**APPENDIX 1**

**MATERIALS AND METHODS**

**Paleobiological analyses**

Except for Unit 5, rich and diversified assemblages of mammals and scanty remains of birds, reptiles, freshwater mollusks, ostracods, plants, and pollen have been recovered from the excavated succession. Bulk sampling procedures were followed for collecting microvertebrates, mollusks, and ostracods, and high-resolution sampling techniques for pollen. Large vertebrate bones have been examined using field-based and standard laboratory investigations.

*Mollusks*

Data were obtained from qualitative and quantitative analyses of mollusks and ostracods from nine samples of about 300 g of sediment each, collected from lithologic Units 1, 3, and 6. All the samples were disaggregated in a 5% H2O2 solution for 24–48 hours, sieved with 1, 0.5, and 0.063 mm mesh screen under tap water, and dried in an electric oven at 40°C. Fossil specimens were picked up under stereomicroscope, identified, and counted. For mollusks, each recovered species was assigned to an ecological class (EC; Table 2), based on their different ecological requirements following Ložek (1964), Girod et al. (1980), Giusti and Pezzoli (1980), Kerney (1999), Manganelli et al. (2000), Cianfanelli (2009), Cianfanelli et al. (2010), Welter-Schultes (2012). The percentages of shells per species in each sample from the three sedimentary units were used to build the relative malacological diagrams (Fig. 4), to detect faunal changes throughout the sequences (e.g., replacing of biotic communities with different ecology requirements and changes in species abundance).

*Ostracods*

Up to 300 ostracod valves were picked per sample, photographed under the Scanning Electron Microscopy Philips XL30 at the Interdepartmental Laboratory of Electron Microscopy (LIME) of Roma Tre University and identified following Martens (1990), Meisch (2000), Minati et al. (2008), Ligios et al. (2009), and Fuhrmann (2012). Each species frequency was counted and a frequency matrix normalized to 10 g of dried sieved sample was calculated. From this matrix, a dataset including a minimum 3% relative abundance per taxon constituted the basis for the application of Cluster Analysis (Morisita-Horne and Chord distance measures and the unweighted pair group method using arithmetic average [UPGMA]) in order to estimate the assemblage similarities and enable paleoenvironmental interpretation. Multivariate analysis was performed using the software package PAST 2.17b (Hammer et al., 2001). The Mutual Ostracod Temperature Range method (MOTR; Horne, 2007; Horne and Mezquita, 2008; Horne et al., 2012) was applied to the different ostracod assemblages to estimate the paleotemperature ranges for winter (January) and summer (July). The MOTR method was developed by Horne (2007) and Horne et al. (2012), based on the present geographical distribution of the species (from the Nonmarine Ostracod Distribution in Europe Database [NODE]; Horne et al., 1998) and on their comparison with a modern interpolated climate data set, WorldClim (version 1.3; Hijmans et al., 2005). More recently, MOTR calibrations have been based on OMEGA (Ostracod Metadatabase of Environmental and Geographical Attributes; Horne et al., 2011).

*Vertebrates*

The analyses of the vertebrate remains started with the identification of the specimens. The skeletal elements were identified both anatomically and taxonomically. The number of identified specimens (NISP) was calculated to assess the relative abundances of the different taxa. To avoid biases produced by different fragmentation potential, NISP was calculated separately for each of three distinct size classes: <10–100 kg; 100–300 kg; and >300 kg. To estimate the minimum number of individuals (MNI), specimens were attributed to single individuals by side-matching, allowing for size, proportions, degree of ossification, age, and state of preservation. All the specimens come from a single depositional unit and from a relatively small area. For this reason, the archeological context had no effect on in the estimation of the MNI. Moreover, we analyzed the entire Poggetti Vecchi faunal sample to avoid the effects of aggregation on the MNI counts (Grayson, 1978, 1984; Brewer, 1992).

*Pollen*

Sampling for pollen analysis was carried out along the stratigraphic sequence at the interval when Paleolithic human presence is attested. The samples were treated using routine methodology, including the acetolytic method (Erdtman, 1960). The grains were identified referring to the available literature as well as to a pollen reference collection set up for this purpose. Pollen concentration (Absolute Pollen Frequency, APF) was calculated as number of pollen grains/g. Pollen percentages were calculated on the total pollen grains and spores. The pollen diagram was drawn using TILIA 2.0 (Grimm, 1994, 2004).

*Woods*

Basing on the criteria of minimum invasiveness, woods were sampled to carry out the identification of the constituting taxa. Where existing, the connections among different fragments were found in order to sample the same finding only one time. The identification was performed following the Italian technical standard UNI 11118:2004. Samples were prepared and observed under light (DM LB 2, Leica) and electron microscopes (FEI, Quanta 200): the collected images/data were compared to reference wood atlases (Schweingruber 1990; Gale and Cutler 2000).

**Numerical dating**

*Pisolithes*

A representative sample of pisoliths (220 g) from Unit 4 was first analyzed using high resolution gamma-ray spectrometry (HPGe-Ortec count rate system) to estimate the uranium content of the pisoliths. The following analysis by isotope dilution alpha spectrometry was optimized by adding 232U spike in amounts comparable to the uranium content of the sample. In a following step, lighter-colored pisoliths were selected to minimize the possible insoluble residue during the acid attack, but also to avoid the correction for 230Th, 234U, and 238U inherited from the leaching of the insoluble residue. The final sample (20 g) was pretreated with H2O2 and successively dissolved by 1N HNO3 acid. After filtration, the acid-leached fraction (carbonate fraction = 95.4%) was spiked with a solution of 232U and 228Th in transient equilibrium (228Th/232U activity ratio = 1.027), and the isotopic complexes of U and Th were separated and counted by alpha spectrometry following the procedure proposed by Voltaggio et al. (2001). The results of the analysis are presented in the Table 1. The 230Th/232Th activity ratio >40 indicates that the correction for the leaching of isotopes from insoluble residue is quite negligible.

*Vertebrate teeth*

ESR/U-series dating approach was applied, using the protocol of Bahain et al. (2010), on Aurochs teeth recovered from different units of the Poggetti Vecchi site. After mechanical separation of the dental tissues, the enamel layers were cleaned from any contamination by sediment or dentine using a dental drill. The enamel was then grounded and sieved. After this, a 100–200 µm grain-size fraction was used for equivalent dose (DE) determination. It was split into ten aliquots: nine of them were irradiated by γ 60Co source at doses ranging from 260 to 12500 Gy. The ESR intensities of the ten aliquots were then measured using a Bruker EMX ESR spectrometer and a dose-response curve was built based on the data set for each tooth. DE were determined using a single saturating exponential function (according to Duval and Grün, 2016). Radioelement contents of the dental tissues, as well as of the associated sediments, were measured using γ-ray spectrometry. The U-series were studied on each dental tissue using α-spectrometry following the protocol of Bischoff et al. (1988). Finally, dose-rate contributions, U-uptake parameters and ESR/U-series ages were calculated (Table1). A classical US model (Grün et al., 1988) could be applied on the tooth of Aurochs. Possible radium and radon losses from the dental tissues were also estimated from cross-checked γ and α data (Bahain et al., 1992). The dose conversion factors used by Adamiec and Aitken (1998) were adopted here. Water contents of 0 ± 0, 7 ± 5, and 15 ± 5 were employed for enamel, dentine, and sediments, respectively.

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