A New Cultural Frontier for the Last Neanderthals: The Uluzzian in Northern Italy

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The Middle–Upper Paleolithic shift was a crucial event intimately involved in Neanderthal biogeography and the patchy scenario that emerges from the last marked cultural and behavioral evolution our extinct relatives underwent during the interval 50-30 k.yr. BP. In Mediterranean Europe, this behavior, considered modern, gave rise to the Uluzzian, a cultural complex confined to central-southern Italy and Greece as a consequence of the supposed retreat of archaic humans in the face of the rapid diffusion of *Homo sapiens*. The recent discovery of dwelling structures and lithic implements at Fumane Cave in northeastern Italy redraws this scenario and depicts at 33.4 k.yr. BP the northernmost frontier to which the Uluzzian spread around the Great Adriatic Plain, a pivotal region near the western edge of the Middle Danube basin, where the last Neanderthals were using very different cultural items.

The northern coastal belt of the Mediterranean Sea is recognized as an ideal place to examine hypothetical migrations, refugia, and other forms of population interactions in the Late Pleistocene. During the last glacial period, the most open routes of faunal and human movement would have been to the east, around the Great Adriatic Plain, which emerged as a result of an 80-m drop in sea level.

The Uluzzian culture is documented at several open sites and in the sedimentary sequences of the Uluzzo Bay caves (Grotta del Cavallo, Grotta Bernardini, Grotta-Riparo di Uluzzo) in southern Apulia and the Cala and Castelcivita caves in Campania, where it systematically overlies the last Mousterian layers, separated from it by a discontinuity, or sterile level, that proves the absence of stratigraphic alternations between the two cultural sequences. The relationship of the Uluzzian to its remains is extremely weak and is based on two deciduous teeth found at Grotta del Cavallo (Palma di Cesnola 1989). For the most part, Uluzzian assemblages have been assigned a chronological position based on either broad paleoclimatic indicators or typological affinities with the different phases described for the reference sequence of Grotta del Cavallo. Numerical ages are available only from Grotta del Cavallo and Castelcivita, where the Uluzzian upper chronological boundary is in stratigraphic continuity; at the first site, layer Ei-ii produced a single radiocarbon determination of >31 k.yr. BP (Palma di Cesnola 1989); at Castelcivita, a handful of dates frame the Uluzzian between 33.5 and 32.5 k.yr. BP (Gambassini 1997). These measurements contrast with the first appearance of the proto-Aurignacian (a proxy for anatomically modern humans) at 37–35 k.yr. BP in northern Italy (Broglio 1996), a penetration by the bearers of this complex onto the peninsula that was slowed by existing populations that were firmly entrenched from Tuscany to Apulia and were using Mousterian and Uluzzian technologies (Kuhn and Bietti 2000). These criteria suggest that the technocomplexes were contemporaneous and that the Aurignacians spread over the peninsula at 33–32 k.yr. BP as a result of the penetration beyond a river frontier that was presumably coincident with the Po (Kuhn and Bietti 2000; Mussi 2001). Delayed colonizations by modern humans might have been induced by climatic and ecological factors, as in large zones of the Iberian Peninsula at the beginning of Heinrich Event 4 (Zilhão 2000; D’Errico and Sánchez-Goñi 2003; Sepulchre 2007).

Various cultural evidence later than the Mousterian complexes suggests that Uluzzians were in a process of modernization, as indicated by larger lithic tool sets containing new implements and also by early production of bone items and the use of pierced mollusc shells (Palma di Cesnola 1989; Gambassini 1997). Uluzzian lithic technology is characterized mostly by unidirectional or bidirectional flake production

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(Palma di Cesnola 1989) and multidirectional, polyhedral, and discoidal cores. Blades and bladelets were produced as well; not standardized, these products are short, sometimes covered by cortex. Tools include burins, end scrapers, side scrapers and denticulates, steeply retouched tools, and splintered pieces. Other implements with curved or arched backs are unusual in this context. Splintered pieces are prevalent in some assemblages and not in others and were used as intermediate objects to produce slits and to split bones and antlers. Bone perforators made on atrophic metaphyseals have been recovered at Grotta La Fabbrica and Grotta del Cavallo caves (Pitti and Tozzi 1971; Palma di Cesnola 1989). Cylindrical bone points with fractured bases have been interpreted as rough throwing spears (Palma di Cesnola 1989). Perforated marine shells, ochre, and limonite fragments complete the cultural record. Taking the Grotta del Cavallo sequence as a reference, the Uluzzian has been divided into lower, middle, and upper periods of typological variability: semi-retouched scrapers and denticulates are in the lower period, backed pieces and splintered pieces are in the middle, and Aurignacian-type products (see Gioia 1990) are in the upper. From typological indexes, Palma di Cesnola (1989) argued that different facies can be identified in caves and open sites. Stratigraphic sequences show the Uluzzian possibly developed out of some variety of late Denticulate Mousterian (Palma di Cesnola 1989).

Although some authors produced a generalized description of the Uluzzian, many assemblages, including some from key stratified sites (Grotta La Fabbrica, Castelcivita), simply do not fit well with the Grotta del Cavallo type of sequence (Kuhn and Bietti 2000). The ambiguity of what exactly constitutes this technocomplex is exacerbated by the fact that most of the collections were recovered at the surface from unstratified sites that had been subjected to mixing and perturbation. Data on the chronology, diffusion and land-use patterns, lithic economy, technology, and tool function are thus unavailable or remain unstudied. In particular, chronology and regional diffusion are two targets of crucial importance for depicting where the cultural frontier was positioned during oxygen isotope stage 3 (Broglio 1996; Kuhn and Bietti 2000; Mussi 2001; Peresani 2006) and how it shifted in relation to the supposed rapid spread of the Aurignacian along the Mediterranean coastal belt and around the Great Adriatic Plain. Whereas the Italian and Greek stratigraphic evidence demonstrates that the Uluzzian systematically precedes the Aurignacian, radiocarbon data sets are still insufficient and, moreover, may be affected by problems encountered for this specific time interval (limits of the method, contamination, cosmogenic events, calibration) that have been noted by various workers (Voelker et al. 2000; Muscheler et al. 2005; Giaccio et al. 2006; Hughen et al. 2006). So, if we accept the evidence that the Uluzzian extends to the southeasternmost Balkan region, new challenges may arise in investigations of its origin and diffusion routes in the central Mediterranean Europe.

Uluzzian geographic isolation from the western regions is proven by its absence in Liguria, Provence, and the Rhône Valley, where a patchy scenario with late Mousterian, “Néronien,” and proto-Aurignacian assemblages covers the time interval in question (Palma di Cesnola 1989; Slimak 2007). Conversely, looking east, affinities with some implements from eastern Europe indicate less isolation (Palma di Cesnola 1996; Gambassini 1997). The recent discovery of remains of human occupation embedded between the local final Mousterian and the proto-Aurignacian layers at Fumane Cave in northeastern Italy may open new perspectives for reconstructing the dynamics of the late Middle Paleolithic–early Upper Paleolithic biocultural shift in the Northern Adriatic (fig. 1), a geographically and biologically privileged region during the Late Pleistocene. Closed by the Alpine chain to the north and the displaced Adriatic coast, this area was a corridor along which faunal migration waves (Sala and Marchetti 2006) from the easternmost European regions occurred and possibly in which humans were driven during that period.

The Uluzzian at Fumane Cave

Fumane Cave lies on the southern fringe of the Venetian Pre-Alps at an altitude of 350 m between the low alluvial plains and the summit of the Monti Lessini plateau. This site belongs to a fossil complex karst system that is probably Tertiary in age and comprises several cavities that variably contributed to the formation of a sedimentary succession over 10 m thick. Explored since 1988, this conspicuous cave-fill includes tens of Middle and Upper Paleolithic levels with well-preserved Mousterian and Aurignacian paleo–living floors and traces of

Figure 1. Sketch map showing the position of the most relevant Uluzzian sites in the Italian Peninsula (2, La Fabbrica; 3, Castelcivita; 4, La Cala; 5, Grotta Bernardini, Grotta di Uluzzo, and Grotta del Cavallo) and in Greece (6, Klisoura Cave) and the extreme northernmost evidence at Fumane Cave (1), positioned less than 300 km from the different cultural association found at Vindija (7) in Croatia.
Gravettian incursions (fig. 2). Its cultural and paleoenvironmental succession is recorded from four main macro-units (S, BR, A, D) with distinct lithological composition, pedological features, and dense archaeological remains that document the main climatic events of the last glacial cycle, from the Early Weichselian to the second half of the Middle Weichselian, and the influence those events exerted on pedosedimentary processes and human settlement (Cremaschi et al. 2005; Peresani et al. n.d.). Final Mousterian to Aurignacian occurrences are recorded in macro-unit A, a set of densely spaced and horizontal layers labeled A13 to A1 and made up of residual sands disturbed by frost heaving (A13–A12), frost-shattered breccia, and aeolian loamy matrix (A11–A1) with variable amounts of organic matter and locally affected by faunal bioturbation. Mousterian flint implements have been recovered in units A11, A10, A9, A8, A6, A5, Uluzzian implements were in units A4 and A3, and proto-Aurignacian implements were in units A2 and A1.

The final Mousterian levels are commonly characterized by lithic and faunal remains densely scattered on the ground, as in units A11, A10, A6, and A5. The presence of macromammals and hunted ungulates from units A12 to A4 indicates moist-cool climatic phases that expanded forests, which then extended over alpine grasslands. Nevertheless, Capra ibex, Rupicapra rupicapra, and Marmota marmota and the birds Pyrrhocorax graculus and Lagopus mutus indicate the cave was in the proximity of an open alpine environment. In the A11 and A10 units, Cervidae progressively increased while Capridae declined, revealing a moist-temperate climatic shift and forest expansion. Despite a certain tendency toward cooler conditions observable toward the top sequence (A2, A1), the situation seems to have been fairly stable until layer A3. Flints were locally obtained and exploited by means of Levallois technology in the A11, A10, A6, A5, and A4 units and by means of discoid technology in A9 and A8 (Broglio et al. 2003; Lemorini et al. 2003). Dwelling structures, lithic assemblages, bone and antler tools, painted stones, and pierced mollusc shells occur in unit A2, in coincidence with the arrival of the first Aurignacians in this region and marking a clear discontinuity with the preceding cultural entities (Broglio and Gurioli 2004; Broglio et al. 2005, 2006).

The A3 and A4 layers consist mostly of frost-shattered slabs with variable sand content and aeolian dust that becomes more prevalent toward the outermost part of the cave. Excavation took place at different times from 1989 on and at varying distances beyond the present-day drip line and in the cave mouth, and even more extensive explorations were made in the past two years in a 20 m² area at the left of the cave.
mouth. Dwelling structures with hearths and a toss zone (i.e., a concentration of discarded, knapped by-products, charcoals, and a few bones) have been brought to light; flakes and bones have also been found scattered on the soil and in proximity to the combustion structures (see CA+ online supplement A). Suspected during the first exploration more than ten years ago (Bartolomei et al. 1992), a clear differentiation in lithic technological and typological features of layers A4 and A3 has been observed between the late Mousterian (A6, A5) and the directly overlying Aurignacian levels A2 and A1, and it is characterized mostly by formal blade and bladelet production, with typical retouched tools. Specifically, levels A3 and A4 contain about 300 and 500 lithic implements, respectively. A few blade and bladelet cores, flakes, and flake-cores reduced by means of direct hammer and stone percussion have been found associated with certain tools that can be framed in an Uluzzian-type association, such as backed knives, backed lunates, and one end scraper. Splintered pieces are also present (fig. 3); their interpretation as chisel-like tools or cores for the production of splinters needs functional analysis. Flint nodules and rough cobbles came provisioned mostly from the local stream and were exhaustively exploited at the site, although some cobbles or large flake-cores were introduced from more distant sources. A persistence of Mousterian technological tradition is recorded in the lowermost A4 level from Levallois flakes and cores produced using the recurrent method and shown in the shapes of side scrapers, points, and pieces thinned on the ventral face. Conjoinable flakes and cores scattered on the A3 surface point to a certain variability in lithic production. There was no evidence of Levallois technology; large flakes were detached from flat cores, short thick flakes from core flakes, short thick blades from unidirectional cores, and large thin bladelets and flake bladelets from simple single-strike platform cores. Selected high-quality flint was specifically exploited to make these latter products. Although innovations were limited, possible further shifts in other behavioral aspects involving lithic economy, the bone industry, and fuel provisioning cannot be ruled out. Current field evidence suggests the cave was used for short-term purposes involving knapping of a limited number of flint cobbles and processing of some prey, mostly ibex and red deer. In contrast to the underlying Mousterian units, Uluzzian layers seem to record a weakening of human presence or a change in the mobility of groups. New radiometric dates, analyses, and investigations focusing on site organization, hunting, lithic technology, and tool function are in progress. Radiocarbon chronology provides three dates for level A4 (OxA-8021: 33,300 ± 400 yr BP; OxA-6462: 33,150 ± 600 yr BP; LTL566A: 33,700 ± 350 yr BP). Despite this chronometric consistency, most of both the Mousterian and Aurignacian dates largely overlap in the interval 40–30 k yr BP (Giaccio et al. 2006; Peresani et al. n.d.). However, the fine stratigraphic resolution demonstrates no clear evidence of contact, exchanges, or relations between the Mousterian, the Aurignacian, and the Uluzzian and no alternation among different cultural layers.

Figure 3. Uluzzian implements found in units A3 and A4: splintered piece (1), backed knives (2, 3, 6), implement with curved back (5), bladelet core (4) (drawings by S. Muratori and G. Almerigogna).
A New Scenario around the Great Adriatic Plain

The Uluzzian at Fumane Cave is a very isolated case in the cultural scenario at the end of Neanderthal life in the North Adriatic area. Besides Fumane Cave, where evidence suggests frequent and abrupt changes in lithic technology as well as new solutions in space utilization, dwelling structures, and combustion areas, sites in the same Italian region bear witness to a certain dynamism, and more high-resolution data are needed to correlate these different situations (Peresani, n.d.). Radiocarbon chronology at the Castelcivita key site is strictly consistent with the Fumane Cave data set, and it records the first Uluzzian appearance at 34–33 k.yr BP in both southern and northern Italy (Gambassini 1997), two regions where the persistence of some technological traditions typical of Mousterian times seems gradually to decrease along the Uluzzian sequence. Conversely, the presence of similar Uluzzian items at the extreme south of the Balkan peninsula offers an explanation for the absence of the Uluzzian in the large area that extends from the Peloponnese and the northern Adriatic. Limited site visibility, the state of research, and density of the human population may be some of the factors that should be taken into account. In contrast to the the North Italian site, no Mousterian industry in Slovenia and Croatia recorded in the interval 40–30 k.yr. BP contains items similar to those found in the A3 and A4 levels of Fumane Cave. Specifically in Croatia, late Mousterian non-Levallois industries with denticulated and notched tools have been found at a few sites on the Dalmatian coast and in Croatian Zagorje. At Vindija, layer G1 presents an assortment of Mousterian tools (denticulates, scrapers, one bifacial point, and Upper Paleolithic types of stone tools (end scrapers, dihedral burins, retouched blades; Karavanić 1995). Furthermore, a chronological correlation with Fumane Cave is provided by the revised direct radiocarbon dates obtained on human remains from the G1 layer, which is proof that Neanderthals were present in that region until 33–32 (and possibly earlier) k.yr. BP (Higham et al. 2006) and that they used other types of tools (although this is debated by scholars; see Karavanić and Smith 1998, 2000). Janković and colleagues (2006) argue that the association of late Neanderthal remains with one split-base bone point and three massive-base bone points (Mladeč type; Karavanić and Smith 1998) was not due to artificial mixing of specimens from different strata (Kozlowski 1996; Zilhae and Ravnic 1998) was not due to artificial mixing of specimens from different strata (Kozlowski 1996; Zilhae and Ravnic 1998) but rather that these artifacts were produced by the Neanderthals as a consequence of contacts with modern humans who were already present in the Balkans 5 k.yr. BP (Soficaru et al. 2006; Trinkaus et al. 2006). In any case, technological and typological features of the lithic assemblage from layer G1 rooted in the Mousterian tradition are represented in layer G3, although the single bifacial point made from nonlocal radiolarite is similar to Szetelian implements (Svoboda 2006). The whole remains markedly different from the A4 and A3 Fumane Cave assemblages. Farther east in the Balkans, reexamination of Aurignacoid industries shows that they are clearly distinct from the Aurignacian and probably have to be included in a broad spectrum that includes a combination of Middle Paleolithic Levallois technology and the emergence of Upper Paleolithic tool sets coinciding with modifications in economic behavior (Teyssandier 2006). To this end, investigations in progress on the Fumane Cave record and on settlement dynamics in this pivotal region will help determine the timing and the modalities with which the Middle Paleolithic–Upper Paleolithic biocultural scenario unfolded and its relations with developments in the surrounding regions.

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