other sites of the Transcaucasus,[107] naked wheat (*Triticum aestivum*) is the dominant food of the Kura-Araxes society of Dzedzvebi, while a greater variability of cereals can be observed in the Late Chalcolithic. The use of specialised harvesting techniques is indicated by the presence of sickle blades with denticulated working edges, which have been preserved in the settlement in relatively large numbers.[108] The bladelets, like the plant remains themselves, indicate harvesting close to the ground. Examining the seasonality of the harvests on the basis of the cereal weed communities[109] makes it clear that indications for harvests in late spring to July are more apparent in the Late Chalcolithic features (especially Buglossoides, for instance *Lithospermum arvensis* [field stonewort] and *Silene* spec. [campion]) (see Tab. 4b). Autumn sowing and therefore also the maintenance of the fields over winter likely indicate the presence of populations in the cold season during both the LC and the EBA. *Fallopia* spec. (bindweed), *Neslia paniculata* (finch seed) and *Galium* spec. (bedstraw species) suggest a somewhat different sowing time or longer ripening times, as well as deep soils with good phosphate conditions (somewhat different sites also seem conceivable) but are generally also associated with a summer harvest. They were found in Chalcolithic contexts as well as in Bronze Age features, in smaller quantities. These findings suggest summer/autumn harvests and therefore year-round cropping activities.

It must be emphasised that cauldron-shaped storage pits are attested for both the Late Chalcolithic and the Early Bronze Age settlement (for example in IV.3, II.7). They are not necessarily directly connected with metallurgical activities (as in the grinding house of II.3 and the copper workshop of II.2 or in the surroundings of House 4 [Pit 6 there belongs to the older settlement phase of II.8]). This finding could indicate a specific division of labour between different groups of people in Dzedzvebi during the Early Bronze Age. The three cauldron-shaped storage pits found near Grave 3 (Area III.1) (see above)[110] and later refilled with stone implements associated with gold processing activities, provide interesting insights into the interconnected practices of gold processing and subsistence activities.

### 5.3. Managing Mineral Resources: Access and Processing in the Late Chalcolithic and Early Bronze Age

The sites of the middle Mashavera Valley were, at least during the Early Bronze Age, closely linked to the extraction of gold- and copper-bearing ores. Sites such as the Kachagiani Hill (Sakdrisi) and the valley of Abanoskhevi can be identified as probable mining zones.[111] The connection is particularly clear in relation to the processing of ores with free gold at Kachagiani (see above). These ores were scattered especially across the workshops in areas II.2, II.3, II.8, and III.5, and demonstrate a regular supply of ore concentrates to the Early Bronze Age settlement. Meanwhile, installations for gold panning as well as crucible smelting of heavy mineral concentrates have also been documented. These findings show that gold grinding, washing of the ground material and melting did not take place in the same locations as copper-ore processing. Significant distribution patterns of gold-grinding tools and crucibles suggest different specialisations (see Fig. 28). In addition, the craft areas suggest that these activities took place at specific, ritually significant sites (such as skull burials of children) and not necessarily year-round, but perhaps only at specific times or for special occasions. The size of the houses associated with gold preparation (especially houses 3, 6–7) suggests that relatively large groups of people were involved in the time-intensive fine beneficiation activities of grinding and milling. Results from experiments indicate that gold milling is the most time-intensive part of the processing chain and it can be assumed that only assaying was done at the deposit itself.[112] It is more difficult to determine the origin of the copper ores discovered in the workshop of Area II.2: in addition to oxide carbonate ores, chalcocite and chalcopyrite must also have been processed there. Furthermore, the increase of arsenic contents with arsenic-rich ores such as fahlores or arsenopyrites is probable. These ores may have come from the Madneuli-Sakdrisi mineralisation zones

107 Longford, Sagona 2022.
108 Thomalsky 2021, 397 and Fig. 10b.
109 Also N. Boenke in Stöllner et al. 2021, 120 and Tab. 3.

110 Also Stöllner et al. 2014, 100 and Fig. 26.
111 Stöllner et al. 2014. – Stöllner 2021a, 463–464 and Fig. 9. – Stöllner et al. 2021.
112 For the amount of time required, see Stöllner et al. 2012. – Timberlake 2017. – Stöllner et al. 2021, 110–111 and Fig. 7.


Fig. 44. Distribution of Sioni mangals and spiked shaft-hole axes of the late 5th millennium in and around the Caucasus (after Stöllner in press).

(e.g. Mount Kvirazchoveli [Sakdrisi V]; volcanogenic massive sulphide deposit of Madneuli). The LIA data of a piece of slag from II.2 suggest this is the case. In contrast, the slags and metals that have been studied so far scatter into a broader regional lead isotopic field (see Fig. 26).[113] This field is so unspecific that a supply from other ore zones of the Caucasian TEMB (Tethyan-Eurasian Metallogenetic Belt) cannot be excluded.

For the Sioni-period occupation of the Dzedzvebi Plateau, such a specialised link to the deposits of the Bolnisi-Madneuli zone cannot be demonstrated as clearly. So far, no evidence of specialised working areas like those of the Early Bronze Age occupation has been found. However, some metallurgical remains and pieces of equipment have been found that can be compared with those of the late 5th millennium BCE in the Kura Valley.[114] Individual pure copper objects such as the rod-shaped device (29242) from Pit 1 do not match the regional deposits, nor do the copper prills from crucible 27905. While the metal object thus provides no evidence for the local processing of copper ores, the crucible not only reveals local smelting took place, but also provides insight into the complexity of social and technical practices. The connection of the crucible and the metallurgical ensemble with a shaft-axe casting mould for axe types of the late 5th millennium points to the Armenian Plateau as a possible catchment area (Fig. 44).[115] However, the deposits of origin have not yet been determined, either in the case of the copper prills and the associated axes or in the case of the small implements. It is clear that ore concentrates from non-regional deposits were processed locally. Whether this also applies to precious metals is unclear. In the small crucible from Pit 6 (22434), increased gold contents and copper contents are noticeable.[116] A regular processing of silver and gold can only be proven in the later Leilatepe/Berikldeebi period.[117] That lead and silver contents could enter the slag crusts via the ores that were used is also shown by the prills from crucible 27905 (see above). Thus, the processing of precious metals cannot be proven at present.

113 Stöllner 2021b, 105 and Fig. 4.

114 Especially Mentesh Tepe: Courcier 2014, 594–595. – Astruc et al. 2021.

115 Shaft-hole axes with a tapered pick end: Hansen 2021, Fig. 23. – Close lead isotopic agreement with specimens from Ovçular Tepesi (Nakhicevan) and Dmanisi in Stöllner 2021b. – See also Gailhard et al. 2017.

116 Stöllner et al. 2014, Fig. 21.

117 Courcier 2014, 623–426.

### 5.4. Emerging Identity: Ritual and Social Practices in Kura-Araxes Communities at Dzedzvebi Plateau

Finally, we discuss the question of the social identity of the communities found at Dzedzvebi. The Chalcolithic communities identified in pits on the southern plateau largely elude this question, mainly because no graves from this period are known so far. Grave finds from this period are extremely rare, and the few known settlement burials are difficult to interpret.[118] However, the question is even more interesting for the Kura-Araxes period. The features known from the craftsmen's settlement at Dzedzvebi II and III reveal a wealth of ritual activities in grave finds as well as in the vicinity of gold processing and extraction. Thus, commensality plays an important role in the environment of gold preparation practices, as indicated by the pottery deposits in House 4 or Pit 37006 from II.7 (Fig. 45).[119] The deposition of gold-grinding implements in stone layers has been attested at least five times in areas II.2, II.3, II.8 and III.5, in house features that are most likely associated with the grinding of gold-bearing ores. Also particularly striking is the context of the presumed washing hearth in House 4, which is associated with the deposition of aniconic idols and feasting dishes.[120] The installation of the washing hearth over a ritually reused storage pit also indicates an incipient connection to tradition at this settlement site, which took place over four hearths above the pit mouth for a certain period of time and was eventually linked to gold extraction. The connection seen in houses 2, 3, 6 and 7 between metallurgy and gold extraction activities and the burial of children's skulls also points to common ritual practices that were developed alongside gold extraction traditions. The very specific burial rites also point in this direction, with evidence of the reopening of graves and the removal of skeletal parts, especially the spine. The regular co-burial of a juvenile also points to the special role of juveniles in the gold-making society of Dzedzvebi. This is also true of the children up to 6 years of age, who, in skull burials, may have played a kind of founding role in the houses and workshops. The overall finding is made particularly significant by the lack of evidence of any biological relationship between the individuals buried in the collective graves that have been examined so far (see section 4.7). Clearly, biological kinship did not play a role in the formation of common ritual ideas. Conversely, it could be hypothesised that the clear evidence of rites and

118 In general, see Nebieridze 2010. – Sagona 2017. – Iserlis 2018. – Shapardon 2020.

119 See already Stöllner 2017, Figs. 2, 5–6.

120 Stöllner 2017, 125–127 and Fig. 3.

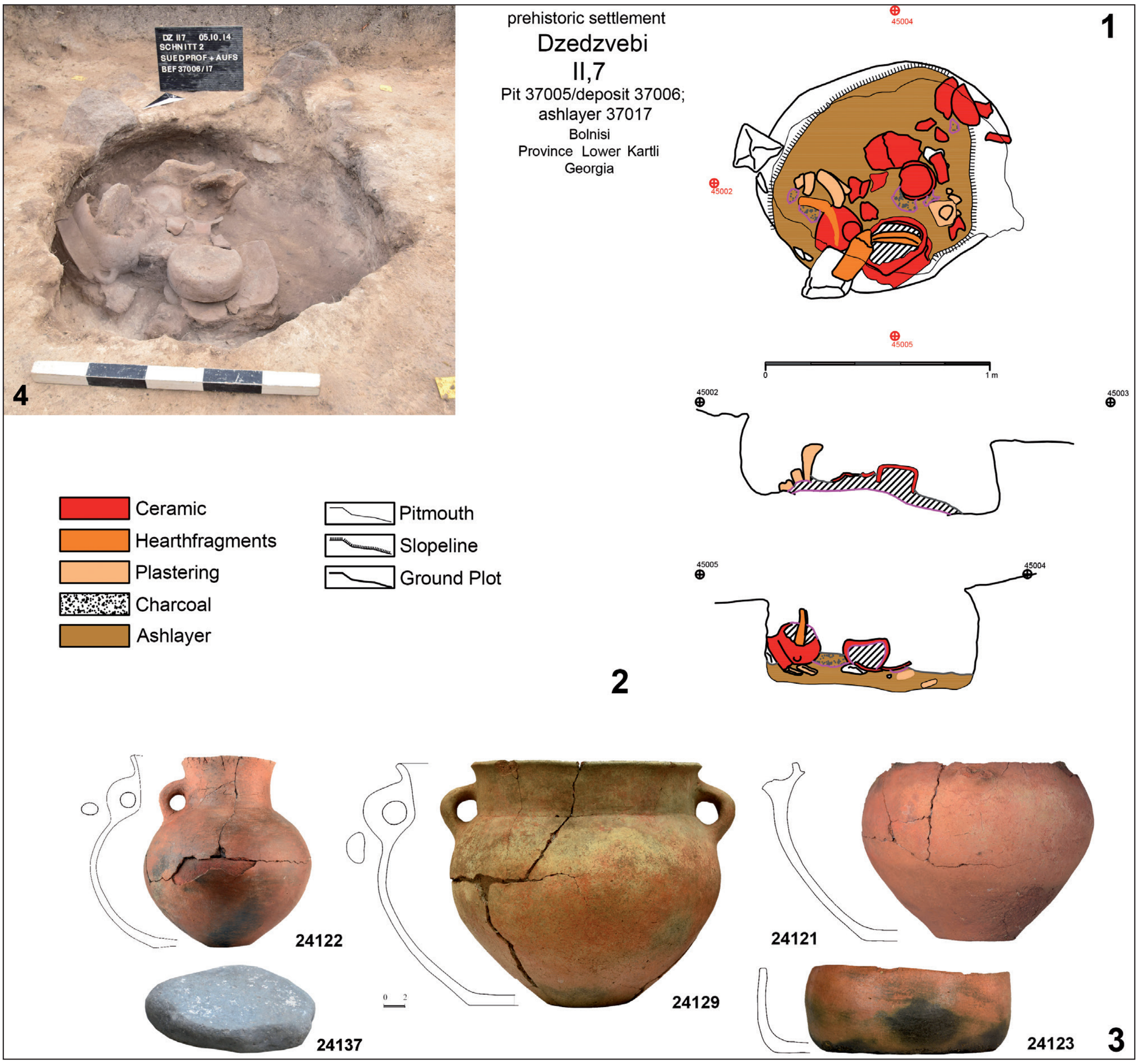



Fig. 45. Dzedzvebi, Area II.7, Pit 37005/37006. – 1–2, 4. Sections through Pit 37005/37006 and photograph. – 3. Pottery and stone tool from the pit (Graphics/photos: GNM and DBM/RUB; H.-J. Lauffer [artefacts], F. Klein [drawings], T. Stöllner [photo]).

the peculiarities of these findings are in fact the expression of newly formed ritual practices associated with a complex division of labour involving different groups and lineages, the ritual connotation of gold making and the appeasement of the dangers associated with it. In this regard, elders and physically prominent persons may have had a role in managing these processes and the associated negotiation processes. The complex around the round platform (House 5) with a conspicuously large central hearth, as well as graves 8–9 close to it, are particularly striking in this respect. For example, mainly older people, four men and two women, were buried in these graves. The fact that rites *a priori*, *iugiter* and *a posteriori* can be proven speaks for an all-encompassing ritual penetration of daily work and life practices (a ritual interplay), which brought together and held together the perhaps very diverse community in the Dzedzvebi settlement in a cooperative way – at least for a certain time.

## 6. Conclusions: Dzedzvebi as an Intermediate Site in South Caucasian Mountain Corridors

The Dzedzvebi Plateau was probably an important point of exchange between the Kura Valley and the plateaus of the Lesser Caucasus as early as the 5$^{th}$ millennium BCE. It is likely that the summer pastures were accessed from here via the upper Mashavera Valley and with them, the resources located there (Fig. 43). The plateau may also have served as winter quarters for the pastoralists of these communities and as an access point during summer from the lower Kura Valley and its tributaries, as indicated mainly by the mobility of grazing animals. It is interesting to note that as early as the Late Chalcolithic (Late Chalcolithic 1–2), the Dzedzvebi Plateau developed into an intermediate station from which activities emanated and towards which activities from the lowlands were directed at the same time. The fact that Dzedzvebi lies in a rich metallogenic zone may also have been an important advantage in the late 5th millennium BCE, a time when metallurgy was first extensively documented, as was the location itself. Nevertheless, despite the documented diversity of resource use, no clear mining specialisation of the communities who settled at least partially in Dzedzvebi can yet be discerned. Nevertheless, the specific cultural pattern of the Sioni Group[121] may have been rooted precisely in these ambivalent living environments between valleys and mountains.

Conversely, the Kura-Araxes communities, which originated around the middle of the 4th millennium BCE, characterised by gold mining and other metallurgical activities, regional agriculture and a herding economy oriented towards an exchange between the lowlands and the summer pastures, appear much more specialised, particularly in terms of gold mining and processing activities.[122] The aim of ongoing studies within the current research project is to determine whether some of the people and animals in these communities were mobile at times and whether different communities participated in the activities around and on the Dzedzvebi Plateau. However, it is highly likely that the Dzedzvebi Plateau continued to play an intermediary role, although the various social and economic activities may have become more regular. This is indicated not only by the division of labour around gold extraction, which presumably required numerous social activities to create a sense of community. Although it remains unclear how the extracted gold was distributed among the Transcaucasian communities, especially during the early phase of gold extraction, it is likely that a resident group exercised a certain amount of control over metal or deposits (such as Sakdrisi). These communities preserved the ritual as well as technical knowledge (for example, the lineages of the older remains in the graves of Area II.7 or the continued ritual use of Pit 6 in II.8). The metals extracted in the craftsmen's settlement in association with surrounding deposits (e.g. those of Sakdrisi-Kachagiani) may thus have acquired an increasingly explicit role in the social networks and the narratives associated with their extraction. They may have enabled social control over other, ultimately more important resources, such as the high-altitude grazing areas of the Transcaucasus. An investigation of the relationships between the Javakheti/Baraleti and Trialeti plateaus and the valleys of the Kura and the Mashavera is planned in the next phase of this project. It is already clear, however, that numerous settlements (especially in the younger phases of the Early Bronze Age) were founded at these heights and, from the early 3rd millennium BCE onwards, Kurgan burials were established there.[123] As territorial markers, these burials may have symbolised the control of these zones by individual communities. One can only suggest that the new function and presentation of individuals and lineages in ceremonial burials, which has been highlighted elsewhere,[124] was also justified in the sense of increased competition for such resources.

121 E.g. Kiguradze, Sagona 2003. – Iserlis 2018. – Lyonnet 2018. – Marro 2022.
122 Stöllner et al. 2021.
123 Stöllner 2016, Fig. 10. – Stöllner 2018.
124 Stöllner 2017.

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