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Article

A good place to camp: settlement dynamics on a Mesolithic "high-way" in the Dolomites region of Seiser Alm-Auf der Schneide/ Cresta di Siusi and upper Val Duron (Italy)

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Key words

- Alps
- Dolomites
- Mesolithic
- Landscape archaeology
- Settlement dynamics
- Route system

Parole chiave

- Alpi
- Dolomiti
- Mesolitico
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- dinamiche insediative
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Summary

Human settlement at high altitudes in the Alps during the Holocene has brought about gradual changes to mountain dynamics and ecology. Over the last few decades, if the growing problem of soil erosion has on one hand removed a part of the archaeological stratification, on the other, it has made it possible to map 125 new sites in an area of approx. 1 sq. km, between Seiser Alm, auf der Schneide/Cresta di Siusi and the upper Val Duron. This paper discusses the data collected in the systematic surveys carried out by the authors (K.K. & N.H.K.) starting in 1991.
The extremely high concentration of sites and human presence involves the last 10,500 years, with an evident gap in the radiometric dating between 5500 and 2200 cal BC. In the Sauveterrian-Early Mesolithic, the preferred position for pitching a camp was Auf der Schneide/ Cresta di Siusi (2200 m.a.s.l.). In the Castelnovian, the bivouacs were located at a lower altitude, where the morphology of the slopes is flatter. The distribution of the sites in both phases of the Mesolithic points to the presence of an important route: a Mesolithic "high-way", where groups of hunter-gatherers from the Adige Valley were able to stay and easily reach their hunting grounds on the surrounding Dolomites peaks.

Riassunto

La colonizzazione umana olocenica delle alte quote alpine ha prodotto una progressiva modificazione delle dinamiche del paesaggio e dell'ecologia montana. Negli ultimi decenni il crescente fenomeno dell'erosione del suolo, se da un lato ha asportato parte della stratificazione archeologica, dall'altro ha consentito la mappatura di 125 nuovi siti su un'area di circa 1 kmq, compresa tra Auf der Schneide /Cresta di Siusi (Bozen/Bolzano) e l'alta Val Duron (Trento). In questo lavoro si discutono i dati raccolti nelle sistematiche ricerche di superficie effettuate dagli autori (K.K. & N.H.K.) a partire dal 1991. L'altissima concentrazione di siti e di presenze antropiche interessa gli ultimi 10.500 anni, con un evidente assenza di datazioni radiometriche compreso tra 5500 e 2200 cal BC. Nel Sauveterriano la posizione preferita per piantare un campo è Auf der Schneide/ Cresta di Siusi (>2200 metri s.l.m.). Nel Castelnoviano, invece, i bivacchi sono ubicati a quota inferiore, in corrispondenza di morfologie pianeggianti dei versanti. La distribuzione dei siti in entrambe le due fasi del Mesolitico identifica, la presenza di un importante percorso: una *Mesolithic "high-way"*, lungo la quale i gruppi di cacciatori-raccoglitori provenienti dalla Valle dell'Adige potevano sostare e tramite cui raggiungere agevolmente i territori di caccia sui rilievi dolomitici circostanti.

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Introduction

The area between the Adige Valley and the Dolomites is the Alpine area that has been most surveyed in terms of archaeological research into the Mesolithic. The oldest Lateglacial settlement in the Dolomites dates back to the Upper Palaeolithic (recent Epigravettian) and is recorded in the nearby Cionstoan rock shelter on Alpe di Siusi/Seiser Alm (Broglio & Lanzinger 1990) (Bozen/Bolzano) (1850 m.a.s.l.) and Casera Staulanza in Val di Zoldo (Belluno) (1681 m.a.s.l.) (Fontana et al. 2017). However, it was at the start of the Early Holocene that the recolonization of the higher alpine altitudes reached its peak, as shown by the hundreds of sites identified and new findings identified from the 1970s onwards (Bagolini 1972; Bagolini et al. 1984; Broglio 1992; Cesco Frare & Mondini 2005; Fontana et al. 2009; Fontana 2011; Fontana & Visentin 2016; Kompatscher & Hrozny Kompatscher 2007; Visentin et al. 2016).

Reconstruction of Mesolithic settlement patterns at high altitudes has made it possible to identify recurring patterns near specific morphologies such as passes, ridges, and water sources (above all, lakes). Analyses of individual sites have allowed us to establish their functions, and the hierarchical relationships between residential base camps in the valley basin and seasonal base camps at high altitudes (Bagolini & Dalmeri 1987; Broglio 2016; Broglio & Improta 1995; Broglio & Lanzinger 1990; Dalmeri & Pedrotti 1992; Fontana 2011). High altitude areas underwent profound changes during the Holocene, due to climate and above all due to the impact of human behaviour, which is considered the main cause of transformation in the landscape (Previtali 2011). Palaeoenvironmental and archaeological surveys show that mountain areas (uplands) were used by groups of herders from the first quarter of the third millennium BC, and that this continued to grow during the second millennium BC. (Carrer & Angelucci 2017; Festi et al. 2014; Kothieringer et al. 2015; Migliavacca 2016; Moe et al. 2007; Nicolis et al. 2016; Pearce 2016; Walsh et al. 2014), above all, between the Middle Ages and the mid-19th century (Andres 2016; Avanzini & Salvador 2014; Avanzini & Salvador 2016; Carrer 2015).

Initial archaeological research in the Cresta di Siusi/Auf der Schneide area was carried out by J.M. Moroder in 1980 (SAXV site), followed by Lunz's findings in 1981 (SAIII, SAXII, and SAXIII sites) (Lunz 1982; Lunz 1986), and systematic digs by the Geology Institute of the University of Ferrara (Lanzinger 1985). The SAXV and SAXVI sites, respectively excavated over 16 and 6 sq. m, have been analysed according to a typological approach (Broglio & Kozlowsky 1984) that links the relationship between tools/ armatures and microburins/armatures to the functional nature of the site. This method has made it possible to define SAXV and SAXVI as hunting grounds in which preparatory activities for armatures took place (Lanzinger 1985).

Over the last thirty years, the gradual spread of sheet erosion in the soil, together with archaeological stratification triggered by overgrazing, pressure from tourism, and the increase in extreme precipitation caused by climate change (Cristofolini et al. 2008; Hock et al. 2019), has led the authors (K.K. & N.M.H.K.) to carry out systematic surface surveys.

Parallel to survey activities, a project entitled "Archaeological research into human settlement and use of the area in the early Holocene, Cresta di Siusi-Val Duron", authorised by the Archaeological Heritage Office of the Autonomous Province of Bolzano and the Archaeological Heritage Office of the Autonomous Province of Trento, which includes annual digging campaigns, has been in place since 2015. New research into the Mesolithic sites of Auf der Schneide / Cresta di Siusi and Val Duron is being undertaken with a multidisciplinary approach. This includes applying a microstratigraphic approach, classifying all the lithic artefacts to make a detailed definition of the high-altitude camp's spatial organisation. Starting with a previous experiment on a regional scale, based on the distribution of several hundreds of sites at altitude (Kompatscher & Hrozny Kompatscher 2007; 2011), this paper aims to reconstruct a model for mobility patterns in this specific area of the Dolomites.

Further objectives of the project concern the development of an archeological map to be used for the active protection of the sites of Cresta di Siusi-Val Duron and a detailed analysis of the area organization of the individual settlements.

Geological framework

The Dolomites are located on the southern side of the south-eastern Alps. The "Dolomite landscape" is known throughout the world for its spectacular beauty and for the unique nature of its geological environment, which led it being recognised as a UNESCO World Heritage Site in 2009 (Panizza 2004; Soldati 2010). The area under study is located in the central-western part of the Dolomites, between the Gruppo dello Sciliar /Schlerngruppe to the west (Monte Pez/Petz, 2563 m.a.s.l), the Catinaccio/Rosengartengruppe to the south (Catinaccio d'Antermoia/Antermoi, 3002 metres above sea level) and Sassolungo/Langkofelgruppe to the northeast (3181 m.a.s.l).

The ridge of Cresta di Siusi/Auf der Schneide is the watershed separating Alpe di Siusi/Seiser Alm to the north (province of Bolzano) and the Duron valley-floor to the south (province of Trento). It extends over 5 km in a west-easterly direction, from the slops of the Denti di Terrarossa/Rosszähne (2653 m.a.s.l) to Jouf de Fascia (2304,7 m.a.s.l), through Passo Duron/Mahlknechtjoch (2187 m.a.s.l). It is bordered in the east and west by Sasso Piatto/Plattkofel (2964 m.a.s.l). The upper Val Duron is deeply split by its river of the same name (Ruf de Duron), which currently flows at the bottom of the northern face of the Catinaccio/Rosengartengruppe (Molignon), near the lithological contact with the vulcanites. This area is a European Community Interest Site (SIC), identified by code number IT3120119. During the Triassic period, subsidence and lifting events controlled the development of a series of carbonate platforms, surrounded by deep water basins which were filled from time to time with volcanic, volcanoclastic and terrigenous sediments (Neri et al. 2007).

The Dolomite area is the least deformed by orogenesis in the whole southern Alpine chain and therefore, the current landscape is like an "instant snapshot" of the paleogeographic picture of the mid-Triassic (Ladinico-Carnico, 236-223 million years): the current massifs of Sassolungo/Langkofelgruppe, Sciliar/Schlerngruppe and Catinaccio/Rosengartengruppe are the ancient carbonate atolls surrounded by a large sea basin and a tropical environment (Brondi et al. 1974; 1977).

The succession of carbonate platforms is represented by the Dolomia of the lower Sciliar (early Ladinian), cropping out in the Catinaccio/Rosengartengruppe, covered by Dolomite from the late Sciliar (early Carnian). In the mid- and late Ladinian, a series of submarine magma events filled the basins between the platforms and it is possible to distinguish pillow-lava flows, latite-andesite or latite-basalt flows, pillow breccias, basaltic hyaloclastite (Wengen formation, late Ladinian) (Neri et al. 2007).

During the alpine orogeny, the Triassic sequence was deformed into a series of anticlines and synclines in the directions ENE-WSW and E-W, the most important of which is the syncline of the Alpe di Siusi/Seiser Alm, split by the Plan anticline, forming the Gardenazza and Sella syncline. To the south, the Val Duron is set on an important tectonic line, in an E-W direction, parallel to the southernmost Line of Tires (Brondi et al. 1974; 1977).

Geomorphological setting

The morphogenesis of the current landscape is essentially the result of two factors: the geological-structural setting and selective erosion processes. Erosion has mainly acted on the vulcanites, leading to undulated morphology with softened steepness compared

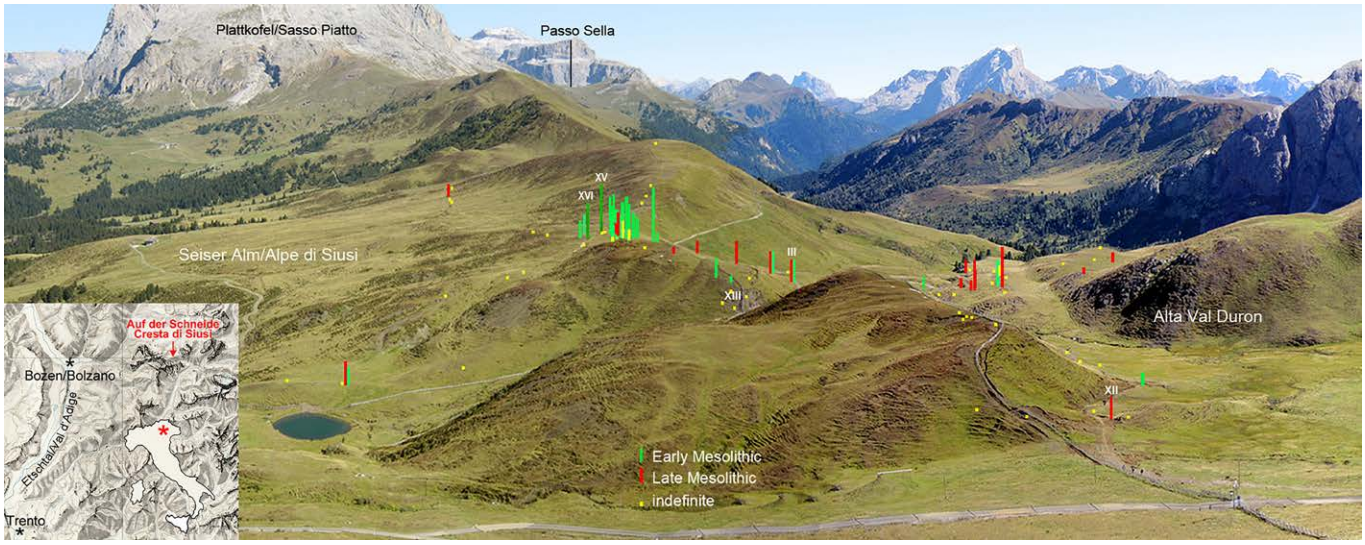


Fig. 1 - The Cresta di Siusi/Auf der Schneid seen from the west showing the lithic findspots (III,XII,XIII Lunz 1986; XV,XVI Lanzinger 1985). / La Cresta di Siusi/Auf der Schneid vista da ovest con la posizione dei ritrovamenti litici (III,XII,XIII Lunz 1986; XV,XVI Lanzinger 1985) .

to the more competent dolomitic rocks of the Catinaccio Group/Rosengartengruppe (Panizza et al. 1978). The most important morphotectonic element in the area being studied is the homoclinal ridge of Auf der Schneide/Cresta di Siusi: a dip slope consisting of mid-Triassic vulcanites (Wengen Formation), sloping towards the north by about 15-25° and characterised by gullies soil erosion, the typical phenomenon caused by deforestation and over-grazing. The southern face has a slope of up to 60°, and it is subjected to spectacular processes of selective erosion ("i Frati"). In the upper Val Duron, the different degree of lithotype erodibility that forms the vulcanites has given rise to undulated morphologies and dome shapes on the slopes (e.g.: Col de l'Agnel, 2285 m.a.s.l.) (Panizza et al. 1978).

The valley floor of upper Val Duron features an extensive alluvial cone interdigitating with the peaty soil (Pian della Torba, 2193 m.a.s.l. from 1 to 2 metres deep). This wet area is the source of Rio della Vecchia, a left-bank affluent of the Duron river. During the first World War (1915-1918 in Italy), along the ridge of Auf der Schneide/Cresta di Siusi an extensive trench was dug up by the Austro-Hungarian army.

The area is currently formed by high-altitude alpine grazing (*Nardetum)*. There are frequent degradation patterns caused by over grazing (Morandi 2013), with the formation of characteristic patterns from cross trampling and sheet erosion. The soil is medium depth in this area, and the main process is podzolization (Zilioli et al. 2011). The soil in the area under study consists of Entic Podzols (IUSS Working Group-WRB 2015; Sartori & Mancabelli 2009); its moisture regime is udic (soil is not dry in any part for as long as 90 cumulative days per year) and the soil temperature regime is cryic (mean annual temperature < 8°C with no permafrost) (Morandi 2013). It began to form around 7000-5000 cal. BP, during the middle stage of the Holocene (Egli et al. 2010).

Palaeoenvironmental framework

During the Pleistocene, the Dolomites were repeatedly occupied by glaciers, but the heritage of the glacier forms is owed above all to the Last Glacial Maximum-LGM, 27,000-18,000 cal BP; (Monegato et al. 2007; Borgatti et al. 2006, Ravazzi et al. 2014) and to successive deglaciation. During the LGM, glaciers covered the whole area, up to around 2300 m.a.s.l., with a maximum thickness of 900-1000 metres. Therefore, higher peaks emerged like *nunatak* while local glaciers were on the peaks of the higher mountain groups (Marchetti et al. 2017). In this period the glacier tongue, fed by the Catinaccio/Rosengartengruppe flowed north-eastwards through the Val Duron, splitting into two at Col de l'Agnel (Morandi 2013). During the Lateglacial period (18,000-11,600 cal BP), the glacial flow began to shrink back towards the higher altitudes of the Val Duron. In the northernmost Alta Badia, ^{14}C dating of a carbon sample shows that the altitudes in the vicinity of 1937 metres above sea level were already free from glaciers 16,610 cal BP (Panizza et al. 2011). The area being surveyed has shown no recognisable advanced Lateglacial glaciers relevant to the Gschnitz and Clavadel/Sanders stadials, dated between 17,000 and 16,000 cal BP, as in other alpine valleys (Ivy-Ochs et al. 2008) and not even in Younger Dryas (12,900-11,700 cal BP, Rasmussen et al. 2014).

During the Late Glacial period, periglacial processes became increasingly significant, with the formation of extensive detritus talus at the base of the dolomite platforms. Reforestation (*Pinus sylvestris, P. mugo, P. cembra, Larix decidua*) in the Southern Alps occurred in the latter part of the Lateglacial (Heiss et al. 2005). Starting with the Lateglacial-Holocene, many landslides – even on a large scale - were triggered at altitudes above 1500 metres, in areas already covered with vegetation (Soldati et al. 2004), a phenomenon that could be linked to the melting of permafrost on the slopes (Borgatti et al. 2006). At the start of the Holocene, these forests grew over the stable slopes at a height above 1500 metres; in the early and mid-Holocene, they expanded upwards, perhaps due to warmer climate conditions compared to the second part of the Holocene (Porter & Orombelli 1985; Magny & Haas 2004), and specifically, due to hot, dry summers (Tinner & Theurillat 2003). The timberline reached 2000 metres during the rapid Preboreal warming (Tinner & Vescovi 2007; Drescher-Schneider 2009). Palaeoenvironmental reconstruction during the early Holocene indicates the presence of pioneer plants (*Salix, Betula, Pinus mugo*), later replaced by dense woods dominated by *Picea, Larix* and *Pinus cembra* (Soldati et al. 1997). Pollen analysis carried out in the Mondeval de Sora site in the eastern Dolomites (2150 m.a.s.l.), under the overhang of a large glacial erratic, have pointed to the presence of an alpine meadow dominated by grass species and accompanied by wet species, and to the establishment, next to the site and starting in the Boreal, of a forest environment dominated by *Picea-Pinus* (Cattani 1992, Colombo et al. 2016).

In the period of approx. 8800-8400 cal BC, the timberline rose from 2100 to 2250 m.a.s.l. (Oeggl & Wahlmüller 1994; Wick 1994; Drescher-Schneider 2009).

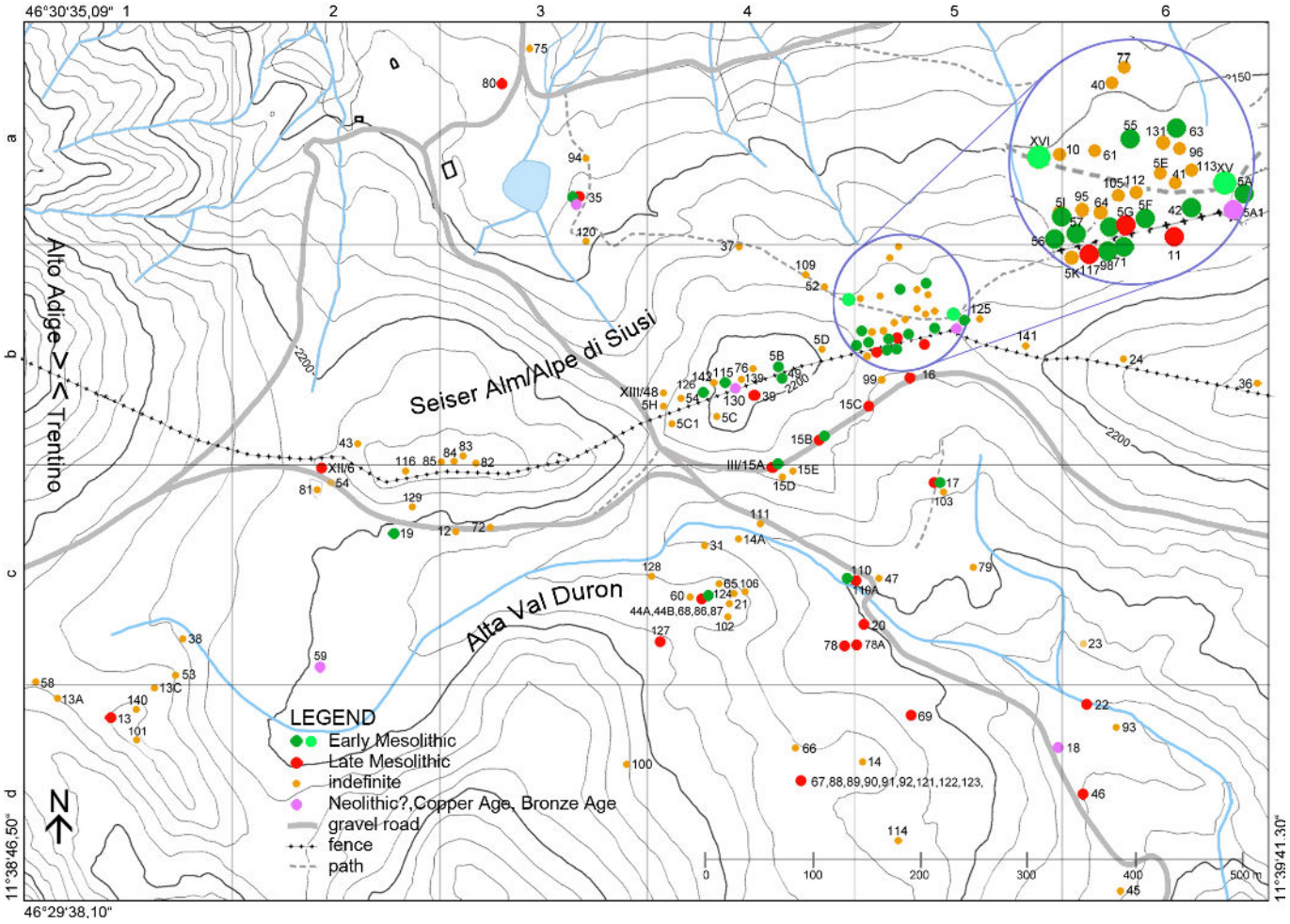


Fig. 2 - Distribution of the prehistoric findings in the investigation area of the Seiser Alm-Schneid/Cresta di Siusi and of the upper Val Duron. The classification follows tecno-topological features. / Distribuzione dei ritrovamenti preistorici nell'area di studio compresa tra Seiser Alm-Schneid/Cresta di Siusi e alta Val Duron. La classificazione è stata fatta in base alle caratteristiche tipo-tecnologiche.

Methods

Survey

The survey area covers approximately 1 sq. km and includes Auf der Schneide/Cresta di Siusi and upper Val Duron. Beginning with an initial inspection in the summer of 1991 and until 2018, the authors (K.K & N.M.H.K) carried out regular and repeated surface inspections, constantly monitoring the areas subject to erosion phenomena, which were still very limited at the start of research. Gradual stripping of the soil has made it possible to identify and map out the extension of settlements (Fig. 1, 2, 3).

The methodological, empirical approach adopted then defined a "site" based on the evident concentration of artefacts on the surface. Other "traces of human presence" were mapped, as represented by single artefacts. All of these elementary documentation units have been given progressive numbers preceded by the letters SA, which stand for Seiser Alm/Alpe di Siusi. The findings have been recorded in detail on specific site sheets, accompanied by drawings and photographs, georeferenced with geographical coordinates using GPS, and accurately placed in context from a topographical, morphological and pedological viewpoint.

Site dimensions have been described, along with the main characteristics of the artefact outcrop areas, with indications of current topographic references, such as pickets and tracks, eroded surface limits, maximum slope line, areas characterised by charcoal remains, the artefact dispersion area and the sampling points for ^{14}C analysis. At the same time, all the lithic samples were collected and cataloged.

For the organisation of the whole area on larger sites, a sheet was drawn up to provide the following information (Fig. 4-9):

a. map of the site: indicating the limits of soil erosion, the area with lithic artefacts concentration (green circle), land slope and the presence of find-spots together with radiometric dating;
b. general view of the site: photo of the area with indication of the respective discovery spots;
c. lithic artefacts: the number and different categories of lithic elements are given;
d. raw materials: the percentages of the different lithotypes used as raw materials are listed: Maiolica, Alpine Scaglia Variegata, Scaglia Rossa, local material, rock crystal and material with thermal alteration;
e. microlith typology: for the SA 5B sites, with the high number of armatures, comparison has also been made between the frequencies of the different categories, following the proposed typology for the lithic industries of the Romagnano III shelter (Broglio & Kozlowski1984) (Fig. 4);
f. drawings of the armatures divided into categories have been made for all sites.

The main aim of this intensive survey is to draw up an archaeological map as a means of active site protection against the erosion

year	site	m	46°...	11°...	n°		sq
1991	SA 5A	2192	29'53,94"	39'24,90"	578	●	6a
1991	SA 06	2212	29'50,52"	38'58,14"	262	●	2c
1992	SA 05B	2230	29'53,05"	39'17,82"	2214	●	4b
1992	SA 10	2195	29'54,82"	39'22,40"	25	●	6a
1992	SA 11	2192	29'53,73"	39'24,84"	16	●	6a
1992	SA 12	2190	29'48,48"	39'06,66"	11	●	3c
1992	SA 13	2240	29'43,44"	38'50,10"	68	●	1d
1993	SA 05C	2229	29'51,54"	39'15,30"	13	●	4b
1993	SA 05D	2220	29'50,56"	39'18,98"	9	●	4c
1993	SA 13A	2235	29'44,58"	38'47,76"	17	●	1d
1994	SA 16	2175	29'52,02"	39'25,14"	54	●	5b
1994	SA 17	2165	29'50,40"	39'24,00"	328	●●	5c
1994	SA 18	2125	29'41,80"	39'30,00"	7	●	5d
1995	SA 14A	2130	29'48,36"	39'15,48"	4	●	4c
1995	SA 19	2200	29'48,93"	39'01,64"	40	●	2c
1995	SA 20	2150	29'45,49"	39'22,22"	18	●	5c
1995	SA 21	2180	29'46,38"	39'15,30"	15	●	4c
1995	SA 22	2125	29'43,08"	39'29,94"	25	●	6d
1995	SA 23	2130	29'43,10"	39'22,16"	3	●	6c
1995	SA 24	2200	29'53,21"	39'28,26"	7	●	6b
1998	SA 31	2140	29'48,20"	39'14,16"	1	●	4c
2002	SA 05C1	2227	29'53,82"	39'14,37"	1	●	4b
2002	SA 05E	2197	29'50,64"	39'19,39"	4	●	4c
2002	SA 05F	2199	29'54,12"	39'23,94"	29	●	6a
2002	SA 05G	2198	29'54,06"	39'23,58"	690	●●	6a
2002	SA 05H	2190	29'52,08"	39'13,56"	5	●	4b
2002	SA 05I	2197	29'54,11"	39'22,39"	214	●	6a
2002	SA 05K	2220	29'53,61"	39'22,37"	9	●	6b
2002	SA 13C	2230	29'44,64"	38'51,60"	7	●	1d
2002	SA 15A	2180	29'50,58"	39'18,96"	689	●●	4c
2002	SA 15B	2178	29'50,76"	39'19,74"	45	●●	4b
2002	SA 15C	2175	29'51,42"	39'21,90"	50	●	5b
2002	SA 35	2140	°29'59,10"	39'10,08"	432	●●	3a
2002	SA 36	2245	29'52,68"	39'41,58"	14	●	6b
2004	SA 37	2170	29'57,48"	39'16,32"	1	●	4b
2004	SA 38	2220	29'46,50"	38'52,14"	3	●	1c
2004	SA 39	2205	29'52,26"	39'16,32"	6	●	4b
2004	SA 40	2190	29'55,50"	39'23,16"	4	●	6a
2004	SA 41	2192	29'54,18"	39'24,54"	22	●	6a
2005	SA 14	2180	29'41,52"	39'21,72"	28	●	5d
2005	SA 15D	2180	29'50,28"	39'19,19"	7	●	4c
2005	SA 15E	2180	29'50,48"	39'19,40"'	1	●	4c
2005	SA 42	2192	29'54,08"	39'24,88"	1106	●	6a
2005	SA 43	2220	29'51,91"	39'00,52"	1	●	2b
2005	SA 44A	2180	29'46,68"	39'13,86"	50	●	4c
2005	SA 44B	2180	29'46,68"	39'13,88"	2	●	4c
2005	SA 45	2110	29'37,74"	39'32,22"	1	●	6d
2005	SA 46	2120	29'40,32"	39'30,66"	2	●	6d
2005	SA 47	2150	29'46,92"	39'23,04"	4	●	5c
2006	SA 48	2180	29'52,32"	39'14,88"	5	●	4b
2006	SA 49	2228	29'52,81"	39'18,06"	14	●	4b
2007	SA 52	2180	29'55,14"	39'20,70"	3	●	4b
2007	SA 53	2225	29'45,12"	38'52,20"	1	●	1c
2007	SA 54	2208	29'50,39"	38'58,72"	9	●	2c
2007	SA 55	2185	29'55,02"	39'23,40"	103	●	6a
2007	SA 56	2198	29'53,88"	39'22,38"	624	●	6a
2007	SA 57	2198	29'53,88"	39'22,68"	656	●	6a
2007	SA 58	2235	29'45,06"	38'46,92"	9	●	1c
2007	SA 59	2180	29'45,06"	38'58,32"		●	2c
2007	SA 60	2178	29'46,74"	39'12,36"	5	●	4c
2007	SA 61	2185	29'54,96"	39'23,16"	6	●	6a
2009	SA 63	2185	29'54,78"	39'24,24"	117	●	6a
2009	SA 64	2198	29'54,18"	39'23,22"	30	●	6a
2009	SA 65	2163	29'47,65"	39'14,91"	12	●	4c
2009	SA 66	2170	29'42,30"	39'19,38"	9	●	4d
2009	SA 67	2170	29'41,40"	39'19,20"	16	●	4d
2009	SA 68	2176	29'47,01"	39'14,58"	1	●	4c
2010	SA 69	2155	29'41,58"	39'25,08"	6	●	5d
2011	SA 71	2198	29'54,00"	39'23,34"	399	●	6a
2011	SA 72	2190	29'48,78"	39'08,04"	2	●	3c
2012	SA 75	2130	30'02,33"	39'07,93"	4	●	3a
2012	SA 76	2230	29'53,16"	39'17,82"	11	●	4b
2012	SA 77	2183	29'55,62"	39'23,40"	1	●	6a
2012	SA 78	2148	29'44,76"	39'21,12"	763	●	5c
2012	SA 79	2155	29'46,98"	39'26,10"	1	●	5c
2013	SA 80	2130	30'02,22"	39'07,44"	20	●	3a
2013	SA 81	2212	29'49,92"	38'58,86"	3	●	2c
2013	SA 82	2245	29'50,88"	39'05,04"	38	●	3b
2013	SA 83	2225	29'51,00"	39'04,68"	17	●	3b
2013	SA 84	2225	29'50,88"	39'04,20"	1	●	3b
2013	SA 85	2225	29'50,82"	39'04,02"	2	●	3b
2013	SA 86	2180	29'46,68"	39'14,22"	2	●	4c
2013	SA 87	2180	29'46,80"	39'13,62"	3	●	4c
2013	SA 88	2170	29'41,16"	39'18,48"	2	●	4d
2013	SA 89	2170	29'41,28"	39'18,90"	6	●	4d
2013	SA 90	2170	29'41,28"	39'19,02"	6	●	4d
2013	SA 91	2170	29'41,46"	39'19,32"	6	●	4d
2013	SA 92	2170	29'41,28"	39'19,38"	8	●	4d
2013	SA 93	2125	29'42,84"	39'30,24"	5	●	6d
2013	SA 95	2198	29'54,18"	39'22,72"	3	●	6a
2013	SA 96	1990	29'55,38"	39'24,88"	1	●	6a
2013	SA 98	2198	29'53,94"	39'22,92"	422	●	6b
2013	SA 99	2175	29'52,87"	39'23,41"	1	●	5b
2013	SA 100	2210	29'42,42"	39'16,20"	2	●	3d
2014	SA 101	2240	29'42,78"	38'51,00"	1	●	1d
2014	SA 102	2174	29'46,98"	39'16,15"	1	●	4c
2014	SA 103	2160	29'50,28"	39'25,50"	2	●	5c
2014	SA 105	2200	29'54,66"	39'23,22"	2	●	6a
2014	SA 106	2175	29'46,62"	39'16,44"	1	●	4c
2015	SA 05A1	2192	29'53,94"	39'24,90"	0	●	6a
2015	SA 94	2135	30'00,30"	39'10,32"	4	●	3a
2015	SA 109	2180	29'54,78"	39'22,14"	1	●	4b
2015	SA 110	2155	29'47,04"	39'21,12"	55	●●	5c
2015	SA 111	2165	29'49,44"	39'16,98"	5	●	4c
2015	SA 112	2197	29'54,42"	39'23,82"	5	●	6a
2015	SA 113	2197	29'54,66"	39'24,78"	2	●	6a
2015	SA 114	2165	29'37,32"	39'23,76"	1	●	5d
2015	SA 115	2199	29'52,32"	39'15,06"	140	●	4b
2015	SA 116	2228	29'50,76"	39'03,00"	2	●	2c
2015	SA 117	2189	29'53,80"	39'22,74"	108	●●	6b
2016	SA 120	2145	29'57,90"	39'09,78"	0	●	3a
2016	SA 121	2170	29'41,04"	39'18,96"	6	●	4d
2016	SA 122	2170	29'41,16"	39'18,84"	1	●	4d
2016	SA 123	2170	29'41,40"	39'19,02"	3	●	4d
2016	SA 124	2180	29'46,80"	39'15,66"	1	●	4c
2016	SA 125	2191	29'54,60"	39'26,10"	7	●	6a
2016	SA 126	2198	29'52,32"	39'14,82"	1	●	4b
2016	SA 127	2190	29'45,36"	39'12,06"	5	●	4c
2016	SA 128	2180	29'47,40"	39'11,52"	1	●	4c
2017	SA 129	2205	29'47,04"	39'06,06"	1	●	2c
2017	SA 130	2200	29'52,21"	39'15,63"	1	●	4b
2017	SA 131	2186	29'57,18"	39'30,09"	5	●	6a
2018	SA 78A	2148	29'44,76"	39"21,70"	40	●	5c
2018	SA 138	2214	29'51,24"	38'59,10"	1	●	2b
2018	SA 139	2200	29'52,27"	39'15,55"	1	●	4b
2018	SA 140	2196	29'43,73"	39'50,44"	2	●	1d

Fig. 3 - List in chronological order of the findings during the survey activity on the Seiser Alm Schneid/Cresta di Siusi (for geographic position of every single prehistoric evidence see figg. 4-9, for cultural attribution see fig. 1). / Elenco in ordine cronologico dei rinvenimenti nel corso dell'attività di survey Alpe di Siusi/Cresta di Siusi (per la posizione geografica di ogni singolo rinvenimento vedi figg. 4-9, per attribuzione culturale vedi fig. 1)

problems as described above, and the possible creation of future infrastructures. The vast amount of data recovered is also a base on which to construct settlement models in this particular geographical context.

Stratigraphic investigations

Survey activities have made it possible to select the contexts in which the archaeological record was more representative and in a good state of conservation, and then to schedule stratigraphic excavations.

Excavations were carried out with a micro stratigraphic approach and performed by dividing a square-metre grid into 9 squares, each 33x33 cm, identified with the letters a through to i. All lithic artefacts identified, independently of size, were recorded in the space using Cartesian coordinates (x, y, z in cm) and progressively numbered. All the sediment was sifted in water using a 1 mm screen and screened in the laboratory under stable light conditions. A sediment sample was systematically treated by floating through 0.5 mm screens for archaeobotanical analysis.

The stratigraphic units are identified using the abbreviation "S.U." and have been described according to FAO guidelines for Soil Description (2006). The symbols used for soil classification and horizon definitions follow Soil Taxonomy criteria (Soil Survey Staff 2014). Soil classification follows the dictates of the IUSS Working Group WRB (2015). Colours were determined in the wet state and codified with the Munsell Soil Color Charts® (2000). During the excavation, 16 undisturbed sediment samples were taken for micromorphological analysis. At the current time, the stratigraphic investigation has focused on 6 new open-air sites (SA 42, SA 35B, SA 44A-B, SA 93, SA 122,), where excavations are ongoing.

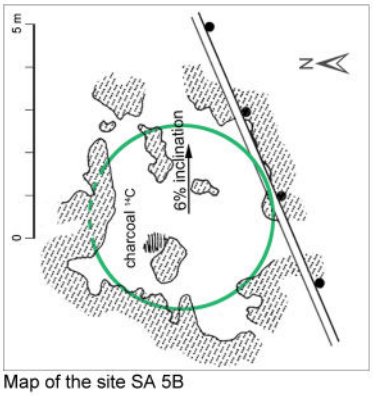
Techno-typological analysis and raw materials

Technological examination was carried out on 10,194 lithic elements, including cores, retouched artefacts, residues from the production of geometric microliths (microburin and *piquant-dièdre*) and non-retouched artefacts.

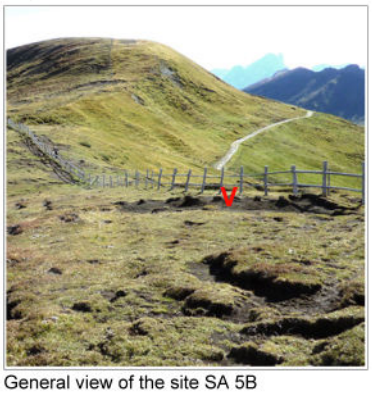
Chronological and cultural attributions were carried out based on the techno-typological feature of the lithic industry, developed by Broglio & Kozlowski (1984) for the Romagnano III site in the valley floor in the Adige Valley, near Trento (Alessio et al. 1984).

The lithic assemblage was divided according to various lithotypes used in order to suggest probable lithic resource areas. The artefacts were classified according to their macroscopic features (colour, structure and cortex), using a reference collection of rocks, minerals and fossils that includes cherts from the south alpine outcrops of the Prealpine area of Veneto, the Adige Valley floor and the Dolomites area.

Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 5B	2210	LTL14818A: 8615 + 50BP 7745-7566 BC (95,4%)	surface findings



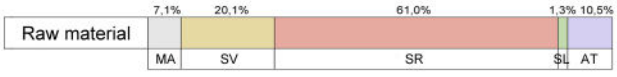
Map of the site SA 5B



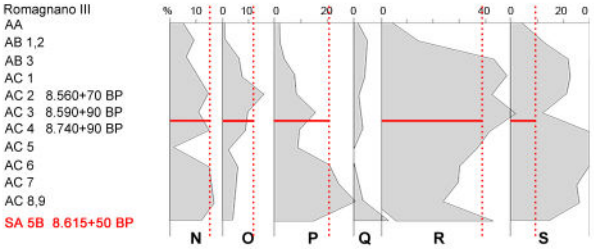
General view of the site SA 5B

Lithic artefacts		
	Tools (entire and fractured)	10
	Armatures (entire and fractured)	64
	Microburins	116
	Cores	4
	Débris	2020
	Total lithic assemblage	2214

Percent value armatures/tools	86,5%
Percent value microburins/armatures	1,8/1



Lithic material
MA: Maiolica, SV: Scaglia Variegata SR: Scaglia Rossa, SL: Local material
C: Hyaline quartz, AT: Thermal alteration



Microlith typology (Broglio & Kozlowski 1983)
N: Backed blades; O: Backed points; P: Segments;
Q: Segmented backed bladlets; R: Triangles; S: double-backed points

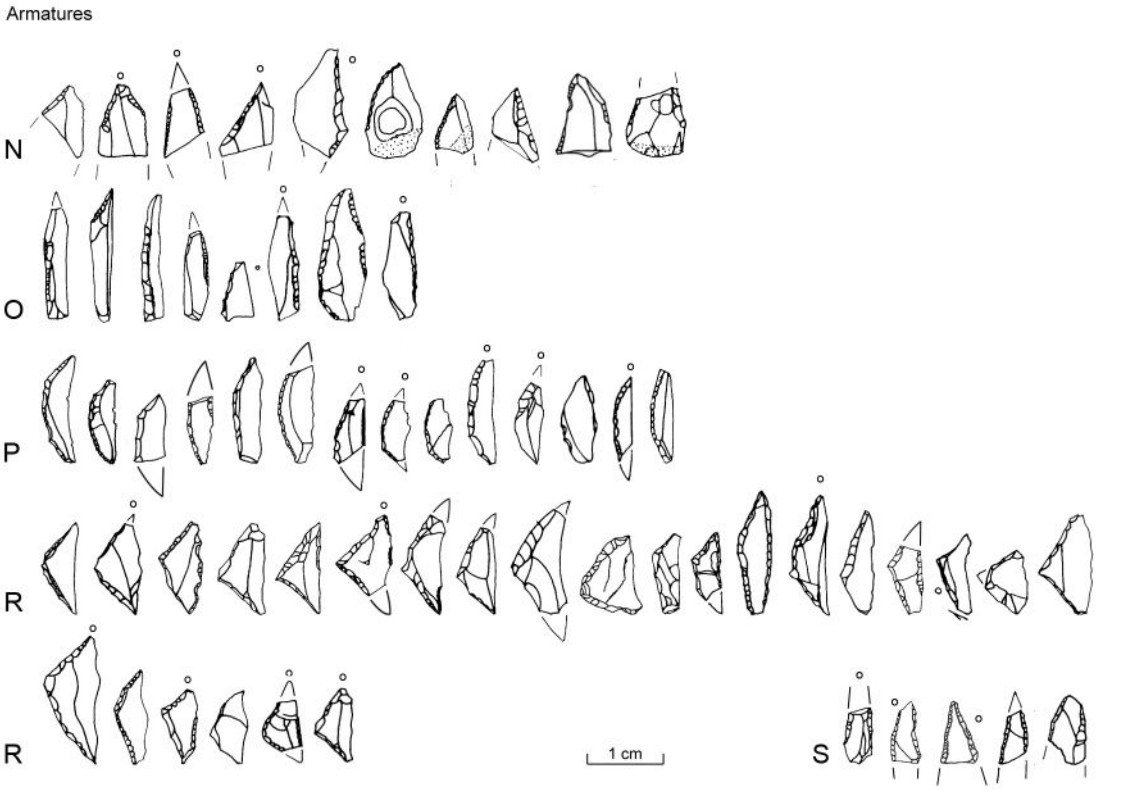
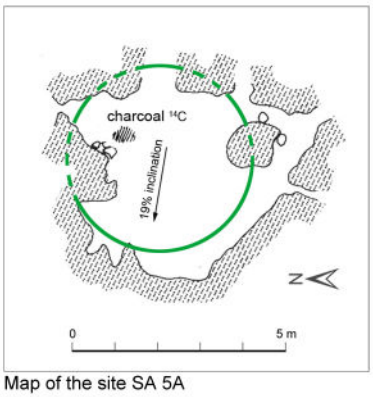


Fig. 4 - Summary form for site SA 5B. / Scheda informativa del sito SA 5B.

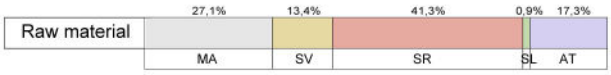
Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 5A	2200	LTL15958A: 8862 + 65BP 8240-7750 BC (95,4%)	surface findings



Map of the site SA 5A

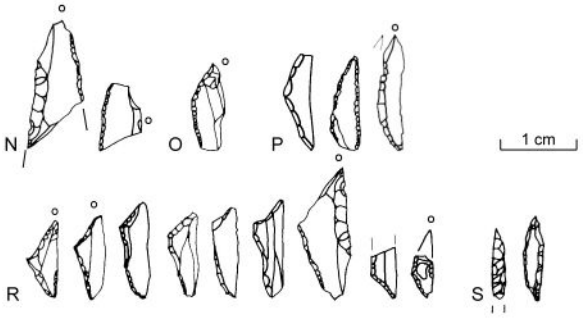
Lithic artefacts		
	Tools (entire and fractured)	3
	Armatures (entire and fractured)	16
	Microburins	51
	Cores	1
	Débris	507
	Total lithic assemblage	578

Percent value armatures/tools	94,1%
Percent value microburins/armatures	3,2/1

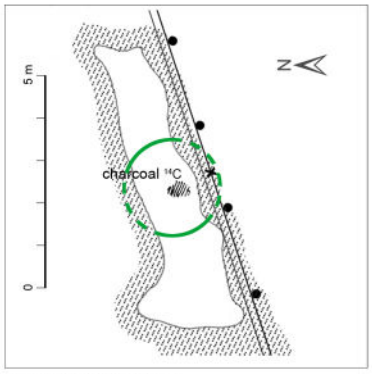


General view of the site SA 5A

Armatures



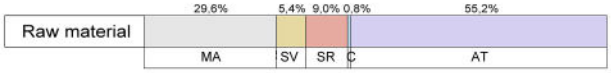
Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 42	2190	LTL14024A: 8650 ± 60 BP 7760-7350 BC (95,4%)	surface findings



Map of the site SA 42

Lithic artefacts		
	Tools (entire and fractured)	3
	Armatures (entire and fractured)	18
	Microburins	67
	Cores	
	Débris	1018
	Total lithic assemblage	1106

Percent value armatures/tools	85,7%
Percent value microburins/armatures	3,7/1

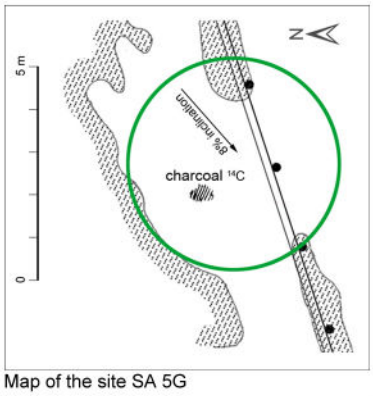


General view of the site SA 42

Armatures

Fig. 5 - Summary form for sites SA 5A and SA 42. / Scheda informativa dei siti SA 5A e SA 42.

Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 5G	2190	LTL14921A: 8788 + 55BP 8006-7646 BC (82,4%)	surface findings

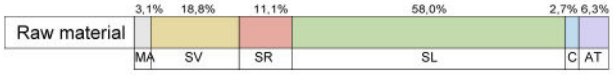


Map of the site SA 5G

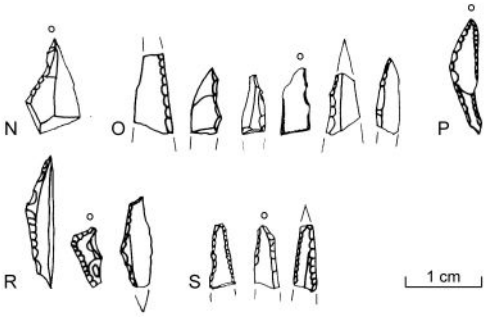
General view of the site SA 5G

Lithic artefacts		
	Tools (entire and fractured)	5
	Armatures (entire and fractured)	14
	Microburins	23
	Cores	5
	Débris	643
	Total lithic assemblage	690

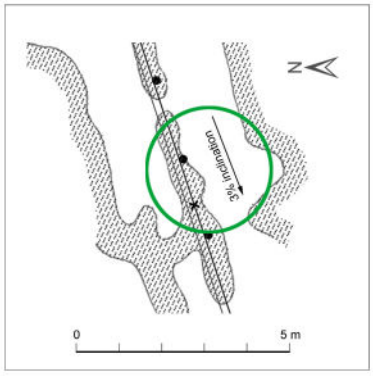
Percent value armatures/tools	73,7%
Percent value microburins/armatures	1,6/1



Armatures



Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 98	2200		surface findings

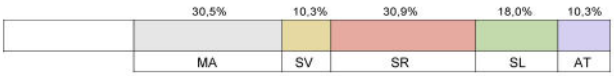


Map of the site SA 98

General view of the site SA 98

Lithic artefacts		
	Tools (entire and fractured)	1
	Armatures (entire and fractured)	12
	Microburins	10
	Cores	3
	Débris	396
	Total lithic assemblage	422

Percent value armatures/tools	92,3%
Percent value microburins/armatures	0,8/1



Armatures

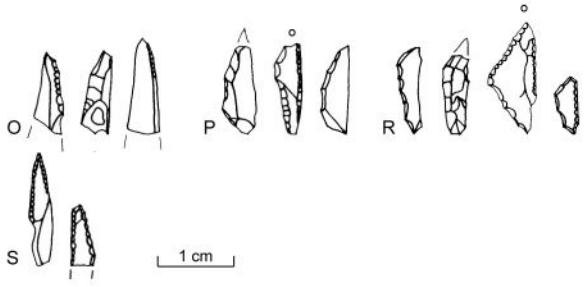
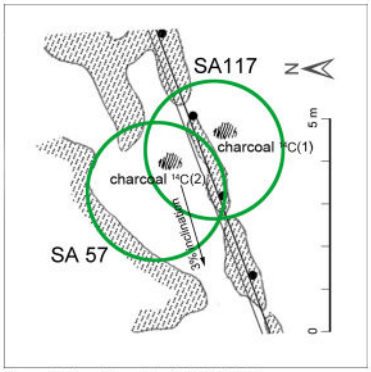


Fig. 6 - Summary form for sites SA 5G and SA 98. / Scheda informativa dei siti SA 5G e SA 98.

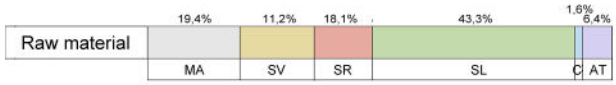
Site	Altitude m a.s.l.	(1)LTL15958A: 8659 ± 65BP/ 7870-7570 BC (93,1%)	Type
SA 57/117	2188	(2)LTL15956A: 7664 ± 60BP/ 6630-6420 BC (95,4%)	surface findings



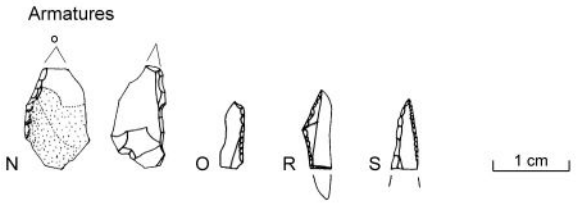
Map of the sites SA 57 SA 117

Lithic artefacts	Tools (entire and fractured)	1
	Armatures (entire and fractured)	5
	Microburins	9
	Cores	
	Débris	749
	Total lithic assemblage	764

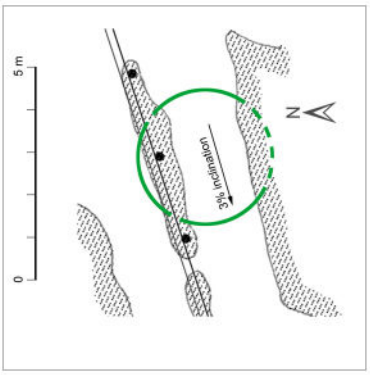
Percent value armatures/tools	
Percent value microburins/armatures	



General view of the sites SA 57, 117



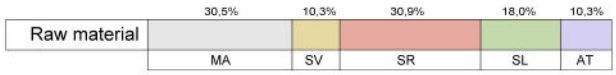
Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 71	2200		surface findings



Map of the site SA 71

Lithic artefacts	Tools (entire and fractured)	
	Armatures (entire and fractured)	18
	Microburins	9
	Cores	1
	Débris	371
	Total lithic assemblage	399

Percent value armatures/tools	
Percent value microburins/armatures	0,5/1



General view of the site SA 71

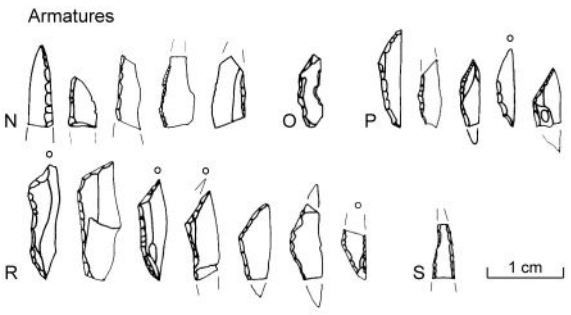
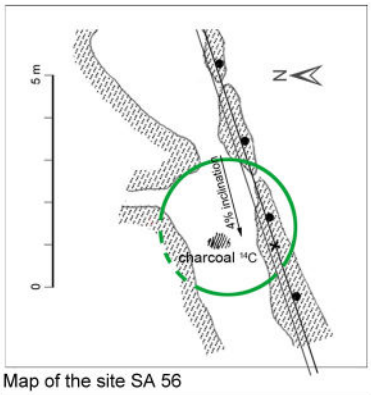


Fig. 7 - Summary form for sites SA 57/117 and SA 71. / Scheda informativa dei siti SA 57 e SA 71.

Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 56	2185	LTL13695A: 8915 ±45BP 8150-7960 BC (55,8%)	surface findings



Map of the site SA 56

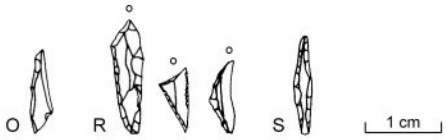
General view of the site SA 56

Lithic artefacts		
	Tools (entire and fractured)	1
	Armatures (entire and fractured)	5
	Microburins	6
	Cores	
	Débris	612
	Total lithic assemblage	624

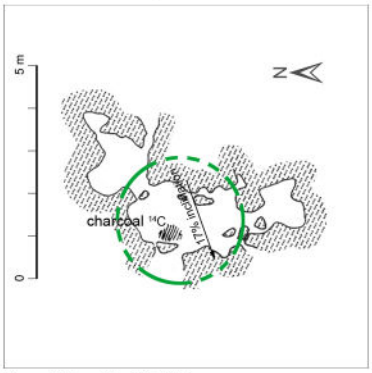
Percent value armatures/tools	83,3%
Percent value microburins/armatures	1,2/1

Raw material	MA	SV	SR	SL	C	AT
	23,4%	7,3%	24,3%	22,0%	0,1%	22,9%

Armatures



Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 115	2205	LTL15957A: 8492 ± 60BP 7610-7450 BC (95,4%)	surface findings



Map of the site SA 115

General view of the site SA 115

Lithic artefacts		
	Tools (entire and fractured)	
	Armatures (entire and fractured)	6
	Microburins	
	Cores	8
	Débris	126
	Total lithic assemblage	140

Percent value armatures/tools	
Percent value microburins/armatures	

Raw material	MA	SV	SR	SL	AT
	18,1%	11,4%	62,8%	2,9%	4,8%

Armatures

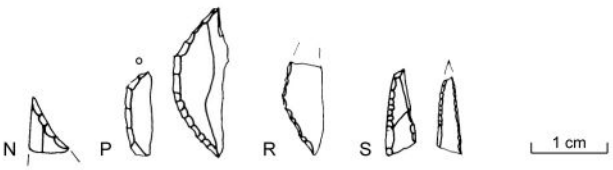
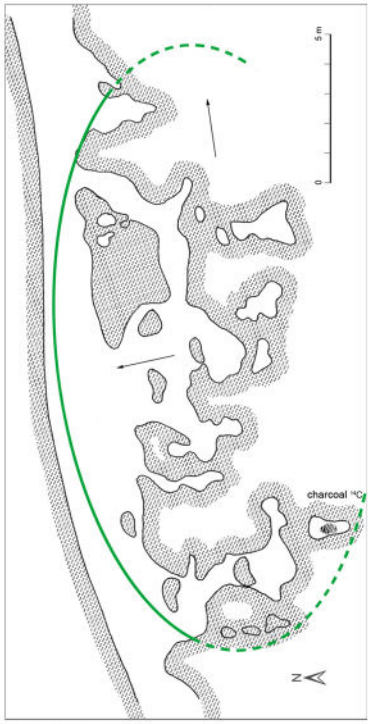


Fig. 8 - Summary form for sites SA 56 and SA 115. / Scheda informativa dei siti SA 56 e SA 115.

Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 15A	2180	LTL17732A: 3350±45BP 1744-1520 BC (95,4%)	surface findings



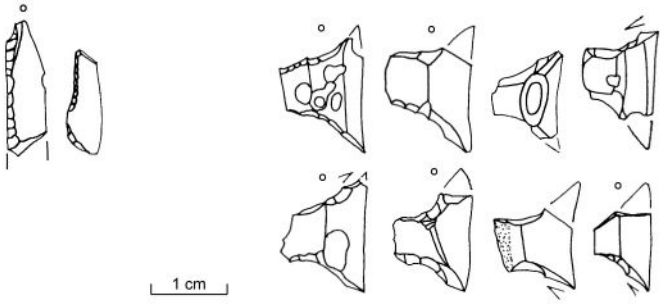
Map of the site SA 15A

Lithic artefacts	Tools (entire and fractured)	6
	Armatures (entire and fractured)	10
	Microburins	37
	Cores	6
	Débris	630
	Total lithic assemblage	689

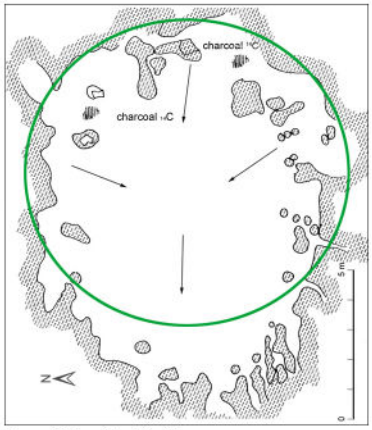
Percent value armatures/tools	
Percent value microburins/armatures	

Raw material	21,0% MA	14,9% SV	12,6% SR	3,9% SL	47,6% AT

Armatures



Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 78	2148	LTL14820A: 2634 + 35BP 850-770 BC (91,7%)	surface findings



Map of the site SA 78

Lithic artefacts	Tools (entire and fractured)	9
	Armatures (entire and fractured)	12
	Microburins	11
	Cores	1
	Débris	730
	Total lithic assemblage	763

Percent value armatures/tools	
Percent value microburins/armatures	

Raw material	56,9% MA	2,1% SV	4,8% SR	36,2% AT

Armatures

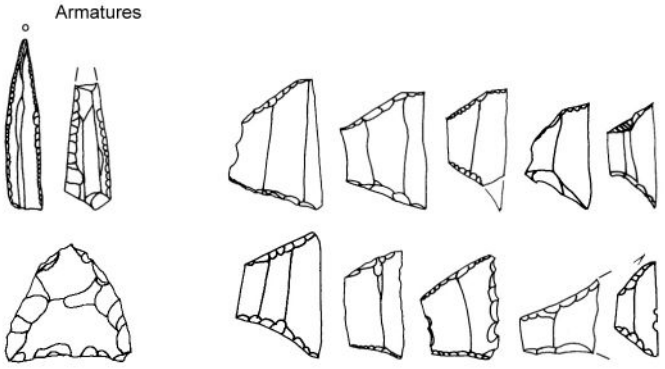


Fig. 9 - Summary form for sites SA 56 and SA 115. / Scheda informativa dei siti SA 56 e SA 115.

Lab.n.	site	position	material	Radiocarbon date (BP)	$\delta^{13}C$ (%0)	Calibrated date
LTL18503A	SA78	surface findings	charcoal	144+-55	-28,0+-0,2	1793AD - 1950AD
LTL 18504A	SA110	surface findings	charcoal	8385+-55	-20,2+-0,3	7570BC - 7330BC
LTL17732A	SA15A	surface findings	charcoal	3350+-45	-24,3+-0,3	1744BC - 1520BC
LTL17586A	SA42	S.U.39	charcoal	8452+-45	-23,1+-0,5	7586BC - 7457BC
LTL17588A	SA44B	S.U.54	charcoal	9048+-45	-22,5+-0,5	8322BC - 8210BC
LTL17589A	SA44B	S.U.56	charcoal	8351+-45	-30,6+-0,5	7530BC - 7309BC
LTL17468A	SA35	S.U.36	charcoal	9159+-75	-22,2+-0,4	8563BC - 8252BC
LTL16729A	SA122	excavation	charcoal	1762+-45	-22,2+-0,3	130AD - 390AD
LTL16730A	SA122	excavation	bone	1735+-45	-21,3+-0,6	210AD - 410AD
LTL16549A	SA35	S.U.16	charcoal	2463+-45	-20,6+-0,5	770BC - 410BC
LTL16669A	SA44A	S.U.22C	charcoal	6678+-50	-22,0+-0,5	5680BC - 5490BC
LTL16668A	SA5I	surface findings	charcoal	8693+-PB	-27,9+-0,6	7820 BC - 7590BC
LTL16670A	SA44B	S.U.23	charcoal	6632+-40	-29,9+-0,5	5630BC - 5490BC
LTL14921A	SA5G	surface findings	charcoal	8788+-55	-22,4+-0,3	8006BC - 7646BC
LTL15954A	SA5A	surface findings	charcoal	8862+-65	-23,6+-0,3	8240BC - 7750BC
LTL15955A	SA42	S.U.10	charcoal	8868+-65	-23,2+-0,6	8240BC - 7780BC
LTL15956A	SA57	surface findings	charcoal	7664+-60	-23,3+-O,6	6630BC - 7750BC
LTL15957A	SA115	surface findings	charcoal	8492+-60	-23,3+-0,7	7610BC - 7450BC
LTL15958A	SA117	surface findings	charcoal	8659+-65	-24,2+-0,7	7870BC - 7570BC
LTL14819A	SA35 est	surface findings	charcoal	2730+-35	-26,8+-0,4	940BC - 800BC
LTL14820A	SA78	surface findings	charcoal	2634+-35	-25,4+-35	850BC - 770BC
LTL14024A	SA42	surface findings	charcoal	8605+-60	-25,8+-0,5	7760BC - 7530BC
LTL13694A	SA35 ovest	surface findings	charcoal	8139+-45	-25,8+-o,6	7200BC - 7040BC
LTL13695A	SA56	surface findings	charcoal	8945+-45	-18,7+-0,5	8150BC - 7960BC
LTL13596A	SA80	surface findings	charcoal	3715+-45	-24,1 +-O,7	2210BC - 1970BC
LTL13697A	SA91	surface findings	charcoal	2878+-45	-18,6+-0,5	1210BC - 920BC
LTL13698A	SA93	surface findings	charcoal	2840+-40	-18,3+-0,5	1130BC - 900BC
LTL14818A	SA5B	surface findings	charcoal	8615+-50	-22,2+-O5	7745BC - 7566BC

Fig. 10 *- ^{14}C AMS datings of the sites discovered in the investigated area (CEDAD Università del Salento using OxCal v. 4.3.2 Bronk Ramsey et al. 2013). / Datazioni ^{14}C AMS dei siti scoperti nell'area indagata (CEDAD Università del Salento utilizzando OxCal v. 4.3.2 Bronk Ramsey et al. 2013).*

The results of this analysis have been entered in the descriptive sheet for each individual site (par. 6). (The material analysed is granted for authorised study purposes by the Archaeological Heritage Office of the Autonomous Province of Bolzano and the Archaeological Heritage Office of the Autonomous Province of Trento).

Radiocarbon dating

Twenty-eight ^{14}C-AMS dating were carried out on wood charcoal fragments sampled during survey activities, mainly from stratifications brought to light by erosion phenomena and explorative surveys. Samples were analysed by the Centre for Dating and Diagnostics - CEDAD, Department of Mathematics and Physics "Ennio de Giorgi", University of Salento, Lecce (Italy). These data were then calibrated for calendar age applying OxCal v. 4.3.2 Bronk Ramsey et al. (2013), IntCal13 atmospheric curve (Reimer et al. 2013), with a probability of 95.4%, unless otherwise stated (Fig.10, 11).

Results

Spatial distribution of sites and chrono-cultural context

To date (2018) 122 lithic artefact find-spots have been found in the investigated area, 22 of which (18.0%) are attributed to the early Mesolithic-Sauveterrian, 24 (19.6%) to the late Mesolithic-Castelnovian while 76 (62.2%) are indeterminable (Fig. 3, 11).

In some cases, two or more very close find spots have been grouped into the same site (e.g. SA 122). A site is a single area of settlement identifiable by the presence of a significant concentration of lithic artefacts. With only find-spot distribution to go by, defining site limits with any degree of certainty is not always possible. On the ridge of Auf der Schneide/ Cresta di Siusi the sites are concentrated over a limited section some 300 metres long, distributed towards the west and above all, to the east of Passo Duron/Mahlknechtjoch (2.168 m.a.s.l.).

Crest sites

The discovery of further lithic concentrations in the immediate vicinity of the SAXV and SAXVI sites, which were dated using techno-typological methods to the mid-Sauveterrian (Lanzinger 1985), confirms the theory that this part of Auf der Schneide/ Cresta di Siusi could be a key area for the reconstruction of Mesolithic settlement dynamics in the Dolomites. Fourteen of these findings are attributed to the Sauveterrian, eight of which have been dated to the mid-Sauveterrian period with ^{14}C. The Castelnovian is represented by a limited number of sporadic artefacts and a combustion structure in site SA 57, dated to 6,630-6,420 cal BC (Fig.12).

The different concentrations range from a minimum diameter of approx. 2 m (SA 42) up to approx. 5 m (SA 5G). The slope of the terrain extends in different directions, except southwards. Traces of open hearths were mainly recognized at the centre of the different lithic concentrations (Fig. 4-9).

As far as the lithic industry is concerned, the frequency of armatures compared to tools for all the sites studied to date shows an extremely high level of activity connected to hunting rather than subsistence. This fact was also observed in the SA XV and XVI sites (Lanzinger 1985). The ratio of microburins to armatures shows a high

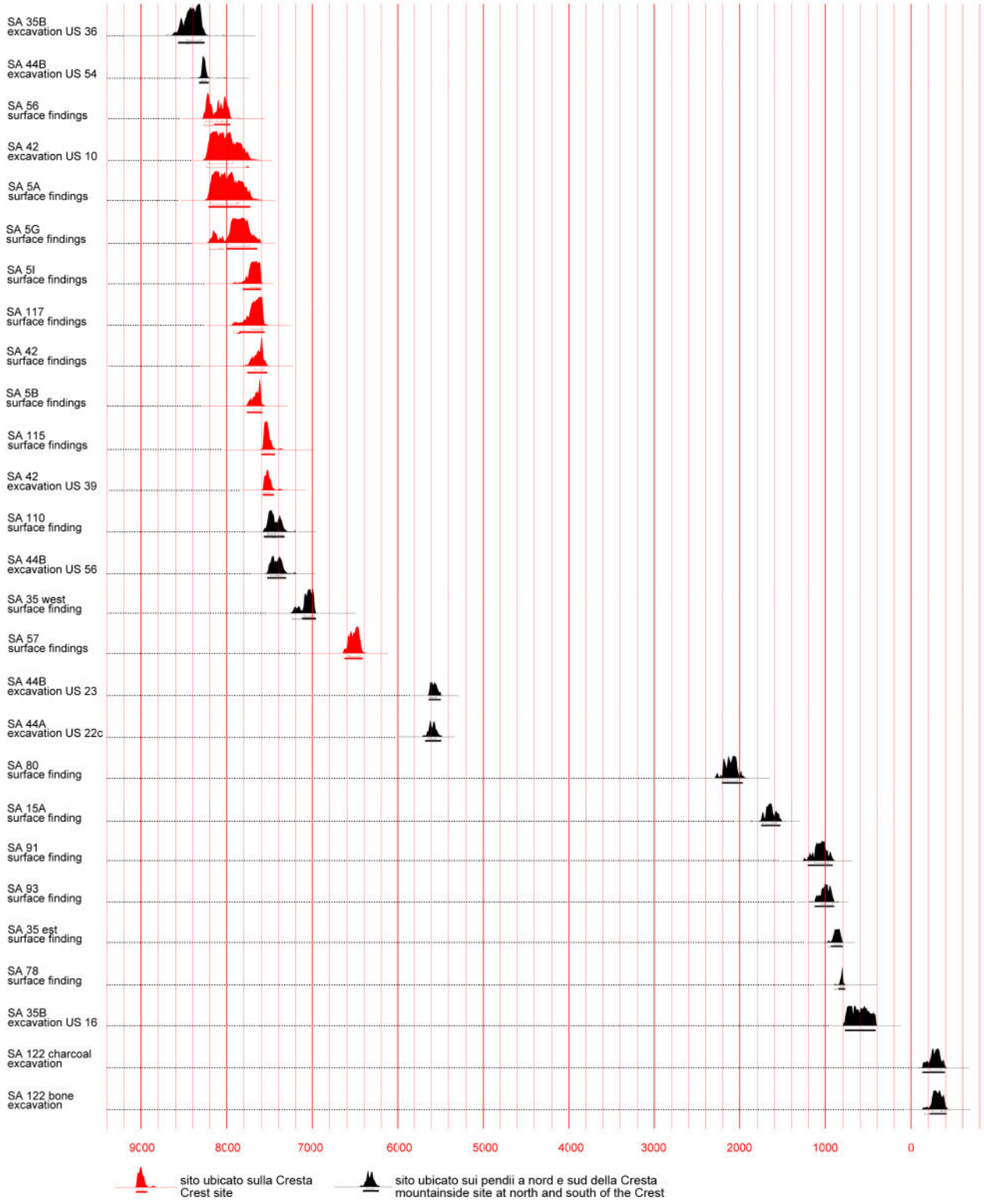


Fig. 11 - Plot of the ^{14}C datings of sites on the crest (in red) and sites on the slopes (in black). / Datazioni ^{14}C dei siti situati sulla Cresta (in rosso) e sui versanti (in nero).

level of specific on-site working. This ratio is normally between 2:1 and 1:1. Values of more than 2:1 suggest that armatures were taken elsewhere, while in cases where the ratio is lower than 1:1, armatures seem to have been brought to the site already made (Lanzinger 1985). The sites SA 5B, SA 5G, SA 57 and SA 115 show a balanced ratio, while in SA 71 there is a strong prevalence of armatures; in SA 5A and SA 42, there is a high percentage of microburins.

Cherts that are qualitatively and morphometrically suitable for working, such as Maiolica, Scaglia Variegata and Scaglia Rossa are the most used materials, while rock crystal is only found in some lithic concentrations, and always in low percentages. The same applies for cherts from the Buchenstein formation and quartz from the aplite and/or pegmatite seams. For artefacts attributed to Maiolica, Scaglia Variegata and Scaglia Rossa, the procurement areas are located in

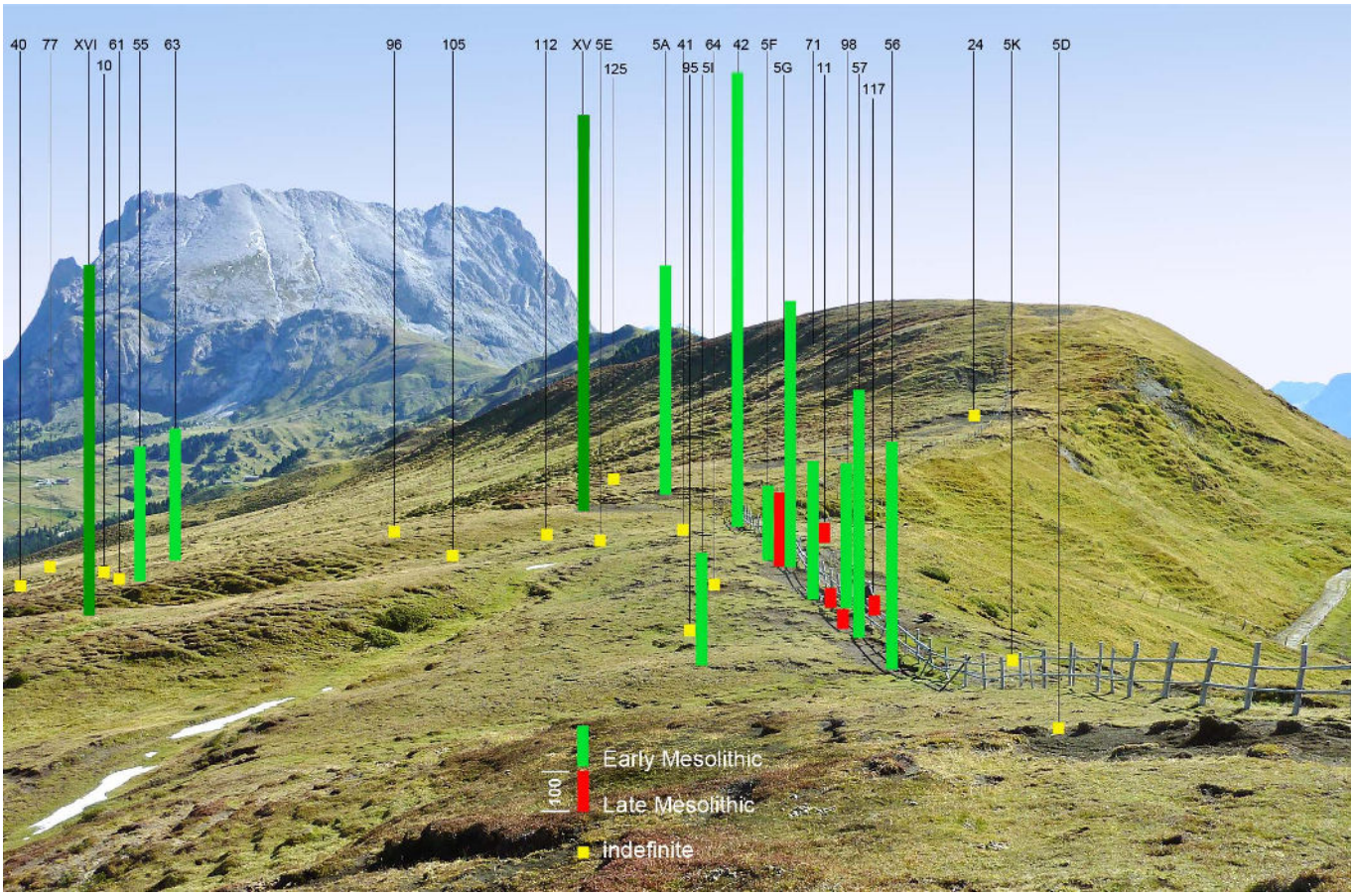


Fig. 12 *- Detail of the find-spots located in the western part of the crest (for cultural attribution see fig. 1). / La maggior parte dei punti di ritrovamento mesolitici si trova nella parte occidentale della cresta (per l'attribuzione culturale vedi fig. 1)*

the Cretaceous outcrops of Trentino Prealps. Cases with uncertain results include a material of the very poorest mechanical quality, identified in some sites (SA 5G; SA 98; SA 71; SA 57; SA 56), and in part, in high percentages. The consistent presence of elements with unusable cortex and parts indicate a nearby source (Alpe di Fanes? Gruppo del Puez?).

For the SA 5B site, which includes a high number of armatures, comparison has also been made between the frequencies of the different categories, following the typological classification proposed for the lithic industries of Romagnano III rock shelter (Broglio & Kozlowski 1984) (Fig. 4). This site has thus been classified as belonging to the middle Sauveterrian. With some reservations, the same applies to the majority of other sites.

Mountainside sites

Compared to the sites located on the crest, those along the mountainside have undergone greater degradation due to post-depositional processes caused mainly by bioturbation and human intervention, which can be dated back to the proto-historic and historic periods, such as deforestation and overgrazing. The outcome of radiometric dating of sites with a Castelnovian lithic assemblages can be included in these phenomena, where only one dating out of 15 corresponds to the typological classification for the tools collected. Moreover, analysis of the stone tools show that the sites surveyed are palimpsests, the result of diachronic occupation with partial overlapping of similar distribution patterns.

The collection of a large number of chert artefacts in sites SA 15A and SA 78 from the surface along with artefacts recovered from the excavation of site SA 44B offers the opportunity for a preliminary study of the lithic tools, focusing exclusively on classifying the type of armatures, identifying the origins of raw materials and defining the flaking techniques (Fig. 17).

Site SA 15A was identified at an extended erosion surface, formed through over-grazing along the dirt track passing on the southern side of the crest. 720 flint artefacts were collected on a strip about 20 metres long. The lithic assemblages includes 12 tools, a backed point, a segment, 8 trapezes, 36 microburins and 6 cores. All trapezes are relatively small, symmetrical and with concave truncations; they are about the same size and sometimes preserve a *piquant-dièdre.* Raw materials include Maiolica, Scaglia Variegata, and Scaglia Rossa lithotypes as well as some local silicified rocks (Puez, Buchenstein Formation). This site features a high percentage of elements altered by fire. A combustion area dated to 1,744-1,520 cal BC is not compatible with the chrono-cultural classification of the industry brought to light (Fig. 9).

The site SA 78 was identified due to the installation of a salt lick stone for livestock. The area consists of a sub-horizontal terrace adjacent to a spring near the river, which flows in a west-eastern direction. The resulting erosion from intensive breeding has made it possible to identify a concentration of lithic artefacts within a circular area with a diameter of approx. 10 metres. The archaeological record includes 825 elements and it is represented by 6 scrapers, 5 retouched blades, two retouched points, 10 trapezes, 8 microburins and a foliated arrowhead. As the drawings show, the trapezes are symmetrical, with retouched and normally straight or partially concave or convex truncations. The lack of *piquant-dièdre* and of small, regular retouching marks are the main features of these tools (Fig. 9).

Stratigraphically excavated sites

Sauveterrian excavated sites

Site SA 42, which was investigated during four excavation campaigns between 2015 and 2018, is on the Auf der Schneide/ Cresta di Siusi, 2190 m.a.s.l. The site is on flattish terrain, a few metres to the west of the SAXV and SAXVI sites (Lanzinger 1985). This sector of the ridge is subject to strong soil degradation, caused by erosion - mostly from grazing - which has stripped the ground through to the substrate over the last decades. Over 1100 lithic elements have been collected on the surface along an erosion strip, next to the fence that marks the boundary of the province. Typometric analysis of artefacts has made it possible to attribute the site to the middle Sauveterrian, compatibly with the chrono-cultural classification of the SAXV and SAXVI sites (Lanzinger 1985).

The data acquired from an area of some 15 sq. m have confirmed the chrono-cultural classification of the surface record. Specifically, erosion has only minimally affected the archaeological stratification. During the last two campaigns, the presence of combustion structures (S.U. 10, S.U. 39) and some structural evidence interpreted as the marks of post holes, have suggested the presence of dwellings, so far undocumented with this degree of detail in the Sauveterrian sites in the open and at high altitudes (Fig.13).

As far as the lithic industry is concerned, this site is characterised by a high density of flint artefacts (3880 spatially registered), a large number of microburins, armatures and a low incidence of tools. The armatures show a prevalence of triangles and crescents while there are only a few backed points. Considering the extremely high incidence of microburins (299) compared to armatures (54) in the inventory (percentage value 5.5/1), analysis of the site's functional activities would suggest specialisation in manufacture of armatures.

Site SA 44A is located on a slope in the opposite direction, on the left side of the Val Duron, at the top of a flat area (2170 m.a.s.l.). Limited excavation (2.67 m x 0.33 m over 2170 m.a.s.l.) in a W-E direction has brought to light a lithic assemblage that includes 376 artefacts in flint and in rock crystal.

Castelnovian excavated sites

The site SA 122 is located in the upper Val Duron on a flat area of approx. 90 sq. m. There are various find-spots on small erosion surfaces (SA 67, SA 88, SA 89, SA 90, SA 91, SA 92, SA 121,122) with 39 elements that can be attributed to the Castelnovian. Excavation of an area 1.66 x 1.00 m in size has recovered 8 chert artefacts, compatible with the surface industry. A multi-phase combustion structure, 95 x 60 cm in size was also found, with an abundant concentration of large-sized charcoals and burnt goat remains (identified by F. Boschin, Department of Physical, Earth and Environmental Sciences, Prehistory and Anthropology Research Units, University of Siena, Italy). ^{14}C dating of the charcoals provided a date of 130-390 cal AD, compatible with that of calcined bone 210-410 cal AD (93.3%).

Site SA 35 is located on a small rilief on the north side of the crest, upstream of a small lake basin. It has a large number of chert artefacts (524) that can be attributed to the early and late Mesolithic periods. In 2016, 54 flint artefacts were documented from an excavation of 1.3 sq. m; these included a rhomboid and two microburins made in Scaglia Rossa. The extension of the dig by a further 1.40 sq. m towards the south and south-east yielded 84 artefacts and also pointed to occupations during the Mesolithic period. It should be noted that unlike the Maiolica artefacts collected from the surface on the west side of the site, those recovered in the excavation on the south-eastern side of the site are exclusively made in Scaglia Rossa (Fig. 14).

The SA 93 site is located on a large flattish area on the right bank of the Rio della Vecchia river. In 2016, a small test-pit was carried out (33 x 66 cm). In total, 35 artefacts were found, set out vertically in a stratigraphic profile that had been modified by post-depositional

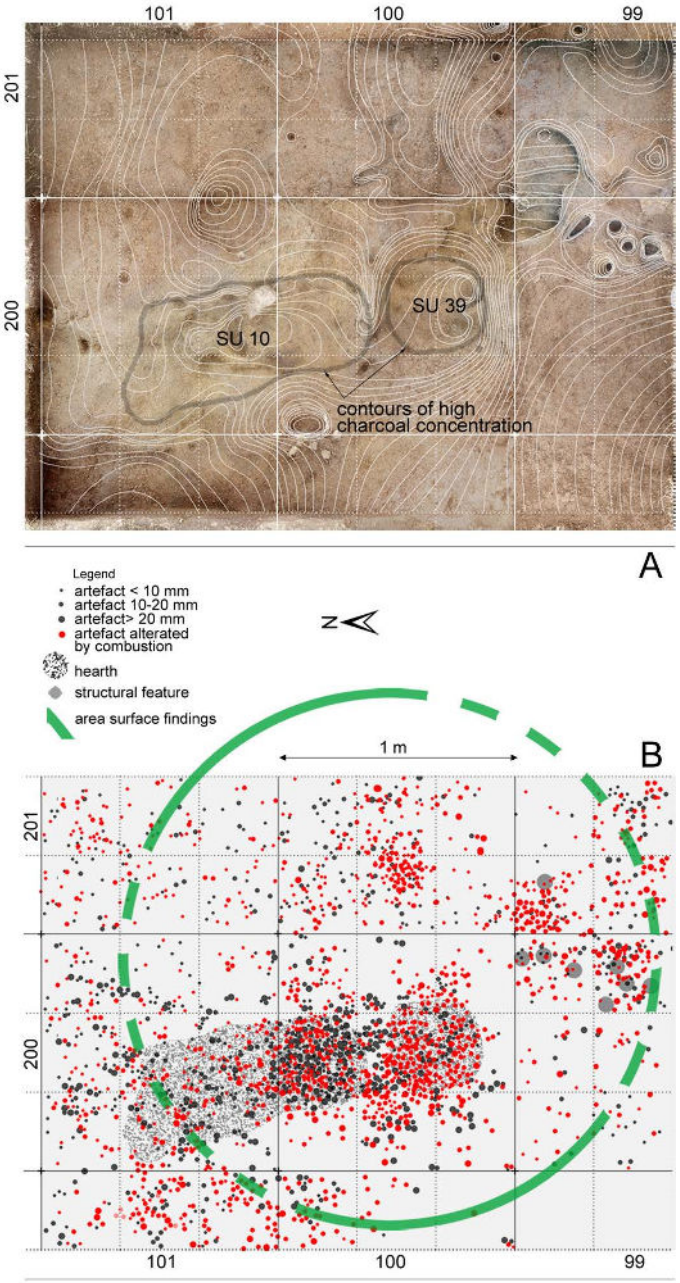


Fig. 13 *- Detail of the topview (A) and the spatially recorded artefacts from the excavation of site SA 42 in 2017 (B). / Rilievo plano-altimetrico (A) e dettaglio della distribuzione dei manufatti ritrovati durante lo scavo del sito SA 42 nel 2017 (B).*

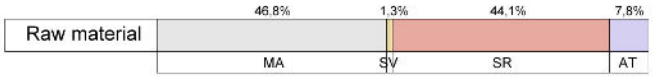
disturbance connected to human activities of deforestation. Radiocarbon dating (LTL136984A) has set it at 1130-900 cal BC (95.4%).

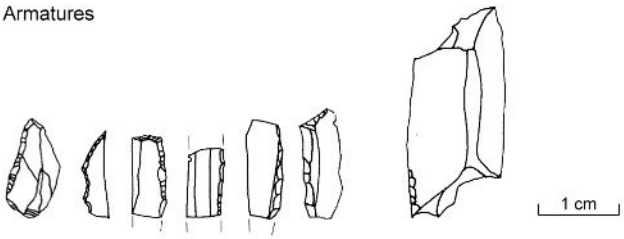
A few metres to the west of the Sauveterrian site SA 44A, the SA 44B site extends over a flattish surface of some 20 sq. m, bordered by a slight slope to the north-west/south-west. The 666 artefacts recorded during the excavation are evenly distributed spatially, except for some densification in the northern and southern parts of the area. The lithic tools are Castelnovian and mostly consist of laminar blanks made in chert (Maiolica, Scaglia Variegata and Scaglia Rossa), while there is a lack of ordinary flakes. The artefacts include 2 end scrapers, some retouched/truncated blades, 5 trapezes, a triangle, various blades and 4 cores. Many of the artefacts are thermally altered. The trapezoids are relatively large, asymmetrical and irregular. The truncation at the base (small) is concave, while the large truncation is extended, concave and always shows a thick

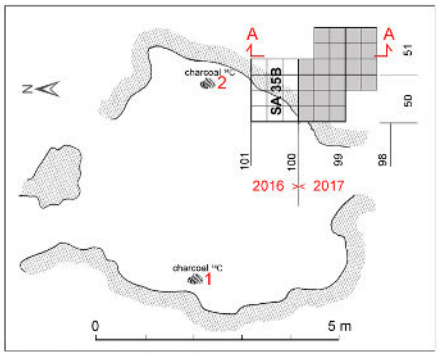
Site	Altitude m a.s.l.	^{14}C-AMS datings	Type
SA 35B	2155	LTL13694A: 8139±45BP 7200-7040 BC (80,5%)	surface findings 1
		LTL14819A: 2730±35BP 940-800 BC (93,7%)	surface findings 2
		LTL16549A: 2463±45BP 770-410 BC (95,4%)	excavation US 16
		LTL17468A: 9159±45BP 8563-8252 BC (95,4%)	excavation US 36

General view of the site SA 35B

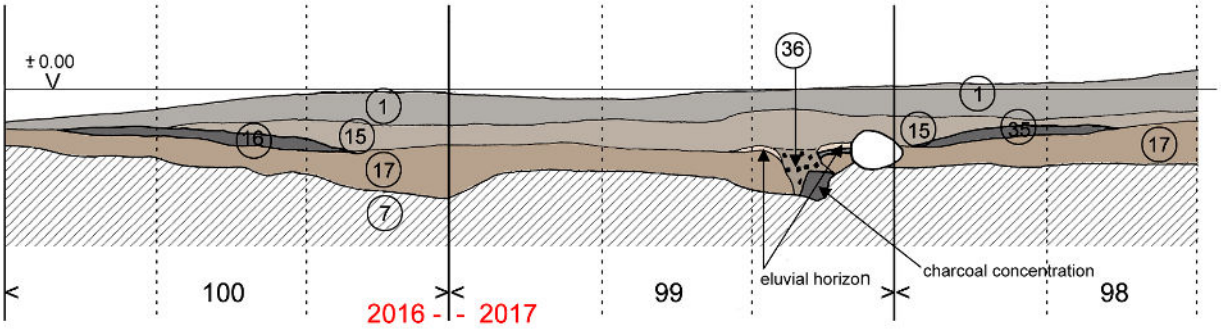
Lithic artefacts	Tools (entire and fractured)	4
	Armatures (entire and fractured)	7
	Microburins	9
	Cores	
	Débris	412
	Total lithic assemblage	432







Map of the site SA 35B



Trasversal stratigraphic section A-A displaying the excavation units

Fig. 14 *- Detail of the topview (A) and the spatially recorded artefacts from the excavation of site SA 42 in 2017 (B). / Rilievo plano-altimetrico (A) e dettaglio della distribuzione dei manufatti ritrovati durante lo scavo del sito SA 42 nel 2017 (B)*

piquant-dièdre with a sharp tip. A single charcoal sample from S.U. 23B gave a date of 5,680-5,490 cal. BC. Various settlement periods can be assumed for this site, considering the presence of a Sauveterrian-like isosceles triangle, found near the pit of a fire and dated to 7,530-7,309 cal BC (Fig. 15).

Technological analysis of the lithic assemblages

The local raw material includes lithotypes than can be found in the Buchenstein (mid-Triassic) and in the Marls of Puez and Fanes (early Cretacean). Material imported from the south gives us the Cretaceous Maiolica, Scaglia Variegata and Scaglia Rossa lithotypes, while some pieces are in hyaline quartz ("rock crystal") from the Main Alpine Ridge and Quartz from the aplite and/or pegmatite seams (Avanzini 1992).

Technological analysis of the various lithic assemblages reveals a sharp change in the shaping and preparation of the support between the early and late Mesolithic periods, when flaking moved from direct percussion to indirect percussion and pressure. The different techniques of *debitage* can be observed on all flaking products examined. The various Sauveterrian armatures consist of small elements such as triangles, segments, and different types of backed points, while the Castelnovian products are far larger and decidedly more regular, with triangular or trapezoidal sections in most cases.

One aspect in need of clarification is the difference in flaking techniques for which the blades from sites SA 15A, SA 44B and SA 78 stand out. When comparing the width/thickness values, it emerges that the thickness of the SA 78 artefacts is lower than that of the first two sites (Fig- 16).

As far as the regularity of the blades concerns, it emerges that the ones from the SA 78 site have more parallel ridges and shapes than those from the SA 44B and SA 15A sites (Fig. 17,18).

These data support the use of two different flaking techniques

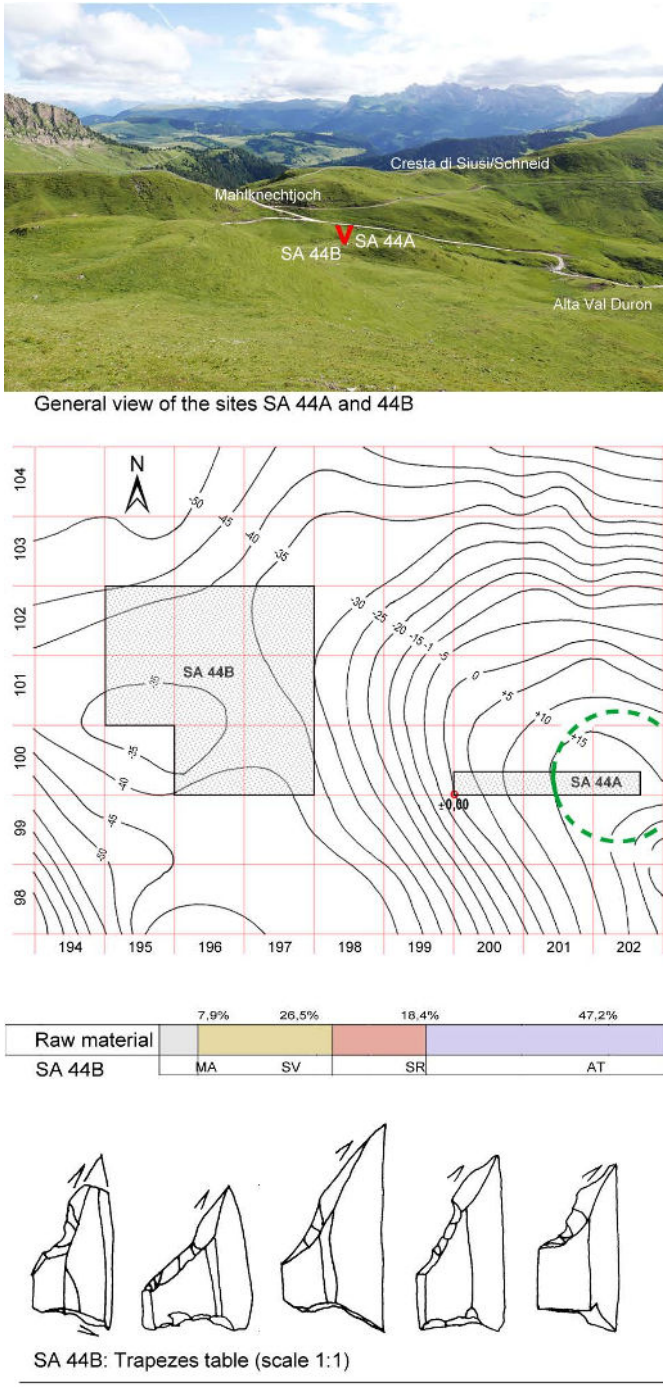


Fig. 15 *- Summary form for site SA 35. / Scheda informativa del sito SA 35.*

in the three sites: for the first two, as the result of indirect flaking and for the third, artefacts obtained using the pressure method (Gallet 1998). Comparisons between a core from the SA 44B site and the only core found on the SA 78 site reinforces this hypothesis (no core for blades has yet been found on the SA15A site). Nonetheless, it is necessary to stress that an evaluation of lithic technology, exclusively based on the shape of the blades and cores does not provide a full, unequivocal picture; in fact, using different techniques, it is possible to obtain morphologically identical blades (Pelegrin 1991).

Lastly, the fact that while trapezoids in the three different lithic concentrations in the single site show standardised shapes and sizes, these trapezoids are substantially different between sites. The question is whether these characteristics depend on the activity carried out in specific sites or if they represent cultural development over time.

site	width	thickness	quantity
SA 15A	9,24 mm	2,73 mm	31
SA 44B	9,42 mm	2,67 mm	38
SA 78	10,04 mm	2,40 mm	43

Fig. 16 *- Mean values of width and thickness recognized in the lithic assemblages of the sites SA 15A, SA 44B and SA 78 / Valori medi di larghezza e spessore riconosciuti negli insiemi litici dei siti SA 15A, SA 44B e SA 78.*

Taking into consideration all the data collected, it is considered possible to formulate some observations about the chronological classification of these three sites:

The characteristics of the different elements of SA 78 site may indicate that they come from the late Castelnovian, possibly from a transitional stage between the Mesolithic and the Neolithic. This is in the light of the use of pressure flaking and the strong presence of elements made in Maiolica. If this hypothesis is correct, it would raise a completely new series of questions/issues concerning human settlement in the mountains during the Holocene, and also a new and complex sphere of research.

For SA 15A and SA 78 sites, there are still some missing radiometric measurements in line with the respective lithic industries, and even the dating for SA 44B remains to be checked.

^{14}C-AMS dating

The results of radiometric dating on 28 charcoal samples have provided a whole chronological spectrum that allows us to set the Sauveterrian occupation on the crest within a short time period spanning from approx. 8,200 cal BC to approx. 7,500 cal BC (Fig. 10). The range of sites identified on the slopes to the side of the crest indicate a chronology between approx. 8,500 cal BC (SA 35 and SA 44B) and the historic period (SA 122) with a time gap between 5,500 and 2,200 cal BC (Fig. 10, 11).

Discussion

Settlement patterns

During the Sauveterrian, the site of Mondeval de Sora (2150 m.a.s.l.) in the eastern Dolomites was located in a prevalently alpine meadow environment close to the upper treeline, and hunting activities were mainly focused on red deer and ibex (Colombo et al. 2016; Fontana et al. 2009; Soldati et al. 1997; Thun et al. 2016). The sites of Auf der Schneide/ Cresta di Siusi have similar conditions and altitude, and are located inside a forest ecotone, in a transition band that gave optimum access to diversified ecosystems at high altitudes and to the habitats of the large ungulates (deer, ibex and chamois). It is therefore evident that the start of Mesolithic settlement in the Alpe di Siusi/Seiser Alm and upper Val Duron, coincided with this phenomenon.

There is a clear correlation between the physiographic characteristics that constitute the Dolomite landscapes and the settlement strategies adopted by Mesolithic hunter-gatherer groups. The sites are located in transitional altitude zones between the alpine altitudes dominated by carbonate platforms (>2200 m.a.s.l.) - the ideal ground for hunting ibex and chamois - and the subalpine forest environment that is the ideal habitat for deer. This transitional zone, where most Mesolithic sites are located, mainly consists of uplands with gentle morphologies, free from sudden ruptures in slope, resulting from the degradation of the soft volcanic and terrigenous rocks that filled the ancient Triassic seabeds.

Archaeological surveys have made it possible to attribute the

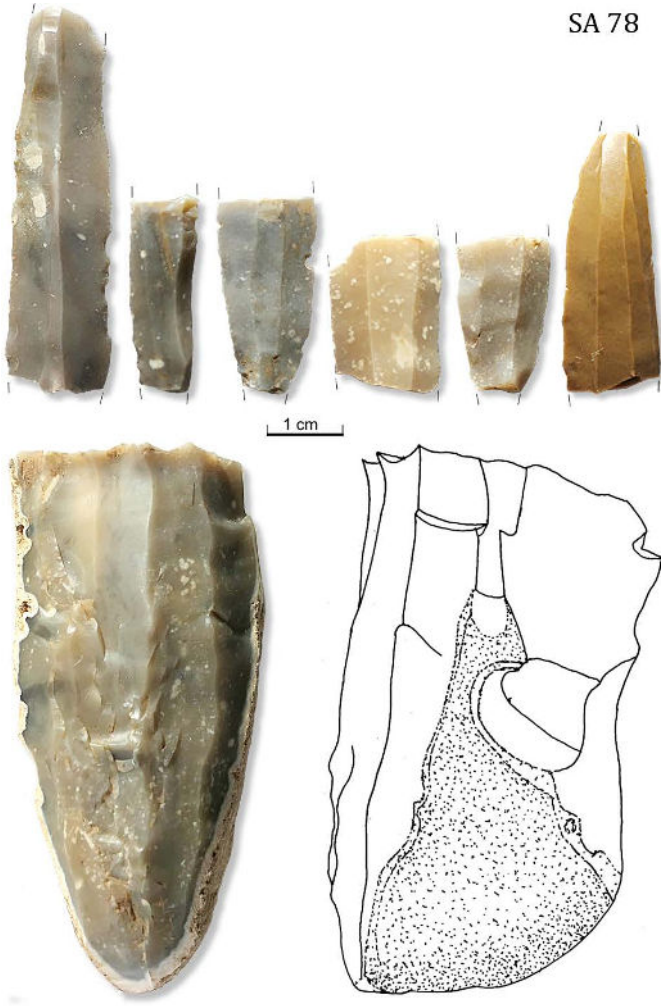


Fig. 17 - SA 78: Blades, bladelets and core recovered during surface investigations (scale 1:1). / SA 78: lame, lamelle e un nucleo recuperato in superficie (scala 1:1).

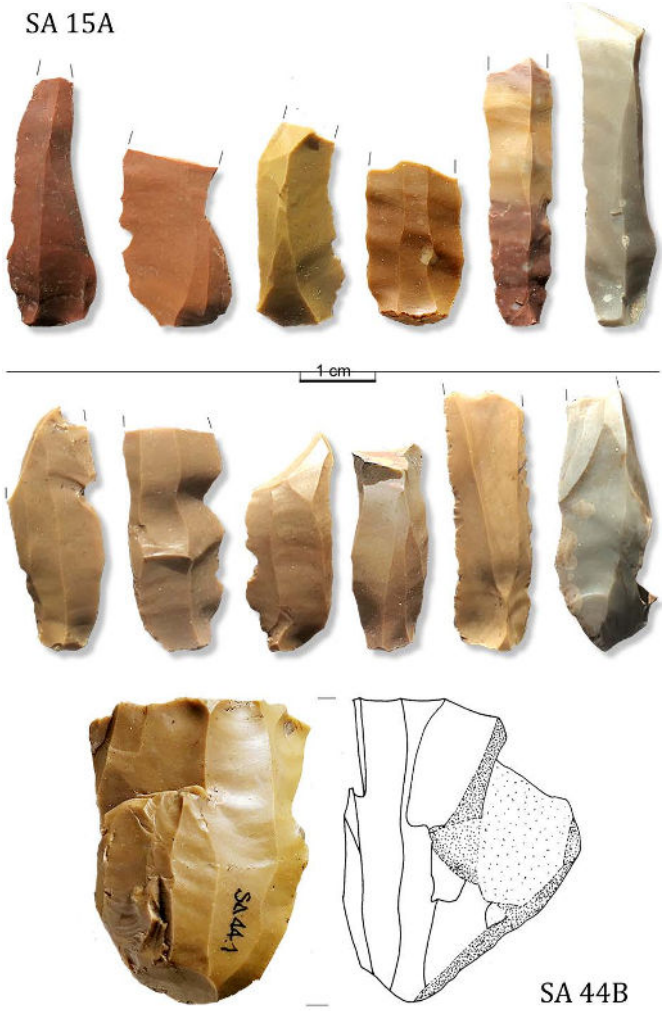


Fig. 18 - SA 15A: Blades and bladelets; SA 44B: blades and core recovered during surface investigations (scale 1:1). / SA 15A: lame e lamelle; SA 44B: lame e un nucleo recuperato in superficie (scala 1:1).

Mesolithic sites identified to two cultural phases: the Sauveterrian, concentrated above all on the crest in a west-east position along the ridge, which had easy access to water sources at the bottom of the valley; and the Castelnovian, identified on the north face, which descends to the plateau of Alpe di Siusi/Seiser Alm, and on the northern slope of the upper Val Duron.

The picture emerging from the classification of numerous sites in the investigated area shows an articulated choice of settlement contexts. The different topographical positions are optimal in terms of hunting ground logistics and residential or strategic camps; they are also strategic locations for accessibility to the vast and different hunting grounds to the south, the sediment layers of Catinaccio, in the west, the Sciliar Plateau, through the Tierser Alpl (2440 m.a.s.l.) and to the north, the large forest-covered plateau of the Alpe di Siusi. To the east it was possible to reach the meadows at the foot of Sasso Piatto/Plattkofel and Sasso Lungo/Langkofel and further on, the vast area around Passo Sella/Sellajoch, one of the most important Mesolithic sites in the Dolomites (Lunz 1986). Another extension of the settlement and hunting ground has been identified to the south of the crest, where the Val Duron saddle/pass leads to the adjacent Val di Dona and further on to Catinaccio di Antermoia (Avanzini 1992) (Fig. 19).

Analysing the lithic concentrations in the sites attributed to the early Mesolithic, it emerges that camp areas are very restricted, with a surface reaching approx. 15 sq. m (Bagolini & Dalmeri 1987; Kompatscher et al. 2016). For the most recent sites, both the spatial distribution of the artefacts – now characterised by a lower density - and the size of the sites increases, with dimensions of 80-100 sq. m.

The dating gap between 5,500 and 2,200 cal. BC, or rather, between the initial stages of the Neolithic and the start of the Early Bronze Age, seems at least partially covered by the finding of two rhomboids (Broglio & Kozlowsky 1984): one in the SA 35 site and another one along the gravel road down to Malga Docoldaura in the upper Val Duron (SA 18), and by three arrowheads in the sites SA 78, SA 5A1 and SA 130. Some pottery fragments that can be dated back to the latter stages of the Bronze Age (Cultura Luco/Laugen, Marzatico 2019) (SA 59) have been found at the head of Val Duron, in the distal part of an alluvial cone overlooking a large wet area.

The routes

Between the Preboreal and the start of the Boreal, the altitude that includes the sites of Auf der Schneide/ Cresta di Siusi corresponds to an open meadow environment very near to the upper treeline (Cattani 1992; Soldati et al. 1997; Tinner & Vescovi 2007; Nicolussi et al. 2005; Drescher-Schneider 2009).

Following a methodology already applied in alpine environments (Kompatscher & Hrozny Kompatscher 2007; 2011), it has been observed that the location of the sites depends on two sets of environmental and topographical co-variants: 1) the position along the main route, water availability, the view over the surroundings, the

Fig. 19 - The western part of the crest allowing connections to vast adjacent hunting and gathering territories for the provisioning of food sources. / La parte occidentale della Cresta consente collegamenti con estese aree di caccia e raccolta, fonti di riserve alimentari.

suitability of the ground for setting up camp and the orientation of the slope; 2) the position of the site within the territory, i.e., opportunities to access hunting and subsistence areas. This would suggest seasonal nomadism at high altitudes during the summer, along a preferred "high-way" between 1800 and 2300 m a.s.l., reducing the climb to a minimum along the way. Routes at altitudes lower than 1800 m a.s.l. are obstructed by thick woods and, in our case, also by steep slopes and deep valleys. Routes above 2300 m a.s.l. seem to be improbable, since they are often obstructed by rocky barriers or extensive detritus. All these natural limits forced human groups to use approved routes along paths that were morphologically more convenient, both in the early and late Mesolithic. These criteria are considered valid throughout the Alps within the basin of the Adige Valley examined, where a single ideal "high-way" was identified for the different routes, with limited variations. (Kompatscher & Hrozny Kompatscher 2007; 2011)

These observations on routes are complementary to the definition of a preferred area for temporary camps. Moving from the Adige Valley sites (150-250 m.a.s.l) to the high lands, the Mesolithic groups followed this route, along which are located the most important sites in the central Dolomites such as Passo Sella and Passo Gardena, both at some 2200 m.a.s.l. The sites of Passo Falzarego (Lunz 1986) and Passo Giau (Visentin et al. 2016) and little further Mondeval de Sora (Fontana et al. 2009) give the evidence that the establishment of such high altitude routes could also allow contacts and exchanges between groups coming from different valleys. The groups who arrived in Mondeval de Sora not necessarily came from the Adige valley. In fact, the Sauveterrian raw materials used by the people of Mondeval de Sora came from the Piave valley (Fontana et al. 2009, Visentin et al. 2016), while for the lithic assemblages found in most of the western sites of the route the procurement areas are located in the Cretaceous outcrops of Trentino Prealps.

In the Sauveterrian, the preferred position for planting a camp was in an exposed area on ridges, small reliefs or terracing at higher altitudes and, more rarely, away from the high-way. In the Castelnovian, large plateaus or terraces divided into more protected areas were used to bivouac, sometimes a little away from the main alpine route. This framework seems to be ascribable to different means of using the areas and a new, different choice of settlement that developed over time. Not only did the types and technologies of lithic industry change, so did the dimensions and location of settlements. What did not change between these two stages in the Mesolithic seems to be the choice of route, a Mesolithic "high-way" in the Alps, along which, groups of hunter-gatherers were easily able to organise summer hunting camps (Fig. 20).

Conclusions and research perspectives

Over the last few decades, the gradual progression of erosion and as a result, of archaeological stratification caused by interacting human and climate factors, has made it possible to map 125 sites in the area between Auf der Schneide/ Cresta di Siusi and the head of Val Duron. In spite of these gaps and the "condensed" nature of stratifications, some of these sites have revealed anthropogenic remains preserved well enough to allow a reconstruction of the occupied surface. The area under survey belongs to the soil-forming domain from podsolization, to which humus build up is often associated, and the formation of thick umbric epipedon that has preserved the archaeological record so well. In the Sauveterrian (Early Mesolithic), the preferred position for pitching a camp was Auf der Schneide/ Cresta di Siusi (2200 m.a.s.l.). In the Castelnovian (Late

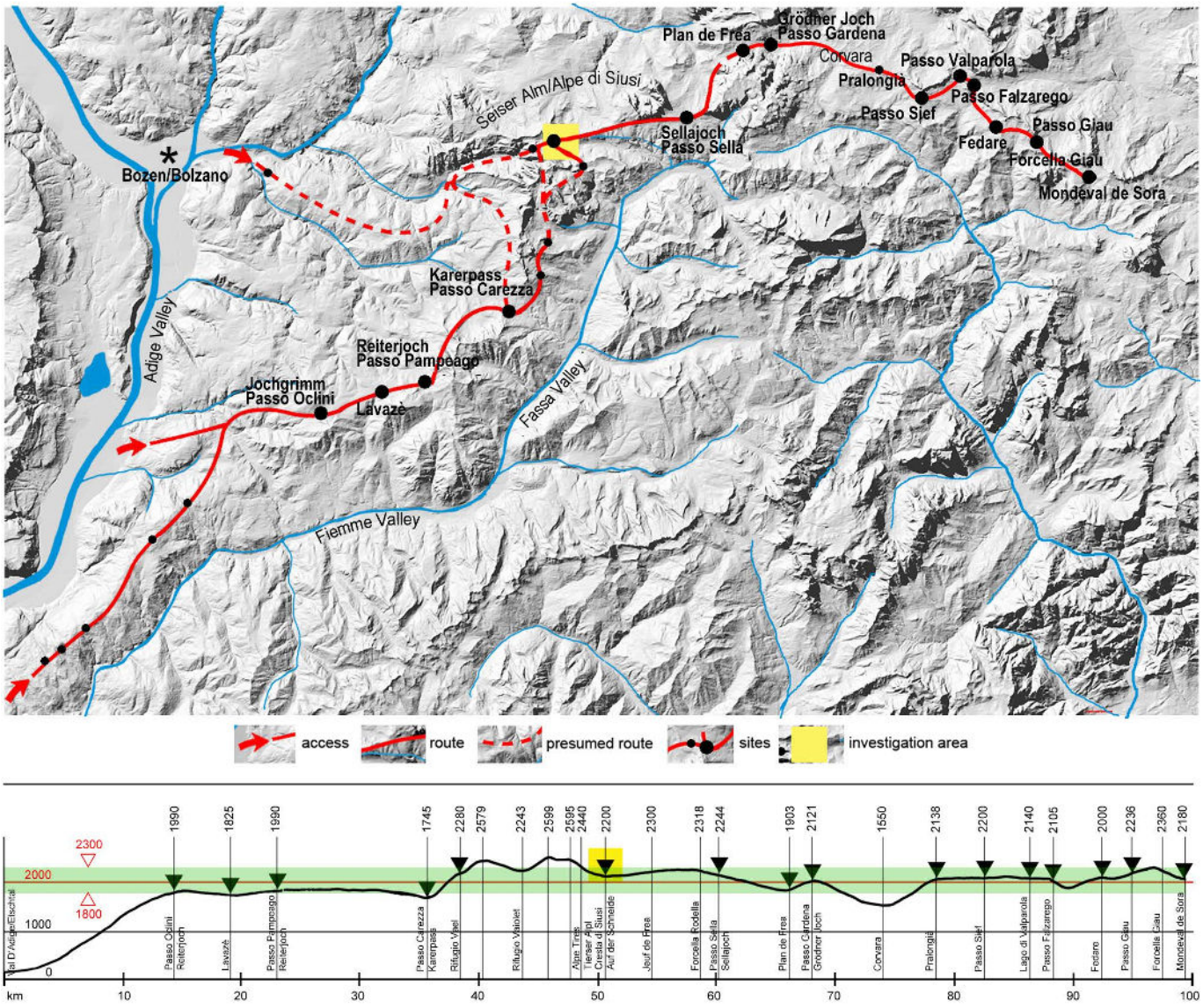


Fig. 20 - A reconstructed Mesolithic route system starting in the Adige Valley allowing a notable territorial extention. / *Ricostruzione di un sistema di percorsi mesolitici che parte dalla Val d'Adige permettendo una notevole estensione territoriale.*

Mesolithic), the bivouacs were located at a lower altitude, where the mountainsides are flatter. According to the authors, the distribution of sites in both periods/phases of the Mesolithic points to the presence of an important Mesolithic "high-way", where groups of hunter-gatherers from the Adige Valley were able to stay and easily reach their hunting grounds on the surrounding Dolomite peaks. As part of this research project, both the survey and excavation activities will continue in the identified sites with high archaeological potential. A detailed microstratigraphic and multidisciplinary excavation method will be used to allow a more detailed examination of the settlement strategies and changes in the organisation of spaces during the Mesolithic.

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