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RESSOURCES LITHIQUES, PRODUCTIONS ET TRANSFERTS ENTRE ALPES ET MÉDITERRANÉE

ACTES DE LA SÉANCE
DE LA SOCIÉTÉ PRÉHISTORIQUE FRANÇAISE
NICE
28-29 MARS 2013

Textes publiés sous la direction de
Antonin Tomasso, Didier Binder, Gabriele Martino,
Guillaume Porraz, Patrick Simon et Nicolas Naudinot

Société préhistorique française
www.prehistoire.org

2016

ISBN : 2-913745-64-4 (en ligne)
ISSN : 2263-3847

SÉANCES DE LA SOCIÉTÉ PRÉHISTORIQUE FRANÇAISE
5

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Société préhistorique française
Paris
2016

Les « Séances de la Société préhistorique française » sont des publications en ligne disponibles sur :

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Illustration de couverture : Carole Cheval, artcheograph.fr.

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Publié avec le concours du ministère de la Culture et de la Communication (sous-direction de l'Archéologie),
du Centre national de la recherche scientifique,
de l'université Nice - Sophia Antipolis,
de l'UMR 7264 « Cultures et environnements, Préhistoire, Antiquité, Moyen Âge (CEPAM) », Nice - Sophia Antipolis
et de la Maison des sciences de l'homme et de la société Sud-Est), Nice.

Dépôt légal : 2[e] trimestre 2016

ISSN : 2263-3847 – ISBN : 2-913745-64-4 (en ligne)

SOMMAIRE

Ressources lithiques, productions et transferts entre Alpes et Méditerranée
Actes de la journée de la Société préhistorique française de Nice, 28-29 mars 2013
Textes publiés sous la direction de
Antonin Tomasso, Didier Binder, Gabriele Martino, Guillaume Porraz,
Patrick Simon et Nicolas Naudinot
Paris, Société préhistorique française, 2016
(Séances de la Société préhistorique française, 5)
p. 229-256
www.prehistoire.org
ISSN : 2263-3847 – ISBN : 2-913745-2-913745-64-4

The Sauveterrian Chert Assemblage of Galgenbühel Dos de la Forca (Adige Valley, South Tyrol, Italy)

Procurement Areas, Reduction Sequences, Tool Making

Ursula Wierer and Stefano Bertola

Abstract: Raw-material analysis combined with a techno-typological study was carried out on the lithic assemblages stemming from the Sauveterrian site Galgenbühel/Dos de la Forca. The aim was to gain a better insight into the management of raw material, reduction sequences *(chaînes opératoires)* and human mobility in the context of the Early Mesolithic frequentation of the Adige Basin.

The Galgenbühel/Dos de la Forca rock-shelter is located in Salurn (Adige Valley, Northern Italy), in the province of Bolzano/Bozen. The site lies on a debris cone at the foot of a Triassic wall and overlooks the valley bottom. Radiocarbon dates attest to repeated human frequentation between 9265 ± 70 BP (ETH-27173, 8425–8089 cal. BC) and 8560 ± 65 BP (ETH-22091, 7705–7478 cal. BC). The economy of the site was related to the resources of the valley bottom wetland and the forested surroundings. The exploitation of aquatic fauna, mainly represented by fish, freshwater molluscs and beavers, ungulates (mostly wild boar and red deer) and small carnivores (dominated by wild cat) is documented.

The present study regards the lithic assemblages of phases 2, 3 and 4. Raw-material analyses, conducted on a sample of about 1,300 artefacts, provide evidence for the exploitation of Upper Jurassic to Eocene cherty limestones that were deposited on the western margin of the Trento Plateau, namely the Maiolica, Scaglia Variegata Alpina, Scaglia Rossa and Chiusole formations. On the basis of the depositional patterns of the area that influenced the qualitative and quantitative distribution of the cherts, two procurement areas were identified: the outcrops of the Non Valley, 10 km in a straight line to the west of the site, and those located in the area of Mount Finonchio and the Folgaria Plateau, at a straight-line distance of approximately 35–40 km southwards. Non Valley cherts were collected predominantly from detritic covers, whilst Finonchio/Folgaria raw material was collected mainly from the residual soils of the karstic plateau.

Despite the different distances from the site, the frequency of Non versus Finonchio/Folgaria cherts does not present a relevant difference. The relatively high number of the latter cannot be explained by the better quality of raw material, as the varieties of chert from both areas, being all very fine crystalline cherts, are similar. Indeed, no significant differences were observed as regards the size and shape of the exploited blocks, reduction processes, blank selection and tool manufacturing.

Rough chert blocks from both areas, of 6–8 cm maximum side length, were transported to the site to be worked. Natural diaclases were generally used as striking platforms and core flanks. The lithic production aimed to produce small series of thin and non standardised bladelets. Three different reduction sequences have been identified: on prismatic volumes, on oval flat surfaces (namely thick flakes with facial exploitation) and on narrow surfaces. Knapping was unipolar. Maintenance was carried out through lateral flakes or thick detachments to eliminate hinged negatives.

Thin blanks, mostly bladelets, were transformed into armatures. These are mostly represented by triangles and backed points. Transformation occurred by means of intentional shortening using the microburin technique and by unipolar abrupt retouch. Common tools were obtained from all the different blank categories (mostly on generic flakes), including by-products stemming from initialisation and maintenance. All stages of the production process are represented, attesting that flaking occurred on site. Only a modest number of large specimens are incompatible with the described bladelet reduction sequences, suggesting the importation of finished items, which, at least for phase 2, are more frequently made on Finonchio/Folgaria raw material.

A picture emerges of a rather indistinct raw-material procurement carried out in two different areas located at some distance from each other. The same knapping goals were met, suggesting the collection of raw material during periodic migrations possibly on the occasion of other economic activities, such as the exploitation of several ecological niches in a wider area. This supply strategy persisted over a time span of several hundreds of years, revealing a continuity in the habits of hunter-gatherer groups belonging to the same cultural tradition.

As regards the accessibility of the identified areas, the outcrops in the Non Valley and in the Finonchio/Folgaria area are located in a mid-mountain territory and are easily accessible from the Adige Valley. Evidence of collection from torrent pebbles during phase 4 could indicate chert collection along the Noce River. A direct conjunction between the Folgaria Plateau and the Galgenbühel runs along the Adige Valley. Because of the complex hydrographic setting of the valley bottom supposed in the Early Holocene, with a meandering river course and secondary standing waters, the routes along the valley would have possibly crossed the detritic talus and alluvial cones. Furthermore, the use of water ways has to be taken into account as we are referring to human groups with a wetland-based economy.

Keywords: chert-bearing formations of the Trento Plateau, Non Valley, Finonchio/Folgaria area, bladelet production, armatures, common tools, possible routes.

Résumé : L'assemblage lithique du site sauveterrien de Galgenbühel-Dos de la Forca a fait l'objet d'une analyse des matières premières siliceuses associée à une étude techno-typologique. L'objectif était de comprendre la gestion des matières premières, les chaînes opératoires et la mobilité des groupes humains dans le cadre de l'occupation du premier Mésolithique de la vallée de l'Adige.
L'abri de Galgenbühel-Dos de la Forca est situé près de Salurn (val d'Adige, Italie septentrionale), dans la province de Bolzano-Bozen. Le site est localisé sur un cône détritique au pied d'une paroi du Trias, face au fond de la vallée. Les datations radiocarbones documentent des occupations humaines successives entre 9265 ± 70 BP (ETH-27173, 8425-8089 cal. BC) et 8560 ± 65 BP (ETH-22091, 7705-7478 cal. BC). L'économie du site était liée à l'exploitation de ressources d'un environnement humide propre au fond de la vallée et aux forêts environnantes, en particulier des espèces d'eau douce, représentées par des poissons, des mollusques, des castors, ainsi que des ongulés (surtout le sanglier et le cerf) et de petits carnivores (dominés par le chat sauvage).
L'étude présentée ici porte essentiellement sur les assemblages lithiques des phases 2, 3 et 4. L'analyse des matières premières, effectuée sur un échantillon d'environ 1300 artefacts, témoigne de l'exploitation de calcaires siliceux déposés, sur une période s'étendant du Jurassique supérieur à l'Éocène, sur la marge occidentale du plateau de Trento, notamment les formations de Maiolica, Scaglia Variegata Alpina, Scaglia Rossa et Chiusole. Sur la base des modèles dépositionnels qui ont influencé la distribution qualitative et quantitative des silex, deux aires d'approvisionnement ont été identifiées: les gîtes du Val di Non, 10 km à l'ouest du site et ceux de l'aire du mont Finonchio et du plateau de Folgaria, situés à 35-40 km au sud. Les silex du Val di Non étaient surtout collectés dans les couvertures détritiques ; les matières premières de Finonchio-Folgaria l'étaient dans les sols résiduels du plateau karstique.
Malgré des distances au site différentes, les fréquences des silex du Val di Non sont semblables à celles de Finonchio-Folgaria. Le nombre relativement élevé de silex de Finonchio-Folgaria ne peut pas être expliqué par une meilleure qualité des matières premières, puisque les variétés de silex des deux aires sont comparables. Dans tous les cas, il s'agit de silex cristallins très fins. Aucune différence significative dans les dimensions et la forme des blocs exploités, les chaînes opératoires, la sélection des supports ou encore la confection d'outils n'a été observée.
Les blocs bruts de silex provenant des deux aires ont une longueur maximale de 6-8 cm. Ils ont été transportés sur le lieu du site pour être débités. Des diaclases naturelles ont généralement été utilisées en tant que plans de frappe ou flancs de nucléus. L'objectif concernant ces silex consistait en la production de séries limitées de lamelles fines et non standardisées. Trois chaînes opératoires différentes ont été distinguées selon le support utilisé : sur des volumes prismatiques, sur des surfaces convexes (notamment des éclats épais à exploitation faciale) et sur des surfaces étroites. Le débitage était unipolaire et la gestion se déroulait par le débitage d'éclats de flanc ou d'éclats épais destinés à éliminer des négatifs réfléchis.
Les supports minces, en particulier les lamelles, étaient transformés en armatures, représentées surtout par des triangles et des pointes à dos. Les transformations concernaient le raccourcissement intentionnel par la technique du microburin et par retouche unipolaire abrupte. Les outils du fonds commun étaient obtenus sur toutes les catégories de supports (surtout des éclats standards), y compris les sous-produits d'initialisation et de gestion. Tous les stades du processus de production sont représentés, apportant la preuve que le débitage avait lieu sur le site. Seul un nombre limité de supports de grandes dimensions est incompatible avec la chaîne opératoire lamellaire, suggérant l'importation de produits finis qui, du moins pour la phase 2, sont plus fréquemment obtenus lorsque les matières premières proviennent de Finonchio-Folgaria.
L'image d'une utilisation non préférentielle des matières premières des deux aires, situées à une certaine distance l'une de l'autre, destinées aux mêmes objectifs, suggère un approvisionnement au cours des migrations périodiques orientées vers la réalisation d'autres activités économiques, peut-être l'exploitation de différentes niches écologiques dans un territoire plus vaste. Cette stratégie d'approvisionnement a persisté sur une période de plusieurs centaines d'années, révélant une continuité des traditions parmi les groupes de chasseurs-cueilleurs au sein d'une même tradition culturelle.
Concernant l'accessibilité des aires identifiées, les gîtes du Val di Non et ceux de Finonchio-Folgaria, se situent dans un territoire de moyenne montagne et sont donc facilement accessibles depuis le val d'Adige. Les données concernant la collecte de galets de rivière dans la phase 4 pourraient indiquer une collecte des silex le long du cours du Noce. Une connexion directe entre le plateau de Folgaria et le site de Galgenbühel existe le long du val d'Adige. À cause de la complexité du réseau hydrographique pendant l'Holocène, avec un cours d'eau méandriforme et des eaux stagnantes secondaires, les cheminements le long de la vallée ont probablement traversé les talus détritiques et les cônes alluviaux. L'utilisation des voies d'eau devrait aussi être prise en compte dans ces économies fondées sur l'exploitation de ressources d'environnements humides.

Mots-clés : formations siliceuses du Plateau de Trento, Val di Non, aire de Finonchio-Folgaria, production de lamelles, armatures, outils du fond commun, itinéraires possibles.

INTRODUCTION

Aim of the research

The Sauveterrian lithic assemblages from phases 2, 3 and 4 of the Galgenbühel/Dos de la Forca site (Adige Valley, Northern Italy) were studied by integrating both raw-material and techno-typological studies. The aim was to reconstruct the raw-material procurement strategies in order to obtain a precise idea of human behaviour at the site with regard to the availability of chert raw-material sources and the aims of lithic production. The different occupation phases were critically compared to assess possible changes over time. This research helps to reconstruct one part of the Sauveterrian mobility by surveying potential sources along the Adige Valley, a key area for the Early Mesolithic settlement of the Alps.

Geological and palaeogeographical overview of the Galgenbühl/Dos de la Forca site

The Galgenbühel/Dos de la Forca site is located in Salurn/Salorno in the province of Bozen/Bolzano in Northern Italy and it is part of several hundred Mesolithic sites identified since the 1970s in the Adige basin (fig. 1).The general distribution of Mesolithic sites is characterised by site locations in the valley bottom (190-250 m a.s.l.), which is also the case for the Galgenbühel, and in high altitudes (1800 and 2300 m a.s.l.; Broglio,1980; Bagolini et al., 1983; Lunz, 1986; Dalmeri and Pedrotti, 1992; Kompatscher and Hrozny Kompatscher, 2007).

The Galgenbühel rock-shelter lies at 225 m a.s.l., on a debris cone covering the foot of a vertical Triassic wall, mainly formed by dolomitic rocks, in a position where the Adige Valley shows considerable shrinkage (Geological Map of Italy, 1:50,000, sheet 43 Mezzolombardo). The site was investigated during systematic archaeological excavations carried out between 1999 and 2002 (Bazzanella and Wierer, 2001). Previous illegal excavations had unfortunately destroyed part of the deposit and therefore the original size of the site could not be determined. The 2.5-m-thick stratigraphic sequence, excavated over an area of 4–18 m^2, is formed by an alternation of anthropogenic and debris layers (Coltorti et al., 2009). Radiocarbon dates attest to human presence between 9265 ± 70 BP (ETH-27173, 8425–8089 BC calibrated) and 8560 ± 65 BP (ETH-22091, 7705–7478 BC calibrated) corresponding to the middle phase of the Sauveterrian (fig. 2). In order to apprehend diachronic changes throughout the sequence the excavation units were grouped into five different phases, each reflecting more than one occupation.

The economy adopted by the Mesolithic groups during their presence at the site was mainly based on the exploitation of resources in the nearby wetland and the valley bottom including the lower slopes. These resources consist of fish and freshwater molluscs, forest ungulates (predominantly wild boar and red deer), small mammals (mostly beaver and wild cat) and pond turtles (Bazzanella et al., 2004, 2006 and 2007; Wierer and Boscato, 2006; Girod and Wierer, 2012).

The lithic industry has already been the subject of publications regarding typology, technology and a preliminary analysis of the lithic raw materials (Bertola et al., 2006; Wierer, 2007 and 2008).

From a paleogeographic and structural perspective the area is located on the western edge of the Trento shelf, which formed during the Upper Triassic/Lower Jurassic with the dismemberment of the European and African continental blocks caused by the opening of the Piemont-Liguria ocean (Winterer and Bosellini, 1981). Starting from the Upper Jurassic, the strong thermal subsidence led to pelagic conditions in the whole area: the Trento shelf became a submerged plateau (Trento plateau; Bosellini and Winterer, 1975). From the Middle Cretaceous the continental margins, until then divergent, began to converge and the interposed Piemont-Liguria ocean gradually disappeared as a result of continental collision (Alpine orogeny) that started in the Upper Cretaceous and that is still active today.

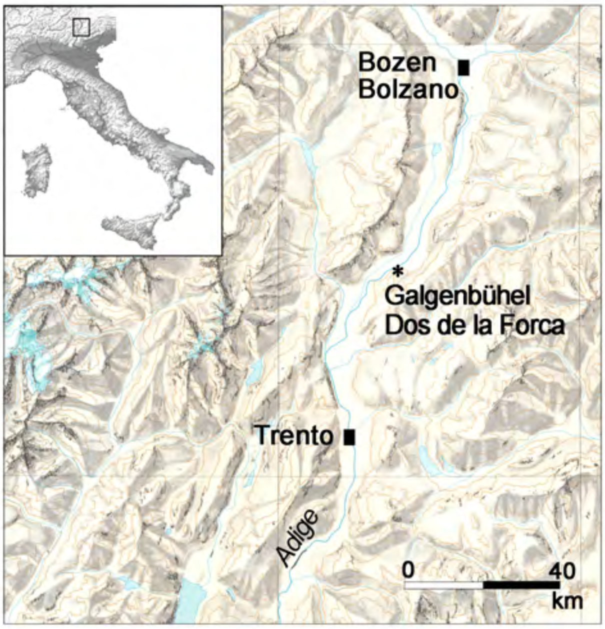


Fig. 1 – Location of the Galgenbühel/Dos de la Forca site in the Adige valley (Bozen/Bolzano Province, Northern Italy).
Fig. 1 – Localisation du site de Galgenbühel-Dos de la Forca dans la vallée de l'Adige (province de Bolzano, Italie du Nord).

MATERIALS AND METHODS

Cherts are sedimentary rocks derived from the diagenesis of siliceous sediments, and often inherit their textural features. These latter were studied in a geological, i.e. formational, approach. This research was carried out with the aid of the geological mapping support of the ISPRA, which is also available online (http://www.isprambiente.gov.it/it/cartografia/carte-geologiche-e-geotematiche)

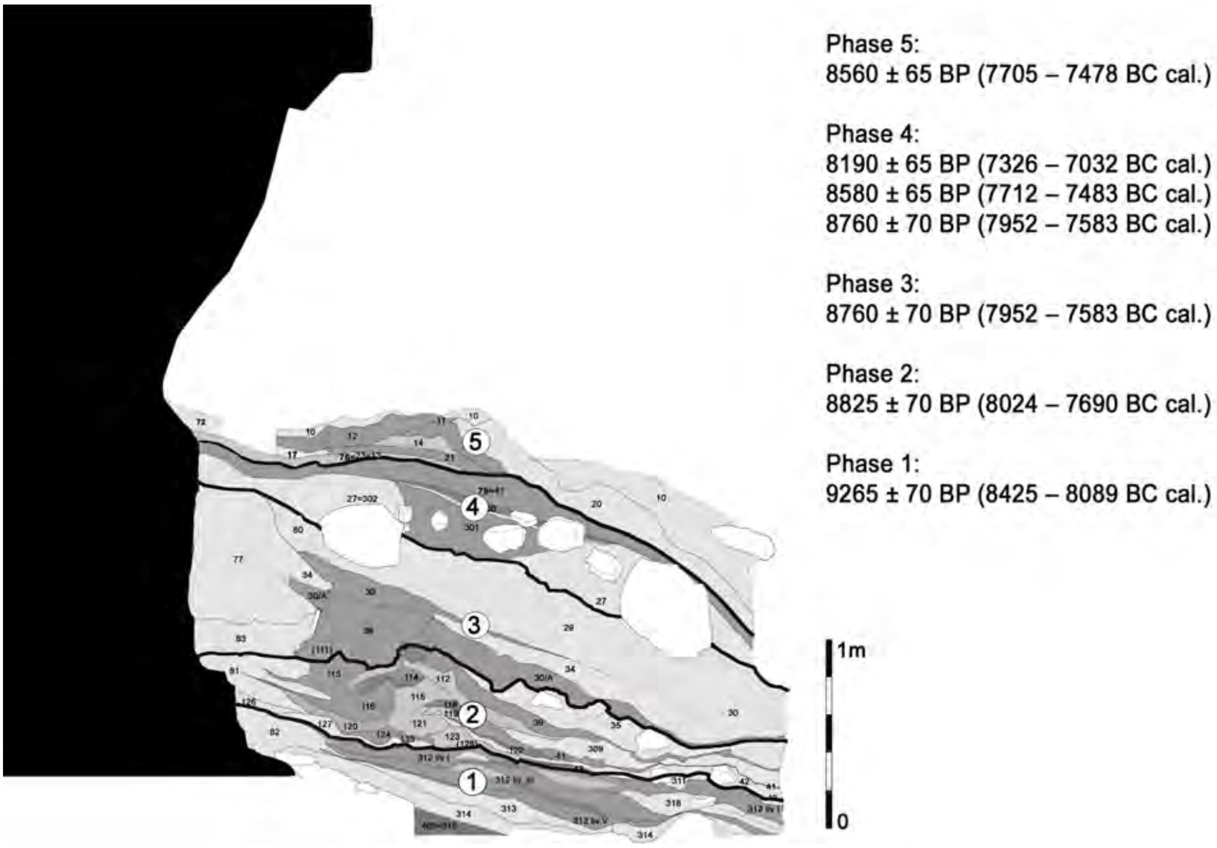


Fig. 2 – The stratigraphic sequence of the Galgenbühel/Dos de la Forca site. Units grouped into five phases. ^{14}C–AMS dating (ETH Zürich). Dendrochronological calibration using CalibETH (Niklaus et al., 1992).
Fig. 2 – La séquence stratigraphique du site de Galgenbühel-Dos de la Forca. Couches regroupées en cinq phases. Datations ^{14}C–AMS (ETH Zurich). Calibration dendrochronologique avec CalibETH (Niklaus **et al.,** ***1992).***

and which serves as a constantly up-to-date, powerful instrument for research. For many years we prospected a large area in the Southalpine, sampling cherts both from the outcrops and from secondary deposits. We built up a large lithoteca, which was fundamental for the initial stage of the analysis, as a comparison. The cherts were primarily attributed to the geological formations using diagnostic information. Specifically, they differ as regards age, colour, morphology and size, structure, textural feature, mineralogy, micropaleontology and rheology. Based on the study of these characteristics it was possible to properly define them from a chronostratigraphic point of view, thus helping to understand the geological formations in which they were included. During a second stage the areal distribution and horizontal variations of the formations were considered. The depositional pattern of each cherty formation may vary considerably within a wide sedimentary basin, in both time and space. This is due to a combination of factors including syndepositional and post-depositional processes. The variations or tendencies may relate to different scales, involving small or large areas. With regard to the siliceous sediments, the variability affects both qualitative and quantitative patterns. The same formation in different areas may include more or less abundant cherts and/or different features related to their depositional environment. Mapping these areas represents an essential working basis for formulating hypotheses related to the management of lithic resources (supply, mobility, exchanges) by prehistoric groups who gravitated to the area. Important information can also be deduced through an analysis of the aspect of the diaclastic surfaces still preserved in the archaeological artefacts. This provides information on the origin of the blocks, whether these were collected from detrital covers, near to or far from the rocky outcrops (blocks with sharp edges and traces of gravitational transport along the slopes), from torrent gravels (roughly pronounced roundness) or from soils or karst cavities (chemical dissolution of carbonates with no traces of transport; impregnation of residual red clay; Fe and Mn crusts).

The presented work refers to the assemblages of phases 2, 3 and 4 recovered during the excavation campaigns of 1999–2001 through systematic water screening with 1-mm fraction. The technological analysis was conducted on 2,300 lithic elements, including cores, modified artefacts, waste stemming from the manufacturing of geometric microliths (microburins and 'notches with adjacent fracture'), and unretouched artefacts bigger than 10 mm (table 1). Approximately one hundred refittings of artefacts of 2 to 10 elements each, collectively provided insights into reduction sequences, blank production and core maintenance.

	Technological analysis					Raw material analysis				
Artefacts	Phase 2	Phase 2+3*	Phase 3	Phase 4	Total	Phase 2	Phase 2+3*	Phase 3	Phase 4	Total
Cores	14	–	20	10	44	13	–	17	8	38
Retouched artefacts	190	1	128	155	474	99	1	64	75	239
Waste from microlith manufacturing**	82	–	30	71	183	19	–	15	18	52
Burin bladelets and other technical elements	4	–	–	4	8	1	–	–	1	2
Unretouched blanks (≥ 1cm), natural plaques, scatter	630	3	582	395	1,610	375	1	308	294	978
Total	920	4	760	635	2,319	507	2	404	396	1,309

Table 1 – The analysed assemblage. *: connection of fragments stemming from different phases; **: microburins and 'notches adjacent to fracture'.
Tabl. 1 – L'assemblage étudié. * : raccord des fragments appartenant à différentes phases ; ** : microburins et « encoches adjacentes à une fracture ».

The artefacts have a fresh appearance only a few pieces are altered by heat or heavy patinas. The dimensional limit between blades and bladelets was established after a size evaluation of the microburins. The limit is set at a width of 12 mm, where the vast majority of the microburins are concentrated (bladelets: length/width ≥ 2; width < 12 mm; blades: length/width ≥ 2; width ≥ 12 mm). Furthermore, in order to evaluate if there is a distinct production of blanks with an intermediate elongation index, an additional class, represented by laminar flakes, was distinguished. The definition is based on the length/width ratio (laminar flakes: length/width ≥ 1.5 and < 2). All blanks with a length/width ratio < 1.5 are classified as flakes.

The typological analysis of the assemblages, already published in previous papers (Wierer, 2007 and 2008), has been reported following the typology of A. Broglio and S. K. Kozłowski (Broglio and Kozłowski, 1983) in order to distinguish two large categories of retouched artefacts, i.e. geometric microliths and common tools.

A total of 1,309 artefacts of all technological categories were randomly selected for raw-material analysis. The artefacts were first grouped together on the basis of their macroscopic characteristics, (such as colour, texture, structure, cortex) thanks to an important lithoteca of the numerous outcrops recorded in the Adige Valley. The colours were determined using the Munsell Soil Colour Charts (Munsell Color, 1990). The chert groups were further analysed using a stereomicroscope (Nikon SMZ-U), enabling a detailed study of the microfacies of the cherts (micropaleontological inclusions, microstructures). With a Nikon D 7000 reflex camera affixed to the microscope, numerous pictures relating to details of the microfacies were taken and subsequently compared.

The microfossils were studied using specific atlases (Bolli et al., 1985; Premoli Silva and Sliter, 2002) and the works were furnished with illustrations, thin sections and drawings (Bosellini et al., 1978; Luciani, 1989).

The following abbreviations are used in the text and in the figures: B = Biancone; CHIU = Chiusole formation; CG = Calcari Grigi; DP = Dolomia Principale; DT = Dolomie di Torra; F/F = Mount Finonchio and Folgaria plateau; MAI = Maiolica; RA = Rosso Ammonitico; SR = Scaglia Rossa; SVA or SV = Scaglia Variegata Alpina.

AGE, DISTRIBUTION AND DEPOSITIONAL CHARACTERS OF THE CHERTY FORMATIONS ON THE WESTERN MARGIN OF THE TRENTO PLATFORM

The lithic resources of the area

The Permian and Triassic rocks outcropping in the Trentino district generally do not include cherts. These are continental clastic rocks (Val Gardena sandstones), evaporites (Bellerophon Formation) and shallow water series (sandstones, marls, limestones: Werfen formation). In the middle Triassic the sedimentation was predominantly neritic carbonate. The mid-Triassic adjacent basins, in which the cherty-bearing limestone of the Livinallongo formation (Buchenstein) was deposited, were mainly distributed across the actual Dolomites area (> 100 km to the east from the site; Bosellini, 1989). In the Upper Triassic a wide lagoon area (Dolomia Principale) extended over the current Southern Alps and the adjacent sectors; similar conditions also persisted in the Lower Jurassic (Calcari Grigi). From the Upper Jurassic fine calcareous and biosiliceous muds began to deposit throughout the area in pelagic conditions. The Jurassic/Eocene pelagic succession is represented by the Rosso Ammonitico Veronese, Maiolica (or Biancone), Scaglia Variegata Alpina, Scaglia Rossa and various eteropic Eocene basinal formations. These formations include many chert varieties differing in age, colour, morphology and size, struc-

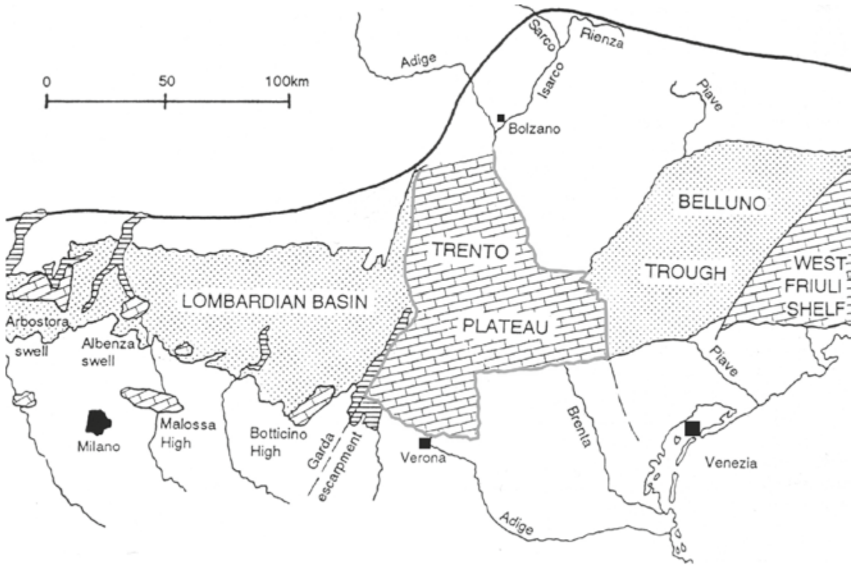


Fig. 3 – Palaeogeography of the Southalpine during the Upper Jurassic/Lower Cretaceous. Position of the Trento plateau with respect to the adjacent Lombardian and Belluno basins (modified after Lehner, 1993).
Fig. 3 – Paléogéographie du « Sudalpin » au Jurassique supérieur-Crétacé inférieur. Position du plateau de Trente par rapport au bassin lombard et au bassin de Belluno adjacents (modifié d'après Lehner, 1993).

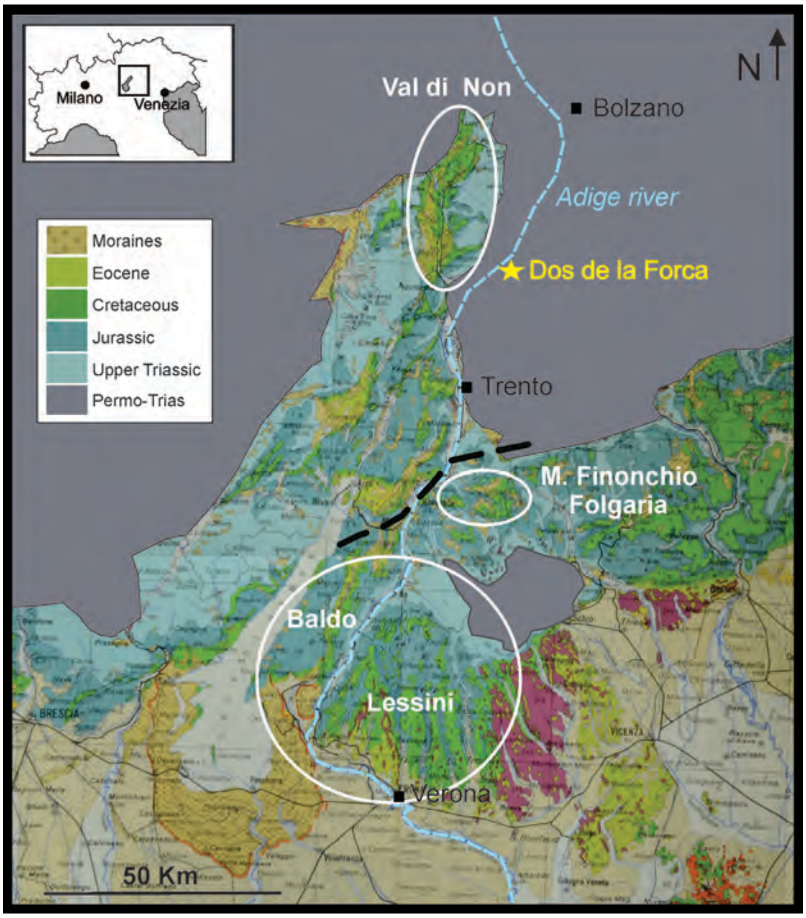


Fig. 4 – Schematic geological map of Veneto and Trentino (modified after Vetters, 1933). The white circles indicate the areas with the greatest abundance of cherts highly suitable for knapping. The black dashed line separates the series including a strongly condensed Jurassic/Cretaceous interval (in the north) from the more complete ones (in the south).
Fig. 4 – Carte géologique schématique de la Vénétie et du Trentin (modifié d'après Vetters, 1933). Les cercles blancs indiquent les zones dans lesquelles les silex sont les plus abondants et présentent une bonne aptitude à la taille. La ligne noire pointillée sépare les séries dans lesquelles l'intervalle Jurassique-Crétacé est fortement condensé (dans le nord) des séries plus complètes (dans le sud).

ture, texture, mineralogy, micropaleontology and rheology (Bertola, 2001).

Palaeogeographical and structural evolution of the area: the Trento platform

The margin of the African continent, and the Southern Alps within it, was cut by extensional faults with a NW-SE trend in consequence of the Jurassic rifting. These faults delimited uplifted blocks denominated shelves and basins. The main structural elements of the Southern Alps were represented by the Lombard basin, the Trento shelf, the Belluno basin and by the Friuli shelf (Winterer and Bosellini, 1981; here: fig. 3). The sedimentation was strongly influenced by the presence of these structural elements (shelves, submerged plateaus and basins). In this article we will focus on the western edge of the Trento shelf which occupies roughly the Veneto and Trentino districts. As mentioned above, throughout the Triassic and most of the Jurassic the sedimentation predominantly occurred on shallow seas, with periodic episodes of emersion. From the Dogger the Trento shelf drowned in pelagic conditions and became the so called Trento plateau (Bosellini and Winterer, 1975). Predominant pelagic deposition lasted until the Eocene.

The distribution of the biosiliceous sediments

The current distribution of the Jurassic - Eocene rocks has been strongly affected by erosion. The slow and gradual uplift of the bedrock (Alpine orogeny) progressively exposed more recent covers to weathering. In large sectors of the Southalpine with stronger uplift these covers completely eroded and Triassic or Paleozoic successions crop out (Dolomites). To the south they are better preserved. In the north-western part of the Trento shelf a wide strip of pelagic successions is distributed in the Non Valley (fig. 4).

The Non valley

Many of the topics in this chapter were covered in greater detail in a previous work (Bertola, 2011). The Non Valley lies in the Trentino region, south-west of Bolzano between 600 and 1000 m a.s.l. It extends north-south over about 30 km, sub-parallel to the deeper and larger depression of the Adige Valley, which delimits it to the east. In this area the Non Valley dated between the Upper Triassic (Dolomia Principale) and the Eocene (Ponte Pià formation; fig. 5). From a structural perspective, the evolution of this area is strictly connected to the Giudicárie line, in particular to the northern part of this

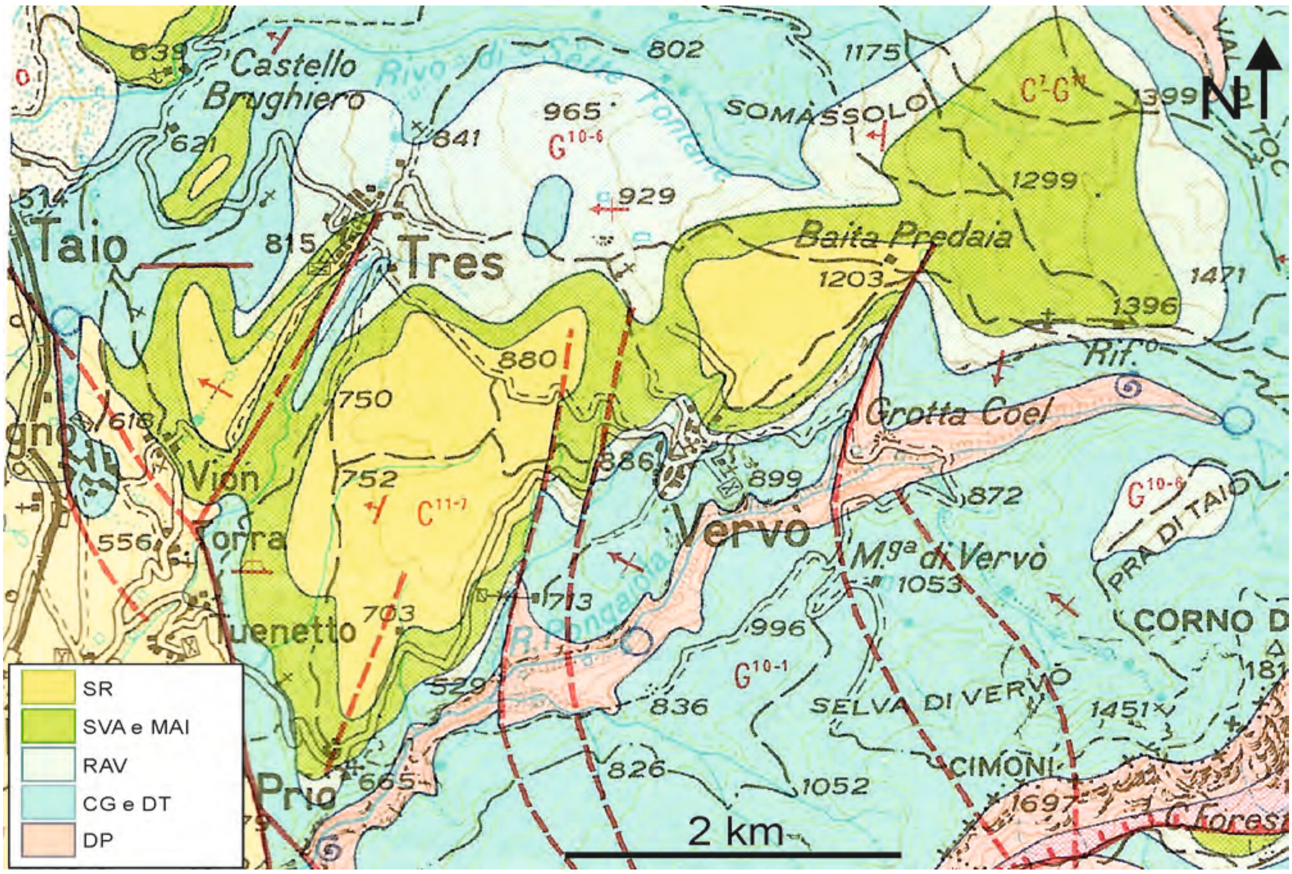


Fig. 5 – Detailed geological map of the mid-Non valley where the best chert outcrops of the entire valley are located (Carta Geologica d'Italia, 1:100,000, 21 Trento, 1969).

Fig. 5 – Carte géologique détaillée de la partie centrale du Val di Non où sont localisées les meilleurs affleurements de la vallée (Carta Geologica d'Italia, 1: 100,000, 21 Trento, 1969).

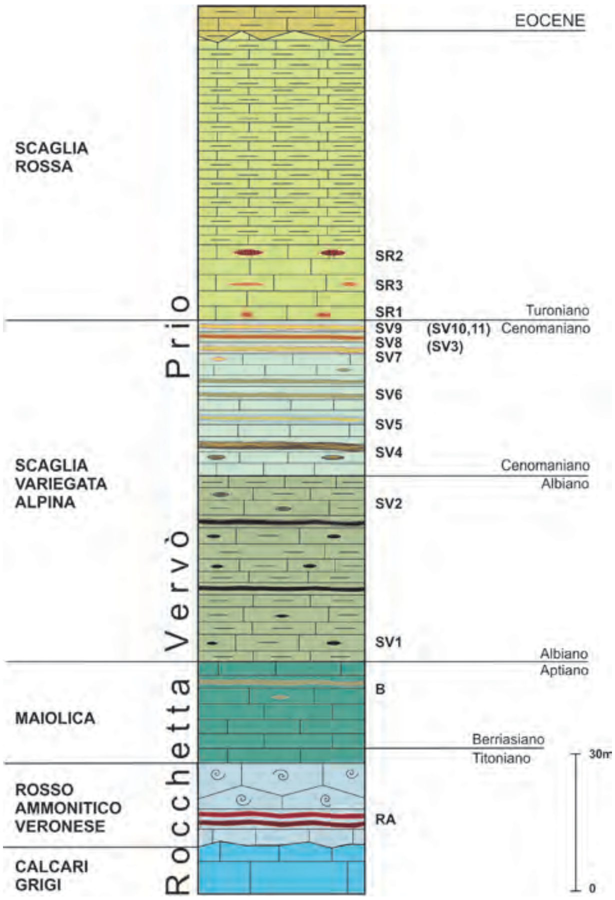


Fig. 6 – Stratigraphic column of the pelagic Jurassic-Cretaceous succession of the Non valley. The chert-bearing horizons are highlighted on the right (RA, B, SV, SR). The upper Jurassic/Lower Cretaceous interval is extremely condensed and almost chertless (drawing S. Bertola).

Fig. 6 – Colonne stratigraphique de la succession pélagique Jurassique-Crétacé du Val di Non. Les horizons siliceux sont indiquées à droite (RA, B, SV, SR). L'intervalle Jurassique supérieur-Crétacé inférieur est extrêmement condensé et presque dépourvu de silex (dessin S. Bertola).

fault zone. The reduced thicknesses of the sedimentary covers and even the stratigraphic gaps led to the assumption of an anomalous paleogeographic and structural condition existing ever since the Jurassic time. Starting from the Permian and throughout the Mesozoic, the interposed area between the Adige Valley and the Giudicárie line maintained a relatively high paleogeographic position compared to the adjacent Western Dolomites and the Veneto Prealps (Italian IGCP 203 Group, 1986; Cassinis et al., 1988). In the Non Valley, and generally in the whole Southalpine area, cherts are basically included in the Jurassic-Eocene pelagic successions deposited in the Piemont-Ligurian basin.

In the Non Valley the Rosso Ammonitico Veronese formation (Upper Jurassic) is sporadic (fig. 6). The Maiolica (Tithonian – Aptian) formation is extremely condensed or even absent. It exhibits distinct continuity at the southern limit of the valley (Rocchetta site), where the thickness of the formation does not exceed 30 m (Bosellini et al., 1978). In other sites (Vigo di Ton, Vervò and Tres Villages) it reaches a thickness of just one metre (Lehner et al., 1987). The limestone changes from greyish – wine red colours in the lower part to a classic ivory white in the upper part. Likewise the cherts, atypical, sporadic and mainly layered, change from brownish to yellowish colours (fig. 5, chert type B). The Scaglia Variegata Alpina formation (Albian – Cenomanian) is liable to erosion or sedimentation gaps, especially in the lower part. It consists of grey layered marly limestones, often with undulating joints, rich in planktonic foraminifers and radiolarians and with dark bioturbation stains and greenish grey clayey intercalations, ranging from centimetre-thick to decametre-thick layers. There are also black marl horizons including fish scales. The lower and middle parts belonging to the Upper Aptian – Albian age consist of a repeated and monotonous series of limestone layers with dark marl horizons (Biolcati, 2000). The chert nodules and lists, never abundant, are grey to black, with different degrees of silification and it is sometimes very difficult to isolate them from the limestone (SV1). Towards the top of this unit some nodules differ by their shades, tending to brownish colours, and by their cortex, which feels rough (SV2). The upper part of the formation (Cenomanian) differs because it presents more dense bedding, with rather undulated planar joints, and lighter colours reflecting a higher calcium carbonate content (Lehner, 1993). The limestone layers often alternate with thin bedded grey, light blue or violet marl horizons, even decametre-thick, and also with rather continuous and characteristic yellow or olive green chert layers (SV4–SV10). These layers are quite common, up to 20 cm thick and very suitable for knapping. Brown or reddish brown colours also occur towards the edge, below the Scaglia Rossa (Turonian – Maastrichtian) formation. This latter is made up of bedded layers of marly limestones with thin reddish interlayers of marl and clay. The lowest part of this formation (Turonian – Senonian) is characterised by compact limestone layers up to 20 cm with a high calcium carbonate content. There are also horizons of calcareous breccias of tectonic origin. Towards the top, as the terrigenous input increases, the stratification becomes more undefined and the dark red limestones become slightly silty. The Campanian to Maastrichtian layers were recently named the Val d´Agola formation (Carta Geologica d'Italia, sheet 43 Mezzolombardo 2012). Cherts are distributed only in the bottom layers (first 6–7 metres) and this basal part of the formation is often absent because of a gap. Just above the transition to the Scaglia Variegata Alpina formation bi-coloured reddish brown and yellow chert nodules are quite common (SR1). Going up the layers the yellow shades disappear, giving way to exclusively reddish brown ones. Chert is never abundant and almost always present as isolated nodules. Two lithotypes can be distinguished, a more homogeneous and crystalline one (SR2), and another characterised by strikingly horizontal bands in beige or cream colours (SR3).

The Ponte Pià formation (former Scaglia Grigia; middle to upper Eocene) follows the Scaglia Rossa and crops with continuity in the middle Noce Valley. They are well stratified and planar marly limestones seldom occur with thin brown chert horizons. These layers alternate with bioclastic turbidites, mainly in the upper part. The cherts are not very pure and are of rather poor quality. In addition, the reduced dimensions and irregular morphologies of the layers and nodules are not suitable for flaking.

The Trento area and surroundings

In the areas situated south of the Non Valley (Fai della Paganella, Andalo, Molveno) and in the surroundings of Trento (San Massenza, Vezzano; Terlago, northern slope of Mount Vason right of the Adige river, southern slope of Mount Calisio, Oltrecastello left of the Adige River) the pelagic Jurassic – Eocene succession outcrops discontinuously (Carta Geologica d'Italia, sheet 60 Trento, 2012). The middle Ammonitico Rosso Veronese unit contains layers of reddish radiolarian chert, often poorly silicified. The Maiolica formation, represented by pink and white mudstones, sometimes including yellow to brown chert nodules, still presents thicknesses of a few metres. The Scaglia Variegata Alpina and the Scaglia Rossa formations crop more continuously and show similar characteristics to those described for the Non Valley but with less abundant chert horizons. In general the outcrops are highly disturbed by tectonics and the cherts are often fractured. Eteropic to the Ponte Pià formation, the Chiusole formation (Lower Eocene) starts cropping (and extends to the south). It contains nodules and layers of brownish grey to reddish grey chert of quite good quality. In general this area is poor in lithic resources suitable for flaking. It is possible to hypothesise occasional exploitations by human groups in transit.

Mount Finonchio and the Folgaria plateau

Many of the topics in this chapter are presented in greater detail in a previous work (Bertola and Cusinato, 2004). About 25 km kilometres south of Trento, near Rovereto, above the Triassic – Jurassic rocks of the left slope of the Adige Valley, there are interesting series of cherty mudstones. Mount Finonchio (1,603 m) is located close to the Adige valley, while the Folgaria Plateau stretches to the east up to ten kilometres from the Adige Valley. The most complete series is located in the Mount Finonchio area, where it is overlain by the Chiusole formation (fig. 7, chert type CHIU). Compared to the previously described areas, located more to the north, the pelagic successions show a significant difference. The Maiolica formation shows the most relevant differences, first of all much greater thicknesses, exceeding, in distinct areas one hundred metres (Mount Finonchio, Sommo Alto). At the base there are pink mudstones, only rarely including reddish cherts (B1). Upwards mudstones with conchoidal fracture, rich in layers and nodules of light grey chert (ranging from light grey to light brown grey or to light green grey) follow, with a characteristic spotted texture due to whitish limestone remains (B2). Towards the upper part of the formation the cherts tend to become darker, dark grey (B4). Between the two units

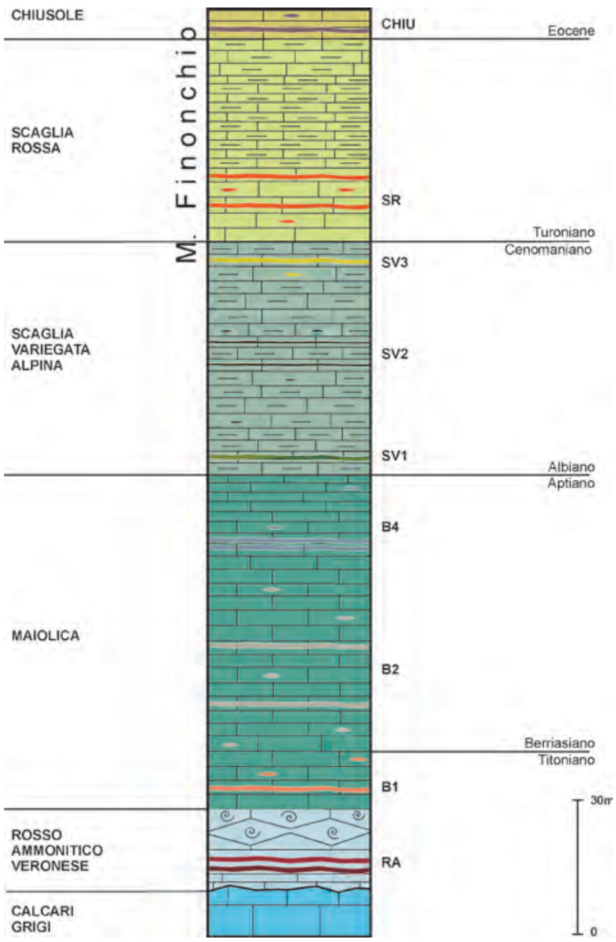


Fig. 7 – Schematic stratigraphic column of the pelagic Jurassic-Cretaceous succession of the Mount Finonchio/Folgaria area. The chert-bearing horizons are highlighted on the right (RA, B, SV, SR, CHIU). The Upper Jurassic/Lower Cretaceous interval exhibits greater thickness and it is rich in flint when compared to the Non valley (drawing S. Bertola).
Fig. 7 – Colonne stratigraphique schématique de la succession pélagique Jurassique-Crétacé de la région du mont Finonchio/Folgaria. Les horizons siliceux sont indiquées à droite (RA, B, SV, SR, CHIU). Par rapport au Val di Non, l'intervalle Jurassique supérieur-Crétacé inférieur est plus épais et riche en silex (dessin S. Bertola).

grey tending to dark grey flints (B2/B4) may be present. Within this formation the cherts are always abundant and, when not affected by fractures, very homogeneous. The following Scaglia Variegata Alpina formation is generally significantly less rich in flint than in the Non Valley. The distribution of the chert types is only partly comparable as regards colour and textural features to similar stratigraphic horizons located in the Non Valley. The basal marly layers sometimes alternate with dull greyish green to yellow chert layers (SV1). This is followed by a much thicker unit, consisting of bituminous mudstones alternating with black marls and thin black chert layers or isolated nodules, often brecciated and almost useless (SV2). In the upper part of the formation, a few metres before the passage to the Scaglia Rossa formation, frequent layers of yellow good-quality cherts (SV3) alternate with the limestones. The Scaglia Rossa formation contains frequent nodules and layers of reddish brown chert, distributed in the lower part of the formation. The features of the chert clearly differ from those of the Non Valley. This is generally lighter and more vitreous, quite homogeneous in colour and texture. It also contains frequent limestone remains, finely dispersed in the matrix (SR). In the series at Mount Finonchio the Chiusole formation follows the Scaglia Rossa formation; it contains frequent grey or reddish grey chert horizons (CHIU). The area of Mount Finonchio and Folgaria Plateau is rich in cherts. At Mount Finonchio they can be collected easily as they are harvestable among the detritus of the slopes (MAI and SVA) and in the soils (SVA, SR and CHIU). By contrast, in the vast area of the Folgaria plateau cherts (MAI and SVA) are abundant in residual soils.

A look to the south: the Baldo and Lessini areas

The Adige River reaches the Po Plain about 70 kilometres south of Rovereto, after crossing the Baldo und Lessini chains. This is an area (like all the Venetian Prealps) in which the Jurassic – Eocene cherty limestones widely outcrop. Throughout the entire stratigraphic interval the pelagic series are rich in cherts and show similarities but also significant differences with respect to the areas described above.

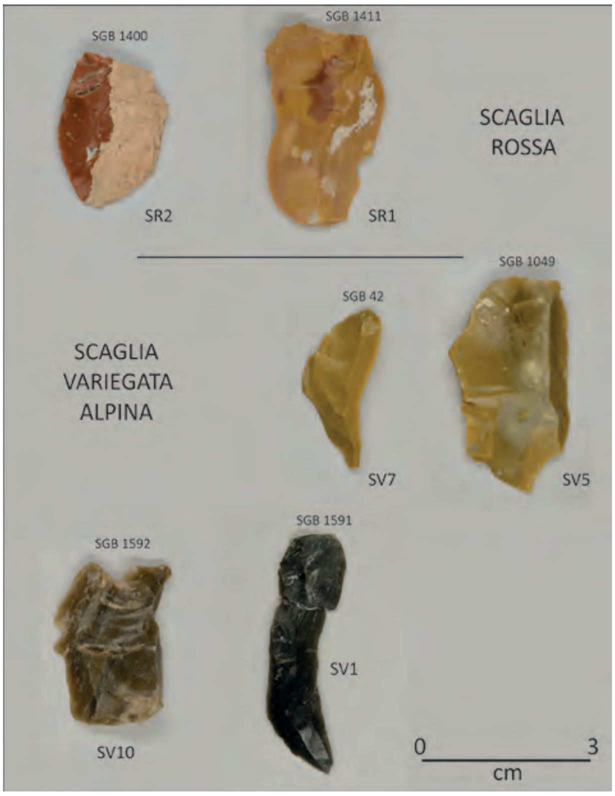


Fig. 8 – Artefacts made from Non valley cherts. The stratigraphic position of the chert types is shown in fig. 6 (photos S. Bertola).

Fig. 8 – Artefacts en silex du Val di Non. La position stratigraphique des silex est indiquée dans la fig. 6 (clichés S. Bertola).

The great variety and availability of chert types represents a rather distinctive feature of this area (Bertola, 2001).

PETROGRAPHIC ANALYSIS OF THE ARTEFACTS AND THEIR GEOGRAPHIC CONTEXTUALISATION

The study of the lithic assemblages of phases 2, 3 and 4 is based on a comparative work with the lithic resources available in the territory, presented in the previous chapter.

Considerations about the areal distribution of the formations and their horizontal variations in thickness, depositional and textural patterns, enabled the attribution to two different geological contexts of provenance, one more condensed, the other more complete. The first is attributable to the Non Valley, where the only cherty formations suitable for knapping are represented by the Scaglia Variegata Alpina and the Scaglia Rossa formations (fig. 8 and fig. 9). The second area is located more

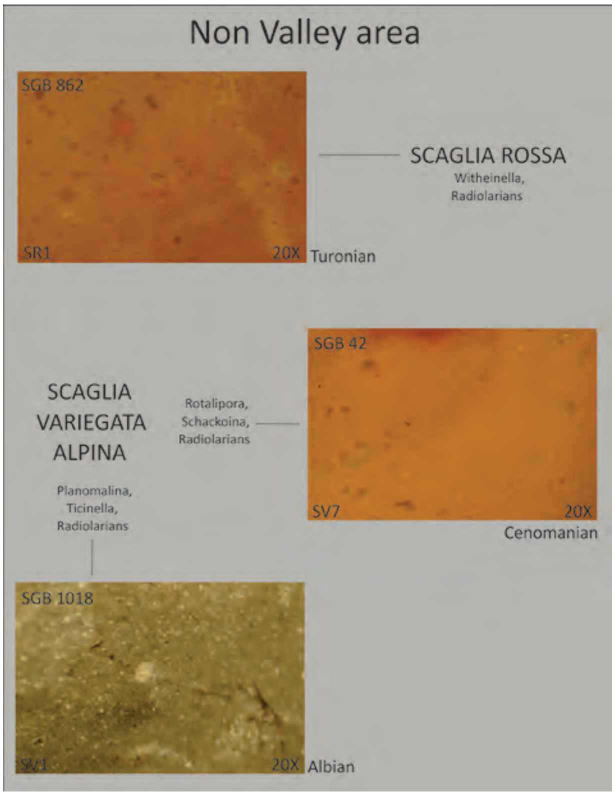


Fig. 9 – Thin sections (× 20) of the three most representative chert types from the Non valley. Limestone remains are almost completely absent. The fairly well-preserved microfossile associations enable the chronostratigraphic attribution of the samples (photos S. Bertola).

Fig. 9 : Lames minces (× 20) des trois types de silex les plus représentatifs du Val di Non. On remarque l'absence presque totale de résidus de calcaire. Les associations de microfossiles assez bien conservées permettent l'attribution chrono-stratigraphique des échantillons (clichés S. Bertola).

to the south, where the series are more complete and include, in addition to the two above-mentioned formations, cherts from the Maiolica and the Chiusole formations (fig. 10 and fig. 11). The petrographic features of the artefacts of this second group fit very well with the chert varieties from the Finonchio/Folgaria area. Furthermore this is reinforced by the fact that many of the artefacts bear traces of red clay attesting that they were collected from residual soils, common in this specific area (fig. 12).

More southern chert provenances, namely the Baldo-Lessini area, characterised by a richer chert variability (Bertola, 2001), can be excluded.

The lithic assemblage of phase 2

The assemblage studied includes 507 artefacts subdivided as shown in table 1. During phase 2 mainly cherts from the Non Valley were exploited (59.8%; fig. 13).

The chert types from the Non Valley area

The Scaglia Rossa cherts are dominant (44.2%). All the lithotypes are well represented, although mainly the SR1and SR2 varieties were exploited. The Scaglia Variegata Alpina chert types are all present but less frequent (15.6%). Preferential selection of distinct chert types at the expense of others is not apparent. The relative frequencies of the different cherts seem to be rather consistent with their abundance in the natural environment.

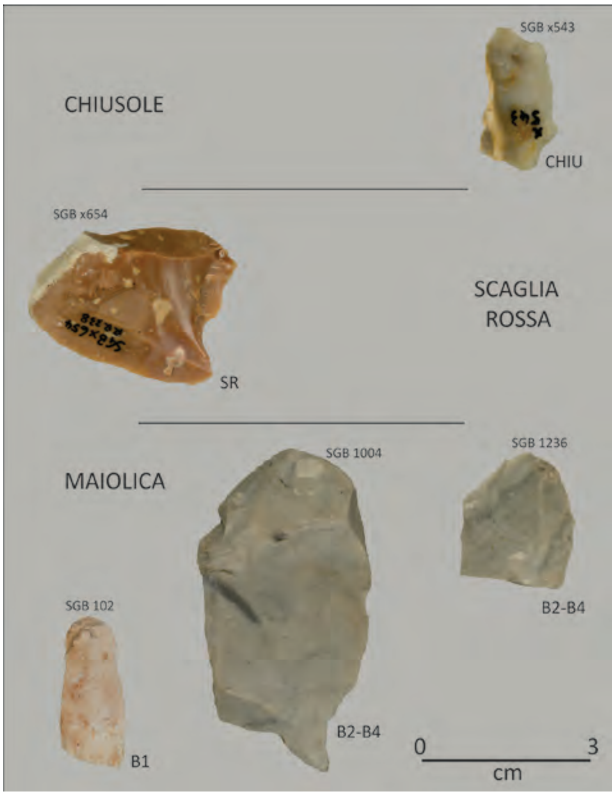


Fig. 10 – Artefacts made from cherts stemming from the Monte Finonchio/Folgaria area. The stratigraphic position of the chert types is shown in fig. 7 (photos S. Bertola).
Fig. 10 – Artefacts en silex de l'aire du mont Finonchio-Folgaria. La position stratigraphique des silex est indiquée dans la fig. 7 (clichés S. Bertola).

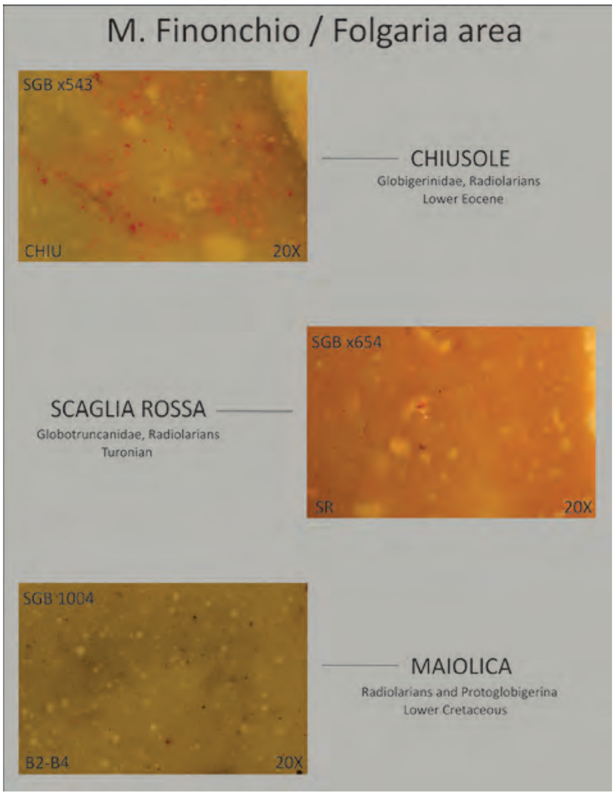


Fig. 11 – Thin sections (× 20) of the three most representative chert types from the Monte Finonchio/Folgaria area. The here presented Maiolica cherts (Lower Cretaceous) and the Chiusole cherts (Lower Eocene) do not outcrop in the Non valley; the Scaglia Rossa cherts show different features (cortex, colours, higher crystallinity, higher frequency of limestone remains) compared to the Non valley types (photos S. Bertola).
Fig. 11 : Lames minces (× 20) des trois types de silex les plus représentatifs de l'aire du mont Finonchio-Folgaria. Le silex de Maiolica (Crétacé inférieur) et celui de Chiusole (Eocène inférieur) n'affleurent pas dans le Val di Non ; les silex de la Scaglia Rossa montrent des caractéristiques différentes (cortex, couleur, haute cristallinité, haute fréquence de résidus de calcaire) par rapport aux variétés du Val di Non (clichés S. Bertola).

The chert types from the Finonchio/Folgaria area

The Scaglia Rossa (19.5%) and the Maiolica (19.1%) cherts show similar frequencies. The amount of the Scaglia Variegata Alpina cherts (1.4%) is small, whilst the Chiusole cherts are sporadic (0.2%). Similarly to the Non Valley area, the presence of different cherts does not suggest a selection of certain chert types, but rather reflects their availability. The Scaglia Rossa cherts are frequent at Mount Finonchio, together with the Chiusole ones, whilst the Maiolica and the Scaglia Variegata Alpina cherts are distributed in both areas, but mainly on the Folgaria plateau.

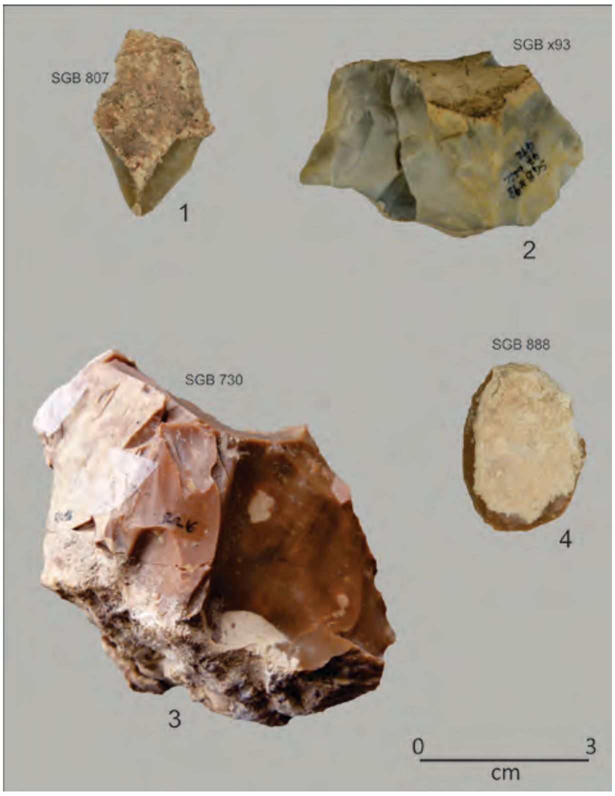
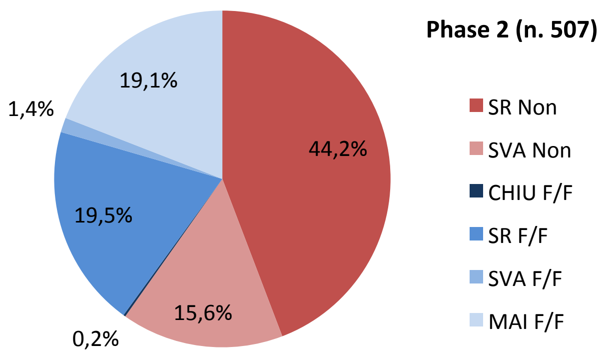


Fig. 12 – Natural surfaces preserved on some artefacts from the Monte Finonchio/Folgaria area. Red iron-rich clay (nos. 1 and 3) and manganese crusts (no. 2) are clearly visible on many artefacts. Other samples show evidence of chemical dissolution of the limestone cortex and no evidence of rounding (no. 4). These characteristics indicate that cherts included in residual soils were exploited. Such residual soils are widespread in this karst area and occur as thick layers. (photos S. Bertola and U. Wierer).

Fig. 12 – Surfaces naturelles préservées sur certains artefacts de l'aire de Mont Finonchio/Folgaria. Beaucoup de ces artefacts montrent la présence de croûtes argileuses riches en fer (n^{os} 1 et 3) et de croûtes de manganèse (n^{o} 2). D'autres échantillons indiquent des dissolutions chimiques du cortex calcaire mais ne présentent aucune trace de roulement fluitation (n^{o} 4). Ces caractéristiques indiquent l'exploitation de silex inclus dans des sols résiduels qui sont très communs et apparaissent dans des couches épaisses dans cette région karstique (clichés S. Bertola et U. Wierer).



The collection contexts

In the Non Valley the rough chert blocks were collected mainly from debris talus (85.1%) and secondarily from soils (14.9%; fig. 14). In the Finonchio/Folgaria area, on the other hand, chert blocks collected from residual soils on the plateau (66.0%) prevail over those collected from debris talus (34.0%). There is no evidence of procurement from torrent pebbles.

The lithic assemblage of phase 3

The assemblage studied includes 404 artefacts (table 1). In phase 3 mainly cherts from the Mount Finonchio/Folgaria area (61.6%) were exploited (fig. 15).

The chert types from the Finonchio/Folgaria area

The group of Mount Finonchio/Folgaria cherts is quite diversified. The Maiolica cherts are the most represented (31.2%), followed by those of the Scaglia Rossa formation (27.2%). The Scaglia Variegata Alpina (2.0%) and the Chiusole (1.2%) cherts were sporadically used. The high frequency of Maiolica cherts suggests the exploitation of outcrops located on the Folgaria plateau, whilst the Scaglia Rossa cherts are more frequent in the Mount Finonchio area.

The chert types from the Non Valley area

The Scaglia Rossa cherts (22.5%) are more strongly represented than those of the Scaglia Variegata Alpina (15.8%). The frequencies of the chert types are more or less proportional to their natural availability. There was no strong anthropogenic selection.

The collection contexts

In the Finonchio/Folgaria area the chert blocks were mainly collected from residual soils (78.6%; fig. 16). There is very clear evidence of red clay impregnations on the cortical surface of the cherts, exclusive to the blocks from this area. Other blocks were collected from detritic covers (21.4%).

In the Non Valley area several deposits were exploited. The raw-material blocks were mainly collected from detritic covers (76.4%), but there is also evidence of procurement from soils (22.4%) and from torrent gravels (1.4%). The data are a good match with the geomorphological context of the valley.

Fig. 13 – Lithologic composition and chert procurement areas of the lithic assemblage of phase 2. In red: Non valley, in blue: Monte Finonchio-Folgaria plateau.

Fig. 13 – Composition lithologique et aires d'approvisionnement du silex de la phase 2. En rouge: Val di Non, en bleu: monte Finonchio-plateau de Folgaria.

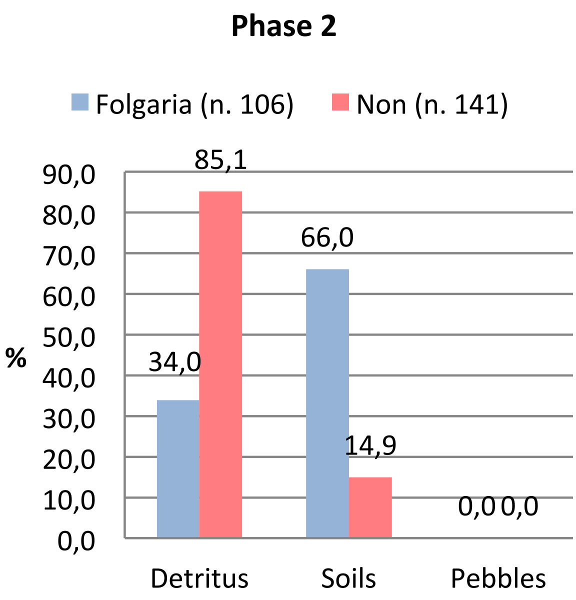


Fig. 14 – Raw-material collection contexts of the two procurement areas of phase 2.
Fig. 14 – Contextes de collecte des matières premières des deux aires d'approvisionnement de la phase 2.

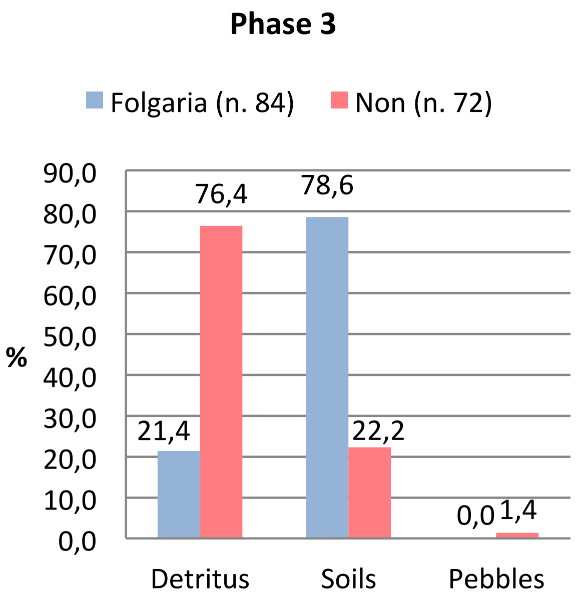


Fig. 16 – Raw-material collection contexts of the two procurement areas of phase 3.
Fig. 16 – Contextes de collecte des matières premières des deux aires d'approvisionnement de la phase 3.

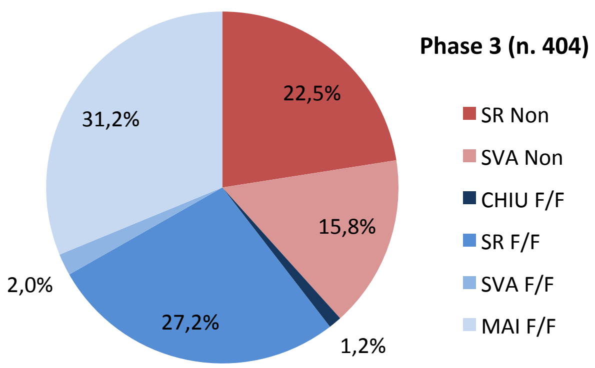


Fig. 15 – Lithologic composition and chert procurement areas of the lithic assemblage from phase 3. In red: Non valley, in blue: Monte Finonchio/Folgaria plateau.
Fig. 15 – Composition lithologique et aires d'approvisionnement des silex de la phase 3. En rouge: Val di Non, en bleu: mont Finonchio-plateau de Folgaria.

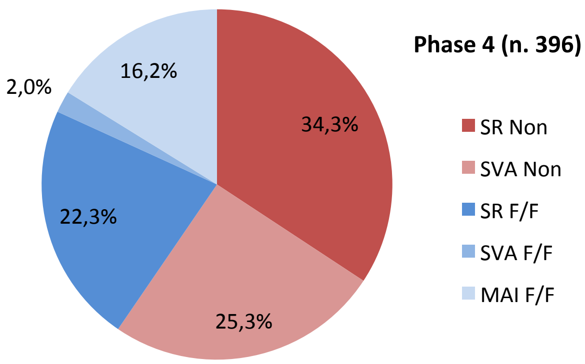


Fig. 17 – Lithologic composition and chert procurement areas of the lithic assemblage from phase 4. In red: Non Valley, in blue: Monte Finonchio/Folgaria plateau.
Fig. 17 – Composition lithologique et aires d'approvisionnement du silex de la phase 4. En rouge: Val di Non, en bleu: mont Finonchio-plateau de Folgaria.

The lithic assemblage of phase 4

The study involved 396 artefacts (table 1). In phase 4 mainly cherts from the Non Valley (59.6%) were exploited (fig. 17).

The chert types from the Non Valley area

Although the Scaglia Rossa chert types (34.3%) are still the most exploited, compared to the other phases, the frequency of the Scaglia Variegata Alpina chert types is higher (25.3%). Together with a more intensive exploitation, a strong selection of chert types becomes apparent: as a matter of fact, among the Scaglia Variegata Alpina cherts exclusively types from the upper part of the formation (SV6, SV7, SV8, SV10), which are more homogeneous and glassy, were exploited.

The chert types from the Finonchio/Folgaria area

The commonest type is the Scaglia Rossa (22.3%) chert, compatible with the Mount Finonchio outcrops. Another group of artefacts (16.2%) made from grey Maiolica cherts presents features that are perfectly compatible with the outcrops of the Folgaria Plateau; a smaller group of Scaglia Variegata Alpina cherts (2.0%) can be attributed to the same area.

The collection contexts

Compared to the other phases the origin of the raw-material blocks from the Val di Non area is quite diversified (fig. 18). They were collected from detritic covers (51.1%), soils (27.3%) and in the form of torrent gravels (21.6%). Chert pebbles are quite abundant and may have been collected from the bed of the Noce torrent, which descends from the Non Valley and flows into the Adige River just a few kilometres downstream of the site.

In the Finonchio/Folgaria area the cherts were collected both from residual soils (59.7%) and from detritic covers (40.3%).There is no evidence for the collecting of torrent pebbles.

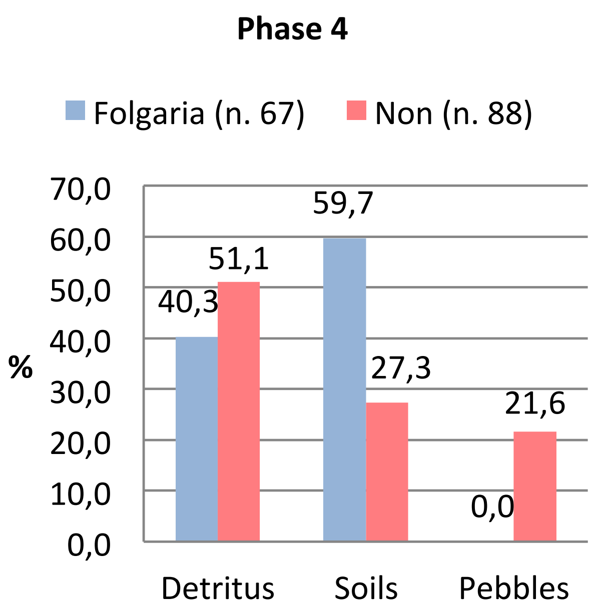


Fig. 18 – Raw-material collection contexts of the two procurement areas of phase 4.
Fig. 18 – Contextes de collecte des matières premières des deux aires d'approvisionnement de la phase 4.

Discussion of the results

While in phases 2 and 4 most of the cherty materials originate from the Non Valley outcrops, which is also the nearest source, in phase 3 most of the cherty materials originate from the more distant Finonchio/Folgaria area. The significant difference in the proportion between the phases may reflect diachronic variations in the behaviour of human groups or it may suggest distinct occupation dynamics of the site. During phase 4 the preferential use of distinct high-quality chert types was also observed. This is evident both for the Non cherts and for the varieties of the Mount Finonchio/Folgaria area. At the same time there is a greater diversification of procurement contexts. This is particularly evident regarding the Non Valley, where the chert blocks were collected from detritic covers, soils and from torrent gravels. In phases 2 and 3 this selection was not observed or is at least less pronounced.

LITHIC REDUCTION SEQUENCES AND TOOL MAKING RELATED TO THE NON AND FINONCHIO/FOLGARIA PROCUREMENT AREAS

In this chapter the techno-economic choices are discussed by incorporating the results of the raw-material provenance areas into the techno-typological study. The aim is to understand, while reconstructing the reduction sequences, whether there are differences in the management between the cherts from the adjacent Non Valley and those from the more distant Mount Finonchio and Folgaria plateau.

Cherts knapped on site

Raw material originating from both procurement areas was knapped in situ. During all three phases cores made from Non and Finonchio/Folgaria cherts were discarded at the site (fig. 19). Despite the general predominance of Non varieties in phase 2, the cores of the Finonchio/Folgaria varieties prevail. Raw-material exploitation from both areas at the site is also highlighted by refittings (fig. 20). Amongst these the Non and Finonchio/Folgaria frequencies are roughly in line with the overall percentages.

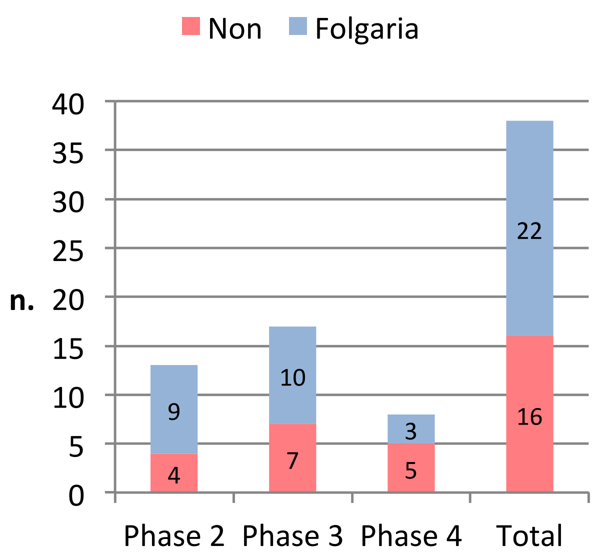


Fig. 19 - Distribution of the cores according to the chert procurement areas (n = 38).
Fig. 19 – Répartition des nucléus selon les aires d'approvisionnement du silex (n = 38).

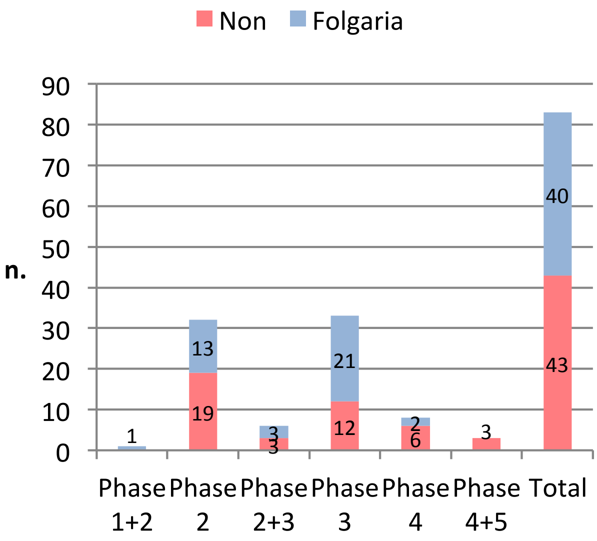


Fig. 20 – Distribution of the refittings according to the chert procurement areas (n = 83).
Fig. 20 – Répartition des remontages selon les aires d'approvisionnement du silex (n = 83).

Reconstructing the bladelet reduction processes

Bladelets were the main objective of the flaking process. On the basis of the abandoned cores, the refittings and the diagnostic artefacts, three different bladelet production sequences have been identified.

Bladelet production on prismatic volumes

The best attested reduction sequence regards bladelet production on blocks generally displaying three or more diaclastic fracture planes (fig. 21a). The use of nodules and naturally fragmented nodules is rarely attested. The original block sizes probably varied between 3 and 5/6 cm maximum in length. Only limited preparation or no preparation at all was needed, as the perpendicular fracture planes were used as both striking platforms and flaking surfaces (fig. 22, no. 1). The opening often occurred along natural edges (fig. 23, no. 7). The exploitation was unipolar. Bladelets (and laminar flakes) were produced in series (fig. 23, no. 1–6). A rather wide flaking surface

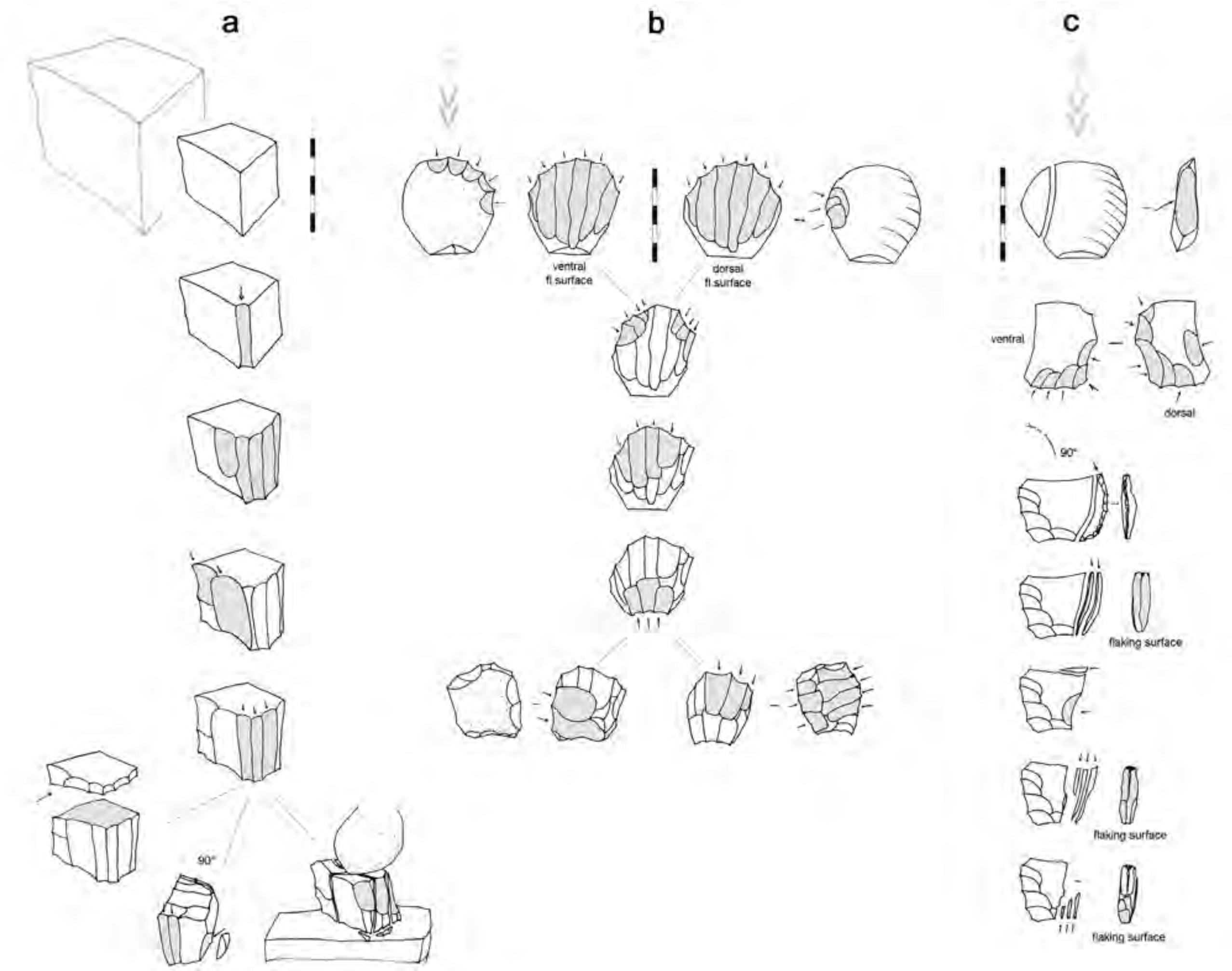


Fig. 21 – Reduction sequences of bladelet production. a: on prismatic volume; b: on flat oval surfaces; c: on narrow flaking surface (drawing U. Wierer).
Fig. 21 – Chaînes opératoires de la production lamellaire. a : sur volume prismatique ; b : sur surface plane ovale ; c : sur surface d'extraction étroite (dessin U. Wierer).

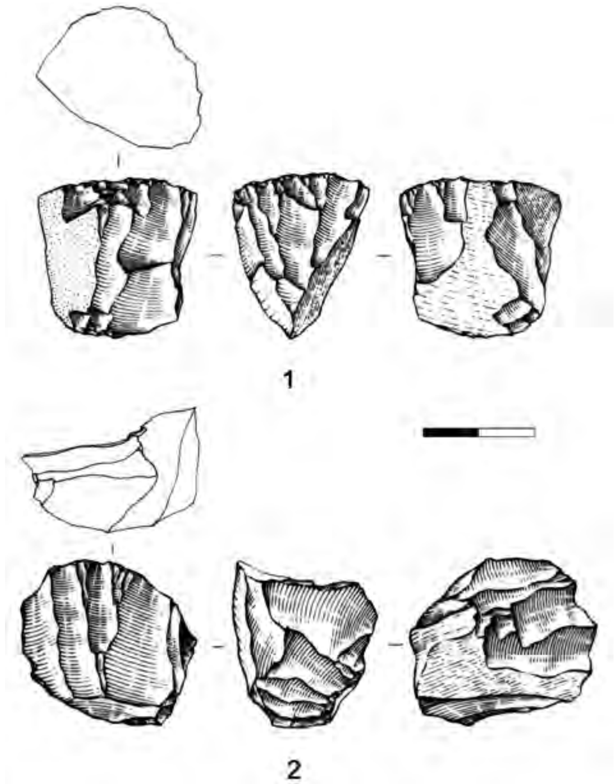


Fig. 22 – Bladelet cores. a: prismatic volume on block, phase 3; b: re-oriented core, phase 2 (drawings L. Baglioni, 75% of the original size).

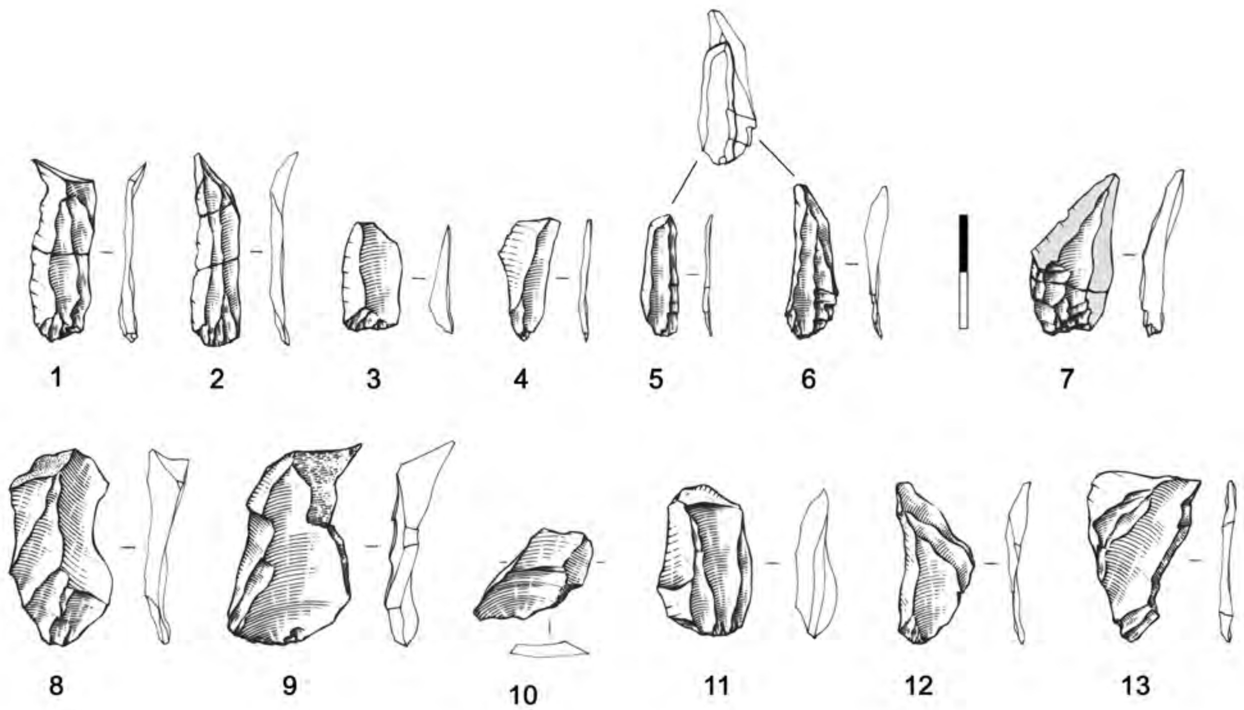
Fig. 22 – Nucléus à lamelles. a : volume prismatique sur bloc, phase 3 ; b : nucléus réorienté, phase 2 (dessins L. Baglioni, 75% de la taille originale).

combined with a reduced longitudinal convexity made it possible to produce thin blanks. The transversal convexity of the flaking surface was maintained through lateral detachments (fig. 23, no. 8), including the aim of correcting hinged negatives (fig. 23, no. 9–10), from the same or from an opposite secondary striking platform (fig. 23, no. 11). Some of the abandoned cores show low lamellar productivity with a limited series of detached bladelets (and blade flakes).

Residual cores show the different choices made during the exploitation process: repeated rejuvenation of the striking platforms by the removal of core-tablets (semi-tablettes), core re-orientation by a 90° rotation (fig. 22, no. 2), and splintering of the residual core (the core breaks apart into several pieces, some of which could be used).

Fig. 23 – 1 to 6: bladelets and laminar flakes, probably removed from the same core, phase 3; 7: laminar flake with orthogonal diaclastic surfaces, phase 2; 8 to 12: blanks resulting from maintenance (nos. 8, 9, 12: phase 2; no. 10: phase 3; no. 11: phase 4); 13: Blank with residual ventral face made from a core on flake, phase 4 (drawings L. Baglioni, 75% of the original size.

Fig. 23 – 1 à 6 : Lamelles et éclats laminaires, probablement détachées du même nucléus (phase 3) ; 7 : éclat laminaire avec surfaces diaclasiques orthogonales (phase 2) ; 8 à 12 : éclats d'entretien (nos 8, 9, 12 : phase 2; no 10 : phase 3 ; no 11 : phase 4) ; 13 : support montrant une face ventrale résiduelle, issue d'un nucléus sur éclat, phase 4 (dessins L. Baglioni, 75% de la taille originale).



Bladelet production on flat / slightly convex oval surfaces

Bladelets were also produced by exploiting slightly convex surfaces on oval-shaped cores (fig. 21b). In rare cases the original core surface can still be recognised: either a medium-sized thick flake, 4–5 cm large, or a flat plaque. On the core represented in figure 24 (fig. 24, no. 1) the flaking surface is established on the dorsal face of the flake without any evident preparation. The narrow flaking angle, on some pieces measuring only 40–50°, has been accurately prepared. Oblique detachments from the sides converging towards the centre of the core assure the convexity of the wide flaking surface (fig. 23, no. 12). Maintenance operations are attested which aimed at rejuvenating or flattening the striking platform, which is also the back of the core. Bladelet production (associated with the detachment of some laminar flakes) proceeded and gradually reduced the thickness of the core. This type of exploitation illustrates a low productivity.

It is very likely that in some cases the flaking surface was also established on the opposite side, i.e. the ventral side of the flake, as is attested to in Romagnano Loc-III (Broglio and Kozłowski, 1983, nos. 12–16). The assemblage indeed contained blanks with a double ventral face (fig. 23, no. 13). Some oval-shaped residual cores with a back completely covered by cortex could be related to this type of exploitation.

Bladelet production from narrow flaking surfaces

This reduction sequence is observed on sporadic cores made on thick flakes or on slabs (fig. 21c). In the case of flakes these underwent an initial shaping phase followed by the opening of the striking platform (fig. 24, no. 2). The narrow flaking surface was then exploited in a frontal way. Hinged negatives or the decrease in size were the main reasons for core abandonment. Maintenance bladelets of such cores are well represented in phase 4.

This category roughly corresponds to the subconical and burin-like cores found at Romagnano (Broglio and Kozłowski, 1983, nos. 8 and 9).

Provenance of the thick flakes used as cores

The provenance of the thick flakes exploited as cores is not clear. No production of thick flakes is attested at the site. The only core attesting to the potential extraction of thick flakes is established on a nodule of Finonchio/Folgaria chert (estimated original size: 8 cm) abandoned during the shaping phase (fig. 12, no. 3). Therefore it can be supposed that the large flakes, meant to be exploited as cores, were either brought from outside or produced in an area of the site which has not been investigated.

Cherts used for bladelet production

In order to verify which cherts were used for the bladelet production in situ, comparative graphs of the analysed bladelets of all categories (retouched and unretouched bladelets as well as waste products stemming from the manufacturing of microliths) that were distinguished on the basis of the Finonchio/Folgaria and Non chert procurement areas are reported (fig. 25, fig. 26 and fig. 27). Phases 2, 3 and 4 show a roughly comparable incidence of bladelets from the different stages of the operational sequences *(chaînes opératoires)*, with the highest frequency of regular bladelets referring to full debitage *(plein débitage)*. Regarding the two provenance areas, both Non and Finonchio/Folgaria specimens are equally represented among the cortical, the maintenance and the regular bladelets. In phases 3 and 4 a slightly higher frequency of Finonchio/Folgaria varieties may be observed among the regular bladelets compared to the total number of specimens. This is particularly notable for phase 4, as the Non varieties prevail here over the Finonchio/Folgaria cherts.

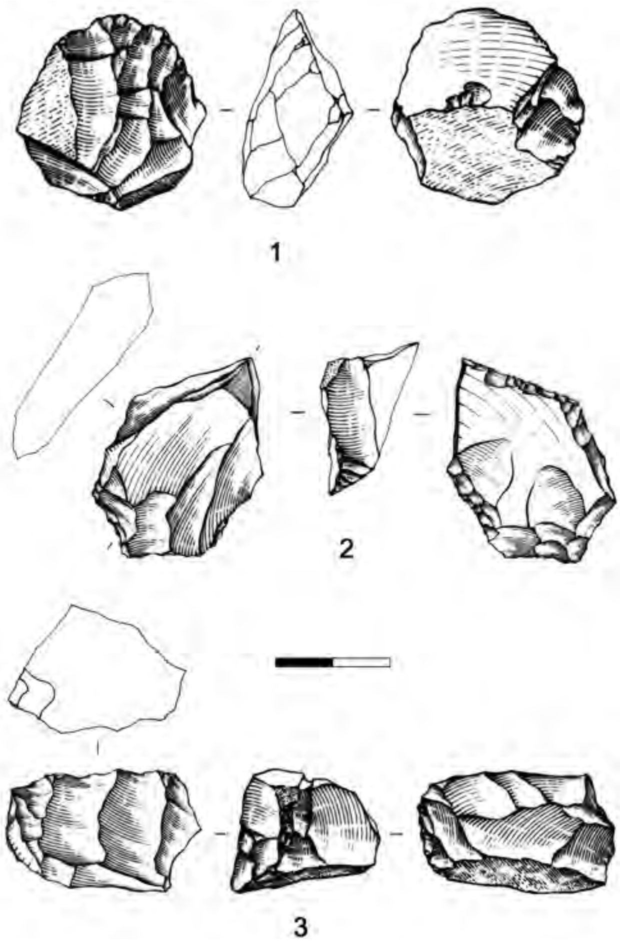


Fig. 24 – 1: bladelet core, exploitation from the dorsal face of a flake, phase 2; 2: bladelet core, exploitation from the narrow surface of a flake, phase 3; 3: flake core on a block with diaclastic surfaces, phase 2 (drawings L. Baglioni, 75% of the original size).

Fig. 24 – 1 : nucléus lamellaire, exploitation sur la face dorsale de l’éclat, phase 2 ; 2 : nucléus à lamelles, exploitation sur surface étroite de l’éclat, phase 3 ; 3 : nucléus sur éclat avec surfaces diaclasiques, phase 2 (dessins L. Baglioni, 75 % de la taille originale).

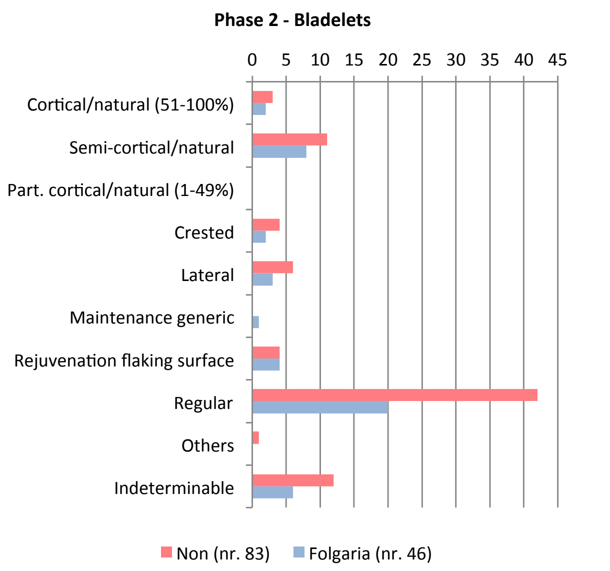


Fig. 25 – Bladelets of phase 2 originating from the different stages of the reduction sequence (n = 129) and their distribution according to the chert procurement areas.
Fig. 25 – Lamelles de la phase 2 issues des différents stades de la chaîne opératoire (n = 129) et leur répartition selon les aires d'approvisionnement du silex.

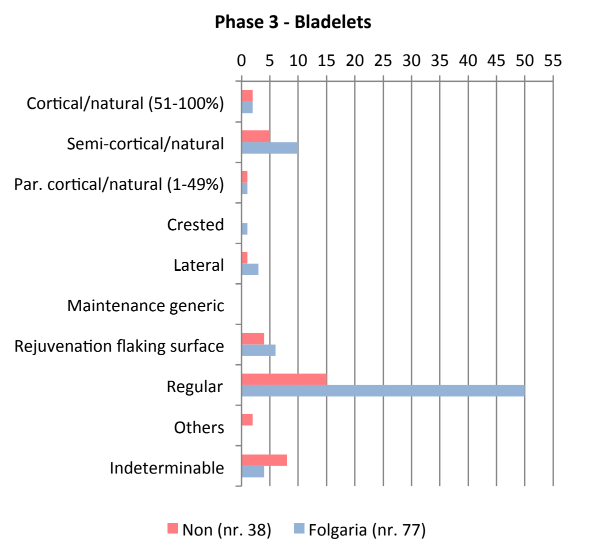


Fig. 26 – Bladelets of phase 3 originating from the different stages of the reduction sequence (n = 115) and their distribution according to the chert procurement areas.
Fig. 26 – Lamelles de la phase 2 issues des différents stades de la chaîne opératoire (n = 115) et leur répartition selon les aires d'approvisionnement du silex.

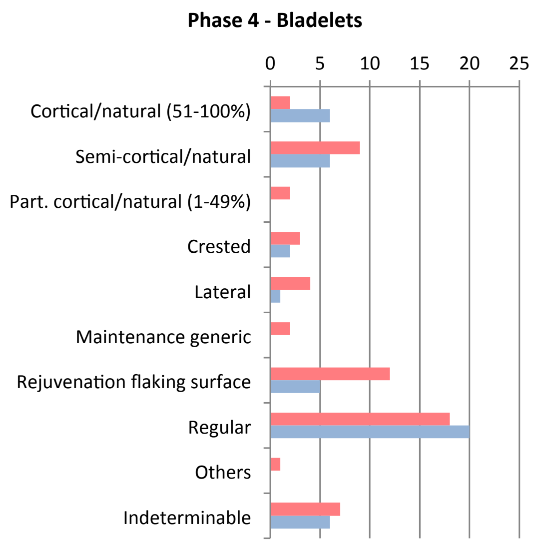


Fig. 27 – Bladelets of phase 4 originating from the different stages of the reduction sequence (n = 111) their distribution according to the chert procurement areas.
Fig. 27 – Lamelles de la phase 4 issues des différents stades de la chaîne opératoire (n = 111) et leur répartition selon les aires d'approvisionnement du silex.

Other productions

Small flake cores from separate production

Some residual cores on small blocks and nodules characterised by flat and wide flaking surfaces display negatives of small and thin flakes (fig. 24, no. 3). These cores are probably related to a separate flake / laminar flake production.

Large blanks – produced on site or imported?

Large blanks, referring to blades longer than 4 cm (up to 7–8 cm maximum) as well as to flakes larger than 3 cm, are not abundant. These are better represented among the retouched tools, namely among the common tools, than among the unretouched artefacts. Judging from their size, the technological features and the chert varieties they are not consistent with the bladelet reduction sequences attested on site. Such large artefacts could therefore have been imported to the site, ready to be used. Their blanks are often related to maintenance operations (fig. 28, nos. 1 to 3).

The large pieces among the retouched tools are made from both Non and Finonchio/Folgaria cherts. There is a clear preference for the latter in phase 2 (fig. 29, fig. 30 and fig. 31).

Percussion techniques

The analysis of the butts shows that the features that were considered as diagnostic for the use of soft percussion are the best represented. These are displayed by flat or

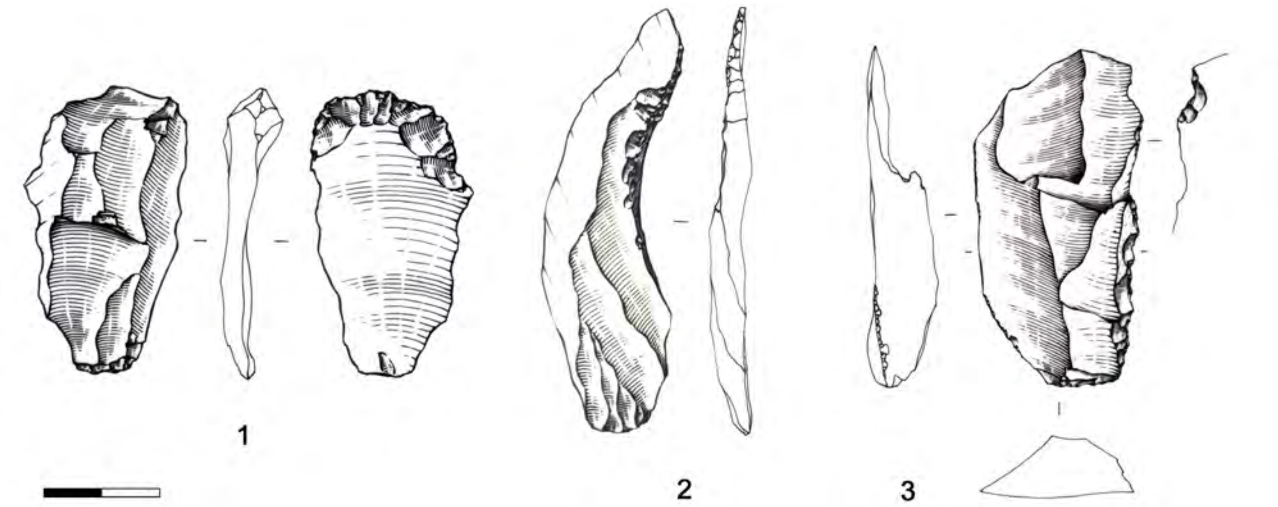


Fig. 28 – Large artefacts. 1: denticulate tool on a flake resulting from maintenance from Scaglia Variegata Alpina flint of the Non area; 2: unretouched crested blade made from Maiolica chert of the Finonchio/Folgaria area, 3: denticulate tool on a flake resulting from maintenance from Maiolica chert of the Finonchio/Folgaria area. (drawings L. Baglioni, 75% of the original size.)
Fig. 28 – Produits de grandes dimensions. 1 : pièce denticulée sur produit d'entretien de la Scaglia Variegata Alpina-Val di Non ; 2 : lame à crête non retouchée en silex de la Maiolica de la région de Finonchio-Folgaria ; 3 : pièce denticulée sur éclat d'entretien en silex de la Maiolica de la région de Finonchio-Folgaria (dessins L. Baglioni, 75 % de la taille originale).

punctiform butts with accurate abrasion of the overhang, punctiform impact point, small but slightly prominent bulb, sometimes with fine ripples up to the impact point (Pelegrin, 2000). Small bulb splinterings *(esquillements bulbaires)* are quite common. Such features are systematically found on the bladelets and on the thin blanks of the different size classes (fig. 32, nos. 1–2).

Hard hammerstone stigmata have been recognised on thick maintenance blanks to correct flaking accidents and on cortical blanks from the opening of the blocks (fig. 32, no. 3).

The butts, either natural diaclastic, flat abraded or facetted, frequently show a punctiform impact mark framed by small cracks or even a totally open Hertzian cone. These blanks are usually characterised by prominent and large bulbs.

Destination of the produced blanks

The data collected hitherto are mainly based on typological and therefore partial observations, in the hope of including the results of the functional analysis.

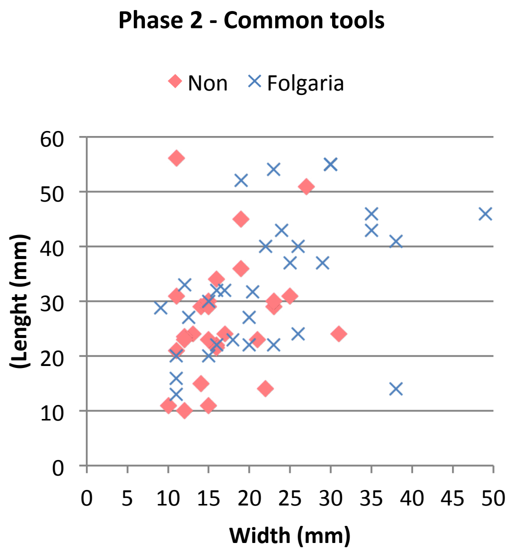


Fig. 29 – Dimensions of the complete common tools of phase 2 (n = 58) according to the chert procurement areas.
Fig. 29 – Dimensions des outils entiers du fond commun de la phase 2 (n = 58) différenciés selon les aires d'approvisionnement des silex.

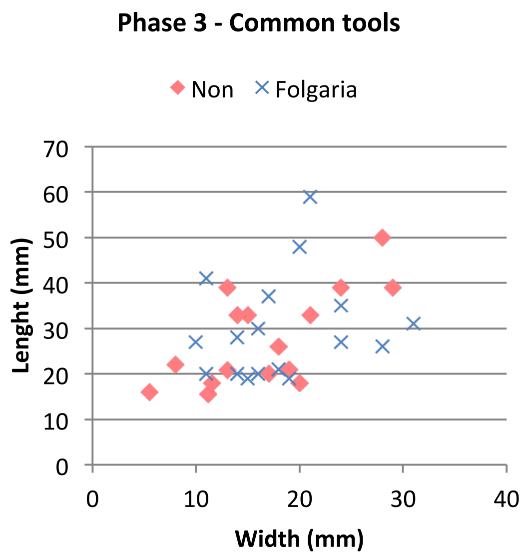


Fig. 30 – Dimensions of the complete common tools of phase 3 (n = 33) according to the chert procurement areas.
Fig. 30 – Dimensions des outils entiers du fond commun de la phase 3 (n = 33) différenciés selon les aires d'approvisionnement de silex.

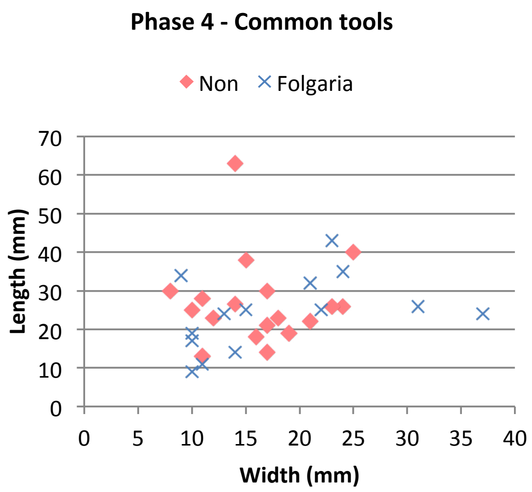


Fig. 31 – Dimensions of the complete common tools of phase 4 (n = 32) according to the chert procurement areas.
Fig. 31 – Dimensions des outils du fonds commun entiers de la phase 4 (n = 32) distingués selon les aires d'approvisionnement de silex.

The retouched artefacts of the assemblage

On the basis of the typology adopted by A. Broglio and S. K. Kozłowski (Broglio and Kozłowski, 1983), retouched tools are divided into two main categories: the geometric microliths, supposed to be elements hafted on arrows, and the common tools, destined to be used for several domestic activities. By introducing this distinction, the Galgenbühel lithic assemblage is characterised by the predominance of common tools over microliths in all three phases (table 2; Wierer, 2007). The frequency of geometric microliths is particularly low in phases 2 and 3.

The geometric microliths: types and technology

The most significant geometric microliths for the attribution of the assemblage to the Sauveterrian techno-complex are the triangles and the double-backed points. Because of the low number of intact microliths, no statistical considerations have been made (table 3). Most of the backed and double-backed points present an elongated morphology (fig. 33, no. 1–4). Some specimens, increasingly numerous in phases 2 and 3, are needle-shaped and double-backed, thus corresponding to the 'Sauveterrian points' (Barrière et al., 1972). The shape of the triangles changes throughout the series: phase 2 is characterised by elongated and isosceles types, whilst phase 4 (after the absence of triangles in phase 3) shows a predominance of elongated scalene types, together with the emergence of short-based triangles (fig. 33, nos. 5–10). A single triangle of the 'Montclus' type stems from phase 4 (fig. 33, no. 8). During this latter phase the increasing variability of microliths is attested to by several segments and

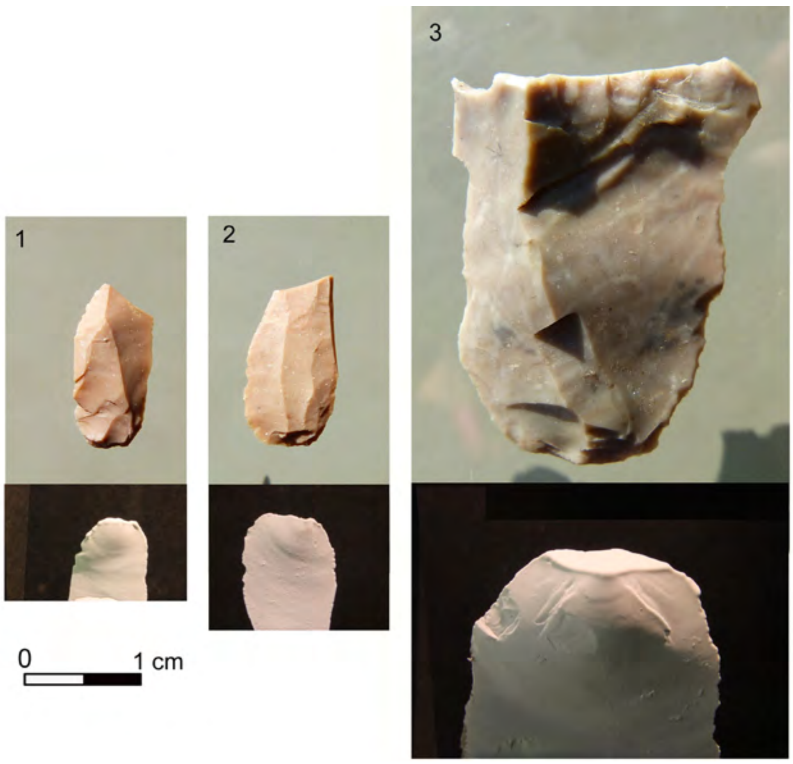


Fig. 32 – Features compatible with the use of a soft hammerstone (1 and 2: fragments of backed tools made on bladelets) and a hard hammerstone (3: retouched maintenance flake). After magnesium fumigation (photos S. Ricci and U. Wierer).
Fig. 32 – Stigmates compatibles avec l'usage d'un percuteur tendre (1 et 2 : fragments à dos sur lamelle) et l'usage d'un percuteur dur (3 : éclat d'entretien retouché). Après fumigation au magnésium (clichés S. Ricci et U. Wierer).

Retouched artefacts	Phase 2	Phase 2+3	Phase 3	Phase 4	Total	Phase 2 %	Phase 3 %	Phase 4 %
Common tools	154	1	107	90	352	81%	84%	58%
Microliths	36	0	21	65	122	19%	16%	42%
Total	190	1	128	155	474	100%	100%	100%

Table 2 – The retouched artefacts of the assemblage (typology according to Broglio and Kozłowski, 1983).
Tabl. 2 – Les pièces retouchées de l'assemblage (typologie d'après Broglio et Kozłowski, 1983).

Microliths	Phase 2	Phase 3	Phase 4	Total
Points on blades or laminar flakes		1	2	3
Backed points	3	2	5	10
Segments	1		5	6
Backed tools and truncation	1	2	8	11
Backed fragments with truncations/fragmented triangles	1	3	1	5
Triangles	6		13	19
Double-backed points	5	4	1	10
Marginal backed points and bladelets	1	1	2	4
Other backed tools	3	1	5	9
Indeterminable backed fragments	15	7	23	45
Total	36	21	65	122

Table 3 – Typological account of the microliths (typology according to Broglio and Kozlowski, 1983).
Tabl. 3 – Décompte typologique des armatures (typologie d'après Broglio et Kozłowski, 1983).

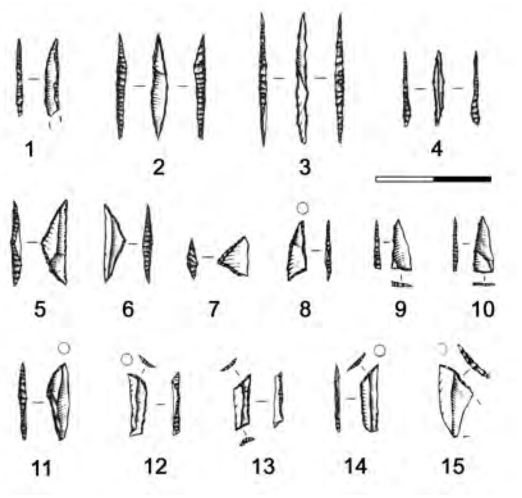


Fig. 33 – Microliths. 1: backed point; 2 to 4: double-backed points; 5 to 10: triangles; 11: segment; 12 to 14: truncated backed blades; 15: point made on a flake. 1, 2, 5 and 6: phase 2; 3 and 14: phase 3; 4, 7 to 13 and 15: phase 4 (drawings L. Baglioni, 75% of the original size).
Fig. 33 – Armatures. 1 : pointe à dos ; 2 à 4 : pointes à double dos ; 5 à 10 : triangles ; 11 : segment de cercle ; 12 à 14 : lames à dos et troncature ; 15 : pointe sur éclat. 1, 2, 5 et 6 : phase 2; 3 et 14 : phase 3 ; 4, 7 à 13 et 15 : phase 4 (dessins L. Baglioni, 75 % de la taille originale).

truncated backed tools (fig. 33, no. 11–13). During the process of manufacturing of the different types of microliths, the microburin technique was used for the intentional shortening and shaping of the blanks. This is attested to by the ends of backed tools formed by a trihedral point and by the presence of microburins that are typical waste products. Shortening was also carried out by breakage through bending on a notch, as displayed by 'notches adjacent to fracture' recovered from all phases (table 4).

In order to understand which blanks were used for the manufacture of the microliths a combined analysis of both microliths and microburins was carried out because of the limited readability of the original blank of the former (table 5 and table 6). In most cases the blanks determined for these two categories were bladelets. Flakes were used to only a limited extent. The rare blades identified among the microburins are small in size, with width values between 12.4 and 14.5 mm. The blade incidence in microlith manufacturing could thus be underestimated.

The main technological feature of the blanks transformed into backed tools was their reduced thickness, which favoured, first, the use of the microburin technique and, second, shaping by deep abrupt unipolar retouch. In fact both the microliths and the microburins are clustered in a thickness range between 1 mm and 2.5 mm and in a width range between 5 mm and 12 mm (Wierer, 2008).

Waste of microlith manufacturing	Phase 2	Phase 3	Phase 4	Total
Microburins	65	25	63	153
Notches adjacent to fracture	16	5	8	29
Total	81	30	71	182

Table 4 – Account of the waste elements resulting from the manufacture of microliths.
Tabl. 4 – Décompte des débris de la taille des armatures.

Blanks of the microlith	Phase 2	Phase 3	Phase 4	Total
Flakes	3	2	1	6
Bladelets	6	11	25	42
Indeterminable	27	8	39	74
Total	36	21	65	122

Table 5 – Blanks used for the manufacture of microliths (identified on the base of the technological analysis of the microliths).
Tabl. 5 – Supports sélectionnés pour la confection des armatures déterminés à partir de l'analyse technologique des armatures.

Blanks of the microburins	Phase 2	Phase 3	Phase 4	Total
Flakes	5		3	8
Blades	1	2	1	4
Bladelets	29	19	22	70
Indeterminable	30	4	37	71
Total	65	25	63	153

Table 6 – Blanks used for the manufacture of geometric microliths (identified on the base of the technological analysis of the microburins).
Tabl. 6 – Supports sélectionnés pour la confection des armatures déterminés à partir de l'analyse technologique des microburins.

Cherts used for the manufacturing of microliths

Combining the data related to raw-material provenance with the artefact categories reveals that the use of Non and Folgaria/Finonchio varieties for the manufacturing of microlithic armatures is in line with the general frequencies of the Non and Finonchio/Folgaria varieties: Non cherts predominate in phases 2 and 4, Finonchio/Folgaria cherts in phase 3 (fig. 34, fig. 35 and fig. 36). This means that there is no clear preference as regards procurement areas of the raw material used for the manufacturing of microliths.

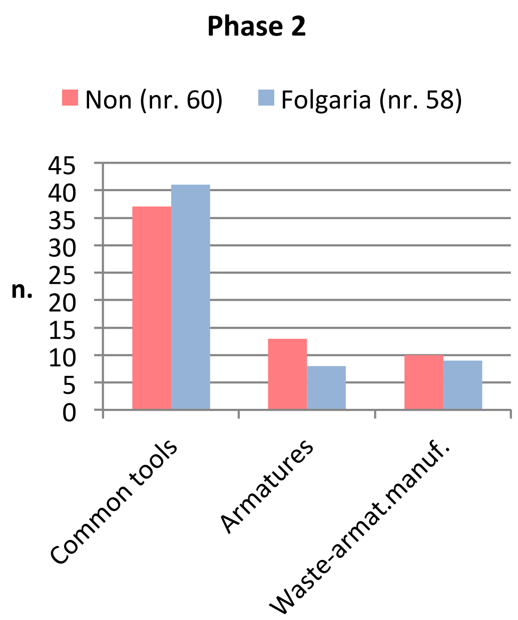


Fig. 34 – Procurement areas of the cherts used for the production of common tools, microlithic armatures and of those present among the knapping waste related to the manufacturing of the microliths, phase 2 : n = 118.
Fig. 34 – Aires d'approvisionnement des silex utilisés pour la production des outils du fond commun, des armatures et des silex présents parmi les débris de la production des armatures, phase 2 : n = 118.

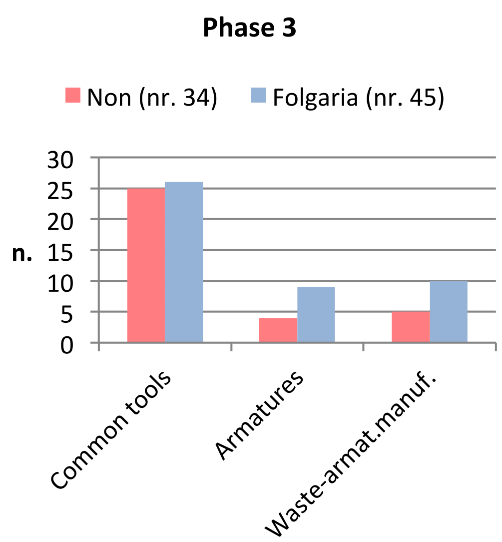


Fig. 35 – Procurement areas of the cherts used for the production of common tools, microlithic armatures and of those present among the knapping waste related to the manufacturing of the microliths, phase 3: n = 79.
Fig. 35 – Aires d'approvisionnement des silex utilisés pour la production des outils du fond commun, des armatures et des silex présents parmi les débris de la production des armatures, phase 3 : n = 79.

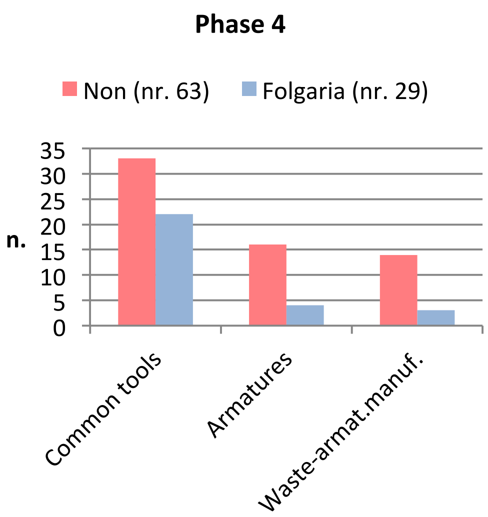


Fig. 36 – Procurement areas of the cherts used for the production of common tools, microlithic armatures and of those present among the knapping waste related to the manufacturing of the microliths, phase 4: n = 92.
Fig. 36 – Aires d'approvisionnement des silex utilisés pour la production des outils du fond commun, des armatures et des silex présents parmi les débris de la production des armatures., phase 4 : n = 92.

The common tools: types and technology

The retouched flakes are the most abundant common tools in all phases. They are followed by the retouched blades, the truncations and the end scrapers whose incidences vary according to the phases (table 7; Wierer, 2007). Among the retouched flakes notched pieces are very frequent (fig. 37, no. 6). The retouched blades, particularly frequent in phase 2, are comprised of specimens with lateral or bilateral notches. The truncations, often made on flakes, are mostly partial. Unlike other Sauveterrian assemblages end scrapers are not frequent. These are mostly frontal, short types (fig. 37, no. 2). Only one characteristic 'backed knife' of the 'Rouffignac' type was found in phase 3 (fig. 37, no. 4). The retouched flakes and blades include artefacts with marginal and partial retouch which seem to be expedient tools.

The common tools were mostly made on flakes, followed by laminar flakes, bladelets and blades, besides the more sporadic use of other elements (table 8). The flakes are in most cases generic specimens without particular technological features.

The size of the common tools is highly variable, from about 7 cm downwards. The same is valid for their morphology, reflecting the provenance from different stages of the operational sequence *(chaîne opératoire)*.

Common tools	Phase 2	Phases 2+3	Phase 3	Phase 4	Total
Endscrapers	10	1	10	14	35
Retouched flakes (including notches)	63		41	29	133
Burins	6		3	3	12
Truncations (also on flakes)	12		11	12	35
Retouched blades	28		16	10	54
Beaks and perforators			1	2	3
Backed knives			1		1
Points	2		1		3
Splintered pieces	5		2	3	10
Miscellaneous			2	1	3
Indeterminable fragments	28		19	16	63
Total	154	1	107	90	352

Table 7 – Typological account of the common tools (typology according to Broglio and Kozłowski, 1983).
Tabl. 7 – Décompte typologique des outils du fond commun (typologie d'après Broglio et Kozłowski, 1983).

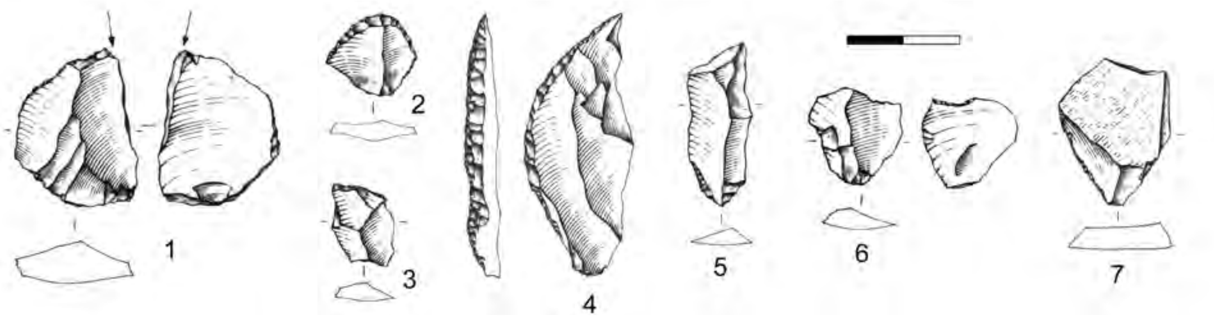


Fig. 37 – Common tools made on different blank types. 1 and 3: phase 4; 2, 4 and 5: phase 3; 6-7: phase 2.
Fig. 37 – Outils du fond commun sur supports différents. 1 et 3 : phase 4 ; 2, 4 et 5 : phase 3 ; 6 et 7 : phase 2).

All together more than half of the common tools display diaclastic surfaces of the original block (tables 9 and 10). Because of the features of the knapped blocks, diaclastic fracture planes prevail over limestone cortex. The former, presenting a smooth surface, neither hindered flaking nor limited the use and modification of the obtained blank. In a great majority of cases the diaclastic or cortical portions cover at most 25% of the dorsal face.

A fair number of common tools were made on maintenance blanks, probably because of their robustness. This can be inferred from the frequency of rejuvenation blanks, mostly stemming from the correction of hinged negatives, of lateral flakes, core tablets and crests (table 11).

Blanks / elements of the common tools	Phase 2	Phase 2+3	Phase 3	Phase 4	Total
Flakes	48		35	29	112
Laminar flakes	24	1	24	11	60
Blades	20		15	11	46
Bladelets	22		17	12	51
Former core				1	1
Debris / Scatter	2			1	3
Natural block / plaquette	2		1	5	8
Indeterminabile	35		14	20	69
Total	153	1	106	90	350*

Table 8 – Blanks and other elements used for the production of common tools.
Tabl. 8 – Supports et autres éléments sélectionnés pour la confection des outils du fond commun.

Limestone cortex on common tools	Phase 2	Phase 2 + 3	Phase 3	Phase 4	Total
1%–25% of dorsal face	34		16	15	65
25%–50%	4	1	5	9	19
50%–75%	2		2	4	8
75%–100%	1		3	1	5
Total	41	1	26	29	97

Table 9 – Extension of limestone cortex on the dorsal face of the common tools.
Tabl. 9 – Distribution du cortex calcaire sur la face dorsale des outils du fond commun.

Diaclasic fracture planes on common tools	Phase 2	Phase 2 + 3	Phase 3	Phase 4	Total
1%-25% of dorsal face	27		21	18	66
25%-50%	10		5	9	24
50%-75%	11		2	4	17
75%-100%	3		3	1	7
Total	51		31	32	114

Table 10 – Extension of diaclastic fracture planes on the dorsal face of the common tools.
Tabl. 10 – Distribution des surfaces diaclastiques sur la face dorsale des outils du fond commun.

Maintenance blanks among common tools	Phase 2	Phase 2 + 3	Phase 3	Phase 4	Total
Rejuvenation flaking surface	18		14	13	45
Crested product	2		1		3
Core tablet	1		2	1	4
Lateral products	7		5		12
Rejuvenation generic	1				1
Total	29		22	14	65

Table 11 – Account of the maintenance blanks used for the manufacture of common tools.
Tabl. 11 – Décompte des éclats d’entretien sélectionnés pour la confection des outils du fond commun.

Cherts used for the common tools

Chert varieties oth from both the Non and Finonchio/Folgaria areas were exploited for the common tools (fig. 34, fig. 35 and fig. 36). Whilst their values are nearly equal in phases 2 and 3, with a slight predominance of Finonchio/Folgaria chert, Non cherts largely prevail among the common tools in phase 4. Raw materials from both areas are represented by products and by-products originating from the different stages of the reduction sequence. Again no substantial difference can be recognised with regard to the selection of distinct blanks for these implements.

CONCLUSIONS

The analysis of the lithic industries from the phases 2, 3 and 4 of the Galgenbühel site offers insights into raw-material management, reduction sequences and displacements of Sauveterrian groups along the Adige Valley and its adjacent areas.

The analysis of the raw materials provides evidence for the exploitation of Upper Jurassic to Eocene flint-bearing limestones deposited in the western margin of the Trento plateau. On the basis of the depositional patterns of the cherty formations that influenced both the qualitative and quantitative distribution of the cherts, two main procurement areas have been identified. The closest area is the Non Valley, 10 km in a straight line west of the site. In the condensed Non series cherts from the Scaglia Variegata Alpina and from the Scaglia Rossa formations were exploited. A second procurement area, located at about 35–40 km in a straight line south of the site, comprises the Mount Finonchio and the Folgaria plateau. Here more complete sedimentary sequences outcrop, including the chert-bearing Maiolica, Scaglia Variegata Alpina, Scaglia Rossa and Chiusole formations.

Despite its close proximity to the site the Non Valley cherts are only slightly predominant (during phases 2 and 4) and even less frequent than the Finonchio/Folgaria varieties (during phase 3). The relatively high frequency of Finonchio/Folgaria material cannot be explained by the seeking for raw material of better quality, as the cherts from both areas are comparable with regard to texture, rheology and block morphology. In both areas cherts predominantly occur as blocks affected by natural cracks caused by tectonic or thermoclastic processes, thus isolating small rectangular prisms with diaclastic flat surfaces. The rough chert blocks collected from both areas were transported to the site, where all the stages of the reduction sequences are represented. The side length of the exploited blocks was generally 3–6 cm (a single block with 8 cm represents the largest example). The size limit did not constitute a problem for the attested debitage, which principally aimed at producing limited series of thin and not standardised bladelets, on flaking surfaces with weak convexities. During the reduction process the diaclases were generally used as striking platforms and core flanks. It has to be highlighted that no significant differences in the size and shape of the exploited blocks, the reduction processes, blank selection and tool manufacturing can be observed between the Non and the Finonchio/Folgaria raw material. It should be noted that in phases 2 and 4 the latter varieties seem to be slightly more related to bladelet production than in phase 3. The manufacturing of microliths was based on the modification of thin blanks, mostly bladelets, by intentional shortening through the microburin technique and by unipolar abrupt retouch. Common tools were obtained from all the different blank categories (mostly generic flakes), including by-products originating from core initialisation and maintenance. A modest number of large specimens, mostly common tools on large laminar flakes and blades, are not compatible with the bladelet reduction sequences, and suggest the importation of finished items. Such evidence can be reported from both procurement areas, with a concentration of Finonchio/Folgaria cherts during phase 2.

At the same time a slight change in raw-material management, debitage and tool manufacturing are observed going from phase 3 to phase 4. It is not clear at the moment how the increased preference for better-quality chert types and the more diverse procurement contexts perceptible in phase 4 could be related to the contemporaneous size reduction of the industry, especially the microliths, and the emergence of 'new' microlith types in this phase. Is it just a coincidence, or is this evidence related to occupation by groups with slightly different equipment?

The idea of rather indistinct raw-material procurement from two different areas, located at a certain distance from each other, meeting the same flaking objectives, suggests that collection took place on the occasion of periodic migrations based on other economic activities, maybe on the exploitation of different ecological niches in a wider area. This procurement strategy persisted over a time span of several hundred years, indicating a continuation of habits among hunter-gatherer groups belonging to the same cultural tradition.

Considerations about the accessibility of the identified areas provide indications about mobility patterns. The outcrops of the Non Valley are located in a mid-mountain environment. They are easily accessible from the Adige Valley along two possible routes (fig. 38): either by passing the mountain chain on the left side of the Adige Valley opposite the site, or by travelling along the Noce River. Indeed, besides the general evidence that the Non cherts were mainly collected from detritic talus, the additional use of torrent pebbles attested in phase 4 could be related to the latter itinerary.

The Finonchio/Folgaria area is also located in a mid-mountain environment. The cherts were collected mainly from the residual soils of the karstic plateau. The territory is easily accessible from the bottom of the Adige Valley by passing through the west-east-oriented depression of the Gola valley, which opens east of the Calliano village. The most direct connection between the plateau

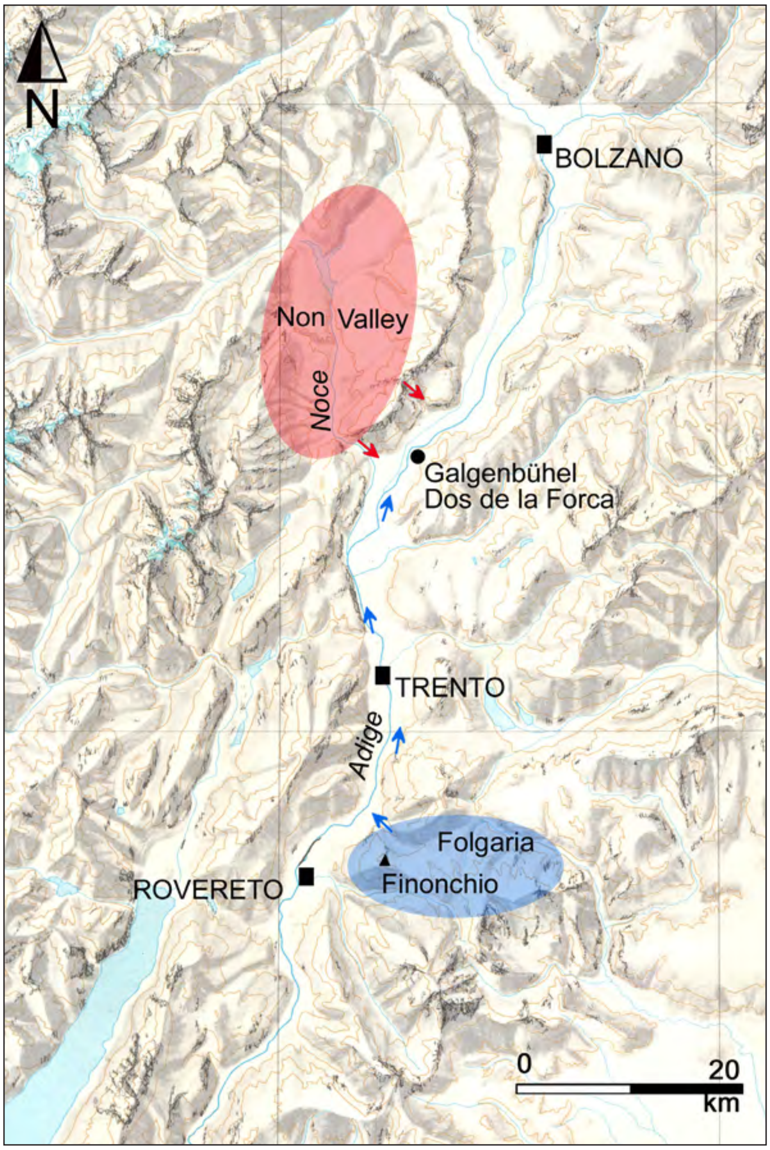


Fig. 38 – Possible routes connecting the identified chert procurement areas (in red and in blue) and the Sauveterrian site Galgenbühel/Dos de la Forca in the Adige valley.
Fig. 38 – Itinéraires possibles entre les deux aires d'approvisionnement identifiées (en rouge et en bleu) et le site sauveterrien de Galgenbühel-Dos de la Forca dans la vallée de l'Adige

and the site runs along the Adige Valley itself, a straight trajectory without great altitude variations as no secondary valleys have to be crossed. Because of the complex hydrographic setting of the valley bottom expected in the Early Holocene, with a meandering river course and extended secondary standing and slow-flowing waters, the best possible routes would have crossed the detritic talus at the foot of the rock walls and the alluvial cones bordering the valley. Furthermore the additional use of waterways has to be taken into account as we are referring to human groups with a strongly wetland-based economy.

Acknowledgements: This work is part of the multidisciplinary research project "Leben am Wasser. Ressourcen, Technik und Mobilität im Mesolithikum am Beispiel der Fundstelle Galgenbühel in Salurn (Südtirol)" funded by the Autonomous Province of Bolzano - South Tyrol, Higher Education Support, University and Research Office. The project is headed by the South Tyrol Museum of Archaeology and coordinated by U. Wierer. Project partner is the Ufficio Beni Archeologici of Bolzano.
We thank Lapo Baglioni for the drawings of the lithic artefacts, Paolo Boscato and Stefano Ricci for their help with the magnesium treatment and photos, Beatrice Vacca for correcting the English text, Federica Fontana for the French translations and the unknown reviewer for the useful comments.

NOTE

S. Bertola carried out the raw material study and U. Wierer the techno-typological study. The conclusions were drawn up jointly by the authors.

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