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# ORNAMENTAL TRADITIONS OF THE LATE PLEISTOCENE AND THE EARLY HOLOCENE FORAGERS IN THE EASTERN ALPS: THE CASE OF RIPARO BIARZO

## ANALISI DELLE SCELTE ORNAMENTALI DEI GRUPPI DEL PALEOLITICO FINALE E DEL MESOLITICO AL RIPARO DI BIARZO

**Riassunto breve** - Il Riparo di Biarzo (Prealpi Giulie, Friuli) ha restituito un ricco insieme di ornamenti in conchiglia attribuibili alle occupazioni del Pleistocene finale (Epigravettiano) e dell'Olocene antico (Mesolitico). In questo articolo, i risultati dell'analisi tecno-funzionale condotta su tali ornamenti vengono presentati e discussi in un ampio contesto regionale che coinvolge possibili reti di scambio, strategie di mobilità e connessioni tra l'arco Alpino orientale e le regioni dell'Adriatico settentrionale.
**Parole chiave**: Pleistocene Superiore, Olocene Antico, Tradizioni ornamentali dei cacciatori-raccoglitori, Conchiglie ornamentali, Gasteropodi marini e d'acqua dolce, Reti di scambio e strategie di mobilità.

**Abstract** - *Exceptionally for the eastern Alpine region, this site of Riparo Biarzo (Julian Alps, Friuli) has yielded a rich ensemble of shell ornaments related to both Late Pleistocene (Epigravettian) and Early Holocene (Mesolithic) occupations. The results of the techno-functional analysis carried out on these ornaments are presented and discussed in a wider regional context, which entails exchange networks, mobility strategies and connectivity between the eastern Alpine and the north Adriatic regions.*
**Key words**: *Late Pleistocene, Early Holocene, Foragers' ornamental traditions, Shell ornaments, Marine and freshwater gastropods, Exchange-networks and mobility strategies.*

## 1. Introduction

Ornaments are widely recognized as most important media of social communication among human societies and their role in expressing and constructing personhoods. They can convey social identity, ethnicity, status, age class, etc. (e.g. Kuhn & Stiner 2007; Vanhaeren 2009), as shown by a number of ethnographic accounts and anthropological studies.

Archaeological data have shown that beads, pendants, or appliqués were part of a visual vocabulary that related to the evolution of human cognitive and behavioral modernity along with their function in broadcasting social information during various periods in the past. For this reason, archaeologists consider ornaments as key evidence in discussions about past societies and their symbolic expressions. In Europe, the presence of body ornaments first became widespread during the Early Upper Palaeolithic (ca. 40ka years ago). In the course of the Upper Palaeolithic for the first time we find regionalized patterns in the use of particular types of ornaments for body adornment, and some of these patterns remained persistent throughout millennia of forager existence (Vanhaeren & d'Errico 2006). In particular marine as well as freshwater gastropods and shells were an important component of these ornamental repertoires, with evidence of long-distance circulation of particular gastropod and shell species (ref. Vanhaeren & d'Errico 2005).

This paper examines personal ornaments made of shell from the site of Riparo Biarzo in the Natisone Valley of Friuli Venezia Giulia (Julian Pre-Alps), as a particular case of diachronic changes in the use of different types of marine and freshwater species for the manufacturing of ornamental beads from the Late Palaeolithic to the Neolithic periods. Exceptionally for the eastern Alpine region, this site has yielded important evidence of continuous occupation by Late Pleistocene and Early Holocene foragers. The techno-functional analysis of these ornaments focuses on the reconstruction of foragers' ornamental traditions and their transformations over time. The paper will examine the place of shell ornaments from Riparo Biarzo in wider regional exchange networks, mobility strategies and connectivity between the eastern Alpine and the north Adriatic regions.

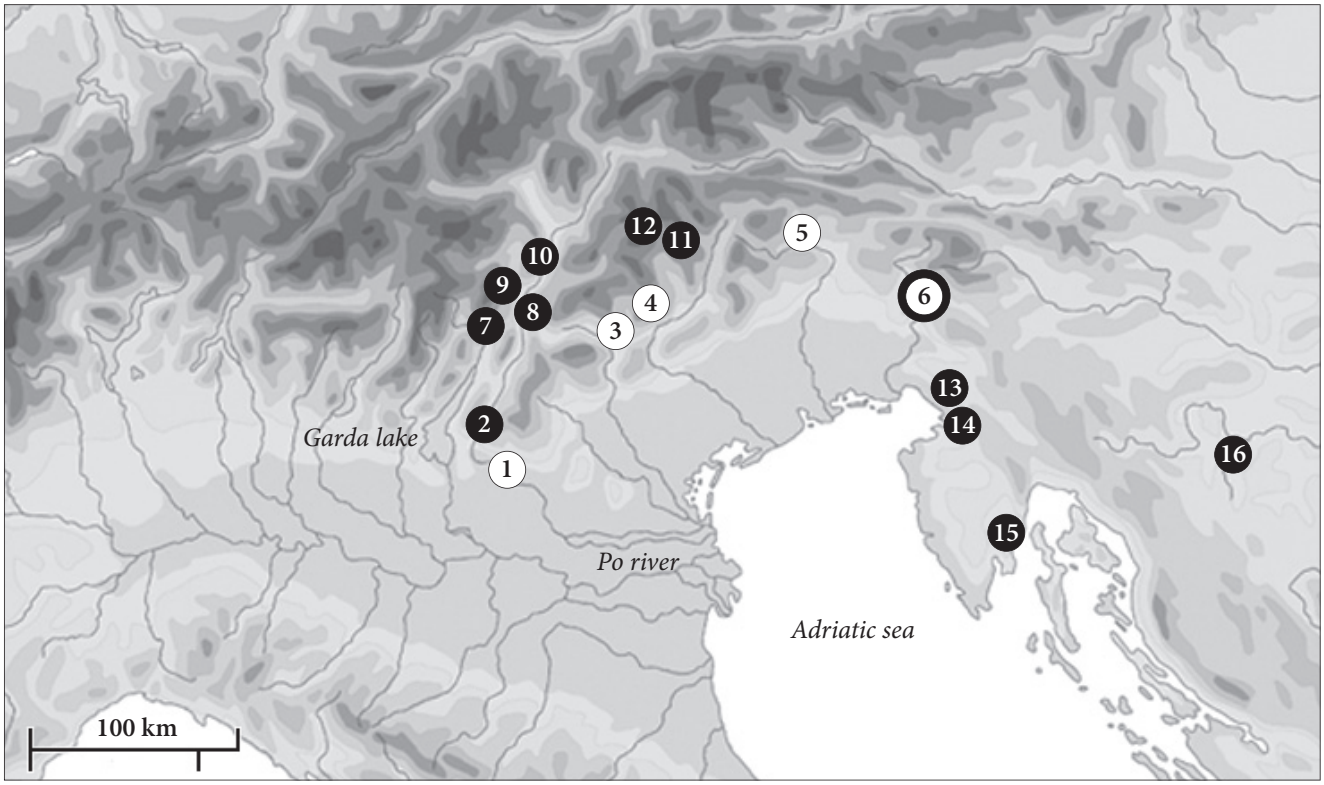


Fig. 1 - Map of the sites located in the eastern Alpine region, North Adriatic area and its hinterland cited in the article. White dots indicate Late Epigravettian occupations and black dots indicate Mesolithic occupations. 1 - Riparo Tagliente, 2 - Riparo Soman, 3 - Riparo Dalmeri, 4 - Riparo di Villabruna, 5 - Grotte Verdi di Pradis, 6 - Riparo Biarzo, 7 - Riparo Romagnano, 8 - Riparo Gaban, 9 - Riparo Pradestel, 10 - Vatte di Zambana, 11 - Mondeval de Sora, 12 - Plan de Frea, 13 - Grotta dei Cliclami, 14 - Grotta Azzurra, 15 - Pupićina Cave, 16 - Zala Cave.
- *Mappa dei siti localizzati fra Alpi Orientalie e nord Adriatico citati nel testo. I cerchi bianchi indicano siti del tardo Epigravettiano, quelli neri siti del Mesolitico.*

## 2. Site background, chronology and excavation methodology

Riparo Biarzo is located at the altitude of 160 m asl, on an alluvial terrace on the left bank of the Natisone River, in the Julian Pre-Alps (north-eastern Italy) (fig. 1).

The site was excavated from 1982 to 1984 by F. Bressan and A. Guerreschi and has yielded a stratigraphic column ca. 1.5 m thick, which has been excavated over the area of ca. 2 m$^2$ (Bressan & Guerreschi 1987). The site stratigraphy revealed during the excavation consists of the following main layers/archaeological phases (fig. 2):

- Bronze Age (US1);
- Middle Neolithic (US2);
- Early and Late Mesolithic (US3-characterized by 2 sub phases 3B and 3A)[(1)]
- Early Mesolithic U4
- Late Epigravettian (US5).

1) US 3 has later been divided in two sub phases: US3A which is attributed to Late Mesolithic (Castelnovian) with Early Neolithic disturbance (presence of Impresso potsherds) and US 3B which is attributed to Early Mesolithic (Sauveterrian), on the basis of the presence of geometrics (triangles in 3B and trapezes in 3A).

The layers belonging to the Late Epigravettian occupation are best characterized in the entire stratigraphy of this site. The US5 has yielded a date of 11,100±125 BP (R1850) (13128-12826 BP at 68.2% - OxCal v4.1.7, Bronk Ramsey 2009) made on charcoal, which puts this Final Palaeolithic occupation of the site in the Late Glacial Interstadial (Allerød).

Pollen data for the Epigravettian occupation (US5) indicate forests with spruce/larch (*Picea*/*Larix*), scots/mountain pine (*Pinus sylvestris*/*montana*) and birch (*Betula* sp.).

The lithic industry from US5 is mainly characterized by scrapers, in particular the small circular ones (thumbnails scrapers), burins, truncations, becks and backed blades (Bressan, Cremaschi & Guerreschi 1983). Functional analysis carried out on the lithic material has revealed that the processing of animal material (e.g. hunting, hide treatment, bone working) represented the main activity carried out at the site (Ziggiotti 2007).

Faunal remains from the different prehistoric levels of Riparo Biarzo have been studied by P. Rowley-Conwy in 1996 and, recently, by M. Romandini and M. Bertolini. The latter authors have analyzed in more detail the Late Pleistocene fauna from US5 (Bertolini

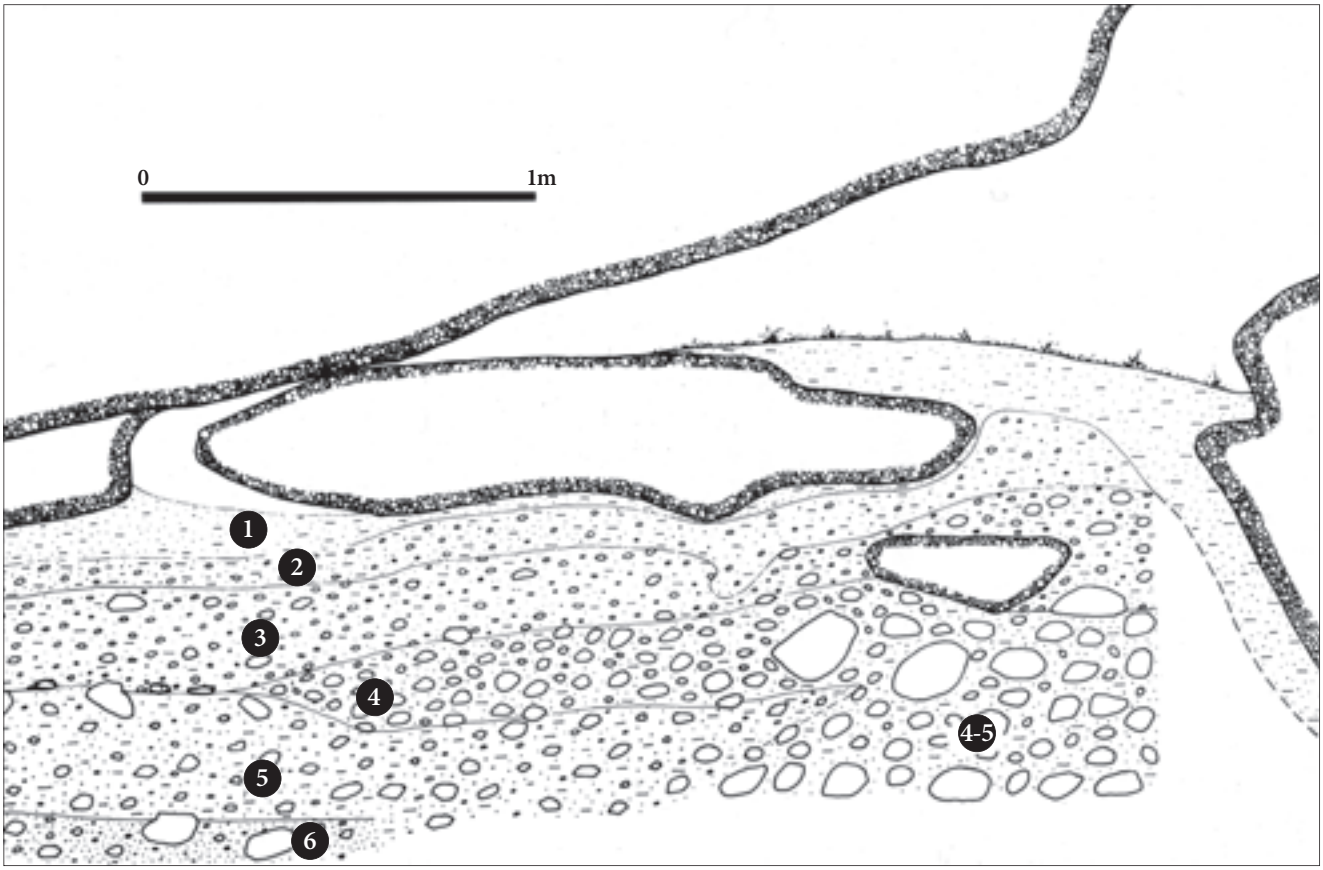


Fig. 2 - Stratigraphy of Riparo Biarzo and (right) the entrance and the inside of the Cave.
- *Stratigrafia del Riparo di Biarzo e (a destra) l'ingresso e l'interno della cavità.*

& Romandini 2010). Epigravettian groups hunted a wide range of species (ibex, deer, wild boar, marmot and bear) associated with different environmental eco-zones found in the proximity of the site. Some fishing activity has also been evidenced. Based on the seasonality of wild boar, the site might have been occupied during the cold season, from the end of autumn to the beginning of summer, whereas the ichthyofauna suggests that the site might have been used all year round, with intensified fishing activity during summers and autumns. Faunal remains from Mesolithic levels (US 3B and 3A) reveal that foragers mainly hunted red deer and roe deer, and to a lesser degree wild boar, typical of more forested environments. Palaeo-botanical remains from Mesolithic layers are poorly preserved. The presence of the following tree species has been documented: elm (*Ulmus* sp.), hazel (*Corylus avellana* L.), oak (*Quercus* sp.) and ash (*Fraxinus* sp.).

The lithic industry from layers 4 and 3B represents a typical Sauveterrian industry, characterized by burins, backed points, truncations, geometrics such as triangles (comparable to the triangles of Montclus) microburins, tools with backed retouch, which is comparable to the upper part of layer AC of Riparo Romagnano in the Adige Valley (Bressan et al. 1983). In layer 3A some

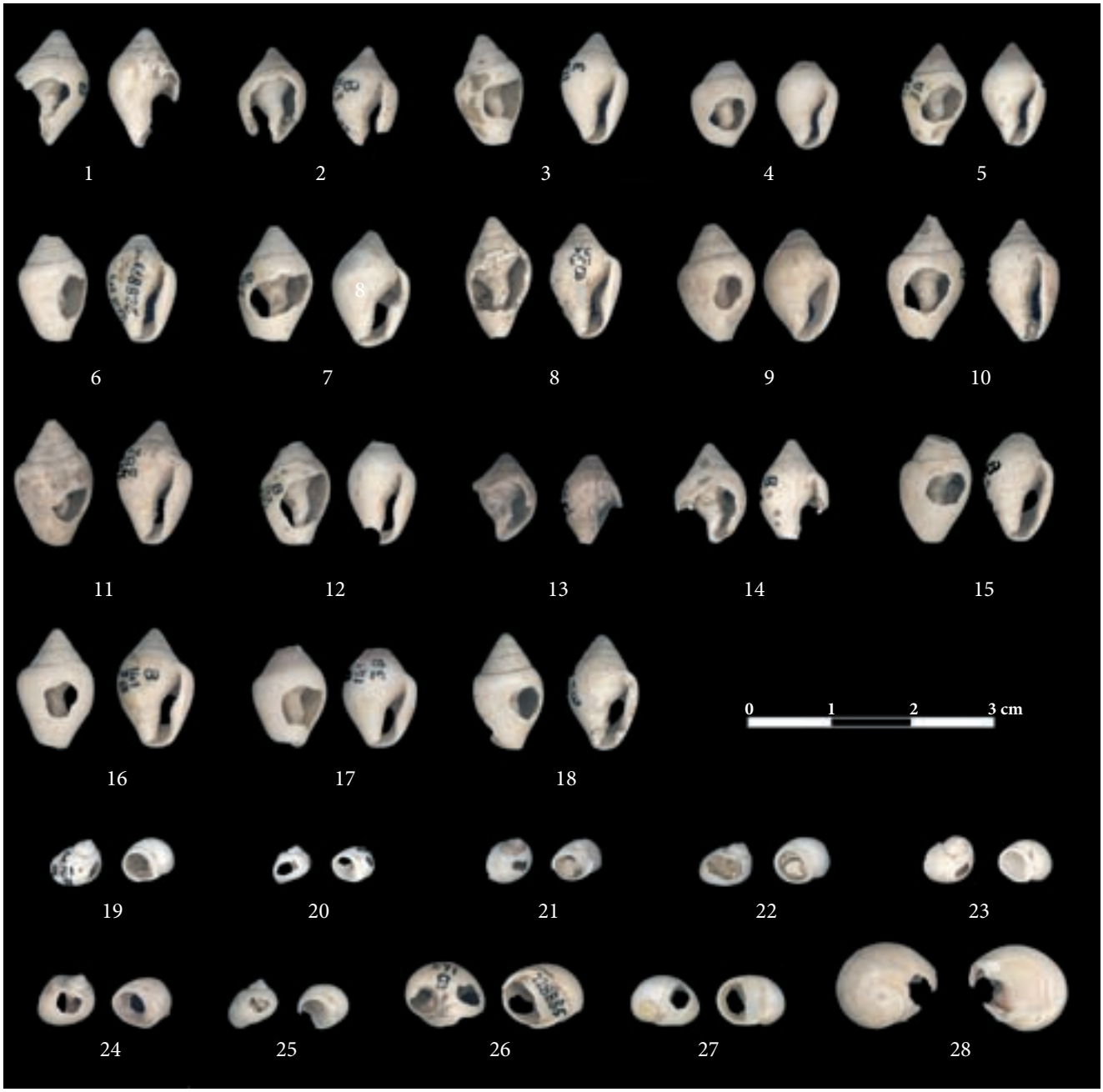


Fig. 3 - Selection of ornaments from Riparo Biarzo. 1-18: *Columbella rustica*; 19-25: *Lithoglyphus naticoides;* 26-27: *Theodoxus danubialis*; 28: *Cyclope neritea*.
- *Selezione di ornamenti dal Riparo di Biarzo.*

| **Period/phase** | *Cyclope donovani* | *Cyclope neritea* | *Columbella rustica* | *Cardium* sp. | *Cerastoderma glaucum* | *Lithoglyphus naticoides* | *Theodoxus danubialis* | **Total** |
|---|---|---|---|---|---|---|---|---|
| Neolithic | | | 2 | 1 | 1 | | 1 | 5 |
| Castelnovian (with Early Neo disturbance) | | | 8 | | | 7 | 1 | 16 |
| Sauveterrian | | 1 | 14 | | | | | 15 |
| Late Epigravettian | 1 | 5 | 1 | | | 3 | 1 | 11 |
| NA | 1 | 1 | 8 | 1 | | 1 | | 12 |
| **Total** | 2 | 7 | 33 | 2 | 1 | 11 | 3 | 59 |

Tab. I - Frequencies of gastropods and bivalves species used for the production of ornaments by the main chrono-stratigraphic units at Riparo Biarzo.
- *Frequenza di gasteropodi e bivalvi utilizzati al Riparo di Biarzo per la realizzazione di ornamenti, in base alle principali unità.*

trapezes, which are typical of the later Castelnovian phase, have also been recovered, whereas in the upper part of layer 3A, few Impresso potsherds have been found. The presence of pottery fragments has been interpreted as a Neolithic disturbance on the basis of geo-archaeological data, which report the erosion of the more superficial part of layer 3A, where materials from layers 2 and 1 have been found (Bressan et al. 1983). Furthermore, pollen data and microfaunal remains are more comparable to the end of Boreal (i.e. those recoded in layer 4) and the climate was still not humid and warm as would be expected if the layer 3A would have formed during the Atlantic. Consequently, the hypothesis that the presence of Impresso potsherds could relate to a later Neolithic disturbance is highly probable. The only date on charcoal available for layer 3A is 5600 ± 300 BP (R1S51) (5210-3906 BC at 93.5% - OxCal v4.1.7, Bronk Ramsey 2009), which is too recent to be considered as reliable.

## 3. The assemblage

The whole assemblage of prehistoric ornaments from Riparo Biarzo is composed of 59 perforated shells from marine and freshwater gastropods and bivalves. In particular, 11 ornaments can be attributed to the Late Epigravettian, 15 to the Sauveterrian period, 16 to the Castelnovian layers and 5 to the Early Neolithic. In addition, a total of 12 ornaments lack a precise stratigraphic provenance (fig. 3).

Throughout the stratigraphic sequence, ornaments have been produced on bivalves (*Cardium* sp. and *Cerastodema glaucum*), marine gastropods (*Cyclope neritea*, *Cyclope donovani*, *Columbella rustica*) and freshwater snails shells (*Lithoglyphus naticoides* and *Theodoxus danubialis*).

Marine gastropods (*Cyclope neritea*, *Cyclope donovani*, *Columbella rustica*) selected overtime for the production of ornaments at Riparo Biarzo are typical of both rocky and sandy seashores of the northern Adriatic region and the Po River delta. In particular, *Cyclope neritea* L. 1758 is a species of marine gastropods that belongs to the family Nassariidae, and is widespread in shallow waters of the Mediterranean, sandy shores of the Atlantic coast (e.g. in Portugal, Spain and France) as well as in coastal lagoons, saltmarshes (Nordsieck 1968; Pérès & Picard 1964; Sacchi 1960; Southward et al. 1997) and close to river mouths (Shackleton 1998: 25; Sakellariou 1957). As for *Columbella rustica* L. 1758, this gastropod lives in warm waters and can be found on the coasts of the Mediterranean Sea as well as in the nearest parts of the Atlantic Ocean (Algarve in Portugal, NW Africa, the Canary islands, the Azores and Madeira - Poppe & Goto 1991). As for the freshwater gastropods, *Theodoxus danubialis* is a common species in the rivers and streams of the north Alpine regions whereas *Lithoglyphus naticoides* is distributed in the shallow waters of rivers and lakes in central and eastern Europe (Harzhauser et al. 2007; Mastitsky & Samilenko 2006) as well as in the Balkans, in the rivers of the Black Sea drainage basin (Radoman 1983).

Although most of these species are present throughout the stratigraphic sequence, some changes in the selection of shells for the production of ornaments can be observed from the Late Epigravettian to the Early Neolithic. (The Bronze Age layer has yielded only a small fragment of an unidentifiable perforated shell) The major variety in shell selection characterizes the Late Epigravettian, with both freshwater snails (*Theodoxus danubialis* and *Lithoglyphus naticoides*) and marine gastropods (*Columbella rustica*, *Cyclope neritea* and *Cyclope donovani*) used. In particular, the use of Neritidae gastropods (*Cyclope neritea* and *Cyclope donovani*) characterizes only the later phases of the Epigravettian, with the exception of one specimen found in the Sauveterrian level. On the other hand, the use of bivalves (*Cardium* sp. and *Cerastodema glaucum*) is restricted to the Early Neolithic period. *Lithoglyphus naticoides* characterizes the Upper Palaeolithic and Late Mesolithic phases of occupation as 7 ornaments of this species come from the Castelnovian layer and three from

| | No residue | Ochre | Total |
|---|---|---|---|
| **Neolithic** | **3** | **2** | **5** |
| *Cardium* sp. | 1 | | 1 |
| *Cerastoderma glaucum* | 1 | | 1 |
| *Columbella rustica* | | 2 | 2 |
| *Theodoxus danubialis* | 1 | | 1 |
| **Castelnovian/Early Neo** | **9** | **7** | **16** |
| *Columbella rustica* | 6 | 2 | 8 |
| *Lithoglyphus naticoides* | 3 | 4 | 7 |
| *Theodoxus danubialis* | | 1 | 1 |
| **Sauveterrian** | **12** | **3** | **15** |
| *Columbella rustica* | 11 | 3 | 14 |
| *Cyclope neritea* | 1 | | 1 |
| **Late Epigravettian** | **6** | **5** | **11** |
| *Columbella rustica* | 1 | | 1 |
| *Cyclope donovani* | 1 | | 1 |
| *Cyclope neritea* | 4 | 1 | 5 |
| *Lithoglyphus naticoides* | | 3 | 3 |
| *Theodoxus danubialis* | | 1 | 1 |
| **Unclear stratigraphic provenance** | **4** | **8** | **12** |
| *Cardium* sp. | | 1 | 1 |
| *Columbella rustica* | 3 | 5 | 8 |
| *Cyclope donovani* | 1 | | 1 |
| *Cyclope neritea* | | 1 | 1 |
| *Lithoglyphus naticoides* | | 1 | 1 |
| **Total** | **34** | **25** | **59** |

Tab. II - Presence of ochre residues in the ornamental assemblage.
- *Presenza di residui d'ocra negli elementi ornamentali.*


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16

the Late Epigravettian layer. Ornaments of *Columbella rustica* define the Mesolithic ornamental preference, as 22 out of 24 shells with stratigraphic provenance come from the Sauveterrian and Castelnovian layers, one from the Late Epigravettian and two from the Neolithic layers.

## 4. The methodology

The assemblage of ornaments from Riparo Biarzo has undergone a technological and residue analysis with the aim of reconstructing the modalities of ornaments production and use. The methodology is based on the integration of metrical, technological and use-wear studies, aided by taphonomical analysis and experimental comparison. Metrical variables included dimensions of the ornaments (maximal length, width and thickness of the entire and fragmented artifacts) as well as measurements made on perforations (maximal length and width). Moreover, the location of the perforations on the shells has also been documented.

Archaeological ornaments have been microscopically examined at magnification ranging from 0.75 to 80X using a stereoscopic microscope Leica S8APO with optical fibers lighting and an environmental SEM Hitachi T3000. The analytical criteria for the technological study of Riparo Biarzo ornaments were established by reference to several publications on the production and use of shell and osseous ornaments from prehistoric contexts (e.g. Bonnardin 2007, 2009; d'Errico & Vanhaeren 2002; Vanhaeren & d'Errico 2001, 2003, 2005). Experimental replicas of archaeological ornaments made on modern specimens of *Cyclope neritea* and *Columbella rustica* marine shells were used for testing technological and functional interpretations of the archaeological specimens from Riparo Biarzo. The evaluation of taphonomic alteration on archaeological ornaments has been based on the articles by Driscoll & Weltin (1973), Claassen (1998) and d'Errico et al. (2005). Type and distribution of use-wear traces and residues on well preserved ornaments have been recorded with regard to the hole, the lip of gastropod shells and their dorsal and ventral surfaces[2].

2) In this article, the ventral surface of coiled gastropods is considered the part of the shell which faces downwards during locomotion and where the aperture is located. The dorsal surface is the part of the shell which emerges during locomotion and where the body whorls are located (e.g. *Cyclope neritea*) or the one which is opposite to the surface where the aperture is located (e.g. *Columbella rustica*).

Fig. 4 - Technological use-wear traces and residues identified on Late Upper Palaeolithic and Mesolithic ornaments from Riparo Biarzo: 1. Close up of one perforated shell of *Columbella rustica* from Sauveterrian level; 2. Perforated *Columbella rustica* shell from Sauveterrian level; 3. Modern *Columbella rustica* perforated by indirect percussion from outside to inside using a flint flake and a stone pebble. Note the irregular outline of the perforation; 4. Close up of the experimental hole produced on a modern *Columbella rustica* shell by indirect percussion from the outside to the inside and using a flake and a pebble. Note the flint striations on the side of the perforation, close to the impact point; 5. SEM image of a worn and flattened upper dorsal surface of a *Columbella rustica* from Sauveterrian level; 6. Perforated *Columbella rustica* with rounding on the upper and lower parts of the perforation from Sauveterrian level; 7. Striations and ochre residues recognized along the upper part of the perforation of a *Colubella rustica* from Castelnovian level (scale bar 200 μm); 8. Close up of the perforation of a *Cyclope neritea* from Late Epigravettian level; 9. Experimental hole on *Cyclope neritea* produced by pressure from the inside of the shell to the outside using a wooden stick; 10. Rounding along the lip of a *Columbella rustica* perforated shell from Castelnovian level; 11-12. SEM images of a *Lithoglyphus naticoides* perforated shell from Castelnovian levels. Note the perforation on the left and the deformation from use on the right (11); note a close up of the deformation and micro-striations due to compression from prolonged use (12); 13. Perforated shell of *Cyclope neritea* from Late Epigravettian level with broken lip; 14. Close up of a facet located on the perforation rim of one *Cyclope neritea* from Late Epigravettian level; 15. Rounded and slightly deformed lip of a perforated shell of *Theodoxus danubialis* from Epigravettian level; 16. *Lithoglyphus naticoides* with ochre residues from Castelnovian level. Except when differently indicated, scale bar = 1 mm.

- *Tracce tecnologiche, di utilizzo e residui identificati su ornamenti del Paleolitico superiore finale - Mesolitico dal Riparo di Biarzo: 1. Dettaglio di una conchiglia perforata di* Columbella rustica *dal livello del Sauveterriano; 2. Conchiglia perforata di* Columbella rustica *dal livello del Sauveterriano; 3.* Columbella rustica *attuale, forata tramite percussione indiretta, dall'esterno all'interno, utilizzando una scheggia di selce ed un ciottolo. Si noti il bordo irregolare della perforazione; 4. Dettaglio del foro sperimentale realizzato sulla conchiglia di una* Columbella rustica *attuale, tramite percussione indiretta, dall'interno all'esterno, utilizzando una scheggia ed un ciottolo. Si notino le striature della selce sulla perforazione, vicino al punto di impatto; 5. Immagine al SEM della superficie dorsale superiore, con faccette di appiattimento prodotte dall'utilizzo di una* Columbella rustica *dal livello del Sauveterriano; 6.* Columbella rustica *perforata con arrotondamento sulle parti inferiore e esuperiore del foro, dal livello del Sauveterriano; 7. Striature e residui di ocra, individuati lungo la parte superiore della perforazione di una* Columbella rustica *dal livello del Castelnoviano (scala pari a 200 μm); 8. Dettaglio di una perforazione su* Cyclope neritea *dal livello dell'Epigravettiano finale; 9. Foro sperimentale su* Cyclope neritea *prodotto con la pressione dall'interno della conchiglia verso l'esterno; 10. Arrotondamento al labbro di una conchiglia perforata di* Columbella rustica *dai livelli del Castelnoviano; 11-12. Immagine al SEM della conchiglia forata di* Lithoglyphus naticoides *dai livelli del Castelnoviano. Si noti, in fig. 11, la perforazione sulla sinistra e la deformazione dall'uso sulla destra. Un dettaglio, in fig. 12, della deformazione e delle micro-striature dovute alla campressione per uso prolungato; 13. Conchiglia forata di* Cyclope neritea *con il labbro rotto, dal livello del'Epigravettiano finale; 14. Dettaglio della faccetta sul labbro di una* Cyclope neritea *dal livello dell'Epigravettiano finale; 15. Labbro arrotondato e leggermente deformato di una conchiglia foratata di* Theodoxus danubialis *dal livello dell'Epigravettiano finale; 16.* Lothoglyphus naticoides *con residui di ocra, dal livello del Castelnoviano. Salvo differenti indicazioni, la scala è pari a 1 mm.*

## 5. The analysis

All the shell beads have been analyzed in order to reconstruct the modalities of their production and use (tab. III).

Most of the shell beads recovered at Biarzo (67.8%) are entire and well preserved. Little exfoliation and pitting have been recorded on the ornaments with regards to the earlier phases of anthropic occupation (US5). The development of use-wear traces and the presence of residues (tab. II) indicate that ca. 90% of the perforated shells have been used. In particular, lip is missing on the 73% of the perforated gastropods shells.

*Late Epigravettian*

The Late Epigravettian assemblage is comprised of 11 specimens (see tab. I), which illustrate high diversity in the selection of the raw material. The ornaments comprise five *Cyclope neritea*, one *Cyclope donovani*, one *Theodoxus danubialis*, one *Columbella rustica* and three *Lithoglyphus naticoides*, all in a good state of preservation.

The technological analysis has shown that most of the shell bead perforations were produced by inserting a (wooden) stick inside the mouth of the shell and exercising a gentle pressure (fig. 4). As for the *Columbella rustica* bead, the outline of the perforation and the location of technological chipping on the perforation suggest the use of indirect percussion practiced from the outside towards the shell interior (fig. 4).

The distribution of the traces varies according to the species. Almost all the *Cyclope neritea*, *Cyclope donovani*, *Litoglyphus naticoides* and *Theodoxus danubialis* beads (10) show developed traces of use around the lip of the shell, where the shell was retained. The prolonged use has caused the breakage of the lip of two *Cyclope neritea* shells as well as the deformation of the lip of all the *Lithoglyphus naticoides* and *Theodoxus danubialis* beads (fig. 3). These four beads have also ochre residues on the siphon and the lip (tab. II).

Traces are also developed on the dorsal surface of the ornaments (8 out of 9 specimens show rounding on the dorsal surface). Also the specimen of *Columbella rustica* shows use-wear traces, which are located on the left side of the dorsal surface in proximity to the hole and inside it. It is likely that this ornament was displayed on its ventral side.

In the Epigravettian layer an atrophic red deer canine with an incomplete perforation has been found (Bressan et al. 1983).


Fig. 5 - Selection of the shells from the ornaments of Riparo Tagliente (from Gurioli 2006).
- *Selezione di conchiglie dagli ornamenti del Riparo Tagliente (da Gurioli 2006).*

*Early Mesolithic (Sauveterrian)*

The Early Mesolithic Sauveterrian assemblage comprises 15 ornaments out of which 14 are made of *Columbella rustica* and one of *Cyclope neritea* (tab. I).

Seven *Columbella rustica* shells lack their lips whereas the shell of *Cyclope neritea* is fragmentary (tab. III). Eight *Columbella rustica* shells show a specific perforation outline and technological traces (chipping), indicating that perforations were made from the outside to the inside (fig. 4). On eight best preserved specimen of *Columbella rustica* bead traces indicate a prolonged use. The developed rounding on the dorsal side and on the superior part of the perforations suggests that the beads were fastened through the lip (6 cases out of 8) and displayed in such a way that the ventral side of the shell (the one with the lip) was visible. It is not possible to ascertain whether they were used as appliqués or necklace/bracelet beads.

Four *Columbella rustica* and three *Lithoglyphus naticoides* beads come from unspecified locations within general Mesolithic layer US3. The *Lithoglyphus naticoides* beads have their lips deformed and the dorsal part of the hole rounded due to their prolonged use as appliqués. Ochre was found on three *Lithoglyphus naticoides* beads inside their perforations (fig. 4) and on inside two *Columbella rustica*, on their siphon.

*Late Mesolithic (Castelnovian)*

Sixteen ornaments from the Castelnovian layer comprise 7 specimens of *Lithoglyphus naticoides*, 8 specimens of *Columbella rustica* and one specimen of *Theodoxus danubialis* (tab. I).

In general, perforations on *Columbella rustica* shells have been practices from the outside to the inside through indirect percussion whereas freshwater gastropods have been perforated from the inside to the outside, by means of pressure technique. All the ornaments are characterized by very developed use-wear traces, the distribution and appearance of which is comparable with the Sauveterrian ornaments and suggest the prolonged use of the perforated shells as appliqués. In particular, modifications such as rounding and flattening of the dorsal surface characterize three *Columbella rustica* shells whereas rounding of the dorsal surface and deformation of the lip have been recognized on all the seven *Litoglyphus naticoides* ornaments as well as on the *Theodoxus danubialis*. Red ochre residues have been identified inside the siphon and along the ridges of the perforations of seven ornaments (2 *Columbella rustica* and 4 *Litoglyphus naticoides* and 1 *Theodoxus danubialis*), suggesting the use of ochred threads. Additionally, ochre is also present on the dorsal surface of one *Litoglyphus naticoides*, which suggest it might have been embroidered on colored leather.

*Ornaments with uncertain stratigraphic provenance*

A total of 12 perforated shells (one *Cyclope neritea*, one *Cyclope donovani*, 8 *Columbella rustica*, one *Lithoglyphus naticoides* and one *Cardium* sp.) lack precise stratigraphic provenance (tab. I). A part from the *Cardium* sp., which is present at Riparo Biarzo from the Neolithic levels, it is not possible to speculate about the likely stratigraphic provenance of these ornaments on the basis of their species. As a matter of fact, *Columbella rustica* and *Cyclope neritea* and *Cyclope donovani* are species present both during Late Upper Palaeolithic and Mesolithic at the site. Nevertheless, the presence of one shell of *Litoglyphus naticoides* would suggest a Late Epigravettian-Mesolithic provenance for this bead.

With the exception of *Columbella rustica*, all of the other shell ornaments have been perforated by indirect pressure from the inside part of the shells. On three *Columbella rustica* shells the lip is missing whereas use-wear traces on the other specimens reveal they have been used for a long time. A flattening deformation on the dorsal surface of the *Cyclope donovani* reveals this shell was used as an appliqué. A similar use is also suggested for the *Litoglyphus naticoides* on the basis of the distribution and appearance of the use-wear traces. Residues of ochre are present on ridge of the hole of eight shells.

| Species | Lip and base missing | Lip missing | Only apex preserved | Only siphon and lip preserved | Only siphon preserved | Whorls missing | Entire | Total |
|---|---|---|---|---|---|---|---|---|
| *Cardium* sp. | | | | | | | 2 | 2 |
| *Cerastoderma glaucum* | | | | | | | 1 | 1 |
| *Columbella rustica* | 3 | 7 | 1 | | | | 22 | 33 |
| *Cyclope donovani* | | 1 | | | | 1 | | 2 |
| *Cyclope neritea* | | 2 | | 1 | 1 | 1 | 2 | 7 |
| *Lithoglyphus naticoides* | | | | | | | 11 | 11 |
| *Theodoxus danubialis* | | 1 | | | | | 2 | 3 |
| **Total** | **3** | **11** | **1** | **1** | **1** | **2** | **40** | **59** |

Tab. III - Degree of preservation of the shell ornamental assemblage from Riparo Biarzo.
- *Grado di conservazione delle conchiglie utilizzate come elementi ornamentali al Riparo di Biarzo.*

*Neolithic*

The Neolithic assemblage comprises only 5 ornaments made of both marine gastropods such as *Columbella rustica* (two specimens), marine bivalves such as *Cardium* sp. (one specimen) and *Cerastoderma glaucum* (one specimen) and freshwater snail *Theodoxus danubialis* (one specimen).

All of these five specimens shells are complete and well preserved apart from the *Theodoxus danubilais*, which has the lip missing, and the *Cerastoderma glaucum*, which is fragmentary. Shells have been perforated by pressure, using a stick from inside towards outside and only *Columbella rustica* shells from the outside to the inside. Ochre residues are present on the two *Columbella rustica* shells.

## 6. Discussion and conclusions

The re-colonization of the eastern Alpine region and the adaptations of the Late Pleistocene and Holocene foragers of the region have been studied in detail over the last 40 years. However, few sites document continuous occupations from the end of the Pleistocene to the beginning of the Holocene and few of those have yielded rich assemblages of ornaments to inform about foragers' symbolic traditions and their transformations over time.

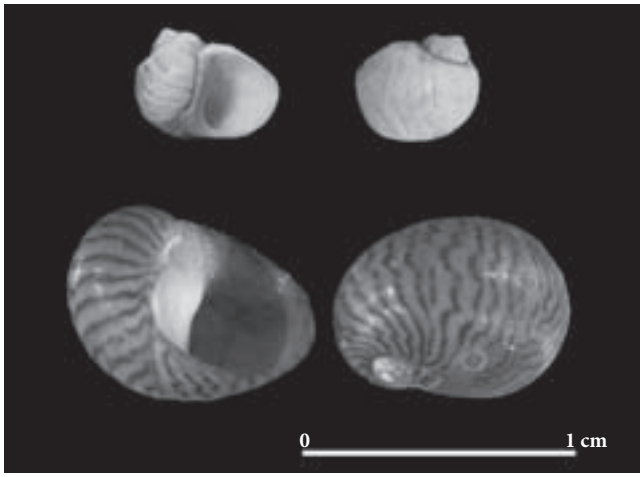


Fig. 6 - Modern examples of *Lithoglyphus naticoides* and *Theodoxus danubialis*.
- *Reperti attuali di* Lithoglyphus naticoides *e* Theodoxus danubialis.

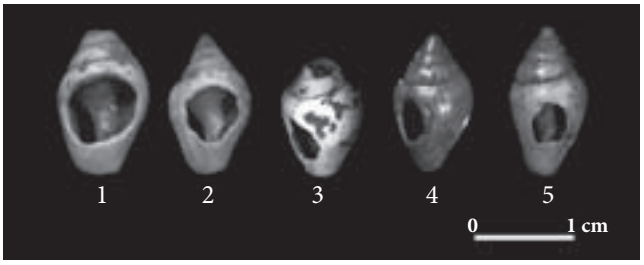


Fig. 7 - Selection of ornaments on shell (*Columbella rustica*) found at the Mesolithic sites of Adige valley. 1-2: Riparo Pradestel; 3: Riparo Romagnano; 4-5: Riparo Gaban.
- *Selezione di ornamenti su conchiglia (*Columbella rustica*) rinvenuti in siti mesolitci della Valle dell'Adige.*

In the following, I will review aspects ornaments recovered at Riparo Biarzo in the context of diachronic changes in the Late Pleistocene and Early Holocene foragers' ornamental traditions for the wider geographical framework of the eastern Alpine region and the north Adriatic area with its hinterland.

The characterization of the Late Epigravettian ornamental tradition in the eastern Alpine region is based on a series of findings recovered at a few sites (fig. 1). The most important site of the period is Riparo Tagliente in the Lessini Mountains (Verona) (fig. 1). At this site, which gave the first testimony of human re-colonization of the Pre-Alps at the end of the Last Glacial period, dated to the Oldest Dryas, ca. 14,500 years cal. BC (Bisi et al. 1983; Bartolomei et al. 1982; Fontana et al. 2002), a total of 728 ornaments have been recovered (Accorsi Benini 1972; Fiocchi 1998). The variety of shells and technological solutions related to beads production and use (e.g. gastropod shells and bivalves are characterized by both single and double perforations) make the ornaments from Riparo Tagliente one of the key-reference collections when trying to characterize the main components of the Epigravettian ornamental traditions in the eastern Alpine area (fig. 5). In total, 29 taxa have been recognized in the assemblage of ornaments from this site, out of which 24 belong to the class of Gastropods, 3 to Bivalves, and 2 are Scaphopods (Gurioli 2006). Most of the gastropod ornaments (638) belong to *Cyclope neritea*, followed by *Nassarius* sp. (25), *Columbella rustica* (16) and *Homalopoma sanguineus* (12) (Fiocchi 1998; Gurioli 2006).

All species present at Riparo Tagliente come from the Adriatic Sea but some exceptions are represented by *Nassarius circumcinctus* and *Buccinum undatum*, the former coming from the Levant and the latter not surely documented in the Mediterranean area (Fiocchi 1998). In addition to marine shells, ornamental choices at Tagliente involved the use of bone (a cylinder from a bird long bone and a long and thin entirely worked and perforated plaque with traces of red ochre) and mammal teeth (a bovine incisor, the third lateral incisor of wild boar, 15 perforated red deer canines and 7 unperforated specimens) (Cilli & Gurioli 2007).

Ornamental choices at other Late Epigravettian sites in the eastern Alpine region, such as Riparo Dalmeri in the Asiago Plateau, Riparo Villabruna in Val Cismon, are all comparable to Riparo Tagliente with regard to the frequency of perforated *Cyclope neritea* and *Columbella rustica* shells as well as red deer atrophic canines.

However, the analysis of ornaments from Riparo Biarzo has revealed that ornamental habits at this site also included the use of freshwater snail shells - *Theodoxus danubialis* and *Lithoglyphus naticoides* - from the Late Pleistocene onwards (fig. 6). Such ornaments show clear traces of use as appliqués, sewed onto clothes along with the presence of red ochre residues, which would suggest the use of colored threads, as already emphasized for other Epigravettian contexts in the eastern Alpine and Balkan regions (Cristiani et al. 2009; Cristiani & Borić 2012).

*Theodoxus danubialis* is a common species along the Danube River region from Germany to Bulgaria, also found in lakes and rivers from northern Italy to Slovakia, Ukraine and Croatia. Perforated *Theodoxus danubialis* has been found only in Aurignacian layers at Riparo Broion in the Berici Mountains and at Riparo Fumane in the Lessini Mountains (Romandini et al. 2012; Gurioli et al. 2003). Nevertheless, there is no evidence of any continuity in the utilization of such species until the end of the Mesolithic. Only at the end of the Mesolithic some examples are documented at Riparo Biarzo, Riparo Pradestel in the Adige Valley (contra Cristiani 2009[3]), Pupićina Cave in Istria, and at Zala Cave in central Croatia (Komšo & Vukosavljević 2011).

As far *Litoglyphus naticoides*, evidence about the use of this freshwater gastropod in the production of ornaments in Istria and central Croatia during the Mesolithic has recently been discussed (Komšo & Vukosavljević 2011). Intriguingly, apart from Late Epigravettian levels at Riparo Biarzo, this species is virtually absent from other contemporaneous Late Upper Palaeolithic locations in the eastern Alps as well as in the rest of the Italian peninsula.

As mentioned above, studies on the modern distribution of *Litoglyphus naticoides* have revealed that this species is present only in the rivers of the Black Sea drainage basin (Radoman 1983). In particular, *Litoglyphus naticoides* has disappeared or retreated to the downstream portions of Black Sea rivers during the Pleistocene glaciations and has recolonized Eurasia during the following post-glacial warming (Tyutin & Slynko 2010). Furthermore, paleoenvironmental records for northwestern Hungary show the presence of *Litoglyphus naticoides* in the Carpathian Basin between approximately 13,800 and 10,200 cal BP (Sümegi et al. 2008) and in the area between the NW Hungary and the Upper Danube Basin at the beginning of the Holocene.

These information about the ecology and distribution of *Litoglyphus naticoides* at the end of the Pleistocene and during the Early Holocene are very important as they reveal important aspects of foragers exchange networks and/or mobility strategies in the eastern Alpine region.

Prior to the discovery of perforated *Litoglyphus naticoides* shells in the Late Epigravettian layers of Riparo Biarzo, the use of such freshwater gastropods was virtually unknown in the Late Pleistocene and early Holocene archaeological record of the Mediterranean Basin. The few exceptions are all located in the Balkan peninsula, and in particular in the Mesolithic layers of Pupićina Cave in Istria (where they most probably represent imported items) and at Zala Cave in central Croatia (Komšo & Vukosavljević 2011). Perforated *Litoglyphus naticoides* have also been found in Gravettian (Cârciumaru et al. 2010) and Epipalaeolithic sites in Romania (Boroneant 1999), Mesolithic levels of northern Europe sites (Rähle 1978; Eriksen 2002) as well as in the Central European Early Neolithic burial contexts (Hladilová 2002; Lenneis 2007; Harzhauser et al. 2007).

The new data provided by the analysis of the ornaments of Riparo Biarzo testifies to the presence of perforated *Litoglyphus naticoides* in the Julian Pre-Alps already during the Late Pleistocene with the continuing use of this species for the production of ornaments in the Early Holocene. This evidence reveals the existence of exchange networks and connections between the Alpine valleys of Friuli and the central Croatian region to the east. It seems that such links were already established at the end of the Late Pleistocene. It is highly probable that such connections and/or mobility strategies between the eastern Alps and the Adriatic region of the Balkan Peninsula have developed through the Natisone valley, where the site of Riparo Biarzo is located; following the Natisone valley one can easily reach the Isonzo and Sava Valleys to the east into the Balkans.

The analysis of ornaments from Riparo Biarzo reveals both important continuities and transformations characterizing Late Pleistocene and Early Holocene forager ornamental habits and symbolism. In particular, the beginning of the Sauveterrian represented the end in the predominance of ornaments made of *Cyclope neritea*, which were replaced by *Columbella rustica*. Unquestionably, *Columbella rustica* represents the fundamental element of the Mesolithic decorative tradition in all of the Early and Late Mesolithic sites in the eastern Alpine region of Italy (e.g. Riparo Soman, Riparo Romagnano, Riparo Gaban, Riparo Pradestel, vatte di Zambana in the Adige Valley as well as Mondeval de Sora in Val Fiorentina, Plan de Frea in Val Gardena and Edera, Ciclami and Azzurra caves in the Trieste Karst), and the whole Adriatic region and its hinterland (e.g. at Pupićina Cave in Istria, Zala

3) In Cristiani 2009 p. 194, I have claimed the presence of *Theodoxus fluviatilis* amongst the Mesolithic ornaments of Riparo Pradestel. On the basis of the re-examination of the material from this site I would like to change the author's interpretation into *Theodoxus danubialis*.

Cave in the central Croatia, Crvena Stijena rockshelter and Vruća Cave in Montenegro) (fig. 7). In the Adige valley, as well as in Riparo Biarzo, the use of *Columbella rustica* for the production of beads characterizes also the Neolithic ornamental tradition, together with the introduction of new element of a visual vocabulary of the adornments such as *Cardium* sp. (see tab. I). In the Adige Valley, Mesolithic foragers also used few ornaments on *Dentalium* sp. (e.g. Riparo Gaban and Riparo Romagnano), whereas the presence of *Cyclope neritea* is reported in Mesolithic levels of Riparo Romagnano (Borrello & Dalmeri 2004). The high percentage (71%) of perforated *Columbella rustica* shells, which characterizes Riparo Biarzo as much as other Mesolithic sites of the eastern Alpine and the Adriatic regions, would suggest that this species might have substituted *Cyclope neritea* in the symbolism of the last Holocene foragers of the region as a non-verbal mean of visual expression and communication. At Riparo Biarzo as well as on the other side of the Istrian Peninsula (Pupićina Cave) and in central Croatia (Zala Cave), social messages were conveyed also by using other gastropods as ornaments, such as freshwater *Litoglyphus naticoides*, which, on the basis of its specific distribution in Epigravettian and Mesolithic sites discussed above, might have also been mobilized actively in the process of personhood construction among the Upper Palaeolithic and Mesolithic foragers of the region.

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