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## Agriculture and livestock economy among prehistoric herders based on plant macro-remains from El Mirador (Atapuerca, Burgos)

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### ABSTRACT

Plant macro-remains including charcoal, fruits and seeds from El Mirador contribute to the study of different aspects related to Neolithic and Bronze Age human groups. The El Mirador deposit has yielded a sequence from 3390–3140 to 7970–7770 yrs cal BP, which was formed by dung layers that were systematically burned, producing a *fumier*, a unique context for the preservation of archaeobotanical material. The anthracological record provides data recording abundant evidence of deciduous and evergreen oaks with slight modifications over time. The seed and fruit record includes crop plants, synanthropic plants and wild fruits. Both assemblages make it possible to thoroughly analyze the uses of plants in relation to a mixed economy based on agriculture and herding.

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### 1. Introduction

The adaptation to an economy based on agriculture and herding changed people's use of plants and their relationship with the environment. This process might have caused changes in landscape management activities and soil uses, thereby modifying the structure of the landscape, a topic that has been approached in the western Mediterranean from several different perspectives (Geddes, 1983; Zilhao, 1993; Zapata et al., 2004; Zeder, 2008; Antolín et al., 2014; Bendrey et al., 2014; Revelles et al., 2014). These changes affected the use of different resources (food, livestock, and energy) and altered how they were exploited.

In the Iberian Peninsula the intensity of human activity throughout the Neolithic and Bronze Age is reflected in anthropogenic disturbances that became increasingly significant at the end of the Neolithic. Climate variations during this period further contributed to the transformation of the landscape (Fletcher et al., 2007; Allué et al., 2009; Carrión et al., 2010; Revelles et al., 2014). Moreover, according to some studies, the sustainable use of resources in a mixed economy organization might have played a role in the preservation of plant formations (Revelles et al., 2014).

Caves used as sheepfolds during prehistoric times provide key records for the understanding and characterization of Neolithic and

Bronze Age economies (Angelucci et al., 2009; Polo-Díaz et al., 2014). In the Mediterranean area, caves were used to shelter sheep, and human practices related to herds included burning dung accumulations. These types of deposits have been described as *fumiers* and have been studied from various different approaches, yielding information on several aspects related to human groups (Badal, 1999; Bergadà et al., 2005; Angelucci et al., 2009; Polo-Díaz and Eraso, 2010; Polo-Díaz et al., 2014). The high degree of preservation of archaeobotanical materials, including micro- and macro-remains, makes it possible to employ multidisciplinary approaches to their study, cross-referencing data with different taphonomic histories (Badal, 1999; Argant et al., 1991; Thiébaud, 2005; Delhon et al., 2008; Cabanes et al., 2009).

Based on the plant macro-remains, El Mirador deposit represents a well preserved sequence, which makes it possible to analyze these processes. Hence, the aim of this paper is to present a synthesis of the plant macro-remains record from El Mirador. This will enable the understanding of the interaction between landscape and humans regarding plant resources. This aspect has been analyzed through the environment, agriculture and livestock macro fossil records yielded from the human occupations at El Mirador during the Neolithic and Bronze Age.

### 2. Site description

El Mirador cave (Ibeas de Juarros, Burgos) is located in the Sierra de Atapuerca at 42°20'58" N and 03°30'33" W, at

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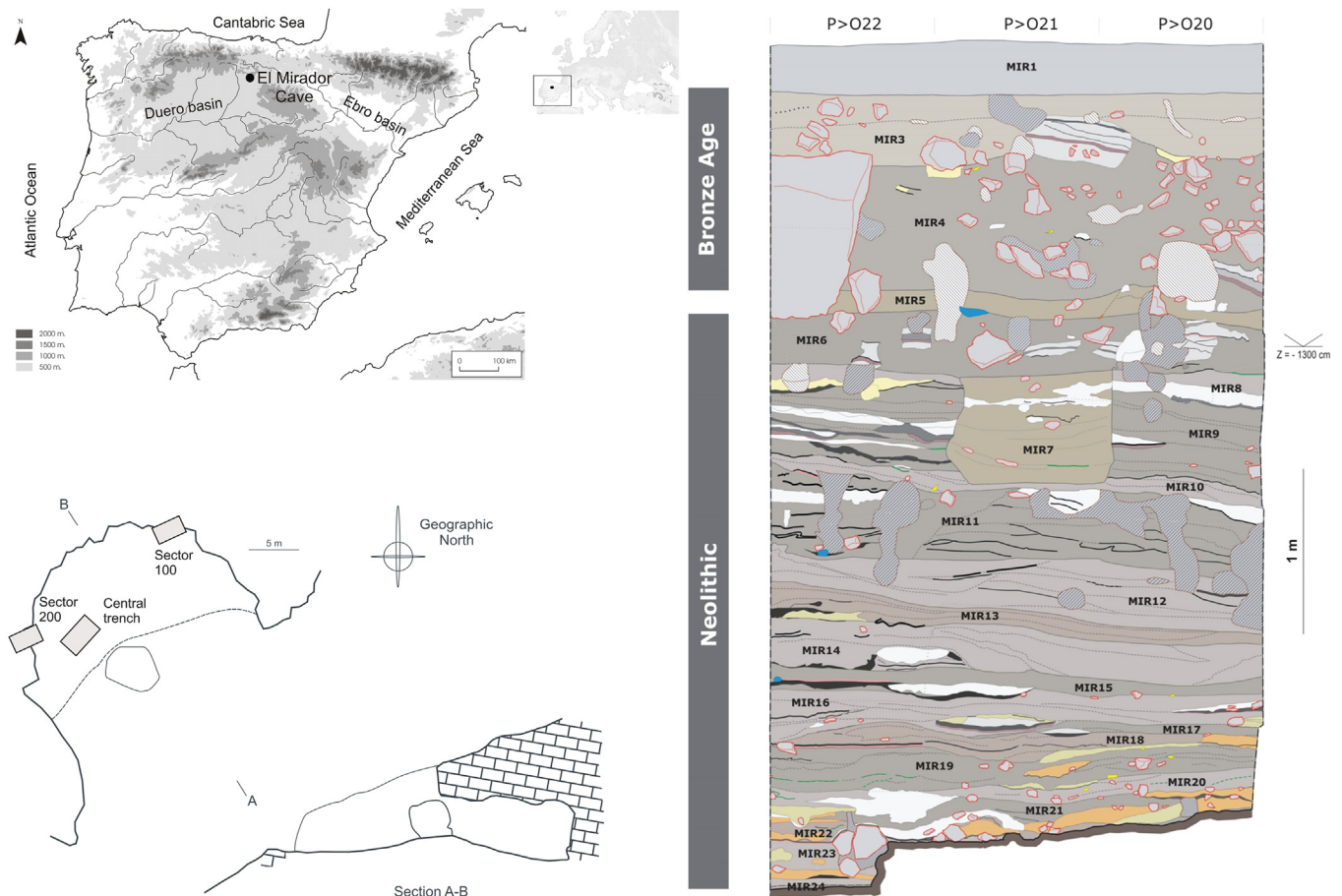
E-mail address: [eallue@iphes.cat](mailto:eallue@iphes.cat) (E. Allué).

1033 m.a.s.l (Fig. 1). El Mirador is a deposit formed by a successive accumulation of anthropic origin containing various different combustion phases (Vergès et al., 2002, 2008, this volume; Angelucci et al., 2009). The chrono-cultural sequences studied in this work encompass the Neolithic to the Bronze Age layers, with a chronology of between 3390–3140 yrs cal BP and 7970–7770 yrs cal BP (Vergès et al., 2008) (Fig. 1, Table 1).

The Sierra de Atapuerca is located in a biogeographic crossroad connecting the North sub-plateau, the Iberian Range and the Cantabrian cornice. In this geographical context the Euro-Siberian and the Mediterranean regions converge in a mixture of ecological trends (Pérez-González et al., 1999). Present vegetation is characterized by a mixed open continental forest of *Quercus rotundifolia* or *Quercus ilex* subsp. *ballota* and *Quercus faginea* with an Atlantic

**Table 1**  
Dating from the Holocene sequence of El Mirador modified from Vergès et al., this volume.

Unit	Material	Taxa	Lab. Code	AMS Radiocarbon Date BP	Cal Year BP
MIR 4 (top)	charcoal	<i>Quercus</i> sp. evergreen	Beta-154894	3040 ± 40	3390–3140
MIR 4	charcoal	<i>Quercus</i> sp. deciduous	Beta-153366	3400 ± 40	3720–3530
MIR 6	charcoal	<i>Quercus</i> sp. evergreen	Beta-153367	4780 ± 40	5630–5350
MIR 8	charcoal	<i>Quercus</i> sp. evergreen	Beta-181086	4970 ± 40	5770–5570
MIR 9	seed	<i>Triticum aestivum</i> / <i>durum</i>	Beta-220912	5090 ± 40	5940–5660
MIR 11	charcoal	<i>Quercus</i> sp. evergreen	Beta-181087	5360 ± 50	6300–5940
MIR 13	seed	<i>Triticum dicoccum</i>	Beta-208131	5470 ± 40	6310–6150
MIR 14	seed	<i>Triticum aestivum</i> / <i>durum</i>	Beta-220913	5480 ± 40	6340–6180
MIR 16	charcoal	<i>Quercus</i> sp.	Beta-181088	5700 ± 70	6680–6320
MIR 18	seed	<i>Triticum dicoccum</i>	Beta-208132	6120 ± 40	7080–6840
MIR 19	charcoal	<i>Quercus</i> sp. deciduous	Beta-182040	6130 ± 50	7210–6850
MIR 20	seed	<i>Triticum dicoccum</i>	Beta-197384	6100 ± 50	7070–6790
MIR 21	charcoal	<i>Quercus</i> sp.	Beta-197385	6380 ± 40	7390–7190
MIR 22	seed	<i>Triticum aestivum/durum</i>	Beta-208133	6150 ± 40	7200–6840
MIR 23	seed	<i>Triticum dicoccum</i>	Beta-208134	6320 ± 50	7330–7130
MIR 24	seed	<i>Triticum dicoccum</i>	Beta-220914	6110 ± 40	7060–6820
	charcoal	<i>Pinus</i> sp.	Beta-197386	7060 ± 40	7970–7770



**Fig. 1.** Location of El Mirador and stratigraphic sequence of the studied deposit.

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