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THE STEINWEIDBAND IN MUOTATHAL (CT. SCHWYZ / CH): A MESOLITHIC HUNTING CAMP IN A SUBALPINE SETTLEMENT LANDSCAPE

Regular archaeological prospection and excavation has been taking place in the municipal territory of Muotathal in central Switzerland since 2005 (Leuzinger et al. 2022). This long-term research project was initiated by the local speleologist Walter Imhof of the Arbeitsgemeinschaft Höllochforschung (AGH). On behalf of and with the financial support of the State Archives of Canton Schwyz, several field campaigns were carried out with volunteer archaeologists during the summer months. Numerous sites from the Late Palaeolithic to the modern era have been discovered and investigated (Imhof 2013; Leuzinger et al. 2022). In the main, these are located near overhanging rock faces or boulders, mountain passes or at *passages obligés*.
The Steinweidband terrace was archaeologically investigated from 2 to 11 August 2023. The site is located on the right bank of the Muota River at the coordinates 46°57'58.55 N / 8°48'51.33 E at 1048 m a. s. l. in steep and almost impassable terrain (**fig. 1**).

Fig. 1 Location of the Muotathal-Steinweidband site in the steep mountain flank (arrow). – (Photo U. Leuzinger).

DOI: https://doi.org/10.11588/ak.2023.4.104061

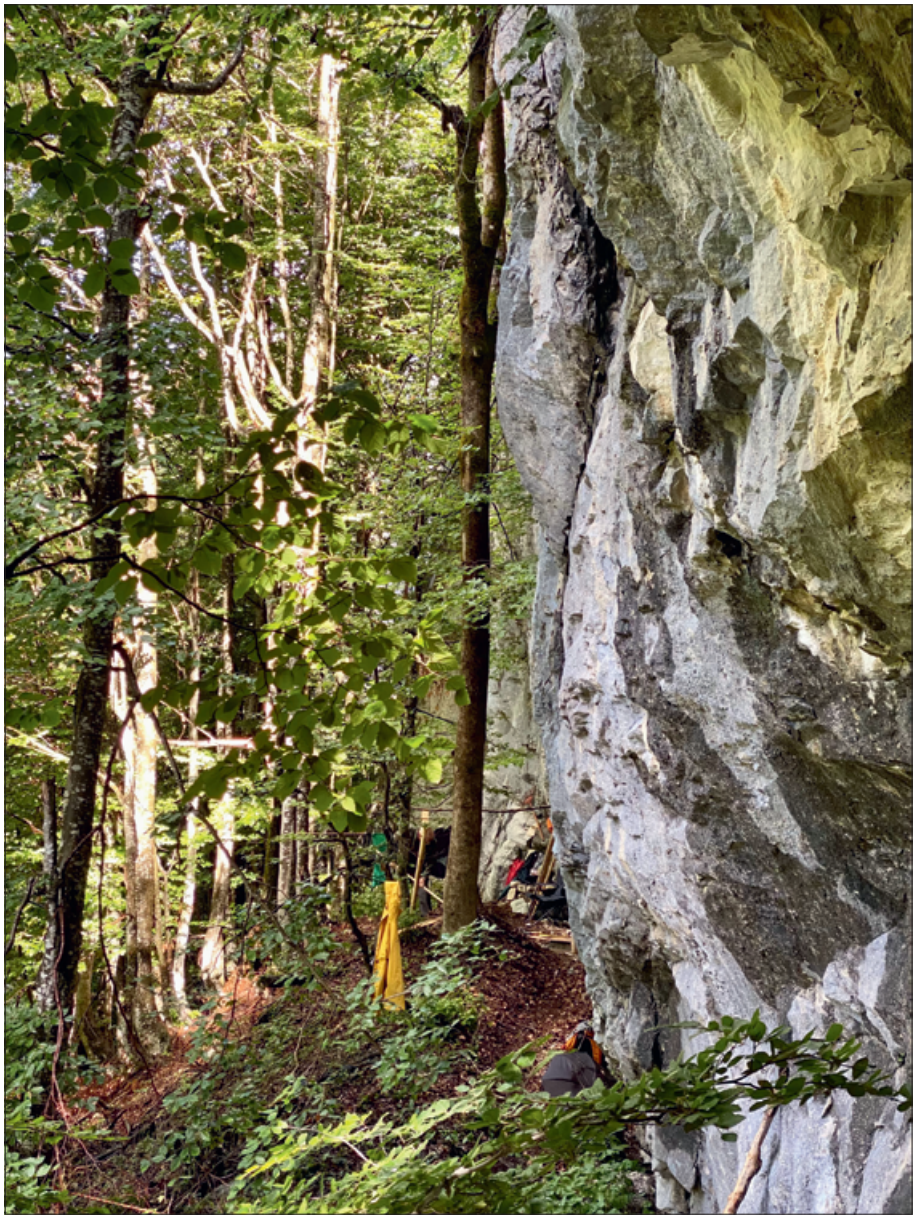

Fig. 2 The Steinweidband site under the slightly overhanging rock face. Excavation summer 2023. – (Photo U. Leuzinger).

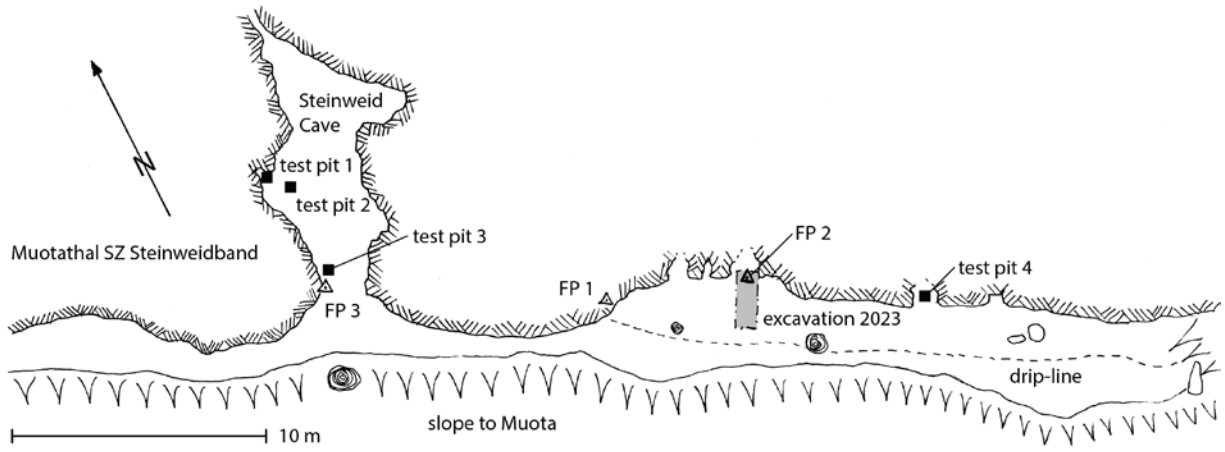

Fig. 3 Ground plan of the Steinweidband site with the Steinweid cave and the 2023 excavation. – (Drawing J. Näf / U. Leuzinger).

In 2020, cave explorers from the Höhlengruppe Muotathal investigated the Steinweidhöhle, a cave located in the rock face of the Cretaceous Betlis formation (Hantke et al. 2013). About 10 m east of the cave, they opened an additional trench at the base of the overhanging rock face to record more precisely the extent of a small cavity. In 2021, Walter Imhof had discovered several charcoal fragments in the profile of this trench that were subsequently radiocarbon-dated by the Laboratory of Ion Beam Physics at ETH Zurich. Worth noting was the sample ETH-126684 from a charred fragment of Scots pine (*Pinus sylvestris*) from a depth of 90 cm, which could be dated to around 9328 ± 27 BP, 8641–8538 BC (cal. 2σ). This early date was ultimately the reason for the small excavation campaign in the summer of 2023. The documentation, as well as the finds and samples, are inventoried in the State Archives of Canton Schwyz under the abbreviation STASZ, SG.CIX.4.432.

THE EXCAVATION

The long, narrow terrace, ca. 23 m long and 4 m wide at its maximum, is located beneath the overhanging rock shelter and above the steep slope; as such, it is well suited as a prehistoric campsite (**figs 2–3**). The Steinweidhöhle to the west could also be a conceivable stopover site, although the ground slopes and is wet from dripping water in some places. However, the steep ascent of almost 300 m from the Muota Valley floor to the rock shelter is extremely challenging and not without danger in places.
In the area of the geological prospection, a 2 m long and 0.8 m wide excavation area was marked out and excavated in five spits to a depth of 1.45 m. Several concentrations of charcoal were discovered. Based on radiocarbon analyses, these date to the modern era, the Middle Ages, the Early Medieval period, Late Antiquity and the older Early Mesolithic. The finds revealed were sparse: three stone artefacts and a few bone fragments.

Stratigraphy and Features

The 1.45 m deep stratigraphic sequence is divided into four sediment units, which – from top to bottom – are described as follows (**figs 4–5**):

1. Large stone blocks (»Versturz«) and many smaller, sharp-edged limestone clasts (frost weathering) in a dark brown silty-sandy matrix, heavily rooted, with occasional charcoal (1b). A facies change is evident in the direction of the rock face (1a), where densely packed stone rubble could be observed. The sediment also changes towards the slope (1c). There, the intercalated stones plainly decrease.
2. Dark brown, sandy-silty sediment with frequent sharp-edged limestone clasts, still strongly influenced by roots. At the base, a clearly defined stratum change to Sediment Unit 3. Dating: Medieval period (ETH-136876).
3. Compact, yellowish silt with sharp-edged limestone clasts, only lightly rooted. The layer intercalates numerous charcoal fragments. Dating: Late Antiquity to Medieval period (ETH-136874, ETH-136875, ETH-139249, ETH-139250).
4. Yellowish silt with sharp-edged limestone clasts and large stone blocks, only lightly rooted. The sediment becomes much wetter towards the base. Several boulders at the base of the stratigraphy hinder further excavation. In Layer 4, the three stone artefacts, numerous mollusc shells and a few faunal remains of small ruminants came to light. Dating: older Early Mesolithic (ETH-126684 and ETH-136877).

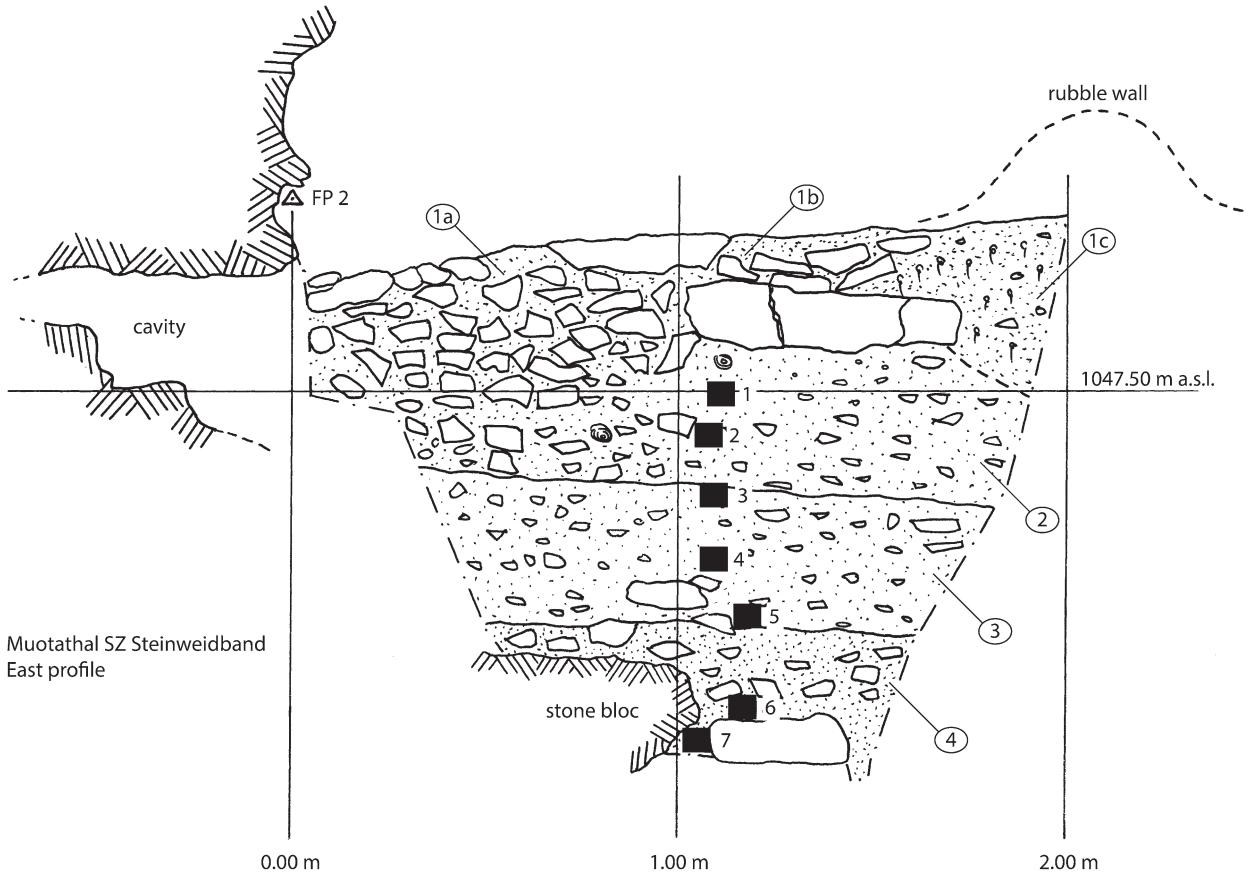

Fig. 4 East profile of the 2023 excavation in the Steinweidband. – (Drawing J. Näf / U. Leuzinger). – Scale 1:20.

No definite features could be recognised within the 0.8 to 2.0 m excavated area. The charcoal fragments recovered at various levels probably came from hearths located outside the excavation area. Only in Spit 2, at a depth of 79 cm, did numerous charcoal fragments from maple (*Acer* sp.) come to light; these probably originated from a fireplace of the 10th century AD *in situ*, although rubefaction of the sediment was not observed, and no stone demarcation was present. Seven sediment samples (MSB 1–7) were taken from the eastern profile for scientific investigations, i. e. anthracology, malacology, osteology, palaeoethnobotany and palynology (fig. 4–5).

Find Material

Only three lithic artefacts were found in Early Mesolithic Layer 4 (Spit 5), although the spoil was partially wet-sieved through 3 mm mesh. The artefacts were a rock crystal flake with chlorite deposits, a splinter of a *pièce ésquillée* made of fine-grained quartzite and a flake made of fine-grained quartzite. The latter artefact displays slight traces of fire exposure and an air patina. Both pieces of fine-grained quartzite can be assigned to the locally-occurring raw material type 359 from Oberiberg (Ct. Schwyz/CH) (Affolter 2022). The 1.4 cm long, 1.3 cm wide and 0.5 cm thick rock crystal artefact bears traces of the idiomorphic crystal surface and two possible retouches. Technically, it could, therefore, be an *ad hoc* thumbnail scraper.

Fig. 5 East profile of 2023 excavation in the Steinweidband with the sampling points of the seven sediment samples MSB 1–7 (yellow labels). – (Photo U. Leuzinger).

In addition, a few faunal remains of small ruminants, probably ibex (*Capra ibex*), came to light (see below). They are interpreted as the remains of hunted game; however, the bone fragments could also have entered the Mesolithic layer through natural processes since they bear no cutmarks or traces of burning.
Compared to neighbouring Mesolithic sites, the find inventory is relatively modest. This suggests that the difficult-to-access rock shelter was only very rarely and briefly visited by prehistoric hunters who used it as an observation post. Even today, red deer follow a game trail along the rock face.

Scientific Analyses

Although only a few anthropogenic traces were uncovered in the small excavation area, a series of scientific analyses could nevertheless be performed to gain further insights into the chronology and environment of the site.

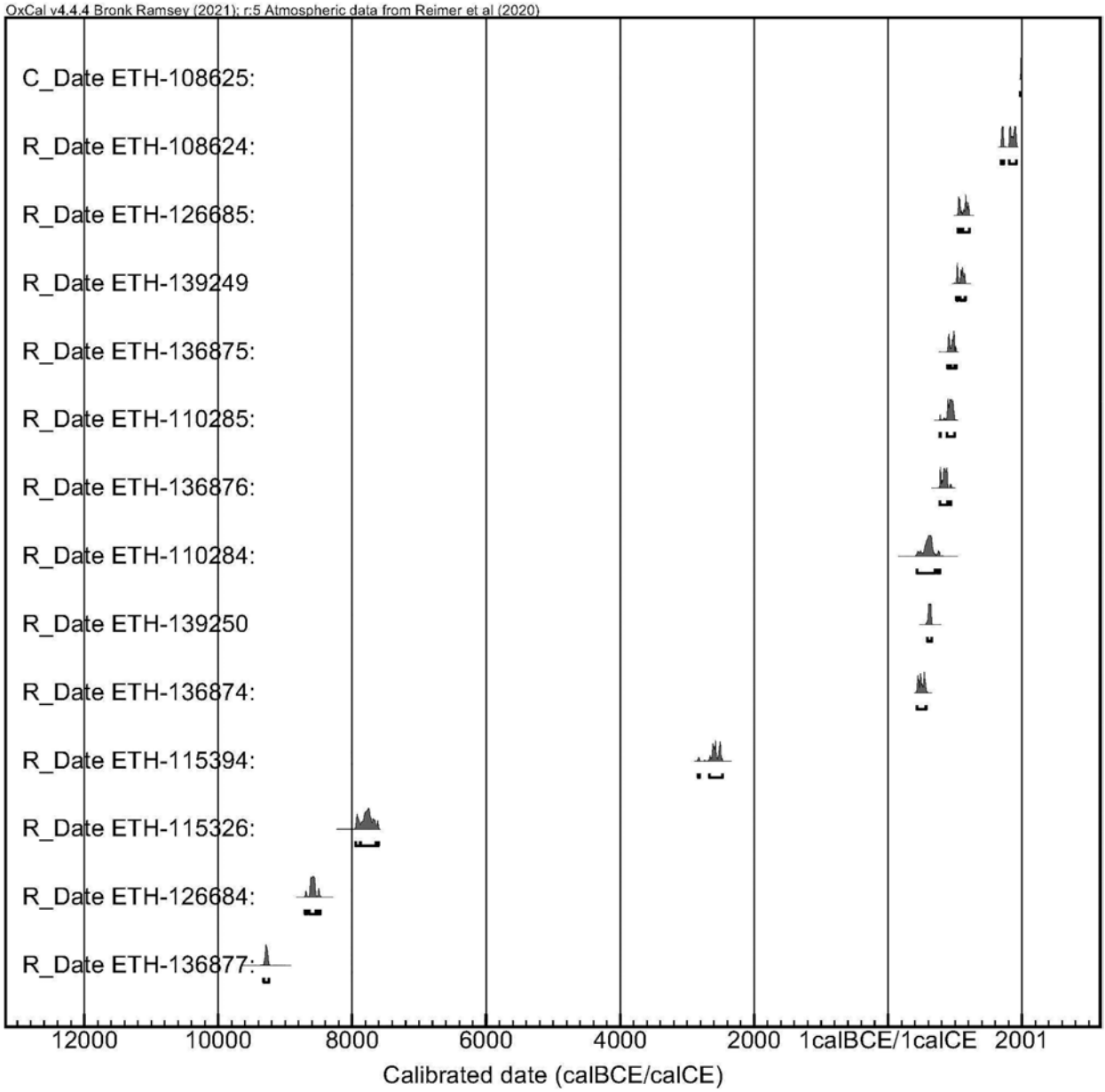

Fig. 6 Distribution of radiocarbon dates from the Steinweidhöhle and the Steinweidband (BC cal. 2σ); radiocarbon ages were calibrated using OxCal 4.4 (Bronk Ramsey 2009) and IntCal20 calibration curve (Reimer et al. 2020). – (Graphic I. Hajdas).

Radiocarbon Dating

There are now 16 radiocarbon analyses from the Steinweidhöhle and the excavations in the Steinweidband, all of which were carried out at the Laboratory of Ion Beam Physics at ETH Zurich. A total of 14 samples could be dated (fig. 6).

Steinweidband (test pits 2021 and excavation 2023):

ETH-108625: -1673 ± 22 BP, 1958–1984 AD (cal. 2σ, post-bomb atmospheric NH1 curve), charcoal, beech (*Fagus sylvatica*)

ETH-126685: 904 ± 22 BP, 1093–1105 AD (cal. 2σ), charcoal, undeterminable

ETH-139249: 976 ± 20 BP, 1022–1154 AD (cal. 2σ), charcoal, juniper (*Juniperus* sp.)

ETH-136875: 1089 ± 22 BP, 892–1017 AD (cal. 2σ), charcoal, maple (*Acer* sp.), juniper (*Juniperus* sp.) and deciduous wood
ETH-136876: 1184 ± 22 BP, 772–941 AD (cal. 2σ), charcoal, maple (*Acer* sp.)
ETH-110284: 1439 ± 80 BP, 430–704 AD (cal. 2σ), charcoal, maple (*Acer* sp.)
ETH-139250: 1441 ± 23 BP, 588–652 AD (cal. 2σ), charcoal, deciduous wood, coniferous wood, beech (*Fagus sylvatica*)
ETH-136874: 1560 ± 22 BP, 432–567 AD (cal. 2σ), charcoal, juniper (*Juniperus* sp.)
ETH-126684: 9328 ± 27 BP, 8641–8538 BC (cal. 2σ), charcoal, Scots pine (*Pinus sylvestris*)
ETH-136877: 9822 ± 33 BP, 9321–9241 BC (cal. 2σ), charcoal, Scots pine (*Pinus sylvestris*)
ETH-136878: --- tooth, ibex (*Capra ibex*), date undeterminable, no collagen

Steinweidhöhle:
ETH-108624: 99 ± 21 BP, 1810–1919 (modern), charcoal, birch (*Betula* sp.)
ETH-110285: 1129 ± 24 BP, 775–993 AD (cal. 2σ), charcoal, Norway spruce (*Picea abies*)
ETH-115394: 4057 ± 25 BP, 2836–2476 BC (cal. 2σ), charcoal, Scots pine (*Pinus sylvestris*)
ETH-115326: 8750 ± 29 BP, 7944–7609 BC (cal. 2σ), tooth, ibex (*Capra ibex*)
ETH-136676: --- tooth, ibex (*Capra ibex*), date undeterminable, no collagen

Two analyses provided data from the 20th century and are likely to date the campfires of hunters or woodcutters. These visitors also left behind several tins, disposed of in crevices. Such rusty containers form a helpful reference horizon for mountaineers from the beginning of the 20th century to around 1980. Radiocarbon dating shows that the difficult-to-access Steinweidhöhle and the adjoining rock shelter were also visited several times in the more-distant past.
Hearths provide evidence of medieval occupation, both in the Steinweidhöhle and in the area of the excavations. They date to ca. AD 1100 and (surprisingly early) to the 5th–7th centuries AD. These sporadic activities – sometimes even before the Alamannic land grab of the 7th century onwards – are likely to have been related to hunting or alpine farming.
The date range of 2836–2476 BC (cal. 2σ) on charcoal from the entrance area of the Steinweidhöhle is notable since it falls into the Corded Ware period. Neolithic finds and features are – compared to the subsequent Bronze Age – rare in the study area and, more generally, in the Swiss Alpine region. In the municipality of Muotathal, only one Corded Ware fireplace with faunal remains (pig tooth from the Stali Rock Shelter in the Hürital [Ct. Schwyz/CH]) is known (Leuzinger et al. 2007, 123–124). The charcoal samples from ca. 9200 and 8600 BC (cal. 2σ) and the three stone artefacts attest to short-term Early Mesolithic visits to the Steinweidband. Whether the ^{14}C-dated, ca. 9800-year-old ibex tooth from the Steinweidhöhle should be interpreted as debris from a Mesolithic hunt or the remains of an animal that died naturally cannot be definitively determined. However, the location of the find – deep within the cave – could indicate that it was utilised as a cool place for meat storage.

Archaeozoology

Very few faunal remains were found during the 2023 excavation. These were identified at the archaeozoological laboratory of the University of Neuchâtel. Only one rib from a stone or pine marten (cf. *Mustelidae*) was found in Layer 1. In the wet-sieved sample from the Early Mesolithic Layer 4 were a fragment of a molar from a small ruminant, which, however, had too little collagen for radiocarbon dating, a milk incisor

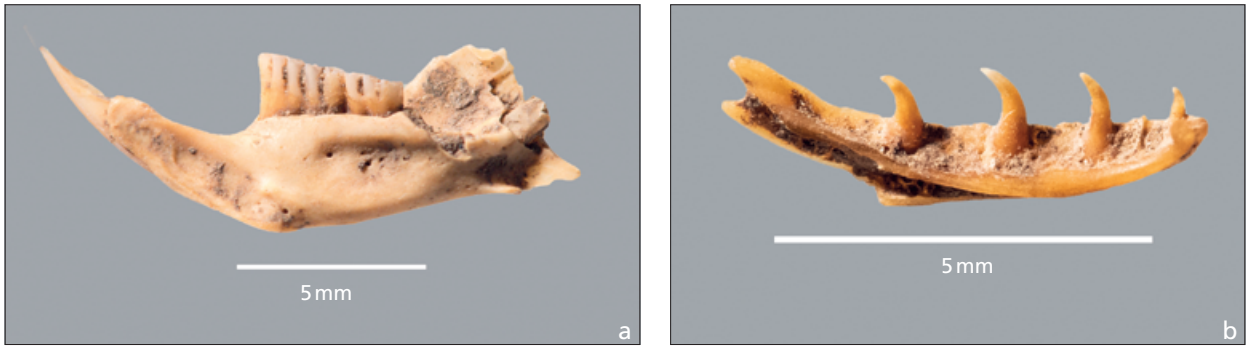

Fig. 7 **a** Mandible of a bank vole (*Clethrionomys*/*Myodes glareolus*). – **b** mandible of an asp viper (*Vipera aspis*) from sediment samples MSB 1 and MSB 2 of the eastern profile. – (Photos W. Müller).

of a small ruminant and five undeterminable bone fragments. Approximately 100 additional faunal remains came from the wet-sieved retent of the sample series from the eastern profile (MSB 1–7) (**fig. 4–5**), which had been completely wet-sieved and floated.

MSB 1: A mandible with dentition (**fig. 7a**) and an isolated molar of a bank vole (*Clethrionomys*/*Myodes glareolus*), a molar of a wood mouse (*Apodemus* sp.), three incisors of an undetermined mouse, five vertebrae and eight keeled scales of a snake that is probably an asp viper (*Vipera aspis*). In addition, around 45 individual bones or fragments of mice are present.
MSB 2: Six molars of a bank vole, one molar of a wood mouse, two upper incisors of an undetermined mouse, one lower incisor of a red-toothed shrew (*Soricidae*) and around 70 additional remains of mice. Ten vertebrae, a skull fragment and a toothed jaw fragment were recovered from a snake (**fig. 7b**). Based on morphological features on the skull bone, this individual can securely be identified as an asp viper (*Vipera aspis*). Additionally, two mandible fragments from a warbler (*Sylviidae*) were present.
MSB 3: Two fragments of a mouse tibia and four micromammal remains.
MSB 6: Two undeterminable bone fragments.

The faunal remains from the Steinweidband excavation were almost exclusively introduced naturally into the strata. The small mammals probably lived in the rock shelter or were quarry brought in by snakes, martens or birds of prey. The tooth and bone fragments of the small ruminant from the Early Mesolithic layer are probably skeletal elements of ibex (*Capra ibex*) or chamois (*Rupicapra rupicapra*). As these remains show no traces of cutting or burning, it is impossible to determine whether they represent food waste from Mesolithic hunter-gatherer groups.

Malacological Analyses

All snail shells from the MSB 1–7 profile samples were collected and analysed. The shells are very well preserved; only the larger taxa are more frequently fragmented. Altogether, the minimum number of individuals totalled 2506. These comprise 47 land snail species, assigned to 10 ecological groups (Favre 1927; Puisségur 1976; Kerney et al. 1983; Turner et al. 1998; Welter-Schultes 2012). In contrast to the neighbouring Flözerbändli site, no burnt shells were found in the Steinweidband (Thew/Leuzinger 2023, 64) (**tab. 1**).

The snail species from Samples MSB 1–2 fit well with the radiocarbon dating of Layer 2 to the Middle Ages; in particular, the incarnate leaf snail (*Monachoides incarnatus*) is characteristic of these periods (Thew 2022, 293). Samples MSB 3–5 from Layer 3 contain mainly forest-loving species such as the pale door snail (*Cochlodina fimbriata*) or the lapidary snail (*Helicigona lapicida*), which, from a malacological point of view, belong to the Older Atlantic period (Late Mesolithic), but which, based on radiocarbon dating, date to the period from Late Antiquity to the Middle Ages. The single shell of a dwarf pond snail (*Galba truncatula*) from Layer 3 is worth special mention. This specimen probably lived on the banks of the Muota River and may have reached the site via collected plants such as rushes, sedges or horsetail (see below). In the Early Mesolithic Layer 4, the species composition indicates a slight vertical displacement of the snail shells, which the presence of calcareous sediment could easily explain. The taxa from MSB 6 date malacologically to the Middle to Late Boreal, although the ^{14}C dating suggests that the sediments were deposited in the later Preboreal. Forest-loving species such as the craven door snail (*Clausilia cruciata*), the cheese snail (*Helicodonta obvoluta*), or the smooth needle snail (*Platyla polita*) are characteristic. The composition of the snail species from sample MSB 7 is characteristic of the Early Boreal (although the radiocarbon data point to an Early Preboreal). Typical gastropods from this period are the forest-loving species such as *Acicula lineolata*, the mask snail (*Isognomostoma isognomostomos*) or *Oxychillus glaber*. Noteworthy is a pioneer species, the brown disc snail (*Discus ruderatus*), which comes from the lowest level of the stratigraphic sequence and provides evidence of Scots pine stands (*Pinus sylvestris*) in the vicinity of the Steinweidband (Liniger/Thew 2008; 2016; Thew 2022).

The presence of *Acicula lineolata* is significant, as this species is now found in Switzerland only in Ticino, and the southeast of Canton Graubünden. In the Steinweidband, it is found in all samples from the Early Holocene to the Middle Ages. This snail may, therefore, have been widespread on the northern side of the Alps in earlier times and may only have become extinct in the northern Alpine region during the Little Ice Age.

In summary, it can be said that the diverse ecological conditions of the Steinweidband have changed surprisingly little over the millennia. The rock face still provides a habitat for the rock snail (*Pyramidula pusilla*) and *Chondrina avenacea*. A relatively open deciduous forest with mature trees has always existed in the rock shelter's vicinity, while the undergrowth forms a dense herbaceous layer with shrubs and young trees. The malacological analysis also supports the assumption that the Steinweidband was only sporadically visited by humans, since not a single snail shell shows exposure to fire.

Anthracological and Palaeoethnobotanical Analyses

The Laboratory for Ancient Wood Research (Langnau am Albis) analysed seven charcoal samples from the sediment layers and the eastern profile. In Medieval Layer 2, the charcoal pieces were analysed as spruce (*Picea abies*) and maple (*Acer* sp.). In Layer 3, which dates to the period between Late Antiquity and the Middle Ages, maple (*Acer* sp.), beech (*Fagus sylvatica*) and juniper (*Juniperus* sp.) were detected, all used as firewood; in addition, there were some deciduous and coniferous woods that could not be identified more precisely. In Early Mesolithic Layer 4, only charcoal fragments from Scots pine (*Pinus sylvestris*) were found. Nowadays, beech trees predominate near the cliff, interspersed with a few ash (*Fraxinus excelsior*) and spruce (*Picea abies*).

Seven sediment samples (MSB 1–7) were taken from the eastern profile of the excavation. These were wet-sieved through a sieve sequence (4-, 2-, 0.5-, 0.25- and 0.125-mm fractions) and floated. The botanical macro-remains, including many as-yet-unidentified charcoal fragments (approx. 500), were then selected

Site		Steinweidband, Profile E, Muotathal, Ct. Schwyz / CH (46°57'58.55 N / 8°48'51.33 E / 1048 m a. s. l.)							Totals
Layer		4		3			2		
Sample		MSB 7	MSB 6	MSB 5	MSB 4	MSB 3	MSB 2	MSB 1	
Sample depth (cm)		140	125	110	95	75	60	50	
Sample volume (ml)		300	1200	1000	750	1000	800	500	
Layer description		yellowish silt with angular limestone clasts + larger blocks + several large boulders at base; significantly damper towards base; some small roots		compact yellowish silt with angular limestone clasts, becoming yellowish-brown at summit; abundant charcoal; moderate smaller roots			dark brown sandy-silty with frequent angular limestone clasts + larger blocks; strongly influenced by roots		
Radiocarbon dates (uncal. BP) and calibrated (BC/AD)		9822±33 BP 9321–9241 BC	9328±27 BP 8641–8538 BC	588–652 AD	---	1022–1154 AD	772-941 AD		
Archaeological material		a few stone artefacts + rare animal bones							
Archaeological period		Early Mesolithic	Early Mesolithic	Early Medieval		Medieval	Medieval	Medieval	
Malacozone		Sw-1	Sw-2	Sw-3a	Sw-3b	Sw-3c	Sw-4a	Sw-4b	
Regional Biozone (radiocarbon dates + molluscs)		^{14}C: Early Preboreal molluscs: Early Boreal	^{14}C: Late Preboreal molluscs: Mid-Late Boreal	^{14}C: Subatlantic molluscs: Older Atlantic	^{14}C: Subatlantic molluscs: Older Atlantic	^{14}C: Subatlantic molluscs: Older Atlantic	Subatlantic	Subatlantic	
Ecological Group	Species								
1	*Clausilia cruciata*		3	1				1	
	Cochlodina fimbriata			1	4	1	1	1	
	Ena montana	1	9	1			2	1	
	Isognomostoma isognomostomos	1	23	1	1				
	Macrogastra attenuata						1	1	
	Macrogastra ventricosa	1	9			2	1		
	% group 1	*2.5*	*4.1*	*1.3*	*2.6*	*0.8*	*1.6*	*3.0*	
2	*Vertigo alpestris*		2			1		1	
	Vertigo pusilla			1					
	% group 2	*0.0*	*0.2*	*0.3*	*0.0*	*0.3*	*0.0*	*0.7*	
3	*Acanthinula aculeata*	1	51	14	8	24	24	4	
	Acicula lineata		2						
	Acicula lineolata	8	46	7	7	8	11	3	
	Aegopinella pura	14	83	37	29	21	12	3	
	Clausilia dubia	2	2		1	1			
	Helicigona lapicida				1				
	Helicodonta obvoluta		1					1	
	Macrogastra plicatula		7	3	1	1	1	1	
	Merdigera obscura		17	2	1	4	2	1	
	Monachoides incarnatus						2		
	Oxychilus glaber	1	7	1	1		2	2	
	Platyla polita		1	1		2			
	% group 3	*21.3*	*20.1*	*21.7*	*25.1*	*17.2*	*16.9*	*11.1*	

4	*Aegopinella nitens*	4	10	1	3	15	9	5	
	Clausilia rugosa parvula	1	21	7	4	10	5	2	
	Discus rotundatus	12	91	16	14	11	8	9	
	Discus ruderatus	1							
	Oxychilus cellarius			1					
	Trochulus clandestinus		3		2	2	2	1	
	Trochulus villosus		3	5	1	3			
	Vitrea subrimata	8	44	10	4	2	5	2	
	% group 4	*21.3*	*15.9*	*13.4*	*14.4*	*12.1*	*9.1*	*14.1*	
5	*Chondrina avenacea*	24	171	44	27	60	51	33	
	Pyramidula pusilla	20	241	58	37	68	70	27	
	% group 5	*36.1*	*38.1*	*34.1*	*32.8*	*36.1*	*37.9*	*44.4*	
6	*Arianta arbustorum*	1	9			2			
	Carychium tridentatum		11	1	1	2	6	5	
	Cochlicopa lubrica	1	10	7	2	12	2	2	
	Columella edentula		1						
	Fruticola fruticum					2			
	Punctum pygmaeum		10	2	1	4	2	1	
	Trochulus sericeus		18	6	3	5	14	2	
	Vitrea crystallina		1						
	Vitrina pellucida	1	1	1			1		
	% group 6	*2.5*	*5.6*	*5.7*	*3.6*	*7.6*	*7.8*	*7.4*	
7	*Cepaea hortensis*		3			1	1	1	
	Euconulus fulvus	5	19	2	1	1	2	2	
	Nesovitrea hammonis		4	3	2	6	1	1	
	Trochulus hispidus	1	1	2			2		
	% group 7	*4.9*	*2.5*	*2.3*	*1.5*	*2.3*	*1.9*	*3.0*	
8	*Abida secale*	14	125	46	28	56	67	19	
	Cochlicopa lubricella		3	2					
	% group 8	*11.5*	*11.8*	*16.1*	*14.4*	*15.8*	*21.0*	*14.1*	
9	*Vallonia costata*		18	15	10	28	12	3	
	% group 9	*0.0*	*1.7*	*5.0*	*5.1*	*7.9*	*3.8*	*2.2*	
12	*Galba truncatula*				1				
	% group 12	*0.0*	*0.0*	*0.0*	*0.5*	*0.0*	*0.0*	*0.0*	
Total Terrestrial Molluscs		**122**	**1081**	**299**	**195**	**355**	**319**	**135**	**2506**
Number of Terrestrial Species		**21**	**38**	**31**	**27**	**29**	**29**	**28**	**47**
7	*Coenococcum geophilum*		1	9	6	17	17	5	
	earthworm granules		9	x	11		2	21	

Tab. 1 Land snail finds from the sediment samples from the eastern profile of the Steinweidband rock shelter (MSB 1–7), listed according to ecological groups: 1. Stable, mature forest with trees of all ages and well-developed undergrowth. – 2. Dry, open forest. – 3. Younger forest, semi-forested scrub + tree-shaded rocks. – 4. Shaded habitats, including forest, scrub, vegetated rocks + dense tall herbs. – 5. Rupestral, living on rocks or stone walls. – 6. Tolerant, but requires some dampness. – 7. Tolerant of a wide range of habitats. – 8. Tolerant, but normally in drier habitats. – 9. Open ground. – 10. Open ground, in dry, well-drained locations. – 11. Marsh, shaded by trees or tall marsh plants. – 12. Marsh, normally among low marsh vegetation or on bare mud. – (Table and species identification N. Thew).

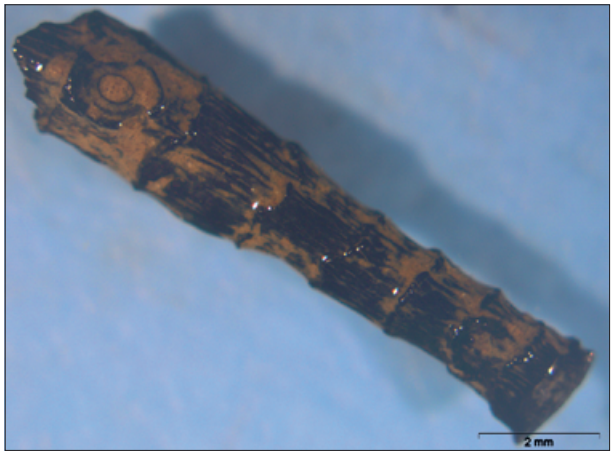

Fig. 8 Charred fragment of horsetail (*Equisetum hyemale*) from sample MSB 3 of the Steinweidband profile, dated to Medieval period. – (Photo M. A. Steiner).

and studied in more detail at the Department of Botany at the University of Innsbruck as part of a bachelor's thesis (Steiner 2023).

As expected, only a few charred macro-remains were detected in the seven small-volume samples MSB 1–7. In the Early Mesolithic layer, there were only seven charred, undeterminable leaf fragments. Noteworthy are the two charred fragments of winter horsetail (*Equisetum hyemale*) from Layers 2 and 3 (MSB 2 and MSB 3) (**fig. 8**). This plant definitely did not grow in the near vicinity of the site. A swampy location along the banks of the Muota River, such as an alder-riparian forest, seems probable. The marsh snail found in the malacological analysis from MSB 3 possibly entered the Steinweidband with the horsetail during the Medieval period. Due to its high level of stored silicic acid, this plant was used as a polishing agent for metal objects, bows and arrow shafts. Horsetail is also said to have anti-inflammatory and immunostimulant properties and can alleviate prostate complaints (Bäumler 2006; Gartmann 2015, 109).

A MESOLITHIC SETTLEMENT LANDSCAPE IN SUBALPINE TERRAIN

Viewed in isolation, the newly discovered Steinweidband findspot would hardly be worth mentioning. However, if one considers the distribution map of Mesolithic sites in today's Muotathal municipal territory, it fits perfectly as an element in a settlement landscape utilised in various ways by prehistoric people. So far – including the Steinweidband – nine sites are known in the study area (**fig. 14**, see below). These are summarised as:

Muotathal (Ct. Schwyz / CH) Flözerbändli East and West

The Flözerbändli (STASZ, SG.4.263 [East] and STASZ, SG.CIX.4.292 [West]) archaeological sites are located on the right bank of the Muota River, close to the area called the »Zwingsbrücke«. Due to the overhanging rock faces, it has always been obligatory (»zwingend«) to cross the river at this point. The rock shelter is, therefore, favourably located in terms of transport geography and hunting strategy at a so-called *passage obligé*.

Flözerbändli East

In two campaigns in August 2020 and 2021, an area of 4 m² was excavated in 13 spits in the eastern part of the 140 m long rock face (46°58'3.80 N / 8°48'4.81 E / 748 m a. s. l.) where a 1.85 m deep stratigraphy could be documented (Leuzinger et al. 2022) (**fig. 9**). Three hearths were found which, based on radiocarbon analyses, date to the Early Mesolithic, the earlier Late Bronze Age and the Early Medieval period. So far, 255 stone artefacts and 2460 faunal remains have come to light in the Early Mesolithic layers. Based

Fig. 9 Muotathal-Flözerbändli East, excavation 2021. – (Photo U. Leuzinger).

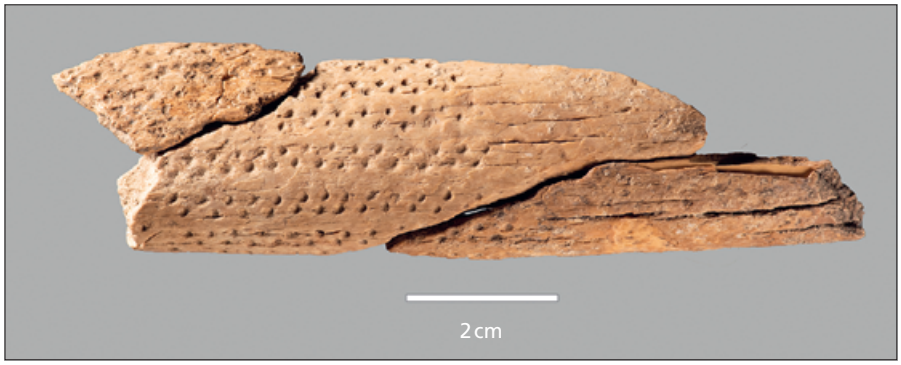

Fig. 10 Muotathal-Flözerbändli East, the ornamented deer antler object. – (Photo W. Müller). – Scale 1:1.

on the ^{14}C analyses, these date to two phases, namely the periods from 9746–9282 BC (cal. 2σ) and 8552–8294 BC (cal. 2σ). One ornamented antler fragment even dates to the Late Palaeolithic (Younger Dryas) at 10,519–10,028 BC (cal. 2σ). The siliceous raw materials consist of fine-grained quartzite (locally present), rock crystal (regional), radiolarite (southern Alpine, Chur [Ct. Graubünden/CH], Kleinwalsertal [Bez. Bregenz/AT / Lkr. Oberallgäu/DE]) and Jurassic chert (Wangen [Ct. Solothurn/CH] and Lägern [Ct. Zurich/CH]). Nine microliths are present. Among the faunal remains, the bones and teeth are highly fragmented and can only be identified to species in very few cases. Only the ibex can securely be identified as

hunted game, evidenced by burn- and cutmarks on the bones. Of particular interest are the four fragments of deer antler, which fit together and are ornamented with rows of small pit marks: such portable art objects of the Late Palaeolithic are very rare throughout Europe (**fig. 10**).
Malacological analyses of 585 individuals confirm the chronological classification (Thew/Leuzinger 2023, 63–68). The species composition shows that the rock shelter's surroundings were forested in the Mesolithic period. Finds of charred hazelnut shells suggest that the hunter-gatherer groups chiefly visited the rock shelter on the right bank of the Muota River in the late summer or autumn.

Flözerbändli West

There is an additional well-protected site in the western section of this rock ledge (46°58'03.80 N / 8°48'05.48 E / 740 m a. s. l.). In 2019, a 30 to 30 cm »trowel test« had been conducted. At that time, charcoal from spruce (*Picea abies*) was found at a depth of 80 cm, dated to the modern era (ETH-107553, 238 ± 21 BP, 1636–1800 AD [cal. 2σ]; ETH-108612, 163 ± 21 BP, 1665–1950 AD [cal. 2σ]). In the summer of 2023, another small test pit was dug, yielding several pieces of spruce charcoal at a depth of between 35 and 76 cm. The lowermost sample dates to the Medieval period (ETH-136873, 829 ± 18 BP, 1177–1266 AD [cal. 2σ]). During this investigation, four stone artefacts came to light on the surface of the washed-out dripline (Trauflinie) of the overhang: small flakes of fine-grained quartzite and rock crystal. Although these new finds may seem unprepossessing, they are highly significant for the site's overall assessment; they confirm the previous speculation that the exploratory excavation in Flözerbändli East merely cut into the edge of an Early Mesolithic campsite (Leuzinger et al. 2022, 471). Therefore, the entire rock ledge can now be classified as a potential archaeological site deserving protection.

Muotathal (Ct. Schwyz / CH) Berglibalm

The large, west-facing Berglibalm rock shelter lies in a 300 m long rock ledge above the right bank of the Muota River at 1140 m a. s. l. (46°55'50.1 N / 8°50'29.18 E) (STASZ, SG.CIX.50.4.4.50). Here, charcoal, bones and a rock crystal flake were found in the spoil of a badger sett. In the summers of 2015 and 2019, a total of 6 m² was excavated and archaeologically recorded. This revealed a 5–10 cm thick Early Mesolithic archaeological stratum (Leuzinger et al. 2020). The six ^{14}C analyses of charcoal from the find layer yielded the following dates: ETH-55851, 9138 ± 37 BP, 8454–8279 BC (cal. 2σ); ETH-63150: 9044 ± 35 BP, 8297–8234 BC (cal. 2σ); ETH-63685: 8912 ± 33 BP, 8150–7965 BC (cal. 2σ); ETH-63686: 8812 ± 33 BP, 8180–7744 BC (cal. 2σ); ETH-63687: 8909 ± 47 BP, 8253–7879 BC (cal. 2σ); ETH-101031: 8760 ± 76 BP, 8197–7599 BC (cal. 2σ).
The lithic assemblage comprises 535 stone artefacts made from fine-grained quartzite, Jura chert, rock crystal and radiolarite. A total of 15 artefacts are classified as projectile points and micro-burins (*Kerbreste*). There are also 15 retouched tools such as endscrapers, end-retouched pieces, splintered pieces and retouched flakes. The anthracology showed that hazel was the predominant firewood, but maple (*Acer* sp.), stone fruit (*Prunus* sp.) and elm (*Ulmus* sp.) were also used. Among the charred botanical macro-remains were a yew seed (*Taxus baccata*) and seven hazelnut shells (*Corylus avellana*). The Early Mesolithic layer produced 567 faunal remains (243.6 g). Traces of burning appear on 56 bones. Ibex (*Capra ibex*), chamois (*Rupicapra rupicapra*), red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) could be identified as hunted game.

Fig. 11 Muotathal-Alt Stafel 1 rock shelter and slope with zone of the surface finds. Visible in the photo (left of centre) are the dry-stone walls and clearance cairns of the deserted medieval settlement. – (Photo U. Leuzinger).

Muotathal (Ct. Schwyz / CH) Alt Stafel 1 Rock Shelter

In the extensive karst region of the Silberen, the Alt Stafel 1 rock shelter lies beneath an overhanging rock ledge at 1840 m a. s. l. (46°59'14.57 N / 8°55'40.50 E) (STASZ, SG.CIX.4.265). The south-facing rock shelter overlooks a gently sloping terrace, on which the remains of the dry-stone walls of a rectangular building are clearly visible (**fig. 11**). Here, three test pits had been dug in 2006 (Leuzinger et al. 2007, 120). They showed that, during the construction of the building (probably in the Middle Ages), the sediments had been partially cleared down to the bedrock and displaced downhill. A water pipe laid in the 1960s was refurbished in 2007 and sunk into the slope fill; the vegetation along this pipeline was slow to recover. In 2012, the footpath and cattle track were also relocated to the slope directly in front of the rock shelter; the plant cover here was similarly sparse due to the earthworks. As part of the annual research week organised by the Gruppe Schwyzerschacht, a speleological sub-division of the AGH, the pipeline route, the many marmot burrows, the newly relocated path and the cattle track in front of the rock shelter were all subjected to detailed surface investigation.

Archaeological finds in secondary position were repeatedly uncovered (Leuzinger/Imhof 2022, 221). To date, 22 stone artefacts, 10 faunal remains, 8 fragments of pottery and several charcoal fragments have been collected. Based on the find inventory and radiocarbon dating, it is clear that a multi-phase stratigraphy was originally present in the Alt Stafel 1 rock shelter. The six ^{14}C analyses carried out so far (ETH-

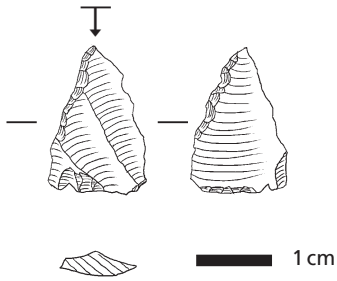

Fig. 12 Muotathal-Alt Stafel 1 rock shelter, the bifacially edge-retouched point with partially worked base discovered in summer 2023. – (Drawing U. Leuzinger). – Scale 1:1.

128905, 9909 ± 32 BP, 9450–9287 BC [cal. 2σ], charcoal; ETH-47240, 3274 ± 50 BP, 1679–1440 BC [cal. 2σ], charcoal; ETH-52171, 2869 ± 29 BP, 1130–930 BC [cal. 2σ], charcoal; ETH-63232, 2508 ± 33 BP, 791–535 BC [cal. 2σ], pig bone; ETH-101033, 1120 ± 21 BP, 938–968 AD [cal. 2σ], charcoal; ETH-117865, 640 ± 22 BP, 1287–1395 AD [cal. 2σ], bovine tooth), as well as additional finds, indirectly attest to utilisation phases of the rock shelter that range from the Early Mesolithic (silices, charcoal) through the Late Bronze Age (pottery, charcoal), Iron Age (charcoal), Medieval period (tooth, charcoal) and the modern era (pottery).

The prehistoric stone artefacts are made from local fine-grained quartzite, non-local radiolarite and rock crystal. The tools comprise a bifacially edge-retouched point with partially worked base made of fine-grained quartzite (**fig. 12**), an end-retouched bladelet made of red radiolarite, a thumbnail scraper made of green radiolarite, and a borer made of fine-grained quartzite. The projectile point and the three tools date typologically probably to the older Early Mesolithic, which fits well with the existing radiocarbon date from the second half of the 10th millennium BC. However, there is good reason to expect other Stone Age utilisation phases in the rock shelter. Even if the multi-phase stratigraphy has been irretrievably destroyed, this rock shelter still occupies a key position in the Silberen region. In the Mesolithic period, it was presumably close to the tree line and probably served as a base camp for hunting trips in the direction of Silberen, Twärenen and Bödmeren. The nearby Pragel Pass also provided access to the Linth Plain via Lake Klöntalersee and the gently rising Schwialp Pass to Lake Zurich.

Muotathal (Ct. Schwyz / CH) Pfaff Pass

The hiking trail from the Glattalp to the Charetalp crosses a pass (46°55’28.66 N / 8°52’20.33 E) located at 2057 m a. s. l., north of Pfaff Mountain (STASZ, SG.CIX.4.431) (**fig. 13**). The trail was rerouted in 2019, which involved major earth movements. Because the topographical situation is favourable for a Mesolithic stopover site, a prospection team searched the pass in the summers of 2022 and 2023. So far, seven stone artefacts have come to light on the surface. These comprise four specimens of crystal-clear rock crystal and three of homogeneous fine-grained quartzite. None of the artefacts have been retouched, meaning that the small inventory cannot so far be dated typologically. However, the characteristic location on a pass crossing may indicate a Mesolithic date. During the Mesolithic period, the site was located above the tree line and, at that time, provided a good view of the two extensive hunting grounds of the Glattalp and Charetalp. Therefore, it was probably an observation post used by a prehistoric hunter-gatherer group.

Muotathal (Ct. Schwyz / CH) Wunderfitzhöhle

The Wunderfitzhöhle, discovered in 1990, lies south-west of the Twärenen summit plateau at 2240 m a. s. l. (46°59’19.28 N / 8°53’43.87 E) (STASZ, SG.CIX.50.4.4.149). This cave is 422 m long and descends to a depth of 90 m into the mountain. In 2003, over 500 bone and antler fragments from at least six individual red deer (*Cervus elaphus*) were discovered in a narrow side passage among rock debris (Auf der Maur et al.

Fig. 13 Muotathal-Pfaff Pass, where the probable Mesolithic artefacts were found. – (Photo U. Leuzinger).

2005, 55–57). The ^{14}C analysis (ETH-27609) on a humerus revealed an age of 8855 ± 70 BP, 8035–7694 BC (cal. 2σ). Several bones bear cutmarks from stone tools, and there are also deliberately-opened metapodials. Unshed antlers show that the animals died in summer or autumn. The worked deer bones testify, albeit only indirectly, to the presence of Mesolithic hunter-gatherer groups on Twärenen. The faunal remains presumably come from butchery waste disposed of in a karst shaft in the Wunderfitzhöhle.

Muotathal (Ct. Schwyz / CH) Milchbalmhöhle

The Milchbalmhöhle (STASZ, SG.CIX.50.4.4.93) is located in the Chalbertal Valley at 1622 m a. s. l. (46°57'52.51 N / 8°50'31.81 E). It lies in the midst of a karst field, and its entrance is orientated to the north. The surface of the cave floor, strewn with limestone rubble, was explored in 2005 and 2006. A »trowel test« yielded no results. All the more interesting, therefore, are the more than 300 bone remains that were recovered from the cave floor 20 m from the entrance. Several fragments show clear traces of burning and cutting (Auf der Maur et al. 2005, 37–39). The fire-exposed shoulder blade of an ibex (*Capra ibex*) dates to the Early Mesolithic period (ETH-25109, 9415 ± 75 BP, 9150–8450 BC [cal. 2σ]). A thoracic vertebra from the same animal shows a cutmark on the spinous process. A pelvic bone from a red deer (*Cervus elaphus*) also bears cutmarks. On this piece, the ^{14}C analysis ETH-26807 revealed an age of 7975 ± 55 BP, 7032–6649 BC

(cal. 2σ). A tibia fragment with cutmarks from another red deer provided a radiocarbon date (ETH-23845) of 6960 ± 75 BP, 6000–5710 BC (cal. 2σ). Thus, there are indications that groups of hunter-gatherers used the cave during the Early and Late Mesolithic.

Muotathal (Ct. Schwyz / CH) Steinbockhöhle

The Steinbockhöhle (STASZ, SG.CIX.4.4.100) is a cave located in the Silberen region at 2053 m a. s. l. (46°59'48.44 N / 8°54'50.84 E). In the area of a tectonic fault 10 m from the lower entrance, 170 bones of ibex (*Capra ibex*) were found on the surface of the cave floor. Some show clear cutmarks from stone tools (Hüster-Plogmann / Schibler 2005, 67). The ^{14}C analysis ETH-29331 on an ibex premolar revealed an age of 8815 ± 70 BP, 8017–7680 BC (cal. 2σ), suggesting that Early Mesolithic hunters used the cave. Therefore, a small test excavation was carried out in the upper entrance area in 2006. The sediment consisted of coarse, sharp-edged clasts and lime gravel with a matrix of brown clay. After a few decimetres, larger rocks prevented further digging. The test excavation yielded no finds.

Muotathal (Ct. Schwyz / CH) Hüenderbalm

The small, north-west orientated cave (STASZ, SG.CIX.50.4.4.66/94) is located on the edge of the Bödmerenwald Virgin Forest Reserve at 1460 m a. s. l. (46°58'53.30 N / 8°50'10.78 E). A small test excavation had already been carried out in the entrance area in 2006, which yielded no finds (Leuzinger et al. 2007, 122). Two further probes in 2017 also failed to reveal traces of human activity (Leuzinger / Imhof 2018, 23–24). However, several bones were discovered beneath a boulder at the back of the cave; they came from the loose spoil generated by AGH cave explorers in 2004 when they attempted to extend the collapsed cave passage to the south-east.

A series of six ^{14}C dates yielded late Palaeolithic to modern dates: ETH-29732, 10770 ± 80 BP, 11200–10650 BC (cal. 2σ), ptarmigan bone; ETH-30049, 10600 ± 80 BP, 11000–10350 BC (cal. 2σ), tarsal bone of a small ruminant; ETH-29394, 9850 ± 70 BP, 9204–8981 BC (cal. 2σ), ibex rib; ETH-80903, 6212 ± 25 BP, 5292–5062 BC (cal. 2σ), ibex long bone with cutmarks; ETH-29731, 1000 ± 45 BP, 975–1160 AD (cal. 2σ), charcoal; ETH-30050, 250 ± 50 BP, 1487–1686 AD (cal. 2σ), and a bone fragment (probably domestic pig) with cutmarks.

Of note are two bones that show evidence of human modification. One undated bone fragment, which cannot be identified more precisely, bears distinct traces of burning. Another faunal find, the deliberately-opened long bone of an ibex (*Capra ibex*), clearly displays the cutmarks of a flint knife. It is dated to the second half of the 6th millennium BC (ETH-80903), thus providing evidence for prehistoric visits to the Hüenderbalm during the transition between the Mesolithic and Neolithic periods. At that time, people seem to have used the cave entrance as a shelter, where they butchered at least one ibex with stone tools.

LANDSCAPE UTILISATION IN MUOTATHAL

After almost 20 years of archaeological field research in the Muotathal district, we can now try to place the nine Mesolithic sites found to date in the context of a settlement landscape used by prehistoric hunter-gatherers at a montane-alpine altitude. Models from the southern Alpine region are applicable, since the

state of research and the site density there provide a more stable basis for such an evaluation (Bazzanella et al. 2007; Broglio/Lanzinger 1990, 53–69; Fontana 2011, 302–303; Fontana et al. 2011, 76–79; Grimaldi/Flor 2009; Kompatscher/Kompatscher 2011, 205–241; Kompatscher et al. 2020, 47–48; Lanzinger 1996, 125–140). In South Tyrol and Trentino, in particular, the different compositions of raw materials and artefacts, as well as the topographical location of the sites, reveal links between the valley camps and the high-altitude hunting stations. According to these models, Mesolithic hunter-gatherer groups roamed the lower altitudes from autumn to spring – as did a large proportion of the population during the summer months (Bazzanella et al. 2007, 98). Specialised hunters and gatherers moved into the mountains in summer and autumn to hunt alpine game above the tree line or to obtain raw materials such as rock crystal or fine-grained quartzite (Reitmaier et al. 2016). On the way into the mountains, favourable locations at the montane level (800–1200 m a. s. l.) served as rest stops or stopover sites. Comparable land use systems have recently been identified in the Kleinwalsertal in Austria, as well (Posch 2022).

Even if well-studied Mesolithic sites from the Swiss Alpine region are still relatively rare compared to the neighbouring Alpine regions in France, Italy and Austria, the state of research has improved significantly in recent years thanks to extensive surveying activities (Cornelissen/Reitmaier 2016). There are now also sufficient Mesolithic sites in the Muotathal municipal territory to propose an initial, model analysis of landscape utilisation by prehistoric hunter-gatherer groups.

For climatic reasons, the area could only be visited in summer and autumn in prehistoric times. On the Glattalp (1858 m a. s. l.), the snow cover during the winters from 1969 to 2023 was between 230 and 550 cm, and the lowest temperature was -52.5°C on 7 February 1991 (https://glattalp.ch/cms/upload/dokumente/glattalp_wetterdaten.pdf [14.8.2023]). This seasonal interpretation is also supported by the discovery of unshed red deer antlers, a second lower molar of a 15-month-old ibex and charred hazelnut shells from Mesolithic find-layers.

The palynological off-site investigations in the Schattgadenmoor on Hinter Silberenalp (Haas et al. 2013), the on-site pollen profile from Flözerbändli East (Leuzinger et al. 2022, 482–484) and the malacological analyses (Thew/Leuzinger 2023) prove that the area was densely forested in the Mesolithic era. The timberline in the Central Alps rose rapidly from 1500 to over 2000 m a. s. l. at the beginning of the Holocene (Gobet et al. 2010, 107; 2011, 71). Palaeoecological investigations of sediment cores from the Schattgadenmoor at 1890 m a. s. l. show that a sparse pine forest existed in the vicinity of the coring site ca. 8950 BC (Haas et al. 2013, 24–25).

Orientation in such densely forested and largely uninhabited areas was then quite challenging. The Mesolithic hunting groups had to be familiar with a network of terrain features such as the course of rivers, the sequence of lakes or the location of characteristic landmarks like rock formations, waterfalls, caves or pass crossings in order to traverse a route from the Swiss Plateau – e. g. the Wauwilermoos – to the Muotathal district.

There are currently nine Mesolithic sites in the study area (**fig. 14**). Despite intensive prospection activity, it can be assumed that they represent only a fraction of the sites originally found in the municipality of Muotathal. For the utilisation model, the Flözerbändli (West/East) and the Berglibalm were defined as base camps at lower altitudes (between 750 and 1150 m a. s. l.). The Alt Stafel 1 rock shelter was also probably a more extensive, multi-phase camp, used as a base for hunting expeditions, although it is already close to the tree line at 1840 m a. s. l. The sites at the Wunderfitzhöhle, Steinweidband, Steinbockhöhle, Milchbalmhöhle, Hüenderbalm and the Pfaff Pass are defined as short-term rest stops or observation posts for hunting Alpine game. In Mesolithic times, such sites were located both in the forest and slightly above the tree line.

From an archaeological perspective, the strikingly flat valley floor of the Muotathal municipal territory, filled with alluvions and slope-debris fans, has been largely ignored until now (Hantke et al. 2013, 48–50). In

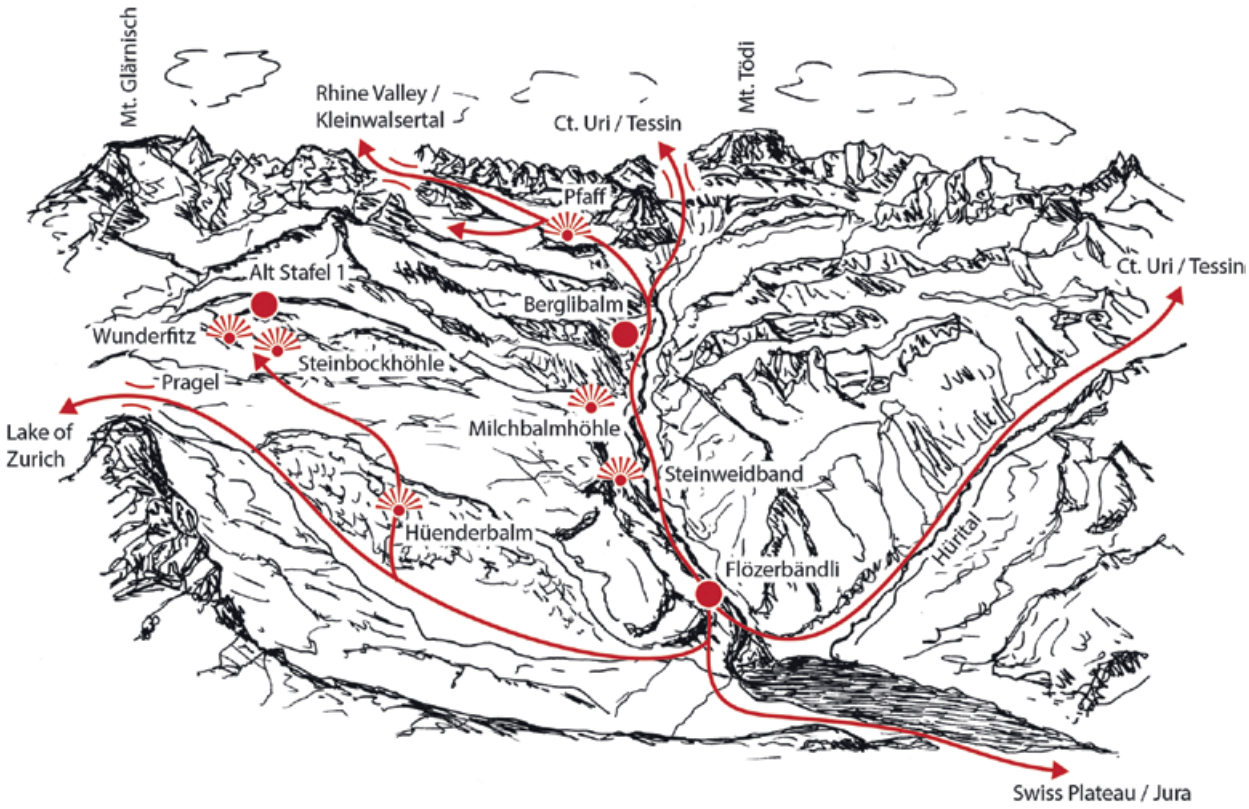

Fig. 14 Terrain model of the study area in Muotathal with the Mesolithic findspots and the ancient lake in the foreground. – (Based on the Muotathal panoramic map by W. Kettler, drawing J. Näf / U. Leuzinger).

Late Palaeolithic and Mesolithic times this was a deep lake, dammed by a rising rock bar and a terminal moraine in an area called the »Schlattli«. Geophysical subsoil analyses show that the basin sediments in the Muotathal valley floor are at least 200 m deep (Faber et al. 2003, 29). This prehistoric body of water should be included in the Mesolithic site catchment analysis, as it probably served as a landmark and productive fishing ground at the time.

The function of the Flözerbändli site is the easiest to assess. It lies directly on the stretch of the river where, because of the steep rock faces, the Muota had to be crossed when going up the valley to the higher-altitude hunting grounds of Glattalp, Charetalp and Ruossalp (or if travelling in the opposite direction). During periods of high water, people were forced to wait at this *passage obligé* until the waters receded. The topographical situation also made the rock shelter strategically attractive for hunters, as it channelled game migration.

The very large Berglibalm lies above the Schwarzenbach terrace. From there, one can reach the high-altitude hunting grounds of Glattalp and Charetalp directly via the Milchbüelen Alp, connected by the Pfaff Pass. The sheltered Berglibalm probably served as a base camp for hunting expeditions above the tree line. In bad weather, it could also accommodate a larger group of hunters. In addition, the rock shelter was used to repair hunting weapons, process game, and temporarily store equipment or food supplies. These activities are all confirmed by finds and features (Leuzinger et al. 2020).

The Wunderfitzhöhle, Steinweidband, Steinbockhöhle, Milchbalmhöhle and Hüenderbalm sites, designated as hunting camps, are sheltered locations that are remote and sometimes very difficult to access. For this reason, however, they will have been conducive to successful game stalking. The small number of finds – just isolated stone artefacts or faunal remains with cutmarks and traces of burning – show that these over-

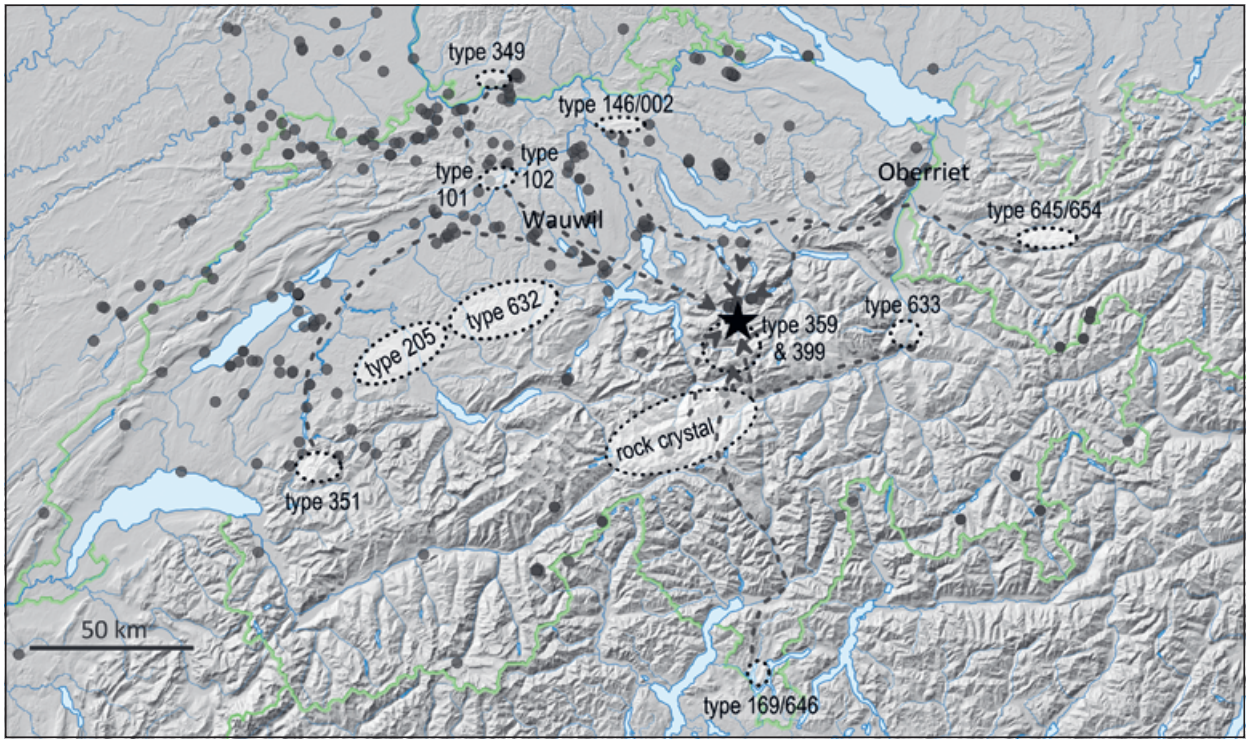

Fig. 15 Origin of the lithic raw material from the Mesolithic sites in Muotathal based on analyses by J. Affolter, Ar-Géo_lab Neuchâtel. Dots: Mesolithic sites in Switzerland, eastern France and southern Germany (unpubl. database R. Jagher). – (Map swisstopo, R. Jagher).

hanging rock formations were only visited sporadically and for short periods by Mesolithic hunting groups. The discovery of additional prehistoric stopover sites can be reasonably anticipated in the future. During the earlier archaeological prospection campaigns, especially on the Silberen and in the Hürital, prehistoric features and finds were only searched for in suitable cave entrances and rock shelters using narrowly defined »trowel tests«. These can only be excavated to arm's length, or a maximum depth of 80 cm. Therefore, it can be assumed, due to the methods used before 2015, that the teams stopped too soon – often in Bronze Age layers – and did not reach the potentially older remains (Leuzinger et al. 2007; Imhof/Leuzinger 2021, 93–95).

MUOTATHAL IN SUPRA-REGIONAL CONTEXT DURING THE MESOLITHIC PERIOD

Macro- and microscopic analyses of raw material are available from all the sites in the municipality of Muotathal that yielded lithic artefacts. These analyses make it possible to localise the deposits from which the artefacts originated and thus to recognise the directions in which the hunter-gatherer groups maintained contacts and exchange (**fig. 15**) (Affolter 2002; Affolter et al. 2022, 33–35; Nielsen 2022).

According to the southern Alpine models cited above, the base camps of the hunter-gatherers who seasonally roamed the Muotathal municipal territory were probably found on the Lucerne Plateau. It is likely that these people spent the colder half of the year in the Wauwilermoos or in the region around Lake Sempach (e. g. Sursee-Vierherrenplatz [Ct. Lucerne/CH]), where numerous large and small Epipalaeolithic and Mesolithic settlement sites are documented (Nielsen 2009; 2022). The route from Wauwil (Ct. Lucerne/CH) to the Flözerbändli in the municipality of Muotathal is around 80 km long, involving a total ascent of 1300 m.

Today, such a distance can be covered in 20 hours, i. e. in 2–3 days, using a well-developed network of hiking trails (according to the Bergfex tour app). In the Mesolithic period, a journey into the alpine terrain – perhaps interrupted by gathering and hunting activities – probably lasted no longer than a week. The microscopic analyses from Ar-Géo_lab Neuchâtel show that the hunter-gatherer groups used projectile points and implements whose raw material came from deposits in Muotathal (type 359, fine-grained quartzite, thus 50–75 % was supplied locally), Canton Uri (rock crystal), southern Ticino (type 169, 646), the Rhine Valley near Chur (type 633), the Kleinwalsertal (type 654), the Lägern (type 146/002), Wangen near Olten (Ct. Solothurn/CH) (type 101, 102), the southern Black Forest (type 349), the Swiss Central Plateau/subalpine area (type 205) and from the Napfschüttung (type 632) (Leuzinger et al. 2020, 312–314; 2022, 470–471). The high proportion (>50 %) of artefacts made of locally occurring fine-grained quartzite shows that people supplied themselves with suitable stones directly at each site as needed. In the Gotthard Massif (crystalline bedrocks) in today's Canton Uri, there are numerous rock crystal fissures that were within 1–2 days' walk from the Muotathal municipal territory e. g. via Hürital and Chinzig Chulm, or from the Berglibalm via the Ruosalper Chulm into the Schächen valley and from there into the Reuss- and Maderan valleys. For example, evidence of Mesolithic quarrying in a crystal fissure is known from Fuorcla da Strem (Ct. Uri/CH) at 2800 m a. s. l. (Cornelissen et al. 2022). Rock crystal prisms suitable for knapping can be found in areas with crystalline bedrock but are also secondarily displaced in the bed load of mountain streams and rivers.

From the Urner Reuss Valley, it is possible to reach the Leventina and, thus, the Southern Alpine region via the Gotthard or one of the secondary passes. Several Mesolithic sites known on this route (Hospental [Ct. Uri/CH]; Airolo [Ct. Ticino/CH]) (Cornelissen 2020) provide evidence for crossing the main Alpine crest. The western and eastern parts of the country are also accessible via the Reuss Valley. The passes over the Surenen, Susten, and Furka (Grimsel) into western Switzerland, and those over the Klausen and Oberalp into the eastern parts of the region, have been significant routes since prehistoric times.

However, one can only speculate how the radiolarite from Arzo (Ct. Ticino/CH) on Lago di Lugano was transported over the main Alpine crest to the findspots in the municipality of Muotathal.

This raises the question of the networks and exchange systems that prevailed at the time. In extreme cases, one individual would have procured these exotic raw materials by travelling all the way to and from the primary deposit. However, it is also conceivable and more likely that different groups met *en route* and exchanged not only information – which, of course, cannot be recorded archaeologically but was probably quite significant – but also food and tools.

Radiolarite artefacts from the Chur area and the Kleinwalsertal have been found in several sites in the Muotathal municipal territory. The supply axis could have extended from Berglibalm via the Glattalp and Charetalp to the Bärentritt Pass towards Braunwald (Ct. Glarus/CH), from there over the Panixer Pass or then via the then-marshy Linth plain over the Walensee route or the Toggenburg into the Alpine Rhine Valley. From the campsite at the Alt Stafel 1 rock shelter, one can also descend to Glarus via the Rossmatter and Klöntal valleys and from there travel towards the Alpine Rhine Valley via the mentioned routes. The Late Mesolithic artefacts made of fine-grained quartzite in the Unterkobel rock shelter in Oberriet (Ct. St. Gallen/CH) are particularly interesting since the raw material types 359, 399 and 622 identified there come from geological outcrops in the vicinity of Muotathal municipal territory (Affolter 2022, 107–109). Thus, a Mesolithic site between the radiolarite quarries in Kleinwalsertal (Posch 2022) and the fine-grained quartzite deposits in central Switzerland is shown to have yielded artefacts made of raw materials from both deposits. Here, we seem to have evidence from the natural sciences proving contact between hunter-gatherer groups from widely distant areas.

The finds of Jurassic chert from the camps could have come to the Muotathal area either via the Wauwilermoos region or, for example, via the Sihltal, the Saas- and the Pragel Pass. The Epipalaeolithic and Mesolithic

site of Einsiedeln-Langrüti (Ct. Schwyz/CH) is located on Lake Sihl; its inventory also contains numerous Jurassic cherts (Leuzinger-Piccand 1996).
The other silex varieties from the western Alpine foothills, the Central Plateau, the Jura and the southern Black Forest probably found their way initially to the base- and winter camps suggested by the model in the Wauwilermoos and Sempachersee regions. The raw material from Degerfelden (Lkr. Lörrach/DE) is worth noting. These Trigonodus-dolomite-cherts (type 349) provide evidence for a communication axis from the Upper Rhine Valley to the Lucerne Plateau and the Alpine foothills. Artefacts made from this raw material were not only found in Berglibalm but also in Einsiedeln-Langrüti (Leuzinger-Piccand 1996, 16).

CONCLUSIONS

The municipality Muotathal can be considered well-studied after almost 20 years of archaeological research and excavation. This is due to several factors, chief of which is Walter Imhof's research activity. This local educator and speleologist has explored the vast and often inaccessible area since childhood and knows the region's history inside out. As a former primary school teacher, he maintains an extensive network of personal contacts in the local community. These include two speleological societies (Höhlengruppe Muotathal and the Arbeitsgemeinschaft Höllochforschung), to whose archives he arranged access. Without Walter Imhof's assistance, the research team would surely have been far less successful in the field. The financial support and interest shown by the relevant cantonal authorities – the State Archives of Canton Schwyz and the political decision-makers in the Canton – also played a significant role. Other factors are the perseverance and persistence of the research team and, last but not least, that little bit of luck essential to such endeavours.
The archaeological investigations have so far identified nine Mesolithic sites within the Muotathal municipal territory. The features and finds from the Berglibalm, the Flözerbändli and the Steinweidband are well-stratified, absolute dated, analysed on an interdisciplinary basis, and have been published. Thanks to the location in a karst zone, not only charcoal and silices survive, but the calcareous sediments also preserve numerous faunal remains and snail shells; this contrasts with sites from the high Alpine area, such as the rock shelter Zermatt Alp Hermettji (Ct. Valais/CH), where only tiny, calcined bone fragments were found (Curdy et al. 2003, 80). A number of faunal samples from the Flözerbändli were successfully subjected to proteomic and aDNA analysis (Leuzinger et al. 2022, 477–479). There was also surprisingly good pollen preservation in this rock shelter, which could, therefore, be subjected to palynological analysis (Leuzinger et al. 2022, 482–484). These taphonomic conditions, combined with a dense database of ^{14}C dates, point to the great potential for future research in this area. Despite the limited excavation areas, the Muotathal sites presented here are key sites within Swiss Mesolithic research. However, it is too soon to rest on one's laurels. Our evaluation has shown that only a minimal number of potential Mesolithic stopover sites have been discovered so far. Take, for example, the remote and inaccessible Steinweidband which, to a depth of 145 cm, remained empty of finds apart from isolated pieces of charcoal, snail shells and a few micro-mammal bones. Only in the final bucket did the first rock crystal flake come to light. Here, the Mesolithic find layer could have been missed by a hair's breadth or rather by one last scrape of the trowel. This points to the necessity of adapting excavation methods in the future. It is likely that the »trowel tests« used to date, which reach a maximum depth of 80 cm, may have often missed the deeper prehistoric layers. Therefore, follow-up investigation may well be needed at specific findspots.
The Ar-Géo_lab Neuchâtel's identification of the provenience of raw material provides vital insight concerning the supply strategies and networks of the Mesolithic hunter-gatherer groups. Comparable geological

analyses of flint inventories from several Mesolithic sites in Switzerland are now available, making it possible to roughly envision connections and relationships in supra-regional context. Nevertheless, it must be noted that the Mesolithic period lasted several thousand years (9700–5500 BC), and the temporal resolution based on typological and radiometric data is still far too low to prove the contemporaneity of settlement sites and, thus, direct contacts.

In future, we must further consolidate the network of sites in the Muotathal municipal territory; for example, it is worth noting that the Pfaff Pass findspot is the only open-air site identified so far. Here, the many small passes and trail routes should be surveyed in a targeted manner, even when the dense vegetation often severely restricts exploration. Also desirable would be the organisation of prospecting campaigns in the neighbouring cantons of Glarus and Uri so that the municipality of Muotathal, which up until now has been studied in isolation, could better be integrated into the broader regional context.

Translation: Carola Murray-Seegert

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Zusammenfassung / Summary / Résumé

Das Steinweidband in Muotathal (Kt. Schwyz/CH): ein mittelsteinzeitliches Jagdlager in einer voralpinen Siedlungskammer

Die archäologischen Prospektionen und Grabungen von 2005 bis 2023 in der Gemeinde Muotathal haben bisher neun mesolithische Fundstellen mit radiokarbondatierten Holzkohlen und Faunenresten sowie typologisch bestimmbaren Silices geliefert. Die unterschiedlichen topografischen Lagen der Fundplätze und Fundzusammensetzungen ermöglichen eine modellhafte Rekonstruktion der Landnutzung durch mesolithische Wildbeutergruppen im montan-alpinen Untersuchungsgebiet. Es lassen sich Basislager, Lagerplätze an *passages obligés* sowie Jagdbeobachtungsposten charakterisieren, die im Sommer/Herbst aufgesucht wurden. Im Winter hielten sich die Menschen wohl im Schweizer Mittelland auf. Anhand der Rohmaterialbestimmungen an den Silices können Kontakte und Austauschsysteme ins Mittelland, in den Jura, ins Alpenrheintal sowie in südalpine Regionen nachgewiesen werden. Paläoethnobotanische, osteologische, anthrakologische und malakologische Untersuchungen liefern zudem wichtige Daten zu Klima, Umwelt und anthropogenen Versorgungsstrategien.

The Steinweidband in Muotathal (Ct. Schwyz/CH): A Mesolithic Hunting Camp in a Subalpine Settlement Landscape

Archaeological surveys and excavations from 2005 to 2023 in the municipality of Muotathal have so far revealed nine Mesolithic sites with radiocarbon-dated charcoal and faunal remains, as well as typologically identifiable silices. The differing topographical situations of the sites and find assemblages make it possible to propose a modelled reconstruction of land usage by Mesolithic hunter-gatherer groups in the mountainous Alpine study area. Base camps, campsites at *passages obligés* and hunting observation posts visited in summer or autumn can be identified. In winter, groups of people probably remained on the Swiss Plateau. Determination of siliceous raw materials provides evidence of contacts and exchange systems involving the Central Plateau, the Jura, the Alpine Rhine Valley and southern Alpine regions. Palaeoethnobotanical, osteological, anthracological and malacological investigations additionally provide valuable data regarding the climate, environment and anthropogenic supply strategies.

Le site de Steinweidband, commune de Muotathal (Ct. Schwyz/CH): un campement de chasse mésolithique en contexte préalpin

À ce jour, les prospections archéologiques et les fouilles menées de 2005 à 2023 sur le périmètre de la commune de Muotathal ont livré neuf sites mésolithiques recelant des charbons de bois datés au radiocarbone, de même que des vestiges de faune et des silex déterminables sur le plan typologique. Les différentes situations topographiques des sites et les assemblages permettent de proposer une restitution modélisée de l'exploitation du territoire par des groupes mésolithiques de chasseurs-cueilleurs dans la zone étudiée, à la charnière entre les étages montagnards et alpins. Il est possible d'y caractériser des camps de base, des campements situés à des passages obligés, ainsi que des postes d'observation pour la chasse, fréquentés durant l'été ou l'automne. En hiver, les groupes humains demeuraient probablement sur le Plateau suisse. La détermination de la matière première siliceuse permet d'attester des contacts et des systèmes d'échange avec le Plateau suisse, le Jura, la vallée alpine du Rhin et les régions situées au sud des Alpes. Des analyses paléoethnobotaniques, ostéologiques, anthracologiques et malacologiques ont par ailleurs livré d'importantes données sur le climat, l'environnement et les stratégies d'approvisionnement anthropiques.

Schlüsselwörter / Keywords / Mots-clés

Archäologische Prospektion im Alpenraum / voralpine Siedlungskammer / Mesolithikum / Kleinkunst / ^{14}C-Analysen / Archäozoologie / Malakologie / Paläoethnobotanik / Anthrakologie
Archaeological surveying in the Alps / Subalpine settlement landscape / Mesolithic / portable art / radiocarbon analysis / archaeozoology / malacology / palaeoethnobotany / anthracology
Prospection archéologique en milieu alpin / exploitation du territoire préalpin / Mésolithique / art mobilier / radiocarbone / archéozoologie / malacologie / paléoethnobotanique / anthracologie

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