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Fontana Ranuccio (excavations 2019-2022) and Colle Marino (excavations 2020-2021): Middle Pleistocene chronostratigraphic evidence of the earliest inhabitants in the Anagni basin

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ABSTRACT - Recent fieldwork of the Istituto Italiano di Paleontologia Umana in the Anagni basin (Latin Valley, southern Latium, central Italy) has provided new insights into the dynamics of human settlement and adaptation in this area during the Middle Pleistocene. This paper summarizes the still partially unpublished data on the chronostratigraphy of two important prehistoric sites: Fontana Ranuccio, dating from about 400,000 years ago, and Colle Marino, whose lithic industry has so far been attributed to an early stage of the Middle Pleistocene. At Fontana Ranuccio, stratigraphic studies highlighted the depositional dynamics and the processes involved in the formation of the archeological unit, consisting of partly reworked volcanic material, which can be now divided into distinct sub-units. At Colle Marino, a 35-meter-deep core drilling and an excavation campaign allowed us to verify the nature and provenance of lithic artifacts found on the surface in past decades. Radiometric analyses dated these artifacts from about 700,000 years ago.

Keywords: Colle Marino; Fontana Ranuccio; Italy; Quaternary; Middle Pleistocene; Geoarchaeology; Lower Palaeolithic.

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1. INTRODUCTION

Fontana Ranuccio and Colle Marino are two prehistoric sites located four kilometers northwest of the town of Anagni (southern Latium, Central Italy), about 50 km southeast of Rome (Fig. 1). The sites are very relevant in the scientific literature for the understanding of the peopling dynamics during the Middle Pleistocene.

Fontana Ranuccio is particularly noteworthy for its extraordinary richness of faunal remains, the presence of four human teeth, probably belonging to *Homo erectus* (Ascenzi et al., 1993) or *Homo heidelbergensis* (Rubini et al., 2014), abundant lithic and bone tools, including the well-known hand axe made from an *Elephas* long bone fragment, and a few highly deteriorated wooden remains. The site has recently been dated from about 407 ka through $^{40}Ar/^{39}Ar$ (Pereira et al., 2018), which should correspond to the temperate MIS 11. Colle Marino, on the other hand, is known to be one of the earliest sites in Italy as, since the 70s, it was relatively attributed - following a) the absence of macroscopic volcanic minerals, b) the presence of *Pachycrocuta brevirostris*, and c) the typological archaicity of the lithic assemblage found on its surface - to an early stage of the Middle Pleistocene; despite its potential scientific relevance, no further researches have been carried out in this locality until 2020-2021.

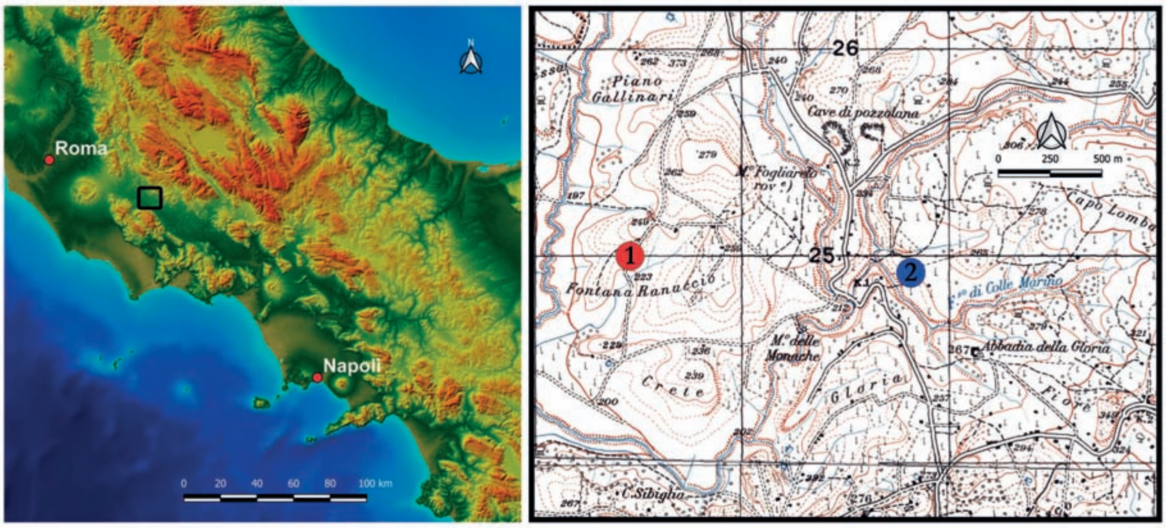

Fig. 1 - (left) Location of the investigated area in the black square (relief map modified from Tinitaly Dem, see Tarquini et al., 2023); (right) Location of: 1) Fontana Ranuccio and 2) Colle Marino archeological sites (base map IGM 1:25.000, Geoportale Nazionale).

These two sites are located in the Anagni basin (Latin valley), a region investigated by the Istituto Italiano di Paleontologia Umana since the 70s; nevertheless, despite the large number of reports, few chronologic constraints have been obtained for the faunal and lithic assemblages recovered at several sites in the Latin Valley until recently. The first integrated, modern approach to the study of these sites was performed, in collaboration with several national and international research centers, at Coste San Giacomo (Segre Naldini et al., 2009; Bellucci et al., 2012), where an outstanding vertebrate faunal record of Villafranchian age was obtained, as well as at Fontana Ranuccio and at Colle Marino (see below).

In this paper, preliminary chronostratigraphic data from Fontana Ranuccio (2019-2022 excavations) and Colle Marino (excavation 2020-2021) will be summarized, providing a focus on the geoarchaeology and sedimentary setting of both sites.

2. GEOGRAPHIC AND GEOLOGICAL SETTING OF THE ANAGNI BASIN

A detailed description of the geological setting of the Anagni basin has recently been published by Florindo et al. (2021). This region is home to numerous paleontological and archeological sites that have provided insights into the faunal and early human occupation of the area over the last two million years. The distribution of these sites is a direct result of the paleogeographic evolution of the region, which is a back-arc extensional domain that has undergone progressive continentalization due to the uplift of the Apennine chain and the southwest migration of the Tyrrhenian Sea basin and its coastline. The Latin Valley, a tectonic depression that has been under an extensional regime since the late Pliocene, resulting in the formation of lacustrine basins such as Anagni and Ceprano, is situated at the southern margin of this area.

3. METHODS AND MATERIALS

In this research, we present the results of the new field activity conducted at the Fontana Ranuccio (2019-2022) and Colle Marino (2020-2021) sites. Particularly, the Fontana Ranuccio investigated area has been extended; an area of 30m^2 has been almost entirely excavated to physically connect it with the previously already excavated areas in the 80s and in later years (Segre Naldini et al., 2009). When Colle Marino is concerned, an excavation area of 24 m^2 has been investigated in 2021 very close to the spot where the core drilling was performed in 2020 (Florindo et al., 2021).

In both sites, particular attention has been devoted to the general assessment of the stratigraphic sequence and its contextualization within the regional setting by means of geoarcheological and chronostratigraphic approaches (detailed references regarding each site are provided below). Excavation activity in both sites has been carried out by following modern excavation standards which include the detailed positioning of any item, and the recording of their depositional data (such as orientation, inclination,..) in order to allow ongoing spatial distribution analyses, which could be useful to further develop the preliminary interpretation here presented.

4. RESULTS

4.1. FONTANA RANUCCIO

4.1.1. Chronostratigraphy of the site

The chronostratigraphy of Fontana Ranuccio (Fig. 2) has been re-assessed by Florindo et al. (2021), based on the $^{40}Ar/^{39}Ar$ age determination by Pereira et al. (2018) and field investigations in the area surrounding the archeological site, reframing the detailed stratigraphic schemes reported in previous studies (Biddittu et al., 1979; Muttoni et al., 2009; Segre Naldini et al., 2009)

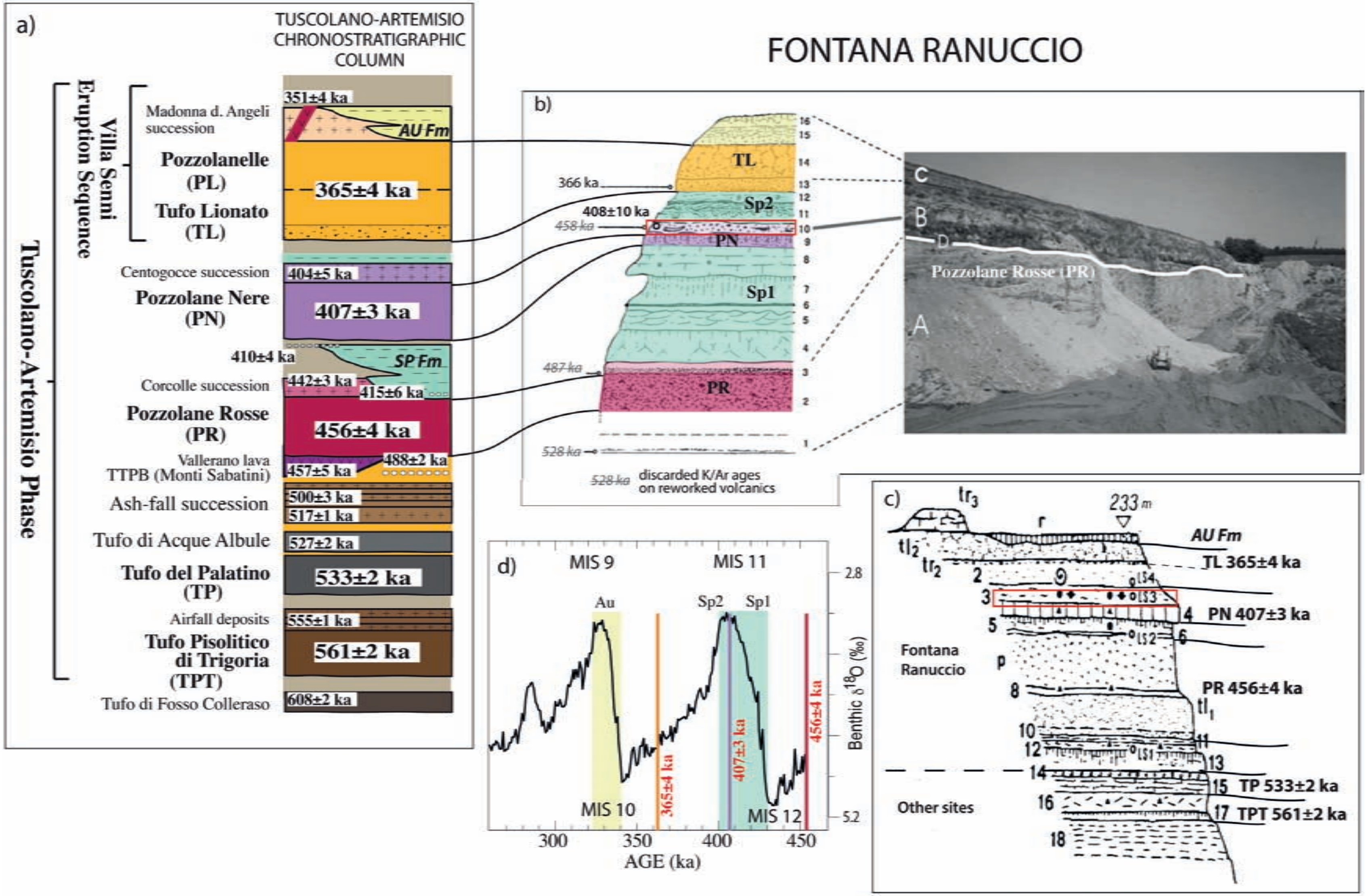

Fig. 2 - Fontana Ranuccio: Chronostratigraphic framework of Fontana Ranuccio archeological site based on volcano-stratigraphic and climatic-stratigraphic constraints (see text for detailed explanation).a) Stratigraphic column of the eruptive phase spanning 608-351 ka at the Colli Albani volcanic district (modified from Marra et al., 2011); b) Stratigraphic scheme of FR site modified from Segre and Ascenzi (1984) - picture added from Segre Naldini et al.(2009) - and c) from Biddittu et al. (1979); d) Excerpt of the Oxygen isotope curve encompassing MIS 11 - MIS 9 (Lisiecki and Raymo, 2005), showing the chronologic constraints to the deposition of the MIS 11 aggradational succession (Sp 1-2) cropping out at FR (Sp Fm: San Paolo Formation; Au Fm: Aurelia Formation). The position of the archeological evidence corresponding to FR4 (compare text and Figure 3) is marked by a red box above Pozzolane Nere in Figures 2b and 2c.

(Fig. 2 b,c) within an updated geochronological picture of the Colli Albani volcanic succession (Marra et al., 2009; Gaeta et al., 2016) and the new acquisitions on the glacio-eustatic forcing on the sedimentary processes in the Tyrrhenian Sea margin of central Italy (e.g., Giaccio et al., 2021; Marra et al., 2022, and references therein).

The original chronology of the site (Biddittu et al., 1979) was based on four K/Ar age determinations on samples of volcanic material collected in as many stratigraphic horizons (Fig. 2c). Except for the sample ls4 dated at 366±4.5 ka (Fig. 2 b,c), which was collected in the basal fallout deposit of the Tufo Lionato (TL) pyroclastic flow deposit (i.e., the lower unit of the Villa Senni Eruption Sequence dated to 365±4 ka, see Marra et al., 2009), the ages of the other three samples should be considered as resulting from reworked crystal populations. Indeed, these ages correspond to those of as many known eruptive units of the Colli Albani and Monti Sabatini volcanic units (Fig. 2a).

A new sample of reworked volcanic material collected in 2008 in the archeological layer by A.G. Segre and F. Parenti and published in Pereira et al. (2018) yielded a $^{40}Ar/^{39}Ar$ age of 408±10 ka (Fig. 2b), which evidences its origin from the underlying pyroclastic-flow deposit and should be considered a *terminus post quem* (maximum age) to the time of deposition of the archeological horizon. Similarly, the age of 365±4 ka belonging to the overlying Tufo Lionato pyroclastic-flow deposit constitutes as *terminus ante quem* (minimum age). However, such time frame can be significantly reduced by combining these geochronologic constraints with climatic-stratigraphic age-constraints deriving from the evidence for a glacio-eustatic control on the sedimentary processes (e.g., Marra et al., 2021).

Such chronostratigraphic approach provides tight age constraints to the faunal and lithic assemblages of Fontana Ranuccio, which were recovered within a complex sedimentary deposit overlying and partially reworking the Pozzolane Nere pyroclastic-flow deposit (407±3 ka, Marra et al., 2009) (red box in Fig. 2 b,c).

The archeological horizon is embedded within a 1.5 m thick fluvio-lacustrine succession (Sp2 in Fig. 2b), representing the uppermost portion of the MIS 11 aggradational succession (San Paolo Formation, Karner and Marra, 1998), deposited from 407 ka through 400 ka, during the late MIS 11 highstand (Fig. 2d). The remaining portion of this aggradational succession (Sp1), emplaced during the glacial termination V at the onset of the MIS 11 (430 through 407 ka, Fig. 2d), is comprised between the Pozzolane Nere and the Pozzolane Rosse pyroclastic-flow deposits (Fig. 2b). Such combined geochronologic and climate-stratigraphic constraints allow to date the archeological layer within the interval 407-400 ka.

4.1.2. The archeological layers

Archeological evidence is embedded within Unit 4 (FR4; see Fig. 3). This unit is a deposit approximately 1.5 meters thick, consisting of sandy-silt volcaniclastic sediment with sedimentary structures and hydromorphic diagenetic features. It corresponds to the 'Pozzolane nere lahar' as described by Pereira et al. (2018). FR4 is the result of the reworking of the underlying FR3, a laterally discontinuous primary pyroclastic flow that matches the so-called Pozzolane Nere layer, which has been dated to 408±10 ka (Pereira et al., 2018).

In summary, the archeological layers at Fontana Ranuccio are a volcaniclastic deposit that mainly results from the reworking of pyroclastic materials through sedimentary dynamics comparable to alluvial processes. The accumulation of the Unit FR4 was briefly interrupted, giving rise to a weak-developed soil profile with evidence of subaerial conditions, surface stabilization, and weak bioturbation. The delineation of this hiatus corresponds to an almost flat, slightly irregular layer.

Within Unit FR4 (Fig. 3 b,c), four sub-units have been identified, namely FR4-1. FR4-3 and FR4-4 (which have already been excavated since the 1980s), and FR4-5, which was discovered more recently.

The most recent archeological sub-unit FR4-1, which is 50 cm thick, is composed of volcaniclastic sediments derived from resistant but non-lithified tuffs. It is composed of a series of bodies that resemble channels directed from east to west, with an erosive base cut into each other. Often, small-sized (in the order of cm) faunal remains are found inside the channel fillings, which are frequently oriented coherently with the direction of the sedimentary interfaces or structures. This sub-unit appears homogeneous throughout its thickness. One of the characteristics of the sub-unit FR4-1 is the presence of large empty pores along a plane roughly corresponding to the surface on which the macrofaunal remains are distributed. The interpretation of these pores is still uncertain: they could be degassing porosity or may have resulted from the alteration of organic material, perhaps of animal origin, that originally filled them; the latter appears to be the best working hypothesis, but still needs to be verified. Another possibility to be checked is that they are pores resulting from the degradation of bulbs or rhizomes. The lower limit of FR4-1 (contact with FR4-3) is defined by a slightly marked but recognizable interface due to the presence of clasts and archeological materials lying flat in a non-derived position.

The second sub-unit, FR4-3, is made up of volcaniclastic sediments that have the same characteristics as the FR4-1 unit. The lower limit with FR4-4 is indistinguishable.

The earliest sub-unit FR4-5 is dark in color, with unclear origin and geometry, apparently resting on FR3. The dark color is partially due to abundant organic matter and partly due to manganese oxide. FR4-5 contains faunal material with bones of large mammals and scattered fragments of carbonized/mineralized vegetation in the unit. The cumuliform upper limit is clear, and in some places, it appears partially erosive.

4.1.3 Archeological evidence

Fontana Ranuccio provides an outstanding richness of archeological and paleontological evidence, and a wealth

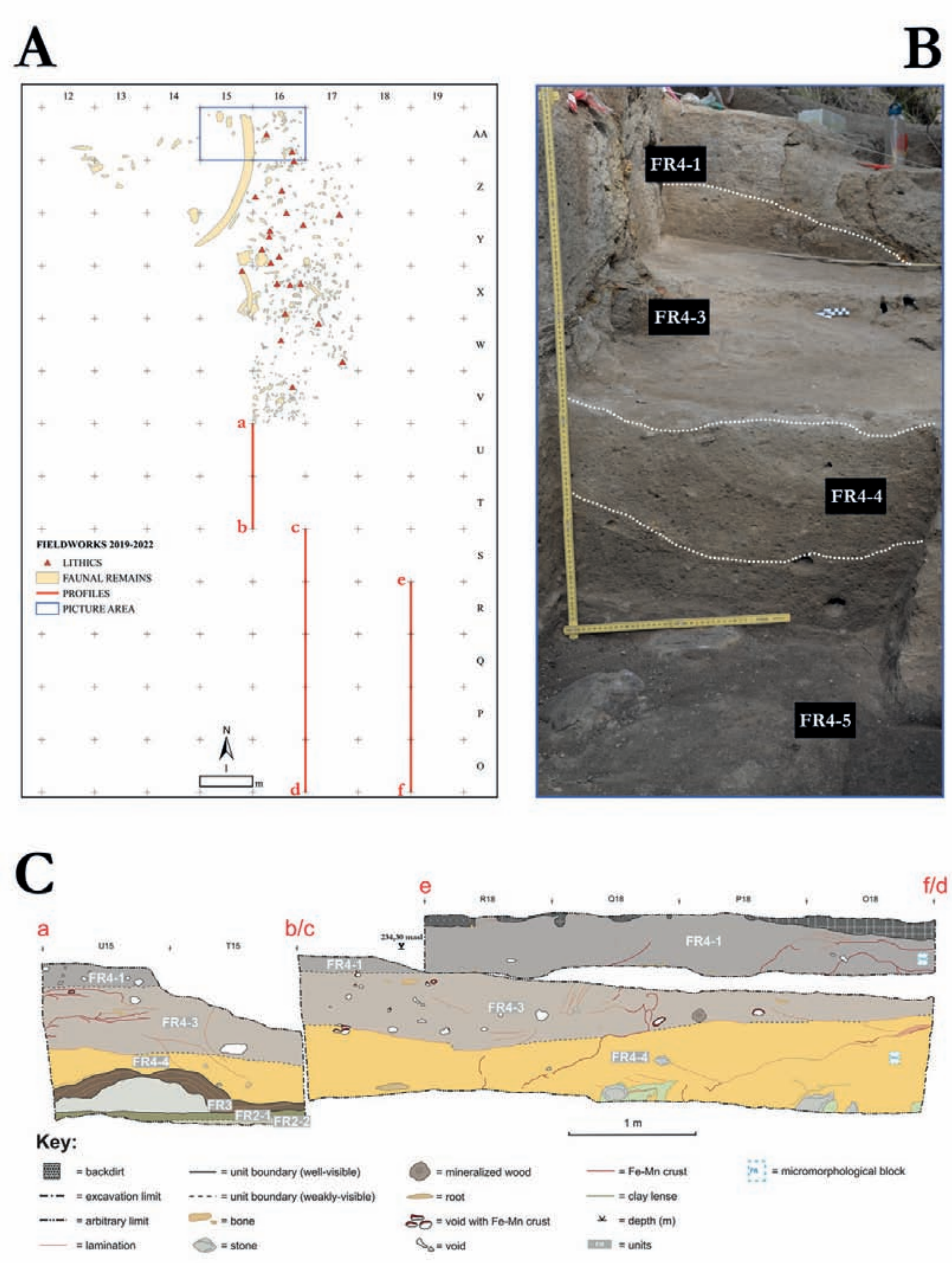

Fig. 3 - Fontana Ranuccio: A) Distribution of the archeological remains recovered between 2019 and 2022 (blue square: see picture in b; red lines: see profiles in c); B) The excavated profile in squares AA15 and AA16, showing the excavated stratigraphic sequence (compare the text for the description and the subdivision of the Unit FR4); C) The archeological cross-sections excavated until 2018 with their stratigraphic attributions.

of evidence has already been published on the subject, thus it will be just synthesized in this paper. Four human teeth have been unearthed (Rubini et al., 2014; Segre and Ascenzi, 1984) at the site, in association with abundant faunal remains (Bona and Strani, 2021; Strani et al., 2018) which attest to the presence of a complex environmental scenario. Human activity is confirmed by the presence of both large stone tools such as bifaces (Segre Naldini et al., 2009) and small tools recently investigated by a technical-functional approach (Grimaldi et al., 2020). A significant bone tool assemblage is attested at the site including the famous biface on elephant bone (Biddittu and Bruni 1987) but also bone flakes and knapping waste. Ongoing studies are being conducted on the new archeozoological evidence (Fig. 3a) as well as on old collections to obtain fresh data on taphonomy and bone technology. Finally, some mineralized wooden remains are attested (Segre Naldini et al., 2009).

4.2. COLLE MARINO

4.2.1. Chronostratigraphy of the site

The archeological/paleontological site of Colle Marino is situated in the Fasly at an elevation of 220 to 230 meters above mean sea level (Fig. 1). The valley is part of a complex hydrographic system that drains the slopes of the Affilani Mountains, where Miocene turbidite deposits and Triassic and Meso-Cenozoic silicic-carbonate successions of the Abruzzo Platform are exposed. Near to Colle Marino, fluvial erosion has revealed a sedimentary succession consisting of travertine deposits alternating with sands and sandy silts of carbonate origin. Along an exposed erosion surface within these deposits, lithic and faunal remains were discovered and have been previously studied (Biddittu et al., 1979).

Discontinuous outcrops of volcanic products, both primary and reworked and highly pedogenized, are found above these deposits. Between Colle Marino and Fontana Ranuccio, an almost complete sequence of pyroclastic flows erupted by the Colli Albani Volcanic District during the Tuscolano Artemisio phase, between 561 and 365 ka, can be observed (Marra et al., 2009; Gaeta et al., 2016).

In the year 2020, continuous core drilling was carried out to a depth of 35 m at the archeological site of Colle Marino (CM1, Fig. 4), with the aim of defining the chronostratigraphy of the area (Florindo et al., 2021). Below the travertine deposits containing the lithic finds described in Biddittu et al. (1979) the borehole recovered a thick lacustrine succession (Fig. 4), consisting of dark gray clays, substantially abiotic, passing upwards to whitish carbonate muds, typical of clear lacustrine waters allowing photosynthetic activity of charophytes, leading to precipitation of autochthonous carbonates (Florindo et al., 2021).

A primary tephra with an olivine-plagioclase composition interbedded in the lower portion of the clayey succession recovered in the CM1 borehole gave a $^{40}Ar/^{39}Ar$ age of 2.233±0.032 Ma. The paleomagnetic analysis along the clayey succession highlighted its stratigraphic continuity throughout the Matuyama chron, comprising the sub-chrons Reunion, Olduvai, Jaramillo, and the beginning of the Brunhes chron at 0.78 Ma (Fig. 4; Florindo et al., 2021).The $^{40}Ar/^{39}Ar$ dating using the "detrital sanidine" method (see Marra et al., 2019a) of twenty-one sanidine crystals extracted from a sediment sample collected within the travertinous-silty-sandy succession at 223 m asl, provided a *terminus post quem* of 0.6888±0.0027 Ma for the age of the sediment (Tab. 1). A second sample (B3-21), collected in the BCL complex exposed by the archeological excavation, was dated for the present study. It did not yield any sanidine crystals but only 6 plagioclase crystals that were analyzed at the *Laboratoire des Sciences du Climat et de l'Environnement* of Gif-sur-Yvette (France) facility using the procedure described in Nomade et al. (2011) (see appendix for full $^{40}Ar/^{39}Ar$ data). Two of the six analyzed samples have not produced reliable ages, while the remaining four range from 58 Ma through 460 Ma and are affected by large uncertainties, due to the unexpected very old age, which caused the crystals to have been insufficiently irradiated (Tab. 1).

The absence of crystals younger than 689 ka in the

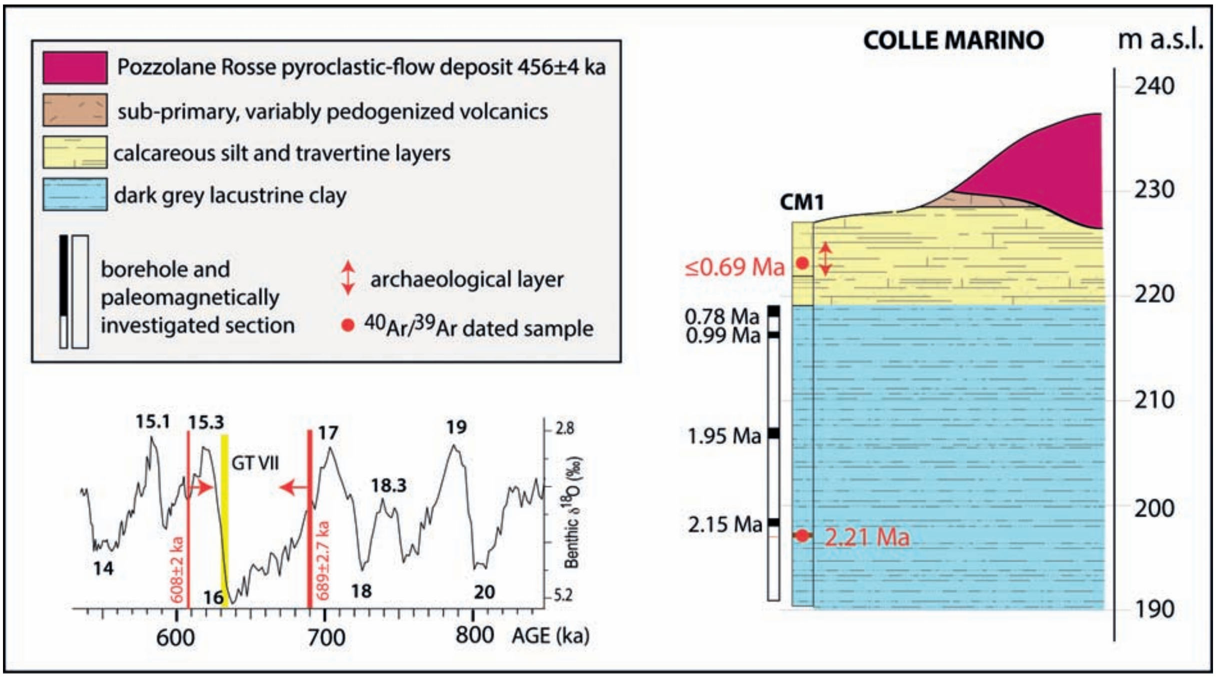

Fig. 4 - Colle Marino: a chronostratigraphic framework based on paleomagnetic and $^{40}Ar/^{39}Ar$ constraints (Florindo et al., 2021). The excerpt from the Oxygen isotopes curve (Lisiecki and Raymo, 2005) shows the chronologic relationship between the deposition of the archeological layer and the occurrence of glacial termination VII at the onset of MIS 15 (see text for detailed explanation). The position of the archeological evidence (unit BCL compare text and Figure 5) is marked by red arrows.

Tab. 1 - Colle Marino: crystal ages of CM-3.9 (in Florindo et al., 2021) and B3-21 (present study) dated samples.

CM-3.9		B3-21	
Age (ka)	±1s	Age (ma)	±1s
688,8	± 2,7	58,33	± 41,64
714,3	± 5,2	67,69	± 21,56
728,5	± 4,7	222,13	± 54,26
789,8	± 5,7	460,49	± 285,20
801,5	± 4,2		
831,8	± 4,6		
840,3	± 3,7		
840,7	± 4,9		
841,7	± 4,2		
842,7	± 3,7		
842,9	± 5,0		
843,6	± 3,4		
843,8	± 3,4		
844,6	± 3,3		
847,1	± 3,6		
862,3	± 5,2		
862,5	± 3,5		
866,9	± 4,1		
876,3	± 6,0		
951,0	± 5,7		
952,0	± 5,4		

dated samples, if contextualized with the widespread presence in the outcrops above the silty-sandy-travertine succession of the products of the Colli Albani eruptive activity, allows us to consider the age of 608 ka (beginning of the explosive activity at Colli Albani, Marra et al., 2009; see figure 2a) as a *terminus ante quem*, and to constrain the age of this sedimentary succession between 0.689 and 0.608 Ma. The fact that the Anagni basin remained a lacustrine environment, not directly influenced by sea level oscillations, throughout the interval 2.2-0.78 Ma makes it more difficult to apply the principles of glacio-eustatic forcing on the sedimentation. However, the diffuse presence within the travertinous-silty-sandy succession of cm- to dm-sized pebbles, deriving from erosion and transport of the carbonate and flysch units cropping out at the nearby Affilani mountains, testifies for a sudden increase in capacity of transport in the sedimentary basin. Notably, coarse clastic sediments (gravel with grain size >1<10 cm) at the base of the aggradational successions in the hydrographic basins of central Italy extending to the Apennine's divide have been shown to represent the testimony of global deglacial events (Marra et al., 2019b, 2022; Giaccio et al., 2021). Based on this hypothesis, by comparing the maximum age of 690 ka with the chronology of the oxygen isotopes stages, a tentative correlation between the emplacement of the pebbly horizon of Colle Marino and the occurrence of the glacial termination VII around 630 ka (Lisiecki and Raymo, 2005) is proposed here (Fig. 4). Such a pebbly horizon is likely the source material of the recovered lithic artifacts at Colle Marino.

4.2.2. The archeological layers

In 2021, an excavation campaign and several trenches were carried out by the Istituto Italiano di Paleontologia Umana and the University of Trento (Fig. 5). The main result was the sedimentological definition of the archeological deposit found in the layer dated at about 700 ka.

The general characteristics of the succession allow its subdivision into four stratigraphic complexes, from top to bottom (compare Fig. 5b): (1) Ap complex, present-day soil A horizon; (2) SLO complex, clay-loam sediment, with a lower boundary characterized by a discontinuous stone-line; (3) ARG complex, thick succession of pedogenic clays; (4) BCL complex, coarse detrital unit with limestone elements.

The Ap complex ("soil" unit in Florindo et al., 2021) outcrops below the present topographic surface and forms a body with predominantly tabular geometry, parallel to it. It is a pedogenetic horizon, well recognizable when developed from the BCL complex (due to the lithologic contrast and abrupt lower boundary), less distinct when resting on the SLO complex. The average thickness is around 25 cm, but locally there are pits and agricultural ditches filled with recent material where the unit increases in thickness (up to about 50 cm). The horizon is composed of clayey silt with stones in varying amounts (in places where the Ap horizon is developed on BCL these are heterometric limestones, scarce to common, of variable shapes and sometimes patinated; almost absent where it rests on SLO); it has medium blocky aggregation, angular to sub-angular, poorly developed, color 10YR3/6, common roots and scarce organic matter; it contains archeological material in derived position, dispersed throughout the thickness and of various kinds (lithic artifacts, brick and tile fragments, etc.); the lower boundary is abrupt, wavy on BLC, clear on SLO. The contact between this sub-recent horizon and the Pleistocene succession is affected by several negative structures of various shapes and depths, some with fire traces, with differentiated features, due to agricultural activity. The 2020 core hole insisted on one of these pits, offsetting the depth of the roof of the BCL complex (at 45 cm, see figure 3 in Florindo et al., 2021).

The SLO complex (not detected in the coring described in Florindo et al., 2021) forms a sedimentary body with a trend approximately parallel to the topographic surface and with an apparently constant thickness, around 35 cm. Upstream, the unit closes by thinning and is well recognizable in excavation sectors TR1 and TR2 (Fig. 5).

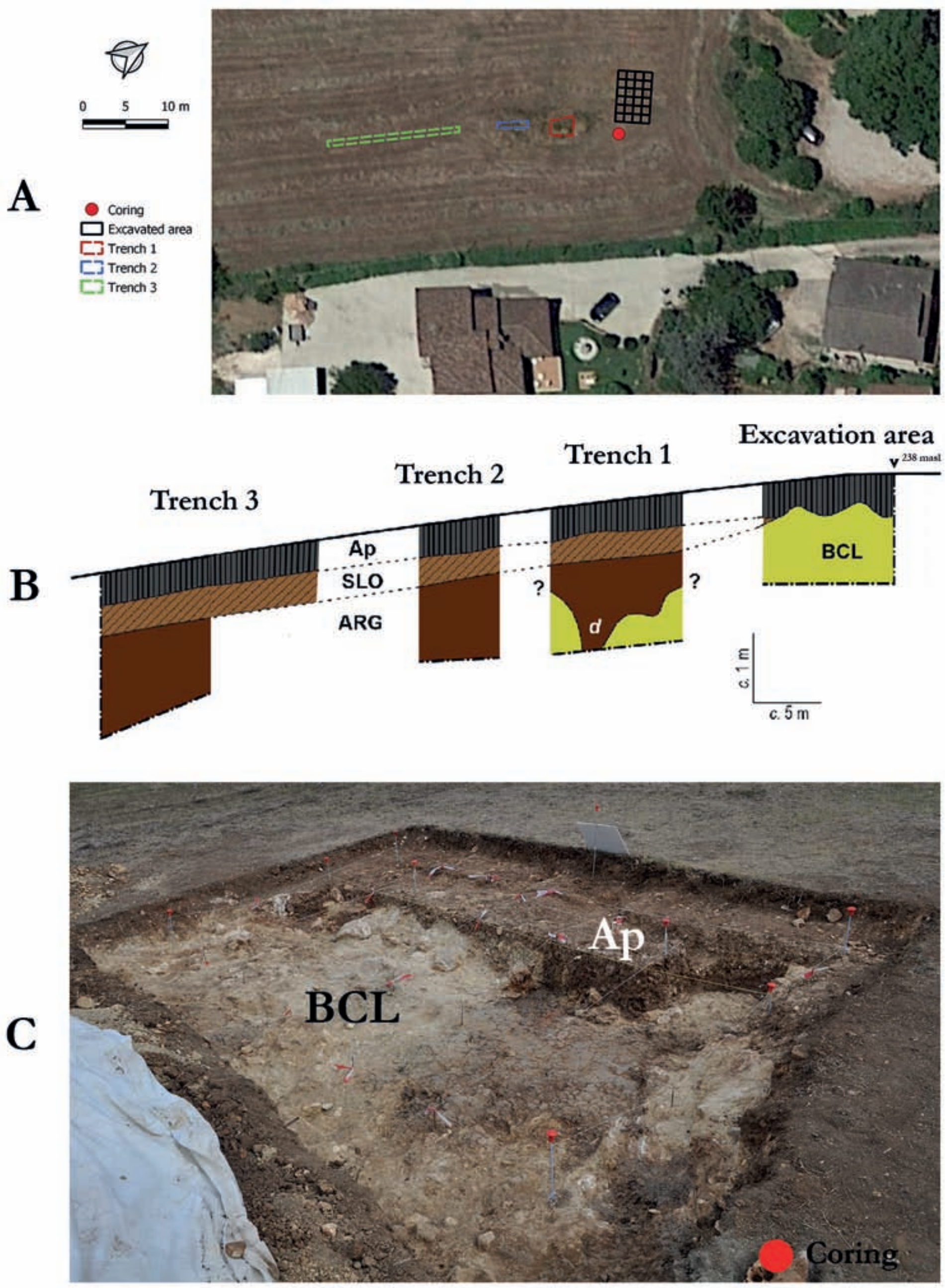

Fig. 5 - Colle Marino: A) Location (base map modified from Google Satellite) of the excavated area (black grid), of the three trenches excavated in 2021, and the position of the coring realized in 2020 (red dot); B) Profiles of the excavated area and trenches with their stratigraphic attributions (see text for description); C) The excavated area showing the relation between Ap and BCL and the position of the coring (red dot).

It consists of clayey silt, with few stones (about 5-8%), variously shaped (angular to rounded), fine (maximum size 3 cm), of calcareous composition, with occasional soft clasts of greenish clay and very rare minute fragments of gray (volcanic) tuff, dispersed throughout the thickness without preferential orientation except at the base, where they are slightly larger, up to 5-6 cm, and arranged flat; it has coarse, poorly developed prismatic aggregation, color 10YR3/3; it is firm, weakly porous, with planar voids with a predominantly vertical orientation; organic matter is apparently absent and roots are very scarce; sparse nodules of Fe oxides or Mn oxides are present; the lower boundary is a clear linear and insists on a preexisting erosional surface marked by the presence of stones, arranged flat if tabular, forming a discontinuous stone-line.

The ARG complex forms a thick clay-textured succession in which several units are distinguishable, named ARG1, ARG2 and ARG3 (not detected in the coring described in Florindo et al., 2021).

The BCL complex (described as “sand with carbonatic concretions and travertine layers” in Florindo et al.,

2021) consists of chaotic diamicton with a silty-loam matrix and variable support (matrix in some places, almost clastic in others). The fine material, 2.5Y6/4.5 in color, is locally affected by secondary calcium carbonate enrichments. The coarse fraction varies laterally and is composed of heterometric clasts (up to 50 cm), sub-rounded to angular, without any textural selection, with random distribution and orientation; fragments of limestone and travertine \ calcareous tuff (in about equal amounts) and soft clasts of greenish clay are recognized. In its upper part, particularly in the EXC excavation area, there are slightly more organized intercalations, of unclear geometry, consisting of coarse sand and very fine grains (up to 1 cm) or medium-coarse, pure sand, up to 3 cm thick, of a deeper yellow color, sometimes with vague flat lamination.

4.2.3. Stone tools assemblage

Several tens of limestone artifacts have been found in the disturbed SLO and ARG sediments (Fig. 6); according to what has been described before, these implements should come from the surface of the BCL complex, being removed from their original position by ancient erosional events as well as by modern agricultural activity. From a morphotypological as well as from an alteration process perspective, the implements resemble those collected since the 70s. Few lithic artifacts have been found on the top of the BCL layer embedded into its sediment (Fig. 7); no faunal remains have been found with the only exception of some fragments of *Crocuta brevirostris* reported by Ascenzi et al. (1993). These implements should be considered of the same age as the BCL layer and represent today the only clear evidence of a very early stage of human presence in the Anagni basin.

The lithic assemblage is made of limestone pebbles, probably included in the same BCL complex as four unmodified limestone pebbles have been found during the excavation; the assemblage is represented by four unretouched flakes (Fig. 6: 2 and 4-6), three retouched flakes, one retouched pebble, and three cores/hammers (pebbles with scars).

From a typological perspective, retouched tools are represented by denticulates (Fig. 6: 3); we need to stress here that the recognition of scars possibly due to a knapping/retouching activity is made very difficult due to the weathered state of preservation of the limestone implements. On the contrary, in the upper disturbed levels, other stone tools are present, and, among them, some choppers or chopping tools morphologies (Fig. 6: 1), similar to those found on the surface in the 70s, have been collected.

5. DISCUSSION AND CONCLUSIONS

In this paper, we presented new data on the chronostratigraphy of the two earliest archeological sites currently known in the Anagni basin (Latin Valley, southern Latium). As described previously (Florindo et al., 2021 and references therein), a gradual shallowing and temporary emersion of the Anagni lacustrine basin can be attributed to the combined effect of sedimentary filling and regional uplift that occurred since 800 ka and peaked around 600 ka, coinciding with the onset of volcanic activity in the Roman Magmatic Region. In this context, the lacustrine basin of the Sacco Valley can be considered a fault-controlled, subsiding basin within the overall uplifting regime of the Apennine chain during Middle Pleistocene times. This location, which contains the earliest evidence of human occupation in central Italy, is characterized by large lacustrine basins and surrounding alluvial plains with prairies and grasslands, and mild climatic conditions. It thus represents an ideal environment for the game and their hunters.

The Colle Marino BCL layer dated from about 700 ka, has been tentatively suggested as the origin of the lithic collection found at the site. This layer could provide valuable insights into the pre-Acheulean technocomplexes in Mediterranean Europe. However, the BCL complex at Colle Marino is difficult to interpret due to its chaotic organization and characteristics. It appears to have been rapidly formed by casting or dejection mechanisms, with material feeding from outcrop zones of limestone, travertine, calcareous tuff, and marls/lacustrine clays, which are packed in carbonate silt. The unit forms a recognizable ridge located at a short distance from the site where its top has been eroded.

Archeological finds appear to be from the upper part of this unit (see also Florindo et al., 2021), where sandy lenses indicate phases of accumulation by more organized, tractive-type flows. The archeological materials found are relevant to these intercalations and are preserved in the excavation sector alone, having been removed by subsequent erosional processes elsewhere. After its accumulation, the succession of the BCL complex was cut by a sloping interface, indicative of a significant moment of erosion toward the S/SE. The topography of this slope is consistent with the presence of a depression where the water stream now stands, downstream of the site.

The erosional interface truncating the BCL complex is covered by a thick clay body, likely attesting to marsh-type conditions, with metric-order thickness, represented by the ARG complex. The primary origin of the clays is unclear: they could derive from the weathering of volcanic or other materials; an undisturbed sample was collected for this purpose, from which a large-format thin section will be obtained to analyze its characteristics. The complex contains a fraction of expandable lattice clays, as evidenced by traceable evidence to vertic processes. The original geometry of the ARG complex was likely planar and horizontal, filling the current depression related to the erosive action of the ditch. After deposition, the clay succession was affected by relatively intense soil formation, resulting in the development of the horizons represented by units ARG1 and ARG2, classifiable as Bt and BCg soil horizons. Contextually, the bedrock on which the clays rest (the BCL unit), is affected by karst-

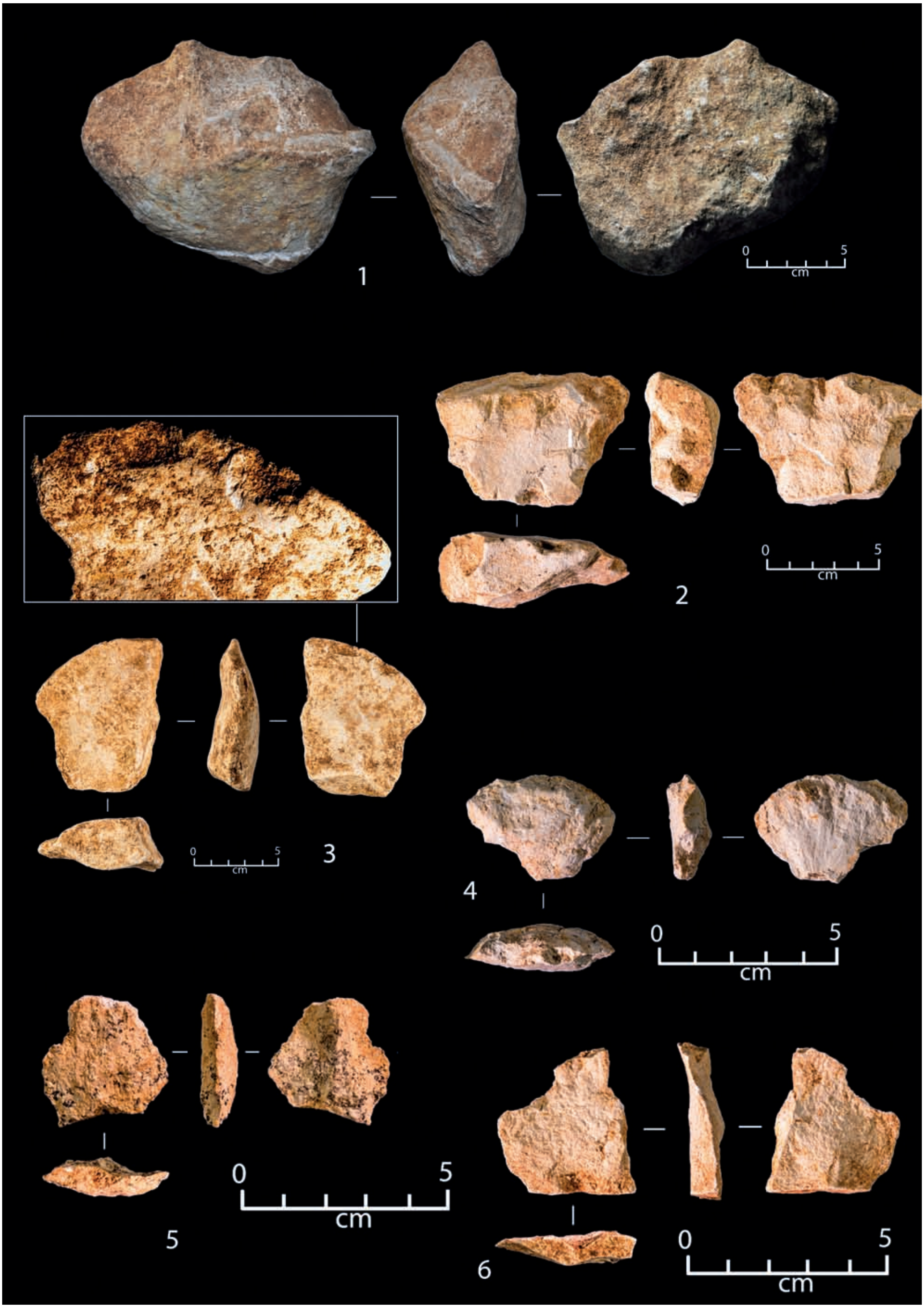

Fig. 6 - Colle Marino: Lithic industry recovered during the excavation. 1: Chopping tool from Unit Ap; 2-6: flakes from Unit BCL.

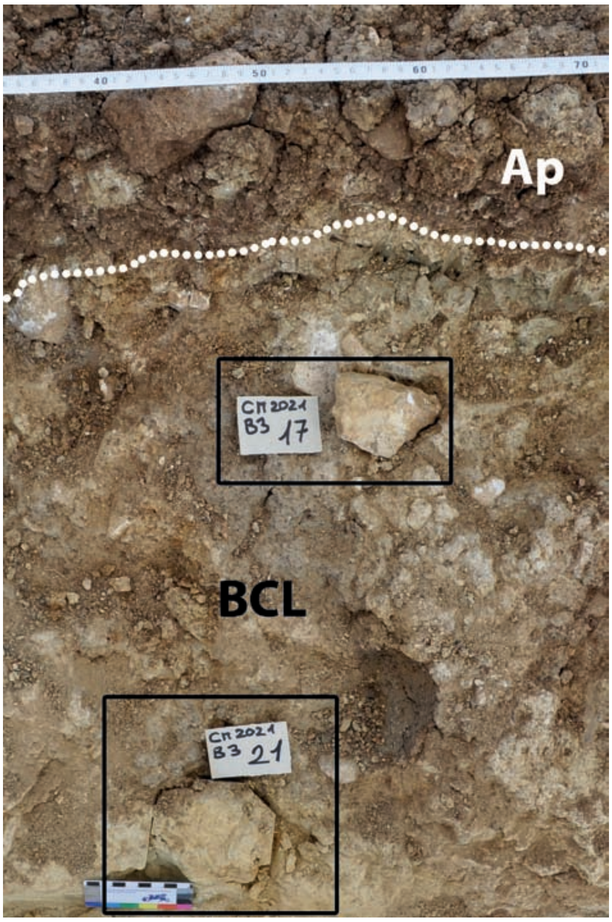

Fig. 7 - Detail picture showing the position of a stone tool (compare Figure 6:2) embedded into BCL, near by the sample B3-21 used for dating (compare section 4.2.1).

like dynamics which result in the development of surface forms such as the covered sinkhole. This sinkhole had already opened when the ARG complex was put in place.

The next episode sees the truncation of the sequence formed by the BCL and ARG complexes by a new erosional interface almost parallel to the present topographic gradient, with the configuration of a gentle slope, draining toward the South. The stratigraphic evidence of this phase of erosion is provided by the lower boundary of the SLO unit. This unit is deposited on top of the previous one and consists of slope sediments related to surface runoff processes. These sediments partially cut and reworked both the ARG units and the BCL complex (as also evidenced by the presence of archeological materials in secondary position). A possible chronological attribution to this phase could be related to the Upper Pleistocene.

The Ap horizon represents the most recent episode in the development of the site's shallow pedogenetic horizon. Its characteristics correlate with a sub-recent, currently inactive agricultural use of the surveyed plot.

In contrast to the Colle Marino site, human occupation of this region reaches a climax at around 400 ka as constrained by the chronostratigraphic framework reconstructed at the Fontana Ranuccio site. This framework is consistent with geochronologic data from recent literature obtained from this site and other sites throughout the Latin Valley, spanning 410-350 ka.

However, several questions still require an answer. For example, the reasons for the accumulation of bones and tools at Fontana Ranuccio are still unclear. The recognized sub-units appear to have formed under moist conditions with periodical (possibly seasonal) water flows that slightly dispersed bones and lithics from their original deposition. The presence of bones of large mammals in association with tiny flakes of flint does not help to solve this problem yet. Generally speaking, sub-units seem to have been exposed for a prolonged period of time of periodic saturation by groundwater, which led to the genesis of the Fe-Mn oxide crusts and other pedofigures related to hydromorphism and oxidation. All of this appears to have occurred before the deposition of the pyroclastic units that cover them.

The anthropogenic evidence at Fontana Ranuccio provides a clear indication of human behavior in this region during the time period in question. In addition to the lithic industry, ongoing analyses of bone tools and archeozoological studies are shedding further light on this topic. The lithic assemblage reveals a significant cognitive gap between modern *Homo sapiens* and the inhabitants of Fontana Ranuccio, particularly in the way retouch was applied during the final stage of the reduction sequence. This process plays a crucial role in the production of tools and is distinct from other technical expedients, such as "debordant" flakes, thick butts, and voluntarily fractured blanks. These methods are used to create standardized tool morphologies that are useful in shaping the prehension part of the tool, as discussed in detail by Grimaldi et al. (2020). Retouch is therefore used as an essential technical process, which cannot be separated from the reduction sequence. The need to modify the original form of flakes and cores to shape them into the final objectives of the production is of particular relevance here. Thus, blank production (*débitage*) and tool shaping (*façonnage*) are tightly interconnected, as already noted by Aureli et al. (2016, 178). These results, along with the upcoming findings from ongoing studies, provide valuable insights into the behavior of hominins and the factors that influenced their location and spatial distribution during the early stages of human occupation of the Anagni basin and more broadly, in the Latin Valley. The new results are expected to shed more light on these topics, further enhancing our understanding of early hominin behavior in these sectors of the Central Mediterranean region.

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