Supporting Information

Early Levallois and the beginning of the Middle Paleolithic in Central Italy

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S3 File. Text and figure.

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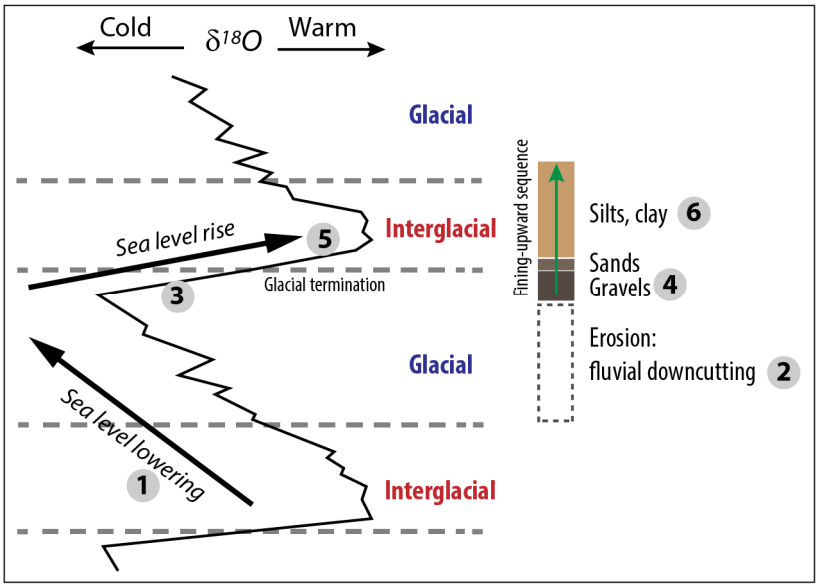
Fluvial aggradational cycle in the Aniene River Valley

The cyclical structure of quaternary fluvial deposits has been described throughout the world and especially in NW Europe (Somme, Seine, Thames, Escaut, Rhine...). In most of the cases, it is considered to be a climatically controlled process [1,2]. Aggradational cycles (deposition of coarser to finer sediments, downcutting) are controlled by cyclical oscillation of sea-levels induced by global climate changes from glacial to interglacial periods and terraces staircases are records of bedrock uplift. Differences in the timing of downcutting and gravel accumulation have been described depending on several factors. In the lower Thames the downcutting has occurred during cold-to-warm transitions according to [3] whereas in other west-european valleys (ie. Somme [4], Moselle [5]) the downcutting event has occurred at the warm-to-cold transition.

In the Aniene River Valley the aggradational cycle can be described as follows (S Fig A) [6–8]:

(1) At the end of the interglacial, cooling induces sea level lowering. The profile of fluvial drainage is unbalanced and fluvial downcutting begins (2). Previous fluvial deposits are now in a terrace position. Downcutting is enhanced by the transport of coarse materials coming from upstream but no deposition occurs along the course. (3) With cooling that begins after the glacial maximum, the level of precipitation increases. Sea level is rising once again and the base level of the drainage is also rising. Down cutting is now impossible and a rapid accumulation of coarse deposits (boulders, gravels) occur (4) between the glacial maximum and the glacial termination. As the sea level is still rising with warming (5), the gradient of the stream is reducing and only fine sediments (6) can be transported and deposited (sand then silts), sometimes in lacustrine/lagoonal context when the seashore is close. This aggradational sequence is repeated each time the change of sea level under glacio-eustatic control is enough to induce a significant modification of the base level of the drainage.

This model of aggradational sequence applies overall to the Tiber River and its tributaries including the Aniene River but irregular and brutal input of huge amount of volcano-clastic sediments in the fluvial system have induced great variations of thickness, rhythm and nature of deposits. From an archaeological point of view, it implies that most of the glacial time is not recorded. Industries recovered in gravels in rather mint conditions (not too rolled) were deposited in a narrow time span as the gravel accumulation is rapid.



S Figure A. Model of a glacio-eustatically controlled fluvial aggradational sequence in the Aniene River Valley. According to [6–9].

Stratigraphy and chronology of Sedia del Diavolo and Monte delle Gioie

The preservation of two Pleistocene terraces in the Aniene River Valley was first described by A. Segre [10] and A.C. Blanc [11–13]. The latest terrace, referred to as Lower Terrace, is famous for the discovery of two Neanderthal cranium in fluvial sand and gravels at Saccopastore [14] associated with fauna and Mousterian industry. This Lower Terrace was first assigned to the Last Interglacial according to fauna and fossil flora recovered in calcareous tufa [11,15] but is now dated to MIS 7 [6]. An earlier terrace, referred as intermediate [16] or median terrace [17], including pyroclastic deposits from the Latial volcanoes interbedded with gravels, sands and fluvio-lacustrine silts have been observed on both sides of the valley at Monte delle Gioie and Sedia del Diavolo. This median terrace was considered to be rissian [11,18]. The same chronological interpretation was presented in Piperno and Segre [16].

Stratigraphy from Sedia del Diavolo (hereafter SdD), Via Mascagni (Circonvallazione Salaria outcrop) and Monte delle Gioie (MdG) can be described as follows (from base to top) according to data from [12,17–21] (see Fig 2):

- Layer 1: Clay with remains of Conifer only observed at MdG. It might be part of a Paleo-Tiber Unit [9]. Above, a thin layer of clay with terrestrial malacofauna is noticed by [17].
- Layer 2: Fluvial gravels without derived volcanic products. At MdG they outcrop around 2 m thick [19]. At Via Mascagni they were only observed by coring and reportedly contained red scoriae [21].
- Layer 3: Thick (more than 25 m at SdD, ca. 12 m at MdG) deposit of Tufo Lionato, a massive volcanic tuff (ignimbrite) from theAlban Hills volcano dated by $^{40}Ar/^{39}Ar$ to 365 ± 4 ka [22,23]. It is constituted of greyish scoria and yellow-orange pumice

scattered in a cineritic matrix. Three superimposed facies have been distinguished. This layer rests on an erosion surface that cuts underlying gravels.

- Layer 4: Pale yellow silts and sands, fluvial epiclastic deposits with pebbles of reworked Tufo Rosso a Scorie Nere. This layer is 1 m thick at SdD and Via Mascagni.
- Layer 5: Fluvio-lacustrine silts and clays (4 m thick at Via Mascagni, close to 10 m at MdG).
- Layer 6: Fluvial sands (lateral variation of layer 5?). Layers 5 and 6 are locally deeply eroded.
- Layer 7: Fluvial gravels (4 m thick at MdG) resting in unconformity on previous layers and starting a new aggradational sequence. The lower part (1 m) contains pebbles of different derived volcanic materials (ignimbrite with black scoria, Tufo Lionato, pumice). The lithic industry was collected at mid-height of this gravel layer according to [17].
- Layer 8: Lacustrine yellow silty-sands with travertine and tuffite.
- Layer 9: Massive pyroclastic deposit called Tufo Giallo di Sacrofano dated to 285 ± 2 ka [24] originating from the Monti Sabatini Volcanic District. White centimetre-sized pumices are embedded in a grey-brown cineritic matrix.
- Layer 10: Marl with palustrean flora, calcareous encrustations with Typha and Cyperacea.
- Layer 11: On hillside of MdG, a travertine developed and later a cave (Indes cave) formed. The infill of this cave now destroyed contained a rich Upper Pleistocene fauna and an Upper Paleolithic industry [25].

The basal gravels with red scoriae (layer 2) outcropping at SdD and MdG and recognised by coring in the Via Mascagni sequence [21] are difficult to interpret. The red scoriae present in the gravels may be reworked from the Pozzolane Rosse, a pyroclastic flow from the Alban Hills volcanic district, with purple-red scoriae, dated to 456 ± ka [23,26]. Usually, the Tufo Lionato directly underlies the aggradational sequence of the Aurelia Formation [27] and rests on eroded older (MIS 11) deposits. As explained by Karner and Marra [28], in the Fosso Galeria the deposition of the Tufo Lionato was massive (>20 m thick) and fast (faunal remains in anatomical connexion embedded at the base). It occurs during MIS 10 in a fluvial channel already deeply embanked but still downcutting older deposits. We can consider that these gravels are remains from an earlier aggradational phase, separated from the Tufo Lionato by a major unconformity. Fluvial deposits follows, partly reworking the Tufo Lionato (layer 4) then fining-upward deposits (layers 5 and 6) are ending the fluvial aggradational sequence. Layer 7 with lithic industry and fauna, is separated from previous deposits by an erosional surface. It is the first layer of the following aggradational sequence, the so-called ‘Via Mascagni succession’. Silty-sands with travertine (layer 8) cap fluvial infilling but they are buried by the Tufo Giallo di Sacrofano, a massive pyroclastic deposit, dated by 40Ar/39Ar to 285 ± 2 ka [23,24].

Thus the Paleolithic artifacts, fauna and hominin remains of Sedia del Diavolo and Monte delle Gioie are time bracketed between two massive volcano-clastic deposits, widely distributed in the area of Rome [23,26]. They are well characterized and well dated by 40Ar/39Ar [22–24]. The age of deposition of layer 7 can be refined taking into account the modelling of pleistocene fluvial aggradation of the Tiber and its tributaries according to Marra et al. [7,8]. Coarse deposits (boulders, gravels) from the base of the sequence are considered

to have been accumulated between the glacial maximum and the glacial termination (See section above). So the lithic industries of Sedia del Diavolo and Monte delle Gioie and hominin remains from Sedia del Diavolo were deposited between the glacial maximum of the MIS 8.6 cold event and the onset of warmer MIS 8.5 episode[1].

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