

## HUMAN RESILIENCE AND THE CLIMATIC IMPACT OF GREENLAND STADIAL 5 ON THE LANDSCAPE OF THE NORTHERN APENNINE WATERSHED. AN ASSESSMENT BASED ON MULTIDISCIPLINARY DATA FROM THE PIOVESELLO GRAVETTIAN SITE

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**ABSTRACT:** The Gravettian settlements of Europe are considered as an expression of the human adaptation to harsh climates. In Southern Europe, however, favorable vegetation-climate conditions supported hunters-gatherers subsistence and the maintenance of their large-scale networks. This was also the case of the North-Adriatic plain and the Apennine mountain ridge in Italy, where the ephemeral site of Piovesello locates at 870 m a.s.l. Cultural and palaeobotanical evidence allows to reconstruct human and vegetation ecology at a glaciated area in the Northern Apennine during Greenland Stadial 5 and also provides hints for the historical biogeography of petrophytic plants and their orographic relics.

**KEYWORDS:** Human settlement, palaeoecology, mountain timberline, Gravettian, Apennine watershed

### 1. INTRODUCTION

The Greenland Stadial 5 at the onset of MIS2 was an extreme cold phase of the Late Pleistocene, impacting the Gravettian hunter - gatherers population across Western Eurasia. In central-northern Europe, ecological contexts on the loess belt during MIS2 and especially the LGM were mostly treeless and provided limited resource availability. However, the settlement patterns documented in those periglacial environments are a demonstration of human culturally-mediated capability to overcome conditions of reduced biomass and ecological variability (Maier et al., 2016). In Southern Europe, milder latitudinal conditions and enhanced moisture supply at the northern Mediterranean rim allowed the growth and forest ecosystems of boreal type including mountain forests, which supported megaherbivores diffusion, a rather favourable conditions for hunters-gatherers subsistence and their maintenance of large-scale networks. Although this general picture has been largely confirmed by lowland open-air and cave sites which record multiple frequentations (Bocquet-Appel et al., 2005), little is known from those potentially inhabitable landscapes situated on the mountain range at extreme conditions. Despite the low density of lithic objects, these contexts contribute to reinforce our inferences about the existence of a wider settlement system in which specific anthropic activities were spatio-

temporally displaced (Foley, 1981). However, whenever investigations are carried out and clusters of sites are disclosed, this pattern may be re-designed to reflect pre-historic reality. It is the case of the following contribution which provides valuable information for the reconstruction of human ecology in the northern Italian Apennines during a critical period for European human population. The availability of both microscopic plant remains and wood charcoal from a mountain site, connected with traces of anthropic presence, provides a chance to obtain unprecedented insight about terrestrial ecosystems and human activities on the northern Apennine watershed at around 30 ka ago (Peresani et al., in press).

### 2. MATERIAL AND METHODS

The main bulk of data here presented has been achieved from interdisciplinary data issued from investigations carried out in the Gravettian site of Piovesello, situated at 870 m a.s.l. on the Mount Camolara-Ragola close to the northern Apennine watershed (Fig. 1): archaeological and geoarchaeological field investigation including soil micromorphology; palaeoecological analysis of charcoal, pollen and other microbiological particles from bulk sediments and a core; radiocarbon dating; petrographic and techno-typological analyses of the lithic industry.

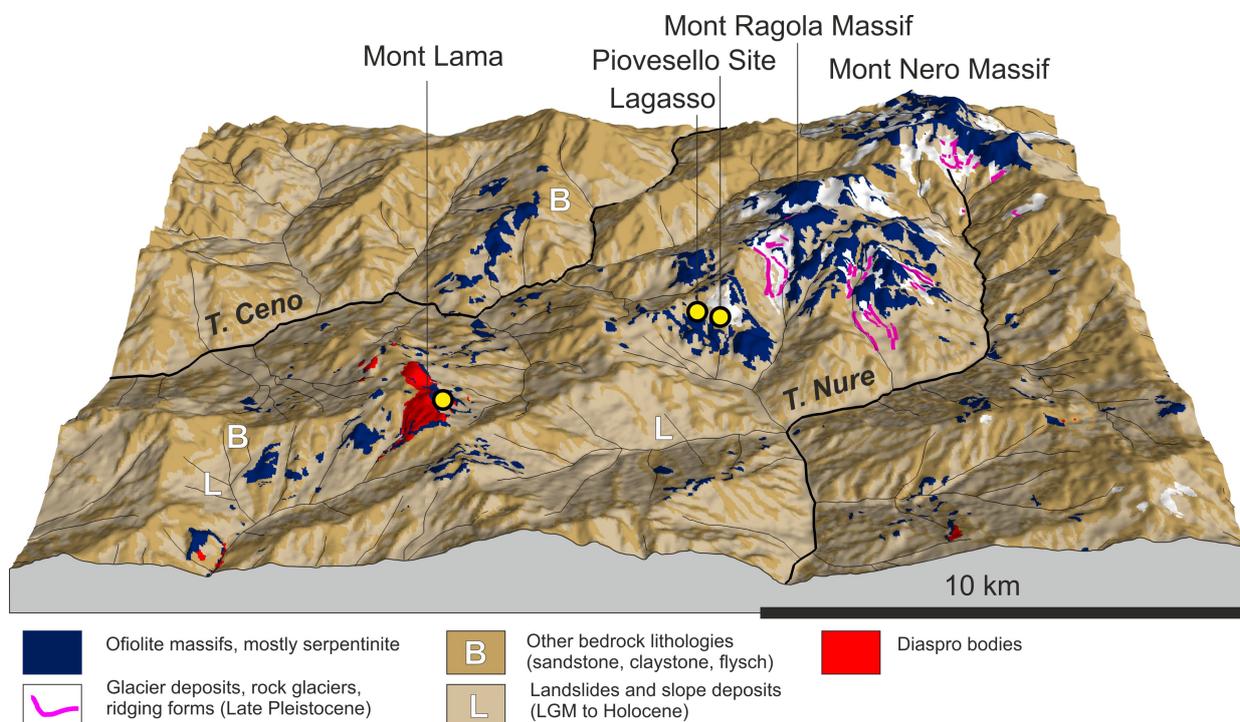


Fig. 1 - A large scale Digital Terrain Model and simplified geological setting of the upper Val Nure on the northern Apennine watershed, showing topographic relationships between the new Gravettian site, the location of the Upper Palaeolithic workshop on Monte Lama ophiolitic sedimentary body, and the Mont Ragola ophiolitic Massif. Notice LGM glacier development on Mont Ragola and widespread landslides.

### 3. RESULTS

Reconstruction of the pedo-sedimentary processes were based on field features and micromorphology and show that the origin of the Piovesello sequence is strictly linked to a series of medium-low energy colluvial processes settling a small basin shaped in an ophiolitic bedrock. Four pollen zones are distinguished, with Arboreal Pollen (AP) values ranging from ca. 30% up to 81%, mostly referred to *Pinus sylvestris/mugo* type, whereas most part of the pollen grains identified belongs to upland herbs (mostly Compositae subfam. Cichorioideae) with pollen diversity increasing upwards along the core among upland herbs, with the occurrence of four different types of Dipsacaceae pollen and the highest concentrations of charcoal fragments related to the human presence. The charcoals from the SU7, the only layer yielding archaeological traces shows a monospecific assemblage, as only Scots and/or Dwarf Mountain Pine were identified. Based on the complete range summing up the two ages obtained from the charcoal (i.e. 29433 – 30681,  $2\sigma$  calibration interval), the site is falling within the cold stadial phase GS 5.1 according to the INTIMATE event stratigraphic scheme for the North Atlantic and Europe subcontinent (Rasmussen et al., 2014). Petrographic and archaeological data prove the local provenance of radiolarite blocks and slabs represented by a rather wide diversity in technological products alongside with many complex refittings, which hint to an on-place exploitation. In addition, a handful of cores and finished artifacts made on flint (chert) prove provenance from Haute Provence, 300 km to the west.

### 4. DISCUSSION AND CONCLUSION

The human settlement at Piovesello open air site falls in the Greenland Stadial 5.1, possibly in connection with a culmination of local glaciers, whose Late Pleistocene frontal moraines lies at only 600 m from the site (Fig. 1). This phase, however, predates both the early glacial culmination of the Last Glacial Maximum in the Alpine realm (Monegato et al., 2017), and precedes the most intense phase of forest withdrawal in N-Italy, the latter event being coeval to the LGM onset (Fig. 2). Although the site was located in the altitudinal open belt above the timberline, meanwhile the stable surfaces in the Po Plain still supported mixed pine-birch forests (Garozzo et al., this volume). The unprecedented palaeobotanical documentation, directly associated to the artefacts-bearing layer, includes pollen of rocky semidesert plants, but also pine wood branches carried up to the site by Gravettians and used as fire fuel. In turn, this pine charcoal made possible to obtain high-precision radiocarbon ages.

This is not a novelty for the mid-Late Palaeolithic settlers of Europe who have largely demonstrated to adapt to environments well above the timberline and also well inside the limit of continuous permafrost in a largely treeless landscape with semidesert, tundra and steppe prevailing (Maier et al., 2016). Furthermore, the impact of GS5 to human ecosystems is under the focus of on-going investigations in northern to Eastern Europe. Despite the sparseness of the archaeological record, in some parts of Europe from Russia to the Paris Basin seems to be a hiatus in occupation in this time

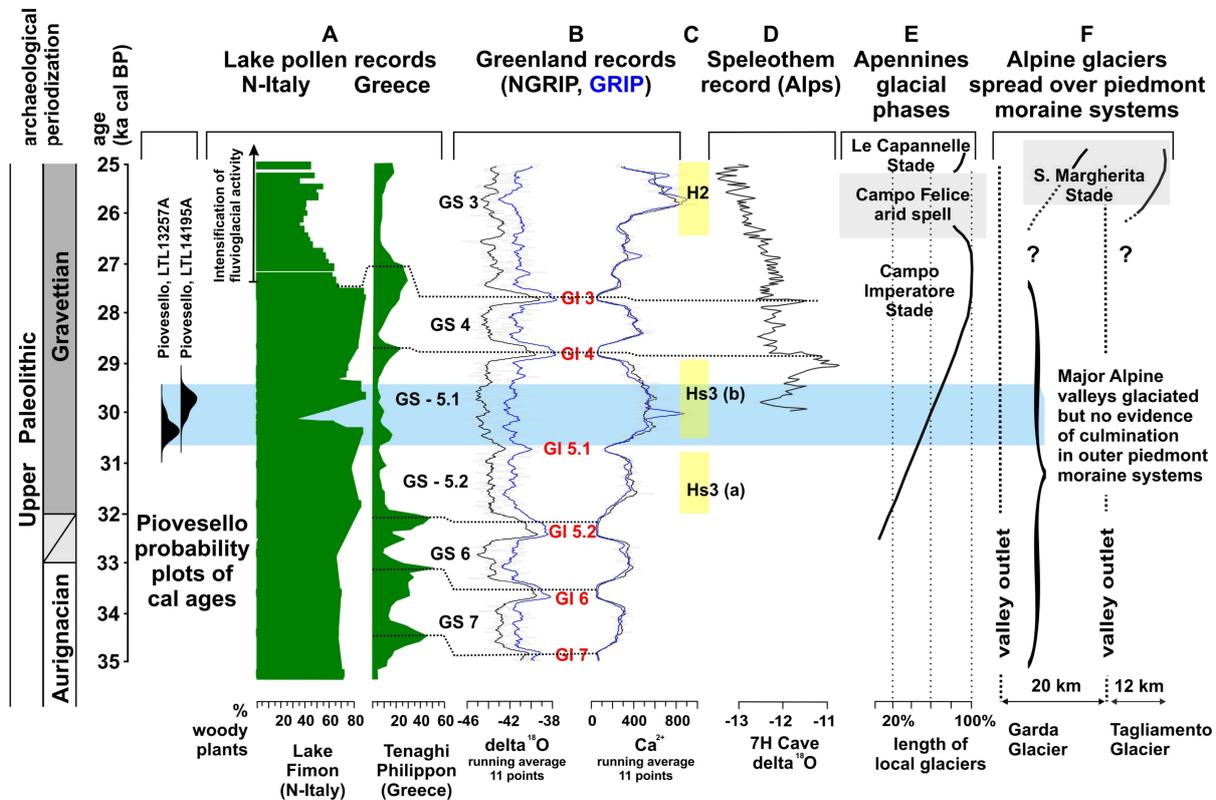


Fig. 2 - The chrono-climatic setting of the Piovesello site compared with hemispheric, Alpine and Apennine climate proxies. A - Lake Fimon and Tenaghi Philippon pollen records as summarized by % of woody plants, from Wick (2000), Pini et al. (2010), Muller et al. (2011); Panel B - Greenland ice core INTIMATE chronology from Rasmussen et al. (2014); C - North Atlantic Heinrich Events; D - Delta  $^{18}\text{O}$  record from speleotheme 7H, Bernese Alps, from Lütscher et al. (2015); E - Glacier advances in the Apennines from Giraudi (2015); F - Glacier advances of Garda and Tagliamento glaciers in their pedemontane moraine systems, eastern Italian Alps; distance from the valley outlet in km, modified from Monegato et al. (2017).

span suggested by a revised chronology (see Peresani et al., in press for references). By contrast, in western Mediterranean regions hunter-gatherers lived in cool and cold-temperate, often moister environments, with higher biomass and human population density than in Central Europe. Despite the aforementioned uneven distribution of early Gravettian sites in the Italian Peninsula and the relatively scanty evidences of human presence, estimates of human population size point to the largest regional settlement area in Western Europe benefiting from suitable conditions for biomass growth (Maier et al., 2016). These environments forced wide or altitudinal movements along mountain timberline gradients aimed to cover high range of logistical mobility.

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