



## Article

# The landscape-archaeological Ullafelsen Project (Tyrol, Austria)

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## Key words

- Landscape Archaeology
- Alpine Archaeology
- Mesolithic
- Ecology
- Stone raw material

## Parole chiave

- Archeologia del paesaggio
- Archeologia Alpina
- Mesolitico
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- Materie prime litiche

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## Summary

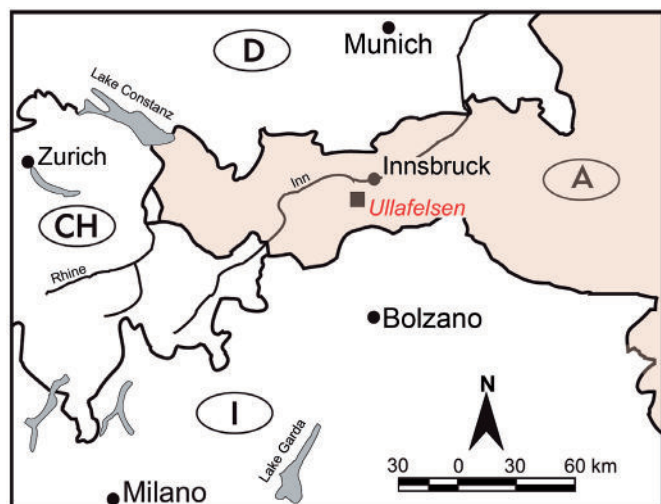
The early Mesolithic site at Ullafelsen is at the centre of a landscape-archaeological project on the Mesolithic in Tyrol (Austria). In this project, for the first time in a subalpine open air site in Austria, mesolithic living floors were identified and explored in great detail. The analysis of the natural sedimentation and soil-scientific processes confirmed that Mesolithic people had manipulated the surface of the living floor, for instance to produce organic tar from birch bark through controlled, oxygen-reduced burning processes. Our C14 dating indicates that the use of subalpine sites in the Austrian Alps started as early as the early Preboreal. Analyses of the introduced cherts revealed that they originated from sometimes quite distant geological sources in Bavaria and in northern Italy. This is proof of people crossing the Alps even in the early Holocene and makes contacts between the southern alpine Sauveterrian and the southern German Beuronian technocomplexes highly likely.

## Riassunto

Il sito Ullafelsen, datato al Mesolitico antico, è al centro di un progetto di Archeologia del paesaggio che riguarda il Mesolitico in Tirolo (Austria). Questo progetto, per la prima volta in un sito all'aperto in Austria, propone una identificazione e una dettagliata indagine di superfici di abitato mesolitico. L'analisi della sedimentazione naturale e dei processi della formazione del suolo hanno confermato la manipolazione della superficie di abitato da parte dei Mesolitici, per esempio per produrre mastice organico dalla corteccia di betulla attraverso processi di combustione controllati e in ambiente scarso di ossigeno. Le nostre datazioni C14 indicano che nelle Alpi Austriache l'utilizzo dei siti della fascia subalpina ha già avuto inizio nel primo Preboreale. Le analisi delle materie prime silicee hanno rivelato la loro derivazione anche da affioramenti geologici di notevole distanza, ubicati in Baviera e nell'Italia settentrionale. Ciò dimostra l'attraversamento delle Alpi fin dal primo Olocene e rende altamente probabile l'esistenza di contatti tra i techno-complessi del Sauveterriano sudalpino e del Beuroniano della Germania meridionale.

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**Fig. 1** - Position of the old Mesolithic Ullafelsen site (Fotscher Valley, Stubai Alps) in the western part of Austria (chart D. Schäfer). / Ubicazione del sito Ullafelsen datato al Mesolitico antico (Fotschertal, Alpi dello Stubai) nell'Austria occidentale (mappa D. Schäfer).

## Introduction

The discovery of the Tyrolean Iceman (also known as 'Ötzi') in September 1991 in the Ötztal Alps served as a trigger for the emergence of a research focus on high-mountain archaeology at the University of Innsbruck. Our main focus is the early Mesolithic Ullafelsen site in the Stubai Alps, discovered in 1994 (Fig. 1). It is located some 25 km south-west of Innsbruck and forms a distinct rocky outcrop (1869 m.a.s.l.), today with excellent views of the surrounding area (Fig. 3). Its 14 identified fireplaces, more than 7900 stone artefacts of diverse geological and geographic origin, numerous findings of wood tar, as well as observations and analyses of the activities of the Mesolithic people represent a rare and lucky break for prehistoric research. Several finds were here identified for the first time in the central eastern Alps. Because of the significance of the site, the archaeological dig was limited to just 25 m<sup>2</sup> with a view to allowing future generations to come to their own conclusions.

Under these circumstances it is clear that investigations of the site had to be conducted on a very broad, cross-disciplinary basis. This included small comparative digs on other sites, surveys of primary chert deposits, as well as ancillary geoscientific and botanical studies. The overall Ullafelsen Project can therefore be seen as landscape archaeology and/or geoarchaeology in K.W. Butzer's sense (Butzer 1982).

As we began to know more from the documented finds and findings of our dig at the Ullafelsen, an ever more closely integrated debate across soil science, glaciology and archaeology developed in some areas of our work. From this resulted issues to be tackled in joint cross-disciplinary efforts ('Transdisciplinarity' in J. Mittelstraß' sense 2003).

The overall project currently includes:

meteorology / palaeoclimatology; soil science / sedimentology / soil micromorphology; glaciology; botany / palaeobotany / charcoal analysis; chert analyses; cartography; prehistory, including use wear analyses.

## Selected themes of the project

Of the results obtained so far (cf. in detail Schäfer 2011a), we will discuss insights on major themes below, including these issues and aspects:

(a) the relation between humans and the environment from the late Glacial to the early Holocene;

(b) the relation between the development of the timber line in the early Holocene and the settlement behaviour of Mesolithic hunter-gatherer groups in our study area;

(c) Are there marker levels in the regional stratigraphy of that period?

(d) Are there identifiable living floors during Mesolithic use of our sites? If so, can these be used to identify specific behavioural patterns of Mesolithic groups?

(e) Which regional and supra-regional resources did the people make use of (chert, minerals, organic matter, etc.)?

(f) When in the early Holocene did people in the central eastern Alps start to use alpine elevations and where did those people come from? What are the key arguments here?

(g) What were the reasons for creating alpine elevation sites during that period and what concrete activities were we able to document in our study area?

There are close links between individual aspects (a) to (g), so that the discussion in section 3 serves to sketch a synthetic overview of the current state of the project. Detailed observations and analyses to the state of knowledge reached in 2010 are found in the individual articles of the first volume on the project (Schäfer 2011a).

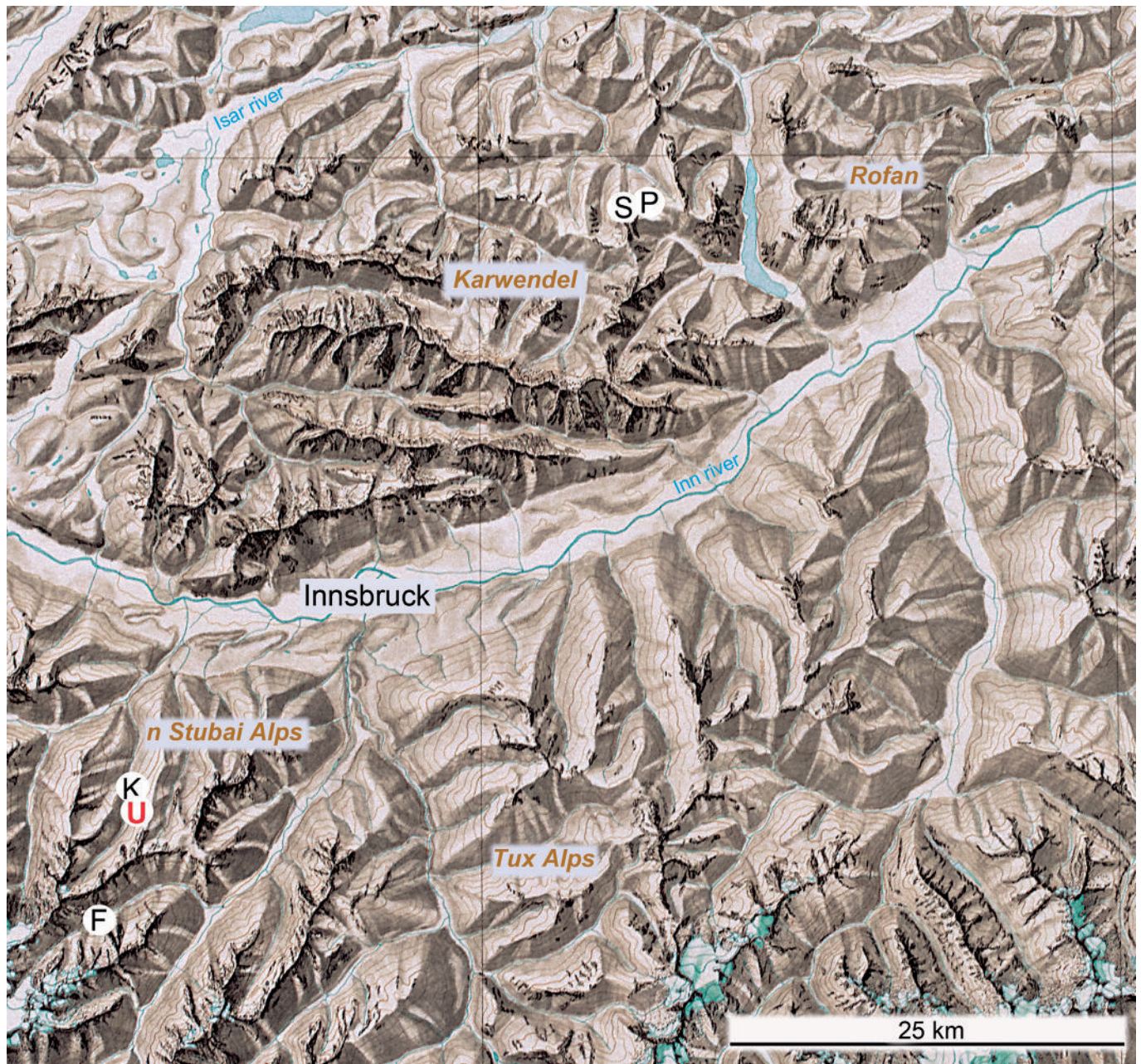
## Synthesis of the results

Both the Ullafelsen site and that on Kaseralmschrofen from the same early Mesolithic period are located in the Fotscher valley in the northern Stubai Alps. At higher altitudes of neighbouring valleys to the north and south several Mesolithic sites have been identified on Krimpenbachalm and at Franz-Senn-Hütte (Fig. 2). In geological terms the entire area belongs to the Ötztal-Stubai crystalline mountain, with predominantly metamorphous rocks (para- and orthogneisses), without local cryptocrystalline chert deposits that would allow the creation of stone artefacts. However, the high geomorphological and pedogenetic diversity, as well as an abundance of water, plants and game must have made it an attractive area from the earliest Holocene for repeated use by Mesolithic hunter-gatherers.

By the late Würmian local glaciers in the area had already retreated so far that at Ullafelsen we were able to verify distinct soil formation in the Bölling/Alleröd periods (Geitner *et al.* 2011), albeit without finding evidence for late Palaeolithic use in the study site (Schäfer 2011b).

During the Egesen stadial (= Younger Dryas) of the Würm glacial period, the glacier of the Fotscher Ferner pushed forward for the last time to roughly 2 km southwest of the Ullafelsen (Kerschner 2011), but without reaching our study site. Early Mesolithic settlement at the Ullafelsen reached a sudden peak during the middle to the late Preboreal, while we only found occasional fireplaces for the Boreal. It is striking that (at least in the dig itself) late Mesolithic artefacts are completely missing, nor are there any charcoal datings for that period. We derived initial background information from the results of wood type analyses from charcoal from Preboreal and Boreal fireplaces (F1 to F3). They suggest that during the middle Preboreal the Ullafelsen was still above or next to the timber line. The location characteristics associated with such a position (see below) and the good view across the area had worsened as early as the middle Boreal, by which time the Ullafelsen was located in the forest edge ecotone (Oeggli & Schoch 2011). With a further rise of the timber line our study site will have been surrounded by closed forest from about 8.300 BP (uncalibrated) when the last sporadic stays of Mesolithic hunter-gatherers end throughout the valley. Only in the neighbouring Oberberg valley to the south, around today's Franz Senn-Hütte, were there any places with the necessary qualities for creating Mesolithic sites, where major high-altitude paths crossed and which





**Fig. 2** - Selected old Mesolithic sites and find areas in Tyrol between Roßan and northern Stubai Alps: F-Franz Senn Hütte, U-Ullafelsen, K-Kaseralmschrofen, S-Schleimssattel, P-Pasillalm (chart D. Schäfer) / Selezione di siti e aree di ritrovamenti del Mesolitico antico in Tirolo, tra Roßan e la zona settentrionale delle Alpi dello Stubai: F-Franz Senn Hütte, U-Ullafelsen, K-Kaseralmschrofen, S-Schleimssattel, P-Pasillalm (mappa D. Schäfer).

were above, yet near the timber line (Fig. 2). Such a site is ecologically significant and characterized by a high diversity of plants and habitats and thus promising for game (Oeggel & Wahlmüller 1997).

Not only ibex and deer followed the climate-induced rise in the timber line, so did the hunter-gatherers of our immediate study area between Fotscher valley and Oberberg valley. For analogies in northern Italy, see, for instance, Fedele (1981) and Dalmeri & Lanzinger (1998). This can also be read off the altitudinal position and dating of three find areas with a total of 27 AMS data (conventional AMS data):

\* Kaseralmschrofen (Fotscher valley, altitude 1755 m):

1 AMS date: 9860±50 BP

\* Ullafelsen (Fotscher valley, altitude 1869 m):

17 AMS data 9580±40 BP - 9240±40 BP; 5 AMS data 8770±80 BP - 8350±40 BP

\* 2 sites near Franz-Senn-Hütte (Oberberg valley, altitudes 2060-2150 m):

4 AMS data 8250±40 - 6455±35 BP.

We assume that this model of anthropogenous settlements and altitudes would have to be modified from region to region, as variations in human subsistence strategies, topography, routing of paths and other factors tend to level out other trends across larger areas (Kompatscher & Kompatscher 2011, p. 220, fig. 18).

In terms of stratigraphic detail our findings on Kaseralmschrofen and on Ullafelsen have yielded interesting observations. Here we found a grey silty-fine sandy horizon, the so-called Light Layer (LL). It lies stratigraphically beneath the Holocene humus and typically





**Fig. 3** - The plateau of the Ullafelsen during the excavation 2002 (photo D. Schäfer). / Il plateau di Ullafelsen durante lo scavo del 2002 (foto D. Schäfer).

forms the living floor of our Mesolithic people. Our current state of investigation suggests that the LL accumulated primarily by eolian processes. Coarser components from avalanches and anthropogenic influences later probably influenced the composition of its grain size, and in the subsequent Holocene the whole profile came under the influence of podsolization. Judging from our observations on Kaseralschrofen, aeolian accumulation of the LL might have continued into the Mesolithic settlement period of the site during the oldest Preboreal, as most stone artefacts were found within the LL. The detailed study of character and sequence of the stratigraphic units on Ullafelsen also allows us to identify anthropogenic interference as well as intentional manipulations on the top and within the LL (Fig. 4). In the central part of the Preboreal fireplace 3 (F3), for instance, birch bark has been converted into organic tar in an oxygen-reduced burning process. The Mesolithic people used a mix of LL material and charcoal from surrounding areas to cover the birch bark (Schäfer 2011b, chapter 4.1, pp. 270-296). The surface next

to F3 was also levelled in places (Fig. 5). Numerous macroscopic and microscopic remnants of tar were found in the dig itself (Fig. 6) and on the surface of more than 100 stone artefacts. On Kaseralschrofen, too, many artefacts presented tar residue (Pawlik, internal project documentation). In connection with traces of use, such tar residues often point to functional connections between stone artefacts and with their mounting (Pawlik 2011). A. Pawlik was able to identify the intended use of 323 analysed stone artefacts at Ullafelsen on 139 objects. About 40% of those served as tools (some of them mounted), another 28% as projectiles (mounted laterally or as points). Often artefacts are associated with rehafting and/or retooling processes. Around 9% of the artefacts demonstrate their multifunctional context and present highly individual and specific features. There have been identified leather/fur, bones, antlers and occasionally wood as contact material (Pawlik 2011). The range of retouched forms at Ullafelsen is evidence of artefacts connected with base camp activities (e.g. scrapers, borers, burins, truncations), as well as those associated with hunting camp activities (backed blades, triangles, segments, micropoints) (Schäfer 2011b). Ullafelsen and neighbouring Kaseralschrofen may therefore be considered seasonal base camps for hunting activities in an alpine environment of major ecological and hunting resources.

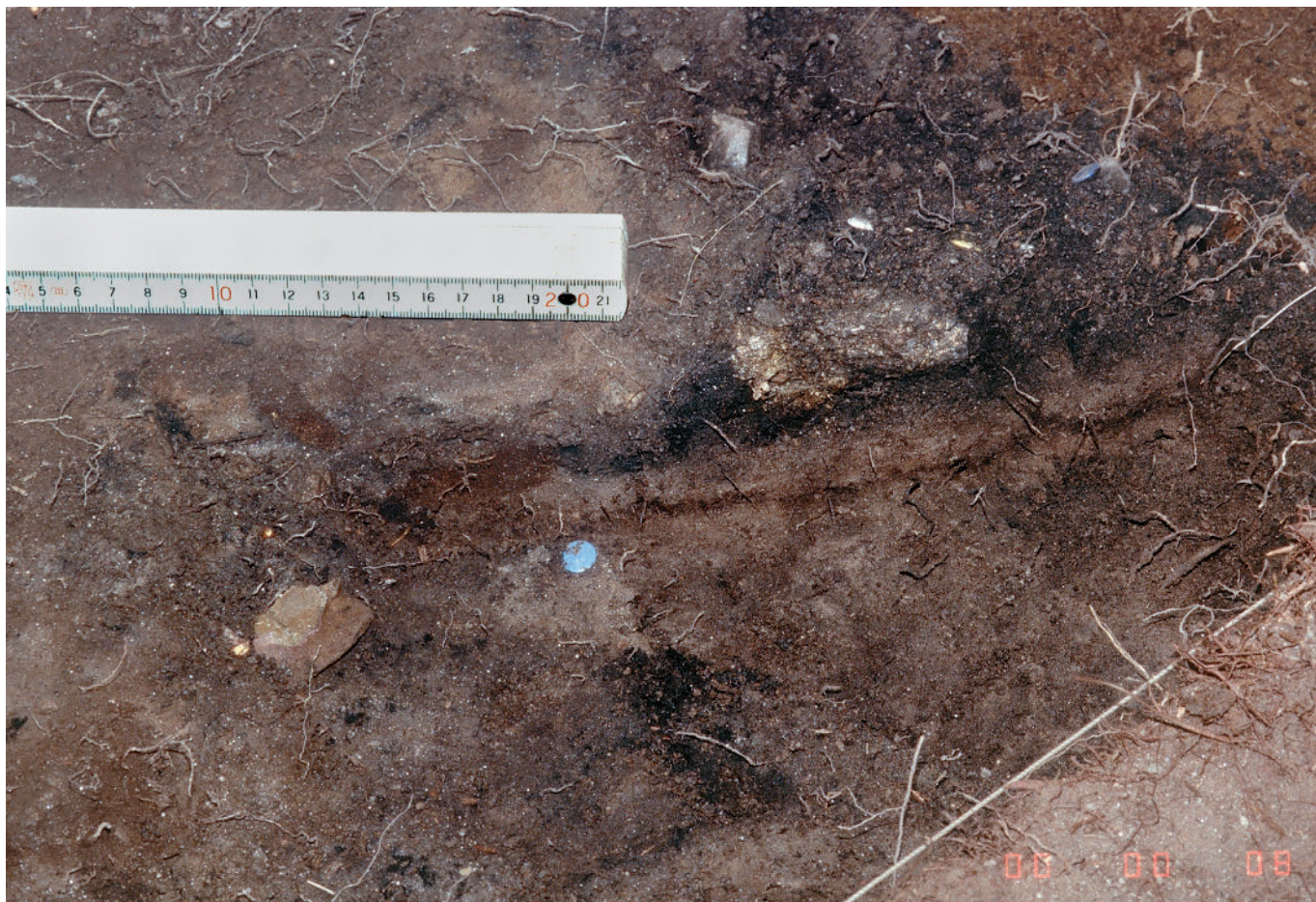
Indirect proof of the appeal of this landscape comes from the origin of the cryptocrystalline cherts used at these Mesolithic sites, as there are no natural deposits of these rocks in the Stubai Alps themselves. A key investigative focus of project is therefore to describe and identify the origin of these rocks (Fig. 7-8) (Bertola 2011a, 2011b, 2014, Bertola & Schäfer 2011).

At the Mesolithic sites at Franz-Senn-Hütte, Kaseralschrofen and Ullafelsen we found cherts from the Southern Alps. This is proof of trans-alpine crossings of the main alpine ridge by Mesolithic groups as early as the Preboreal for our study area. The paths across the Alps may have become established in several stages during the early Mesolithic: At the beginning of the Preboreal, on Kaseralschrofen, only 10.4% of a total of 192 chert artefacts come from the Southern Alps. Nearly 90% of the cryptocrystalline rock comes from



**Fig. 4** - Ullafelsen, cross profile square B8 (2003): The grey LL-horizon with overlaying charcoal and evidence for anthropogenic influences (details a and b) (photo D. Schäfer). / Ullafelsen, profilo trasversale del quadrato B8 (2003): l'orizzonte LL, grigio, con carboni sovrapposti ed evidenze di manipolazione antropica (dettagli a e b) (foto D. Schäfer)





**Fig. 5** - Ullafelsen, cross profile square C7 through east edge of fireplace 3; fine clastic sediments (LL dominating) are covering the charcoal layer. Below the charcoal layer one can see a brown thin sediment which has to be seen as a result of anthropogenic influence (levelling), Aug. 22, 1997 (phot. D. Schäfer). / Ullafelsen, profile trasversale del quadrato C7a attraverso l'angolo orientale del focolare 3; sedimenti a clasti fini (LL predominante) ricoprono il livello carbonioso. Sotto tale livello si può osservare un sedimento marrone sottile che è visto come il risultato di influenza antropica (livellamento), 22 Agosto 1997 (foto D. Schäfer).

the Northern Limestone Alps (Bertola, internal project documentation). Other factors also suggest that Kaseralmeschrofen represents a pioneer stage of early Mesolithic exploration of the central eastern Alps: most artefacts at this site are of relatively large average size,



**Fig. 3** - Ullafelsen, mesolithic tar remain (phot. A. Pawlik). / Ullafelsen, residuo di mastice mesolitico (foto A. Pawlik)

there is hardly any trace of blank form production, instead we found quite a few modified artefacts (13% of all cherts) and blanks brought here from elsewhere. Just a few centuries later, the picture is a rather different one. At Ullafelsen we found most chert artefacts from the Southern Alps on the rim of fireplaces from the middle Preboreal. Here they make up a full 36,7% (n=1082 artefacts) of all analysed cryptocrystalline cherts. For the Ullafelsen finds we were able to identify the origin of the cherts from the Southern Alps as the Valle di Non near Trento (Bertola 2011a, 2014) – i.e. some 100 km south of Ullafelsen across the main Alpine ridge (“SA” in fig. 7). Such rocks were of course brought in to Ullafelsen as part of embedded procurement within seasonal subsistence activities. From the distances covered and their directions we can deduce key parameters for the geographic areas used as well as the potential origin of Mesolithic hunter-gatherer groups, whose presence in the North Tyrolean Fotscher valley has been documented. Such a share of southern alpine cherts in the raw material at a northern alpine site greatly exceeds single finds and points to the existence of by then regularly used transalpine routes. K. and N. Kompatscher have documented numerous such routes, esp. in northern Italy. They found that key factors for the choice of encampment sites along a certain route were, “the strategic position within the territory, a useable area close by, a good view of the surroundings and a supply of water,” (Kompatscher & Kompatscher 2011, p. 205). We can safely assume that it were indeed the foragers from the southern Alps themselves who brought the material to the Ullafelsen and processed it, as is evidenced by





**Fig. 7** - Ullafelsen, examples for used stone raw materials of different geographic and geologic origins: SA-south alpine cherts (*Scaglia variegata*/*Scaglia rossa* from the Val di Non area, Trento); FA-Upper Jurassic hornstone from the south Franconian Alb (Bavaria), NK-Silex of the Northern Calcareous Alps (Ruhpolding and Chiemgau Formation, Upper Jurassic), BK-rock crystal, central-alpine, Q-local quartz (Fotscher valley) (phot. D. Schäfer). / Ullafelsen, esempi di materie prime litiche sfruttate, di diversa provenienza geografica e geologica: SA-selci sudalpine (*Scaglia Variegata*/*Scaglia Rossa* dall'area della Val di Non, Trento); FA-selce del Giurassico Superiore dalla Fränkische Alb (Bavaria), NK-selce delle Alpi calcaree settentrionali (Ruhpolding e formazione di Chiemgau, Giurassico Superiore), BK-cristallo di rocca, Alpi centrali, Q-quarzo locale (Fotschertal) (foto D. Schäfer).





**Fig. 4** - The position of the Ullafelsen (U) southwest of Innsbruck and the evidence of the lithic raw material groups used at this site: SA-south alpine cherts (Scaglia Variegata/Scaglia Rossa from the Val di Non area, Trento); FA-Upper Jurassic hornstone from the south Franconian Alb (Bavaria), NK-Silex of the Northern Calcareous Alps (Ruhpolding and Chiemgau Formation, Upper Jurassic), BK-mountain crystal, central-alpine, Q-local quartz (Fotscher valley) (chart D. Schäfer). / Posizione di Ullafelsen (U) a sudest di Innsbruck e l'evidenza delle materie prime litiche utilizzate nel sito: SA-selci sudalpine (Scaglia Variegata/Scaglia Rossa dall'area della Val di Non, Trento); FA-selce del Giurassico Superiore dalla Fränkische Alb (Baviera), NK-selce delle Alpi calcaree settentrionali (Ruhpolding e formazione di Chiemgau, Giurassico Superiore), BK-cristallo di rocca, Alpi centrali, Q-quarzo locale (Fotschertal) (mappa D. Schäfer).





**Fig. 7** - A radiolarite slab from the old mesolithic Schleimssattel 3c site (S in fig. 2). The slab was extracted directly from a primary geological context. After testing the piece was broken into two large fragments and was not used anymore (photo D. Schäfer). / Una lastra di radiolarite dal sito Schleimsattel 3c (Mesolitico antico, S della fig. 2). La lastra è stata estratta direttamente da un contesto geologico primario. Dopo aver testato il pezzo, questo è stato frantumato in due grandi frammenti e abbandonato (foto D. Schäfer).

the numerous finds of microlithic backed bladelets produced here from southern alpine chert (see among the “SA” group in fig. 7). These tools and typical needle-like points are clearly made in the southern alpine Sauveterrian tradition. One of them (‘punta a due dorsi’) is made of rock crystal and goes back to the same tradition (see the upper artefact in the “BK” group of fig. 7). The nearest potential natural deposits of rock crystal are in the Tux Alps east of the site and will have been brought along by southern alpine Mesolithic people in the course of crossing the main alpine ridge (Fig. 2). Much further away – some 200 km to the north-northeast as the crow flies – are the Upper Jurassic hornstone deposits of the southern Franconian Alb (the area around Kelheim on the Danube, Bavaria), where about 25% of all artefacts identified at Ullafelsen come from (“FA” in fig. 7). They are not only evidence of the longest transport distance to the Stubai Alps but also of contacts with the southern German Beuronian complex (Bertola & Schäfer 2011). The Ullafelsen inventory does indeed include a long-narrow trapeze of this southern German raw material, a tool shape actually not found in the southern alpine region of the Sauveterrian (see “FA” group in fig. 7, left object in the lower row). The area of the northern Stubai Alps thus suggests an overlap of southern and northern alpine traditions during the early Mesolithic.

The most immediate and also easiest connection, at least from the Stubai Alps to the Franconian Alb, will most likely have been the use of the waterway of the Isar river, which originates in the Karwendel mountains. Depending on where you enter a boat (western / eastern Karwendel as part of the Northern Calcareous Alp), at least

about two thirds of the total distance could have been covered in this way.

In just this area of the eastern Karwendel mountains there are regional and (relatively) well suited radiolarites and hornstones of the Upper Jurassic (“NK” in fig. 7). These were used to make 37.4% of all artefacts found at Ullafelsen. We know at least two sites in the eastern Karwendel alone, Schleimssattel 3c and Pasillalm (at around 1560 m), where the local rocks were exploited intensively during the early Mesolithic (Fig. 2). Both workshops for chert exploitation yielded numerous precores, cores, flakes, debris and some microlithic implements (triangles, micropoints, segment, microburins) (Schäfer *et al.* 2006). In the immediate vicinity of the Schleimssattel 3c site the Mesolithic people took up several larger radiolarite slabs from the local (primary) geological context. All of them present an intact cortex without any traces of mechanical wear (from rolling or transport by water) and were processed in situ. One of these slabs was tested for quality by hitting its edge and it broke into two parts and was left unused (Fig. 9) – a unique find in our study area (Schäfer *et al.* 2006, p. 298, fig. 6-7). In the adjoining eastern Rofan range Upper Jurassic radiolarites and hornstones were also exploited during the Mesolithic. In using these, people started from the geomorphologically most advantageous point and created artefacts that were needed in hunting (Kompatscher & Kompatscher 2005).

Of these the typically brick-red radiolarites from the Rofan area in the Northern Limestone Alps of Tyrol usually present the best material characteristics (Fig. 7, see the two upper objects in the “NK” group). They were mainly used regionally, but first finds of this raw material in South Tyrol have been documented, e.g. at Weitenberg Alm (Kompatscher & Kompatscher 2005, p. 33, fig. 16). From what we have learned, transports of northern alpine cherts across the Alps must not be seen as the odd one-off event. We strongly suspect that a revision of sites in northern Italy would yield several surprises in this respect. We came across one such surprise when analysing the Mesolithic production of some artefacts from local, often rough crystalline (vein) quartz at Ullafelsen: this material is a common component of metamorphous gneiss deposits in the region, has only limited if not poor fracture-mechanical characteristics, which make it difficult to identify as artificially processed (Schäfer 2014, p. 40, fig. 7). We were, however, able to document artefacts, organic residues and traces of wear on this material and on rock crystal artefacts in several cases at Ullafelsen (Pawlik 2011). The origin of five hematite samples at Ullafelsen remains unclear for the time being.

## Conclusion

In the short time span of 20 years, the study of the alpine Mesolithic in Tyrol has yielded astonishing insights into the relation between humans and the environment during the early Holocene. What made it possible was the extensive cooperation between researchers from the natural sciences and the humanities. Building on this foundation and continuing to make use of the existing opportunities is the real legacy of the ‘ice man’.

## References

- Bertola S., 2011a - The flints of Southern Alps (Non Valley, Italy) provenance found in the mesolithic site of Ullafelsen (Sellrain, Tyrol). In: Schäfer D. (Ed.), *Das Mesolithikum-Projekt Ullafelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 463-505
- Bertola S., 2011b - Northern alpine radiolarites in the lithic assemblage of the Ullafelsen. An overview. In: Schäfer D. (Ed.), *Das Mesolithikum-Projekt Ullafelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 509-519.
- Bertola S., 2014 - The raw material variability in the mesolithic site of



- Ullafelsen (Sellrain, Tyrol, Austria). ERAUL, 138: 93-101.
- Bertola S. & Schäfer D., 2011 - Jurassic cherts from the Kelheim district (Bavaria, Germany) in the Lower Mesolithic assemblage of the Ullafelsen. In: Schäfer D. (Ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 523-534.
- Butzer K.W., 1982 - *Archaeology as human ecology*. Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney, pp. 364.
- Dalmeri G. & Lanzinger M., 1998 - The evolution of the environment and human population of the Adige basin at the end of the late Ice Age and in the early Holocene. *Preistoria Alpina*, 34: 15-18.
- Fedele F.G., 1981 - Il popolamento delle Alpi nel Paleolitico. *Le Scienze*, 160: 22-39.
- Geitner C., Bussemer S., Ehrmann O., Ikinge A., Schäfer D., Traidl R. & Tschirko D., 2011 - Bodenkundlich-stratigraphische Befunde am Ullafelsen im hinteren Fotschertal sowie ihre landschaftsgeschichtliche Interpretation. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 109-151.
- Kerschner H., 2011 - Spätglaziale Gletschervorstöße im Fotschertal. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 97-105.
- Kompatscher K. & Kompatscher N., 2005 - Steinzeitliche Feuersteingewinnung. Prähistorische Nutzung der Radiolarit- und Hornsteinvorkommen des Rofengebirges. *Der Schlern*, 79: 24-35.
- Kompatscher K. & Kompatscher N.M., 2011 - Mittelsteinzeitliche Fernverbindungen über den Alpenhauptkamm. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 205-241.
- Mittelstraß J., 2003 - *Transdisziplinarität – wissenschaftliche Zukunft und institutionelle Wirklichkeit*. Konstanzer Universitätsreden 214. UVK Universitätsverlag, Konstanz, pp. 26.
- Oeggli K. & Wahlmüller N., 1997 - Die Waldgrenze in den Zentralalpen während des Mesolithikums. In: Oeggli K., Patzelt, G., Schäfer D. (eds.), *Alpine Vorzeit in Tirol*. University Innsbruck, Innsbruck: 29-44.
- Oeggli K. & Schoch W., 2011 - Holzkohlenanalysen aus Bodenproben des altmesolithischen Fundplatzes auf dem Ullafelsen im Fotschertal. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 197-201.
- Pawlik A., 2011 - Die funktionale Analyse der Steingeräte und die Rekonstruktion der Aktivitäten am Ullafelsen. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 355-459.
- Schäfer D., Kompatscher K. & Kompatscher N., 2006 - Zur mesolithischen Rohmaterialversorgung in Tirol. *Mitteilungen der ANI-SA*, 25/25: 293-303.
- Schäfer D. (Ed.), 2011a - *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck, pp. 560.
- Schäfer D., 2011b - Das Mesolithikum-Projekt Ullafelsen – Landschaftlicher Rahmen und archäologische Befunde. Arbeitsstand 2009 / 2010. In: Schäfer D. (ed.), *Das Mesolithikum-Projekt Ullfelsen (Teil 1). Mensch und Umwelt im Holozän Tirols*, vol. 1. Philipp von Zabern, Innsbruck: 245-351.
- Schäfer D., 2014 - The Mesolithic Project Ullafelsen in Tyrol (Austria). ERAUL, 138: 37-45.



