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THE FLÖZERBÄNDLI: A LATE PALAEOLITHIC / EARLY MESOLITHIC SITE IN THE MUOTA VALLEY (CANTON SCHWYZ / CH)

For the past fifteen years, the speleologist Walter Imhof has conducted archaeological surveys in the municipality of Muotathal (Leuzinger et al. 2016; 2020; 2021a; 2021b). During the course of this work, Imhof has discovered and documented numerous deserted medieval sites as well as prehistoric hearths and numerous non-recent animal bones in rock shelters and caves. In spring 2020, Imhof surveyed the Flözerbändli, a 140 m long rock shelter (or *abri*) above the right bank of the River Muota (**fig. 1**). The coordinates of the rock shelter are 46°58′03.79 N 8°48′05.06″ E and it is located at an altitude of 740 m a.s.l., immediately overlooking an area known as Zwingsbrücke. This name derives from the German word *zwingend* (necessarily) and points to the fact that the river must be crossed at this location due to the steep rocky cliffs on

Fig. 1 View of the Bisis Valley in the Muota Valley with the Zwingsbrücke bridge. The Flözerbändli site is located at the foot of the rock ledge directly above the right bank of the River Muota. – (Photo J. Reinhard).

Fig. 2 The Flözerbändli rock shelter site in the Bisis Valley (Muota Valley) during the 2021 excavation. – (Photo U. Leuzinger).

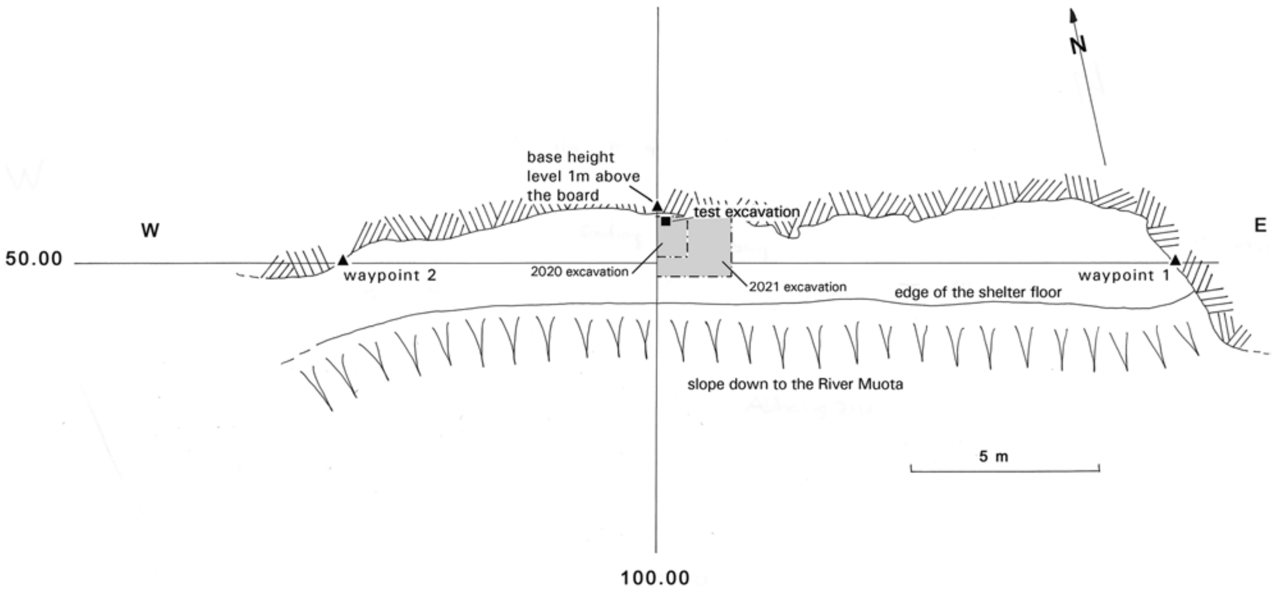


Fig. 3 Overall plan of the Flözerbändli rock shelter site and the excavated area (2020 and 2021 excavations). – (Illustration U. Leuzinger). – Scale 1:200.

either side. The name »Flözerbändli« is associated with 19th-century logging (*Flösserei*) along the adjacent River Muota. The rock shelter is situated in the narrowest and therefore most dangerous part of the route leading over to the Bisis Valley and offers a certain degree of protection from inclement weather. It can thus be viewed as an obvious place to rest and take shelter on a well-trodden path.

In a bid to find the driest areas at the foot of the 140 m long ledge, Imhof purposely carried out his surveying during a period of wet weather. In June 2020 he then undertook trowel testing in three locations. The easternmost area, which was examined to a depth of 73 cm, yielded layers containing charcoal. Radiocarbon analyses dated these layers to the 6th century AD, that is to the Early Middle Ages. This ultimately led to archaeological excavations being conducted in the summer months of 2020 and 2021 (Leuzinger et al. 2021b).

THE EXCAVATION

Licenced and commissioned by the State Archives of Schwyz, an interdisciplinary team of researchers carried out a test excavation of 2 m × 2 m in size in the area of the easternmost trench from 4-12 August 2020 and again from 2-14 August 2021 (site SG.CIX.4.263, **figs 2-3**). The area was excavated to a depth of 1.85 m. The spoil was then dry-screened on site using sieves with a 5 mm mesh. From the sixth spit onwards (i. e. from a depth of 1 m), the sediment was also wet-sieved in quarter-square metres in the nearby River Muota using a 3 mm sieve. This resulted in a large number of tiny finds such as bones of small mammals or chips from flint knapping being retrieved. Drawings were made at a scale of 1:10, and photographs were taken after each spit was removed. Various sediment and charcoal samples were also retrieved from different areas within the trench.

The Stratigraphy

The stratigraphic sequence of the Flözerbändli site from the surface to a depth of 1.85 m can be divided into ten layers, which slope downwards from north to south towards the rock face (**fig. 4**). From top to bottom, they can be characterised as follows:

1. Dark brown topsoil (modern humus) with heavy root penetration and significant amounts of dung (nowadays the overhang is used by deer as a winter shelter).
2. Blackish-brown slightly sandy silt with large pieces of charcoal. This layer was labelled as early medieval Hearth 1 and lay in a pit-like depression of c. 40 cm in depth located directly beside the rock face.
3. Beige-brown coarse sandy silt with sharp-edged limestones and lime gravel (frost weathering). The components were not oriented within the matrix.
4. The facies changed drastically, though with a diffuse boundary, to a compact layer of detritus consisting of angular limestones and lime gravel in a matrix of brown, sandy silt.
5. Grey slightly sandy silt with sharp-edged limestones. The components lay parallel to the layer in the charcoal-rich (yew and ash) matrix. Located in a trough-like depression immediately adjacent to the rock face, this feature was labelled Hearth 2 and dated to the Bronze Age.
6. A clearly defined stratum of brown-red sediment consisting of graded coarse sandy silt. Few roots and limestones.
7. Light brown crumbly loam with sharp-edged limestones and lime gravel. The facies clearly changed towards the rock face to large limestone blocks and angular detritus. Several large, severely weathered bones (including parts of a lynx's skull).
8. Dark brown to dark grey silty loam with many small angular limestones and lime gravel. The components lay aligned parallel to the layer. Several brown-beige lenticular patches of sediment were observed within the layer. Approximately 35 cm thick, this was the actual archaeological layer. It contained large numbers of charcoal fragments (Hearth 3), bones (some calcined), heat-damaged stones and stone artefacts.

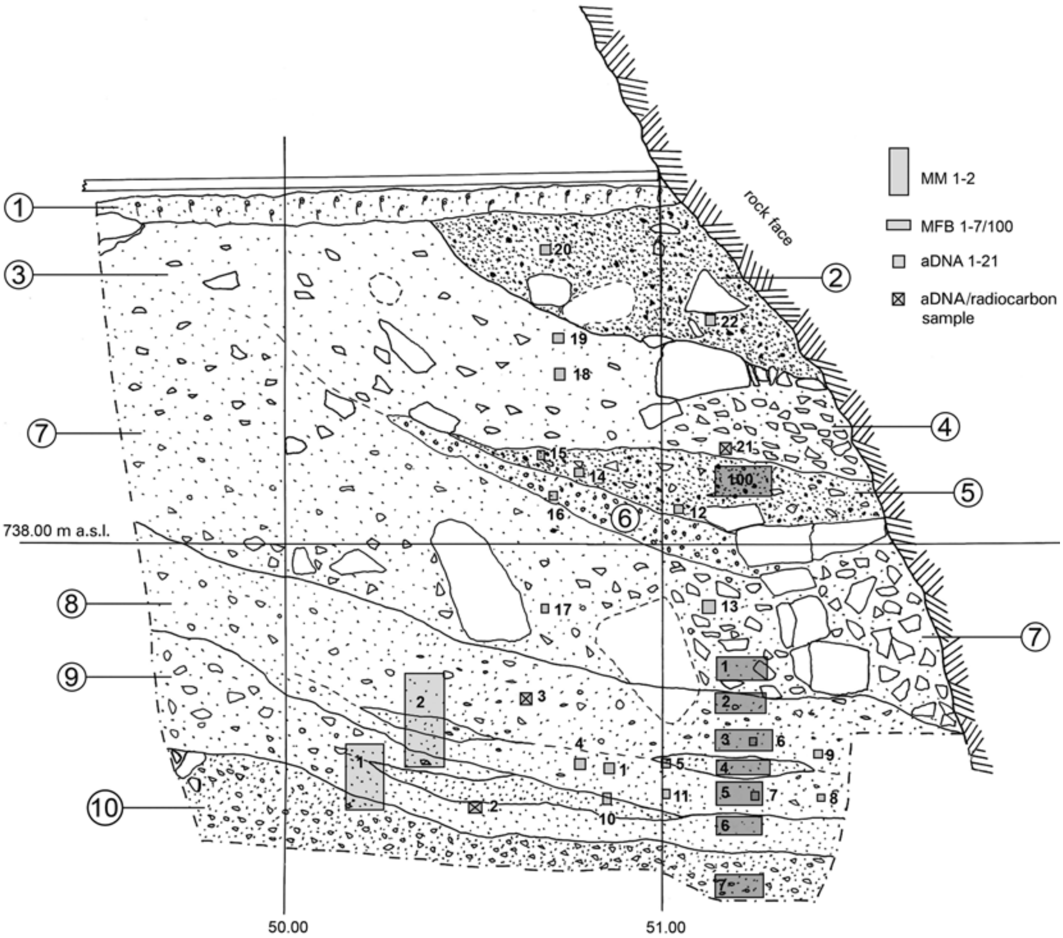


Fig. 4 Flözerbändli, west-facing section during the 2021 excavation with the sample locations. – (Illustration U. Leuzinger). – Scale 1:20.

9. Compact brown-red silty to fine sandy loam with small amounts of lime gravel. Bones and flints were still occasionally found within this layer.
10. Brown-beige dense debris consisting of small angular limestones and lime gravel (frost weathering). Very little matrix could be seen between the components. Devoid of archaeological finds.

Plans

An area of 4 m² was excavated using the planum method by removing 13 spits. Because the soil was removed in horizontal spits and most layers sloped downwards from south to north in the direction of the rock face, the individual plans often showed two different layers of sediment; this had to be taken into account and corrected during the post-excavation analysis. The excavation uncovered several archaeological features, mainly charcoal concentrations, which were interpreted as hearths.

Hearth 1

The hearth (Layer 2) was visible in spits 1-3 (grid coordinates 100/50-51). It was found immediately adjacent to the rock face in a pit c. 40 cm deep. Several relatively large stones at the base of this feature were probably placed there intentionally. A flat limestone rock south-east of the hearth may have been used as a seat when tending the fire. The charcoal was very well preserved and several complete cross-sections of branches could be seen. Most of the fuel was spruce wood (*Picea abies*), though yew wood (*Taxus baccata*) was also identified. Radiocarbon analysis carried out on a fragment of charred spruce from the bottom of the feature yielded an early medieval date of 1529 ± 21 BP, or AD 534-572 (cal. 2σ, ETH-106975). No archaeological finds came to light in this feature.

Hearth 2

Another hearth was found at a depth of 75-85 cm (Layer 5, grid coordinates 100/50.50-51.50). The charcoal concentration was limited in size. The soil at the bottom was not fire-reddened. A limestone rock south-east of the hearth may have been used as a seat when tending the fire. The charcoal fragments retrieved were identified as yew (*Taxus baccata*) and ash (*Fraxinus excelsior*). Radiocarbon analysis yielded a result of 3063 ± 26 BP, or 1411-1235 BC (cal. 2σ, ETH-116923), dating the hearth to the early stages of the Late Bronze Age. A number of bones, including an almost complete but highly fragmented skull and several foot bones of a lynx (*Lynx lynx*) were retrieved in the vicinity of the feature.

The Archaeological Layer

The sediments at the bottom of the stratigraphic sequence (Layers 8-9) were brown-beige in colour and contained Early Mesolithic finds. Their dark colouring was due to the abundance of charcoal. The entire unit of layers was 35 cm thick and, using the west-facing section, could be divided into several strata. Some of them were lenticular in shape. The division was only visible in section and could not be seen during the removal of the spits. The charcoal fragments scattered throughout the soil probably resulted from the clearing out of various hearths located outside of the excavated area. Six radiocarbon dates from charcoal fragments from the archaeological layer pointed to the use of the shelter during two different timespans, the first time from c. 9600-9300 BC (cal. 2σ) and the second time from c. 8500-8300 BC (cal. 2σ). More than half of the artefacts were retrieved from grid coordinates 100/50. The number of finds decreased substantially towards the east and south. There were no obvious indications of the presence of flint knapping sites or any other clearly distinguishable activity zones. The 4 m² trench probably covered the peripheral areas of at least two Early Mesolithic camps.
Hearth 3 came to light in Layer 8 at a depth of 120-131 cm (grid coordinates 100.50-101/50-51) (**fig. 5**). The oval feature measured 130 cm × 70 cm and contained a significant number of charcoal fragments. There was no evidence of the soil being fire-reddened. Several stones formed the north-western boundary of the hearth. The firewood was pine (*Pinus sylvestris*) and yew (*Taxus baccata*). Radiocarbon analysis dated the feature to 9232 ± 26 BP, or 8533-8328 BC (cal. 2σ, ETH-117599), that is the Early Mesolithic.

ARCHAEOLOGICAL FINDS

Flint

A total of 222 artefacts made of rock crystal, Jurassic chert, radiolarite, oil quartzite and Alpine limestone came to light (**tab. 1**). However, 64 % of these were smaller than 10 mm. The limited number did not al-

Fig. 5 The Early Mesolithic hearth found during the Flözerbändli excavation with the position of the stone. – (Photo U. Leuzinger).

basic types	n	%	oil quartzite	rock crystal	radiolarite	Jurassic chert	lime-stone
core	0	0.0	0	0	0	0	0
core correction flake	2	0.9	0	0	1	1	0
debris	1	0.5	1	0	0	0	0
cortical flake	2	0.9	0	0	0	1	1
flake	49	22.1	30	7	10	2	0
blade	9	4.1	3	1	3	1	1
bladelet	18	8.1	5	3	6	4	0
burin spall	3	1.4	1	0	2	0	0
chip	138	62.0	67	34	32	5	0
total	**222**	**100.0**	**107**	**45**	**54**	**14**	**2**

Tab. 1 The basic types of objects in the lithic assemblage from the Flözerbändli excavation.

low us to distinguish between the multiphase archaeological layers. Consequently the assemblage was not divided by stratigraphy but is presented here as a whole.

Basic Types

The artefacts were divided into the standard types that make up the *chaîne opératoire* (**tab. 1**) and recorded as such. The main features in terms of the knapping technique, including the shape of the platform remnants, the presence of dorsal reduction and of bulbs and bulbar scars, were also recorded.
The majority (182 artefacts, 82 %) were preserved intact and only 40 objects (18 %) were fragmented. The average length was 10.3 mm, with the largest artefact measuring no more than 49 mm. Only 7 objects showed signs of burning in the form of fire reddening or craquelure.

tool types	raw materials	n
backed point	radiolarite (type 654)	1
edge-retouched point	radiolarite (type 633)	1
edge-retouched point	rock crystal	1
base-retouched point	radiolarite (type 654)	1
base-retouched point	rock crystal	1
segment	Jurassic chert (type 146/002)	1
backed bladelet	radiolarite (type 654)	1
backed bladelet	radiolarite (type 654)	1
backed bladelet	radiolarite (type 632)	1
total microliths		9
truncated blade	oil quartzite (type 633)	1
retouched flake	oil quartzite (type 633)	1
scraper	oil quartzite (type 633)	1
burin?	radiolarite (type 654)	1
total macroliths		4
total tools		13

Tab. 2 The tool types in the lithic assemblage from the Flözerbändli excavation. The type numbers refer to the definitions by Affolter 2002.

The assemblage did not contain any unworked pieces or cores. Core correction flakes (2 objects), cortical flakes (2 objects) and debris (1 object) were rare, which shows that nodules were sometimes prepared, and cores were only occasionally worked at the site. One elongated, narrow core correction flake made of red radiolarite is worth special mention. The purpose of this flake was to remove a platform on a microblade core, which had been destroyed by dorsal reduction. The removal scars on the core were otherwise clearly visible. The assemblage furthermore included 49 (22 %) simple flakes, 9 (4 %) blades and 18 (8 %) bladelets. A total of 42 platform remnants found on the larger flake tools could be divided into smooth (25), linear (8), cortex-covered (1) and point platform remnants (8). Only 28 objects had a visible bulb on the ventral surface, with 8 also bearing a bulbar scar. Traces of dorsal reduction were found on 20 artefacts. As far as we can tell from such a small assemblage, it appears that the knappers did their best to create elongated, narrow basic forms. Two burin spalls and one possible burin show that such tools were sharpened at the site. As the soil was wet-sieved and diligently handpicked, a large number of chips (< 10 mm) were recovered (138 fragments, 62 %). They show that all types of raw material (see below) were worked in equal proportions, even though no knapping sites could be identified within the excavated area.

Retouched Tools

The assemblage of flints from the Flözerbändli site included a total of 13 retouched artefacts (**tab. 2, fig. 6**); this means that 5.9 % (total number of objects: 222) of the artefacts at the site were worked. The inventory of tools comprised 9 projectile points and 4 macroliths.

Projectile Points

The excavations unearthed a total of 9 microliths. No »microburins« came to light. Because many of the microliths were highly fragmented, only a rudimentary typochronological classification was possible. There

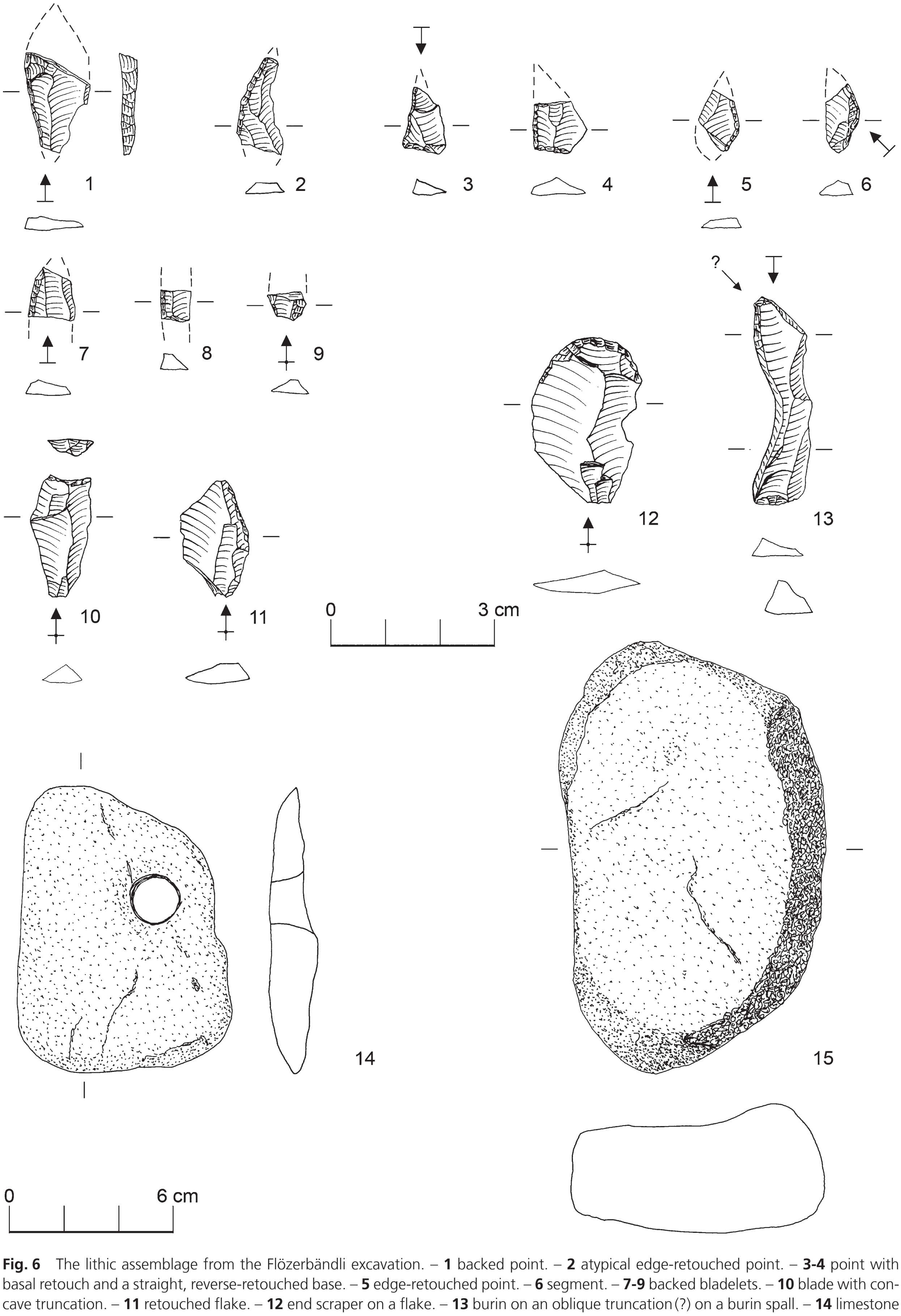


Fig. 6 The lithic assemblage from the Flözerbändli excavation. – **1** backed point. – **2** atypical edge-retouched point. – **3-4** point with basal retouch and a straight, reverse-retouched base. – **5** edge-retouched point. – **6** segment. – **7-9** backed bladelets. – **10** blade with concave truncation. – **11** retouched flake. – **12** end scraper on a flake. – **13** burin on an oblique truncation(?) on a burin spall. – **14** limestone pebble with a natural hole. – **15** hammerstone. – (Drawings U. Leuzinger). – 1-13 scale 1:1; 14-15 scale 1:2.

were one fragmented backed point (**fig. 6, 1**), one atypical edge-retouched point (**fig. 6, 2**), one point with basal retouch and a straight, reverse-retouched base (**fig. 6, 3**), one proximal fragment of a point with basal retouch and a straight, reverse-retouched base (**fig. 6, 4**), one medial fragment (**fig. 6, 5**), one segment (**fig. 6, 6**), two medial fragments of backed bladelets (**fig. 6, 7-8**) and a proximal fragment of a backed bladelet (**fig. 6, 9**).
All projectile points were damaged. In some cases, this may have been due to the arrow hitting a hard surface (bone?). The raw materials used to make the microliths were not local and it is an obvious assumption that the projectile points were probably from arrows that were damaged during hunting and then replaced and repaired at the site.

Macroliths

No more than four retouched tools were found at the Flözerbändli site. Apparently, the excavated area did not contain any specific activity zones. The tools included one blade with concave truncation (**fig. 6, 10**), one retouched flake (**fig. 6, 11**), one end scraper on a flake (**fig. 6, 12**), and a burin on an oblique truncation (?) on a large burin spall (**fig. 6, 13**). The few retouched artefacts show that various activities took place in the shelter. Unlike the nearby site of Muotathal SZ Berglibalm (Leuzinger et al. 2020, 312), the Flözerbändli site did not yield any borers or splintered pieces (*pièces esquillées*).

Conclusion Regarding the Retouched Artefacts

From a culture-historical viewpoint, the small assemblage of finds from the Flözerbändli site is rather difficult to classify. The small number of fairly non-diagnostic microliths and the way the artefacts were made point to an Early Mesolithic context but do not allow us to date it any more precisely. Six radiocarbon dates from the lower end of the stratigraphic sequence, however, clearly point to a relatively early stage of the Early Mesolithic (see below).

Other Stone Artefacts

In addition to the knapped stone artefacts, two lithic objects of a different kind were recovered. One was a flat limestone pebble with a natural hole, weighing 162 g (**fig. 6, 14**). Obviously, such rolled pebbles did not occur naturally in the sediments of the rock shelter. The pebble must therefore have been brought to the site by humans. Whether it was used for a particular purpose, for instance as a net sinker or weight, must remain unknown because it had no recognisable traces of working or wear.
The second object was a hammerstone made of a calcareous sandstone pebble weighing 1150 g (**fig. 6, 15**). One narrow side had a relatively large and clearly defined area with characteristic battering marks. The rest of the stone had a smooth natural surface. Similar pebbles can be found directly below the site on the bank of the River Muota.

raw materials	n	%
oil quartzite	107	48.2
rock crystal	45	20.3
radiolarite	54	24.3
Jurassic chert	14	6.3
limestone	2	0.9
total	222	100.0

Tab. 3 The distribution of raw materials within the lithic assemblage from the Flözerbändli excavation.

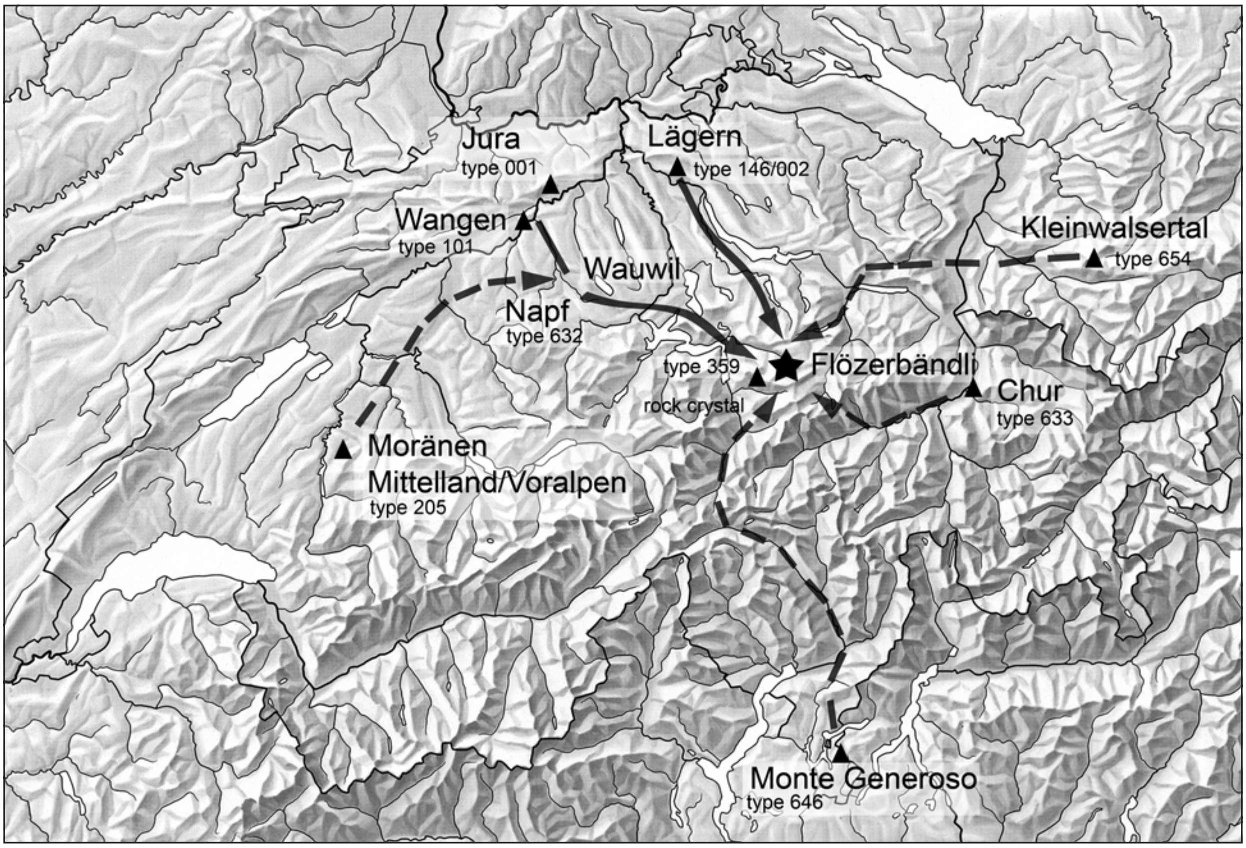


Fig. 7 Provenance of the Mesolithic stone artefacts from the Flözerbändli site according to the microscopic raw material analyses. – (Map swisstopo, E. Belz).

Raw Material

All flints from the 2020 excavation as well as all radiolarite and Jurassic chert fragments from the 2021 excavation (72 pieces in total) were microscopically examined and provenanced at Géolab in Neuchâtel, following the type definitions by Jehanne Affolter (2002). The other artefacts made of oil quartzite, rock crystal and limestone from the 2021 excavation were only macroscopically examined.

The assemblage contained artefacts made of oil quartzite, rock crystal, radiolarite, Jurassic chert and limestone (**tab. 3**). The prehistoric hunter-gatherers who used the Flözerbändli shelter had access to raw materials from various deposits throughout the wider region (**fig. 7**).

Type 359 oil quartzite (Affolter 2002) was by far the most frequently used raw material and made up 48 % of all the finds recovered. It was probably quarried mainly from a local deposit. The northern slope of

Wasserberg mountain in the Dräckloch/Äbnetmatt area (Muotathal, Ct. Schwyz/CH) has redeposited oil quartzite nodules that exhibit very few fissures and are easy to work. The deposit is located no more than 1.5 km south of the Flözerbändli site and corresponds precisely with type 359. One object was identified as a type 205 oil quartzite which could have come from the Fribourg pre-Alps, from moraines on the Swiss Plateau or from Aare River gravel. A total of 45 artefacts (20 %) were made from clear rock crystal. Several had sharp-edged idiomorphous surfaces. The crystal prisms used to make the artefacts probably came from primary fissures, several of which can be found only one or two days' hike away in what is today Ct. Uri, for instance in the municipality of Silenen where archaeological evidence of Mesolithic rock crystal mining previously came to light at an elevation of 2800 m a. s. l. in an area known as Untere Stremlücke (Reitmaier et al. 2016; Cornelissen et al. 2022, 96-102). The lithic assemblage also included 54 red and green radiolarite fragments (24 %). Two thirds of these, or 34 artefacts, were of the red variety. Perhaps the prehistoric people intentionally chose the colour for aesthetic or symbolic reasons (Posch 2022, 725). The microscopic analysis identified types 632, 633, 646 and 654 which originated from the Napf accretion near Trub (Ct. Bern/CH), from the vicinity of Chur (Ct. Graubünden/CH), the southern Alpine Monte Generoso (Ct. Ticino/CH) and the Kleinwalsertal (Bez. Bregenz/A). Remnants of cortex showed that at least some of the raw material from the Vorarlberg region in Austria came from primary deposits rather than alluvial deposits or moraines. The 14 artefacts made of Jurassic chert (6 %) came from deposits in the Lägern mountain range west of Zurich and from the region around Wangen/Olten (Ct. Solothurn/CH) (types 1, 101, 146/002). Two limestone flakes (1 % of the raw material) with obvious traces of working stood out. One had dorsal remnants of its original surface. It could not be ascertained whether the flakes were used as tools or whether they were waste from working or using a limestone pebble.

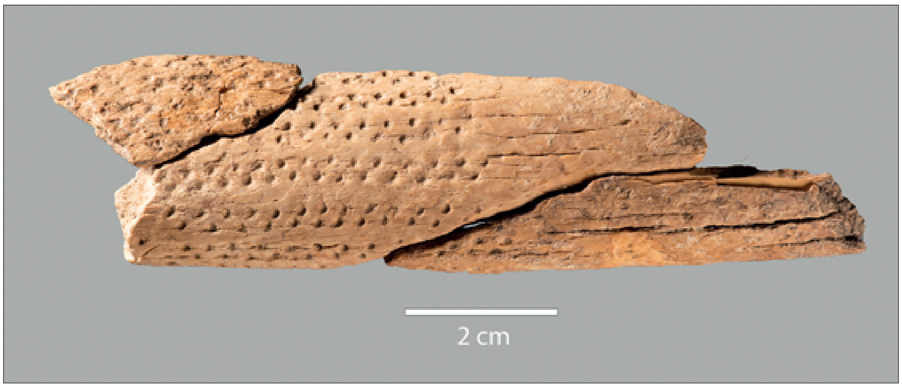
The overall weight of the Flözerbändli flint assemblage was no more than 91 g. As one would expect, the local oil quartzite artefacts were dominant at 38.1 g, followed by rock crystal at 25.4 g and radiolarite at 17.7 g. Jurassic chert (6.6 g) and limestone (3.2 g) accounted for very little of the overall weight. Given the length of time during which the lithic artefacts were deposited in the layers, it was very obvious how little knapping or retouching had taken place within the 4 m² of excavated area.

A Decorated Red Deer Antler Fragment

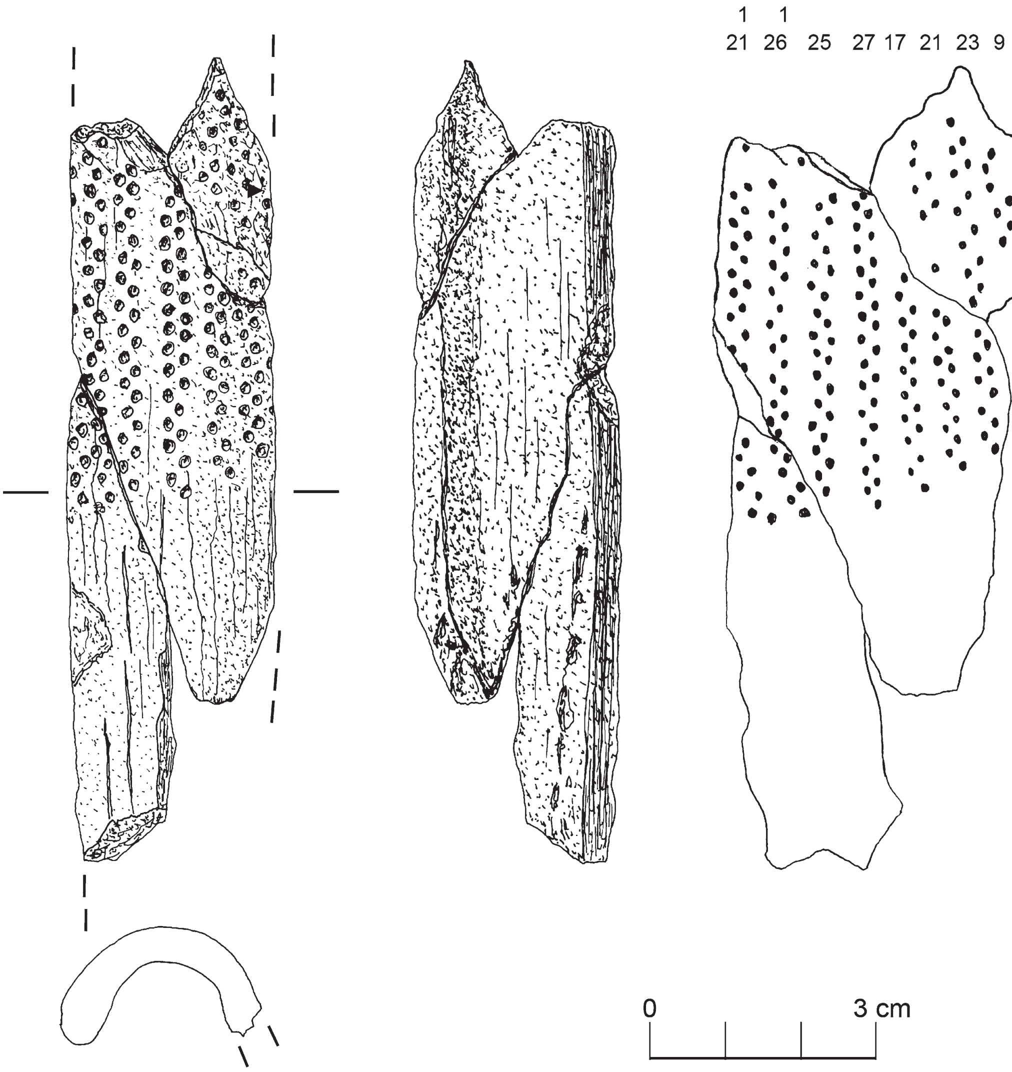
At the end of the 2020 excavation a soil sample was taken for palaeoethnobotanical analysis from a depth of 1.4-1.5 m in the north-facing section. A relatively large antler fragment came to light at a depth of 1.47 m. When it was washed, rows of small pit marks came to light on the surface of the object, and it quickly became clear that this was a unique, decorated artefact (**fig. 8a-b**). Another, partially decorated antler fragment from spit 9 in the 2020 excavation turned out to be another piece of the unusual fragment. Two further fragments of the same object were uncovered during the 2021 excavation.

The fragments were found at grid coordinates 100/50 at a depth of 1.37-1.43 m and at grid coordinates 100.00-100.50/51.00-51.50 at a depth of 1.71-1.75 m. The maximum horizontal distance between the four joining fragments was less than 0.9 m, the vertical distance was largely due to the fact that the layers sloped down towards the rock face. An old blow mark as well as deposits of calcareous sinter on the breaks show that the fragments were not damaged during the excavation but shattered in prehistoric times.

An analysis carried out at the Archaeozoological Laboratory of the University of Neuchâtel revealed that the fragment was most likely red deer antler (*Cervus elaphus*). Two small samples were taken for the purpose of radiocarbon dating the fragment and to identify the animal species by proteomic analysis. The object dates from 10,519-10,028 BC (cal. 2σ, ETH-109223); this is almost 2000 years earlier than the Early Meso-



a



b

Fig. 8a-b A decorated red deer antler fragment from the Flözerbändli excavation. – (a photo W. Müller; b drawing U. Leuzinger). – Scale 1:1.

lithic date obtained for spit 9 (8538-8294 BC, cal. 2σ, ETH-108621), which contained the largest piece, and approximately 1000 years earlier than the date obtained for spit 10, which yielded the two smaller antler pieces (9450-9282 BC, cal. 2σ, ETH-116924). The most probable explanation for this is that the sediments were redeposited in this area and that this was not recognised during the excavation. If we accept the date obtained for the antler fragment itself, we are dealing with a decorated artefact from the Late Palaeolithic, a period characterised by cold climatic conditions at the end of the Younger Dryas stadial preceding the Holocene Interglacial.

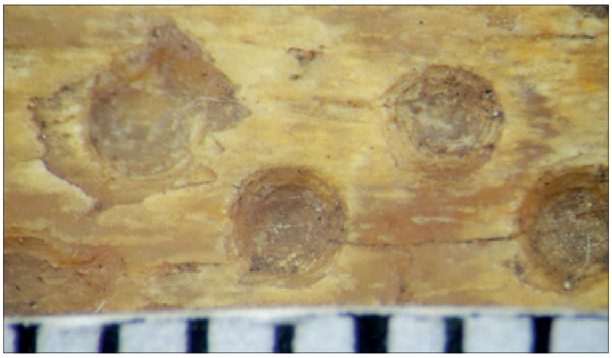


Fig. 9 Close-up photograph of the pit marks bored into the red deer antler fragment. – (Photo L. Leuenberger).

The proteomic analysis carried out by the Globe Institute of the University of Copenhagen confirmed the osteological identification. The decorated artefact was most likely to have been made from the antler of a red deer.

The fragmented antler artefact measured a total of 10.1 cm in length, 2.7 cm in width and 0.5 cm in thickness (fig. 8b). The surface of the artefact showed no trace of the pearling that is characteristic of the surface of red deer antler, which means that it must have been ground off, though this too left no traces. The spongiosa on the inside had almost completely been removed, which was confirmed by clear evidence of working. One longitudinal edge was rounded off, the other had broken off. The object was probably made from a piece of antler that was split in two and then worked both inside and outside. The surface was decorated with eight double rows of small alternating pit marks. The pattern abruptly ended on one line and the remaining surface was undecorated. The pit marks had an average diameter of 1.5 mm. In some cases, they were slightly smaller due to surface weathering, but all were round in cross-section and sunk 0.3-0.5 mm into the compacta (fig. 9). Under the binocular microscope, short and subtle flint incisions were observed on the surface, suggesting that the pit marks were probably made using a flint tool by boring into the surface in a rotating motion. While no grooves could be identified, the round cross-sections were indicative of a fine flint borer.

Eight strips of two lines of pit marks each had survived (fig. 8a-b). The marks were placed in a regular, staggered pattern. The strips alternated with undecorated zones of approximately equal width. From left to right, the strips consisted of 22, 27, 25, 27, 17, 21 (?), 23 (?) and 9 (?) preserved pit marks. The original pattern continued beyond the preserved area, but because only one original edge survived, and the original cross-section of the object could only be roughly surmised, we could not say for certain how many rows of pit marks existed originally. It was clear, however, that just a section of the object was decorated with the delicate pattern.

The question that remained was what the unusual object might have been used for. The fragment was broken off at both ends, so that its original length could not be ascertained. The fact that the surfaces were so carefully smoothened and the spongiosa was removed indicated that the original intention was to achieve a u-shaped cross-section, and perhaps fit several similar fragments together. The actual purpose of the object and the significance of the rows of pit marks remain unknown for now.

Parallels

Discoveries of objects similar to the decorated antler fragment from the Flözerbändli site from 10,500-7800 BC (cal. 2σ,) are extremely rare throughout the wider area. Two fragments of a bone pendant from the Zigeunerfels site near Sigmaringen (Lkr. Sigmaringen/D) (Taute 1975) and a bone fragment with a simple notched decoration from Bad Buchau (Lkr. Biberach/D), Henauhof-Nordwest (Jochim 1993) are the closest parallels, both geographically and chronologically, but exhibit very obvious differences to the Flözerbändli find.

Fig. 10 Fragmented bone artefact with traces of scraping, carving and polishing from the Flözerbändli excavation – (Photo W. Müller). – Scale 3:1.

The closest parallel was found at the Remouchamps cave (prov. Liège/B), where a single-phased archaeological stratum from the Ahrensburgian Culture was excavated by Edmond Rahir around 1902. A fragment of a long bone recovered from the layer bore several rows of drilled pit marks arranged in regular groups of five on its convex surface (Taute 1968, 153-154; Rozoy 1978; 1980; Lejeune 1984, 227). The site dated from around 10,664-9802 BC (cal. 2σ, OxA-4190) or 11,107-10,556 BC (cal. 2σ, OxA-4191) (Charles 1994).

Dotted patterns consisting of small pit marks are extremely rare among finds of decorated objects from the very late Palaeolithic and early Mesolithic periods (Płonka 2003). Artefacts with a similar decoration to the Flözerbändli object are known from Sværdborg I (Zealand/DK) (Brøndsted 1960, 67; Vang Petersen 2021) and from northern Germany, e.g. from Lübeck-Priwall 2 (Bokelmann 1981, pl. 1), but their cultural and geographical contexts are so different from our piece that they can hardly be considered parallels. The same applies to antler picks decorated with rows of pit marks from Montières (dép. Amiens/F), Fontaine-sur-Somme (dép. Somme/F) and Longueil (dép. Seine-Maritime/F) in northern France (Płonka 2003), which do not compare to the Flözerbändli find, neither from a morphological nor from a chronological point of view (Late Mesolithic).

A Bone Artefact

The botanical sample MFB-2 with the grid coordinates 100.0/51.2 yielded a bone fragment with traces of working at a depth of c. 1.4m at the upper edge of Layer 8 (**fig. 10**). Split lengthways, it had a triangular cross-section, was broken at both ends and measured 3.4cm in length, 0.7cm in width and 0.6cm in thickness. It bore traces of scraping and carved facets indicative of the use of a burin and was polished along its

sample no.	sample location	material	^{14}C age BP	± 1σ	from AD/BC	to AD/BC	%	$F^{14}C$	± 1σ	δC^{13}‰	mg C
ETH-106975	-53 cm, early medieval hearth (2020 test excavation)	charcoal	1529	21	AD 534	AD 572	95.4	0.827	0.002	-24.1	0.9
ETH-116923	-88 cm, Bronze Age hearth (2021 excavation)	charcoal	3063	26	1411	1235	95.4	0.683	0.002	-22.6	1
ETH-108620	-124 cm, spit 8 (2020 excavation)	charcoal	9211	34	8547	8301	95.4	0.318	0.001	-23.7	1
ETH-117599	-131 cm, spit 6 (2021 excavation)	charcoal	9232	26	8553	8328	95.4	0.317	0.001	-25.4	1
ETH-108621	-137 cm, spit 9 (2020 excavation)	charcoal	9179	35	8538	8294	95.4	0.319	0.001	-24	1
ETH-116925	-143 cm, west-facing section sample 3 (2021 excavation)	charcoal	10005	35	9746	9331	95.4	0.288	0.001	-23.2	1
ETH-109223	-147 cm, spit 9 (2020 excavation)	antler	10354	31	10519	10028	95.4	0.276	0.001	-20.7	0.58
ETH-108622	-157 cm, spit 11 (2020 excavation)	charcoal	9943	27	9653	9299	95.4	0.29	0.001	-25.2	0.6
ETH-116924	-174 cm, west-facing section sample 2 (2021 excavation)	charcoal	9903	34	9450	9282	95.4	0.291	0.001	-19.8	1

Tab. 4 The radiocarbon dates obtained from charcoal and antler samples from the Flözerbändli excavation. List of samples with their calibrated radiocarbon dates BC (2σ). Atmospheric data from Reimer et al. 2020, OxCal v4.4.1; Bronk Ramsey 2020, r:5.

sharp edge. Judging by the structure of its original surface, which had survived in some areas, it could have been part of a metapodial bone of a red deer (*Cervus elaphus*). It was a fragmented tool, perhaps a chisel or bodkin. A radiocarbon sample from the same stratigraphic position yielded a date of 8547-8301 BC (cal. 2σ, ETH-108620). Antler, bone and tooth artefacts from the Early Mesolithic are extremely rare finds in Switzerland (Crotti 1993, 228-232).

NATURAL SCIENCES

Radiocarbon Dating

A total of nine samples were radiocarbon dated at the Laboratory of Ion Beam Physics at the Swiss Federal Institute of Technology in Zurich (**tab. 4**). The calibrated dates covered the period AD 534-572 (early medieval Hearth 1) and 1235-1411 BC (cal. 2σ, Bronze Age Hearth 2) for the later phases.
Six of the dates from the Mesolithic stratum (Layers 8 and 9) pointed to two clearly distinguished phases of use (**fig. 11**): one very early phase from 9746-9282 BC (cal. 2σ) and another, some 1000 years later, from 8552-8294 BC (cal. 2σ). The date obtained from the decorated antler fragment was somewhat earlier again, 10,519-10,028 BC (cal. 2σ). Based on the analytical values, the date appeared to be reliable and had not been artificially aged, for instance by the »hard water effect«. While from the point of view of cultural history the antler artefact dated from the Late Palaeolithic (Younger Dryas), the charcoal fragments were indicative of the site's use at the very beginning of the Holocene warm phase and thus the early stages of the Early Mesolithic.

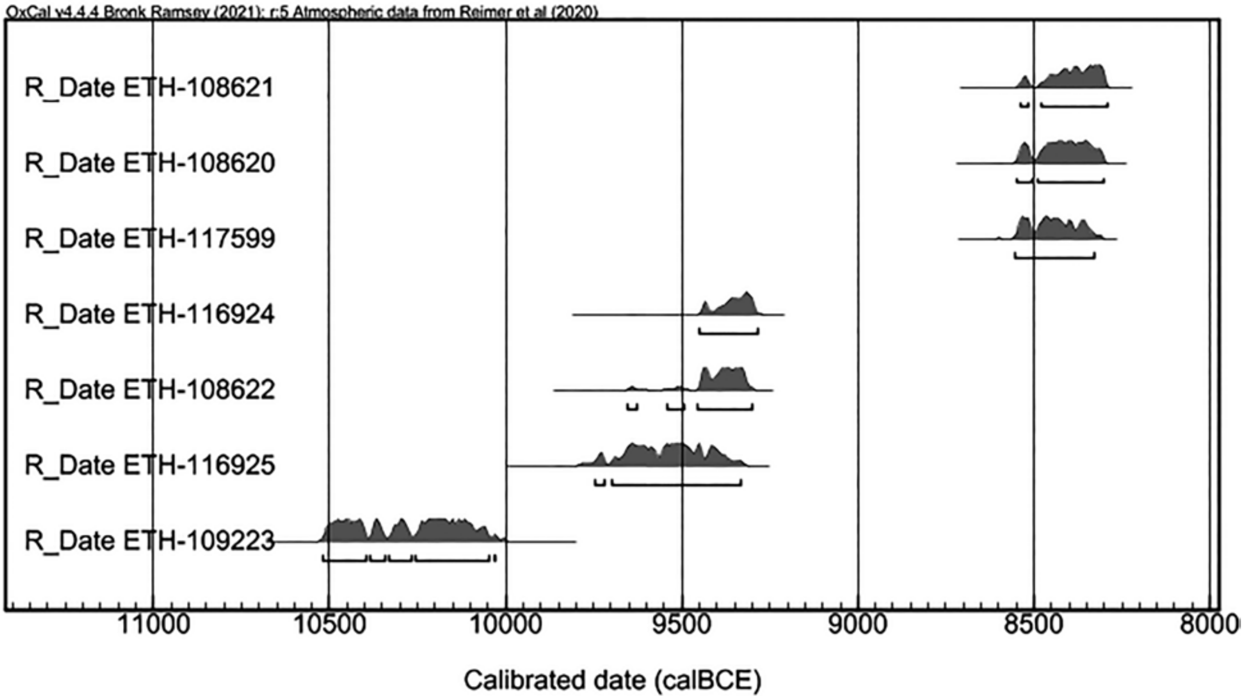


Fig. 11 The distribution of Late Palaeolithic and Early Mesolithic radiocarbon dates from charcoal and antler from the Flözerbändli excavation (BC cal. 2σ, calibrated using Reimer et al. 2020; Bronk Ramsey 2020).

In the absence of any other archaeological finds, it could not be ascertained if the date obtained from the antler artefact represented yet another period of use for the site during the Late Palaeolithic. The unique object was some 1000 years older than the firmly dated first Mesolithic use. Since the three radiocarbon dates obtained as well as the results of the palynological analyses were all consistent with both the end of the Late Palaeolithic and the beginning of the Early Mesolithic, this question could not be answered definitively. One theory was that a group of Early Mesolithic hunter-gatherers used the decorated object over generations or brought an old artefact which they had found elsewhere to the Flözerbändli shelter, where the »curio« was eventually left behind. While the Mesolithic use of the rock shelter clearly occurred during the early stages of the Early Mesolithic, it was not possible based on the morphology of the artefact to firmly place it in this period as well. The other artefacts, however, did support this chronological classification.

Archaeozoology

Osteological Analysis of the Faunal Remains

The excavation unearthed 2460 faunal remains weighing 776 g in total. They were examined by the Archaeozoological Laboratory at the University of Neuchâtel. Due to the diligent use of handpicking and both dry and wet-sieving, the average weight of the bones was no more than 0.3 g. The faunal remains were fairly to very well preserved in the calcareous, alkaline layers (**fig. 12**). The bones, teeth and antler finds were highly fragmented, which is why it was often difficult to identify the species. The later phases (the Early Middle Ages and the Bronze Age) yielded remains of Alpine ibex (*Capra ibex*), chamois (*Rupicapra rupicapra*), lynx (*Lynx lynx*), pine marten (*Martes martes*), least weasel (*Mustela nivalis*), northern mole (*Talpa europaea*),

Fig. 12 Faunal remains from the Mesolithic layers found at the Flözerbändli excavation. Some with traces of burning. – (Photo W. Müller).

shrew (*Sorex* sp.), red squirrel (*Sciurus vulgaris*), vole (*Microtus* sp.), various birds (*e.* g. song thrush, blackbird) and frog (Anura).

The following species were retrieved from the Early Mesolithic layers: red deer (*Cervus elaphus*, decorated antler object, bone tool), Alpine ibex (*Capra ibex*), pine marten (*Martes martes*), least weasel (*Mustela nivalis*), hare / rabbit (*Lepus* sp. / *Oryctolagus cuniculus*), northern mole (*Talpa europaea*), common red-backed vole (*Clethrionomys glareolus*), vole (*Microtus* sp.) and frog (Anura).

The smaller animals were likely to have been naturally deposited in the archaeological layers or perhaps were prey whose remains were left at the shelter by raptors or carnivores (Schibler / Stopp / Wegmüller 2022, 231-233). The bones of the larger animals, for instance ibex, on the other hand, could clearly be interpreted as food waste left behind by prehistoric people. This was attested to by traces of cutting and burning found on several of the bones. Bite marks of carnivores were only rarely found. This suggests that the fresh bones were relatively quickly embedded in the sediment.

No evidence was found in the excavation that would clearly have been indicative of an area for depositing food waste. Compared to the neighbouring site of Berglibalm, where a significantly wider range of hunted animals came to light (Leuzinger et al. 2020, 317), the Flözerbändli site yielded very little food waste overall.

Proteomic Analysis on Selected Bones

In order to identify other animal species included in the Mesolithic diet, 21 osteologically indeterminable bone samples were selected from spits 8-12 and sent to the Institute of Evolutionary Medicine at the University of Zurich for proteomic analysis (**fig. 13**). While the bones did appear to be well preserved, protein preservation between samples was variable and some samples could not be identified. Inter-sample contamination, meaning that some samples contained specific amino acid sequences from multiple species, was probably due to the fact that all faunal remains from a particular square metre and spit were stored in the same bag. It would be advisable in the future to change the method of retrieval accordingly and keep bone fragments stored separately. Subsamples of 3-40 mg were taken from each bone sample. The proteins were extracted from the 100 µl demineralisation solution (0.5 M EDTA, pH 8) and the pellets underwent an SP3 protocol optimised for ancient samples (Wilkin et al. 2020). The extracts were then transferred to the Functional Genomics Center in Zurich for liquid chromatography in tandem with mass spectrometry analysis (LC-MS/MS). The samples were then compared with all known and well-documented protein sequences in

Fig. 13 Proteomic analyses carried out on 21 bones from the Flözerbändli excavation. – List of samples with species- or family-specific peptides. – **A** The 15 individual samples with peptides primarily specific to species within the Pecora subfamily which includes all even-toed ruminants. *Capra ibex* remains (in black) have in fact been recovered from the site and therefore represent the most likely species. – **B** Three individual samples with only human skin and hair peptides. – **C** One individual sample with human, potato and milk peptides attests to modern human and food contamination and poor preservation of the original animal proteins. – **D** Two samples contained only peptides indicative of modern laboratory and environmental contamination. – (Graph S. Wilkin).

the Swissprot Database (available at https://www.uniprot.org/ [16.11.2022]). The resulting identifications were subsequently filtered through a custom R-script (Hagan 2018) in order to remove any poorly scored peptide spectral matches (PSMs) with expect-values above 0.01 and all proteins identified by fewer than 2 PSMs. Identified sequences were checked through UniPept and the Basic Local Alignment Search Tool (BLAST) to find unique sequences of known taxonomic classifications.

Proteins from collagen were sequenced in 19 of the 21 samples (fig. 14). Of these, a further 4 were heavily contaminated (human contamination, food residues [milk, potato]) and did not allow for any further archaeozoological statements. This left 15 samples whose results could be used. None of these could be identified to species level, but many were identified to the tribe or family. All samples included sequences pointing to the Caprinae (sheep and goat which would also include ibex and chamois). While this supports the osteological identifications of ibex (*Capra ibex*), the proteomic analysis did not allow us, unfortunately, to identify any other species that might have been hunted by the Mesolithic hunter-gatherer groups which used the Flözerbändli site.

aDNA Analysis of the Sediments

A total of 22 sediment samples were taken from the west-facing section during the 2021 excavation and sent to the Department of Evolutionary Anthropology at the University of Vienna in order to extract ancient DNA from the soil. Sequencing libraries were then prepared for the DNA extracted from 50 mg of sample material (Rohland et al. 2018; Meyer / Kircher 2010). The sequencing libraries were then compared to a cap-

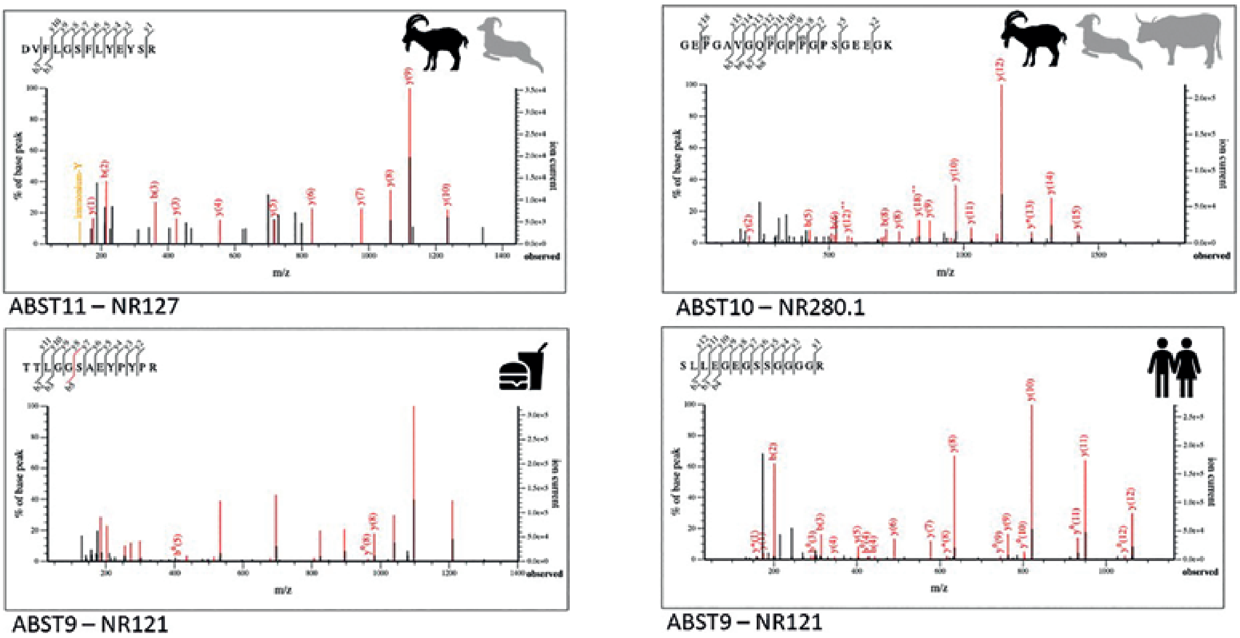


Fig. 14 A selection of four successful proteomic analyses from the Flözerbändli excavation. – Spectra from samples NR127: albumin, Caprinae (sheep/chamois and goat/ibex). – NR280.1: collagen1A2, Pecora (cow/aurochs, sheep/chamois, goat/ibex, and other even-toed ruminants). – NR121: probably linoleate 9s-lipoxygenase 8, *Solanum tuberosum* (potato), and: keratin, type 1 cytoskeletal 10, *Hominidae* (human). – (Graph S. Wilkin).

ture kit of 40 mitochondrial mammal genomes using the software packages BWA and SAMtools (Li/Durbin 2009; Li et al. 2009) in the hope of identifying species sequences in the samples. For cost effectiveness, the individual samples were pooled together in groups of six. Sample pools 9, 11 and 12 did not contain any animal or human aDNA, and subsequently pools 10 and 13 became the main focus; pool 10 contained sediment samples, pool 13 consisted of animal bone samples.

After aligning the sequenced reads against the reference sequences using BWA (Li/Durbin 2009) and excluding duplicates using *samtools* and *picard* (Li/Durbin 2009; Picard-Tools), various animal species were identified. Pool 10 yielded 460 high-quality reads. The preliminary results pointed to the presence of *Capra* sp. and *Lynx lynx*. The pool contained 100 lynx and a small number of *Capra* sp. reads. Unfortunately, the numbers were too low to allow for any further phylogenetic analysis. The lynx reads were a perfect match for the osteologically identified skull fragments of the species from Late Bronze Age spit 4. Pool 13 yielded 18,853 ibex reads (*Capra ibex*). The damage patterns clearly showed that the material analysed was ancient DNA.

Palaeoethnobotanical Analyses

Anthracology

The charcoal fragments recovered from the layers at the Flözerbändli site were analysed at the Laboratory for Ancient Wood Research in Langnau am Albis. The Late Bronze Age hearth contained charred fragments of yew (*Taxus baccata*) and ash wood (*Fraxinus excelsior*). The Mesolithic hunter-gatherers mainly burnt Scots pine (*Pinus sylvestris*) in their hearths. Other species identified were juniper (*Juniperus* sp.), willow (*Salix* sp.) and rose (*Rosa* sp.). Juniper branches were perhaps brought to the shelter to smoke venison.

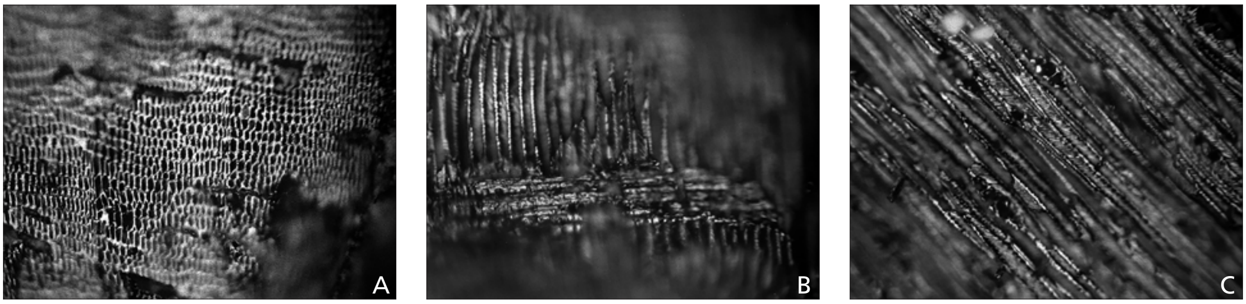


Fig. 15 Microscopic images of the anatomy of charred yew wood (*Taxus baccata*) from the Mesolithic layers found at the Flözerbändli excavation. – **A** cross-section (100× magnification). – **B** radial section (200× magnification). – **C** tangential section (200× magnification). – (Photos W. Oberhuber).

Additional charcoal fragments from the wet-sieved samples were examined at the Department of Botany at the University of Innsbruck; they were retrieved from the upper section of the highly charcoal-rich Layer 8, which dated from around 8400 BC (cal. 2σ). During the 2021 excavation, 20 litres of material from the quadrant 100/50-A (spit 8) were wet-sieved on site. Out of 175 charcoal fragments (>3 mm) handpicked from the screens, 15 of the larger pieces were identified as charred yew wood (*Taxus baccata*) (**fig. 15**). A yew needle was also found in the same layer, showing that this species was already growing near the site in the Early Holocene (as it still does today). Yew branches and needles contain very little resin (Lemke 1902) and are therefore relatively smoke-free when they are burnt. Perhaps prehistoric hunters also extracted poison from fresh yew needles for their arrows. A cut yew seed, which could have been used as a bead, was found at the nearby Mesolithic site of Berglibalm (around 8100 BC [cal. 2σ]) (Leuzinger et al. 2016, 21).

In the Mesolithic, the area surrounding the rock shelter was probably densely forested. This was attested to by palynological analysis of samples from the stratigraphy of the Flözerbändli site (see below) and by research into the vegetational history as represented by sediments from the beginning of the Holocene (around 9700 BC [cal. 2σ]) at Schattgaden Bog on Silberenalp, 9 km away as the crow flies (Haas et al. 2013). The fact that charred juniper wood was found in the bottommost layers of the Flözerbändli, however, shows that there must also have been some open areas in the surrounding woods that had less vegetation at the time.

Macrobotanical Remains

So far, analyses of macrobotanical remains from Mesolithic sites have rarely been carried out, nor have they been particularly fruitful (Jacomet / Vandorpe 2022). Even when large amounts of sediment are wet-sieved, the screens usually only contain a few seeds and fruits from which to gain insight into the sources of plant-based food consumed by Mesolithic hunter-gatherers.

Two sediment samples were taken from the north-facing section of the 2020 excavation (samples A and B) at the Flözerbändli site. A further eight samples, each weighing approximately 1 kg, were taken from the west-facing section of the 2021 excavation (MBF 1-7, 100) and sent to the Department of Botany at the University of Innsbruck for analysis (**tab. 5**). Prior to wet-sieving, the samples were dry-sieved using a 4 mm screen and the differences between the starting weight of the sample, the inorganic matter (stones, artefacts etc. >4 mm) and the residue (0-4 mm fraction) were then recorded in order to calculate the volume of what remained in the sieves. Mesh sizes of 1.0, 0.5, 0.25 and 0.125 mm were used in the wet-sieving process. Using a stereo microscope, the residue in the sieves was then examined for charred seeds, fruits, needles and other macrobotanical remains. Besides tiny charcoal fragments this also brought

sample number sediment description mean depth (cm) age	MFB-7 Strati 193.5 LP	MFB-6 Strati 177 EM1	MFB-5 Strati 169 EM1	MFB-4 Strati 165 EM1	MFB-3 Strati 155.5 EM2	MFB-2 Strati 144.5 EM2	MFB-1 Strati 137.5 EM2	MFB-100 Strati 80 BA	Excav. AL-9 100/49-B Spit 7 EM1	Excav. AL-8 100/50-A Spit 8 EM2	Excav. AL-8 101/50-D Spit 7 EM2
volume (ml)	80	120	150	60	160	150	120	230	10,000	20,000	10,000
total weight (g)	400.4	200	335	326	469.2	430	516.5	816			
weight 0-4 mm (g)	202.3	152.6	200	100	195	237.6	204.7	363			
sample weight >4 mm (g)	198.1	47.4	135	226	275	192.4	311.8	435			
thickness (cm)	7	6	6	6	7	7	5	10			
taxa/finds											
charcoal indet. (>500 µm)		117	403	338	118	103	6	>100			
charcoal indet. (>3 mm)										160	
Taxus baccata charcoal [yew]										15	
Taxus baccata needle [yew]										1	
Pinus sp. needle [pine]					1						
cf. *Pinus* sp. seed coat [pine]					1	1					
Juniperus sp. needle [juniper]								1			
Alnus sp. fruit [alder]		1									
Corylus avellana fruit coat [hazel]			1								1 (in 3 parts)
Tilia sp. fruit [lime]									1		
Caryophyllaceae seed [pinks]							1				
Hypericum cf. *perforatum* seed [St. John's wort]							1				
indet. seed/object charred	2				1			3			
twigs hollow charred (cf. *Sambucus nigra*)								4			
Cenococcum geophilum fruit body [fungus]			1			3	4				
zoological remains [bone, antler, teeth]		16	208	206	371	294	145	49			
mouse droppings charred								2			
archaeological remains [flint/rock crystal]		2			2					1	

Tab. 5 Charred plant remains and archaeological and osteological finds from the sediment samples taken from the west-facing section (MFB 1-7, 100) and from Layer 8 of the Flözerbändli excavation. AL = Archaeological Layer, BA = Bronze Age (1323 ± 88 BC cal. 2σ), EM1 = Early Mesolithic (9514 ± 232 BC cal. 2σ), EM2 = Early Mesolithic (8423 ± 129 BC cal. 2σ), LP = Late Palaeolithic (>9700 BC cal. 2σ). – (Det. F. Kleyhons / W. Oberhuber / J. N. Haas).

Fig. 16 Special charred palaeoethnobotanical finds from the Early Mesolithic layers found at the Flözerbändli excavation. – **A** *Tilia* sp. fruit (lime tree). – **B** *Corylus avellana* hazelnut shell fragments. – (Photos F. Kleyhons).

to light zoological and archaeological finds (**tab. 5**). While the botanical remains were not overly abundant (c. 2 per 100 ml of sediment), they were nonetheless important because they represent the local prehistoric vegetation. Among these were pine needles (*Pinus* sp.), a juniper needle (*Juniperus* sp.), remnants of alder fruits (*Alnus* sp.) and hazelnuts (*Corylus avellana*). Hazelnuts have been used as a nutritious food for a very long time, and charred hazelnut shells are often found at Mesolithic sites (Jacomet/Vandorpe 2022, 9-10; Schlichtherle 2017). The stratigraphy of the Flözerbändli rock shelter also included a number of charred seeds of herbs (*Caryophyllaceae* and *Hypericum* cf. *perforatum*) (**tab. 5**). The presence of St. John's wort is particularly interesting because it has been known as a remedy for a long time and may therefore have been used for medicinal purposes even as early as the Mesolithic. Diligent screening and handpicking of the excavated soil also brought to light an uncharred fragment of birchbark (*Betula* sp.), a charred lime tree fruit (*Tilia* sp.) and fragments of hazelnut shells (*Corylus avellana*) (**fig. 16**). The maturity of both the lime tree fruit and the hazelnuts indicates that the rock shelter was used in summer or autumn.

Microbotanical Remains/Palynology

The sediment samples were also palynologically examined at the Department of Botany at the University of Innsbruck. To everyone's surprise, sample B, the very first sample taken from the north-facing section of the 2020 excavation, was full of microbotanical remains (Leuzinger et al. 2021b). This encouraged us to take further samples from the west-facing section of the 2021 excavation (**fig. 4**). The samples were first prepared according to traditional palynological standards. All identifiable pollen, fern spores and other microscopic remains were then identified and quantified. Layer 10, the bottommost layer, was devoid of archaeological finds and was also revealed to be lacking in palaeoethnobotanically relevant remains (sample MFB-7); the pollen concentration (mainly of *Pinus* sp.) was also extremely low (64 microremains per cm^3, not counting charcoal). The sample can therefore be classified as a late-glacial accumulation of sediment debris with few botanical remains. The six other samples, however, were completely different (300-3200 mircroremains per cm^3, not counting charcoal). Here, the microbotanical remains represented the local flora and vegetation from the end of the Younger Dryas period (Reinig et al. 2021) to the Early Holocene (**figs 17-18**). Sample MFB-6 (bottom edge of Layer 9) contained a large amount of pine pollen (*Pinus* sp., 97 % of the pollen

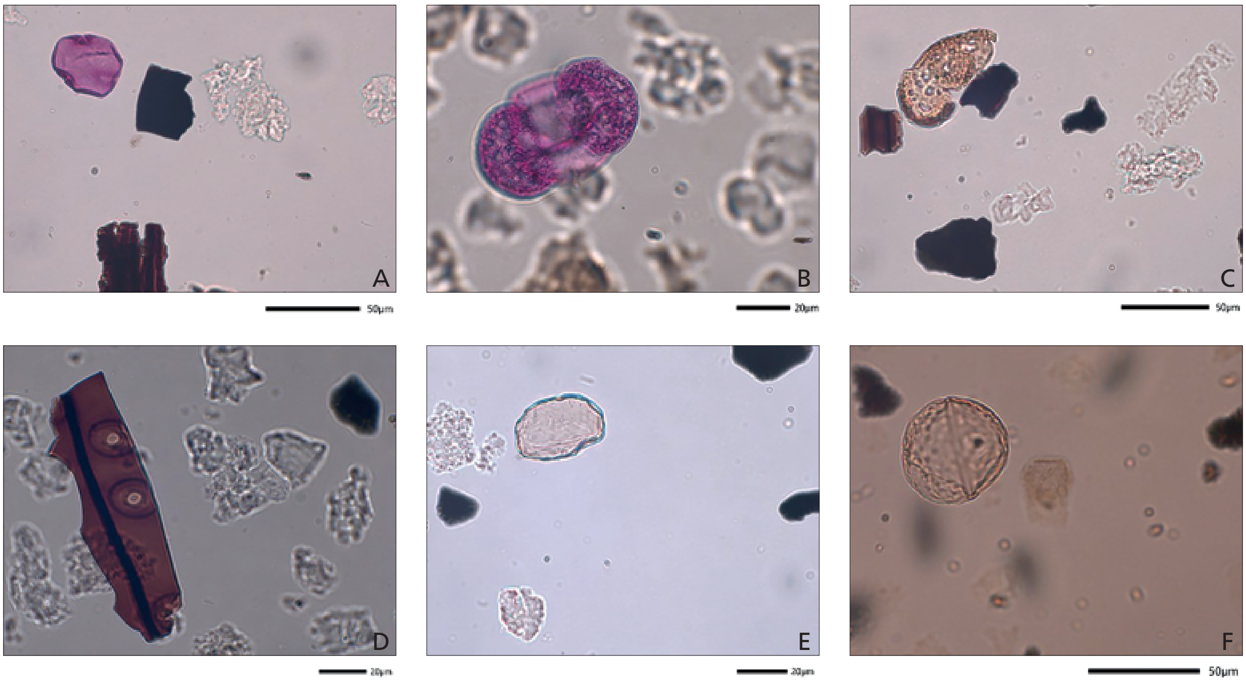
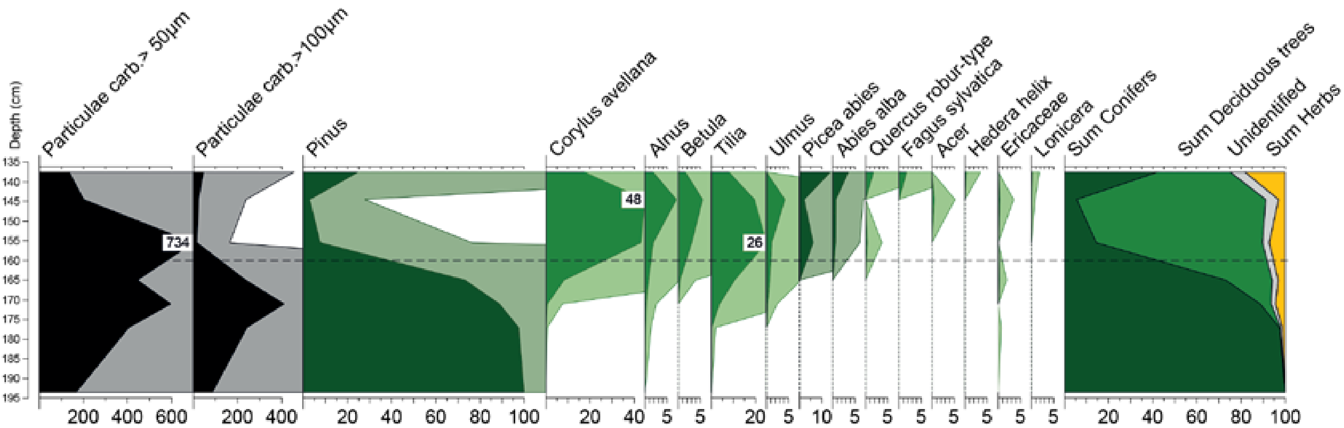


Fig. 17 Pollen, algae and microcharcoal from the Early Mesolithic layers found at the Flözerbändli excavation. – **A** *Tilia* sp. (lime tree pollen). – **B** *Pinus* sp. (pine tree pollen). – **C** *Pinus* sp. (pine tree pollen) with thickened wall due to the impact of heat. – **D** conifer charcoal. – **E** *Trachelomonas* sp. (algae). – **F** *Mougeotia* sp. (algae). – (Photos W. Kofler).



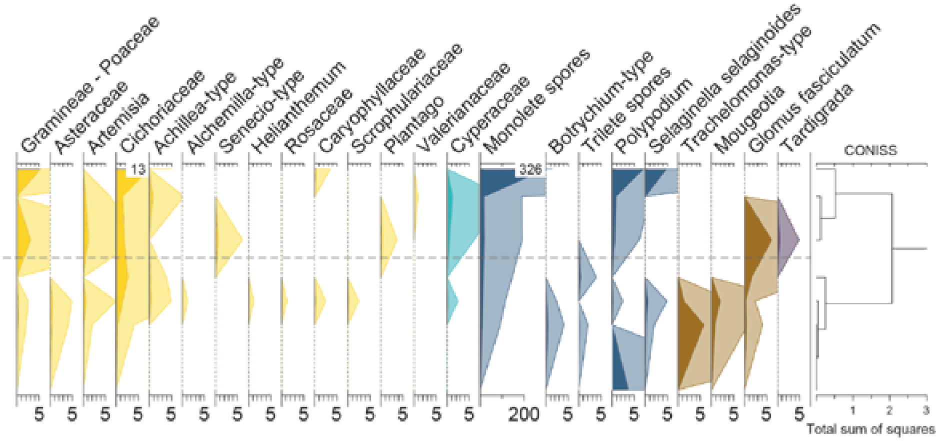


Fig. 18 Palynological diagram based on sediment samples from the west-facing section of the Flözerbändli excavation. From left to right: pollen from trees, shrubs and herbs, spores of cryptogams, microremains of algae and tardigrades, spores of fungi, and microscopic charcoal fragments. – (Graph B. Dietre / J. N. Haas).

sum), as would have been typical of the end of the late-glacial period. This allowed us to reconstruct a forest vegetation dominated by pine trees. Interestingly, the same layer also yielded a number of algae remains (*Trachelomonas* and *Mougeotia*), which occur in stagnant water.
The overlying sediment sample MFB-5 (upper edge of Layer 9), on the other hand, was clearly indicative of an Early Holocene age, i.e. the significant rise in temperatures at the beginning of the Holocene allowed thermophilic species such as lime trees (*Tilia* sp., 3.7 %) to move into the area around the Flözerbändli site, a phenomenon that was also observed in neighbouring regions in the same period (Gobet/Tinner 2012; Tinner et al. 2018). As the pine values steadily decreased in the subsequent period, the lime tree values increased (10.6-25.7 %) in samples MFB-4 to MFB-2 (Layer 8), which points to the local dominance of these insect-pollinated trees. The presence of a charred lime tree fruit was also consistent with this scenario (**tab. 5; fig. 16**). At the same time, other mixed oak forest species, e.g. elm (*Ulmus* sp.), began to immigrate. Hazel (*Corylus avellana*) also became far more common in the region (up to 47 % of the pollen sum). The high charcoal values were also indicative of an Early Mesolithic use of the rock shelter; there were up to 23,000 microscopic charcoal fragments 50-250 µm in size per cm³ of sediment and up to 560 macroscopic charcoal fragments (0.5-4 mm) per 100 cm³ of sediment. The charcoal probably originated from hearths. The top three palynological samples (MFB 3-1) also contained some pollen from spruce (*Picea abies*), silver fir (*Abies alba*) and beech (*Fagus sylvatica*), which were not consistent with the radiocarbon dates of the layers concerned and were thus indicative of downward percolation of pollen from later layers overlying sample MFB-1 (Layer 7), because these tree species did not appear in the Bisis Valley until approximately 6000 BC (cal. 2σ) (Haas et al. 2013; Tinner et al. 2018).
Most microbotanical remains were extraordinarily well preserved given that they were deposited in a rock shelter; this was probably due to the arid conditions beneath the overhanging rock. Together with the small number of charred macrobotanical remains, which bore witness to the local flora at the time, the finds provided an invaluable insight into the environment and the living conditions of the prehistoric population.

CONCLUSIONS

The radiocarbon dates obtained from the Flözerbändli site indicate that the rock shelter was used during two different periods in the Early Holocene, i.e. the early stages of the Early Mesolithic. A highly unusual, elaborately decorated antler artefact from the same layer was dated to another, even earlier period. However, no clear evidence has yet been found that would point to a pre-Mesolithic occupation of the site. It is difficult to suggest a scenario that would definitively explain the features unearthed and any interpretations proposed remain speculative. The two Early Mesolithic phases of occupation at the Flözerbändli site represent some of the earliest evidence for a hunter-gatherer presence in the northern foothills of the Alps after the end of the last Ice Age. The lithic artefacts that were worked or discarded at the site indicate that hunter-gatherer groups roamed far and wide across a landscape that extended from the central Alpine region to the Jura mountains on the one hand and Vorarlberg on the other.
The archaeological surveys carried out over the past 15 years have unearthed evidence of several Mesolithic shelters and hunting camps in the municipal area of Muotathal (Leuzinger et al. 2020). The best-known site so far is the Berglibalm rock shelter, which is situated approximately 5 km upstream from the Flözerbändli site at an elevation of 1140 m a.s.l. In 2015 and 2019, an archaeological layer dating from around 8100 BC (cal. 2σ) was excavated at the site, yielding charcoal, lithic tools, faunal remains and burnt hazelnut shells. Remains of Mesolithic hearths, animal bones with cut marks and a number of fairly non-diagnostic rock crystal, oil quartzite and radiolarite artefacts were found in Muotathal at other small rock shelters and cave

entrances and during surface collections on mountain passes at elevations of 1460-2240 m a.s.l. They included the Steinbockhöhle, the Wunderfitzhöhle and the Milchbalmhöhle caves, the Alt Stafel I and Hüenderbalm rock shelters and the pass-like crossing over Pfaff mountain (Leuzinger et al. 2021b). The sites attest to a complex system of settlement and use of the foothills of the Alps in the Early Holocene. Groups of hunter-gatherers used the high elevations as hunting grounds during the summer and autumn months.

The raw material analyses carried out on the lithic tools from the sites in the Muota Valley show that the Mesolithic hunter-gatherers maintained a network of contacts, both direct and indirect, that extended from the southern Ticino to the River Rhine and from the western Swiss Plateau to Vorarlberg. The omnipresence of radiolarite from Vorarlberg in the lithic assemblages from the Muota Valley sites is worth noting, while local oil quartzite varieties of types 359, 399 and 622 were found in the Unterkobel rock shelter in Oberriet (Ct. St. Gallen/CH) (Affolter 2022, 107-109), which lay on the direct route between central Switzerland and the Kleinwalser Valley.

The scientific analyses highlight the potential for high resolution radiocarbon dating of the stratified sites in the Muota Valley, while the osteological examination and the proteomic and aDNA analyses yield additional insight into Early Holocene fauna and shed light on Early Mesolithic hunting strategies. The identification of different species of wood, along with the palaeoethnobotanical research, allow us to reconstruct the environment in the Muota Valley during the Late Palaeolithic from c. 10,300 BC (cal. 2σ) to the Early Mesolithic in 8400 BC (cal. 2σ).

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Zusammenfassung / Summary / Résumé

Das Flözerbändli – eine spätpaläolithische/frühmesolithische Fundstelle im Muotatal (Canton Schwyz/CH)
In den Sommern 2020/2021 untersuchte ein Archäologen- und Paläoökologenteam die Fundstelle »Flözerbändli«, eine überhängende Felswand auf 740 m ü. M. direkt über dem rechten Ufer der Muota. Dabei entdeckten sie frühmesolithische Schichten, die Holzkohlen aus der Zeit von 9746-8294 v. Chr., Steinartefakte, darunter Geschosseinsätze, sowie Tierknochen und botanische Reste lieferten. Bemerkenswert ist der Fund eines verzierten Hirschgeweihfragments mit regelmäßigen Grübchenreihen, das in die Zeit von 10519-10028 v. Chr. datiert. Solche Objekte aus dem Spätpaläolithikum sind sehr selten. Auf dem Gebiet der Gemeinde Muotathal sind weitere mesolithische Fundstellen bekannt.

The Flözerbändli – a Late Palaeolithic/Early Mesolithic site in the Muota Valley (Canton Schwyz/CH)
In the summers of 2020 and 2021, a team of archaeologists and palaeoecologists examined the »Flözerbändli« site, a rocky overhang located directly above the right bank of the River Muota at an elevation of 740 m a. s. l. The excavations unearthed Early Mesolithic layers which yielded charcoal fragments from 9746-8294 BC, stone artefacts including projectile points, as well as animal bones and palaeoethnobotanical remains. A remarkable find was a red deer antler fragment dating from 10,519-10,028 BC, which was decorated with regular rows of pit marks. Late Palaeolithic finds such as this are extremely rare. Various other Mesolithic sites have also been discovered in the municipal area of Muotathal.

Le Flözerbändli – un site épipaléolithique/mésolithique ancien dans la vallée de la Muota (Canton Schwyz/CH)
En 2020 et 2021, durant l'été, une équipe d'archéologues et paléoécologistes s'est intéressée au lieu-dit »Flözerbändli«, une falaise en surplomb dominant la rive droite de la Muota, à 740 m d'altitude. A cette occasion, on y a découvert un niveau mésolithique ancien qui recelait des charbons de bois datant de 9746-8294 av. J.-C., des outils de pierre dont des pointes de projectile, de même que des vestiges fauniques et des restes botaniques. On relèvera la mise au jour d'un artefact en bois de cervidé orné de rangées de cupules disposées à espaces réguliers datant de 10519-10028 av. J.-C. De tels objets sont très rares au Paléolithique final. Dans la commune de Muotathal, plusieurs autres gisements mésolithiques sont connus.

Schlüsselwörter / Keywords / Mots-clés

Prospektion im Alpenraum / Spätpaläolithikum / Frühmesolithikum / ^{14}C-Analyse / Mikrolithen / Faunenreste / Paläoethnobotanik / Palynologie / Anthrakologie / aDNA / Proteomanalyse / Kleinkunst
Archaeological surveying in the Alps / Late Palaeolithic / Early Mesolithic / radiocarbon analysis / microliths / faunal remains / palaeoethnobotany / palynology / anthracology / aDNA / proteomic analysis / portable art
Prospection en milieu alpin / Paléolithique final / Mésolithique ancien / radiocarbone / microlithes / vestiges fauniques / paléoethnobotanique / palynologie / anthracologie / ADN fossile / analyse protéomique / art mobilier

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