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Anthropic dynamics and vegetation landscape in the inland area of the Iberian peninsula: new perspectives drawn from palynological studies at the villa of Noheda (Cuenca, Spain)

MIGUEL ÁNGEL VALERO TÉVAR

This paper presents the initial findings of an archaeopalynological study to reconstruct and trace the evolution of the vegetation landscape at the site of the Roman villa of Noheda (Cuenca, Spain). The analysis of the pollen diagram enables the reconstruction of the economic foundations of the rural environment during each phase of the site’s occupation. Changes in the crop types, planted area, and forest use were identified, as was an increase in the pressure exerted by animal husbandry.

Keywords: Roman villa, palynology, landscape, anthropic dynamics, economy

L’articolo presenta i primi risultati di uno studio archeopalinologico per ricostruire e tracciare l’evoluzione del paesaggio e della vegetazione relativi al sito della villa romana di Noheda (Cuenca, Spagna). L’analisi dei diagrammi pollinici ha permesso di comprendere la base economica dell’ambiente rurale durante ogni fase di occupazione del sito. Sono stati identificati cambiamenti nei tipi di coltura, di aree coltivate e di uso delle foreste, così come un aumento dell’allevamento.

Parole chiave: villa romana, palinologia, paesaggio, dinamiche antropiche, economia

1. Introduction

The study of the geographical framework in which a given culture develops is a fundamental prerequisite to understanding it. Thus, knowledge of what a site’s surrounding ecosystem was like, particularly through the study of lifeforms, production types and methods, and the overall economic practices of a given society, is a fundamental starting point to explain and understand human behaviour in the past.
Traditionally, texts and other written sources have been the main source of archaeobotanical information on the chronological history of archaeological sites. However, in recent decades, the use of innovative methodologies and techniques such as palynology has enabled a new approach based on interdisciplinary methods.

Although initially this interdisciplinary approach was mainly applied to prehistoric archaeology (López Merino et al. 2008, p. 26), today it is used for a much broader chronological range of sites and has become a fundamental tool for ensuring the thorough analysis of a site.

The current paper presents the initial findings of a study to reconstruct and trace the evolution of the vegetation landscape of the Noheda site. To this end, it will first identify the plant taxa at the site following the abandonment of the first Roman complex in the Early Imperial period. Next, it will address the anthropic dynamics to which the ecosystem was subjected when the site was at its height, coinciding with the emergence and rise of the great villae in the western half of the Empire, as has been documented elsewhere (Vera 1992-1993, p. 299; Volpe 1996, p. 210; Sfameni 2006a, pp. 19-21; Chavarria Arnau 2006, p. 19; Chavarria Arnau 2007, p. 53; Pensabene 2010-2011, pp. 171-174; Hidalgo 2014, p. 229). Finally, it will analyse how different vegetation groups varied throughout the subsequent phases of occupation, revealing a dramatic change in the methods used to exploit the environment.

As a fundamental part of the aforementioned territorial research, which aims to afford an exhaustive understanding of the rural complex, it is crucial to reconstruct the landscapes of the bygone eras. This is because humans carry out their activities within given spatial and temporal coordinates and thus are strongly dependent on the physical milieu in which they live.

Therefore, this paper presents a previously unpublished paleoenvironmental reconstruction at the paleopalynological level of Alcarria Conquense, an inland region of the Iberian Peninsula. This reconstruction spans a chronological and cultural period – the Roman, Late Roman, late antique, medieval, and Early Modern periods – that has scarcely been documented to date.

2. Material, methods, and archaeological context

The Roman villa of Noheda has long been known (Santa María 1897, pp. 13-14; Coello 1897, p. 21; Larrañaga 1966, p. 438; Abascal 1982, p. 68; Palomero 1987, p. 169). It is located in the central area of the Iberian Peninsula, 17 kilometres north of the city Cuenca and close to
the towns of Segobriga, Ercavica, and Valeria. It lies a mere 500 metres northeast of the place it is named for and is part of the municipality of Villar de Domingo García (fig. 1).

To date, two areas of the late period villa have been excavated. The current study will focus on these areas. The first comprises a set of structures that, judging by the excavated area, seem to have belonged to the pars rustica. Hence, the complex had the necessary buildings to indicate that the villa had an inherently agricultural purpose (Richmond 1970, p. 51; McKay et al. 1975, pp. 100-108; Percival 1976, p. 13; Johnston 1983, pp. 3-8; Balmelle 2001, p. 16; Gros 2001, p. 265; Mulvin 2002, p. 3; Chavarría 2005, pp. 523-526; Chavarría 2007, pp. 32 and 54; Arce 2006, p. 14; Arce 2009, p. 136; Sfameni 2006a, p. 110). The second contains a section of the pars urbana consisting of the balneum and certain other rooms pertaining to the residential building.

Research undertaken in the last few years has further shown that, following the peak of the complex’s use as a Late Roman period villa, subsequent inhabitants gradually carried out a structural transformation of the pars urbana (encompassing both the residential sector and the balneum), refitting old rooms to have a dual function. In some cases, the

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Fig. 1. Location of the site of Noheda within the peninsular context.
original habitational purpose of the rooms was restored through the construction of walls made of precarious materials. In others, these same spaces were devoted to local production activities or even used for burial purposes.

In addition to the above, Early Imperial archaeological structures have been shown to exist beneath the Late Roman period villa, some in a good state of conservation despite having been used as a quarry for the overlaid constructions (Valero 2017b, p. 68). Moreover, some areas bear witness to construction techniques of an outstanding quality involving the use of large ashlar stones.

The current paper grew out of the need to contribute to the comprehensive study of the site. Although to date the figurative mosaic has been the element to draw the most attention (Valero 2010, p. 6; 2011,
pp. 91-105; 2013, pp. 312-327; 2014b, pp. 54-60; 2014c, pp. 81 ss.; 2015a; 2015b, pp. 1347-1350; 2015c, pp. 439-444; 2016a, pp. 131-152; 2016b, pp. 10-12; 2017a, pp. 79-80; Valero, Gómez 2013, pp. 87-95), it is believed that research on the site should be conceived as a whole. In other words, without neglecting the mosaic tapestry, the focus should be expanded to include all the other aspects of the villa as well (fig. 2).

To this end, some research has sought to architecturally analyse a number of rooms (Valero 2014a, pp. 522-529; 2017c, pp. 31-36). Likewise, the decorative elements of the complex’s pars urbana have been analysed (Valero et al. 2015, pp. 395-397). Furthermore, an analysis of the territory that may have constituted the fundus of the villa is also underway, with special emphasis on the changes and transformations it has undergone throughout history (Valero 2017b, p. 74-77).

In 2010, the University of Alcalá de Henares was commissioned to carry out a pollen analysis of four stratigraphic units corresponding to, and encompassing, the time span between the abandonment of the Late Imperial period villa and the Early Modern and Late Modern periods. That analysis, performed by specialists (M.B. Ruiz Zapata, M.J. Gil García, T. Martín Arroyo), was the technical basis for the present paper.

The samples were taken from the southern side of Section 18, located in the southwest corner of Sector A, by the outer edge of the triclinium on its southern flank. Specifically, they were taken from stratigraphic units UE 23, UE 10, UE 2 and UE 1. From bottom to top, the stratigraphic units were as follows (fig. 3):

- UE 23 and a number of associated stratigraphic units correspond to the time span between the moment of abandonment of the Early Imperial period complex and the construction of the monumental Late Period buildings. It consists mainly of silting strata.
- Following the filling and levelling of the underlying strata in various areas of the complex, a new period of occupation with substantial construction activity has been documented. A new building complex was raised with brand new, astonishingly large edifices that underwent successive enlargements or changes for the purpose of monumentalising the villa. Such monumentalisation was a fundamental aspect of power display by the possessores of great Late Antique complexes. This latter period corresponds to the apogee of the villa (late 3rd to 4th centuries), a phase recorded in the pollen analysis of UE 10.
- UE 2 corresponds to the new use to which the complex was put in the Late Antique period (5th-6th centuries), where the various original rooms of the previous period were kept but transformed for reuse by the new inhabitants. In particular, some of the wall structures of the...
residential sector were reused, the balneum was entirely reformed, the mosaics were drilled (Valero 2016c, p. 360), the peristyle was closed and modified, new bays were opened, etc. The various aedificia that previously made up the villa were profoundly transformed, and the rooms were adapted to a new and austere way of life.

- The top levels (UE 1) correspond to the collapse and reuse of materials linked to the abandonment of this area as a developed habitat, between the Middle Ages and the Early Modern period, and its transformation into an area of agricultural production and animal husbandry associated with the new rural entity: the hamlet of Noheda, which lies 500 metres away.

With regard to methodology, in order to extract pollen grains, the samples were chemically treated with acids and alkali in accordance with currently accepted standard protocols (Girard, Renault-Miskovsky 1969, p. 276; Couteaux 1977, p. 260). Following this treatment, the resulting residue was subjected to enrichment techniques with Thoulet solution (Goeury, Beaulieu 1979, p. 240). Pollen types were identified according to Moore et al. (1991) and Reille (1992, 1995).

The pollen sum (PS) was established based on the total count of pollen grains (trees, shrubs and herbaceous vegetation) (López Sáez et
The percentages of arboreal and non-arboreal (shrubs and herbaceous vegetation) taxa were calculated in relation to the total pollen sum (TPS) from the cited sources. Furthermore, this assumption made it possible to determine the ratio of arboreal pollen (AP) to non-arboreal pollen (NAP), which defines the vegetation structure for each sample.

The following software packages were used for the statistical processing of the data: Tilia, Tilia Graph (Grimm 1992), and TGView 1.6.2 (Grimm 2004). The results were graphically represented in a bar chart or pollen histogram, recording the frequency and relative percentages of arboreal, shrub, and herbaceous vegetation taxa with regard to the PS. Aquatic taxa, spores, and non-pollen palynomorphs were represented as a percentage of the TPS. The latter proved crucial to interpret environmental conditions in the surroundings due to their distinctly local nature, as has been widely demonstrated (López Sáez et al. 2000, 2005; López Sáez, López Merino 2007; Ruiz Zapata et al. 2012, p. 44).

In accordance with the objective of the present paper, the data were represented in a synthetic pollen diagram, grouping all taxa (pollen and non-pollen) that showed ecologic analogies (fig. 4).

Furthermore, to provide a detailed analysis of the vegetation and its significance in light of the evolution of the taxa percentages by phase, two additional graphic formats were used: a pie chart, which makes it easier to envision structural changes in vegetation over time (fig. 5); and a cumulative frequency curve table of the taxa (fig. 6), which more clearly shows the impact of anthropic and/or climatic aspects in each phase.

### 3. Results

The analysis of the pollen histogram first revealed a certain degree of homogeneity, as evidenced by the notable scarcity in the composition of the species. This is not an isolated occurrence; the literature shows that this is a typical feature of sediments from archaeological sites on the Iberian Peninsula (López Sáez et al. 2003, pp. 12-13; Carrión et al. 2009, pp. 16-21).

A total of 23 pollen types were identified — 6 arboreal pollens, 3 from shrubs, 14 of herbaceous origin — together with 3 aquatic elements, monolete and trilete spores, and 10 non-pollen palynomorphs of various types.

As can be seen in the graphic representation of the data (fig. 4), the pollen sum of all the samples was rather homogenous, reflecting the predominant presence of herbaceous elements distinctive of open landscapes. The predominance of the following in particular should be noted:
Fig. 4. Pollen histogram of the samples taken from the Roman villa of Noheda (Ruiz Zapata et al. 2012, 2, fig. 1).
Asteraceae liguliflorae, Asteraceae tubuliflorae, Poaceae, and, to a lesser extent, Chenopodiaceae.

In short, herbaceous elements in Noheda fundamentally comprised three types of communities:

- Nitrophilous and ruderal vegetation of an anthropic nature, the presence of which is related to the existence of assimilable nitrogen in the soil that is not zoogenic in origin (Asteraceae liguliflorae, Asteraceae tubuliflorae, Boraginaceae).

- Anthropozoogenous-nitrophilous communities associated with soils highly nitrified by cattle, subjected to a certain degree of trampling, that proliferate close to urban centres, property lines, irrigation hedges, stabling facilities, troughs, or regular animal paths where the accumulation of excrements fosters the community’s development (Chenopodiaceae, Plantago, etc.).

- Anthropozoogenic perennial plant grasslands or hay meadows, generally coming from annual pasturelands devoted to grazing activities (Poaceae, Brassicaceae, Caryophyllaceae, Cistaceae, Lamiaceae).

In addition to the herbaceous group, varied amounts of non-pollen palynomorphs have been documented, the development of which is closely related to the nature of the milieu. Coprophilous fungi stand out (Sordaria, or Type 55 A, and Podospora, or Type 368), as do themeso-eutrophic Type 181 spores (Van Geel et al. 2003, pp. 875-877; Van Geel, Aptroot 2006, pp. 321-321; Riera et al. 2006, pp. 130-134) and Glomus (Type 207), which is related to deforestation processes (Ruiz Zapata et al. 2012, p. 2) (fig. 5).

Cerealia pollen was not documented. It is thus impossible to infer the existence of agricultural processes in the site’s immediate vicinity (López Sáez, López Merino 2005, p. 57). However, the discovery of carbonised wheat seeds close to the excavation area itself proves that they were widely grown in relatively distant areas.

In contrast to other relatively nearby sites that are partially synchonous with the stages examined here in the case of Noheda (Casas et al. 2012, p. 22), wet pastures showed considerable variations. Strikingly, the percentage of Nymphaeaceae was greater in the early stages. This is notable because they fall within the so-called Roman Warm period, which overlapped with the Imperial period (López Merino et al. 2008, p. 33; Cacho et al. 2010, p. 18). Furthermore, these taxa rebounded in the second and third stages, both of which coincided with moments of anthropic exploitation of the site.

The above findings indicate an environment heavily influenced by anthropic activities, together with a widespread presence of grazing pastures in the immediate vicinity of the villa.
The arboreal strata showed lower values for the palynoflora. These included perennial and deciduous *Quercus*, *Oleaceae*, *Juniperus*, and the presence of *Abies*, as well as *Pinus* in the final phase. The latter confirms the presence of a Mediterranean-type landscape. The absence of riparian taxa, such as elm trees, should not be interpreted as a result of a lack of water (the Tejar stream runs parallel to the rural complex, thereby guaranteeing the area’s water supply), but rather a consequence of where the samples were taken. Likewise, the presence of aquatic taxa should not be interpreted as reflective of an increase in humidity, but rather of the presence of waterlogged areas probably related to human activity. However, the strong presence of deciduous-type *Quercus* in the sequence, in the context of the analysis of the first phases, could be interpreted as reflecting an increase in water availability and a benign climate related to the aforementioned Roman Warm period (fig. 6).

In the pollen diagram, the shrub strata do not play an important role within the vegetation landscape. This does not imply a lack of shrubs in the area, but rather reflects the origin of the samples. In other words, the samples were extracted from the layers of the *villa* itself, a place that

![Fig. 5. AP-NAP-aquatic ratio for each sample (Ruiz Zapata et al. 2012, 3, fig. 2).](image-url)
would, presumably, have been heavily urbanised and ornamentally cared for. It is thus unlikely that there existed a large amount of shrubbery amongst the buildings. The rural complex, particularly the *pars urbana*, was clearly subject to frequent refurbishment work, with particular care being taken to remove unwanted shrubs. In fact, a slight increase in the presence of shrubs was found only in the Late Antique phase, coinciding with the property's occupation by near-autarkic communities, and, of course, in the late phases, when the area became depopulated.

4. Diachronic interpretation of the historic flora of Noheda: ecological and anthropic considerations

The pollen diagram for the vegetation for the time period under study varied considerably from one phase to the next. However, the existence of an open ecosystem subject to strong anthropic pressure was constant throughout all the phases.
Based on the data obtained from the palynological study, coupled with the initial data from the ongoing carpological and anthracological analyses, which have found evidence, primarily, of the presence of pine, holm oak, oak, and juniper wood, as well as wheat, barley, olive, and grape seeds, amongst others, the vegetation dynamics of the past 1,800 years can be reconstructed. The references offer enough information to enable the quantification of vegetation types in each phase, revealing considerable trend fluctuations amongst them. This latter finding, placed within the appropriate chronological context, makes it possible to verify how anthropic dynamics were exerted on the environment in each chronological and cultural phase and the close link between the human actions undertaken in the environment and the behaviour of the vegetation in the face of the most significant events.

4.1. Phase 1

UE 23, corresponding to the time span in which the complex was abandoned between the Early Imperial occupation phase and the Late Imperial period, is characterised by the scarce presence of the deciduous-type *Quercus* forests that historically have had a notable presence in the area (González Echevarría *et al.* 2006, p. 19). This scant presence may have been due to excessive felling of the *silva* in the previous phase. In other words, throughout the existence of the Early Imperial period *villa*, a large area had to be cleared to create agricultural and grazing lands both to endow the rural complex with a *surplus* yield in the spirit of the age and to extract the necessary wood from the forest to construct buildings and manufacture tools for domestic use (Revilla 2007-2008, p. 316).

This era witnessed the gradual implementation of a new agricultural system intended to make the land ever more profitable and an increasingly complex productive cycle, as well as to allow for the inclusion of manufactured materials in the trade circuit for economic gain. This way of working the land entailed the construction of various specialised structures in the *villae* for the processing of raw materials and, in particular, the treatment, conservation and storage of products, a fundamental process to allow for their export (De Neeve 1984, pp. 74-75). The *villa* of Noheda was no exception, and the excavations carried out to date have begun to uncover significant structures used for these purposes.

In contrast to this arboreal scarcity, there was a widespread dominance of mostly nitrophilous herbaceous vegetation (91.30%). Indeed, once the production system ceased to operate, the extensive tracts of agricultural land required to ensure a surplus economy for the primitive *villa* tended to turn into wasteland. Consequently, in the current unit,
there is a significant amount of Asteraceae, which occupied previously cultivated but then unused lands. However, the area’s abandonment was by no means absolute, since herbaceous taxa, such as Chenopodiaceae and Poaceae, together with certain non-pollen palynomorphs show that the surroundings of the rural complex — now uninhabited — were used extensively for animal-husbandry-related activities.

Additionally, the proportion of aquatic pollen (5.88%) shows that, during the aforementioned Roman Warm period, the Tejar stream played an important role, generating hydrological vegetation consisting of plants that grew naturally in the environment as opposed to ornamental plants cultivated by man.

In this phase, in addition to the aforementioned medium-to-low-intensity pastoralist use of the land, erosion processes increased, as evidenced by the presence of other non-pollen palynomorphs that such conditions entail, such as Glomus (Van Geel et al. 1989, pp. 55-58).

4.2. Phase 2

Following this period of abandonment, a new construction effort has been documented at the rural complex, dating to the late 3rd and early 4th centuries. Subsequent construction undertakings, lasting until the late 4th century, sought to monumentalise the villa through expensive architectural and decorative plans. In fact, over the 4th century, the villae kept and even enlarged the monumental structure begun in the previous century alongside other technical and ornamental features. These features point to continuous residential use by powerful social elites who appeared around that time as the owners of multiple vast estates, the buildings of which were consistent with the fundus.

The recreational aspect of these complexes became more pronounced, turning these country estates into sites for both otium and negotium. In other words, the new owners sought luxury and ostentation without neglecting the economic functions. One example of this multifaceted use can be found in the texts of the writer and aristocrat Symmachus (Matthews 1974), who, at the time, owned a number of domus in Rome and another one in Capua, various suburban villae, and, at least, five latifundia (Sfameni 2006b, pp. 62-63). Many of the letters written by this author describe the various construction activities carried out on the pars urbana of his estates (Symm. Epist., IV, 60), as well as the acquisition of a new mosaic (Symm. Epist., VIII, 42), highlighting the existing dynamism at the time of these great rustic complexes (fig. 7).
The taxa found in UE 10 for this historical period show a gradual reduction of deciduous *Quercus* forests, clearly signalling a renewed deforestation process — probably carried out by means of fire, as evidenced by the presence of the fungus *Coniochaeta cf. ligniaria* (Type 172), (López Sáez et al. 2000, p. 13) — under the authority of the *dominus*, or the *villicus*, who controlled and established the activities to be undertaken in the *fundus* of the estate. The aim was surely to maximise the returns on each plot of land: *ager*, *saltus*, and, of course, the wood of the *silva* from which the materials needed to reconstruct the various buildings of the *villa* were extracted.

In particular, for this period, *Oleaceae* and *Juniperus* were found in similar proportions in the forest. *Juniperus* wood was widely used to manufacture different types of tools and wares thanks to its malleability when freshly cut and toughness once dry.

Again, ruderals became dominant, and hay meadows were reclaimed whilst nitrophilous vegetation receded, showing considerably lower values than in the previous phase. Likewise, there was an increase in herbaceous elements related to agricultural activities, which received a strong boost at the time. The emergence of other wild plants that usually grow in agricultural lands during production periods is also telling. To-

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Fig. 7. Evolution and interpretation of the structure and composition of the vegetation (Ruiz Zapata et al. 2012, 7, fig. 4).
together with the rest of the herbaceous vegetation, it shows that the pressure exerted by the livestock increased in this phase and, along with agriculture, was one of the area’s economic engines. This aspect is apparent given the strong irruption of *Sordaria* (HdV-55A), a fungus that uses the excrements of domestic herbivores as substratum, as shown by the presence of *Podospora* and *Plantago*.

Notably, there was an exponential growth of aquatic taxa, including, along with the elements naturally linked to water courses, a strong presence of floating ornamental plants that were no doubt used to decorate the various monumental ponds that have recently been discovered in the monumental *villa*.

As in the previous phase, non-pollen palynomorphs such as *Glomus* bear witness to the aforementioned deforestation processes. Hence, as documented in sites of analogous chronology (López Merino *et al.* 2008, p. 33), the pressure exerted by livestock activities would in a certain sense have played a positive role in terms of the nutrient enrichment of humid areas that, by then, would have been meso-eutrophic, as evidenced by the presence of Type 181 (López Sáez *et al.* 1998, p. 449; López Sáez *et al.* 2000, p. 16).

4.3. Phase 3

Over time, Noheda reached a new phase, as illustrated by UE 2, corresponding to an entirely new social and political situation in the Western Mediterranean. This is evidenced by various forms of rural occupation (López Quiroga 2009, pp. 59-115), in which, amongst other things, the *villa* gradually ceased to be used as a residential facility, although it continued to function as part of an economic system.

This phase saw the transformation of the old monumental estates through the partition of the lands amongst the inhabitants. This division of the land into lots meant that each family unit focused primarily on its agricultural possessions, neglecting areas such as pastureland or forests. As a result, the latter became a communal territory, freely used for the supply of wood, wild fruit, and animals.

The aforementioned reality is apparent in the diagram for this phase, in which arboreal taxa grew exponentially. For the first time, *Pinus* can be seen to gradually spread over and repopulate the areas of the ancient *silva* that, in the previous phases, had been claimed and transformed into areas for agricultural use.

Furthermore, the gradual decline in deciduous *Quercus* continued, even as the first perennial *Quercus* types appeared. The proliferation of these new arboreal types reveals two realities. The first was the emer-
gence of a completely natural type of forest, only seldom affected by man through the felling of a small number of trees for construction or heating purposes. The second was a possible change in climate trends, perhaps related to the first signs of the new Early Medieval Cold period already documented at other sites (López Merino et al. 2008, p. 33).

Further evidence of the powerful re-emergence of nature due to the lack of anthropic activities is the presence, for the first time, of Abies, which seems to have grown freely on formerly productive and now barren lands (fig. 8).

Herbaceous taxa also suggest the natural recovery of vegetation. Thus, shrubs (Rosaceae) and heather (Ericaceae) appear for the first and only time in the diagram, whilst the rest of the groups detected in the preceding phase remain. Furthermore, the presence of Asteraceae tubuliflorae and Poaceae declined, whilst the proportions of Asteraceae liguliflorae and Chenopodiaceae slightly increased.

Paleo-economic strategies barely changed in relation to the previous phase, even though the way the land was worked did. Although agricul-

Fig. 8. Landscape and general view of the vegetation in the site’s current surroundings.
ture remained one of the fundamental pillars of community subsistence, judging from the pollen diagram readings, there was a slight reduction in agricultural fields. This is probably the result of the allotment of lands amongst the new inhabitants, who occupied only that land which was needed for the development of a new and nearly autarkic production system that did not require the holding of large estates. Parallel to this decline in the size of the agricultural lots, the pressure exerted by the livestock population increased. Animal husbandry accelerated and became a high-intensity activity. This is suggested by certain coprophilous non-pollen palynomorphs, such as *Sordaria* and *Podospora*, which also were related to other new erosive processes as evidenced by the presence of *Glomus*.

Such a context is also implicit in the presence, in this phase, of aquatic plants. The proportion of this type of *taxa* increased significantly, although the analysis of their components suggests that irrigated areas were of a different nature from those of the previous phase; they mainly consisted of natural streams and man-made ponds built for livestock purposes, which apparently underwent a progressive process of eutrophication.

As already noted, the settlement became depopulated at some indefinite point in the Late Antique period (6th-7th centuries), ushering in changes in the area’s use.

4.4. Phase 4

The vegetation register from UE 1 shows that the later phases saw the emergence of a new social and economic reality inherited from the Middle Ages, which was sustained until relatively recently.

From the end of the 12th century, the area was subject to a widespread process carried out in the inland regions of the peninsula, namely, Christian repopulation through the establishment of a large number of small settlements. Two such settlements were established in the town Villar de Domingo García (located 6.5 km from the site) and the hamlet of Noheda (a mere 500 metres away from the site). Together with other settlements, such as Sacedoncillo (1.8 km away), they would house the area’s population (González González 1960, p. 459; Romero 2011, p. 23).

This situation is reflected in the disproportionate growth of arboreal *taxa* at the site, particularly *Pinus*, coupled with the presence of *Juniperus*, offering proof of a vegetation reality in the area that remains largely unchanged to this day. This reality consists of a dense pine forest at high and medium altitudes in the Sierra de Bascuñana, where the resinous
trees share the environment with perennial *Juniperus* and *Quercus*. Indeed, in this phase, trees accounted for nearly half the vegetation spectrum (57.32%), indicating the development of a scarcely anthropised landscape (fig. 9).

In this respect the data offered by the herbaceous elements is clear, showing a slight increase in *Asteraceae liguliflorae*, whilst *Asteraceae tubuliflorae* and *Poaceae* continued to decline. This latter finding, along with the total disappearance of *Chenopodiaceae, Boraginaceae, Lamiales* and *Campanulaceae*, as well as the emergence, for the first time in the pollen histogram, of *Fabaceae*, reveal a fundamentally natural landscape.

The percentage of aquatic *taxa* drastically declined, essentially consisting of *Cyperaceae*, which would have been concentrated around irregular streams and areas of upwelling water.

In short, the findings point to the establishment of a medieval exploitation system that was inherited by subsequent phases. This system was based on extensive cultivation of cereal, along with grapevines and olive trees, and was supported by ample pastureland areas. An extensive forest area, mainly used for wood supplies, completes the picture.
This distribution of the land remained constant until recently, given that the historical estate, which was part of the lands owned by the crown in the 13th century, was ceded to the Church in 1215, which retained ownership until the Spanish government seized it as part of the so-called Madoz Disentailment (1854-1856). However, the area was purchased by a landowner who kept the property as a single land unit, without changing the uses made of it, until the end of the 20th century.

5. Conclusions

The data from the archaeopalynological studies conducted to date in Noheda make it possible to analyse the evolution of the site’s vegetation, as well as the anthropic influence, over a period stretching back nearly 2,000 years.

The landscape revealed was mostly open, due to either agricultural processes, anthropised pasturelands, or even periods of abandonment. However, the forest had a significant specific weight, showing a certain amount of taxonomical variability, mainly due to the varying degree of pressure exerted by man.

From the point of view of the evolution and transformations undergone by the landscape, the pollen taxa clearly show the successive variations in the vegetal context caused by anthropic pressure or its opposite, i.e., the lack of habitation in the area.

Thus, the first documented phase corresponds to a time span between the High Imperial and Late Roman periods in which the villa was abandoned. The landscape reflected this reality, showing evidence of large wastelands where there had once been fertile agricultural lands, which, having lost their original purpose, were used as pastureland.

The second phase coincides with the period of the emergence of large rural complexes for which evidence has been found in the Western Empire. In accordance with the monumental buildings constructed in the villa, the surrounding environment was deeply transformed in order to maximise the agricultural, livestock, and forestry yield, reflecting the estate’s sense of negotium. However, the second aspect inherent to such rustic complexes was not neglected. Thus, evidence of otium, amongst other facets, can be seen in the construction of large ponds filled with numerous ornamental aquatic plants.

The third phase was contemporaneous with the late stages of the late antique period. In keeping with the austere lifestyle of the complex’s new inhabitants, the forest reclaimed terrain, and the agricultural fields decreased, although they clearly continued to exist. In contrast, taxa re-
lated to pastureland increased, bearing witness to a change in economic and, perhaps, dietary behaviour.

Finally, the abandonment of the complex entailed a new change in the landscape. The forest naturally spread over most of the available space. The rest of the surface area was divided almost equally between agricultural lands and pastureland.

In light of the above, it can be concluded that the archaeopalynological studies enabled a faithful reconstruction of the historical landscape around the Roman villa of Noheda, as well as of the changes in the economic foundations of the communities that inhabited it. Clearly, the environment directly influences human behaviour, but it is a two-way relationship: humans are conditioned by the physical environment, whilst the environment, in turn, is constantly being modified by humans.

Additionally, the technological level of a population at any given point in history has been shown to directly influence its ability to transform the environment. Thus, societies such as Roman society, which had a high degree of specialisation throughout almost all its phases, had a strong influence on the ecosystem. People sought to extract the greatest possible benefit from the physical environment, adapting and/or transforming both the means they used and the landscape itself to the benefit of the community. This was accentuated at settlements such as the villae, where economic activity tended to be centred on agriculture and animal husbandry.
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