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ORIGINAL RESEARCH PAPER

The Šenov-Salaš 1 and 4 Upper Palaeolithic sites and settlement and procurement strategies in the Aurignacian of the Moravian Gate

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ABSTRACT

Techno-typological analysis of two chipped stone assemblages from Šenov-Salaš 1 and 4 in the Moravian Gate (Czech Republic) indicates they belong to the Aurignacian. The two assemblages, preferentially made of Baltic (erratic) flints, comprise few distinctive tool types, though. A statistical analysis was conducted to compare their raw material strategy, tool typology, and topography with other Moravian Aurignacian sites. It transpired that they answer to other Aurignacian sites in their specific topography, raw material strategy, and (a few) Aurignacian endscrapers, but both assemblages comprise few carinated burins. The altitude here is somewhat higher than that for most Moravian Aurignacian sites, but it is still probable that the two assemblages belong to the Aurignacian and that their rather atypical aspect (the small dimensions of artefacts, simple core preparation, few distinctive tools) are due to the small size of the processed flint nodules, which did not allow for thorough core preparation. Predominant plain butts, the virtual absence of archaic, or other distinctive tool types speak for either Evolved Aurignacian or some specific Aurignacian facies of the Moravian Gate. The assemblages cannot be linked with the young AMS ^{14}C date 14 270 ± 40 uncal BP, acquired from a bone from the surface at Salaš 1, just slightly preceding the Moravian Magdalenian, as such a date would be too young not only for any Aurignacian but also for Epiaurignacian sites. Still, the Aurignacian estimation of the assemblages is interesting as the Moravian Gate comprises relatively few sites attributed to this Upper Palaeolithic culture.

KEYWORDS

Aurignacian, Moravian Gate, chipped stone analysis, Baltic flint, stone raw materials

INTRODUCTION

The Moravian Gate (Moravia, Czech Republic) and its surroundings comprise dozens of Palaeolithic sites,[1] situated either where the Gate opens towards the North European Plain (e.g., Ostrava-Petřkovice – the Gravettian[2]), towards the Lower Moravian Ravine (Předmostí u Přerova – the Taubachian, the Aurignacian (?), the Gravettian[3]), or in its central part (Hranice III-Velká Kobylanka – the Magdalenian[4]) and in local karstic environments (the

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[1]Neruda (2018).

[2]Oliva and Neruda (1999).

[3]Absolon and Klíma (1977).

[4]Neruda and Kostrhun (2002); Moník et al. (2019).

Šipka and Čertova díra caves – the Mousterian, the Federmesser group, the Epigravettien[5]). Nonetheless, Palaeolithic settlement of this area seems rather scarce compared to more southerly regions of Moravia, with the exception of Příbor town area where intensive field-walking prospection is conducted by amateur archaeologists. It is taken for granted that the Gate served as a natural corridor for human and animal populations from at least the Middle Palaeolithic and, at the same time, as a possible source of Baltic (erratic) flints due to the intrusion of a continental glacier in the Pleistocene[6].

Aurignacian finds are relatively scarce here and are acquired mostly by field-walking prospection (Černotín, Přestavlky, Pavlovice, Lhota at Lipník nad Bečvou, Stachovice 1 and 2[7]), and are sometimes classified as Morava-River type Aurignacian (*pomoravský aurignacien*), a cultural facies characterized by the use of erratic flints, carinated endscrapers, archaic knives, chisels, splitters and leaf points,[8] alternatively termed "Szeleto-Aurignacian" or "Miškovice type", the latter entity not necessarily linked to the Aurignacian technocomplex and of uncertain dating.[9]

In the years 2001–2005, two assemblages were obtained through field-walking prospection in the eastern part of the Moravian Gate, marked by us as Šenov-Salaš 1 and 4 (henceforth Salaš 1 and 4). The first aim of our research was their chronological and cultural specification. As the tool typology from the two sites answered to the Aurignacian, we also targeted the question of what phase of the Aurignacian this should be.

Topography and geology of the sites

The two sites lie in the cadastre of Šenov at Nový Jičín (Fig. 1), on WGS 84 coordinates 49.6175047N, 17.9723714E and 49.6165456N, 17.9671786E, respectively. The altitude here is about 330 m a. s. l. though some finds, especially in Salaš 1, were scattered both lower and higher on the slope. The finding situation, however, is relatively constrained in the two cases, though younger intrusions of a few non-patinated and morphologically non-Palaeolithic lithic artefacts were recovered together with the Palaeolithic finds. Both sites grant a fine view of the Moravian Gate and the Odra River, nowadays about 2 km distant. A stream is located on the eastern slope of Salaš hill (364 m a. s. l.). This gave origin to a calcareous tufa sometime in the Pleistocene or the Holocene.[10] This tufa was still used by local farmers to fertilize their fields in the 19th century and its remnants were uncovered in the spring of 2015 by drainage. Otherwise, the vicinity of the sites is geologically covered by loess, loess loams, and colluvial sediments[11] which lie on the sediments and volcanics of the Silesian Unit of the Magura Group of nappes of the Western Carpathians. The higher altitude of the sites means that they lie above the reach of the continental glacier and any (erratic) flints or cherts must have been brought there by humans.

METHOD

Typological classification of the two assemblages was conducted on the basis of de Sonneville-Bordes and Perrot,[12] complemented by technological analysis (*chaîne opératoire*) of cores and blanks. Techno- and typology complement each other, and both can be useful for distinguishing different archaeological cultures, or even phases within a single culture, and trace socially motivated decisions within past populations.[13] Technological categories used, e.g., by Oliva[14] were used for the classification. All implications based on both tool typology and reconstruction of operational chain at Salaš 1 and 4 (see Discussion) should be considered tentative due to the nature of the assemblage (surface collection). However, as stated in the Introduction, the two areas with finds of lithics are relatively constrained and only a few (<5 pcs.) artefacts are obviously alien to the assemblage (non-patinated blades of probably Neolithic age). All artefacts were also measured with the precision of one tenth of a millimetre. This may serve in the future for comparison with other assemblages in the area.

As we presumed an Aurignacian age of the assemblages from Salaš 1 and 4 on the basis of typology, we compared them with techno-typological indexes gathered from 22 Aurignacian/Epiaurignacian surface collections (the reason some Epiaurignacian sites are included is that certain presumably Aurignacian sites emerged, over time, to be Epiaurignacian[15]). In the work by Jelínková[16] two sites which also lie in the Moravian Gate were analysed, the condition being that the works with which to make comparison used a methodology identical to ours, quantified the analysed finds, and conducted raw material analysis. Although most of the compared categories relate to typology, they also comprise the definition of blanks used for tool manufacture (cores, blades, flakes…). Typological criteria comprise the percentages of (Aurignacian) endscrapers and burins, sidescrapers and leafpoints. In the case of leaf points, we have statistically used their presence/absence (marked 1 and 0) instead of their percentage. This is because they are generally scarce in Moravian Aurignacian assemblages but significant in defining, i.e., the Morava-River type Aurignacian.[17]

[5] Maška (1884); Neruda (2018).
[6] Macoun et al. (1965); Svoboda et al. (2002) 18.
[7] Klíma (1978); Jelínková (2007).
[8] Klíma (1978) 18.
[9] Svoboda et al. (2002) 170; Oliva (1987) 102; Neruda (2018) 17.
[10] www.csop.cz (2020)
[11] Roth (1989).
[12] de Sonneville-Bordes and Perrot (1956).
[13] Andrefsky (1999); Inizan et al. (1999) 60; Riede (2006) 60.
[14] Oliva (2000).
[15] Oliva (1984, 1987, 2016); Jelínková (2007); Neruda et al. (2021).
[16] Jelínková (2007).
[17] Škrdla (2011) 148; Oliva (2016) 62.

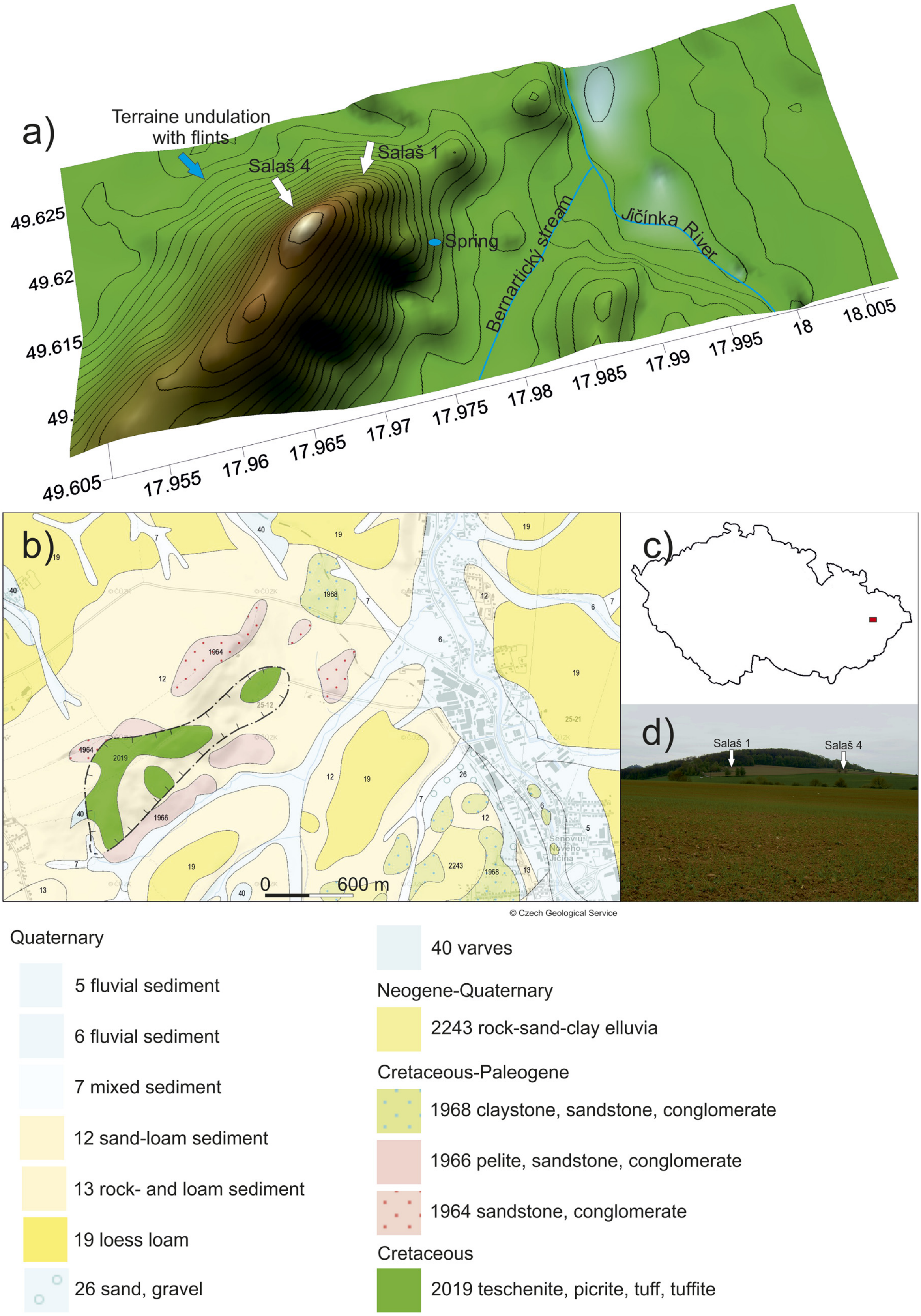

Fig. 1. Topography of the sites Šenov-Salaš 1 and 4 (a, d), their geological background (b) modified from[11], and location in the Czech Republic (c)

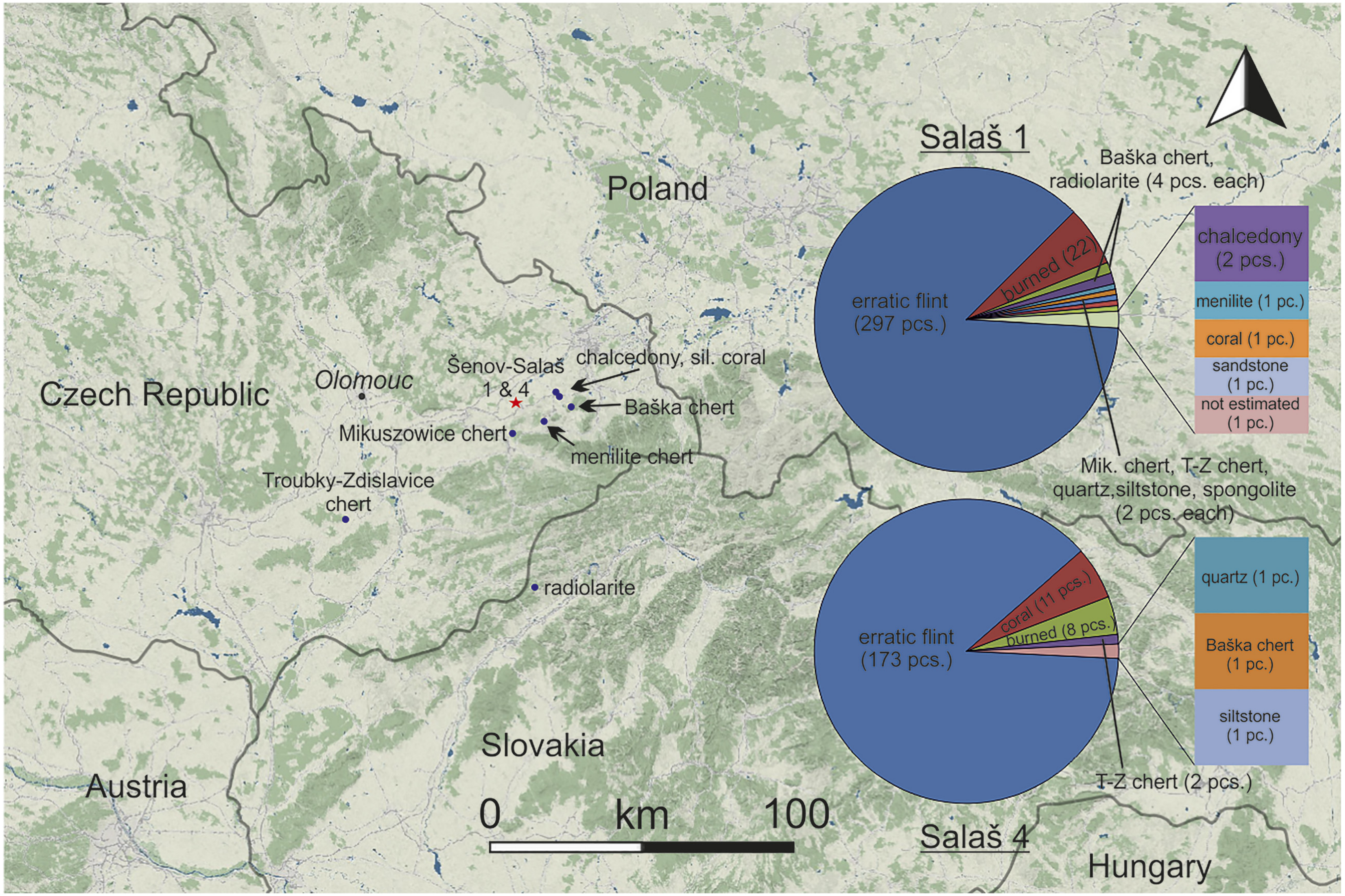

Fig. 2. Raw materials from Šenov-Salaš 1 and 4 sites and the location of known occurrences of selected raw materials

Apart from the mentioned techno-typological protocol, we also used topographical criteria (slope, aspect, altitude, distance to water, and visible area from the sites[18] for PCA (Appendix 1). The reason for including topography was that Moravian Aurignacian sites are often stated to belong to the "Aurignacian landscape",[19] i.e. a landscape which reflects the social and cultural component of the Aurignacian (the social landscape in the sense of Gamble[20]) similarly to tool typology.[21] Frequent for such sites is the transition from highlands to valleys, sometimes relatively far from the nearest watercourse.[22]

Topographical data were obtained from the map and from QGIS freeware. They could be calculated for 135 Moravian Aurignacian sites (mostly visualized in Moník and Hadraba[23] and listed in Appendix 1) which were subsequently compared as regards topography. An attempt to radiocarbon date a bone from Salaš 1 by means of the AMS ^{14}C method was conducted at the University of Georgia (USA). Due to calcination of the bone, the date was obtained from hydroxylapatite fraction. The acquired date must be considered ambiguous due to the collection of the bone from the surface. All data were analysed and visualised with R (4.0.5) and RStudio (1.4.1106). Principal component analysis/PCA/ for the reduction of data dimension and better visualization of the variation present in our dataset was performed using the factoextra package for RStudio.[24] In case Salaš 1 and 4 did not belong to the Aurignacian, they should form a single cluster.

RESULTS

^{14}C AMS dating

The date acquired from the animal bone at Salaš 1 is 14 270 ± 40 BP. After calibration, this gives 17 389 ± 40 cal BP or 15 389 ± 40 cal BC (2 σ), answering to the oldest Dryas, the Heinrich event 1.[25] Should this date belong to the lithic assemblage from the site, the environment by that time would have been a dry cold loess steppe with grasses and cold-loving woody plants.[26] The question of whether such date is or not too recent for our cultural estimation of the assemblages is covered in the Discussion.

Raw materials

Salaš 1. The raw material composition of the lithic assemblages from Salaš 1 (and 4) is influenced by the occurrence of erratics, including Baltic flints with characeristics fossils (Figs 6.9; 9.13), situated about 800 m WNW of the sites on a terrain undulation (Fig. 1a). In the case of Salaš 1, Baltic flints are represented by 296 pieces (86.3% of the total 343 pcs.) though some patinated artefacts could also belong to other fine-grained silica materials like the Cracow chert. Twenty-two pieces (6.4%) are burned beyond reliable estimation, four pieces (1.2%) are made of the Baška chert of the Lower Cretaceous (Apt, Alb), the outcrops of which are situated between Štramberk, Příbor and Hukvaldy,[27] about 10–20 km of the site. Three artefacts are made of radiolarite, probably imported from the Klippen Belt of the Western Carpathians, about 60 km distant, as the crow flies. Apart from the typical brown and green varieties, one yellow-brown (Figs 3a, 3a') radiolarite and one layered white-black chert filled with Radiolaria have been found (Figs 3g, 3g'). Radiolarites, which are commonly used on Moravian Aurignacian sites, were also encountered in the nearby sites of Lhota and Stachovice,[28] and sometimes predominate even on sites tens of kilometres distant from the outcrops as shown by the Tvarožná I site.[29]

Two pieces (0.6%) made of Cretaceous spongolite (Figs 3f, 3f') follow, and twice menilite chert from the Menilite Formation of the Lower Oligocene of the Sub-Silesian Unit of the Western Carpathians appeared. These cherts are encountered in a long belt stretching from southern to northern Moravia[30] where the closest of such outcrops lies about 10 km from the site, south of Štramberk.[31] Two exemplars probably belong to the layered Mikuszowice chert of the Lhotec Formation of the Lower Cretaceous (Alb; Figs 3c, 3c'), so far only sporadically identified in Moravian chipped stone assemblages but well known from the Upper Palaeolithic and Mesolithic sites of Poland.[32] Two artefacts resemble the speckle-patinated Troubky-Zdislavice chert (Figs 3e, 3e') from the Miocene (Carpathian) gravels of the Carpathian Foredeep. This raw material is characteristic for Aurignacian sites from around Kroměříž in Central Moravia[33] and predominates on the Věžky site (see Discussion). These locations are about 70 km distant from Salaš hill but medium-distance imports of Troubky-Zdislavice chert are also known from, e.g., Aurignacian sites in the Brno area and in southern Moravia (Brno-Jundrov, Brno-Kohoutovice, Diváky, etc.[34]). Still, the estimation of the two artefacts is not unambiguous (A. Přichystal – personal information) as a number of cherts of a similar aspect to Troubky-Zdislavice chert are encountered at the front of the nappes of the Outer Western Carpathians, potentially closer to Salaš hill.

[18]cf. Neruda (2018); Moník and Pankowská (2020); Neruda et al. (2021).

[19]Svoboda et al. (2002) 156; Svoboda et al. (2006) 259; Škrdla (2011) 144.

[20]Gamble (1999).

[21]Oliva (2009).

[22]Oliva (2002) 562; Svoboda (2006) 260.

[23]Moník and Hadraba (2016) Fig. 2.

[24]Kassambra and Mundt (2017).

[25]Bradley (1999) Table 6.6.

[26]cf. Sümegi and Krolopp (2002) 60.

[27]Roth (1989).

[28]Jelínková (2004, 2007); Diviš (2011).

[29]Valoch (1976) 8; Oliva (1987) 26.

[30]Přichystal (2013) 86.

[31]Roth (1989).

[32]Foltyn and Jochemczyk (2013) 21.

[33]Přichystal (2013) 89; Oliva (2002) 560.

[34]Oliva (1987) 16, 24.

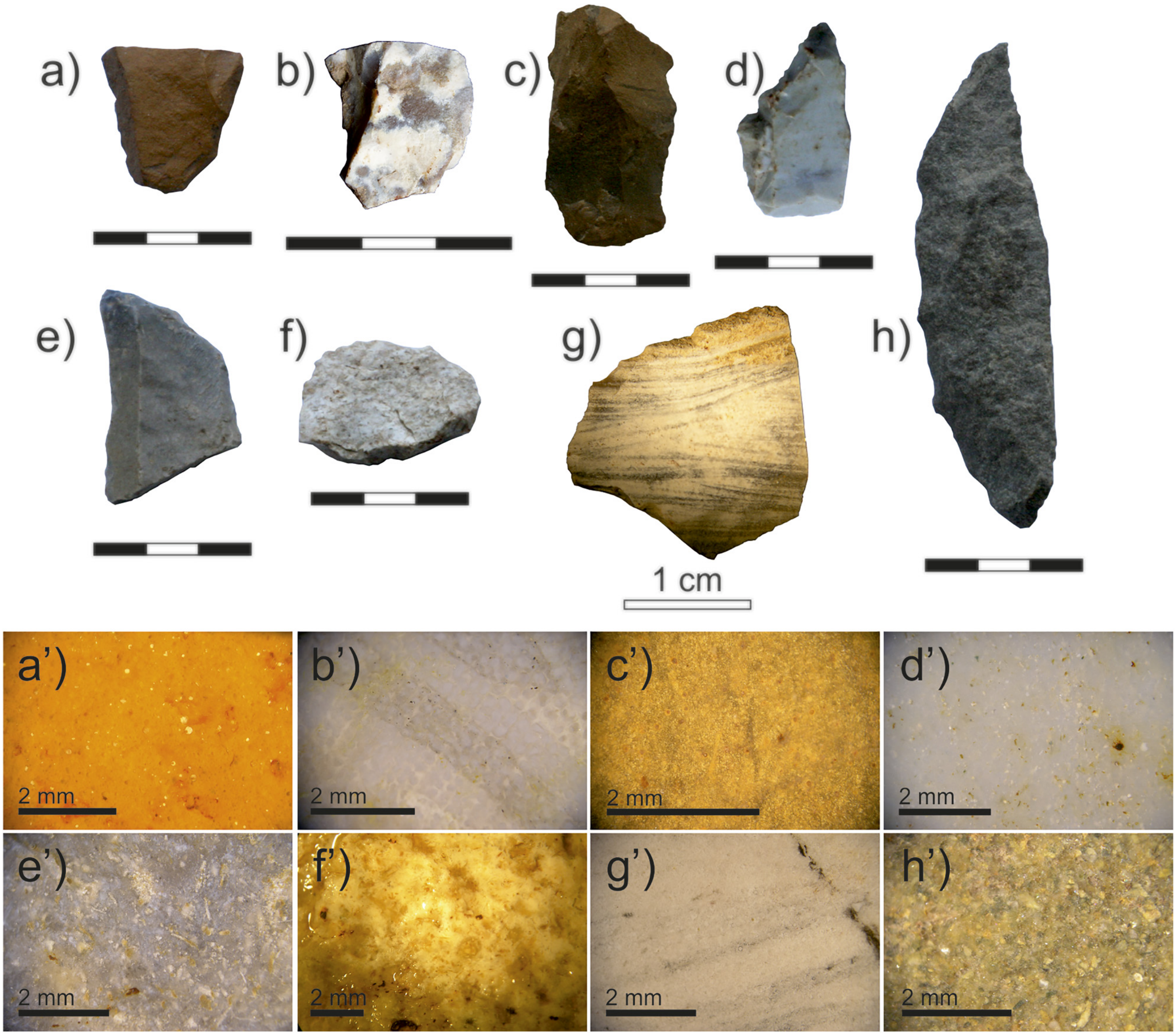

Fig. 3. Selected rare raw materials from Šenov-Salaš 1 (a, c–h) and 4 (b) sites and their aspect in water immersion under stereomicroscope: a, g radiolarite, b silicified coral, c Mikuszowice chert, d chalcedony, e Troubky-Zdislavice chert, f spongolite, h glauconitic sandstone

Quartz artefacts appeared there twice, where the raw material was probably acquired from fluvial sediments, and one dark siltstone, a local raw material outcropping on the southern slope of Salaš, belonging to the pelites of the Sub-Silesian Unit from the break of the Cretaceous. A chalcedony of unclear origin appeared there twice, though it probably originated by hydrothermal mineralization around the Mesozoic volcanites of the Sub-Silesian and Silesian Units of the Western Carpathians. A typical site of such hydrothermal products is Hončova hůrka hill at Příbor, about 15 km distant from the site.[35] One exemplar is of bluish to greenish colour (Figs 3d, 3d'), induced by a green mineral, probably chlorite, in its matrix.

A quartz sandstone to quartz arenite with glauconite (Figs 3h, 3h') with unclear origins appeared once. However, similar material was also evidenced on Aurignacian sites around the Napajedla Gate,[36] about 75 km SW of Salaš hill, and also on the Magdalenian site Hranice III-Velká Kobylanka, 17 km from Salaš.[37] One flake of silicified coral was found in Salaš 1 (Figs 3b, 3b'). Outcrops of silicified corals of Upper Mesozoic to Lower Tertiary age are located not far from the Hončova hůrka hill, SE of Příbor.[38] So far, this raw material has only been rarely evidenced in Late Palaeolithic and Mesolithic assemblages from around the outcrops.[39]

[35] Dolníček et al. (2010) 267.

[36] Škrdla (2010) 121.

[37] Moník et al. (2019) 354.

[38] Přichystal (2013) 186.

[39] Diviš (2012).

One of these outcrops may actually be situated on the Salaš hill, about 500 m SE of the site, where corals were also encountered by the authors. Finally, one artefact was made from an unspecified material.

Salaš 4. On Salaš 4 site, erratic flints are similarly represented as at Salaš 1, numbering 173 pieces (87.8% of the total 197 pcs.). The raw material was probably brought to the site from the nearby occurrences of erratics, situated cca 550 m NW of the site. The second most numerous material (11 pieces; 5.6%; Figs 3b; 3b') is surprisingly the silicified coral; there follow burned pieces (8 pcs.; 4.1%) and cherts, probably of the Troubky-Zdislavice type (2 pcs., 1%).

Another raw material typical for the Aurignacian sites of the Drahany highlands is Tertiary silcrete – the so-called sun boulder – originated through the weathering of siliceous rocks.[40] This raw material is also present once (0.5%) on the Salaš 4 site where the nearest occurrences may be the eluvia of the Hranice Culm. Lastly, single finds of claystone and Baška chert also appeared, as already described at the Salaš 1 site.

In total, the two sites exploited local erratic flints but also made use of raw materials outcropping mostly to the E and SE of the sites, i.e., in the promontories of the Moravo-Silesian Beskid Mountains (Figs 1 and 12). Only the radiolarites of the Klippen Belt of the Western Carpathians and scarce exemplars of Troubky-Zdislavice chert are more distant imports.

Chaîne opératoire

Salaš 1. The operational chain of the lithics from Salaš 1 is summarized in Tables 1 and 2, quantifying raw materials and used blanks. Apart from the blanks without further modification there are also pieces with macroscopic use-wear traces (28 pcs.; 8.2%; Figs 5.21–23; 6.1,2,4, 8; 7.6; 10.3,6,7,13; 11.10,12,13), and typologically classified tools (70 pcs.; 20.4%). Flakes are the most common blanks (199 pcs. of the whole 343 pcs. = 58%) but as regards the reduction/coring phase, blades and bladelets clearly predominate (69 pcs. (78%) of all blanks from the reduction phase; Figs 4.2; 5.3,5,17–19,21–23; 6.3,18; 7.2,5; 8.1,4; 10.2,3,5,9–14,21, 23,24,27; 11.2,13,14). Tool production, however, was also practiced on flakes (Figs 5.10,12; 6.5, 12; 7.9; 10.4,20,22; 11.11,15) and cores (6.17), even in preparation (Figs 4.14; 5.1,2,4,6,7,9,13,16; 7.3,4,7; 11.3,4,16), reparation (Figs 4.4,6–8,10; 6.11; 8.2; 10.7,19,25) (Table 2), and debris (in the case of exhausted cores) phases. One end-scraper is made on otherwise unmodified blank (Fig. 5.15).

It is obvious that unmodified material is scarce on the site (1.2% of the whole; Fig. 7.12). Also, primary modification of the blanks took place here, as indicated by 48 cortical flakes and blades (48 pcs. of 89, i.e., 54% among the preparation products; Figs 4.3; 7.6,7; 10.6,15,17; 11.12). This means that blades were already produced in the preparation phase (Figs 10.16; 11.9,10), though about four times less frequently than flakes. The flakes, on the other hand, are scarce in the reduction phase (ca 20%) and are mostly blade-like flakes (Figs 6.4,8; 11.17). Still, some blades from the reduction phase bear remnants of the cortex (Figs 4.5; 6.13; 10.1,10,13). The reparation of cores by rejuvenation of their striking platform or reduction face (Figs 6.1,2; 7.13; 8.3) also took place on the site (43 pcs.; 12.5% of the whole industry). Most numerous are debris (33.2% of the whole; Fig. 10.8), mostly flake fragments, chips, remnants of cores and unidentified fragments. Evidence of tool manufacture on the site is provided by one burin spall (Fig. 10.18).

The exploitation of raw materials is different in different operation phases, where the most striking difference between erratic flints and other materials is among the debris (not counting unidentified, mostly burned pieces; about 100 × higher amounts of flint), less so in the preparation (9.5 ×) and reduction (13×) phases. This probably reflects the preferential recycling of flint artefacts.

Cores and their reduction strategies

From among the 31 cores within the assemblage (9.1% of the whole), core remains (18 pcs.; Figs 4.1,9,11,13; 5.11,20; 6.6,7,9,15–17; 7.1,10; 11.5,6,8,18) and fragments (6 pcs.; Figs 4.12; 5.24) predominate over un-exhausted cores (two pcs.; Fig. 11.1,7), cores in the phase of preparation (four pcs.; Figs 5.14; 6.10; 7.8,14) and a pre-core. It seems that the exploitation of prismatic cores was the most preferred (Figs 4.1,13; 5.24; 6.6,7,9,17; 7.8,10; 11.5,8,18), while four pieces cannot be estimated as regards shape, and three are carinated pieces (Figs 4.12; 6.10; 11.7). As regards reduction technology, the burin-like (Figs 4.11; 6.16; 7.1), pencil- (Figs 5.14), cubic (Figs 4.9; 6.15) and flat (Figs 5.11; 7.14; 11.1,6) cores are probably the result of reduction of originally prismatic cores where single-platform pieces predominated (19 pcs.; Figs 4.1,9,12; 5.11,14,20; 6.6,9,10,15,16; 7.1,8,10,14; 11.1,6–8) over double-platform (three pcs.; Figs 4.11; 5.24; 6.7) and changed-orientation cores (four pcs.; Figs 4.13; 6.17; 11.5,18; Table 4). The striking platform of the previously mentioned pre-core was not yet prepared. The cores are not larger than unbroken blades (Table 6), with the exception of the longest (unexploited) nodule (4.73 cm) which is slightly longer than the longest unbroken blade (4.5 cm). Understandably, a continuous size diminution occurs in the course of the reduction process from unworked nodules to remains and fragments. The overall mean size of cores is 3.26 cm.

Before proper reduction took place, the core striking platforms were mostly prepared by one blow as indicated by the plain butts of the blanks (108 pcs.; 44.8%; Table 5), but punctiform butts are also numerous (73 pcs.; 30,3%), whereas cortical, dihedral or facetted butts are scarce. Also, broken butts are frequent (21 (8.7%; Table 5). Further core preparation was either simple or absent (7 pcs.; Fig. 4.11). Flat preparation of core back often took place (6 exemplars) (Figs 4.1; 6.6,7,15; 11.6). In two cases, this was accompanied by flat preparation of the core flank (Fig. 11.1), and even the formation of a frontal crest in one of these cases (Fig. 6.10). Single flat preparation of core flank appeared once

[40] Spitzner (1901) 117; Přichystal (2013) 176.

Table 1. Operational chain of chipped stone manufacture in the Salaš 1 and 4 sites according to used raw materials

Salaš 1	Raw material			Total	%
	Baltic flint	unidentified	other		
Unworked raw material					
Chunk of raw material	2		1	3	0.9
Pre-core			1	1	0.3
Total	**2**	**0**	**2**	**4**	**1.2**
Preparation					
Cores	3		1	4	1.2
Blades	16	2		18	5.2
Flakes	58	4	9	71	20.7
Total	**77**	**6**	**10**	**93**	**27.1**
Reduction/coring					
Cores	2			2	0.6
Blades	62	3	4	69	20.1
Flakes	13	1	3	17	5.0
Total	**77**	**4**	**7**	**88**	**25.7**
Reparation					
Blades	1			1	0.3
Flakes	37	1	3	41	12.0
Unidentified	1			1	0.3
Total	**39**	**1**	**3**	**43**	**12.5**
Debris					
Unworked fragments	3			3	0.9
Cores	24			24	7.0
Blades	4			4	1.2
Flakes	61	7	1	69	20.1
Unidentified	9	5		14	4.1
Total	**101**	**12**	**1**	**114**	**33.2**
Tool manufacture					
Burin spalls	1			1	0.3
Total	**1**			**1**	**0.3**
Total all	**297**	**23**	**23**	**343**	**100.0**
%	**86.6**	**6.7**	**6.7**	**100.0**	
Salaš 4	**Raw material**			**Total**	**%**
	Baltic flint	**unidentified**	**other**		
Unworked raw material					
Chunk of raw material	2			2	1.0
Pre-core	1			1	0.5

(continued)

Table 1. Continued

Salaš 4	Raw material			Total	%
	Baltic flint	unidentified	other		
Total	**3**			**3**	**1.5**
Preparation					
Cores	3			3	1.5
Blades	3		1	4	2.0
Flakes	50	1	3	54	27.4
Total	**56**	**1**	**4**	**61**	**31.0**
Reduction/coring					
Blades	16	2	2	20	10.2
Flakes	20	1	3	24	12.2
Total	**36**	**3**	**5**	**44**	**22.3**
Reparation					
Blades	1			1	0.5
Flakes	18	1	1	20	10.2
Total	**19**	**1**	**1**	**21**	**10.7**
Debris					
Unworked fragments	6		1	7	3.6
Cores	7	1	2	10	5.1
Blades	1			1	0.5
Flakes	33	1	3	37	18.8
Unidentified	10	1		11	5.6
Total	**57**	**3**	**6**	**66**	**33.5**
Tool manufacture					
Burin spalls	1			1	0.5
Tool fragment	1			1	0.5
Total	**2**			**2**	**1.0**
Total all	**173**	**8**	**16**	**197**	**100.0**
%	**87.8**	**4.1**	**8.1**	**100.0**	

(Fig. 5.14). A further three pieces bear flat preparation of their foot (Figs 5.24; 6.9; 11.7). The crested back preparation, typical for blade manufacture,[41] appeared twice (Figs 6.17; 7.8). It was not possible to determine the type of preparation in the other ten remains or fragments (Figs 4.9,12,13; 5.11,20; 6.16; 7.1,10,14; 11.5,8,18).

Salaš 4. The operational chain for Salaš 4 site is, again, summarized in Tables 1 and 2. Apart from unmodified blanks, some pieces bear macroscopic use-wear traces (17 pcs.; 8.6%; Figs 7.11; 8.7,9,14,17; 9.1–3), and there are 25 typologically classified tools (12.7% of the whole). As regards blank production, flakes were most manufactured (139 pcs.; 71%) in the preparation (Figs

[41] Ginter and Kozlowski (1990) 55.

Table 2. Operational chain of chipped stone manufacture in the Salaš 1 and 4 sites according to the number of unused blanks, blanks used for working other materials, and typologically classified tools

Salaš 1	Not retouched	Artefacts With work traces	Tools	Total	%
Unworked raw material					
Chunk of raw material	1		2	3	0.9
Pre-core	1			1	0.3
Total	**2**	**0**	**2**	**4**	**1.2**
Preparation					
Cores	4			4	1.2
Blades	12	1	5	18	5.2
Flakes	51	4	16	71	20.7
Total	**67**	**5**	**21**	**93**	**27.1**
Reduction/coring					
Cores	2			2	0.6
Blades	33	12	24	69	20.1
Flakes	6	2	9	17	5.0
Total	**41**	**14**	**33**	**88**	**25.7**
Reparation					
Blades			1	1	0.3
Flakes	26	5	10	41	12.0
Unidentified	1			1	0.3
Total	**27**	**5**	**11**	**43**	**12.5**
Debris					
Unworked fragments	3			3	0.9
Cores	21		3	24	7.0
Blades	4			4	1.2
Flakes	65	4		69	20.1
Unidentified	14			14	4.1
Total	**107**	**4**	**3**	**114**	**33.2**
Tool manufacture					
Burin spalls	1			1	0.3
Total	**1**			**1**	**0.3**
Total all	**245**	**28**	**70**	**343**	**100.0**
%	**71.4**	**8.2**	**20.4**	**100.0**	
Salaš 4	**Not retouched**	**Artefacts With work traces**	**Tools**	**Total**	**%**
Unworked raw material					
Chunk of raw material	2			2	1.0

(continued)

Table 2. Continued

Salaš 4	Not retouched	Artefacts With work traces	Tools	Total	%
Pre-core	1			1	0.5
Total	**3**			**3**	**1.5**
Preparation					
Cores	3			3	1.5
Blades	4			4	2.0
Flakes	42	7	5	54	27.4
Total	**49**	**7**	**5**	**61**	**31.0**
Reduction/coring					
Blades	7	5	8	20	10.2
Flakes	11	5	8	24	12.2
Total	**18**	**10**	**16**	**44**	**22.3**
Reparation					
Blades	1			1	0.5
Flakes	18		2	20	10.2
Total	**19**		**2**	**21**	**10.7**
Abfall					
Unworked fragments	7			7	3.6
Cores	8		1	9	4.6
Blades	1			1	0.5
Flakes	38			38	19.3
Unidentified	11			11	5.6
Total	**65**		**1**	**66**	**33.5**
Tool manufacture					
Burin spalls	1			1	0.5
Tool fragment			1	1	0.5
Total	**1**		**1**	**2**	**1.0**
Total all	**155**	**17**	**25**	**197**	**100.0**
%	**78.7**	**8.6**	**12.7**	**100.0**	

8.7,13,14; 9.3,5,7,9, 10,14, 16), reparation (Fig. 8.10), and reduction phases (Figs 8.9,11,17,18; 9.1,2,4,6,8,21,23) though, in the reduction phase, blades and bladelets are also common (20 pcs.; Figs 8.8,15; 9.11,15,17,18,20). Even at this stage, some blades are corticated (Fig. 7.15). One secondary trimming blade bears a fossil (Fig. 9.13). Tools were mostly applied on flakes (16 pcs.), less on blades (8 pcs.) or cores (one exemplar).

Unmodified raw materials are very rare in Salaš 4; most numerous are debris (33.5% of the whole), i.e., fragments, failures and remains, less numerous are preparation flakes and blades (31%), products of core reduction (22.3%) and reparation (10.7%). Tool manufacture on the site is evidenced by one burin spall and one tool fragment (1%; Fig. 7.16). There are also 16 corticated flakes (28% of the

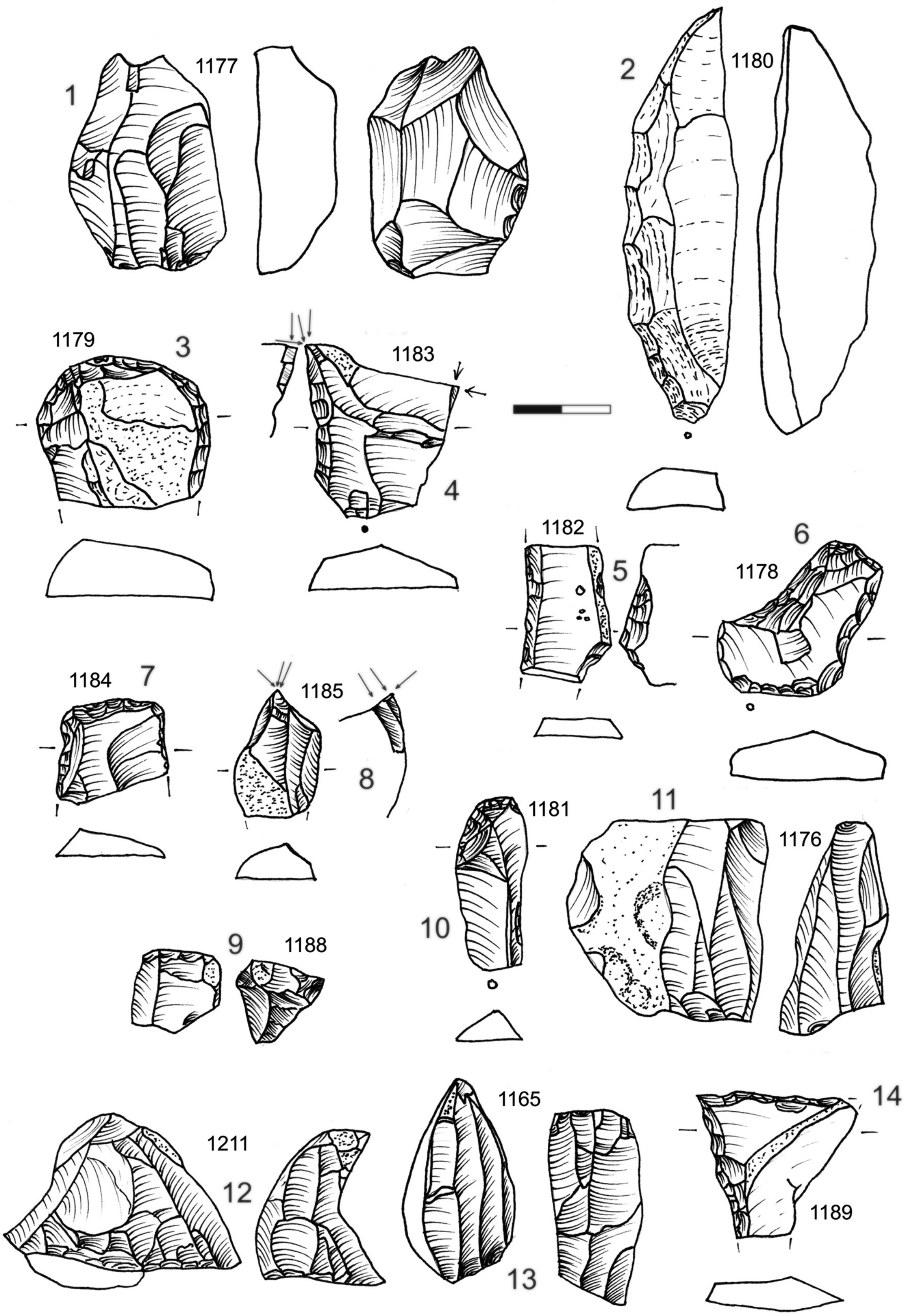

Fig. 4. Salaš 1. Cores (1, 9, 11–13), point (2), flake endscraper (3), multiple dihedral burin (4); laterally retouched blade (5), atypical carinated endscrapers (6, 10, 12), thumbnail endscraper (7), asymmetric dihedral burin (8), borer (14). All Baltic flint, except one glauconitic sandstone (2)

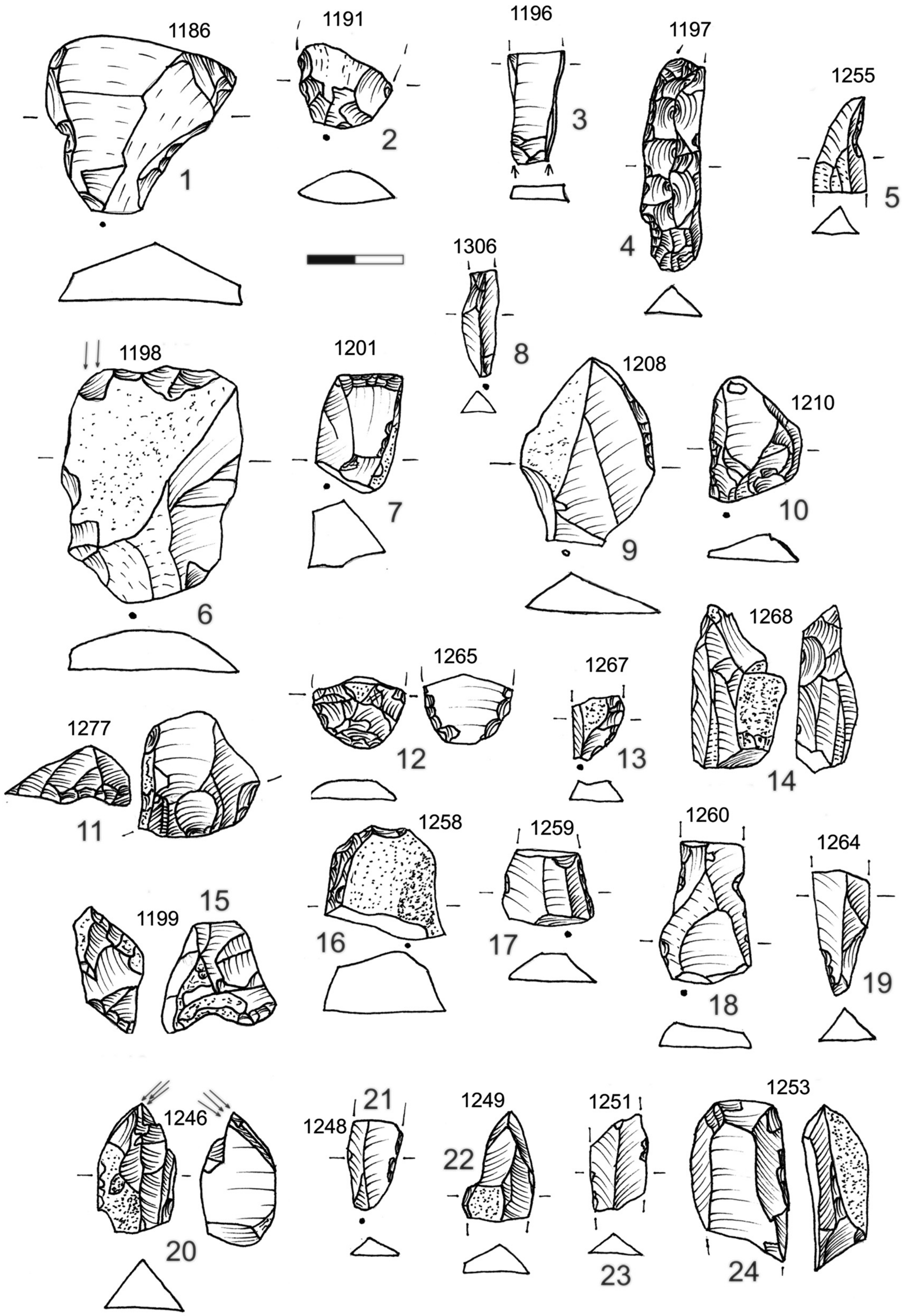

Fig. 5. Salaš 1. Atypical borer (1), leaf point (2), multiple dihedral burin (3), laterally retouched blades (4, 10, 17), notched blades (5, 18), burin on transverse truncation (6), atypical carinated endscrapers (7, 15), bladelet (8), dart (9), cores (11, 14, 24), ventrally retouched flake (12), blade with fine retouch (13), flake endscraper (16), blade with basal retouch (19), carinated burin (20), pieces with use-wear (21–23). All Baltic flint except one radiolarite (1), one spongolite (6), two burned pieces (12, 22), and one chalcedony (14)

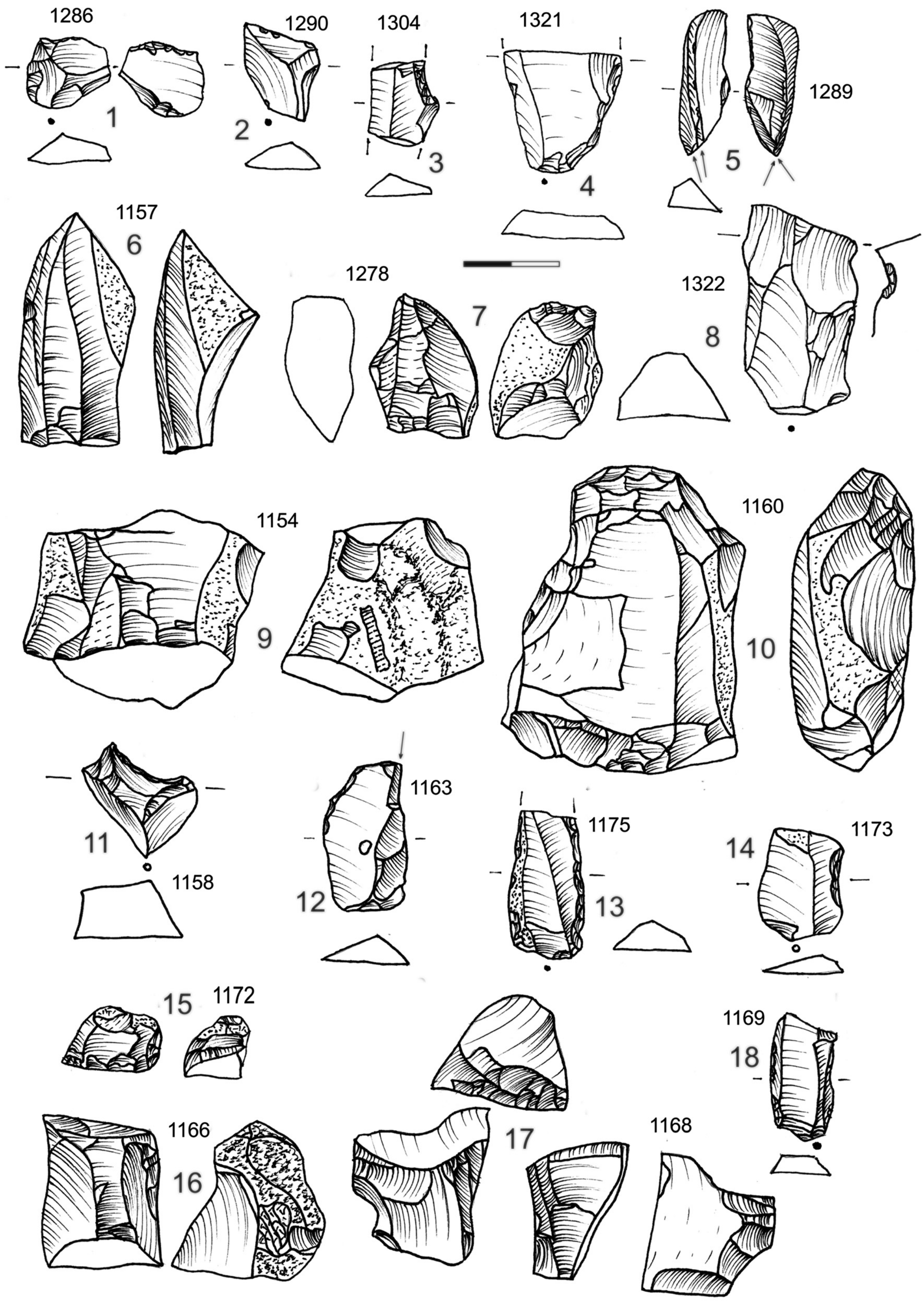

Fig. 6. Salaš 1. Splitter (1), pieces with use-wear (2, 4, 8), notched blades (3, 14), asymmetric dihedral burin (5), cores (6, 7, 9–10, 16–17), notches (11, 17), burin on convex truncation (12), laterally retouched blade (13), core/carinated endscraper (15), blade with fine lateral retouch (18). All Baltic flint except one radiolarite (4) and one Mikuszowice chert (8)

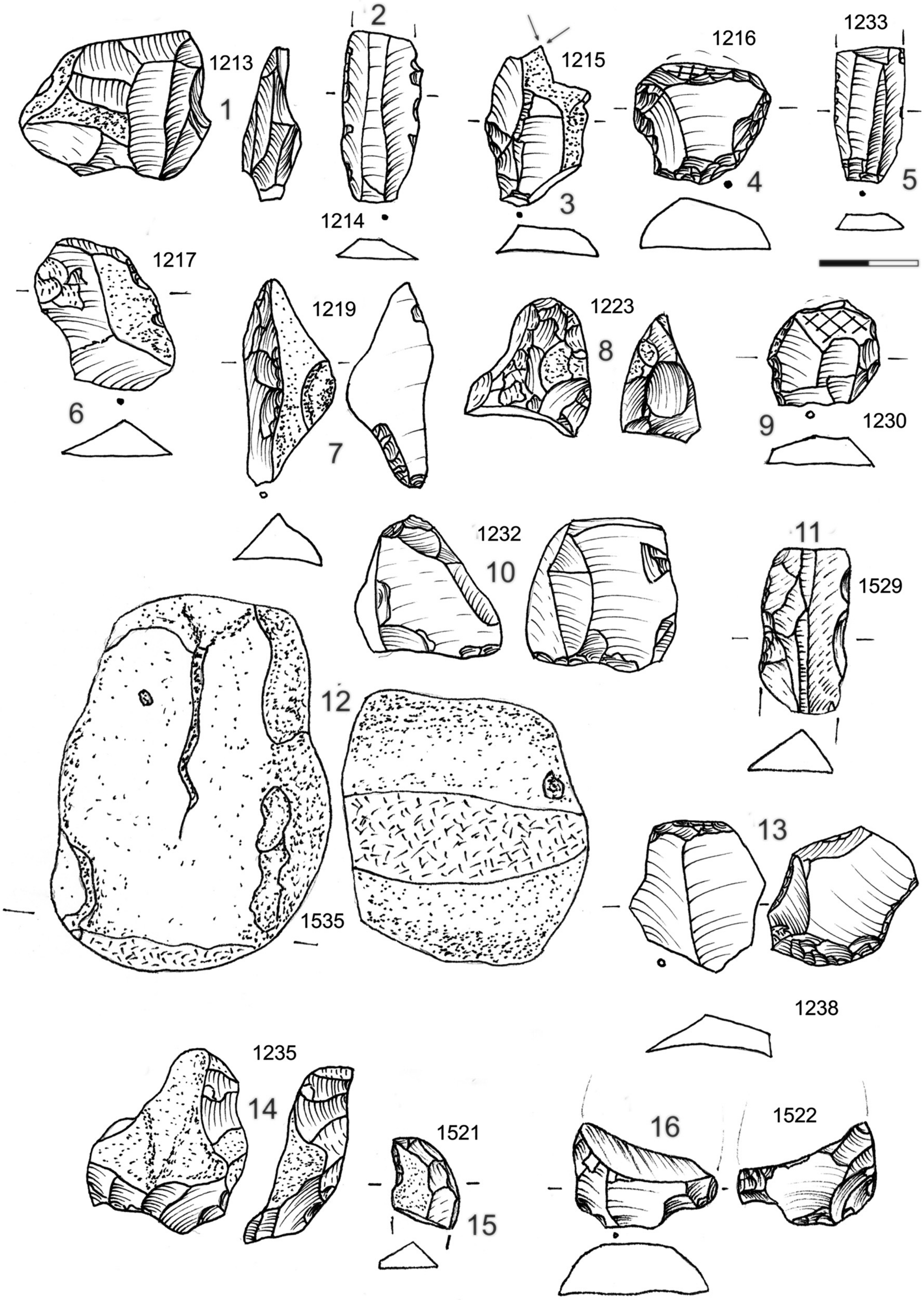

Fig. 7. Salaš 1 (1–10, 12–14) and 4 (11, 15, 16). Cores (1, 8, 10, 14), blade with lateral retouch (2), symmetrical dihedral burin (3), round endscraper (4), pieces with use-wear (5, 6, 11), notched point (7), thumbnail endscraper (9), hammerstone (12), double endscraper (13), atypical borer (15), broken leaf point (16). All Baltic flint except one burned piece (4), two siltstones (11, 12) and one silcrete of "sun-boulder" type (15)

Table 3. Tool types in Salaš 1 and 4 sites according to used materials. TZ – Troubky-Zdislavice chert, Mikch – chert of Mikuszowice type

Salaš 1	**Raw material**									
Tools	**flint**	**burned**	**radiolarite**	**Spongolite**	**TZ**	**Mikch**	**sandstone**	**siltstone**	**Total**	**%**
1 Blade endscraper	1								1	1.4
2 Atypical blade endscraper	2								2	2.9
3 Double endscraper	1								1	1.4
5 Endscraper with lateral retouch	1								1	1.4
8 Flake endscraper	3								3	4.3
9 Round endscraper		1							1	1.4
10 Thumbnail endscraper	4								4	5.7
12 Atypical carinated endscraper	6								6	8.6
Endscrapers total	**18**	**1**							**19**	**27.1**
17 Endscraper-burin	1								1	1.4
Combined tols total	**1**								**1**	**1.4**
23 Borer	1								1	1.4
24 Atypical borer			1						1	1.4
Borers total	**1**		**1**						**2**	**2.9**
27 Dihedral burin, symmetric	3								3	4.3
29 Dihedral burin, asymmetric	2								2	2.9
30 Burin on broken blade	1								1	1.4
30a Burin on natural surface	1								1	1.4
31 Multiple dihedral burin	2				1				3	4.3
32 Carinated burin	3								3	4.3
34 Burin on straight truncation				1					1	1.4
37 Burin on convex truncation	3								3	4.3
38 Transverse burin with lateral retouch	1								1	1.4
41 Multiple burin	2								2	2.9
Burins total	**17**			**1**	**1**				**19**	27.1
46 Large point							1		1	1.4
54 Dart	1								1	1.4
56 Notched point	1								1	1.4
Points total	**2**						**1**		**3**	**4.3**
62 Notched blade	7								7	10.0
65 Blade with lateral retouch	6						1		7	10.0
65a Blade with fine retouch	1								1	1.4
65b Blade with Aurignac-retouch	1								1	1.4
66a Blank with ventral retouch		1						1	2	2.9
67 Blade with basal retouch	1					1			2	2.9
Retouched blades total	**16**	**1**				**1**	**1**	**1**	**20**	**28.6**
71 Leaf point	1								1	1.4
74 Notch	2				1				3	4.3
76e Splitter	1								1	1.4

(continued)

Table 3. Continued

Salaš 1 Tools	**Raw material**									
	flint	**burned**	**radiolarite**	**Spongolite**	**TZ**	**Mikch**	**sandstone**	**siltstone**	**Total**	**%**
"Archaic" tools total	**4**				**1**				**5**	**7.1**
Hammerstone								1	1	1.4
Other tools total								**1**	**1**	**1.4**
Total all	**59**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**70**	100.0
%	**84.3**	**2.9**	**1.4**	**1.4**	**2.9**	**1.4**	**2.9**	**2.9**	100.0	

Salaš 4 Tools	**Rohstoff**			
	flint	**silcrete**	**Total**	**%**
8 Flake endscraper	3		3	12.0
9 Round endscraper	1		1	4.0
10 Thumbnail endscraper	1		1	4.0
11 Carinated endscraper	2		2	8.0
15 Core endscraper	1		1	4.0
Endscrapers total	**8**		**8**	**32.0**
23 Borer	1		1	4.0
24 Atypical borer	1	1	2	8.0
Borers total	**2**	**1**	**3**	**12.0**
29 Dihedral burin, asymmetric	2		2	8.0
30a Burin on natural surface	1		1	4.0
Burins total	**3**		**3**	**12.0**
60 Flake with straight transverse retouch	1		1	4.0
65 Blade with lateral retouch	3		3	12.0
65a Blade with fine retouch	1		1	4.0
66 Blade with bilateral retouch	1		1	4.0
Retouched blades total	**6**		**6**	**24.0**
71 Leaf point	1		1	4.0
77 Sidescraper	3		3	12.0
"Archaic" tools total	**4**		**4**	**16.0**
86 Bladelet with transverse retouch	1		1	4.0
Microtools total	**1**		**1**	**4.0**
Total all	**24**	**1**	**25**	100.0
%	**96**	**4**	100	

preparation phase) which reflect the import of unworked material to the site.

Cores and their reduction strategies

There are 14 cores in the assemblage, though these are mostly represented as fragments (7 pcs.; Fig. 8.12) or remains (three pcs.; Figs 8.5; 9.19,22). Cores in the preparation phase number three pieces; there is also one pre-core, while reduction-phase cores are absent. Given the fragmentary nature of the cores, only five pieces can be classified as prismatic (Figs 8.5,16; 9.22), three are flat, due to their advanced reduction, and six pieces are beyond reliable classification as regards shape. In general, though, an original prismatic shape of the cores can be assumed while single-platform reduction was preferred (7 pcs.; Figs 8.5,16; 9.22); the striking platform is not preserved in more than half of the pieces, however. The length of cores (Table 6) can be compared with blades in the preparation phase where it turns out they are exactly equal though their amounts are

Table 4. Technology of core reduction in the Salaš 1 and 4 sites

Salaš 1	Cores	Raw material				
		flint	chalcedony	Baška	Total	%
Prismatic	without str. platform			1	**1**	**3.2**
	1-str. platform	18	1		**19**	**61.3**
	2-str. platforms	3			**3**	**9.7**
	Changed orientation	4			**4**	**12.9**
Not defined		4			**4**	**12.9**
	Total	**29**	**1**	**1**	**31**	100.0
	%	**93.5**	**3.2**	**3.2**	100.0	
Salaš 4	**Cores**	**Raw material**				
		Flint	**Burned**	**Coral**	**Total**	**%**
Prismatic						
	1-str. platform	6	1		**7**	**50**
Not defined		5		2	**7**	**50**
	Total	**11**	**1**	**2**	**14**	100
	%	**78.6**	**7.1**	**14.3**	100.0	

scarce. It is also evident that rather small nodules were picked up by local stone-knappers as even the largest preparation-phase core measures only 4.7 cm in length. The overall mean length of all cores is 2.67 cm.

Before the core reduction took place, the striking platforms were mostly prepared by one blow, reflected in the plain butts of the blanks (63 pcs., 48.1%; Table 5), but also numerous are punctiform (27 pcs.; 20.6%) and cortical (16 pcs.; 12.2%) butts whereas dihedral butts are rare (2 pcs.; 3.8%), facetted butts are absent, and 20 butts are broken (15.3%). In other aspects, core preparation did not take place at all (6 cases; Figs 8.6,16; 9.22), or if it did, this is no longer visible due to advanced core exploitation (8 pieces).

Tools

Salaš 1. Among typologically classified tools, the most numerous in Salaš 1 site are variously retouched blades and flakes (20 pcs.; 28.6%). Notched blades or flakes (Figs 5.5,18; 10.2; 11.9,15) and blanks with lateral retouch (Figs 4.5; 5.4,10,13,17; 6.13,18; 7.2; 11.2) number seven pieces each. Much rarer (two pieces each) are blanks with basal (Fig. 5.19) or ventral retouch (Figs 5.12; 10.4), unique are blanks with fine lateral retouch and abrupt Aurignacian retouch. Apart from erratic flints (16 pcs.), retouched blanks were also manufactured from Mikuszowice chert, sandstone, siltstone, and burned material (one piece each).

Equally numerous are endscrapers and burins (19 pcs. each; 27.1% among tools). The endscrapers are mostly undistinctive carinated types (six pcs.; Figs 4.6,10; 5.7,15; 6.15; 11.11); tiny thumbnail endscrapers (four pcs.; Figs 4.7; 7.9; 8.7; 11.16) and simple flake endscrapers (three pcs.; Figs 4.3; 5.16; 11.3) are also numerous. Undistinctive blade endscrapers (Figs 8.4; 10.1) appeared twice while an end-scraper applied on the ventral side of a blade (Fig. 11.4), a double endscraper (Fig. 7.13), an endscraper with lateral Aurignacian retouch (Fig. 11.14), and a round endscraper (Fig. 7.4) all appeared once. All but one endscraper, made on a burned piece, were made of erratic flints.

Burins (19 ks; 27.1%) are quite variable, the most numerous being dihedral burins (Figs 4.8; 6.5; 7.3; 10.23), sometimes multiple (Figs 4.4; 5.3; 10.21), accompanied by a burin on a broken blade (Fig. 10.22) or on a natural platform (Fig. 10.25; 9 pcs. in total). Burins on truncations appeared six times (Figs 5.6; 6.12; 10.16, 24), the rest were carinated (three pieces; Figs 5.20; 10.17,26), multiple (two pieces; Figs 8.1; 10.19), and transverse burins (Fig. 10.20; 1 piece each). Most burins were made of flints (17 pcs.); one piece each was made of spongolite and (probably) Troubky-Zdislavice chert.

Tools which are usually found in Early Upper Palaeolithic industries or in the Middle Palaeolithic (five pieces; 7.1%) follow. These are one probable broken leaf point (Fig. 5.2), three notches (Figs 6.11,17; 8.2), and one splitter (Fig. 6.1). One notch was made on Troubky-Zdislavice chert, the rest come from flints. Rare are different types of points

Table 5. Butt types on blanks from the Salaš 1 and 4 sites. 0 – not prepared, 1 – plain, 2 – two or more blows, punct. – punctiform

Salaš 1 Butts	0	1	2	facetted	punct.	broken	Total	%
Preparation								
Blades	1	2		3	4		**10**	**4.1**
Flakes	9	41		2	3	7	**62**	**25.7**
Reduction								
Blades	1	13	4	3	17	3	**41**	**17.0**
Flakes	1	13	4	3	17	3	**41**	**17.0**
Reparation								
Blades						1	**1**	**0.4**
Flakes	2	20		2	8	3	**35**	**14.5**
Debris								
Blades					1		**1**	**0.4**
Flakes	2	19	2		23	4	**50**	**20.7**
Total	**16**	**108**	**10**	**13**	**73**	**21**	**241**	100.0
%	**6.6**	**44.8**	**4.1**	**5.4**	**30.3**	**8.7**	100.0	
Salaš 4 Butts	**0**	**1**	**2**	**facetted**	**punct.**	**broken**	**Total**	**%**
Preparation								
Blades		2			1		**3**	**2.3**
Flakes	7	24	2		7	8	**48**	**36.6**
Reduction								
Blades	1	4			1	2	**8**	**6.1**
Flakes	2	13			3	5	**23**	**17.6**
Reparation								
Blades					1		**1**	**0.8**
Flakes	4	9			2	3	**18**	**13.7**
Debris								
Blades							**0**	**0.0**
Flakes	2	11	3		12	2	**30**	**22.9**
Total	**16**	**63**	**5**	**0**	**27**	**20**	**131**	100.0
%	**12.2**	**48.1**	**3.8**	**0.0**	**20.6**	**15.3**	**100.0**	

(three pcs.; 4.3%); one of these is quite large (Fig. 3h; 4.2) and made of Cretaceous sandstone with glauconite. Erratic flint was used for the manufacture of a dart (Fig. 5.9) and a point with an undistinctive notch (Fig. 7.7).

Borers are quite rare (two pcs.; 2.8%; Fig. 4.14); one piece, made of radiolarite, is rather undistinctive (Fig. 5.1). The combination of burin-endscraper, made of flint, and a hammerstone made of siltstone (Fig. 7.12) appeared once (1.4%).

Salaš 4. Tools from Salaš 4 site are less numerous, even percentage wise. Among the classified types, endscrapers predominate (8 pieces; 32% among tools; Table 3). Most frequent (3 pc.) are undistinctive flake endscrapers (Figs 8.18; 9.8,16); undistinctive carinated endscrapers (2 pcs; Figs 8.11; 9.10) follow. The remaining types are rare: one round (Fig. 9.9), one thumbnail (Fig. 9.11), and one core end-scraper (Fig. 9.19). All are made of erratic flint.

The second most numerous are retouched blades and flakes (6 pcs.; 24%), where the most common types are those with lateral retouch (3 pcs.; Figs 8.15; 9.15,20,23 – the last a serrated flake). Less frequent are flakes with transverse retouch (Figs 9.21), blades with fine lateral (Fig. 9.18), or those with bilateral (Fig. 9.17) retouch (1 pc. Each). All

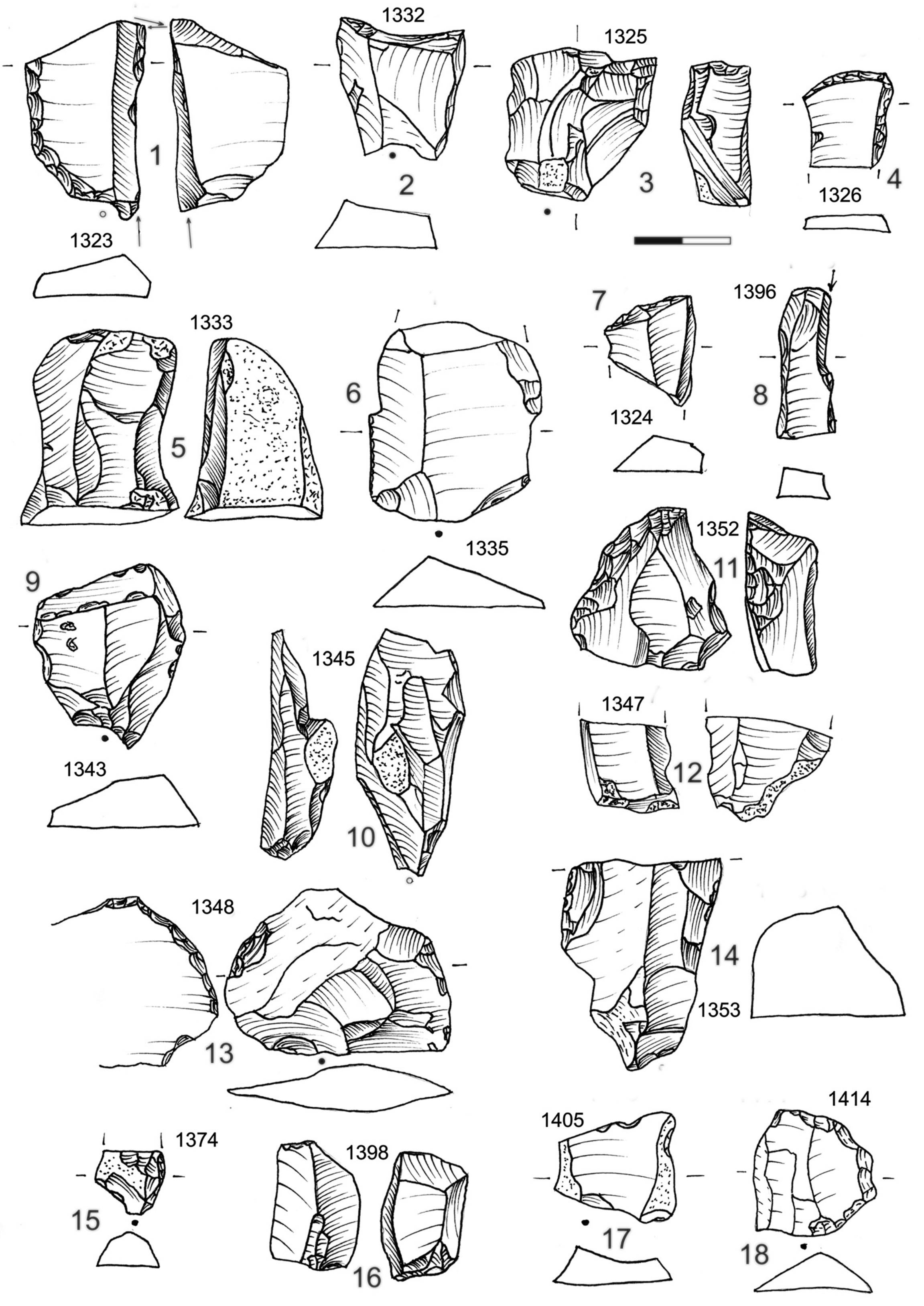

Fig. 8. Salaš 1 (1–4, 7) and 4 (5, 6, 8–18). Multiple burin (1), notch (2), repaired reduction face (3), atypical blade endscraper (4), cores (5, 12, 16), pieces with use-wear (6, 9, 14, 17), thumbnail endscraper (7), burin on natural platform (8), atypical borer (10), carinated endscraper (11), sidescraper (13), laterally retouched flake (15), flake endscraper (18). All Baltic flint except two cherts of Troubky-Zdislavice type (1, 2), one burned piece (5) and one silicified coral (12)

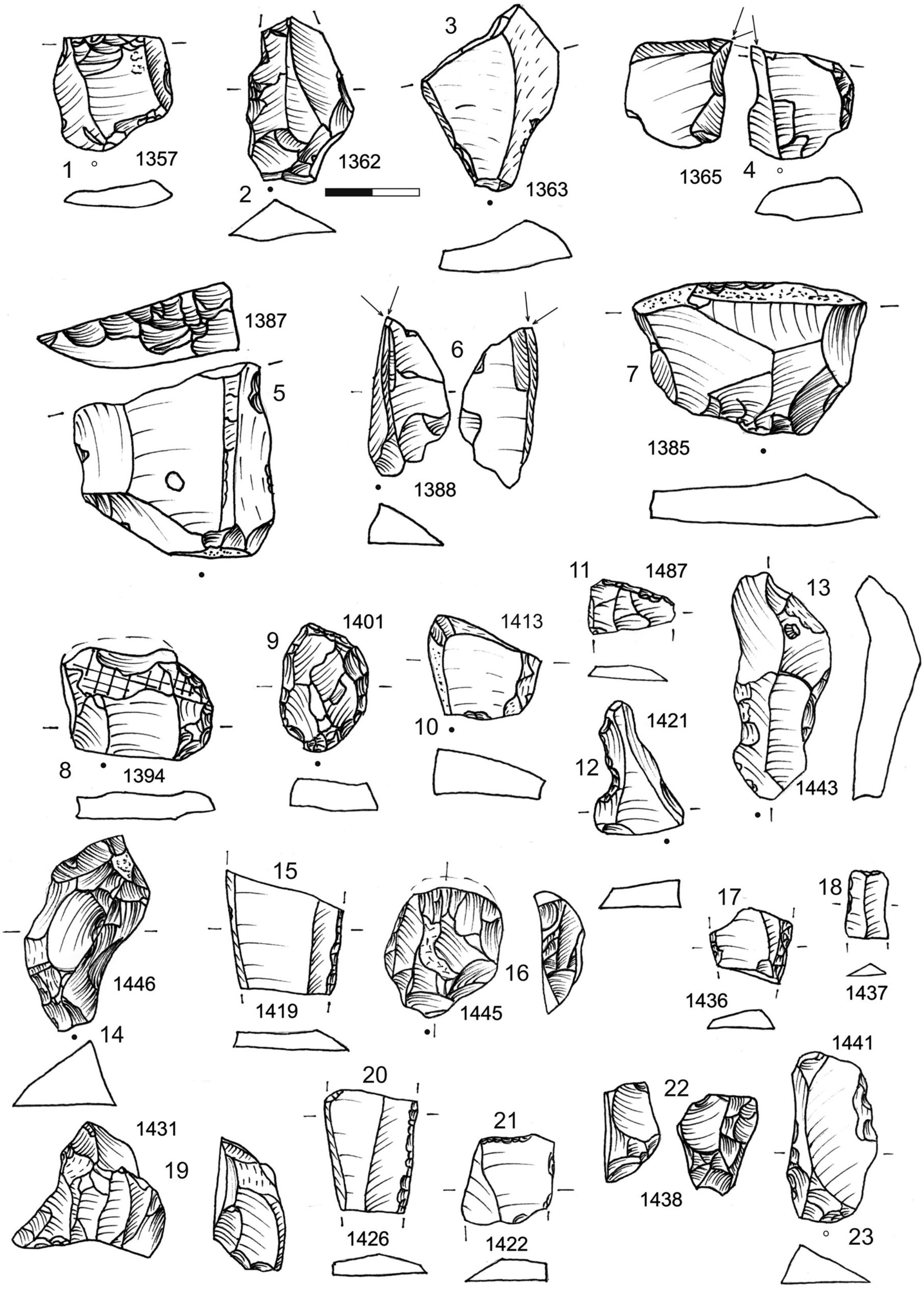

Fig. 9. Salaš 4. Pieces with use-wear (1–3), asymmetrical dihedral burin (4, 6), sidescraper (5, 7), flake endscraper (8, 16), round endscraper (9), atypical carinated endscraper (10), thumbnail endscraper (11), borer (12), blade with a fossil (13), secondary trimming flake (14), laterally retouched blades (15, 20, 23), blade with bilateral retouch (17), bladelet with transverse truncation (18), cores (19, 22), blade with transverse truncation (21). All Baltic flint

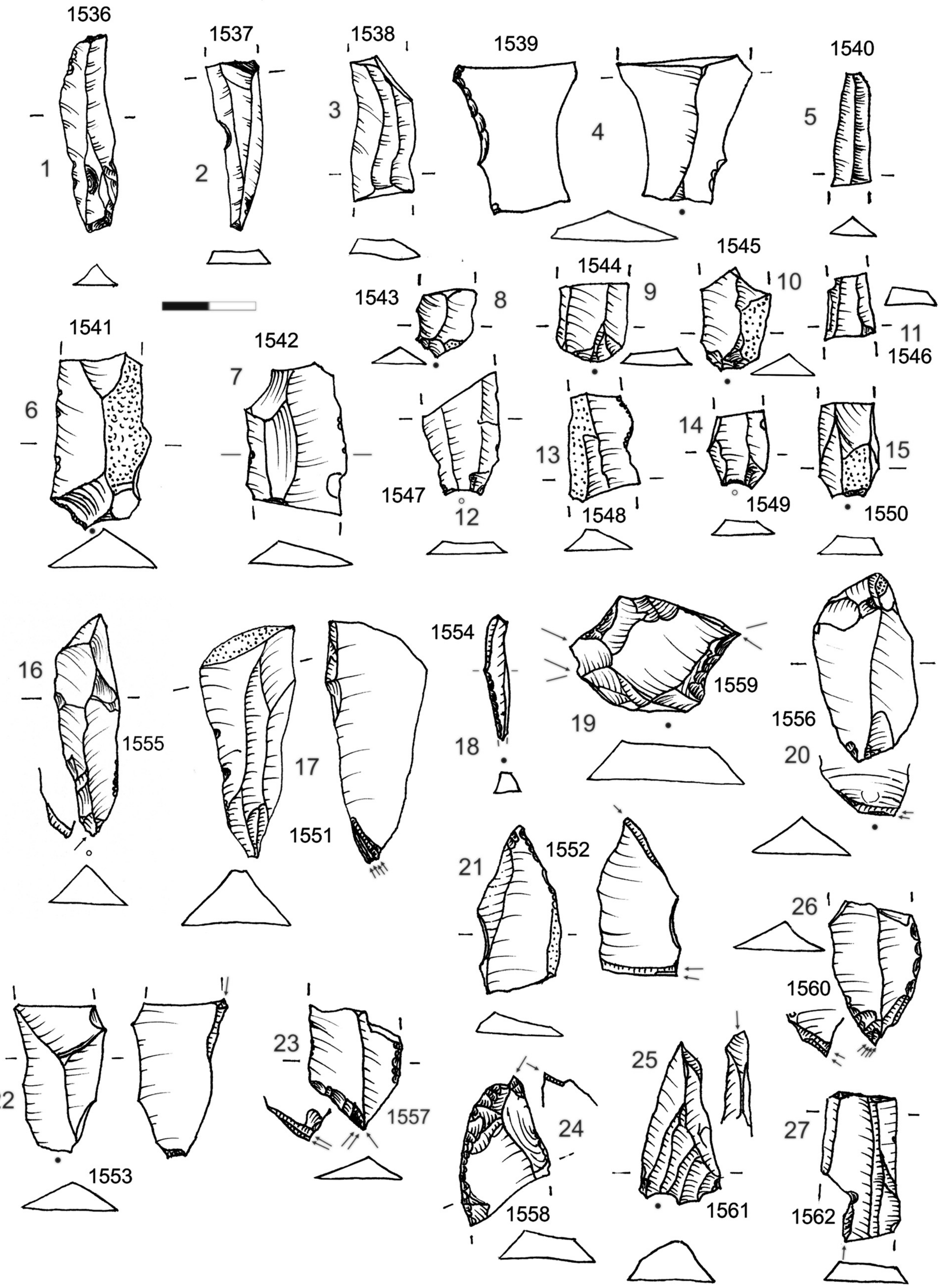

Fig. 10. Salaš 1. Atypical blade endscraper (1), notched blade (2), pieces with use-wear (3, 6, 7, 13), ventrally retouched flake (4), bladelet (5), chip (8), blades (9–14, 15), burins on convex truncation (16, 24), carinated burins (17, 26), burin spall (18), multiple burins (19, 21), laterally retouched transverse burin (20), burin on broken blade (22), symmetric dihedral burin (23, 26), burin on natural platform (25), burin-endscraper (27). All Baltic flint except one siltstone (4)

Table 6. Length of cores and blades from Salaš 1 and 4 sites. Values with and without broken pieces are shown

Salaš 1	Length of artefacts (unbroken pieces, in cm)							
	Cores			Pieces	Blades			Pieces
	Min.	Medium	Max.		Min.	Medium	Max.	
Raw material	4.73	4.73	4.73	1				1
Preparation	2.6	4.1	6.5	4	4.26	4.5	4.8	3
Reduction	2.9	3.6	4.3	2	2.6	4.2	8.5	7
Reparation					3.5	3.5	3.5	1
Debris	1.22	3.1	4.74	21				
Salaš 1	**Length of artefacts (all pieces, in cm)**							
	Cores			Pieces	Blades			Pieces
	Min.	Medium	Max.		Min.	Medium	Max.	
Raw material	4.73	4.73	4.73	1				
Preparation	2.6	4.1	6.5	4	1.33	2.8	4.8	18
Reduction	2.9	3.6	4.3	2	0.87	2.46	8.51	69
Reparation					3.46	3.46	3.46	1
Debris	1.22	3.1	4.74	24	1.07	1.4	1.74	4
Salaš 4	**Length of artefacts (unbroken pieces, in cm)**							
	Cores			Pieces	Blades			Pieces
	Min.	Medium	Max.		Min.	Medium	Max.	
Raw material	2.1	2.1	2.1	1				
Preparation	2.5	3.5	4.7	3	2.6	3.5	4.8	3
Reduction					2	2.5	3	2
Reparation					2	2	2	1
Debris	1.9	2.9	3.9	3				
Salaš 4	**Length of artefacts (all pieces, in cm)**							
	Cores			Pieces	Blades			Pieces
	Min.	Medium	Max.		Min.	Medium	Max.	
Raw material	2.1	2.1	2.1	1				
Preparation	2.5	3.5	4.7	3	2.1	3.2	4.8	4
Reduction					1.1	2.1	3.5	20
Reparation					2	2	2	1
Debris	1.51	2.5	3.9	10	0.9	0.9	0.9	1

retouched blades are made of erratic flint. So-called "archaic" tools follow (4 pcs.; 16%), concretely, three side-scrapers (Figs 8.13; 9.5,7) and one broken point with flat retouch (Fig. 7.16), all made of flint.

There were also three borers (12%), one typical (Fig. 9.12) and two atypical (Figs 7.15; 8.10), one being made of the Tertiary "sun boulder". Burins are represented by two dihedral exemplars (Fig. 9.4,6) and one burin on natural surface (Fig. 8.8), all made of flint. The last tool is a flint bladelet with transverse retouch (Fig. 9.18).

Visualization and interpretation of PCA

In the PCA, the quality of representation of the first two components (Dim1 and Dim2; Fig. 12) is defined by the function *cos2*, i.e., the dots (sites) situated close to the centre of each plot are characterized by variables which are not perfectly represented by the principal components. In other words, no variable that defines them (Table 7) puts them outside of a typical Aurignacian assemblage or Aurignacian landscape. The sites situated far from the centre (violet and red colour in Fig. 12A, D), on the other hand, are atypical in

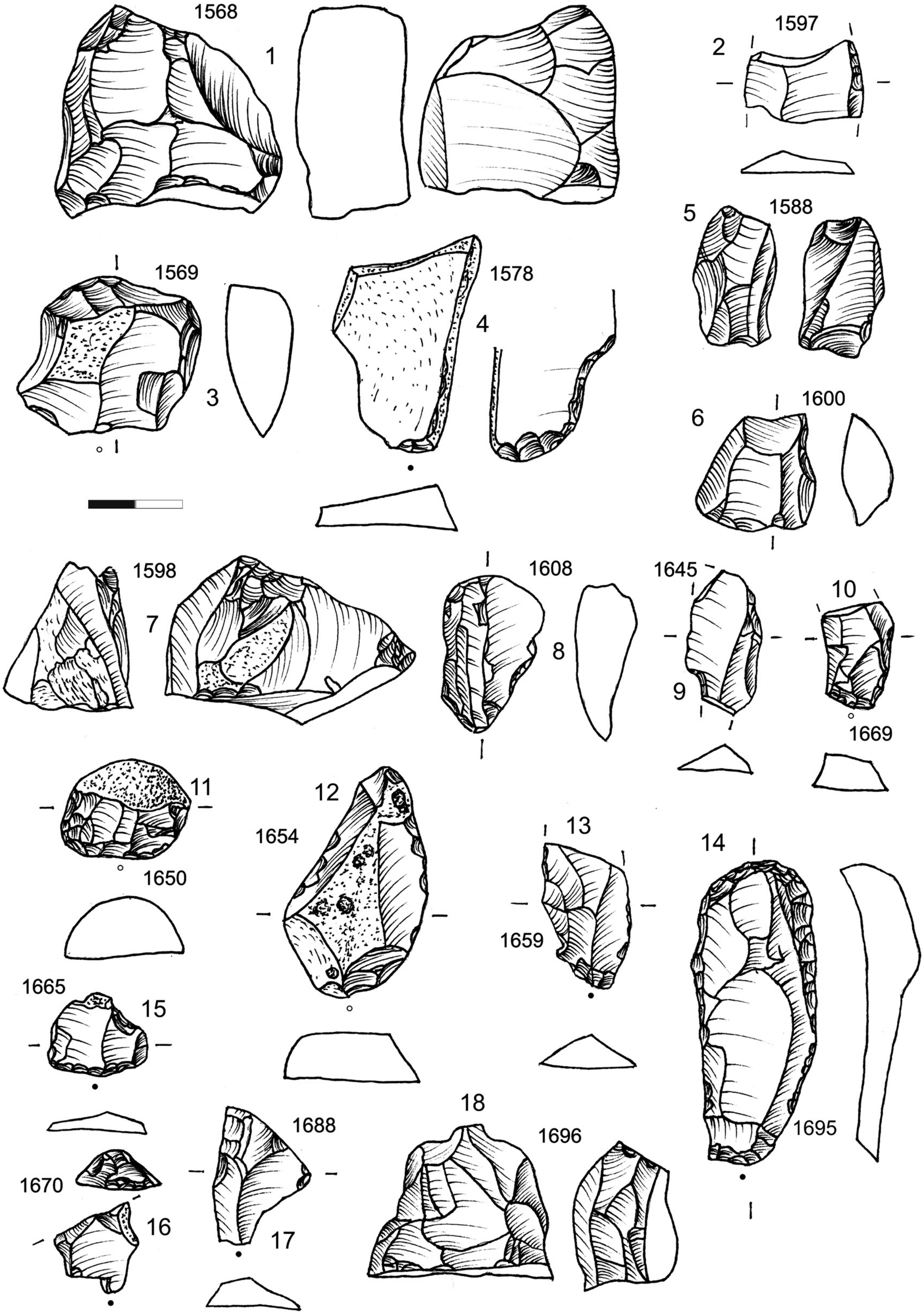

Fig. 11. Salaš 1. Cores (1, 5–8, 18), laterally retouched blade (2), flake endscraper (3), blade endscraper (4), notched blades (9, 15), pieces with use-wear (10, 12, 13), atypical carinated endscraper (11), thumbnail endscraper (16), flake (17), blade endscraper with lateral retouch (14). All Baltic flint

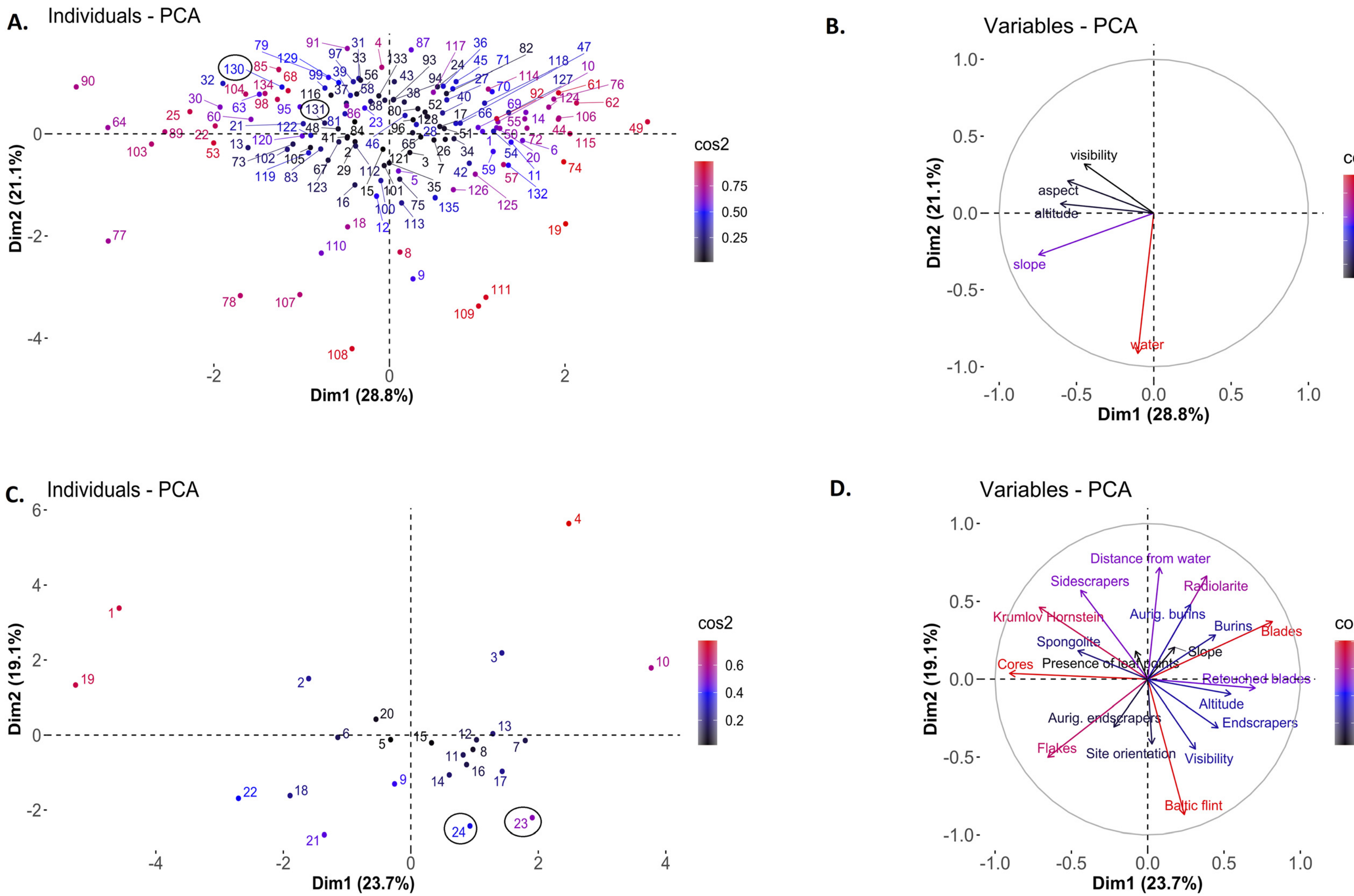

Fig. 12. PCA of selected Aurignacian sites in Moravia when topography for 135 sites (A., B.), and techno-typology and topography for 24 sites (C., D.) are taken into account. cos2, the quality of representation of the variables on factor map. High cos2 indicates a good representation of the variable, i.e., the variable is positioned far from the centre (or close to the circumference of the correlation circle). Low cos2 indicates that the variable is not perfectly represented by the PCs. In this case the variable is close to the centre of the circle. Contrib, the contribution of a variable to a given principal component (in percentage)

Table 7. Characteristics of selected Moravian Aurignacian sites used for PCA (Fig. 12C, D)

	Site	% Baltic flint	% Krumlov chert	Spongolite	% Radiolarite	% Blades	% Flakes	% Cores	% Endscrapers	% Aurig. endscrapers	% Burins	% Aurig. burins	% Retouched blades	% Sidescrapers	Presence of leaf points	Distance from water [m]	Altitude [a.s.l.]	Slope [°]	Site orientation [°]	Visibility [km2]
1	Vedrovice II	3	95	0	0	24	50	26	6.1	3.1	19.4	5.3	3.1	22.9	0	1970	245	9.95	43.15	13.11
2	Brno-Maloměřice. Občiny	16.5	20.9	0	3.2	44.9	33.3	11.1	14.8	8.7	17.4	0.9	13.4	45.2	0	90	260	6.81	45.34	23.74
3	Brno-Kohoutovice	49	5	5	1	64	32	4	8	3	35.5	10.5	9.5	3	1	2240	400	2.03	133.85	18.40
4	Tvarožná	14	1	1	83	74	22	4	10.7	2.1	32	13.6	13.6	35.5	1	1722	360	12.14	18.86	26.45
5	Brodek I	52	3	4	12	55	37	8	18.7	8	20	0	9.3	8	0	510	270	3.33	234.81	12.99
6	(Dolní) Otaslavice I	47	3	8	4	45	45	10	10.2	8	26.1	2.3	8	14.8	0	305	306	3.35	285.34	19.53
7	Určice	87	3	2	2	60	37	3	4.5	1.6	50.3	7.8	11.4	5.2	1	430	330	11.06	354.57	87.05
8	Slatinice I	89	1	1	1	52	39	9	7.4	11.7	33.6	14.2	11.7	3.1	0	350	316	7.71	106.96	86.69
9	Milovice (Kroměříž)	79	0	1	2	47	40	13	16	14.7	12.3	1.3	12.7	8.3	0	370	335	5.98	215.28	32.11
10	Věžky	21	0	0	22	91	9	0	25.7	2.7	21.6	0	32.4	0	0	800	328	14.11	7.78	11.33
11	Kvasice	77	0	1	8	62	30	8	20.4	8.2	18.1	0.4	14.2	6.2	0	490	299	4.04	52.48	43.18
12	Kvasice II	78	0	1	8	60	33	7	14.2	5.7	24.2	1.4	19	6.2	1	440	285	8.79	1.67	73.60
13	Karolín I	64	0	0	15	61	32	7	12.8	6.9	26.1	10.3	12.3	5.4	0	225	316	8.30	339.33	32.76
14	Bělov I	80	0	1	2	54	42	4	18.3	7.5	14	0.3	16.9	8.9	0	350	297	13.20	296.18	14.57
15	Nová Dědina I	61	0	1	14	59	33	8	13.9	16.3	18	0	18.2	4.8	1	455	291	4.34	215.89	10.38
16	Nová Dědina II	80	0	0	6	66	29	5	14.4	11.7	16.2	0.4	18.7	7	1	210	310	0.99	259.99	8.65
17	Žlutava I	79	0	0	10	63	28	9	14.9	19.9	13.5	0	30.5	5	0	515	325	11.82	314.61	28.40
18	Lhotka	83	0	2	1	36	48	16	9	45.5	12.7	2	1.6	2.4	0	295	330	6.00	27.78	12.99
19	Diváky	20	59	15	3	22	58	20	8.2	16.5	11.3	0	6.2	25.8	1	206	235	12.88	185.65	2.12
20	Klobouky u Brna	60	25	5	7	51	45	4	14	6.6	20.7	0.8	16.5	15.7	1	1050	290	1.80	269.09	22.34
21	Stachovice1	96	0	0	0	15.9	70.8	13.3	16.8	4.9	27.4	1.8	0	7.9	1	115	320	4.64	279.93	99.24
22	Stachovice2	95.8	0	0	0	12.5	70.8	16.7	0	0	8.3	0	0	12.5	1	280	365	4.21	161.81	22.56
23	Salaš 1	84.3	0	1.4	0	42.9	52.9	4.3	27.1	8.6	27.1	2.9	28.6	0	0	290	330	11.43	177.45	110.97
24	Salaš 4	96	0	0	0	32	60	4	32	8	12	0	24	12	0	550	330	10.72	131.14	88.42

at least one variable, most likely the distance from the nearest water course or slope inclination (Fig. 12B) as these two answer for a large variability within the sample. As regards position in the landscape (Fig. 12A), Salaš 1 is less typical than Salaš 4 (nos. 130 and 131 respectively) among Moravian Aurignacian sites, but both are situated relatively close to the centre of the plot. It has to be stressed, though, that the amount of variation retained by each principal component is low (28.8% and 21.1% for each dimension respectively) so that some important topographical characteristics are not taken into account in our plot (Fig. 12B). Both Salaš 1 and 4 sites are among the twenty best Moravian Aurignacian sites as regards the control of surrounding landscape (visibility) and Salaš 1 is also favourable as regards the proximity of a freshwater source (place 34 from the 135 samples) whereas Salaš 4 is mediocre in this regard (place 86).

When only techno-typological variables are used (Fig. 12C, D), Salaš 4 site (no. 24) is somewhat more similar to other analysed Aurignacian sites than Salaš 1 (no. 23), but neither is too typical. The reason is probably the intensive exploitation of erratic flints and almost complete absence of Aurignacian burins (Fig. 12D) on the two sites. Again, the variation retained by the first two components is low (23.7% and 19.1% respectively) so that the results have to be taken with care, the more so that sites of variable (Aurignacian) chronology are analysed here. The low number of sites included in the analysis also puts certain sites far from the centre of the plot due to their intensive exploitation of Krumlov chert (Vedrovice II or Diváky, nos. 1 and 19), but in the broader view, this is typical for sites of SW Moravia. Leaf points do not cause much variability (low contrib. in Fig. 12D) within the sample and are probably not too exclusive with any typo-technological or topological criterion (Fig. 12D). As it stands, the variables most responsible for differantiating Moravian Aurignacian assemblages (with the objections mentioned above) are the predominantly used material and the number of blades and cores (Fig. 12D, in red). Slightly less important are the amounts of sidecsrapers, retouched blades, and the distance of the sites from freshwater (Fig. 12D, in violet) etc.

DISCUSSION

The raw supply of the two sites answers to the model of low diversity and low mobility of hunter-gatherer groups.[42] Only local flint was significantly represented in all technological phases in Salaš 1 whereas the raw materials from the hilly landscape SE of the site were imported already modified, and about one third of them comes from the core reduction phase. The location of sites on the border of low- and highlands is typical for the Moravian Aurignacian (Fig. 13), especially the sites along the Morava River.[43] Some materials used at Salaš 1 had not, so far, been recognized in Moravian Aurignacian industries, namely the Mikuszowice and Baška cherts, and silicified coral. As regards the Moravian Gate, however, these are simply the most available raw materials, along with erratic flints. Contrarily, the radiolarites or (probable) cherts of Troubky-Zdislavice type are quite typical in Moravian assemblages of the Aurignacian.[44] These two materials reflect medium-distance contacts and, together with other raw materials, indicate that Salaš 1 was probably occupied repetitively.[45] The materials brought to the site were modified and used intensively for a range of activities, and also the high percentage of tools (20.4%) speaks for a utilitarian hunter-gatherer site. The abundant cores (9.0%) do not contradict this as most are quite exploited and of small dimensions. The rather intensive core exploitation occurred despite the proximity of glacial sediments with erratic flints, and reparation products (12%) are also abundant.

The reduction process aimed at obtaining blades, bladelets (Fig. 5.8; 10.5), and blade flakes, but the process was not standardized, and minimal core preparation was applied, likely due to the easily available raw material (i.e., erratic flints). Single-platform cores, predominant in a number of Central European Upper Palaeolithic industries, e.g., the Aurignacian, Late Gravettian, Epigravettian, or Magdalenian,[46] also predominate on the Salaš 1 site. Their prismatic shape is sometimes preserved even in later reduction stages (Fig. 4.12,13) when they somewhat resemble exemplars of the Kašovian, defined by Svoboda and Novák,[47] or cores of the Epigravettian phase Stránská skála IV as defined by Škrdla et al.[48] Back crests, which are common on the cores of the Moravian Aurignacian, are rare at Salaš 1, reflecting a simplified reduction process which made use of both hard and soft hammers (both thick plain and punctiform butts are present). Plain butts are common, e.g., in the early Aurignacian of Moravia, but also in the Evolved Aurignacian from around the Morava River, and in the Central European Epigravettian.[49] Frequent core reparations are observable throughout the Moravian Upper Palaeolithic, perhaps with the exception of the Pavlovian.[50]

Tools from the Salaš 1 site were applied on all kinds of blanks, within all operational phases. Culturally specific are carinated (Aurignacian) burins (best represented by Fig. 10.17,26), carinated endscrapers (especially Fig. 4.12) and an endscraper with lateral abrupt retouch (Fig. 11.14). Though some variants of multiple burins (Fig. 5.20; 10.19) resemble the types described from the Epiaurignacian/Kašovian of Opava-Kylešovice,[51] this is probably caused,

[42] Blades (2002) 178.

[43] Oliva (2016) 62.

[44] Oliva (1987) 26; Přichystal (2013) 89.

[45] Glauberman (2016).

[46] Svoboda et al. (2002), 159; Neruda and Kostrhun (2002) 111; Oliva (2005) 45; Wilczyński (2015) 204; Lengyel (2018).

[47] Svoboda and Novák (2004) 475.

[48] Škrdla et al. (2014).

[49] Oliva (1984) 605; Oliva (2016) 53; Wiśniewski et al. (2012) 398; Nerudová and Moník (2019) Tab. 1.

[50] Oliva (2016), 68, 86.

[51] Svoboda and Novák (2004) Figs. 10, 11.

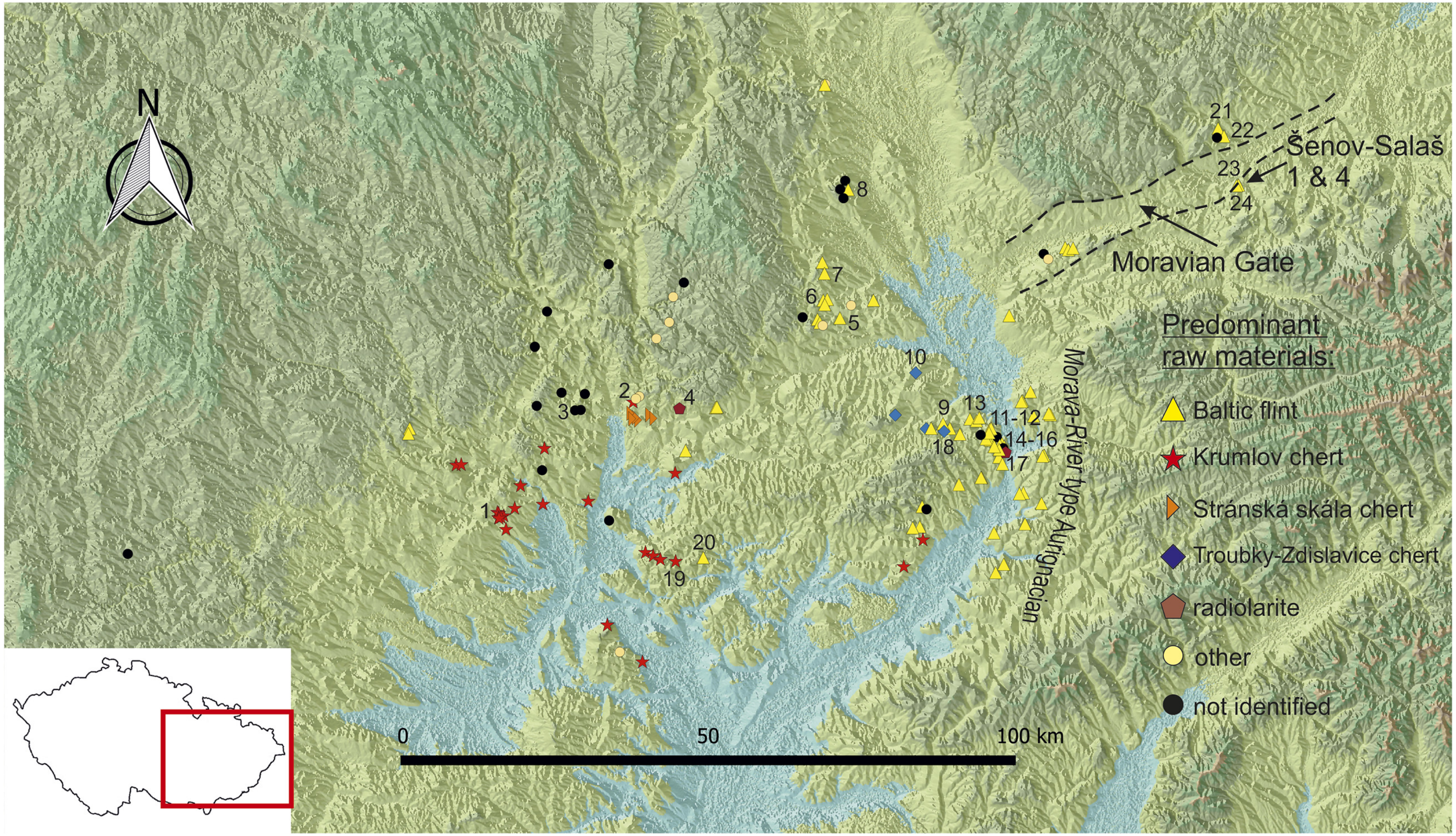

Fig. 13. Aurignacian map of Moravia with predominant raw materials and the approximate position of the Morava-River type Aurignacian and the Moravian Gate. The sites analysed statistically as regards techno-typology (Fig. 12C., D.) are numbered according to Table 7

again, by the small dimensions of available flint nodules. The fragmentary (possible) leaf points (Figs 5.2; 7.16) are probably not chronologically sensitive, and appear in both Aurignacian, Epiaurignacian, and other Upper Palaeolithic sites of Moravia. Lastly, there is the large point (Figs 4.2), similar to the Aurignacian type from Brno-Židenice-Podstránská,[52] which is not too distinctive either.

Simple reduction technology and tool typology may indicate Evolved Aurignacian dating of Salaš 1 whereas the absence of backed blades speaks against its estimation as Gravettian or Epigravettian. Thumbnail endscrapers do not contradict this estimation as they were evidenced on Evolved Aurignacian (based on tool typology) sites at Nová Dědina I or Tvarožná.[53] Analogies for borers from Salaš 1 can be traced in the Aurignacian assemblage from Kvasice[54] whereas notches find analogies at Brno-Maloměříce-Borky II[55]– here defined as borer). These were likely used for the sharpening of wooden hafts.

The absence of sidescrapers, few distinctive tools and small dimensions make the industry from Salaš 1 similar to some Evolved Aurignacian assemblages of Moravia.[56] This cannot be confused, though, with the EASMM (Epi-Aurignacian with Sagaidak-Muralovka-type microliths) Epiaurignacian sites with microlithic points, recently defined by Demidenko et al.[57] and dated at 25, 500–23, 000 cal BP, as we miss such points at Salaš 1. Neither the endscrapers, nor the carinated burins from Salaš 1 seem to have served as microblade cores (see Bataille and Conard[58] for the problematic) as the negatives on these tools are either too irregular (Fig. 4.12) or too small (Figs 4.6,10; 8.11; 10.17,26) to be a result of the production of usable microblades. Although tiny microliths (which also appear in the Evolved Aurignacian) may have been overlooked during the field-walking prospection, other traits typical for the EASMM Epiaurignacian are also absent, namely backed bladelets, and transverse burins on lateral retouch.[59] The average size of cores at Salaš 1, is somewhat higher than, e.g., in most Late Palaeolithic Moravian assemblages,[60] (smaller than at the Hranice III-Velká Kobylanka Magdalenian site (4.8 cm for unipolar cores[61]), and comparable in size to the cores from the Pekárna Magdalenian site (3.35 cm[62] and data granted by S. Voláková to the authors) which are, however, undoubtedly influenced by the greater geographical distance of Pekárna Cave from occurrences of erratic flints. Especially striking is the size difference from Epigravettian and Magdalenian cores from Sowin 7 in SW Poland (6.8 and 9.9 cm in length respectively[63]), also located on occurrences of erratic flints. The reason for such a small size of cores at Salaš 1 (and 4) is probably, and paradoxically, the proximity of the occurrences of erratics below the site as, at these latitudes, nodules of erratic flints are of generally small dimensions.[64] The size of chipped stone artefacts, unfortunately, could not be introduced in our statistical analysis (Fig. 12C, D) as few authors have published the metrics of artefacts in their analyses so far so no data were available for comparison.

The assemblage from Salaš 4 is more of a workshop character due to a higher preparation/reduction phase ratio. Reduction-phase flakes predominate here over blades and other raw materials than flint are represented among the preparation phase and the debris. The absence of cores from the reduction-phase, and the presence of generally shorter blades (Table 5) implies again, an economic concept of raw material exploitation. Plain and prominent butts probably indicate preferential use of hard percussors on the site. The absence of facetted butts, and the predominating flakes, is characteristic for some Evolved Aurignacian sites in southern, and eastern Moravia[65] though, e.g., the assemblage from Lhotka at Kroměříž,[66] where the generally small-sized industry is also made of erratic flint, is more distinctive typologically than either Salaš 1 or 4. At Salaš 4, flake tools predominate, retouched blades are less specific, Aurignacian-type burins are missing, and tools are generally less distinctive than at Salaš 1. We may still speculate about the Aurignacian age of the assemblage due to the shape of some endscrapers (Fig. 8.11), one possible broken leaf point (Fig. 7.16), and the probable use of Troubky-Zdislavice chert, frequently exploited in the Aurignacian of Central Moravia.[67] The absence of tool types indicative of other Upper Palaeolithic cultures may indirectly support this estimate. The dating of the two sites is problematic but, given the plain butts, few "archaic" tools, and indistinctive tool types, it may be tentatively put to the declining phase of the (Evolved) Aurignacian, possibly, around 28 kya, the time when the last Moravian Aurignacian industries probably disappear.[68] The other possibility is that we deal here with a specific Aurignacian facies of unclear dating, typical for the Moravian Gate, which is yet to be defined in more detail.

As indicated by our PCA, Moravian Aurignacian sites (where compatible data were at our disposal) tend to differentiate according to used raw materials (similarly[69]), i.e., the Krumlov chert, erratic flint, spongolite or radiolarite, the other important criteria being the amounts of sidescrapers, flakes,

[52]Oliva (1987) Obr. 6/8.

[53]Oliva (1987) Fig. 17.2–4; Kuča and Škrdla (2007) Fig. 29.1.

[54]Oliva (1987) Obr. 32/10, 12.

[55]Oliva (1987) Obr. 7/12.

[56]Valoch (1976); Svoboda et al. (2002); Mlejnek (2013); Oliva (2016) 86.

[57]Demidenko et al. (2019) 12.

[58]Bataille and Conard (2018).

[59]Demidenko et al. (2017) 32; Demidenko et al. (2019) 36.

[60]Moník and Vích (2014) – and data collected by the authors.

[61]Kostrhun (2005).

[62]Voláková (2004).

[63]Wiśniewski et al. (2012) Table 7.

[64]Macoun et al. (1965) 104.

[65]Valoch (1976) 15–16; Oliva (1987) 78.

[66]Oliva (1987) 78.

[67]Přichystal (2013) 90; Mlejnek (2013) 63.

[68]cf. Oliva (1987) 96; Demidenko et al., 2017 32.

[69]Svoboda (1991) 5.

retouched blades, and distance from freshwater. Aurignacian burins are somewhat exclusive with Aurignacian endscrapers (Fig. 12D), a fact commented on elsewhere.[70] Leaf points are obviously not confined to the so-called Morava River type Aurignacian ("Miškovice type"); they appear in other Upper Palaeolithic cultures of Eastern Central Europe,[71] and may rather testify to a specific function (hunting camps) or the seasonality of Aurignacian sites, similarly to altitude (settling of elevated sites in summer; occupation of strategic points during large-game migration etc.).

It appears, in any case (Fig. 12C), that Salaš 1 and 4 sites are somewhat different from the other two Aurignacian sites from within the Moravian Gate, i.e., Stachovice 1 and 2, due to more intensive production of retouched blades, our explanation being that Stachovice 1 and 2 actually belong to the Lower Aurignacian[72] whereas Salaš 1 and 4 answer to the Evolved Aurignacian. The fact that these four, and other, Upper Palaeolithic assemblages from within the Moravian Gate are somewhat similar is the transitional character of this geographical corridor. Most sites here are relatively small (Fig. 13), probably short-term hunting camps,[73] where index fossils are scarce compared to central sites (see[74] for Epigravettian and Magdalenian analogies of the problematic). As noted above, larger villages/residences might have been situated at the mouths of the Moravian Gate. Cultural manifestations, including lithic *fossils directeurs*, would have been rather manifested at these intersection points where interaction of larger groups of hunter-gatherers took place.[75] Within the small hunting camps, though, both archaic and Evolved Aurignacian groups might have produced comparable products of chipped stone. Analogies of undistinctive Aurignacian industries are also evidenced in other Moravian communication corridors, like the Jihlava river valley in SW Moravia (here we deal with the Epiaurignacian, though[76]), equally close to occurrences of well-knappable (Krumlovský les) chert.

The question of the AMS date (14 270 ± 40 uncal BP) obtained at Salaš 1 remains problematic. There are some similarities of Salaš 1, and possibly Salaš 4, with the Epiaurignacian *s.l.*, or Kašovian,[77] but these are probably caused, again, by the small dimensions of erratic flint nodules at these southernmost reaches of the continental glacier.

CONCLUSIONS

The lithic assemblages obtained on the Šenov-Salaš 1 and Salaš 4 sites in the Moravian Gate answer to other Moravian Aurignacian sites in the raw material supply and typology but differ in the scarcity of carinated burins. Considering the used blade technology, and markers of technological decline in the form of thick plain butts, undistinctive carinated endscrapers and the use of local materials, they may belong to the Evolved Aurignacian of the Moravian Gate or may represent a distinctive Aurignacian facies of unclear dating. The small dimensions of the two analysed industries and simple core preparation are probably not chronologically significant and were rather caused by the proximity of erratic flint occurrences which, at these latitudes, comprise just small-sized nodules. The few sidescrapers, or leaf points (broken but probable) are probably not chronologically significant either. As regards topography, the sites fall within so-called Aurignacian landscape, which was favoured throughout the existence of this culture, with a few exceptions of, i.e., sites on raw material occurrences. The imports of raw materials from different directions at both Salaš 1 and 4 may indicate repetitive occupation of the sites and a scenario may be imagined where smaller hunting groups, dispersed from larger residential villages, moved to these temporary hunting camps and made use of the western promontories of the Beskid Mts. The presence of radiolarites and other materials from the (south)east on the site indicate that during these movements, the corridor of the Bečva river valley may have been used to transport this raw material from the Carpathian Klippen Belt to other Aurignacian sites in Moravia.

[70] Oliva (1987) 85.

[71] cf. Oliva (1987, 2016); Svoboda (2006) 260; Škrdla (2011) 148; Wiśniewski et al. (2012).

[72] Jelínková (2007) 155, 170.

[73] In terms of Binford (1978) 227–228, 285, Fig. 5.33.

[74] See Wiśniewski et al. (2012); Neruda and Kostrhun (2002) 150–152.

[75] Gamble (1999).

[76] Škrdla (2012) 37.

[77] Svoboda and Novák (2004) 475.

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Appendix 1. Topographical variables of the 135 Moravian Aurignacian sites used for statistical analysis (Fig. 12A., B.). X and y coordinates are given in Křovák's S-JTSK projection. In visibility calculations, 10 km were set as maximum visibility radius for each site.

ID	Site	District	Stream	X	y	altitude [a.s.l.]	water [m]	slope [°]	aspect [°]	visibility [km2]
1	Bařice-Chvaletiny	Kroměříž	Těšanský potok	-539205.549	-1162146.256	307	370	6.34142	63.55023	24.81
2	Bělov I-"Kukla"	Kroměříž	no-name spring	-535140.104	-1164895	297	350	13.20113	296.18271	6.55
3	Bělov Ia-"Za humny"	Kroměříž	Široký potok	-534793.211	-1165092.666	263	385	13.57722	157.73601	14.57
4	Bílovice/Nedachlebice	Uherské hradiště	Zlámanecký potok	-530180.412	-1179326.425	307	120	5.85535	226.18526	79.26
5	Blažovice I, Staré Vinohrady	Brno-venkov	no-name stream	-585804.397	-1167338.764	298	870	8.88181	225	22.37
6	Boršice u Buchlovic	Uherské hradiště	Dlouhá řeka	-547417	-1179799	331	555	2.31125	41.98722	17.5
7	Brno-Jundrov	Brno	Svratka	-602297.542	-1158034.955	238	561	8.06583	330.63123	11.32
8	Brno-Kohoutovice, "Na širokých"	Brno	Svratka	-602981.955	-1160653.008	340	1540	10.05613	117.35977	1.11
9	Brno-Kohoutovice, "U Hrubé zmole"	Brno	Svratka	-603905.916	-1160722.465	400	2240	2.02527	133.85423	18.4
10	Brno-Líšeň-Čtvrtě (Podolí I, II)	Brno	Říčka	-591157	-1161454	297	460	3.72929	60.09158	48.22
11	Brno-Líšeň-"Nad výhonem"	Brno	Říčka	-590457.318	-1162031.543	250	360	8.44863	46.36393	22.97
12	Brno-Maloměřice-"Borky II"	Brno	Svitava	-594375.502	-1159391.005	290	1330	7.49575	292.56961	36.55
13	Brno-Maloměřice-"Hády"	Brno	Svitava	-593391.468	-1158440.033	390	515	17.25565	1.5681	87.13
14	Brno-Maloměřice-"Občiny"	Brno	Svitava	-593938.676	-1158820.394	260	90	6.81471	45.33902	23.74
15	Brno-Slatina-Stránská skála IIIa	Brno	no-name stream	-592948.305	-1162293.817	295	1300	1.81125	288.43494	95.68
16	Brno-Slatina, Stránská skála II	Brno	no-name stream	-593334.282	-1161903.519	311	1550	3.68903	336.21796	68.09
17	Brno-"Žebětín"	Brno	no-name stream	-606124.729	-1157825.668	354	590	1.94815	268.31531	6.33
18	Brno-Židenice-Bílá hora	Brno	Kafélanka spring	-594224.049	-1161192.976	290	1610	9.60865	284.36459	39.56
19	Brno-Židenice, Podstránská	Brno	no-name stream	-593933.74	-1162094.897	250	1350	3.64227	46.27303	9.42
20	Brodek I	Prostějov	Brodečka	-560500.702	-1145609.126	270	510	3.32657	234.80609	12.99
21	Březolupy-Čertoryje	Uherské hradiště	Březnice	-527475.008	-1175943.594	380	450	9.56123	309.21759	21.51
22	Buchlovice-Chrastě	Uherské hradiště	Zámecký potok	-547039	-1176470	391	480	13.94335	319.57391	46.16
23	Buchlovice-Ploskárně	Uherské hradiště	V Chrásťách spring	-546324.247	-1176926.65	350	400	6.71204	229.13467	46.39
24	Bulhary	Břeclav	Dyje	-592856.461	-1201960.101	200	375	5.13218	336.71765	74.07
25	Černá Hora IV-"Ješetiny"	Blansko	Litkov	-598391.762	-1136760.735	420	450	12.99598	312.19019	63
26	Diváky	Břeclav	no-name stream	-587426.599	-1185504.805	235	206	12.8771	185.64825	2.12

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ID	Site	District	Stream	X	y	altitude [a.s.l.]	water [m]	slope [°]	aspect [°]	visibility [km2]
27	Dolní Otaslavice I	Prostějov	Brodečka	-563232	-1142699	306	305	3.35299	285.34088	19.53
28	Dolní Otaslavice II	Prostějov	Brodečka	-562576	-1142532	295	435	7.64245	207.5199	34.21
29	Dolní Věstonice III	Břeclav	Dyje	-598616.908	-1195935.589	270	790	10.2293	188.44441	87.59
30	Drahanovice -"U lusthauzu"	Olomouc	no-name stream	-559642.909	-1123101.169	310	575	13.44716	322.81857	110
31	Hlinsko u Přerova	Přerov	no-name stream	-523599	-1134031	333	445	3.76436	223.15239	102.78
32	Horní Otaslavice I - Homole	Prostějov	Brodečka	-562995	-1143397	476	105	9.20215	353.62076	19.66
33	Hostěrádky-Rešov	Vyškov	no-name stream	-587498.656	-1171073.677	307	700	1.81892	236.56013	136.42
34	Hostišová-Strážná	Zlín	Chlumský potok	-526009	-1161469	346	570	5.56954	5.88599	49.21
35	Hostišová-Záhumenice	Zlín	no-name stream	-526293.285	-1161224.237	335	585	12.36785	2.87545	44.04
36	Hradčany I	Brno-venkov	no-name stream	-608491.768	-1144531.039	280	205	3.77021	318.69138	28.77
37	Ivančice-Hrubšice - Prosniska	Brno-venkov	Jihlava	-623392.574	-1169730.302	291	250	10.05636	347.29599	32.99
38	Ivančice-Hrubšice - Nad řekou	Brno-venkov	Jihlava	-622555.01	-1169658.21	273	150	9.02024	288.54907	23.26
39	Karolín I - Chlum	Kroměříž	no-name stream	-538120.197	-1162445.844	316	225	8.30044	339.32904	32.76
40	Karolín II - Jedenáctý	Kroměříž	no-name stream	-537671.725	-1161940.789	280	580	3.15017	267.91745	49.28
41	Kelčice I = Předina-Dobrochov	Prostějov	no-name stream	-558665	-1143526	310	1100	4.52131	237.91782	108.61
42	Klobouky-Hradisko	Břeclav	no-name stream	-582884.194	-1184858.758	290	1050	1.80445	269.09061	22.34
43	Křepice-Domovní kopce	Břeclav	Křepický potok	-592377.755	-1184041.873	322	320	5.2024	91.88819	107.02
44	Kubšice III	Znojmo	Šumický potok	-615208.788	-1180259.586	225	315	3.44313	164.57784	13.05
45	Kudlov u Sušic	Přerov	Libuška	-527116.374	-1135079.448	235	230	4.19058	292.89053	55.88
46	Kudlovice-Za hradskou	Uherské hradiště	Kudlovický potok	-537298.731	-1171752.499	307	540	5.31353	233.74617	52.81
47	Kudlovice-Za hradskou a	Uherské hradiště	Kudlovický potok	-537382.274	-1171764.745	295	410	5.31353	233.74617	12.64
48	Kunovice-Hluboček	Uherské hradiště	no-name stream	-534987	-1187316	345	490	11.30201	71.4744	77.78
49	Kupařovice I	Znojmo	Jihlava	-609162.574	-1176124.876	190	320	0.63283	95.19444	8.42
50	Kvasice I-"Lány"	Kroměříž	Kamenecký potok	-535967.575	-1163827.537	299	490	4.03864	52.48089	43.18
51	Kvasice II-"Skřatovy"	Kroměříž	Kamenecký potok	-535733.32	-1163702.264	285	440	8.78642	1.66834	73.6
52	Lhota (1) u Lipníka n. B.	Přerov	no-name stream	-523079.314	-1134405.674	335	100	9.85473	6.77728	43.5
53	Lhota 4	Přerov	no-name stream	-522302.813	-1134118.136	353	730	14.34273	351.67975	58.41
54	Lhotka-u lesíka	Kroměříž	Zlámanský potok	-542491.935	-1163681	330	295	6.00084	27.78392	12.99

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ID	Site	District	Stream	X	y	altitude [a.s.l.]	water [m]	slope [°]	aspect [°]	visibility [km2]
55	Lubná-Kopaniny	Kroměříž	U Šimkové skale spring	-540846.067	-1164636.929	297	200	4.93646	47.81556	14.77
56	Ludslavice/Miškovice	Kroměříž	Miškovický potok	-529279.709	-1157665.528	285	745	3.627	276.34018	121.73
57	Maršovice III	Znojmo	Jezeřanská strouha	-613789	-1176788	255	685	7.18702	92.27245	20.29
58	Milovice-Horní Kuče	Kroměříž	Skržický potok	-543615.496	-1162907.616	335	370	5.63117	323.24631	32.11
59	Milovice I	Břeclav	Klentnický potok	-596578.658	-1200306.487	233	680	5.97937	215.28331	19.14
60	Miškovice-Křemenná	Kroměříž	Hájská příkopa	-530642.398	-1159157.476	304	450	14.72623	330.60663	67.17
61	Mladeč I, Mladečské jeskyně (Bočkova díra)	Olomouc	Rachavka	-562851.932	-1107263.627	250	90	2.13054	143.74615	19.15
62	Mladeč II	Olomouc	Rachavka	-562970.584	-1107347.778	250	105	2.13054	143.74615	0.5
63	Mohelno-Mančalov	Třebíč	Mančalovský potok	-630994	-1163703	394	30	13.19743	270.12216	32.09
64	Mohelno-na šibenici	Třebíč	Skřipinský potok	-631196	-1164548	411	205	22.60119	317.82352	41.28
65	Mysločovice-Háj	Zlín	Racková	-528772.516	-1161646	281	610	7.66758	174.4588	58.15
66	Napajedla-Hrubé Jestřabí	Zlín	no-name stream	-534464	-1168384	278	300	8.32971	85.69134	40.51
67	Nikolčice - Liščí vrch	Břeclav	St. Gorazd spring	-591107	-1184578	373	920	9.87847	39.17366	87.35
68	Nikolčice - Vinohrady	Břeclav	Nikolčický potok	-589915	-1185182	370	230	9.76973	272.66299	59.04
69	Nová Dědina I-Horákovsko	Kroměříž	no-name stream	-535874	-1165588	291	455	4.34106	215.88864	10.38
70	Nová Dědina II-Kostelíky	Kroměříž	no-name stream	-536284	-1165303	310	210	0.98898	259.99203	8.65
71	Nová Dědina III-Záhumení	Kroměříž	no-name stream	-536556.461	-1165393.98	320	190	2.60657	271.88818	17.52
72	Nová Dědina IV-“v Trůbě”	Kroměříž	Kamenecký potok	-536073.717	-1164404.899	305	385	3.59353	37.23483	23
73	Nová Dědina V-“Zápověď”	Kroměříž	no-name stream	-537438.61	-1164749.533	317	350	15.90118	331.14075	1.1
74	Nové Bránice IV-V Končinách	Brno-venkov	Jihlava	-612826	-1173098	250	720	3.14472	103.15095	6.61
75	Omice	Brno-venkov	no-name stream	-610185.351	-1159984.829	400	1000	4.9542	163.23744	5.52
76	Ondratice VIII - Kopaniny	Prostějov	Ondratický potok	-564177	-1145813	321	160	0.56863	40.91439	20.86
77	Ostrov u Macochy-Dolina	Blansko	Suchdol sifting	-586072	-1139786.427	500	1540	17.17872	325.41034	10.46
78	Vedrovice VIII-u lesního výběžku	Znojmo	Šumický potok	-615580	-1178027	295	2360	14.37665	354.17819	51.89
79	Pavlovice u Přerova	Přerov	Libuška	-526376	-1135935	319	330	7.03221	240.62959	101.56
80	Podivice	Vyškov	Podivický potok	-566610.426	-1145484.957	390	220	5.00965	152.85033	9.99
81	Podolí-Strážné	Uherské hradiště	no-name stream	-533659.332	-1185941.415	351	550	6.19087	289.10309	48.22

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ID	Site	District	Stream	X	y	altitude [a.s.l.]	water [m]	slope [°]	aspect [°]	visibility [km2]
82	Přestavlky	Přerov	no-name stream	-532768	-1145206	300	525	2.75314	27.89727	120.53
83	Radostice	Brno-venkov	Šatava	-608915.24	-1166997.431	340	730	9.60906	339.42416	20.38
84	Rudice	Blansko	Rudice sifting	-588476.839	-1146296.323	520	540	2.29383	65.67442	28.03
85	Seloutky-Vinohrady	Prostějov	Všetičkova skála spring	-563380.036	-1136456.505	345	240	8.38611	303.0972	94.24
86	Silůvky	Brno-venkov	Šatava	-609297.959	-1170548.463	334	470	6.7998	281.12146	57.11
87	Skalka I - Na Skalkách	Prostějov	Skalka spring	-555012.145	-1142667.294	274	95	2.65387	336.47681	74.98
88	Slatinice I -“Příhon”	Olomouc	no-name stream	-559146.453	-1124558.648	315	350	7.7104	106.96272	86.69
89	Slatinice II-“Kobylí hlava”	Olomouc	Deštná	-560451.553	-1124501.328	380	530	18.24158	223.77066	88.77
90	Slatinky I	Prostějov	Nad Ostichovcem spring	-559914.951	-1125976.801	350	270	21.2701	310.729	140.33
91	Stachovice 1	Nový Jičín	no-name stream	-498529.379	-1114521.125	320	115	4.64313	279.92624	99.24
92	Stachovice 2	Nový Jičín	Jestřábský potok	-497582.125	-1115801.9	280	365	4.21404	161.81096	22.56
93	Stachovice 4	Nový Jičín	Jestřábský potok	-498723.646	-1116020.954	300	95	8.54942	326.94418	5.05
94	Stříbrnice-Hořístky	Uherské hradiště	no-name stream	-548576.314	-1179950.902	320	360	4.57125	353.89722	22.94
95	Tlumačov	Zlín	no-name stream	-530771.126	-1159288.245	300	300	12.72676	289.79889	61.05
96	Topolná-Bukovina	Uherské hradiště	no-name stream	-530457.094	-1174237.075	288	330	10.55564	12.39541	79.77
97	Topolná-Osičná	Uherské hradiště	no-name stream	-531098.623	-1174369.347	263	280	7.99386	332.88754	77.8
98	Traplice-Bukáčová	Uherské hradiště	no-name stream	-541012.455	-1172867.827	330	310	11.53182	325.18051	61.31
99	Troubky-Zdislavice-Zadní Kuče	Kroměříž	no-name stream	-551434	-1161493	381	420	4.30129	324.19666	56.38
100	Tučapy-Nad panským	Uherské hradiště	Dlouhá řeka	-546909.921	-1181968.468	330	1150	5.96365	291.03751	21.37
101	Tvarožná I	Brno	Rokytnice	-586796	-1160468	360	560	12.13611	18.85624	26.45
102	UH-Jarošov-Rochuz	Uherské hradiště	Morava	-535259.273	-1180807.303	303	1150	8.67305	286.17758	108.22
103	Újezdsko-Záhumenky	Kroměříž	Hvězda spring	-543439.982	-1164178.523	375	490	20.29279	307.97012	52.48
104	Určice I-Golfštýn	Prostějov	Určický potok	-563029.709	-1138290.845	330	430	11.05506	354.56662	87.05
105	Vavřinec-Suchdol, jeskyně Pod Hradem	Blansko	Vavřinec sifting	-587818.003	-1142124.213	480	570	8.19582	154.50244	3.06
106	Vážany-Vítovice, “Záhumenní”	Vyškov	no-name stream	-580860.473	-1160283.577	310	290	1.60233	24.27445	16.21
107	Vedrovice I-Vanecka	Znojmo	no-name stream	-616610	-1177460	285	2255	12.52804	348.18439	24.95
108	Vedrovice Ia-Vanecka	Znojmo	no-name stream	-616410	-1177618	280	2500	15.70141	91.63075	25.81
109	Vedrovice II-nad hřištěm	Znojmo	Šumický potok	-616418.646	-1178320.317	250	2080	9.95147	43.15239	13.11

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ID	Site	District	Stream	X	y	altitude [a.s.l.]	water [m]	slope [°]	aspect [°]	visibility [km2]
110	Vedrovice III-u vodojemu, u Skalky	Znojmo	Šumický potok	-616033	-1178263	295	2100	8.29515	296.03781	66.39
111	Vedrovice X	Znojmo	Šumický potok	-616358	-1178422	245	1970	9.95147	43.15239	11.32
112	Veverská Bitýška II	Brno-venkov	Svratka	-610497.367	-1150312.946	340	700	8.21305	276.16486	24.41
113	Věžky-Nad Úlehlí	Kroměříž	Věžecký potok	-548093	-1154559	328	800	14.10689	7.77544	11.33
114	Vítovice I - Záhumenní (Rousínov-Vítovice)	Vyškov	Vítovický potok	-580655.508	-1160185.339	308	93	2.9527	191.74564	16.96
115	Vojkovice	Brno-venkov	Šatava	-601738.158	-1175620.44	225	540	2.83397	66.80141	39.91
116	Vratěnín I	Znojmo	no-name stream	-677188.624	-1184249.189	485	450	1.09075	256.3287	28.12
117	Zdounky-kóta 333	Kroměříž	no-name spring	-546365	-1163755	333	280	3.52053	172.52844	50.08
118	Zdounky/Cvrčovice	Kroměříž	no-name stream	-545563	-1163668	335	160	4.70923	10.49148	41.74
119	Zlín-kopce	Zlín	Kaménka spring	-527066	-1168086	306	690	14.01536	178.2782	65.94
120	Zlín-Zážlebí	Zlín	Kaménka spring	-527292	-1168239	318	550	13.22744	209.29137	63.17
121	Židlochovice	Brno-venkov	Svratka	-598331.192	-1178770.058	308	875	4.409	92.97373	91.96
122	Žlutava I-"Díly u Dubníku"	Zlín	no-name stream	-534057.171	-1166470.139	325	515	11.82182	314.61285	28.4
123	Žlutava II-Nivy	Zlín	no-name stream	-533948.691	-1166191.637	300	625	10.57954	328.35229	28.26
124	Žlutava III-Nad myslivnou	Zlín	no-name stream	-534314.798	-1166421.838	310	250	1.41307	17.70043	31.76
125	Žlutava IV-Machovica	Zlín	Morava	-533606.379	-1166616.881	305	780	7.26739	54.2534	19.91
126	Žlutava V-Úpatí vrchů	Zlín	no-name stream	-533738.048	-1166932.344	260	930	9.25386	171.17363	10.91
127	Žlutava VII-Kotáry	Zlín	no-name stream	-533361.761	-1167658.488	260	480	0.61707	338.19858	4.54
128	Žlutava VIII-Dubová	Zlín	no-name stream	-534409.005	-1167155.143	295	440	4.7744	343.30075	8.98
129	Žlutava IX-Paseky	Zlín	no-name stream	-535220.637	-1166661.842	300	45	10.24313	326.96948	41.74
130	Šenov-Salaš I	Nový Jičín	mineral spring	-495194	-1123805	330	290	11.43111	177.4489	110.97
131	Šenov-Salaš IV	Nový Jičín	mineral spring	-495523	-1123901	330	550	10.71516	131.1432	88.42
132	Napajedla-Zámoraví	Zlín	Morava	-533862	-1169531	215	700	8.40435	86.70186	34.93
133	Domanín-Domanínský kopec	Hodonín	no-name stream	-550039	-1186367	305	750	1.5755	297.03085	99.93
134	Ondratice II - Zadní Hory	Prostějov	Ondratický potok	-563795	-1146370	360	250	10.76728	357.58899	48.18
135	Ondratice I/Želeč	Prostějov	no-name stream	-563302	-1146843	336	1200	6.7112	11.02346	51.47