PALAEOLITHIC ITALY

ADVANCED STUDIES ON EARLY HUMAN ADAPTATIONS IN THE APENNINE PENINSULA

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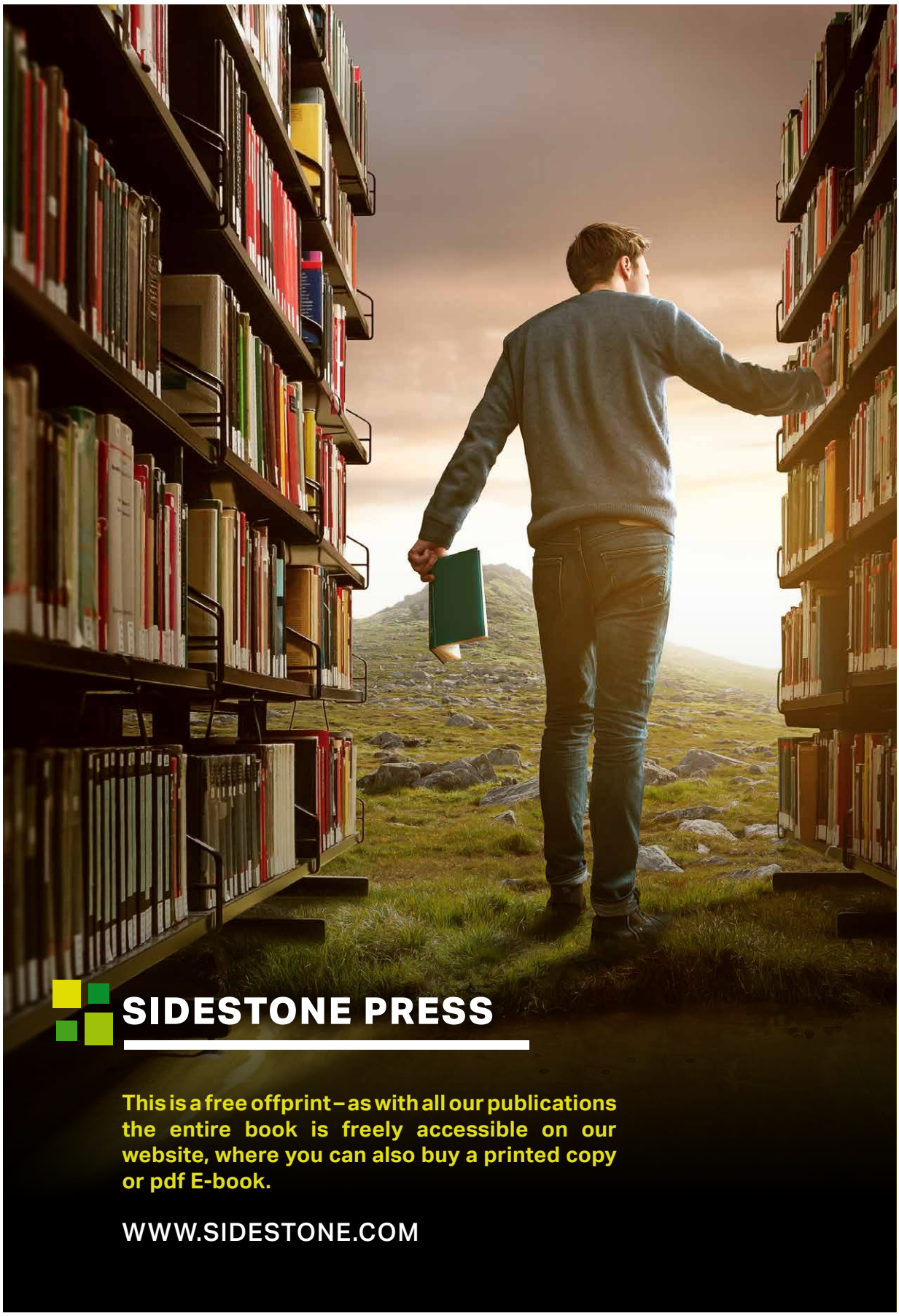

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From Neanderthals to Anatomically Modern Humans in Liguria (Italy): the current state of knowledge

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Abstract

Liguria is a coastal region in northwest Italy bordered by high mountains that descend sharply toward the Mediterranean Sea and that has very limited expanses of coastal plain. The Eastern Ligurian record is known only from open-air sites, while several deeply stratified caves and shelters exist in the Western part of the region. The Mousterian is quite well known throughout Liguria while the earliest Upper Palaeolithic record, in contrast, is known from only a few Protoaurignacian assemblages, an industry indisputably associated with anatomically modern humans. With the possible exception of the assemblage from Via San Francesco (Sanremo), characterized by laminar débitage and Upper Palaeolithic-like formal tools, to date, no Uluzzian or other "transitional" industries have been reported. Recent radiocarbon dates place the disappearance of the Neanderthals in Liguria around 42 ky cal. BP, and the most recent Mousterian deposits are clearly separated by sedimentary discontinuities from the oldest Protoaurignacian ones that date back to about 41.5 ky cal. BP, as highlighted at the Riparo Mochi and Riparo Bombrini (Balzi Rossi). There is no evidence of contact or admixture and the transition between these two cultural worlds is sharp and seemingly very rapid, as if modern humans perhaps colonised an empty land. After the Protoaurignacian, the Classic Aurignacian is docu-

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mented at the Balzi Rossi from about 35-36 ky BP to 30 Ky cal. BP, again in a situation that marks a probable discontinuity between the two cultural phases.

Keywords: Neanderthal, Anatomically Modern Human, Mousterian, Protoaurignacian, Classic Aurignacian, Liguria, Italy.

1. Introduction

The nature of the transition from the Middle to the Upper Palaeolithic and the concomitant biological shift from Neanderthals to Anatomically Modern Humans (henceforth, AMH/AMHs) remains one of the major debates in palaeoanthropology. Recent research on the topic is yielding increasingly fine-grained data, especially as concerns the chronology of the transition interval. For instance, in the Italian peninsula, recent advances suggest the independent origin of the Uluzzian, as a product of the AMHs, and its partial contemporaneity with the Protoaurignacian (Benazzi *et al.* 2011). This would confirm the idea that the Uluzzian was not the result of acculturation of Neanderthals by modern humans (*cf.* Riel-Salvatore 2009, 2010), but a true AMH culture. This interpretation has however recently been challenged by the interpretation of the Uluzzian-like industry from the Grotta di Fumane (Douka *et al.* 2012; Peresani 2008) as rooted in local Mousterian (Peresani *et al*. 2016), as well as by strong criticism on the association between human teeth and Uluzzian artifacts at Grotta del Cavallo on which the case for an AMH attribution rests (Zilhão *et al.* 2015).

The interest in the ultimate origins and chronology of so-called 'transitional' industries has been accompanied by much new research on industries associated with early European modern humans, notably the Protoaurignacian and the Early Aurignacian (*Aurignacien ancien*) (Douka *et al.* 2012; Banks *et al.* 2013; Hublin 2014; Nigst *et al.* 2014). This work has in many cases focused on the reanalysis or reexcavation of sites originally explored several decades ago to provide better context to the cultural facies identified in this pioneering work (Fig. 1).

One such site is Riparo Mochi, in the region of Liguria, in northwestern Italy. Reanalysis of the Protoaurignacian material recovered there in the 1950s recently showed it to be among the earliest Upper Palaeolithic sequences in Europe (Alhaique *et al.* 2000; Grimaldi *et al.* 2014; Kuhn and Stiner 1998). This was confirmed by targeted dating assays conducted in recent years which established that it is the currently earliest known Protoaurignacian site along the putative 'Mediterranean route' of modern human dispersals into Europe (Douka *et al.* 2012). This has shined a new light on the 'transitional' record of the region of Liguria as a whole, since the region has yielded comparatively few other Mousterian and Protoaurignacian sites whose significance is heightened by their potential concordance with the Mochi sequence. This paper thus presents a detailed critical overview of the evidence from this key region.

Liguria is located along one of the main proposed routes for the diffusion of AMH into Europe; as such, the recent upsurge in interest in modern human origins research and our species' conquest of the planet have given the region a central place in renewed research on the topic (Bertola *et al.* 2013; Douka *et al.* 2014; Higham *et al.* 2014; Hublin 2014).

Geographically, Liguria is best seen as a long mountain range that connects the Apennines to the Alps characterized by steep, deeply incised valleys and bordered by very limited expanses of coastal plain. Its position at the northern edge of the Tyrrhenian Sea has also contributed to make it an important refugium zone due to its relatively stable and mild climate even during the coldest phases of the Last Glacial (Negrino and Tozzi 2008; Negrino *et al.* in press/a). The Apennines and southern extension of the Ligurian and Maritime Alps would have exacerbated the challenges posed to foragers by the absence of a continuous coastal plain and selected for mobility strategies along select crests. This confluence of topography and human geography have resulted in the bidirectional dispersal of goods (*e.g.*, lithic raw material) and people along an East-West axis that linked peninsular Italy and Provence (Negrino *et al.* 2016; Negrino and Starnini 2003; Porraz and Negrino 2008; Porraz *et al.* 2010).

Additionally, Liguria is rich in karstic formations that have yielded a large number of caves and rockshelters that contain deposits allowing in-depth investigations of Late Pleistocene human adaptations. As a result, since the 19th Century, the region has been the focus of research by numerous scholars who, using the methods available to them at the time, have excavated a series of key sites, especially in the rich and storied site complex of the Balzi Rossi (Ventimiglia, Imperia) located near the Franco-Italian border (Del Lucchese *et al.* 2007).

The archaeological record of the Late Middle Palaeolithic of Liguria is mostly found at sites in the western part of the region, which have also yielded several Neanderthal fossil remains (de Lumley 2013a, 2013b; Holt *et al.* 2012). In contrast, the Protoaurignacian is known from three localities (at the sites of Riparo Bombrini and Riparo Mochi at the Balzi Rossi, and at the sites of Arma delle Manie and at Arma degli Zerbi, in the municipality of Finale Ligure); Grotte de l'Observatoire, located in the Principality of Monaco not far from the Italian border, also comprises Protoaurignacian deposits (Boule and De Villeneuve 1927; Onoratini *et al.* 1999: Onoratini and Simon 2006; Porraz *et al.* 2010). In spite of this relative scarcity, these sites are extremely important to our understanding of the settlement dynamics of the region by AMHs.

New excavations focusing on the transition from Neanderthals to AMH began in the 1990s at Riparo Mochi, in 2002 at Riparo Bombrini and in 2015 at the newly discovered site of Arma Veirana, located roughly 10km from the coast in the hilly Ligurian hinterland (Negrino *et al.* 2016; Negrino *et al.* in press/b). While this last site will provide us with a first glance at the record of the transitional in an area that has not yet been explored, the former two are separated by only a few dozen meters in the famed Balzi Rossi locality, which comprises deposits stretching from MIS 7 (Rossoni-Notter *et al.* 2016c, 2016d) to MIS 2 at the end of the Last Glacial. These recent ongoing field programmes have yielded important new data on the Transition and they have led to new studies of unpublished material collected in prior excavations at this sites and other sites (Arobba and Caramiello 2009; Benazzi *et al.* 2015; Bertola *et al.* 2013; Bietti and Negrino 2008; Blanc 1938; Cauche 2002; Del Lucchese and Negrino 2008; Douka *et al.* 2012; Higham *et al.* 2014; Holt *et al.* in preparation; Grimaldi 2014; Grimaldi and Santaniello 2014; Grimaldi *et al.* 2014; Negrino and Riel-Salvatore, in press; Negrino and Tozzi 2008; Onoratini 2004; Onoratini and Raux 1992; Porraz and

Negrino 2008; Riel-Salvatore and Negrino 2009, in press; Riel-Salvatore *et al.* 2013; Tejero and Grimaldi 2015; Tozzi and Negrino 2008).

On the topic of chronology, bones recovered alongside an AMH deciduous incisor during the 1976 excavations of the Protoaurignacian levels of Riparo Bombrini (*cf.* Vicino 1984, Formicola 1984, 1989) have recently been dated by AMS in the context of a modern reanalysis of that tooth (Benazzi *et al.* 2015). These dates have greatly refined our understanding of the chrono-climatic context of the technocomplexes dating to MIS3 documented at the site and of the links between the Protoaurignacian and the later Classic (or "Early") Aurignacian, the latter of which is currently known in Liguria only at the Balzi Rossi (Bietti and Negrino 2008; Mussi *et al.* 2006).

In Liguria, the transition from the Mousterian to the Protoaurignacian is best understood as a rapid biological and cultural replacement marked by dramatic changes in the techno-economic and symbolic spheres. This break is further highlighted by recent work on the material from Via San Francesco (Sanremo, Imperia) which has often been considered a 'transitional' phase of the Mousterian on the basis of its abundant laminar component and Upper Palaeolithic tool types (Tavoso 1988). This chrono-cultural attribution has in fact been undermined by recent ESR determinations indicating it may date back to as far back as MIS 6 (Pirouelle 2006). If this age is borne out by additional dates, this will force a significant rethinking of the industry's characteristics and of its cultural interpretation (Bietti and Negrino 2007).

In this paper, we thus present a review of the implications of the results of this abundance of new research on our comprehension of the Late Mousterian and Early Upper Palaeolithic of Liguria, while situating it in the wider context of the Transition in Italy.

2. At the end of Midde Palaeolithic

Assemblages that can be assigned to the Late Mousterian with some degree of certainty are known from the Balzi Rossi (Riparo Bombrini, Riparo Mochi), from Arma Veirana and from Arma delle Manie (Arobba *et al.* 1976; Cauche 2002). Other possible Late Mousterian assemblages come from some of the other Balzi Rossi sites (*i.e.*, Grotta dei Fanciulli, Grotta del Caviglione, Grotta del Principe and Ex-Birreria) which unfortunately still lack radiometric dates and detailed lithic analyses (Bachechi and Revedin 1996; Cremaschi *et al.* 1991; Negrino 2002; Onoratini *et al.* 2012; Rossoni-Notter 2011; Rossoni-Notter *at al.* 2016a, 2016b).

The most reliable data pertinent to our understanding of the final expressions of the Mousterian in Liguria are unquestionably those from Riparo Mochi and Riparo Bombrini, both of which have been the focus of recent excavations and have yielded new absolute dates. As mentioned, the two sites are separated by only a few dozen meters, suggesting they might well have been part of a single extensive occupation of the base of the cliffs of the Balzi Rossi during the Pleistocene. At Riparo Mochi, the topmost Mousterian layers (Cuts 56-25 in Cardini's level I) are the ones that have yielded assemblages assigned to the Late Mousterian (Grimaldi and Santaniello 2014). A recent technological analysis shows that there is a marked techno-economic difference between these cuts and those found below Cut 56. Interestingly, from the bottom to the top of the sequence, there is a gradual decrease in the laminarity of assemblages

that seems to go hand-in-hand with a reduction of the size of blanks; throughout, local raw materials overwhelmingly dominate the lithic industry, while allochthonous raw materials are very rare and reach their highest frequency (5%) only in the cold episode of Cuts 44/46, where mammoth and elk are documented (Grimaldi and Santaniello 2014). Cut 31, which is one of the last expressions of the Mousterian at the site, is an especially good indicator of these trends, having yielded a lithic assemblage dominated by small, irregular flakes bearing centripetal removals. The upper cuts' operational sequences appear to always lead to the production of small flakes struck from discoid cores whereas Levallois products are rarer. Additionally, Cut 31 appears to correspond (or at most slightly postdate) to a phase of massive vault collapse similar to that observed at the top of the Mousterian sequence at Riparo Bombrini (see below). Cuts 30-25 yielded progressively scanter assemblages comprising so few pieces that Cardini attributed them to a distinct, 'semi-sterile' level (Level H). Recent excavations at the site have further established that there is a marked break between the Mousterian and the overlying Protoaurignacian of Level G (Douka *et al.* 2014).

This situation is largely paralleled in the sequence recently brought to light at Riparo Bombrini (Holt *et al.* in preparation). At this site, the latest Mousterian corresponds to levels MS1-2 ("Mousterian Semisterile" or "Level IV – Upper Part") which immediately underlies the Protoaurignacian of A1-3 ("Levels II-III"), from which it is separated by an erosional horizon (Fig. 2). Level IV Upper Part is a 30-40 cm thick layer of clayey loam sedimentary matrix encasing coarse clasts, including several large blocks of roof fall. A few patches of charcoal indicate that hearths were lit towards the back of the shelter. Techno-typologically, the scarce lithic artifacts recovered from this level can be attributed to the Mousterian; notably, a few Discoid cores are documented. Almost all lithics are made on local raw materials. The scant traces of human activity and the presence of large carnivore coprolites combine to suggest that the shelter was, at that time, occupied only sporadically.

The deeper levels (M1-7 or "Level IV – Lower part") have been explored to a depth of about 70 cm. Comprising conspicuous quantities of roof spall, the sedimentary matrix becomes increasingly redder and clayey as one goes down the stratigraphy. These levels have yielded abundant lithic assemblages which, in some levels, are concentrated spatially towards the back wall of the shelter, close to conspicuous hearths. A preliminary analysis of the spatial distribution of different artifact classes in the shelter indicates that it was divided into distinct activity areas within and outside its prehistoric dripline (Riel-Salvatore *et al.* 2013). The lithic industry is made almost exclusively on local or circumlocal raw materials and comprises mostly small flakes and production debris. Flakes and cores attributable to the Discoid method are both found throughout the sequence although the Levallois method is also documented to a lesser degree, being used mostly to manufacture larger blanks. Retouched tools are rare and dominated by sidescrapers and denticulates. The faunal assemblages recovered from those levels are heavily fragmented and often burned; they document a varied faunal spectrum comprising cervids, caprids, equids, bovids, as well as examples of boar, rhinoceros and bear. The presence of shellfish brought to the site and fragmented in order to consume them is especially noteworthy: *Phorcus turbinatus* is the most frequent species, indicating that the site's occupants were collecting these small gastropods in rocky intertidal zones (Del Lucchese and Negrino 2008; Negrino *et al.* in press/a).

Palynological, microfaunal and faunal analyses indicate a gradual shift from humid and temperate conditions in the lower levels to a colder, more rigorous climatic regime in the upper levels of the Mousterian (Arobba and Caramiello 2009). The presence of large blocks of vault collapse in the terminal Mousterian levels provides further support for this climatic reconstruction.

Riparo Bombrini is also the only Late Mousterian site in Liguria to have been directly dated. Radiocarbon dates on charcoal and marine shells indicate that the Late Mousterian at the site dates to between roughly 44 and 41 ky BP (Higham *et al.* 2014; Holt *et al.* in preparation).

Moving eastward along the coast, the only site to have yielded material that can be attributed to a late phase of the Mousterian is Arma delle Manie, although the exact age of those deposits is still disputed (Arobba *et al.* 1976; Mehidi 2005). It is nonetheless very likely that levels I-III date to MIS 3, as palynological analysis shows that they are characterized by relatively temperate conditions. The lithic industry indicates an almost complete reliance on poor quality local raw materials that likely forced toolmakers to rely predominantly on the Discoid method, although here again, a few Levallois and laminar elements are documented (Peresani 2003). The presence of the Discoid method in the lower levels (IV-VII) provides circumstantial evidence that this core preparation method is most likely a response to local environmental factors rather than a strictly cultural signal. The faunal spectrum is dominated by red deer, the most common prey in the Late Mousterian of Liguria (Psathi 2003; Valensi and Psathi 2004; Valensi *et al.* 2004).

Finally, in the newly discovered site of Arma Veirana, in the Neva Valley, a Late Mousterian level has been documented during the first field season that took place in 2015 (Negrino *et al.* 2016). Like at Riparo Mochi, Riparo Bombrini and Arma delle Manie, the lithic assemblage from this level at Arma Veirana comprises both Discoid and Levallois elements, along with a rich faunal collection.

3. The appearance of AMHs: the Protoaurignacian evidence

First defined in 1966 by George Laplace (Laplace 1966), the Protoaurignacian is one of the cultural manifestations of the initial AMH migration into Europe. It is characterized by important technological and symbolic innovations that contrast markedly with the preceding Mousterian. It is found over an area that stretches from Atlantic and Mediterranean Spain to southern France and the Italian peninsula, with episodic reports of its presence in Austria and the Balkans (Bon 2006; Hublin 2014; Teyssandier 2007). The industry is distinguished by the production of Dufour bladelets, that is, straight, elongated bladelets subsequently modified by direct inverse or alternate retouch. Laminar production seamlessly grades into bladelet production with no evident discontinuity. While the Protoaurignacian is also characterized by an abundance of bone tools, ochre and personal ornaments (including numerous perforated shells), it is also devoid of the defining elements of the Early and Classic Aurignacian (*i.e.*, split-based points, robust blades with heavy retouch, etc.) (Bon *et al.* 2010; Le Brun-Ricalens 2005).

As indicated above, the two main reference sites for our understanding of the Protoaurignacian in Liguria are Riparo Mochi and Riparo Bombrini, along with the

Grotte de l'Observatoire, located in the Principality of Monaco. Available calibrated AMS radiocarbon dates bracket the Late Mousterian and Protoaurignacian at Bombrini between 42,580±610 cal BP (level M4, cut 13) and 36,710±580 cal BP (level A1, cut 2), which agrees perfectly with the available dates from Riparo Mochi. In sum, in Liguria, the Protoaurignacian – or at least its main distinctive techno-typological attributes – persists for a long interval of roughly 5,000 years, from 41.5 to 36.5 ky cal BP (Benazzi *et al.* 2015; Douka *et al.* 2012; Higham *et al.* 2014; Holt *et al.* in preparation; Negrino *et al.* 2016). These dates also reveal that Riparo Bombrini so far only documents the latter (post 40 ky BP) part of the Protoaurignacian, while its earliest phases are present at neighboring Riparo Mochi (Fig. 3). In this regard, it is however warranted to highlight that there exist some discrepancies between the actual radiocarbon ages on bone and charcoal samples obtained by the Max Planck Institute and Beta Analytics laboratories (Benazzi *et al.* 2015) and those on shells obtained by Oxford (Higham *et al.* 2014). This is especially true for the Mousterian, where the Oxford dates are systematically more recent, leading to an apparent substantial chronological overlap with the oldest dates for the Protoaurignacian. Ongoing dating programmes at both sites will hopefully help clarify this issue in short order and thus lead to a better understanding of the exact timing of the transition at the Balzi Rossi.

As concerns the material culture, the Protoaurignacian at the Balzi Rossi and at the Grotte de l'Observatoire is documented by a record constituted by thousands of lithic implements, including usually prismatic bladelet cores, endscrapers, splintered pieces and several hundred Dufour bladelets (Fig. 4). These bladelets are usually found fragmented and only very rarely display characteristic point morphologies, although ongoing analyses have identified a few, some of which even bear impact fractures (Riel-Salvatore and Negrino 2017). Additionally, a recent use-wear analysis of some retouched flakes from the Protoaurignacian at Mochi indicates the presence of flint flakes used as "knives" (Grimaldi 2014).

Mollusk shells are very abundant, with many having been intentionally perforated, likely for use as beads in various personal ornaments. Bone, soapstone (steatite) and fossil belemnites were also worked into other kinds of beads and ornaments (Fig. 4), and Riparo Mochi has yielded a canid or felid tooth drilled for suspension; at both sites, red ochre is conspicuous in its presence (Bertola *et al.* 2013; Bietti and Negrino 2008; Kuhn and Stiner 1998; Holt *et al.* in preparation). The presence of steatite demonstrates that this kind of raw material was used beginning in the Early Upper Palaeolithic, well before the Gravettian (*cf.* Onoratini *et al.* 2016). Given the color and texture of the pieces in our sample, their most probable provenance is from the Apennine between Liguria and Emilia, where large steatite outcrops exist (Chella 2002; Gernone and Maggi 1998; Negrino *et al.* 2017a).

Another element that distinguishes the Protoaurignacian from the preceding Mousterian is the increasing presence quantity of fine-grained exotic lithic raw materials procured from sources covering a truly staggering region stretching from the Rhône Valley (*e.g.*, flints from the Vaucluse) to the Marche region (*e.g.*, flints from the Scaglia rossa formations) (Negrino *et al.* 2016; Negrino and Starnini 2003; Porraz *et al.* 2010). At the Balzi Rossi, exotic lithotypes account for about 5-10% of the overall lithic assemblages, and up to 20-30% of retouched tools, while at the Grotte de l'Observatoire exotic Provencal flints prevail. These exotic materials include flints

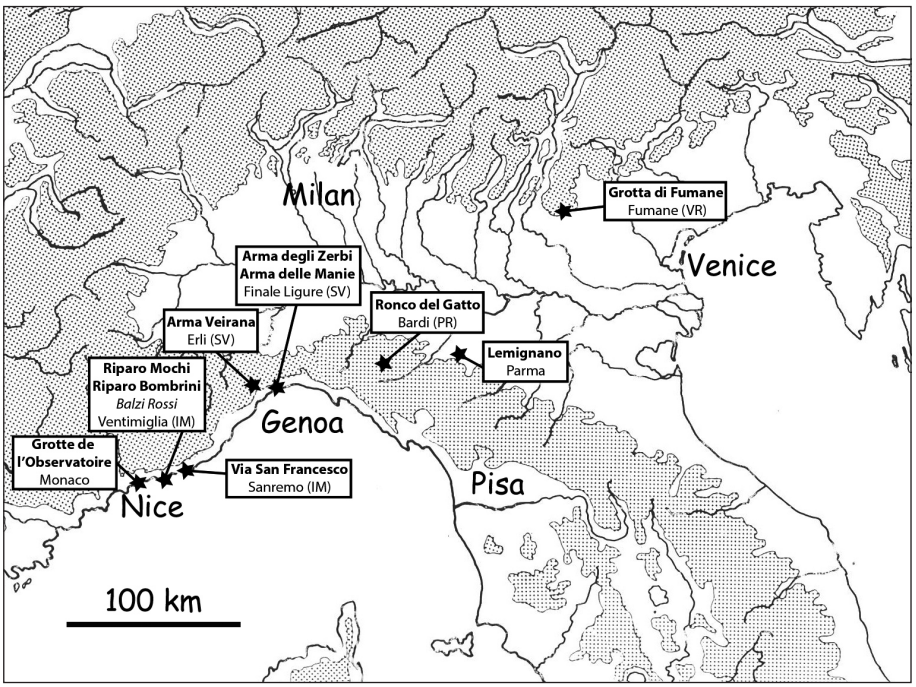

Figure 1. Location of the sites cited in the text.

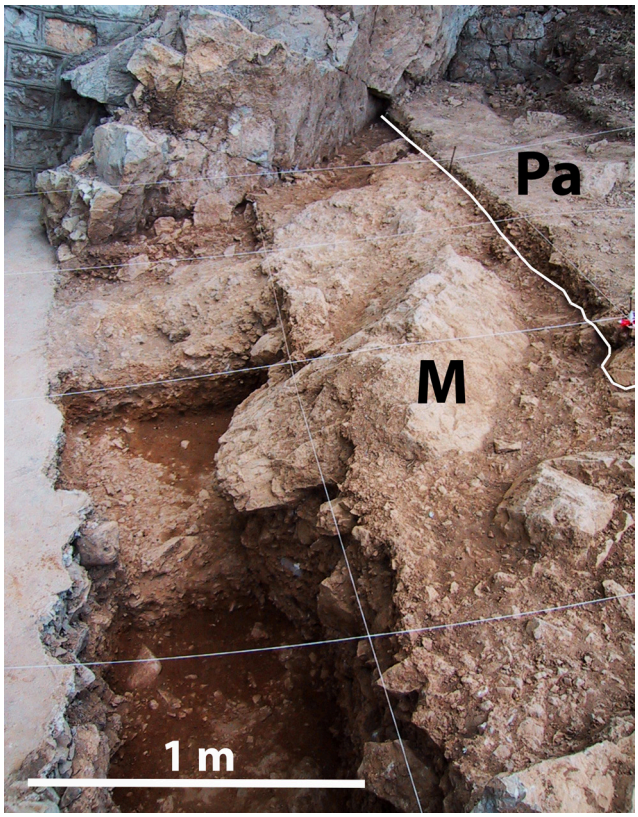

Figure 2. Riparo Bombrini (Balzi Rossi, Ventimiglia – IM -): picture of the site (2005 excavation). The white line highlights the discontinuity between Levels A1-3 (Pa=Protoaurignacian) and Levels M1-7/Ms1-2 (M=Mousterian). Photo by Fabio Negrino.

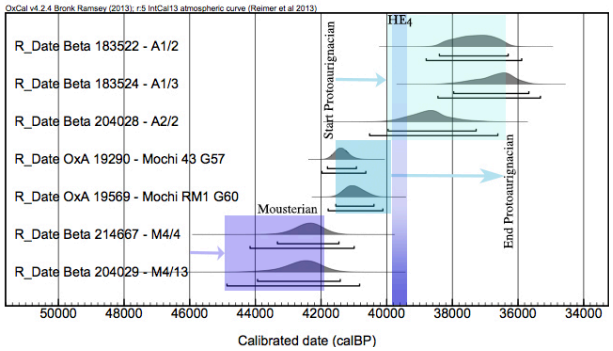

Figure 3. Calibrated radiocarbon dates from Riparo Bombrini (A1/2, A1/3, A2/2, M4/4 and M4/13) and Riparo Mochi (43 G57 and RM1 G60)(OxCal 4.2, Curve Int Cal 13; 95.4% – Bronk Ramsey 2013; Reimer et al. 2013).

from Provence acquired from outcrops some 200km distant as-the-crow-flies as well as radiolarites and flints from sources east of Liguria, notably in the Marche region, more than 400km away. A particularly noteworthy discovery was made during the 2015 field season at Riparo Bombrini when a sidescraper on Pre-Alpine flint was recovered, providing the first definite evidence that at least sporadic contact, direct or indirect, took place between human groups from the Tyrrhenian-Apennine region and groups from northeastern Italy (Negrino *et al.* 2016). However, the prevalence of raw material transfers along the Vaucluse-Marche axis indicates the presence of a cultural corridor along the ridges of the Ligurian Alps and the Apennines that permitted sustained relationships between the various forager groups that occupied it. The existence of such a cultural area is further suggested by the study of personal ornaments, the uniformity of which indicates to some researchers that it was even characterized by a distinct ethno-linguistic identity (Vanhaeren and d'Errico 2006). The rarely crossed boundaries of this area would have been the Rhône Valley (which apparently already served the same function during the Mousterian) and the Po Plain to the north, for which the sidescraper mentioned above constitute the only indisputable evidence of transgression and contact between the two areas to date. The rough terrain of the Rhône-Marche corridor, comprised as it is by an uninterrupted series of Alpine and Apennine mountains, further suggests to us that it was inhabited by a network of interlinked small groups occupying different point along it rather than by a few larger groups that moved along its entire extent.

Overall, then, the Protoaurignacian as evidenced at the Balzi Rossi and at Grotte de l'Observatoire can be seen as the manifestation of groups who already possessed thorough knowledge of the resources available in the territories they occupied. This includes the small lithic assemblage (ca. 200 implements) recovered from the deepest Protoaurignacian unit at Mochi (PA1, Unit GH) from which Dufour bladelets are altogether missing but apparently nonetheless includes the whole range of lithotypes available in the Rhône-Marche corridor (Grimaldi *et al.* 2014). With regards to colonization dynamics as articulated by Rockman (2003), in our view, the available archaeological data from these sites reflect the more advanced, "social" phase of Protoaurignacian colonization of the region when we can already detect the "transformation of the environment into a human landscape"(Rockman 2003, 4). To date, we have no definite evidence of a true "first colonization" from well-excavated stratigraphic contexts, either because this evidence is missing altogether at these sites or it has been

eroded by post-depositional processes. The observation that Unit PA1 at Mochi shows a more intensive use of local lithic resources, which may correspond to such a phase, remains to be confirmed by additional work.

4. Changing cultural tradition: the Classic Aurignacian

While relatively well defined, the Protoaurignacian nonetheless displays some regional techno-typological variants, such as the "micropoints" found in the highest levels at Grotta di Castelcivita (Gambassini 1997). This variability is, however, eventually supplanted by new lithic production strategies and techno-typological elements that are typical of the Classic Aurignacian in France and of the Early Aurignacian more broadly (Bon *et al.* 2010; Liolios 2006). Palma di Cesnola labels this new cultural phenomenon in Italy as "Aurignacian with bone points" (*Aurignaziano a punte ossee* – Palma di Cesnola 1993), on the basis of the split-based points that characterize it, along with carenated and nosed endscrapers, busked burins, twisted retouched bladelets (of Roc de Combe type) and large blades bearing heavy, invasive retouch. Classic Dufour bladelets are absent.

In Liguria, the Classic Aurignacian is so far only known from the Balzi Rossi. Beyond Riparo Mochi (levels E and F), it has been identified in the assemblages collected during old excavations at Grotta dei Fanciulli (levels I and K), at Grotta del Caviglione, at Barma Grande and at the now-destroyed site of Bausu da Ture (Mussi *et al.* 2006). Recently published dates also suggest that the highest part of the Bombrini sequence (*i.e.*, Level I) likely can also be attributed to this phase (Benazzi *et al.* 2015), although this part of the sequence was only documented in the area of the site originally excavated by G. Vicino in 1976 where it is present as a remarkable shell midden comprised almost exclusively of mussel shells; the assemblage itself is however devoid of diagnostic techno-typological elements (Vicino 1984).

Overall, there thus appears to be a sharp break with the preceding Protoaurignacian, as is also suggested by a notable gap in radiocarbon dates (Douka *et al.* 2014). That said, in the Riparo Mochi sequence, dates more concordant with a Protoaurignacian attribution have been reported for the base of Level F where techno-typological features already attest to the presence of the Classic Aurignacian. The presence of a few Dufour bladelets in Level F is another indicator suggestive of possible displacements across the layers, an eventuality only new modern excavation will be able to resolve.

As concerns raw material transfers, these mirror those documented in the Protoaurignacian, with exotic lithotypes from across the Rhône-Marche corridor comprising an important part of the lithic assemblages (Negrino 2002; Negrino and Starnini 2003).

Geographically, the nearest sites to have yielded Classic Aurignacian assemblages are both located in Provence (France) (Onoratini and Raux 1992) and western Emilia. This latter region is particularly rich in good quality lithic raw materials and includes some of the large open-air workshops at the site of Ronco del Gatto (Mount Pràbera, Bardi, Parma) (Negrino *et al.* 2017a) that document extensive extraction activities of the local radiolarites and their subsequent diffusion across the region (see also Riel-Salvatore and Negrino 2009). Another Emilian site, the one of Lemignano (Parma), is instead located a bit further north on the Apennine piedmont and is distinguished by

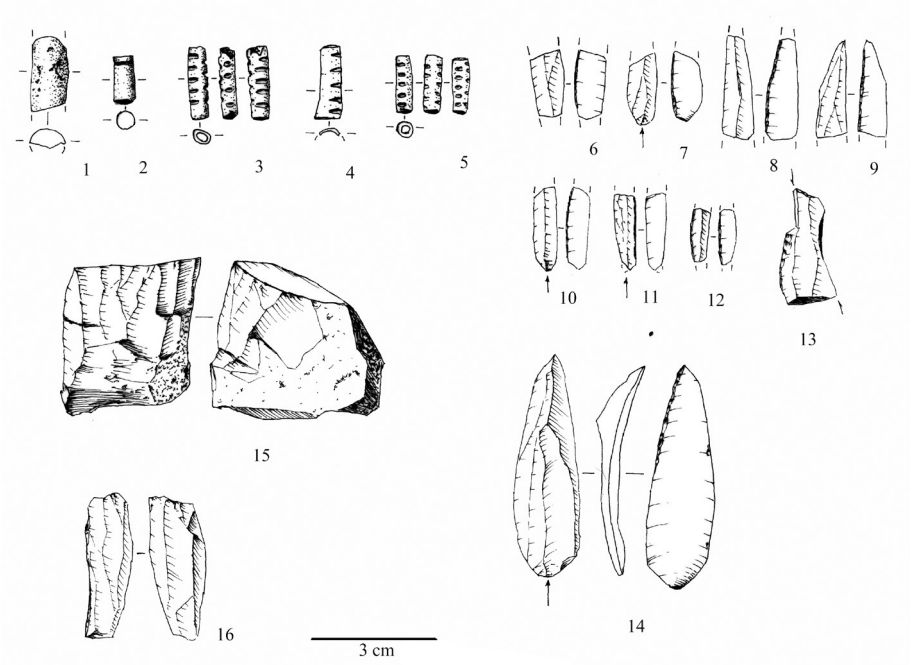

Figure 4. Protoaurignacian artifacts from Riparo Bombrini (Balzi Rossi). Fragments of fossilized belemnites, one of them exhibiting a shallow transversal incision (1-2); incised bird bone diaphysis (3-5); Dufour bladelets in different local or exotic flint types (6-12); burin on retouch opposed to burin on fracture, Provencal flint (13); inverse retouched point, Provencal flint (Bedoulian flint, Vaucluse) (14); bladelet core, local flint ("I Ciotti" flint) (15); bladelet core, Provencal flint (16). Drawings by Fabio Negrino.

the presence of endscrapers and of carenated burins, some of which have a distinctive busked morphology which is quite rare in the broader context of the Italian Aurignacian (Ghiretti *at al.* 1989; Negrino *et al.* 2017b). In the rest of the peninsula, the Classic Aurignacian is found in only a few sites (Mussi *et al.* 2006; Palma di Cesnola 1993) where its characteristics clearly distinguish it from the Protoaurignacian and appear to mark a sharp techno-economic and cultural shift. The Classic Aurignacian is certainly found as far south as Latium (*e.g.*, Grotta del Fossellone) and northern Puglia (*e.g.*, the open-air site of Caruso), with more southerly putative instances (*e.g.*, Fontana Nuova and Cavallo caves) being subject to debate (see Riel-Salvatore and Negrino 2009: 215).

5. Conclusions

Due to its position as Italy's western gateway along the natural corridor linking the Adriatic area and the Balkans to southern France, Liguria certainly represents a choice region on which to focus research to better understand the dynamics of AMH colonization and the disappearance of Neanderthals. As shown by its faunal and floral record, Liguria also served as a biogeographic refugium during the coldest moments of the Last Glacial. This would have made the region especially attractive to populations from neighboring areas associated with more rigorous conditions, which may have led to a higher population density that, especially during the Upper Palaeolithic, gave rise

to an active network across which foragers exchanged tools and raw materials over very large distances, evidence of a tightly woven system of interconnected bands belonging to a complex cultural network.

In contrast, population density seems to have decreased during the terminal moments of the Mousterian, at least at the Balzi Rossi. This demographic phenomenon coincides with a peak in cold conditions likely dating to roughly 42 ky BP, or roughly the interval between interstadials GI 11 and GI 10 of the NGRIP $\delta^{18}O$ record (Andersen *et al.* 2006; Svensson *et al.* 2006). The most recent Mousterian assemblages are associated with the predominance of the Discoid method alongside the Levallois method, an overall decrease in laminarity among end products, and an overwhelmingly local pattern of lithic raw material procurement. This pattern is echoed by the record of other Ligurian sites, notably at Arma Veirana, where locally available quartz cobbles were the main raw material used in stone tool production.

At Riparo Bombrini and Riparo Mochi, the transition from the Mousterian to the Protoaurignacian corresponds to a *paraconformity* caused either by erosional phenomena or a depositional hiatus above which the first Protoaurignacian appears fully-fledged. Field observations at Bombrini along with those made by one of us (F.N.) in 1999 during a targeted excavation of squares A0-A1-Z1-Y1 at Riparo Mochi both indicate the absence of mixing with the underlying Mousterian, suggesting a relatively important temporal separation between the two cultural manifestations. There is no evidence of any 'transitional' industry or of contacts between the two cultures, with the sharp replacement observed suggesting that AMH settled at the Balzi Rossi and in the surrounding area as in a region that had already been abandoned by Neanderthals for some time. The differences between the Mousterian and Protoaurignacian are pronounced: the latter is associated with bladelets, osseous industry, personal ornaments, abundant red ochre, and a high frequency of fine-grained allochtonous lithotypes. There is no precursor for any of these behaviors in the Mousterian, underscoring the radical break between the two.

Another important element to underscore is that, even in the oldest Upper Palaeolithic levels, the lithic industry clearly displays a fully Protoaurignacian character embedded in a wide exchange network stretching hundreds of kilometers to the East and West. We are thus faced with a situation where we cannot at present identify archaeologically the initial "locational" and "limitational" phases of Protoaurignacian colonization, which Rockman defines as, respectively, focused on the "locations and physical characteristics of necessary resources (*e.g.*, the size of the lithic source outcrop)" and on the "boundaries and costs of necessary resources (*e.g.*, the harvesting potential of ripe vegetation, extremity of seasonal variation)" (Rockman 2003, 4). The absence of evidence from the known sequences leads us to believe that this first phase of colonization has yet to be documented in Liguria. The presence of lithotypes from both France and the Marche in fact suggests that the known Protoaurignacian record indicates foragers quite familiar with (and adapted to) the region. In contrast, we could expect pertinent archaeological evidence of a first phase of colonization to be characterized by both local lithotypes and exotic lithotypes from only one of the neighbouring regions, which would yield precious information about the mode and tempo of the colonization dynamics.

As far as the origins of the Protoaurignacian are concerned, the question remains open for now. A western origin is a possibility that would help explain why the Protoaurignacian is found later in south-central Italy where the Uluzzian *sensu stricto* is the earliest Upper Palaeolithic manifestation and appears to last until about 40-39 ky cal BP (Douka *et al.* 2014, Higham *et al.* 2014). The lack of evidence to support this westerly origin, however, means that an origin in the Balkans currently remains the most likely (Broglio *et al.* in press). This, however, raises the questions of why Protoaurignacian sites are so scant in the Balkans and of why there should exist such important techno-economic differences in the Protoaurignacian record of the Veneto and that of Liguria, the latter of which is much more similar to that documented in France and Spain (Falcucci *et al.* 2016).

Chronometric dates are currently of little help to resolve this question, since the oldest dates from Riparo Mochi are for all intents and purposes coeval with those from the sites of Isturitz in France and Kozarnika in Bulgaria (Szmidt *et al.* 2010; Tsanova *et al.* 2012). These dates also raise the issue that the Protoaurignacian in Liguria must have been at least partially contemporaneous with putative Uluzzian groups in Tuscany and the Veneto who were noticeably more local and staid in their adaptations. The AMS dates from Riparo Mochi and Riparo Bombrini, bolstered by those published recently for Grotta di Fumane, also indicate that the Protoaurignacian was an extremely long-lived cultural phenomenon in Liguria, lasting until ca. 36.5 ky BP. This contrasts markedly with the situation westward of the Rhône, where the Early Aurignacian established itself rapidly around 39 ky BP, bringing with it the techno-typological characters of the following Classic Aurignacian (Banks *et al.* 2013; Higham *et al.* 2016).

The Classic Aurignacian is extremely rare in Liguria, being so far documented only at the Balzi Rossi and, even there, having been excavated using modern methods only at Riparo Mochi. Even the Protoaurignacian-Classic Aurignacian transition, however, appears to have been a relatively sudden event, with the first elements diagnostic of the latter, including two split-based bone points, appearing at the boundary between Levels F and G at Mochi (spits 49-50) (Tejero and Grimaldi 2015).

In sum, due to its geographical position, Liguria appears to have been somewhat peripheral to the Uluzzian to the east and the Châtelperronian to the west, which may explain the late perduration of the Mousterian in the region. While the Uluzzian has been attributed by some to AMH, the Châtelperronian is generally agreed to have been made by Neanderthals (Welker *et al.* 2016). A potential second wave of AMH migrants associated with the Protoaurignacian would have marked that hominin's first arrival in Liguria and coincided with the disappearance of Neanderthals and a clear break with the Mousterian tradition. How this process unfolded is still unclear, however: it is conceivable that Neanderthals had disappeared from coastal Liguria or had largely abandoned that part of the region, just as it is that they would have been present in low numbers and played a role in the process of Protoaurignacian colonization, even if there is currently no known trace of such interactions. These various scenarios are not mutually exclusive: the arrival of AMH groups in Liguria could have been accompanied by the displacement of Neanderthal groups towards more hilly inland areas where they would have eventually disappeared while AMH would have continued to occupy coastal areas. Future and ongoing work at the Balzi Rossi, Arma Veirana, Arma degli Zerbi and Arma della Manie, as well as new sites in the region, will help to resolve

the numerous questions raised here and which highlight Liguria's central position in clarifying our understanding of the dynamics of Neanderthal extinction and AMH diffusion in Europe.

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PALAEOLITHIC ITALY

ADVANCED STUDIES ON EARLY HUMAN ADAPTATIONS IN THE APENNINE PENINSULA

The picture of the Palaeolithic adaptations in the Italian Peninsula has always been coarse-grained compared to various well-researched regional hotspots in central and western Europe, as a result of historical research bias preventing the application of new research methodologies. Nonetheless, discoveries regarding Neanderthal extinction and behavioural complexity, the dispersal of Anatomically Modern Humans as well as the origin and diffusion of modern technologies and symbolic behaviour in Europe have brought Italy into focus as an ideal region for understanding the evolutionary development of various hominin species that inhabited the continent in the Late Pleistocene. In particular the dynamics of the earliest human peopling of Europe, the reasons and timing of Neanderthals demise and how environmental factors affected human prehistoric behaviour, rates of technological innovation and connectivity of hunter-gatherer groups in Europe.

The edited volume "Palaeolithic Italy" aims to contribute to our better understanding of the previous, still open, research questions. This will be achieved by presenting the latest advances in Palaeolithic research in Italy due to the application of a variety of modern analytical methods and cutting-edge techniques when studying numerous collections of materials from both old and new excavations as well as the latest results of field research in the country. The volume is intended for the international academia, representing a key reference for all archaeologists and readers interested in Early Prehistory of the Mediterranean region.

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