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Filling the gap: Recent Mesolithic discoveries in the central and south-eastern Swiss Alps

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ABSTRACT

Until 2007 only a handful of surface finds dating to between the end of the LGM and the Middle Neolithic were known in the alpine regions of central and south-eastern Switzerland. A number of recent rescue excavations, research projects and single finds have now shown the presence of people at high altitude in these parts of the Alps from the 9th millennium cal BC onwards. Both open-air sites and rock shelters are represented. Many sites lie above the valley floor, in the upper subalpine or alpine zones, and on routes to minor as well as major passes. Together with new palaeoenvironmental data, these archaeological finds allow us first insights into the nature of interaction of Mesolithic people in the south-eastern Swiss Alps with their social and natural environment, as well as their relationship with regions further afield. Furthermore, the finds allow us to start thinking about future research into the early prehistory of the south-eastern Swiss Alps.

1. Introduction

The past decade has seen an increase in discoveries of Mesolithic sites as well as stray finds in the subalpine and alpine vegetation zones in central and southeast Switzerland. Prior to this, it was thought that, unlike in the surrounding part of the Alps, the part of Switzerland consisting of the cantons of Grisons, Uri, Ticino and Schwyz were not used by people during the Mesolithic (Fig. 1). Only a few undated surface finds were known. The increase in identified sites has been the result of both targeted research as well as of sites discovered by chance. Some of the main research projects in the study area include the Leventina project in the Gotthard region (Hess et al., 2010) (Fig. 1G, H) and the Silvretta Historica project of the University of Zürich in the Silvretta mountains (between the Lower Engadin and Paznaun valleys) (e.g. Reitmaier, 2012) (Fig. 1B, J). The small ongoing and so far unpublished research project, the Traversar survey project in the Canton of Grisons, commissioned by the Archaeological Service of the Canton of Grisons aims to survey a number of the main passes spread across the canton. In response to survey finds a number of smaller fieldwork projects, mostly commissioned and funded by the Archaeological Service of the Canton of Grisons, have taken place, which have also helped to increase the number of known Mesolithic sites. A large part of the study area, including valley floors, is situated in the Montane, Subalpine or Alpine Zones. Consequently, many of these sites are located at high elevations.

High elevation later prehistoric sites are known throughout most of this region, and have been primarily identified during the course of research projects carried out in the 19th and 20th century. These include the Neolithic and Bronze Age site of Hospental-Rossplatten in the Ursern valley (Fig. 1G) in the Canton of Uri, the Mauritius fountain of St. Moritz, dating to the Middle Bronze Age as well as the Bronze Age and Neolithic settlements and terraced fields in the Lower Engadin valley (Fig. 1B; Stauffer-Isenring, 1983; Primas, 1992b; Oberhänsli, 2014). Furthermore, Mesolithic high altitude finds are well known from the surrounding areas in the Austrian Alps and Northern Italy as well as in the Alps of western Switzerland.

Directly to the south of the study area the sites of Pian di Cavalli I and III (Valle San Giacomo; Fig. 1F) are known (Fedele, 1998, 1999, 2015). Despite later prehistoric sites being numerous here and a research history stretching back decades, no Mesolithic sites are known from the Valmalenco, bordering the Canton of the Grisons to the south (Poggiani-Keller, 1989). Further south and southeast

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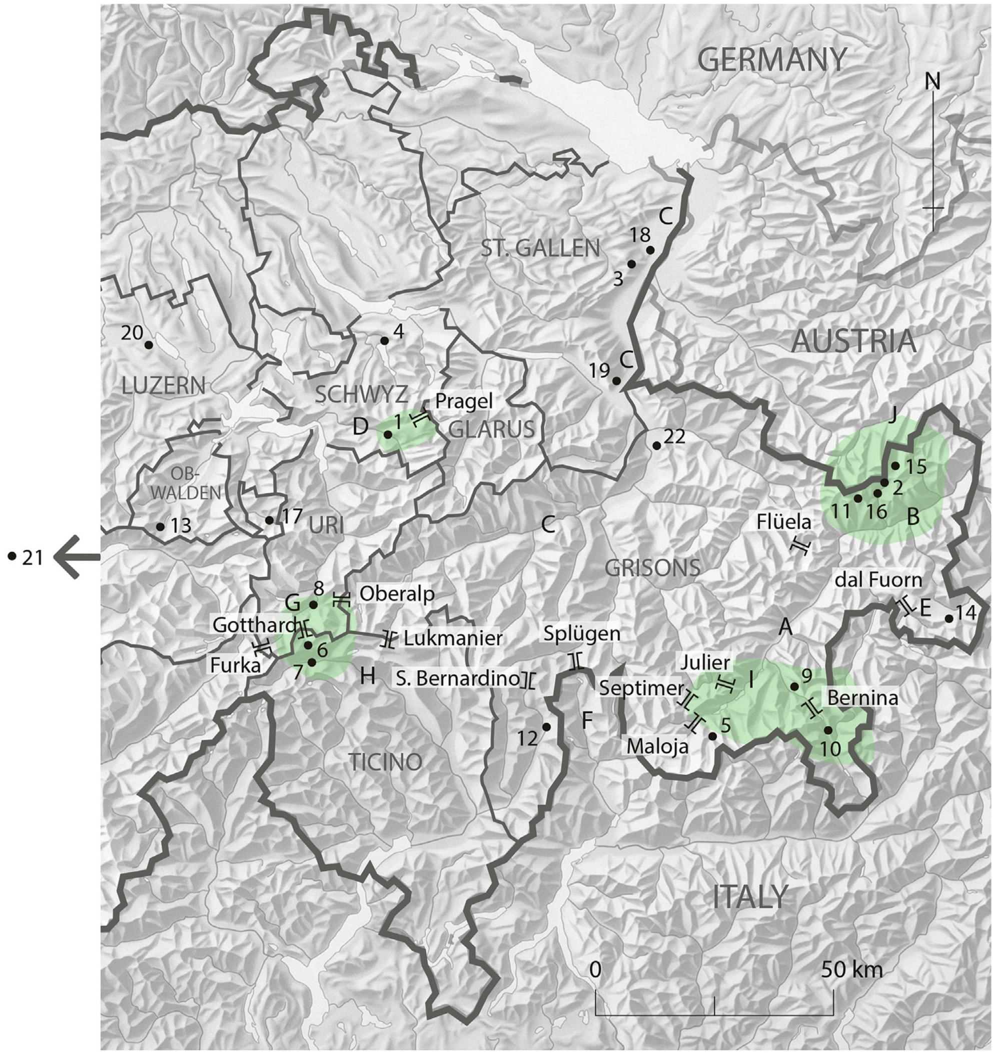

Fig. 1. Mentioned sites (Switzerland): 1. Muotathal, Milchbalm cave, Wunderfitz cave and Steinbock cave and Muotathal, Bisistal-Berglibalm; 2. Ftan, Val Usrchai-Plan da Mattun L2 and L3; 3. Rüte, Altwasser 1 cave; 4. Einsiedeln, Langrüti; 5. Bregaglia, Val Forno-Plan Canin; 6. Airolo, Alpe di Rodont; 7. Airolo, Madrano; 8. Andermatt, Hospental-Moos and Andermatt, Hospental-Mätteli; 9. Pontresina, Val Languard-Chamanna dal paster; 10. Poschiavo, Pru dal Vent and south of the Bernina Pass; 11. Guarda, Val Tuoi-Abri Frey; 12. Mesocco, Tec Nev; 13. Lungern, Brand; 14. Val Müstair-Lai da Rims; 15. Sent, Fimba-Kuppe Blaisch, Sent, Fimba-Aua da Fenga and Galtür, Jamtal-Abri Futschöl; 16. Ftan, Val Urschai-abri; 17. Engelberg, Planggenstaffel. Other sites mentioned: 18. Oberriet, Abri Unterkobel; 19. Wartau, Oberschan-Moos; 20. Wauwiler-Moos; 21. Arconciel, La Souche; 22. Zizers, Freidau. Geographical features: A. Upper Engadin valley; B. Lower Engadin valley; C. Rhein valley; D. Muota valley; E. Müstair valley; F. San Giacomo valley; G. Ursern valley; H. Leventina; I. Lakes of the Upper Engadin valley; J. Paznaun valley. T. Reitmaier and G. Hartmann, Archaeological Service of the Canton of the Grisons.

the Mesolithic presence, for example in the Adige Valley is well known. Indeed, the Mesolithic archaeology of the north Italian Alps has received significant attention since the discovery of the first sites in the 1970's (Broglio, 1992b). Upland landscapes have received most attention and it is indeed here most known sites are located. This is especially true of the earlier Mesolithic (Bagolini and Pedrotti, 1992; Dalmeri and Pedrotti, 1992; Broglio and Lanzinger, 1996). However, over time a large amount of sites has been found on the so-called upland prairies as well as on the valley floors and in the middle high landscapes of the upper woodland zone of the Alps and the Italian Prealps (Dalmeri and Pedrotti, 1992; Bassetti et al., 2009; Fontana et al., 2011). During the last decades of the 20th century settlement system studies assumed a mosaic-like settlement systems with larger residential sites being surrounded by more ephemeral sites, tied together in seasonal, vertical mobility with site functions mostly determined using the chipped stone assemblages (e.g. Broglio and Lanzinger, 1996; Fontana et al., 2011). A more recent attempt at reconstructing the mobility patterns by Kompatscher and Hrozny Kompatscher (2007) suggests the importance of geomorphology to the use of the landscape by Mesolithic hunter–fisher–gatherers in the southern Alps. Recently, new approaches and data including archaeozoological data, landscape analysis and analysis of lithic technology as well as raw material sourcing have shown this view needs to be updated and that land-use was more complex than previously believed (Bazzanella et al., 2007; Bassetti et al., 2009; Grimaldi and Flor, 2009; Fontana et al., 2011).

Due to the proximity of some of the Mesolithic evidence in western Austria as well as the similar lithic raw materials present at some of these sites it is possible to tie the Austrian Mesolithic evidence in with that of some of the Italian Alps. The most well-known Mesolithic site in the Austrian Alps is probably Ullafelsen. The open-air site has been investigated since 1994 and dates to the 9th and 8th Millennium BC (Schäfer, 2011). Since the discovery of Ullafelsen, a number of sites dating to the Mesolithic have been discovered and investigated in Tirol. These include, amongst others, a number of sites in the Karwendel mountains and the site of Defereggen, Hirschbichl in the Ötzvalley (Leitner, 1998). Notable recent discoveries are the Riepenkar rock crystal extraction site and also in the Karwendel mountains, as well as in the Kleinwalser valley in Vorarlberg, evidence for the extraction of radiolarite has been found (Leitner, 2008; Leitner and Bachnetzer, 2011; Leitner, 2013). Moreover, in Vorarlberg a substantial number of surface finds are known, but so far these have not been further investigated (Wischenbarth, 2000).

In the Alps of western Switzerland, Mesolithic sites have been known since the first half of the 20th century (Andrist et al., 1964). But although a number of sites have been found and excavated, e.g. Zermatt, Alpe Hermatji, Chateau d'Œx as well as sites around the Simplon pass (Crotti and Pignat, 1993; Curdy et al., 2003; Crotti et al., 2004), we do not yet have a good understanding of life ways throughout the Mesolithic in this part of Alps.

The notable absence of sites dating between the end of the LGM and the Middle Neolithic in the alpine regions of central and south-eastern Switzerland appeared to have been the result of a research bias and recent finds confirm this. Most of the recent archaeological discoveries are the result of academic research projects, as well as lately of inventory surveying work carried out by the archaeological services of the region.

A number of the sites, such as Bregaglia-Val Forno, Plan Canin (Fig. 1.5; Cornelissen et al., 2013), were found by chance. Andermatt-Hospental, Moos (Fig. 1.8; Auf der Maur and Cornelissen, 2014) was discovered during a building brief. Most find spots, however, are located through archaeological surveying as part of research projects. These have not solely targeted Mesolithic archaeology, but were intended to study the entire occupational history of a region (e.g. Leventina; Hess et al., 2010) or, as was the case with the Silvretta Historica project (Reitmaier, 2012), focused originally on the onset of pastoralism in the Alps. These research projects tend to combine the use of various methods. These include the study of satellite imagery, excavating small test-trenches (initially often up to 0.25 m^2 in surface), augering and field walking, whereby special attention is paid to areas with exposed soil, such as animal burrows and the sides of animal and hiking trails.

This paper will summarise the results of a number of research, site inventory survey and rescue archaeological fieldwork projects, in most of which one or both of the authors have been involved. By synthesising the archaeological evidence of the Preboreal through to the Mesolithic–Neolithic transition, this paper aims to provide initial interpretations that reach beyond individual sites and finds, while also placing these results in a larger regional context.

2. The earliest post-glacial human presence in the central and south-eastern Swiss Alps

2.1. The post-glacial natural environment

The timing of deglaciation in the region is locally variable. In some instances the timing is quite precisely known, such as for parts of the Silvretta Mountains, where for example the Futschöl glacier probably reached onto the valley floor until far into the middle of the 9th millennium BC (Felber, 2011). The Ursern valley, however, was largely ice free from ca. 13 000 BC (Renner, 2014) and the Upper Engadin valley by ca. 9000 BC (Gobet et al., 2003). Locally, smaller glacial advances took place up until 8500 BC (Ivy-Ochs et al., 2009). Palynological evidence from the Lej San Murezzan and Lej Champfer (Upper Engadin Fig. 1.I, A) shows that an initial phase of afforestation in the Upper Engadin valley around 9450–9350 BC was followed by a short cold oscillation. After this,

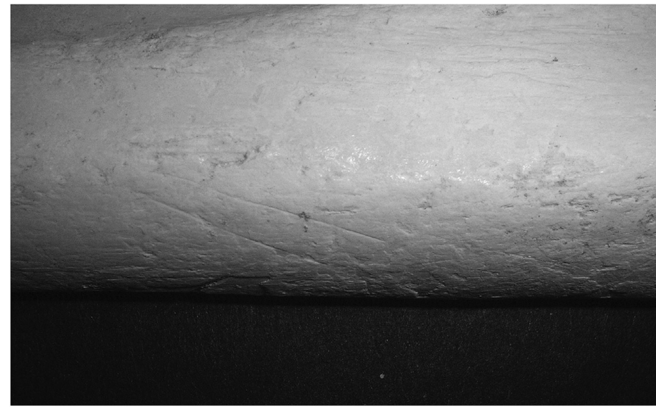

Fig. 2. Muota valley, Milchbalm cave. Alpine Ibex (*Capra ibex*) bone with cut-marks. Depicted bone section: 5 cm wide. Photo: W. Imhof. After Imhof 2013, p. 37.

afforestation sets in truly at around 9000 (Ilyashuk et al., 2009). This seems to happen nearly simultaneously at 1500 and 2340 masl (Gobet et al., 2005). These early forests in the lower Subalpine zone are dominated by *Pinus sylvestris*, in the upper Alpine zones by *Larix decidua* (Gobet et al., 2005). This pattern is similar to that seen at most other locations in and near the Swiss Alps (Gobet et al., 2005; Ilyashuk et al., 2009). Indeed micro and macro botanical evidence, including subfossil wood from the Las Gondas moor (2363 masl; near Fig. 1.15) in the higher reaches of the Fimba valley (Silvretta mountains) illustrates there to have been an open forest consisting mostly of *Pinus cembra*, accompanied by *Larix decidua*, *Pinus mugo* and *Corelus avellana* from ca. 10 500 BC (Nicolussi, 2012; Dietre et al., 2014). From 8600 BC there is an increase in *Pinus cembra* and *Picea abies*, while a marked decrease in *Corelus avellana* is visible from the 8.2 event (Nicolussi, 2012; Dietre et al., 2014).

In the canton of Ticino, on the southern slopes of the Alps, afforestation up to 1800–1900 masl had taken place by 10 550 BC. After a brief opening up of the forest during the Younger Dryas the forest line rose to 2100 masl by 9600 BC (Tinner and Vescovi, 2007).

The situation in the Ursern valley (Fig. 1G) differed from the regions further east and south. The valley was free of ice by 9500 BC (Renner, 2011), and in the central Swiss Alps the forest line was generally situated at 1500 and 2350 masl in 9600 BC and 9400 BC resp. (Tinner and Kaltenrieder, 2005). Subfossil wood samples and palynological evidence show it was not until the Early Atlantic that in the Ursern valley afforestation truly began (Küttel, 1990; Renner, 2014). By 6200 BC the forest had also reached 2000 masl here (Renner, 2014).

2.2. Muotathal, Milchbalm cave

The earliest known post-glacial indications of humans entering the study area have been found in a cave in the Muota valley, Canton Schwyz (Fig. 1.1 and D) and in a rock-shelter near the Swiss-Austrian border above the Lower Engadin, Ftan, Val Urschai-Plan da Mattun abri L2 (Fig. 1.2). Both date to the Preboreal. Alpine ibex (*Capra ibex*) bones (Fig. 2) with cut marks and traces of burning from the Muotathal, Milchbalm cave (1622 masl) have been dated to 9121–8477 cal BC (ETH-25109, Table 1; Imhof, 2013; Leuzinger et al., 2007). All the Muota valley cave finds mentioned in the text have been discovered by speleologists documenting the cave systems in the karst landscape of the Canton of Schwyz, working in cooperation with archaeologists (Auf der Maur et al., 2005; Leuzinger et al., 2007; Imhof, 2013).

Table 1
Radiocarbon dates mentioned in the text. All analyses took place at the Lab for Ionbeam Physics (LIP), ETH Zürich. Calibration: Oxcal v4.2.4Bronk Ramsey (2013); r5; IntCal13 atmospheric curve (Reimer et al., 2013).

Lab nr.	Site	Material	Feature	Radiocarbon (BP)	Cal BC 1 σ	Cal BC 2 σ	Original publication
ETH-34247	Airolo, Alpe di Rodont	Charcoal	Hearth	8300 ± 70	7481–7195	7522–7142	Hess et al., 2010
ETH-36358	Airolo, Alpe di Rodont	Charcoal	Hearth	7990 ± 55	7044–6826	7059–6700	Hess et al., 2010
ETH-36359	Airolo, Alpe di Rodont	Charcoal	Hearth	7985 ± 155	7072–6660	7335–6506	Hess et al., 2010
ETH-36937	Andermatt, Hospental-Mätteli	Charcoal	–	6875 ± 45	5808–5716	5873–5666	Hess et al., 2010
ETH-40955	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 1, context 3	8010 ± 40	7051–6831	7062–6776	Cornelissen et al., 2013
ETH-40956	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 1, context 3	8015 ± 40	7056–6832	7065–6776	Cornelissen et al., 2013
ETH-40957	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 1, context 9	8280 ± 40	7452–7196	7468–7185	Cornelissen et al., 2013
ETH-40958	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 1, context 8/9	8110 ± 40	7140–7051	7293–7035	Cornelissen et al., 2013
ETH-40961	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 3, context 12	7940 ± 40	7022–6701	7032–6691	Cornelissen et al., 2013
ETH-40962	Bregaglia, Val Forno-Plan Canin	Charcoal	Trench 3, context 12	6020 ± 40	4960–4846	5011–4799	Cornelissen et al., 2013
ETH-36474	Ftan, Val Urschai-Abri	Charcoal	–	5580 ± 45	4451–4366	4495–4343	Reitmaier, 2012
ETH-39647	Ftan, Val Urschai-Plan da Mattun L2	Charcoal	Hearth	9270 ± 45	8605–8356	8625–8339	Reitmaier, 2012
ETH-39648	Ftan, Val Urschai-Plan da Mattun L3	Charcoal	–	6595 ± 45	5607–5491	5617–5482	Reitmaier, 2012
ETH-39644	Galtür, Jamtal-Abri Fütschol	Charcoal	–	7030 ± 45	5985–5884	6007–5810	Reitmaier, 2012
ETH-36462	Guarda, Val Tuoi-Abri Frey	Charcoal	–	7455 ± 50	6392–6256	6422–6236	Reitmaier, 2012
ETH-55851	Muotathal, Bisistal-Berglibalm	Charcoal	–	9138 ± 37	8422–8284	8454–8279	Leuzinger et al., 2016
ETH-23845	Muotathal, Milchbalm cave	*Cervus elaphus* bone	–	6960 ± 75	5966–5750	5994–5717	Auf der Maur et al., 2005; Leuzinger et al., 2007
ETH-25109	Muotathal, Milchbalm cave	*Capra ibex* bone	–	9415 ± 75	8796–8574	9121–8477	Leuzinger et al., 2007, Imhof, 2013
ETH-26807	Muotathal, Milchbalm cave	*Cervus elaphus* bone	–	7975 ± 55	7037–6821	7050–6698	Auf der Maur et al., 2005; Leuzinger et al., 2007
ETH-29331	Muotathal, Steinbock cave	*Capra ibex* molar	–	8815 ± 70	8173–7751	8220–7678	Auf der Maur et al., 2005; Leuzinger et al., 2007
ETH-27609	Muotathal, Wunderfitz cave	*Cervus elaphus* bone	–	8855 ± 70	8206–7844	8236–7746	Auf der Maur 2005, Imhof, 2013
ETH-49177	Pontresina, Pru dal Vent	Charcoal	Hearth	7611 ± 32	6472–6437	6506–6416	Reitmaier and Cornelissen, 2013
ETH-49178	Pontresina, Pru dal Vent	Charcoal	Hearth	7755 ± 32	6640–6531	6646–6501	Reitmaier and Cornelissen, 2013
ETH-34454	Pontresina, Val Languard-Chamanna dal Paster	Charcoal	–	6900 ± 65	5870–5720	5971–5665	Huber, 2008
ETH-36719	Pontresina, Val Languard-Chamanna dal Paster	Charcoal, branch	–	7060 ± 40	5991–5904	6016–5847	Huber, 2008
ETH-46503	Sent, Fimba-Aua da Fenga	Charcoal	–	7650 ± 30	6507–6451	6588–6440	Reitmaier, 2012
ETH-34312	Sent, Fimba-Kuppe Blaisch	Charcoal	–	5870 ± 65	4835–4621	4901–4551	Reitmaier, 2012
ETH-36701.1	Sent, Fimba-Kuppe Blaisch	Charcoal	–	7020 ± 45	5982–5850	6001–5796	Reitmaier, 2012
ETH-36701.2	Sent, Fimba-Kuppe Blaisch	Charcoal	–	6560 ± 40	5539–5480	5614–5472	Reitmaier, 2012

2.3. Muotathal, Bisistal-Berglibalm and Engelberg, Planggenstaffel

In the Berglibalm rock-shelter, in the Bisis valley, a side valley of the Muota valley (Canton Schwyz; Fig. 1.1), charcoal and animal bones and later a rock crystal flake, were found in the upcast of a badger sett (a full report is to be published in the Jahrbuch Archäologie Schweiz 2016; Leuzinger et al., 2016). The 76 m long and 1–10 m deep rock shelter faces west and is situated at 1140 masl. Charcoal subsequently recovered from a small test-trench was dated to 8454–8279 cal BC (ETH-55851, Tab. 1).

To evaluate the preservation and nature of archaeological occupation of the abri Muotathal, Bisistal-Berglibalm, a 2 × 2 m trench was excavated in August 2015 (Fig. 1.1 and D). No archaeology was observed in two further test-trenches. All sediments were sieved (3 mm). Although post-excavation analyses are ongoing, first results can be reported here.

Almost all finds come from a 5–10 cm thick charcoal rich layer which lies above a sterile sediment of at least 45 cm thickness. It is sealed by 65 cm of undisturbed sediment. Although no hearth structures were found, charred hazelnut shells, calcinated bone fragments and three burned stone artefacts indicate the charcoal rich layer and the chipped stone assemblage are contemporaneous. It was also possible to stratigraphically correlate the first dated radiocarbon sample (ETH-55851, mentioned above) to the charcoal rich layer (further radiocarbon dates are expected soon).

The chipped stone assemblage consists of 286 artefacts. 76% of these are made on fine-grained quartzite, 17% on flint, 6% on rock crystal and 1% on radiolarite. Both rock crystal (1–2 days walking distance) and fine-grained quartzite (half a day walking) can be found relatively close to the site. All stages of the *chaîne opératoire* are present at Muotathal, Bisital-Berglibalm. While 90% of the artefacts are flakes and chips, blades (3) and bladelets (17) make up 7%. Burin spalls (2), six nuclei, ten microliths and 14 macrolithic tools complete the assemblage. The microliths include four obliquely truncated points, two backed blades, one microlith fragment and two possible micro-burins. The macrolithic collection consists of a scraper/*pièce esquillée*, two burins on end-retouched flakes, an endscraper, four *pièces esquillés* as well as six retouched flakes. Typo-chronologically, this collection of tools fits in well with the radiocarbon date of the second half of the 9th millennium BC. Other finds include three pieces of ochre/sanguine, the three charred hazelnut shell fragments mentioned above and faunal remains (incl. calcinated bones and microfauna). First results of the analysis of the faunal remains show the presence of brown bear (*Ursus arctos*), deer (*Cervus elaphus*) and ibex (*Capra ibex*). The species of 213 charcoal fragments from the Mesolithic finds layer were determined and suggest mostly hazelnut wood was burned, followed by *Acer* sp, *Prunus spinosa* and *Ulmus* sp. It is thus to be expected these would have grown in the site's vicinity. A surface find, a rock crystal distal projectile point fragment, from Engelberg, Planggenstaffel (Canton Obwalden; Fig. 1.17), also located on the northern edge of the study area, might also be dated to the Early Mesolithic (Fricker and Leuzinger, 2006).

2.4. Ftan, Val Urschai-Plan da Mattun L2

The extensive surveys of the Silvretta Historica project, between 2007 and 2012, have led to the discovery of a Mesolithic presence in the Silvretta mountains (north of the Lower Engadin and south of the Paznaun valleys; Fig. 1J and B) from the Preboreal to the early Atlantic. The Plan da Mattun sites in the Urschai valley, located above the Lower Engadin in the Canton of the Grisons, is characterised by a boulder field, resulting from a rock fall combined with glacial action (Fig. 3). The rock-shelter site with the oldest occupation here is Ftan, Val Urschai-Plan da Mattun abri L2 in the Urschai valley (Fig. 1.2) at 2287 masl. In this *abri-sous-bloc* a lithic assemblage consisting of 64 artefacts and an awl-like antler artefact (Fig. 4.6) were excavated around the remains of a hearth partially sunken into the floor of the rock shelter (Reitmaier, 2012). The lithic assemblage contains a bi-directional radiolarite core, four bladelets, two blades (one of which is right laterally notched), eight blade fragments and four retouched flakes (Fig. 4.1–5). The artefacts are made on flint, radiolarite, quartz, rock crystal and fine-grained quartzite (*quartzite à grains fins* or *Ölquarzit*, a homogeneous, grainy metamorphosed sandstone). None of the artefacts are typologically diagnostic, but charcoal from the hearth has been dated to the middle of the 9th millennium BC (ETH-39647; Table 1) and the general characteristics of the assemblage do not contradict this date. Archaeobotanical and glaciological research has shown

Fig. 3. Urschai valley, Plan da Mattun. Boulder field with the Aua d'Urschai streaming through it, with the abris L2 and L3. Seen from the Northeast. Photo: Th. Reitmaier.

that the Futschöl glacier probably still reached onto the valley floor at the time of the occupation of the L2 abri, flowing at 25 m from it (Felber, 2011).

2.5. Synthesis

These finds show that people rapidly followed the retreating glaciers into higher regions (see above). This is not surprising as Preboreal sites at similar altitudes are well-known not far from the study area, e.g. the Pian dei Cavalli sites (Italy), Mondeval de Sora (Italy) and Ullafelsen (Austria; Fedele, 1999; Fontana and Vullo, 2000; Schäfer, 2011). In the light of these southern sites it is worth mentioning the Rüte, Altwasser 1 cave in the Alpstein mountains just north of the study area (Fig. 1.3). Here artefacts normally associated with the Epigravettian south of the Alps were found, demonstrate people crossed the Alps already at the very end of the Late Glacial period (Jagher et al., 2000). Vegetation, as well as herbivores, is known to rapidly recolonize the landscape following glacial retreat (Rachoud-Schneider and Praz, 2002). This is shown, for example, by a dendrochronological date of at least 8400 BC on a stone pine (*Pinus cembra*) sample without sapwood from the Las Gondas moor at 2363 masl (in the Fimba valley near the sites of Sent, Fimba-Kuppe Blaisch and Sent, Fimba-Aua da Fenga; Fig. 1.15; the valley is also known as Fimber or Fenga valley) just south of the Fuorcla da Tasna (between the Plan da Mattun and the Fimba valley

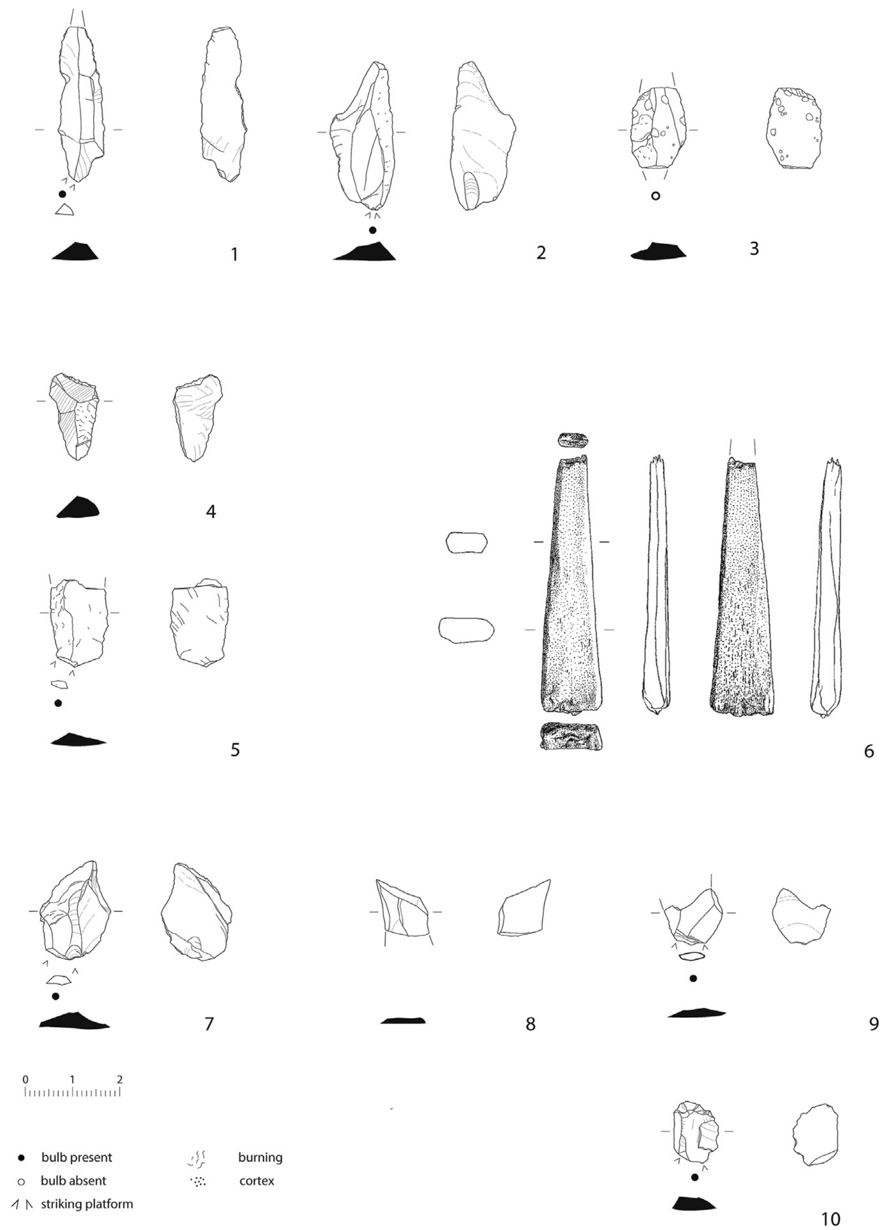

Fig. 4. Silvretta Historica project, selected chipped stone and antler artefacts. Ftan, Val Urschai-Plan da Mattun L3: 2, 3 and 5. fragmented blades; 4. flake; 6. antler tool. Ftan, Val Urschai-Plan da Mattun L2: 7, 9 and 10. flakes; 1, 8: blade fragments. Drawings: 1–5 and 4–10: U. Morell, Arch. Service Canton Grisons; 6. D. Lüscher, ZHdK.

in the Silvretta Mountains; Nicolussi, 2012; Dietre et al., 2014). Indeed macrobotanical evidence shows *Pinus cembra* was already growing here 2000 years earlier (Nicolussi, 2012; Dietre et al., 2014). The average natural timberline for the 20th century lies significantly lower, at 2240 masl (Nicolussi, 2012).

The presently available data do not allow significant insights into the cultural associations of the people in the Silvretta Mountains with the better understood Mesolithic populations in the surrounding areas. The finds from Muotathal, Bisistal-Bergliblam, however, suggest similarities with the Mesolithic of the Plateau Suisse, north of the Alps (Nielsen, 2009). The faunal remains from the Milchbalm cave attest simply to hunting/butchering ibex. Those from Muotathal, Bisistal-Bergliblam might also suggest hunting/butchering activities on site, but further analyses need to be awaited before definite interpretation can be made. Preliminary analysis of the faunal remains from Ftan, Val Urschai-Plan da Mattun L2 by Sabine Deschler-Erb shows that almost all bones preserved here were burnt. The assemblage includes *Capra ibex* (ibex) and/or *Rupicapra rupicapra* (chamois), as well as *Leporidae* and probably some bird bones. Some bones show cut marks. However, without more data it remains difficult to understand the nature of anthropogenic use of the Alpine and Subalpine zones during the Preboreal in the study area.

3. The later part of the Early Mesolithic, 8000–6800 BC

3.1. Muotathal, Steinbock cave, Muotathal, Wunderfitz cave, Einsiedlen, Langrüti

Humans have left further evidence of their presence in the Muota valley (Fig. 1D and 1) during the early part of the 8th millennium BC. A red deer humerus from the Muotathal, Wunderfitz cave was dated to 8236–7746 cal BC (ETH-27609; Table 1). The bones from Muotathal, Wunderfitz (2240 masl) are all red deer (*Cervus elaphus*). Some show cut marks. In addition, a large number of the metapodia found at this site were broken lengthwise, probably to extract the marrow as there is no evidence for the production of bone tools. A relatively large number of red deer antlers still attached to skulls complete the assemblage (Auf der Maur et al., 2005; Imhof, 2013).

The Muotathal, Steinbock cave (2053 masl) faunal assemblage consists solely of *Capra ibex* bones, mostly skull fragments of mature male animals. Many show tool traces. A *Capra ibex* molar was dated to 8220–7678 cal BC (ETH-29331; Table 1). *Cervus elaphus* bones with cut marks from the nearby and above mentioned Muotathal, Milchbalm cave were dated to 7050–6698 cal BC (ETH-26807; Table 1), showing the repeated use of the cave during the Mesolithic (Auf der Maur et al., 2005; Leuzinger et al., 2007). In neither of the caves further artefacts have been found. The nearest site with artefacts is Muotathal, Bisistal-Berglibalm. Ca. 10 km north of the Muota valley a surface collection of Early Mesolithic and Late Magdalenian chipped stone artefacts is known from Einsiedeln, Langrüti (889 masl) (Fig. 1.4). Besides a number of Late Magdalenian artefacts, the assemblage includes 51 microliths, microburins, burins and scrapers. Seemingly most stages of the *chaîne opératoire* are present and the used raw materials come predominantly from the Jura mountains (Leuzinger-Piccand, 1996).

3.2. Bregaglia, Val Forno-Plan Canin

Bone preservation at most other known Alpine sites in the study area, all rock-shelter and open-air sites, is less good, for example, at the multi-phase open-air site of Bregaglia, Val Forno-Plan Canin, Canton of the Grisons (1985 masl; Fig. 1.5; Cornelissen et al., 2013). The site was partly excavated after a number of artefacts and charcoal were observed in the banks of a hollow hiking path where the Muretto and Forno valleys separate (Fig. 5). In Trench 1 the remains of a hearth were excavated. A second multi-phased hearth was cut in Trench 3.

Charcoal rich layers in Trench 1 were shown to represent the remains of a three phased hearth, placed in the lee of a granite block. The three phases are separated by colluvial sediments. The oldest of the three hearths, represented by a thin layer of charcoal east to southeast of the rock, was covered by a 15 cm thick colluvium. Charcoal from the fill of the oldest hearth was dated to the second half of the 8th millennium BC (ETH-40957, ETH-40958; Table 1). Only one radiolarite chunk, the raw-material of which originates from Bellavista in the Canton of Ticino (at ca. 80 km distance), was associated with this hearth (all lithic raw material sourcing of the Val Forno-Plan Canin finds by Jehanne Affolter (unpublished report, 2011), methodology: Affolter, 2011a, 2011b).

Fig. 5. Bregaglia, Val Forno-Plan Canin. View over the site during the excavation summer 2010, looking south towards the Muretto Pass (left) and the Forno Pass (right). Photo: Th. Reitmaier.

The middle hearth was not dated; and the only find associated with it, a burned fragmented blade, is not chronologically diagnostic (Fig. 6.10). However, as the most recent of the three hearths was dated to the first quarter of the 7th millennium BC (ETH-40955, ETH-40956; Table 1), it can be assumed the middle hearth dates to the end of the 8th millennium BC. The 20 cm thick fill of this last hearth was cut by the modern hiking path. A small assemblage of chipped stone artefacts found in the youngest hearth agrees with the radiocarbon dates. It consists of four flakes and a blade made on rock crystal (Fig. 6.7) as well as a flint blade, a notched fragmented blade on Bellavista radiolarite (Fig. 6.4) and a trapezoidal quartz artefact with right lateral dorsal retouch (Fig. 6.3). Surface and topsoil finds probably also belonged to the youngest hearth. They comprise of a flake and a blade made on quartz and flint which originates from north of the Alps (Fig. 6.8 and 9), another trapezoidal quartz artefact (Fig. 6.2) and a unidirectional quartz core (Fig. 6.13) as well as debris of various raw materials.

A further multi-phased hearth was partly excavated in Trench 3. The stratigraphic sequence was cut by a 30 cm deep hollow hiking path. Two radiocarbon dates were obtained from the stratigraphically oldest phase consisting of a charcoal rich sediment filling a depression surrounded by stones. However, due to the incompatible dates (7032–6691 and 5011–4799 cal BC; ETH-40961, ETH-40962 respectively; Table 1), the layer's exact date remains unknown. A single flint flake does not allow us to date the hearth fill more precisely. Finds from stratigraphically younger layers, which were sealed by a Bronze Age hearth, include rock crystal and flint flakes, blade fragments and a notched blade fragment (Fig. 6.6). None of these can securely date these layers typologically, but they do not conflict with a Late Mesolithic date (Cornelissen et al., 2013).

3.3. Airolo, Alpe di Rodont

At similar elevation (2000 masl) the site of Airolo, Alpe di Rodont (Fig. 1.6) lies just north of the Gotthard pass (Fig. 1). It would have been situated in a relatively open landscape with some dwarf-birch (*Betula nana*) and Larch (*Larix decidua*) (Küttel, 1990; Renner, 2014). Part of a four-phase hearth was excavated in a test-trench under an *abri-sous-bloc*. Most of the assemble belonging to these hearths was made on rock crystal and fine-grained quartzite. The oldest phase of the hearth was dated to 7530–7140 cal BC (ETH-34247; Table 1). Finds comprise of a piece of sanguine and a radiolarite blade fragment. The youngest hearth dates to the Bronze Age, while the two in between date to the second half of the 8th millennium (ETH-36358; Table 1) and the first part of the 7th millennium (ETH-36359; Table 1). The recovery of finds such as core preparations flakes as well as small blades show local artefact production. Tools include scrapers, a microburin, retouched blades, a borer and a triangular microlith on rock crystal as well as a rock crystal multi-directional core. One blade is made on fine-grained quartzite (Hess et al., 2010).

3.4. Synthesis

By the time of the occupation of Airolo, Alpe di Rodont and Bregaglia, Val Forno-Plan Canin the environment was decidedly post-glacial. In the Upper Engadin palaeobotanical evidence (Fig. 1A) show postglacial reforestation had taken place by at least 9050 cal BC. Forest vegetation remained dominated by *Picea abies*

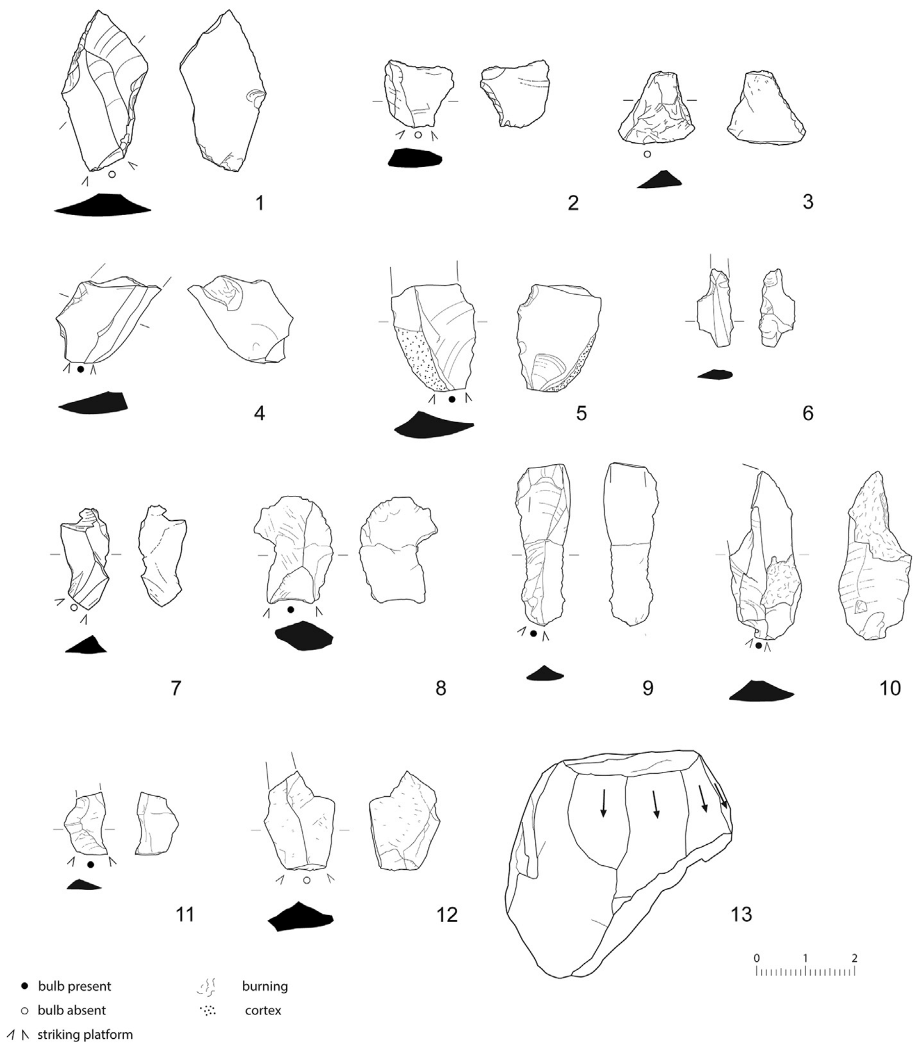

Fig. 6. Bregaglia, Val Forno-Plan Canin, selected chipped stone tools. 1. Rhomboid; 2–3. trapezoidal laterally retouched flakes/bladelets; 4 and 5. notch adjacent to fracture on fragmented blades; 6. notched blade fragment; 7. blade; 8. flake; 9. Blade; 10–12. fragmented blades; 13. unidirectional core. Flint/radiolarite: 1, 4–6, 9, 10, 12; rock-crystal: 3, 7, 8: Quartz: 2, 11, 13. Drawings: U. Morell, Arch. Service Canton Grisons. After Cornelissen et al., 2013, Abb. 5.

(Norway spruce), *Pinus sylvestris/mugo* (Scots and mountain pine), *Pinus cembra* and *Larix decidua* until anthropogenic influences set in around 3500 cal BC (Gobet et al., 2003, 2005; Ilyashuk et al., 2009). However, both early Holocene climate and vegetation varied significantly and there was a substantial regional variation in the time of post-glacial afforestation (Valsecchi and Tinner, 2010), as shown for example by the late afforestation of the Ursern valley north of the Gotthard pass (Fig. 1G; Küttel, 1990; Renner, 2014).

Notably, there is evidence for the local production of microliths and other artefacts at both Bregaglia, Val Forno-Plan Canin and Airolo, Alpe di Rondont, possibly by the breaking of notched blades. True micro-burins, however, seem to be lacking (Miolo and Peresani, 2005; Kompatscher, 2011). The variety of tool types is wider at Airolo, Alpe di Rodont. The technology applied at both sites seems to have been rather pragmatic. However, in order to better understand the relationships between raw material, technology and tool morphology, a larger part of the assemblage than is available at the moment would need to be studied. The raw material used varied. Rock crystal outcrops are well-known near Airolo, Alpe di Rodont (Gnos, 2011), but at both sites raw materials from much further afield are present. They show wide ranging contacts or even movement of people at this time, both within the Alps as well as to the south and as far north of the Alps as the Lägern outcrops at the eastern end of the Jura mountains, 115–160 km north (Affolter, 2011a, 2011b unpublished report; Altorfer and Affolter, 2011; Cornelissen et al., 2013). A comparable observation has been made at sites such as Ullafelsen, Austria (Schäfer, 2011). Similarly, at Early Mesolithic high altitude sites in the Adige Valley, Italy a variety of local and non-local raw materials was used (Cavulli and Grimaldi, 2009).

Due to the lack of either faunal remains or lithic artefacts from Airolo, Alpe di Rodont and Bregaglia, Val Forno-Plan Canin, respectively the Muota valley cave sites our understanding of the activities that took place at these Boreal and Early Atlantic sites remains limited at present. Moreover, the two former sites were only partly excavated. All sites, however, are situated *en route* to what still are now, or were until very recently important passes. Airolo, Alpe di Rodont lies just below the Gotthard pass, south of which a Mesolithic find is known at Airolo, Madrano (Fig. 1.7). Together with the Furka and Oberalp passes, the Gotthard pass (Fig. 1) builds a crossroads in the central Swiss Alps, providing access in all directions to the Ticino, the Valais, the Rhine valley and the Swiss Plateau. The 2265 m high Muretto pass at the end of the Forno valley was an important connection between the Upper

Engadin/Bregaglia, and the Valmalenco and Valtellina until as recently as WWII, e.g. as a smuggling and escape route. The Muota valley and the Pragel pass, as well as a number of less well known passes are part of an inner-alpine east-west route. However, so far, no Mesolithic sites are known either south of the Muretto pass or in the valleys surrounding the Muota valley.

4. The Late Mesolithic, 6800–5800 BC

4.1. Andermatt, Hospental-Moos

The Late Mesolithic in Switzerland is usually taken to have started around 7000–6800 BC. Few sites of this period have been extensively excavated in the Swiss Alps and indeed, well stratified sites and finds assemblages as well as completely excavated sites are rare on the Swiss Plateau as well (Nielsen, 2009). The site of Andermatt, Hospental-Moos, Canton Uri (Fig. 1.8) in the Ursern valley north of the Gotthard pass is thus remarkable for a number of reasons. Not only has it provided the largest recovered assemblage of chipped stone artefacts from any Mesolithic site in the study area so far, but 893 out of 919 artefacts are made on rock crystal (Auf der Maur and Cornelissen, 2014). Its location is also interesting, situated in the Ursern valley (Fig. 1G), at the foot of the Gotthard pass and several other important passes connecting the eastern Swiss Alps with the western Swiss Alps and the Ticino valley as well as with access to the Swiss Plateau (see discussion above). The site lies at 1475 masl on a low *roche moutonnée*, elevated above the valley floor just south of a small upland moor. 125 m^2 were excavated as part of an archaeological rescue campaign.

The find bearing layers are colluvial deposits originating from the top of the gently sloping ridge. Colluvial layers underneath the Mesolithic assemblage have provided Bronze Age radiocarbon dates. The local topography, however, shows that these find bearing layers cannot have come from far away and must originate from the brow of the low hill, some 15 m away and ca. 2 m higher. The lithic artefacts look fresh and do not show any signs of redepositioning. The archaeological material would originally have been located beside a depression, which might have contained standing water. From about 5000 cal BC an upland moor developed here (Haas et al., 2014). Run-off from this moor was probably also responsible for the redepositioning of the archaeological material.

In addition to the 893 rock crystal artefacts, 22 quartz artefacts, one flint chip and three fine-grained quartzite artefacts were also found. The assemblage contains 212 flakes and chunks (>9.9 mm), 25 blades (e.g. Fig. 7.7) and 61 blade fragments. The fine-grained quartzite flake and seven rock crystal flakes are retouched. A considerable number of flakes are laminar flakes, including one notched rock crystal flake (Fig. 7.3). The blades can be divided according to size into two groups. 22 flakes are between 8.6 and 20.6 mm long and three between 36.8 and 39.3 mm. The width of the larger and smaller groups measure 3.4–8.6 mm and 14–18.6 mm respectively. The width of the blade fragments spread more evenly between 4.2 and 23.1 mm.

One rock crystal blade and ten blade fragments were laterally retouched, as was the fine-grained quartzite blade (Fig. 7.5). The latter also has a burin spall removed from its right distal end. It is notable that natural rock crystal surface is present on the dorsal surface of 54 artefacts and on the striking platform of another 32 artefacts. This suggests the use of relatively small crystals for the production of artefacts, which might also be indicated by the small size of the cores found at Andermatt, Hospental-Moos. Six multi-platform cores and one single platform core have been found. Most are relatively irregular and intensively worked.

Formal tools include an asymmetrical trapeze (Fig. 7.8) made on a rock crystal blade. Another artefact (Fig. 7.2), although not a formal trapeze, strongly resembles one. The proximal end shows some natural crystal surface, while the exceptionally thin distal end is retouched. Notably, no microburins were discovered. All three of the assemblage's endscrapers (e.g. Fig. 7.4 and 6) are steeply retouched and produced on rock crystal flakes. The assemblage also includes a distally broken fine-grained quartzite borer (Fig. 7.9), two *pieces ésquillées* made on rock crystal and a flat crystal blade with burin-like negatives on one side, resembling a backed bladelet. A left and right laterally retouched point produced on a thick flake is difficult to date typologically; stratigraphically it belongs to the Mesolithic assemblage. The three fine-grained quartzite tools were probably brought on to the site, as no fine-grained quartzite debitage was found, but the assemblage shows that rock crystal artefacts were produced on site with blanks including blades as well as flakes.

Although numerical Mesolithic dates are lacking, the typologically diagnostic tools and the general size and morphology of the artefacts suggest a Mesolithic date for most if not all of the assemblage. Although there is some overlap in size with the artefacts from the nearby Neolithic and Bronze Age site of Andermatt, Hospental-Rossplatten (Primas, 1992b) the majority of artefacts are decidedly smaller and different in character at Andermatt, Hospental-Moos and are probably of Late Mesolithic date. In addition, they resemble the radiocarbon dated Airolo, Alpe di Rodont assemblage (Hess et al., 2010). However, the possibility that some of the artefacts in the assemblage are of a more recent date cannot be excluded.

4.2. Berninapass region

Three recently discovered Mesolithic sites are now known just north and south of the Bernina pass. In Pontresina, Val Languard-Chamanna dal Paster (Fig. 1.9) a small lithic assemblage consisting of three flakes (one is of which retouched), one blade fragment and four blades was excavated under an *abri-sous-bloc*, located at 2414 masl. Of the four blades, one is laterally retouched and one distally. A multi-phased hearth was dated to the first third of the 6th millennium BC (Huber, 2008; ETH-36719, ETH-34454; Table 1). A retouched blade fragment and flake fragment were also found in the remains of a hearth in a test-pit on the Pru dal Vent plateau (Poschiavo; 2200 masl; Fig. 1.10), just south of the Bernina pass, which was radiocarbon dated to the mid 7th millennium BC (ETH-49177, ETH-49178; Table 1). Closer to the pass, a blade fragment was found on the surface of a hiking trail (Reitmaier and Cornelissen, 2013).

4.3. Silvretta mountains

During the extensive survey work of the Silvretta Historica project in the Silvretta mountains between the Austrian Paznaun and the Swiss Lower Engadin, Late Mesolithic human presence was established at several sites. Two open-air and two rock-shelter sites (Sent, Fimba-Kuppe Blaisch and Sent, Fimba-Aua da Fenga; Galtür, Jamtal-Abri Futschöl (Fig. 1.15) and Guarda, Val Tuoi-Abri Frey; Fig. 1.11), located at elevations between 2180 and 2290 masl were radiocarbon dated between 6600 and 5500 cal BC (ETH-46503, ETH-36462, ETH-39644, ETH-36701; Table 1). The finds associated with them are thus far limited to a radiolarite and a fine-grained quartzite flake from Guarda, Val Tuoi-Abri Frey (Fig. 1.11; Reitmaier, 2012). Both radiocarbon dates and finds were mostly recovered from small test-pits (usually up to 0.25 m^2).

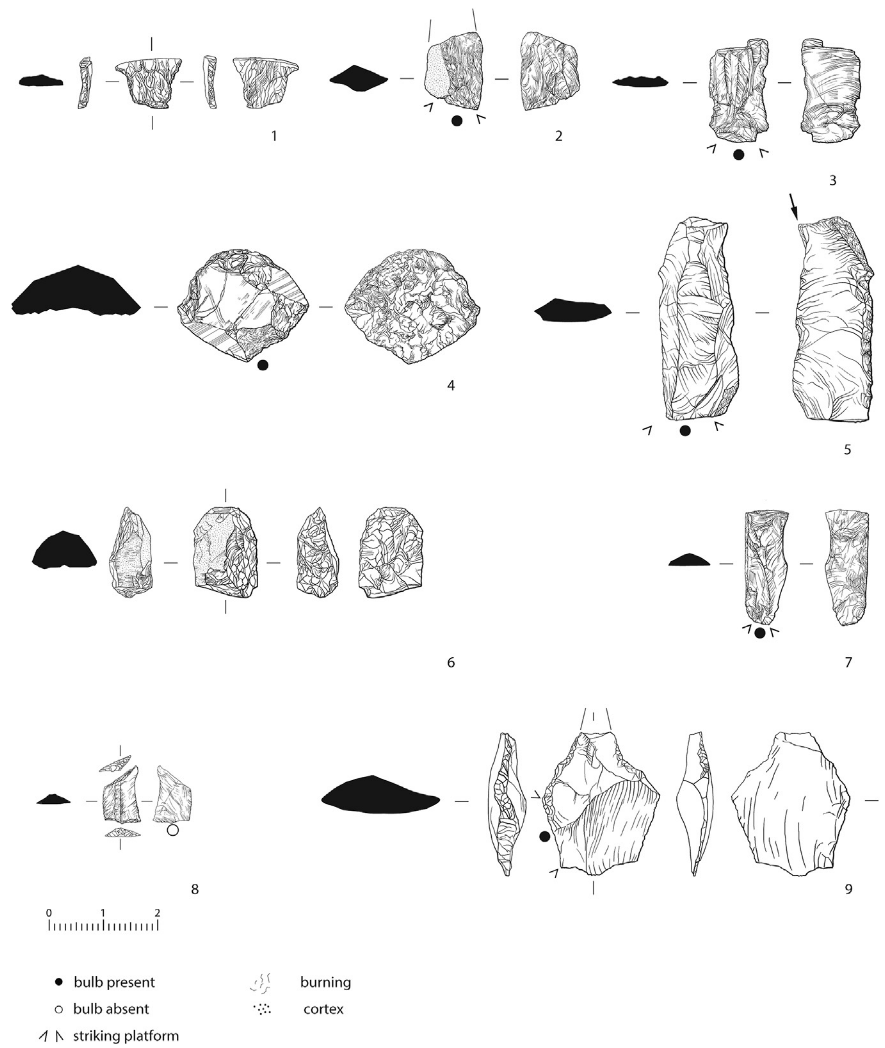

Fig. 7. Andermatt, Hospental-Moos, selected chipped stone tools. 1. Notched flake; 2. retouched blade fragments (retouch was macroscopically established on the exceptionally thin distal edge, but was impossible to draw); 3. notched flake; 4 and 6. endscrapers; 5. burin on blade with lateral retouch; 7. blade; 8. trapeze; 9. borer. 1–4 and 6–8: rock-crystal; 5 and 9. fine-grained quartzite. Drawing: J. Bucher, Universität Zürich. After Auf der Maur and Cornelissen 2014 Taf.1.

4.4. Mesocco, Tec Nev

Only a small part of the Mesocco, Tec Nev site, which at 700 masl is the lowest site discussed, could be excavated in the 1970s (Fig. 1.12), revealing a number of structures, including some hearths, pits and small postholes (Della Casa, 2000a, 2000b). The mixed assemblage of Earlier and Late Mesolithic finds includes artefacts made on rock crystal and other raw materials, mostly of southern origin. It included small, intensely worked cores, scrapers, microburins, backed blades, triangles and trapezes. Della Casa (2000a, 2000b) suggests the presence of pottery sherds in contexts otherwise containing exclusively Mesolithic artefacts might suggest contact between the people employing Mesolithic lithic technology and populations further south who used ceramics.

4.5. Stray and other assorted finds

Just south of the Gotthard pass an unstratified Montbani-blade was found at the Bronze Age site Ariolo, Madrano (Fig. 1.7; Della Casa et al., 2009). Slightly outside the study area, to the northwest, a small Mesolithic assemblage of rock crystal, flint and radiolarite artefacts was found in a small trench at Lungern, Brand (ca. 800 masl; Fig. 1.13; Primas, 1992a). Some of the cut-marked red deer bones in the previously mentioned collection from the Milchbalm cave in the Muota valley were dated to 5994–5717 cal BC (ETH-23845; Table 1; Auf der Maur et al., 2005; Leuzinger et al., 2007).

4.6. Synthesis

Both the Upper Engadin and the Ursern valley would have been forested at this time, with *Larix decidua* and *Pinus cembra* being predominant in the lower reaches of the Ursern valley (Küttel, 1990; Renner, 2014). A dense forest of *Picea abies*, *Pinus sylvestris/mugo*, *Pinus cembra* and *Larix decidua* would have surrounded the lakes in the Upper Engadin (Gobet et al., 2003, 2004). While the sites near the Bernina pass would have been located at the timber line or just above it, Andermatt, Hospental-Moos would have been located well below this in a forested environment, probably in a clearing (Haas et al., 2014; Renner, 2014). Most of the Silvretta sites were situated just below the timberline in an open forest and timberline ecotone (Dietre et al., 2014). Interestingly, like at the earlier site Ftan, Plan da Mattun L2 abri, people seemed to have been present around the Bernina pass around the Tschierva Glacier advances in about 6650 and between 6050 and 5850 cal BC (Joerin et al., 2008). During the 8.2 ka event, however, humans seem to be absent from the region discussed in this paper, and also in many of the surrounding regions (pers. comm. Christoph Walser). This seems to indicate a varying causal effect of glacial advance on the use of the region by humans throughout the Mesolithic.

The Late Mesolithic as well as the Mesolithic–Neolithic transition are still relatively poorly understood in most of Switzerland. Few sites from the period are known and only a small number of these are well stratified. These recently discovered sites are a valuable addition to the existing data. However, at most of these sites, only a small portion of each was excavated or they were discovered during test-trenching, where trenches smaller than 0.25 m^2 were opened, usually in rock-shelters. As a result, we are often dependent on radiocarbon samples for their dating. The small finds assemblages, the poor preservation of faunal remains and the almost complete lack of typologically diagnostic tools – with the exception of Mesocco, Tec Nev and Andermatt, Hospental-Moos – limit our interpretation of these sites and our understanding of the human occupation of the central and south-eastern Swiss Alps during the early Atlantic.

At most sites a variety of lithic raw materials are present. Except for the sites around the Bernina pass, rock crystal was used for the production of artefacts in all regions. The Andermatt, Hospental-Moos assemblage shows that rock crystal was used to produce small blades and – often laminar – flakes. It has not been possible to establish with absolute certainty whether tools were made both on blades and flakes, but it seems probable. Cores seem to suggest a unipolar reduction sequence for the production of rock crystal artefacts. The presence of the well-exploited irregular cores, however, could indicate a bipolar technology such as seen in Scotland and Fennoscandia being applied at Andermatt, Hospental-Moos (Holm and Knutsson, 1998; Ballin, 2008; Auf der Maur and Cornelissen, 2014). It could also suggest a centripetal reduction sequence, as seen at the older site of Mondeval de Sora (Fontana and Vullo, 2000). Whereas this would have been uncharacteristic for the Late Mesolithic technology known from the Swiss Plateau, some kind of bipolar reduction has been observed at, for example Arconciel, La Souche (pers. comm. Laure Bassin). The few tools in the assemblage seem to be similar to those found at lowland sites of similar date, e.g. in the Wauwilermoos and near the Lake Zug region (Nielsen, 2009). However, on the basis of these few and small lithic assemblages, it is not possible to confidently attribute the lithic technology utilised to technological traditions observed on the Swiss Plateau.

5. The end of the Mesolithic

The dating of the Mesolithic–Neolithic transition in Switzerland remains unknown as sites dating to the 6th millennium BC are seldom, but must have taken place during the 6th millennium BC (Nielsen, 2009). Throughout this millennium we see in, for example the Silvretta mountain range, a similar open forest environment around the tree line as in the preceding thousand years. But there is an increase in *Alnus viridis* (green alder), *Picea abies* and *Salix* (willow), which might be related to a climate deterioration seen in the second half of the 6th millennium BC (Dietre et al., 2014).

At an elevation of around 2300 masl, two sites in the Fimba valley and the Plan da Mattun (both in the Silvretta Mountains) illustrate that the area was again visited later in the 6th millennium BC (Tab. 1). Finds are few and include a small number of flakes and a blade fragment (Fig. 4.7–10). Evidence for Late Mesolithic activity in the Ursern valley, potentially slightly younger than Andermatt, Hospental-Moos, comes from a small test-pit near the Gotthard pass: At Andermatt, Hospental-Mätteli (Fig. 1.8), a single flint flake was found. It was associated with charcoal which was dated to 5873–5666 cal BC (ETH-36937; Table 1; Hess et al., 2010).

A number of chunks and flakes as well as a small blade, all surface finds, from Val Müstair, Lai da Rims (2396 masl; Fig. 1.14) are thus far the only indication of a probable Mesolithic presence in the Müstair valley (Rageth, 2006). Two finds from the Upper Engadin, a stray find, a blade from Bregaglia, Maloja-Lunghin (near the Maloja pass) and a rhombic projectile point from Bregaglia, Val Forno-Plan Canin (Fig. 1.5 and Fig. 6.1) probably date to the later 6th or early 5th millennium BC (Rageth, 2011; Cornelissen et al., 2013). The raw material of the latter artefact comes from Nonsberg region in Italy, ca. 120 km away (unpublished report Affolter, 2011a, 2011b; Cornelissen et al., 2013) and its morphology suggests a southern Alpine connection as well. Together with the finds from Ftan, Val Urschai-Plan da Mattun L3 (Fig. 1.2), it might evidence the presence of people during the Mesolithic–Neolithic transition in the 6th millennium BC. So far, we know extremely little about this period in Switzerland and in particular in the Swiss Alps. The earliest Neolithic evidence from the study area comes from the lowland site of Zizers, Friedau (Fig. 1.22) in the Rhine valley, which is about a thousand years younger (Seifert, 2012). Two test trenches at Sent, Fimba-Kuppe Blaisch (Fig. 1.15) and Ftan, Val Urschai-Abri (Fig. 1.16) in the Silvretta mountains have produced radiocarbon dates from the 5th millennium cal BC (Reitmaier, 2012). From Ftan, Val Urschai-Abri also a small number of pottery sherds and faunal remains were recovered. Preliminary analysis by Sabine Deschler-Erb (pers. comm, 2015) shows that the small amount of bones that could be determined all represented wild species.

6. Discussion

The small number of known sites and the lack of valley floor sites, such as those known from the Adige Valley in Italy mean it is as yet impossible to propose settlement and mobility systems or patterns of resource exploitation (whether lithic or animal/vegetable) (Broglio, 1992b; Broglio and Lanzinger, 1996; Kompatscher, 1996; Kompatscher and Hrozny-Kompatscher, 2007; Grimaldi and Flor, 2009). In addition, whereas valley floor sites in the Adige valley are situated below 800 masl, the valley floors in the study area are typically situated in the Montane or even Subalpine zones. Lowland environments with known Mesolithic sites are located much further away, e.g. in the Rhine valley north of the study area and around the Wauwilermoos (Huber, 2004; Nielsen, 2009; Schindler and Wegmüller, 2013). A direct comparison is thus difficult, and much greater effort would have been necessary to exploit a wide resource spectrum similar to that in the Italian Alps. It is therefore difficult to determine the nature of human presence in the Subalpine and Alpine zones during the Boreal and Early Atlantic in the Alps of southeast Switzerland. The procurement of vegetable, animal and mineral resources as well as the use of travel routes are possible reasons for human presence. For the Muota valley cave sites hunting can be assumed to have been important. At Airolo, Alpe di Rodont the procurement of rock crystal appears to have been one of a number of potential reasons for being in the region. As Cavulli and Grimaldi (2009) and Broglio (1992b) conclude for the Trentino province in Italy, in the south-eastern Swiss Alps mobility was independent of lithic raw material resources. The presence of raw materials from diverse sources at a great distance from these sites and the lack of raw material sources, except for rock crystal, in the region make it probable that there was a high degree of mobility during the Boreal and a wide range of natural resources might have been exploited.

The earliest evidence of human presence in the south-eastern Swiss Alps after the retreat of the glaciers dates to the Preboreal. Throughout the following four millennia people would have encountered an increasingly forested environment with the timberline being, at least locally, significantly higher than it is today. The composition of the forest would have changed, though. *Alnus*, *Abies alba* and *Picea* tend to increase in importance over time, with some decrease in the occurrence of *Pinus cembra* and *Larix decidua* (Haas et al., 1998; Gobet et al., 2003, 2005). In the lower regions, such as the Muota valley, besides pine, also elm, maple and especially hazel were widespread (Haas et al., 2013). High microcharcoal values found during the multi-proxy analysis of a peat core taken from the Las Gondas bog in the Fimba valley evidence fire events between 8350 and 7350 cal BC (Dietre et al., 2014). These might be related to local human activity. Around 7350 cal BC this is also observed in the Schattdagenmoor in the Muota valley (Haas et al., 2013). Near the Pian dei Cavalli sites in the Spluga valley, Italy similar evidence is interpreted as indicating that people kept the landscape artificially open (Fedele and Wick, 1996; Fedele, 1999; Moe et al., 2007).

Although the number of known sites is still limited and the resolution of available absolute dates still relatively poor, it appears that once people started using the Alpine and Subalpine zones in southeast Switzerland, they kept doing so. However, there might be some discontinuity around 7680–7530 cal BC and just after the 8.2 ka event (Haas et al., 1998; Tinner and Lotter, 2001). A complete dataset of radiocarbon dates from prehistoric sites above 1800 masl in the Canton of the Grisons, Switzerland the Tirol, Austria and South Tirol, Italy confirms the absence of sites dating to the last quarter of the 7th millennium BC (pers. comm. Christoph Walser) For northern Italy, Perrin (2009) reported a perceived occupational hiatus between ca. 6000–5600 cal BC. How much Mesolithic high altitude occupation was dependent on environmental conditions remains to be seen. It is noteworthy that Mesolithic hunter–gatherers seem to have operated close to glaciers, at least in the Urschai valley and were present at high altitude during glacial advances near the Berninapass.

Very few assemblages, dating to the Preboreal especially, include microliths. Combined with the generally small size of the assemblages, undoubtedly influencing the low occurrence of microliths, this dearth of microliths makes it difficult to attribute the occupation of the study area during the early Holocene to the known technological traditions north and south of the Alps. Whether the absence of microliths might also reflects site function and the nature of resource exploitation in the Alpine and Subalpine zones, remains unclear. The few known microliths seem to date to the later part of the Mesolithic. Lithic technology appears pragmatic in that it seems to have been somewhat adapted to the available raw materials, especially where rock crystal and quartz is concerned. From the few tools we have, it seems they are morphologically similar to those known from lowland sites north and south of the Alps (Dalmeri and Pedrotti, 1992; Broglio, 1992a; Broglio and Lanzinger, 1996; Nielsen, 2009). However, the still few and small assemblages from the study area do not yet allow detailed studies of chipped stone technologies and their development such as those, for example, by Fontana et al. (2011) and Perrin (2006, 2009). This currently limits the scope for comparison between the Italian, Austrian and Swiss archaeological evidence. Raw materials show there must have at least been some contact or movement beyond the Alps in both directions. The Alps were certainly not a barrier to Mesolithic hunter–gatherers in the study area and we should expect the possibility of large ranges and spheres of contact across the Alps.

It is difficult to ascribe function to individual sites, or even groups of sites on the basis of currently available data. It seems most likely lithic raw material procurement happened within a so-called embedded procurement system (Morrow and Jeffries, 1989; Costa and Sternke, 2009). That hunting and the collection of vegetable resources played a role in mobility patterns is to be expected but hard to prove, except in certain instances such as the Muota valley cave sites.

Most Mesolithic sites in the study area are found in the Lower and Upper Subalpine, some in the Alpine and but a few in the (upper) Montane zone. Crotti (2008) has postulated differing uses for Mesolithic sites in these altitudinal zones. Similar hypotheses exist for the Italian Alps (Kompatscher, 1996; Cavulli and Grimaldi, 2009). They raise interesting questions for both the Early and Late Mesolithic occupation of the south-eastern Swiss Alps.

Sites from the valley floors of the main inner alpine valleys in the study area are still rare, with the exception of Andermatt, Hospental-Moos. Our understanding of how the use of the Alps fits in with that of the Swiss Prealps and the Swiss Plateau is also limited. However, with recently excavated sites such as Arconciel, La Souche and further sites in the Fribourger Prealps and Oberriet, Abri Unterkobel in the Rhine valley (Mauvilly et al., 2008; Schindler and Wegmüller, 2013; Mauvilly, 2016) we have the potential to gain a better understanding of at least the later part of the Mesolithic.

We expect a number of factors play to a role in the creation of the site distribution pattern as it presents itself at the moment. The mountainous character of the area not only has an impact on site taphonomy, it also has considerable influence on the nature of the research and fieldwork taking place here. The Subalpine and Alpine zones have been the focus of a number of research projects and the majority of surface finds were recovered here. In contrast, this part of the landscape has largely been neglected in the archaeological scheduling systems which form the basis of much rescue archaeology in Switzerland. Building activity, whether related to infrastructure works, agriculture or tourism, threatens the archaeological record at these high altitudes much more than might be expected. This remains, to some extent, a challenge for the authorities responsible for the cultural heritage management of the mountain cantons that many have not truly learned how to manage. Geomorphological processes also have a role to play. As many of the main valleys in the study area are inner alpine valleys, it is possible that sites and early Holocene landscapes are covered by thick post-glacial slope wash deposits. For example, the bedrock once left bare by retreating glaciers in the Ursern valley is today covered by 200–300 m of deposits (Renner, 2014).

It might therefore not be possible yet to draw significant conclusions from site locations and how site distribution might have changed throughout the Mesolithic at present. However, a variety of local and non-local raw materials was utilised on many sites of both Early and Late Mesolithic date. Bone preservation is rare and so are microliths and other tools, especially in Early Mesolithic sites. Both facts are no surprise considering the taphonomic situation on most sites and the small assemblages retrieved from them. Whether the difference in microlith and tool occurrence between Late and Earlier Mesolithic sites might be coincidental or related to site function remains to be seen.

7. Conclusion

Finds made during the past eight years have not only shown that the perceived lack of Mesolithic presence in this part of the Alps was due to a research bias, but have begun to reveal a widespread and almost continuous presence during the Mesolithic throughout the region, also at high altitudes. The people using the Alps of central and southeast Switzerland have been shown to have exploited the local fauna and to have used a variety of local and foreign raw materials, showing contacts beyond the Alps.

The small number of sites, limited sizes of many of the assemblages, and the small scale of most excavations means that much work is still required to gain a better understanding of Mesolithic use of the area. To further our understanding it will not only be necessary to increase the number of known sites, but also to gain an understanding of sites in the lower reaches of especially the northern Prealpine regions and other parts of the landscape, such as the lower slopes and valley floors. Methodologically, repeated visits to a landscape and a combination of survey and test-trenching have proven to be successful, as has a multi-disciplinary approach, particularly including disciplines studying the palaeoenvironment. Lastly, at the moment few sites have been completely excavated. A more detailed and complete knowledge of the intra-site character of individual sites would be of tremendous value to our understanding of the newly discovered Mesolithic in the central and south-eastern Swiss Alps.

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