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THE *CONHAL* OF ARNEIRO (NISA, NORDESTE ALENTEJANO, PORTUGAL). A GEOARCHAEOLOGICAL VIEW ON ANCIENT GOLD EXPLOITATION IN A LATE QUATERNARY TAGUS RIVERINE LANDSCAPE

ABSTRACT: DEPREZ S. & DE DAPPER M., *The* Conhal *of Arneiro (Nisa, Nordeste Alentejano, Portugal). A geoarchaeological view on ancient gold exploitation in a Late Quaternary Tagus riverine landscape*. (IT ISSN 0391-9838, 2008).

This paper presents the results of geoarchaeological research in the Portuguese Tagus Valley. Until recently, the Late Quaternary evolution of the *Conhal* of Arneiro (Nisa, Northeastern Alentejo, Portugal) was poorly examined and understood. Especially the large-scale exploitation for placer gold in historical times complicated the landscape reconstruction, as it systematically obliterated large parts of the archaeological and palaeoenvironmental record. The Pleistocene T2 Tagus River terrace was exploited over an area of 0.6 km^2, resulting in the removal of ca. 8.4×10^6 m^3 of auriferous sediments. The sterile waste products that were evacuated towards the Tagus and its tributaries, choked parts of the valleys and covered the Late Glacial-Holocene T1 terrace.

A geoarchaeological approach was vital to assess the different natural and anthropogenic processes and their interactions during the Late Quaternary. Firstly, the anthropogenic landforms were identified and interpreted as to their function in the exploitation process. Within this framework, the preserved fluvial landforms could be analysed and the Late Quaternary riverine evolution be reconstructed.

It is important to stress the patrimonial value of the *Conhal* since the unique cultural landscape created by the mining activities has been well preserved. The importance of such old industrial sites is however often disregarded. Of all the placer gold exploitations along the Tagus, only the Conhal area has been declared historical mining patrimony. The research presented in this paper can serve as a guideline for the analysis of comparable areas and can be a stimulus towards protection and preservation of this unique heritage.

KEY WORDS: Geoarchaeology, Late Quaternary, Tagus River, River terraces, Placer gold, *Conhal*, Portugal.

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INTRODUCTION

The study area is located in east-central Portugal, in the municipality of Arneiro (Nisa, Nordeste Alentejano). This paper focuses on the Late Quaternary riverine landscape evolution in the Tagus Valley immediately downstream from the water gap of Portas de Ródão (fig. 1), an area with a unique geomorphological and geoarchaeological setting, as will become clear in this contribution.

Relative subsidence along the Ponsul fault resulted in the formation of a tectonic depression in the area comprised between the Serrinha- and the Serra de São Miguel - hills (fig. 1, fig. 2b). As a result, fluvial processes were controlled by the local conditions inside the depression, complicating age or altitudinal correlation with Tagus River terraces in adjacent areas.

The understanding of the present-day landscape is further obscured by major human interference in historical times. An extensive open-air exploitation for placer gold obliterated large parts of the original fluvial landscape and left behind a «scarred» landscape (Deprez & *alii,* in press). The destructiveness of these activities makes a reconstruction of the pre-existing landscape more complicated as it caused major gaps in both the archaeological (prehistoric) and palaeoenvironmental (dominantly fluvial) record.

Therefore, in order to unravel this complex landscape history, a geoarchaeological approach is essential. Firstly, a clear understanding of the gold exploitation process is required. In this way, the observed anthropogenic landforms can be interpreted as to their function in the exploitation process. With this knowledge, the preserved fluvial landforms can be analysed. Even though the preservation of fluvial sediments is poor, their analysis provides an insight

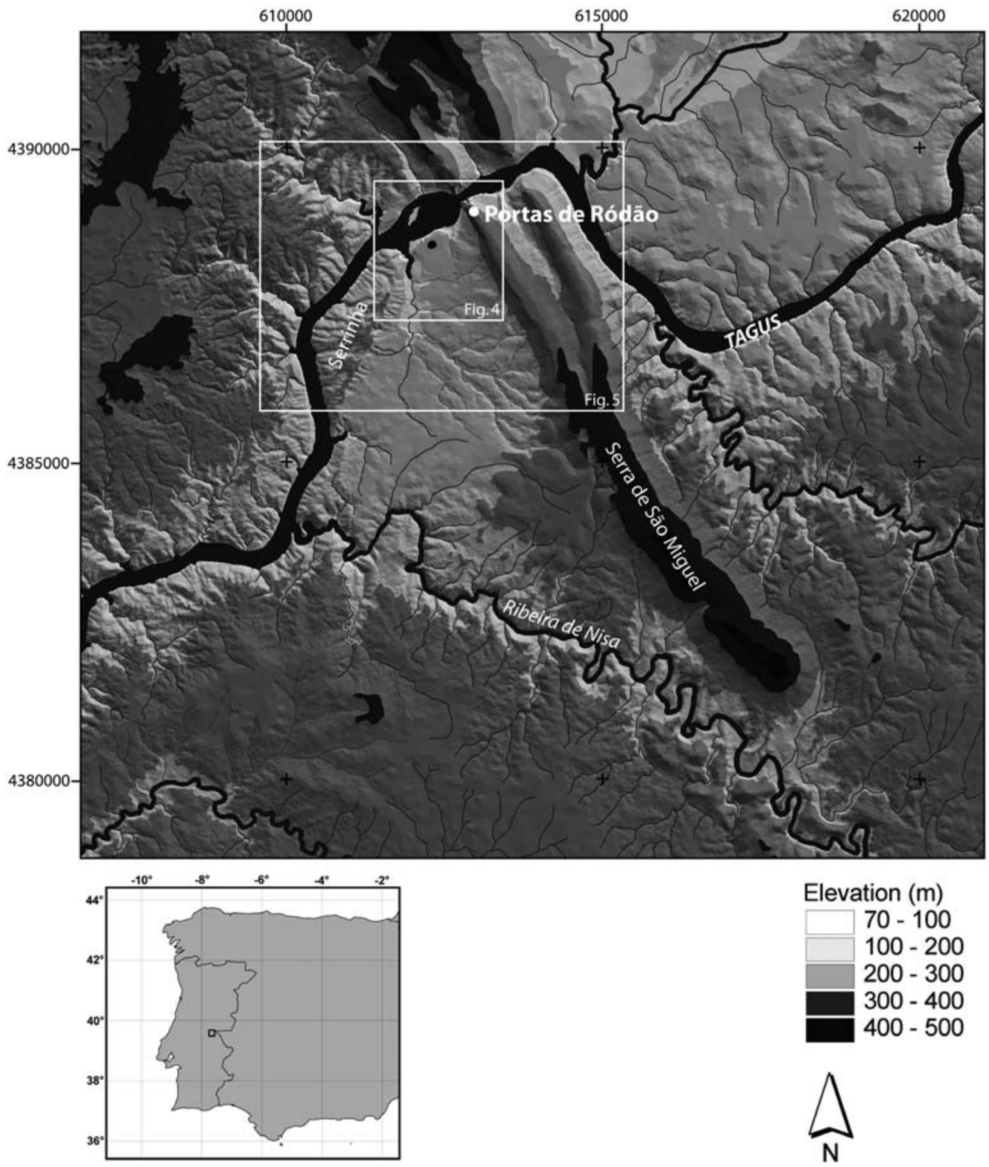

FIG. 1 - Geographical situation of the study area (UTM-coordinates in metres) (TIN-model based on the *Carta Militar de Portugal*, sheets 314 & 324, original scale: 1:25,000).

into the characteristics and evolution of the natural landscape since the Late Quaternary.

GEOLOGICAL AND GEOMORPHOLOGICAL SETTING

The Tagus River is the longest river of the Iberian Peninsula (ca. 1007 km). From its source in the Albarracín mountains in eastern Spain, it crosses the Madrid Tertiary Basin and the craton of the Meseta Extremeña. It proceeds into Portugal in a deeply incised valley in the Hercynian basement. Subsequently, it flows through the Tertiary Lower Tagus Basin to empty in the Atlantic Ocean.

In Portugal, the Tagus River can be subdivided into five reaches (fig. 2a), defined by major faults (Proença Cunha & *alii,* 2005). The study area is located at the transition between the first and second reach, the first is located upstream of the Ponsul Fault (F1), the second between the Ponsul Fault and the NW-SE fault system of Gavião and Ortiga (F2, F3). In these first two fluvial sectors the Tagus flows mainly over Palaeozoic basement rocks, in the downstream reaches (III, IV and V) over Tertiary sediments (Tertiary Lower Tagus Basin).

The major part of the landscape in the study area consists of a strongly dissected planation surface (the so-called Fundamental Planation Surface, see Proença Cunha & *alii,* 2005) with altitudes of 300 to 320 m, developed in Pre-Cambrian to Lower Cambrian schists (fig. 2b). A SSE-NNW oriented double quartzite ridge rises up to 260 m above this peneplain. It is part of a very narrow syncline, of which the outermost Ordovician quart-

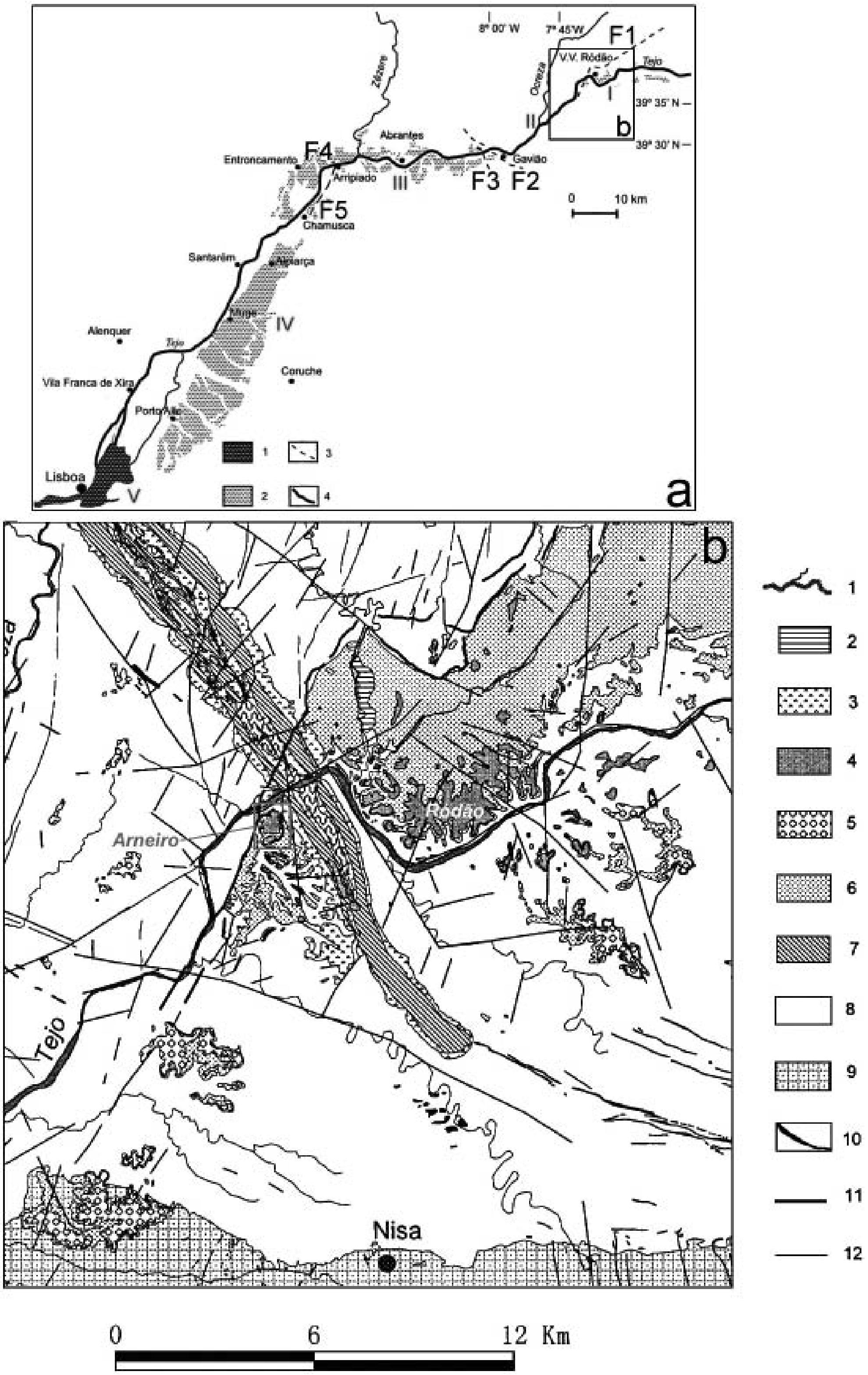

FIG. 2 - a) Main reaches of the Tagus River in Portugal. Legend: 1. Estuary; 2. Terraces; 3. Faults; 4. Tagus main channel (after Proença Cunha & *alii*, 2005). b) Main geological and geomorphological features of the region of Vila Velha de Ródão: 1. Water course; 2. Alluvium (Holocene); 3. Talus cone (Pleistocene); 4. Terraces (Gelasian to Pleistocene); 5. Quartzitic conglomerates and quartz sandstones (Falagueira Formation, Piacenzian); 6. Arkoses (Beira Baixa Group, Paleogene to Miocene) and conglomerates/clays (Torre and Monfortinho Formations, upper Tortonian to Zanclean); 7. Quartzites (Ordovician); 8. Schists, slates, phyllites and metagreywackes (Beiras Group, Pre-Cambrian to Lower Cambrian); 9. Granite; 10. Aplites and dykes; 11. Ponsul Fault; 12. Fault lineament (after Proença Cunha & *alii,* 2005).

zites represent the most resistant and hence highest parts (fig. 2b).

During the Tertiary, a long period of fluvial sedimentation prevailed. The Beira Baixa Group (Paleogene - Upper Miocene) is primarily composed of arkoses (fig. 2b), originating from the Nisa and Castelo Branco granites to the south and northeast (fig. 2b). The Murracha Group (Upper Tortonian – Middle Pliocene) consists mainly of alluvial fan deposits, connected with the breakdown of the uplifted Portuguese Central Range (Torre and Monfortinho Formations) (fig. 2b). In the Late Pliocene Falagueira Formation (fig. 2b), siliceous gravel and quartzite clast-supported conglomerates predominate. They originate from the capture of the drainage network of the Madrid Tertiary Basin, whereby the ancestral Tagus River became a large, gravelly braided river with abundant sediment load. Except for the highest summits of the quartzite ridges, the whole area mapped in Figure 2b became covered with Tertiary sediments (Proença Cunha & *alii*, 2005).

After the deposition of the Falagueira Formation, downcutting became the dominant fluvial process; several incision episodes resulted in the erosion of large parts of the Tertiary deposits and hence the exhumation and eventual dissection of the Fundamental Planation Surface and the quartzite ridges. According to Proença Cunha & *alii*, (2005), this fluvial incision since the Late Pliocene has been controlled mainly by regional tectonic uplift: long episodes of higher uplift alternated with shorter episodes with less or even no uplift, resulting in successive cycles of rapid incision, punctuated by short periods of valley enlargement and local aggradation. These successive regional uplift events ensued deep, V-shaped valleys. The Tagus Valley is now deeply entrenched (more than 200 m) in the Hercynian basement and has eroded a gorge with a depth of 260 m through the double quartzite ridge.

Due to its location in the transition zone between the Tertiary Lower Tagus Basin and the reliefs at the southeastern side of the Portuguese Central Range, the study area is characterised by many faults (fig. 2b) which play a major role in the control of the hydrography and the development of tectonic depressions.

As illustrated on Figures 1 and 2, the Tagus River course is constrained in multiple rectilinear stretches, corresponding to pre-existing, often reactivated faults, which facilitated the downcutting. This structural control is also assumed to have played a role in the superimposition of the river on the quartzitic structure (Proença Cunha & *alii,* 2005).

Due to less uplift in the Ródão and Arneiro tectonic depressions (fig. 2b), fluvial deposition could take place during the Quaternary. Valley enlargement in these areas was facilitated by the substratum of soft Tertiary sediments, which had been preserved in these areas. In the well-investigated Ródão depression, this resulted in the formation of a staircase of four terrace deposits (fig. 2b) (Carvalho & *alii,* 2006; Proença Cunha & *alii,* 2005). In the Arneiro depression, two terraces have been identified (a higher T2 and a lower T1, *cf. infra*).

LATE QUATERNARY LANDSCAPE COMPONENTS

The historical gold exploitation

The river terraces of the study area were subjected to an extensive placer gold exploitation in historical times. Its local name is Conhal, a toponym used to indicate places of antique mining activities (Barbosa & Barra, 1999; Calado, 1999). The large-scale exploitation resulted in profound changes in the riverine landscape. Only a full understanding of the exploitation process allows for its reconstruction.

The gold exploitation has been studied in detail by Deprez & *alii* (in press) (fig. 4). This research was mainly based on fieldwork in a multidisciplinary team involving archaeologists, geomorphologists and geologists. Combined with stereoscopic aerial photographs, ancient literary sources (e.g., Pliny) and a comparison with other, well-studied gold mines in Iberia (e.g., Lewis & Jones, 1970; Jones & Bird, 1972; Domergue & Hérail, 1978; Domergue & Martin, 1978; Domergue & Sillières, 1978; Bird, 1984; Domergue, 1984, 1986, 1990; Sánchez-Palencia, 2000), an insight was gained in the exploitation methods and techniques, and a reconstruction of the spatial organisation of the exploitation could be made.

The extraction method was *arrugia*, a technique for large-scale exploitation of alluvial gold, which has been described by the ancient author Pliny in his *Historia Naturalis* (Deprez & *alii,* in press; Pliny 33.66 in Rackham, 1952). It was applied both by the Romans and the Moors; the presence of Roman sherds (Pereira [1], personal communication) and a Roman coin (Almeida [2], personal communication) point to an early exploitation. However, more archaeological evidence is needed to corroborate this hypothesis.

The exploitation process took place in a very systematic fashion and consisted of three main phases.

Firstly, the auriferous deposit had to be dismantled. Therefore, enormous volumes of water were collected from higher areas and conducted by aqueducts to collecting basins located above and behind the mining area. From here, the water was guided to the deposit, where it was released in steep canals to increase the flow energy. Repeated application of this technique resulted in the collapse of the deposit and the formation of an exploitation «front», which receded as the exploitation progressed inland.

The second phase involved the recovery of the gold by feeding the dismantled sediments into washing canals. These were characterised by natural barriers of gorse (*Ulex*) along the bottom to trap the heavier gold particles as the sediment transited through the canal. To prevent congestion of the canals, the largest clasts (boulders) were manually removed beforehand and arranged in large, elongated piles (*muria*).

[1] Archaeologist, excavations of the Roman city of *Ammaia*, Fundação Cidade de Ammaia, Marvão, Portugal.

[2] Archaeologist, prehistoric occupation of the Northeastern Alentejo, IPA, Extensão de Crato, Portugal,

To allow the continuation of the exploitation, the fine sediments (poor in gold) that accumulated at the end of the washing canals were evacuated from the mining area. Therefore, at regular intervals, successive and powerful flushes of water were released from the reservoirs. Through evacuation channels, this sterile debris was carried away to the Tagus or one of its tributaries, resulting in the accumulation of large volumes of these fines.

Many of the ancient mining features have been preserved up to the present-day (figs. 3 and 4).

Inside the exploited zone, most of the boulder piles are still present, as well as the washing and evacuation canals and the central control hill (Castelejo), a part of the original river terrace which was safeguarded from exploitation, probably for reasons of supervision (figs. 3 and 4).

The exploitation zone is bordered in the southeast and east by an escarpment of 10-15 m, representing the last position of the exploitation front (figs. 3 and 4) (Deprez & *alii*, in press).

The accumulations of fine sediments resulting from the successive flushing towards the Tagus and its tributaries are located north of the exploited zone, on a platform only a few metres above the present water level of the lake behind the Fratel dam (figs. 3 and 4). An escarpment of 20-30 metres in the Palaeozoic schists separates these waste deposits from the exploitation zone (fig. 6e). From Figure 4 it is clear that their extent prior to the inundation by the Fratel dam lake was considerable (ca. 0.4 km^2). Due to the submersion by the lake waters, the exact volume of these accumulations is difficult to assess. Also the total volume of flushed sediments cannot be determined, as a portion of them was carried away by the Tagus' waters.

Soil marks in the area southeast and east of the exploited area represent the traces of an extensive hydraulic infrastructure to supply the exploitation zone with sufficient amounts of water (Deprez & *alii,* in press) (fig. 4).

The impact of the mining activities on the riverine landscape was very profound. The gold-bearing deposit was dismantled over an area of approximately 0.6 km^2 (figs. 4, 5). Assuming an average thickness of 14 m, the volume of processed sediments can be estimated to 8.4×10^6 m^3. With a gold content varying between 200 and 350 mg/m^3 (Carvalho, 1975), this corresponds to 1.7-2.9 metric tons of gold. For this reason, the Conhal of Arneiro is one of the largest known historical open-air gold mines in Portugal (Deprez & *alii,* in press).

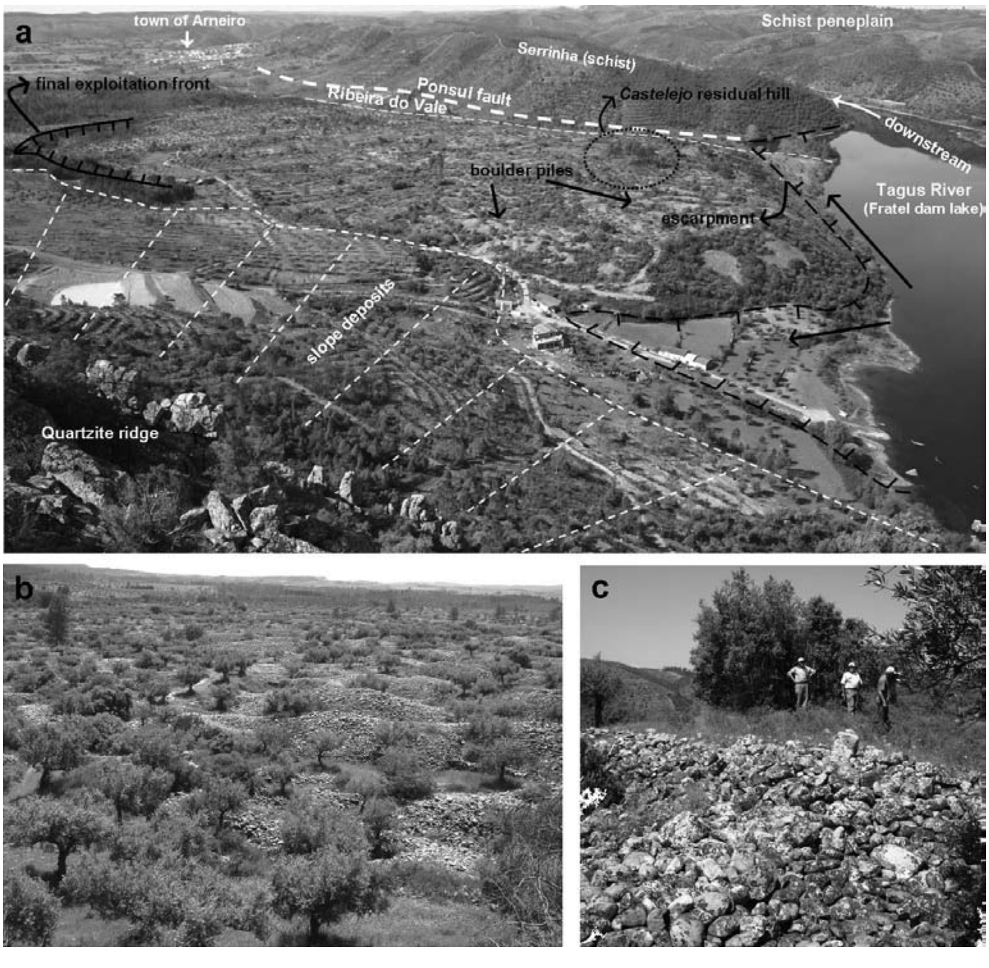

FIG. 3 - a) Main landscape features of the *Conhal* of Arneiro, as seen from Portas de Ródão (Photo: S. Deprez). b and c) Boulder piles (*muria*) (Photo S. Deprez).

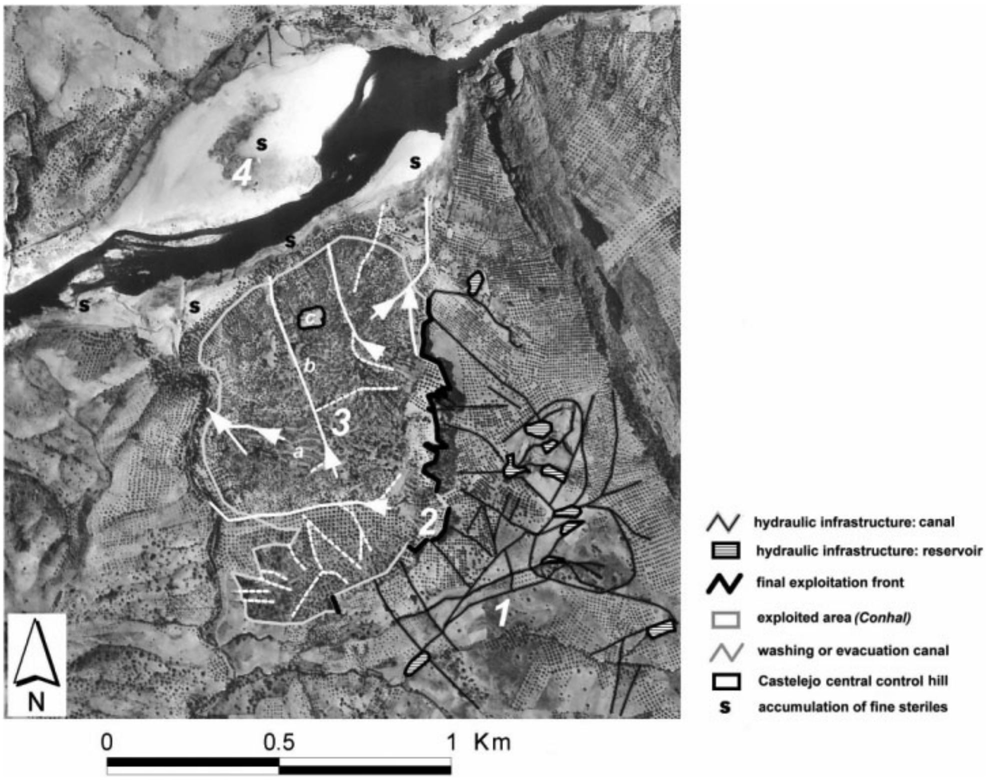

FIG. 4 - Different sectors of the historical gold exploitation [Aerial photograph dating from 1958, before construction of the Fratel dam (1973)]. Legend: 1. Water supply zone; 2. Final exploitation front; 3. Exploited area - a. Boulder piles (*muria*); b. Washing and evacuation canals; c. Castelejo control hill; 4. Accumulation of evacuated fine steriles (photo provided by the Fundação Cidade de Ammaia, Marvão, Portugal, original scale: 1:20,000, series 57AM29).

The exploited Tagus terrace (T2)

The comprehension of the functioning of the historical gold exploitation allows to analyse the characteristics of the auriferous deposit and to gain an insight into the riverine landscape that existed prior to the exploitation. However, as the major part of the original deposit has been exploited and the remaining, unexploited parts have been strongly eroded, dissected and disturbed by subsequent natural processes, it is impossible to make a full and detailed reconstruction of the original extent and characteristics of the river terrace.

The few remains provide sufficient evidence to state that this sedimentary sequence has been deposited by the Tagus River. The sedimentary texture and composition require a highly competent river carrying an abundant sediment load, conditions which can only be met by the Tagus. The crossing of the narrow gorge in the quartzite ridge was followed by a considerable drop in flow velocity, resulting in the deposition of a large part of the sediment load. In addition, the tectonic basin just downstream from the water gap provided a large accommodation space, allowing the river to accumulate large volumes of sediment which extended deeply inland.

The preserved remains of this Tagus deposit (T2) are presented on Figure 5. They are situated at altitudes between 100 m and 130 m and rest mostly on Tertiary arkoses. Where erosion prior to the deposition of T2 reached the underlying basement, they rest directly on Palaeozoic schists.

The thickest continuous sequence was found close to the Tagus River, inside the exploited area. The exploitation's central control hill (Castelejo) is the only terrace remnant inside the exploited zone that has been safeguarded from dismantling (figs. 3, 4 and 5). Here, the deposit has a thickness of 14 metres (base: ca. 106 m, top: ca. 120 m). It is poorly-sorted and composed of sub-rounded to rounded gravel- to boulder-sized quartzite clasts in a red, sandy matrix. Except for a slight tendency to upward fining, no clear stratification could be detected. On some places, minor intercalations of sand can be observed. The top 30 to 50 centimetres of this hill are composed of a brown, sandy soil, in which Neolithic artefacts are embedded (Almeida, personal communication).

At the final exploitation front of the gold extraction (figs. 3, 4 and 5), the sedimentary sequence is made up of a cobble- to boulder-sized base gravel of quartzitic composition, with a thickness of 1 to 2 metres. Overlying this basal unit is an up to 8 metres thick, reddish sand unit of arkosic composition with intercalations of gravel- to cobble-sized quartzite clasts. The top unit is formed by 1.5 to 2 metres of rounded quartzite pebbles and cobbles in the same sandy matrix as the one at the Castelejo. The base and top are situated at altitudes of ca. 105-110 m and 120 m, respectively. The eastern extent of the deposit in this locality is obliterated by slope deposits from the quartzite ridge (fig. 3).

On the Tagus' right bank, another continuous sequence is present (site of Vilas Ruivas, fig. 5). It is comparable with that at the exploitation front. At an altitude of

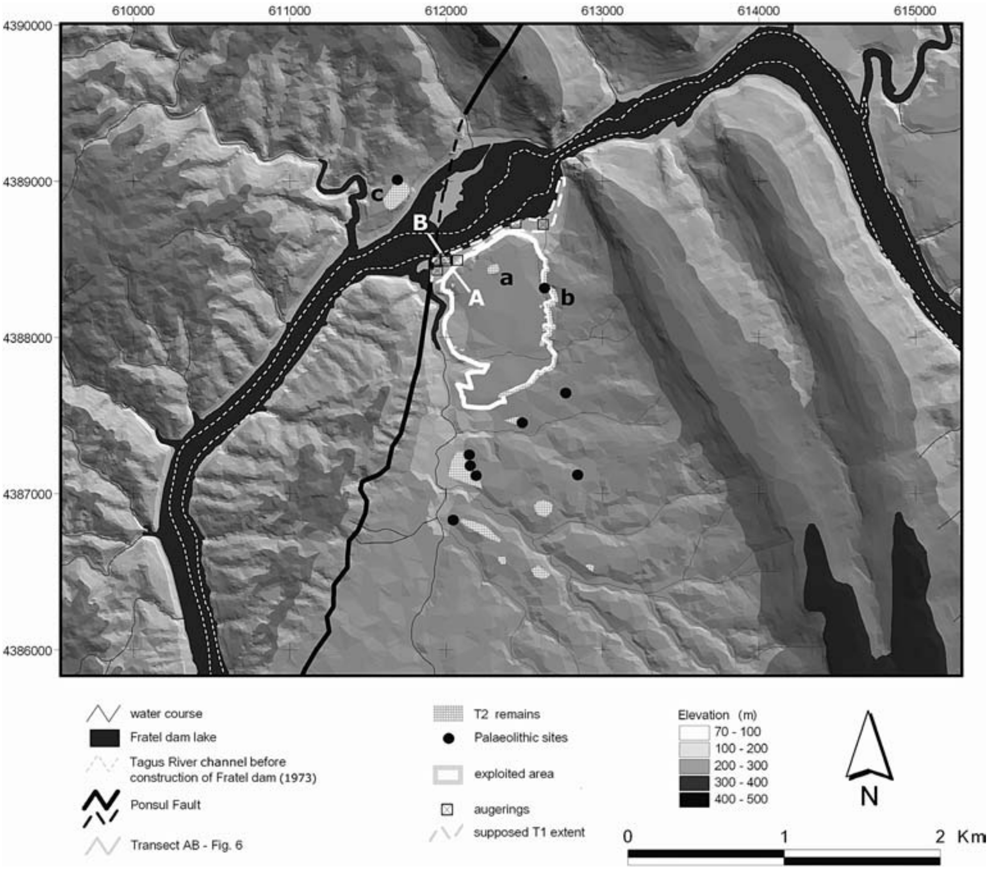

FIG. 5 - Detailed map of the *Conhal* of Arneiro. a) Castelejo; b) Exploitation front; c) Vilas Ruivas (UTM-coordinates in metres) (TIN-model based on the Carta Militar de Portugal, 314 & 324, original scale: 1:25,000).

113 m, a basal unit of rounded quartzite cobbles and boulders is situated, overlain by a reddish sand unit of arkosic composition with some intercalations of quartzite clasts. However, this unit is only 4 to 5 metres thick, and has 1 to 2 metres of silt on top. The top unit is a coarse clastic unit, but here with a thickness of 3.5 to 4 metres and larger-sized quartzite clasts (cobbles and boulders). It reaches an altitude up to 124 m (Proença Cunha & *alii,* 2005).

The other remains of the original deposit are too small and discontinuous to provide useful information on the sedimentary sequence.

On several places in the fluvial deposit (fig. 5), *in situ* Palaeolithic artefacts have been discovered, suggesting important human occupation in the riverine landscape. Their relative ages (based on typology) provide useful *termini* for the time of deposition. On the left bank of the Tagus, the places that have been subjected to archaeological excavations (Pegos do Tejo 1/2/3 and Tapada do Montinho) revealed an abundance of Lower and Middle Palaeolithic artefacts in the sand unit (Almeida, 2004; Almeida & *alii,* in press). At Vilas Ruivas, the sand unit contains artefacts of Lower Palaeolithic typology (Acheulian). In the silt layer, Middle Palaeolithic (Mousterian) artefacts were found (Raposo, 1995a, 1995b).

OSL-dating of the fluvial sediments yielded both a more accurate age and provided a cross-check for the artefact ages. Quartz-OSL-analysis [3] of the sand fraction in the Middle Palaeolithic artefact layer at the Pegos do Tejo site revealed a date of 135 ± 21 ka (GLL code 050301); the top of the terrace deposit was dated to 61 ± 7 ka (GLL code 050302). A late Middle to Late Pleistocene age is therefore attributed to the formation of the gold-bearing deposit.

The younger Tagus terrace (T1)

A younger Tagus terrace (T1) has been identified on the river's left bank. It is covered by the waste sediments from the gold exploitation (figs. 5 and 6e). The main characteristics and extent were surveyed by hand augerings.

The T1 deposit rests on the schist bedrock. Its base is situated at an altitude of 73-75 m, its top at 75-76 m (figs. 5 and 6e). It can be distinguished from the waste deposit by a clear change in composition and grain size: the sterile debris is a very homogeneous accumulation of fine sand, the fluvial deposit consists of an alternation of fine sand, coarse sand, gravel and pebble *facies*.

[3] Executed by the Ghent Luminescence Laboratory, Laboratory of Mineralogy and Petrology, Geological Institute (S8), Ghent University, Krijgslaan 281, B-9000 Gent, Belgium.

The T1 sediments were identified in all augerings (fig. 5), indicating that it was a relatively extensive deposit (fig. 6d).

The absolute time of accumulation of this Tagus deposit is unknown. However, its low position inside the present-day river valley suggests a recent age. In order for the progressively incising river to reach a depth of 73 m in the schist bedrock, several thousands of years were needed after deposition of T2. Assuming a time-averaged incision rate for this area of about 1 m/ka for the period following deposition of T2 [4], ca. 48 kyrs would be needed.

This suggests deposition at the end of the Late Pleistocene or Early Holocene (13 ± 7 ka).

LATE QUATERNARY RIVERINE LANDSCAPE EVOLUTION

The identification and analysis of the different Late Quaternary landscape components allow for a reconstruction of the landscape evolution of the study area.

The presence of a tectonic basin has played an essential role in the Late Quaternary landscape evolution. Against the general background of progressive fluvial incision, controlled mainly by successive regional uplift events, this area underwent less uplift than the adjacent areas along the river (Proença Cunha & *alii*, 2005). The presence of the substratum of soft Tertiary arkoses and the location of the tectonic basin immediately downstream from the water gap in the double quartzite ridge created a large area prone to sedimentation.

One of the aggradational episodes took place from the late Middle to the Late Pleistocene and resulted in the formation of the T2 deposit (fig. 6a). It must be borne in mind that this period was probably characterised by an alternation of depositional and non-depositional (or even erosional) phases, rather than by continuous aggradation.

It is probable that fluvial sedimentation also took place in earlier episodes of the Quaternary, but since no older deposits exist in the area, they must have been removed by subsequent erosion.

Following deposition of T2, incision prevailed in the Tagus River and its tributaries, resulting in the removal, dissection and reworking of the T2 sediments. The parts of T2 closest to the quartzite ridge were covered by slope deposits (fig. 3). As the fluvial incision proceeded (this was probably not a continuous process but rather an alternation of episodes of erosion and non-erosion caused by regional and local tectonics), the underlying arkoses and schists were exhumed and eventually eroded. The deepest incision occurred in the north of the T2 deposit, where the Tagus incised more than 20 metres in the schist bedrock, as attested by the large escarpment in the present-day landscape (fig. 6). In the resulting narrow bedrock valley, fluvial sedimentation was reduced; moreover, the preservation potential of deposits in bedrock channels is very low (Blum & Tornqvist, 2000). Nevertheless, in the Late Pleistocene or Early Holocene the Tagus river aggraded the T1 sediments (fig. 6b): this sedimentation episode must have been followed by rapid bedrock incision as attested by the (partial) preservation of T1 (fig. 6c).

The present river-bed is located at an altitude of 62 m, 14 metres below the top of T1. This implies that the post-T1 incision was considerable: in order to incise 14 metres, about 14 ka were needed (taking into account an average incision rate of 1 m/ka, *cf. supra*). At the onset of historical times, the Tagus River bed must have been already very similar to the present-day one (fig. 6c).

The large-scale historical gold exploitation radically changed the pre-existing natural landscape (fig. 6d). The T2 river terrace was stripped down over an area of 0.6 km^2, which corresponds to a processed sediment volume of about $8.4x10^6$ m^3 and an approximate volume of 1.7 to 1.9 metric tons of gold (gold content varies between 200 and 350 mg/m^3, Carvalho, 1975, *cf. supra*). The river channel of the Tagus, two of its tributaries and the T1 terrace became covered with several metres of fine, sterile sediments resulting from the exploitation process (figs. 3, 4 and 6d).

Since the abandonment of the placer mine, the riverine landscape underwent only minor changes. The main anthropogenic influences encompass agricultural and industrial activities (vine and olive yards, minor crop agriculture and grazing, extraction of some of the boulder piles for building purposes) and the construction of the Fratel dam on the Tagus River in 1973 (figs. 5 and 6e). Recent natural processes mainly consist of fluvial erosion (e.g., erosion of part of the sterile waste deposit, fig. 6e) and local reworking of existing deposits.

CONCLUSION

Until recently, the Late Quaternary evolution of the Tagus Valley in the Arneiro area was poorly examined and understood. The complex genesis of the present-day riverine landscape posed many problems for both archaeologists and geologists working in the region. Especially the complexity and destructiveness of the historical gold exploitation complicated the reconstruction of the original landscape, as it systematically removed large parts of the archaeological and palaeoenvironmental record. Therefore, an integrated geoarchaeological approach was applied in order to gain an understanding of the different natural and anthropogenic processes and their interactions during the Late Quaternary. Within this interdisciplinary framework, the preserved remnants of the gold exploitation were first identified and subsequently interpreted as to their function in the exploitation process. The analysis of the preserved fluvial landforms then allowed to reconstruct the Late Quaternary riverine evolution in this anthropogenically strongly disturbed landscape.

[4] This average incision rate is calculated as follows: (altitude of T2 top - altitude of present river bed) / (age of T2 top). This gives: (121 m - 62 m) / 61 ka ≈ 1 m/ka.

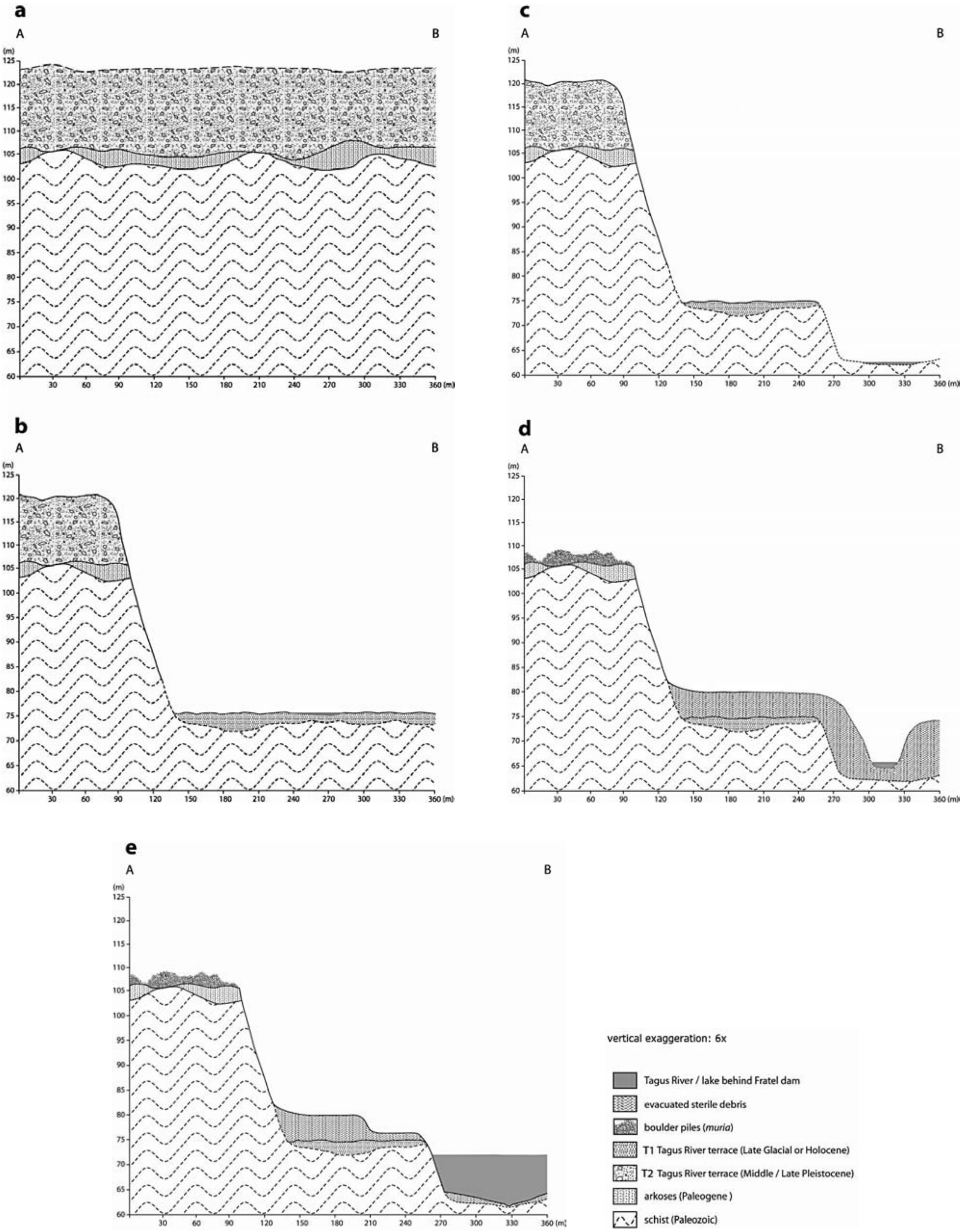

FIG. 6 - Schematic reconstruction of the Late Quaternary riverine landscape evolution at cross-section A-B (situated on fig. 5). a) T2 deposition (Late Middle to Late Pleistocene); b) Post-T2 erosion and T1 deposition (Late Pleistocene to Holocene); c) Situation at the onset of historical times [between 1st and 9th century CE (Roman or Moorish)]; d) Situation after abandonment of the exploitation; e) Present-day landscape.

It is important to stress the patrimonial value of this area, as the profound impact of the mining activities led to the creation of a very unique cultural landscape that has been well-preserved up to the present-day. In the past, the importance of such old industrial sites has been disregarded. Except for the Conhal area, none of the alluvial gold mines along the Tagus have been declared historical mining patrimony. This study can serve as a guideline for the analysis of comparable areas and can be a stimulus towards protection and preservation of this unique heritage.

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