



# Using stable isotopes and functional weed ecology to explore social differences in early urban contexts: The case of Lattara in mediterranean France



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## ABSTRACT

Integrated stable isotope investigation of plant and animal ecology can shed new light on the practicalities and politics of land management. Ecological analysis of archaeobotanical weed flora offers a complementary approach to arable growing conditions. Here we introduce the first combined study of stable isotope compositions (carbon and nitrogen) of plant and faunal remains and functional weed ecology from mediterranean France in order to investigate agricultural strategies under urbanisation and their social implications. Animal bones and charred crops and weeds are investigated from two archaeologically distinct residential areas from 5th century BCE Lattara, zones 1 and 27, during a period characterised by significant urban expansion in the region. Plant carbon and nitrogen isotope composition and functional weed ecology suggest some differences in growing conditions between crops found in the two zones, zone 27 being associated with more intensively cultivated crops than zone 1, where extensive cultivation, which can achieve much greater surplus, was dominant. These findings coincide with archaeological evidence of a 'richer' variety of material culture and foodstuffs in zone 1. Carbon and nitrogen isotopic values of animal bone collagen suggest that the main domesticates from both zones consumed a similar diet; however, rabbits exhibit a difference, with those from zone 1 having significantly higher  $\delta^{15}\text{N}$ , implying that the two zones sourced this species differently.

## 1. Introduction

During the Iron Age, the northwestern Mediterranean, as in other regions of Europe, witnessed or consolidated profound changes in several essential socio-economic and cultural domains, three of which we want to emphasize in this work: urbanism, food production and trade.

First, the 6th-5th centuries BCE witnessed the birth of cities and the establishment of urbanism: that is to say, a new organisation of nucleated housing and associated production and consumption activities (Almagro et al., 2001; Buchesenschutz, 2015; Fernández-Götz, 2017; Garcia, 2004; Sanmartí, 2004; Wells, 2011). In fact, this is not an entirely new phenomenon because in certain regions, such as the southern Iberian peninsula, for example, agglomerated settlements with fortification systems, testifying to a rather large diversity of spaces and

economic and cultural activities, are already known from the third millennium (Aranda Jiménez et al., 2015; Chapman, 2003). In the mid-first millennium BCE, nucleated settlements generally coexist with dispersed ones composed of farms. However, this distinction between urban and rural is not clearly observed everywhere, especially in mediterranean regions (Almagro et al., 2001; Brun and Ruby, 2008; Garcia, 2004; Py, 2012). The main question that we want to address here is how urban and rural areas interacted in our case study, especially with regard to agropastoral and food practices.

Secondly, it is currently accepted (Alonso, 2000; Ferdière et al., 2006; Reynolds, 1985; Wells, 2011) that food production became more 'efficient' during the Iron Age, enabling larger scale production. The role of livestock is thought to have been increasingly crucial, as much for arid-plowing and the transport of crops as for the fertilisation of the fields. In connection with these new practices, the Iron Age is also

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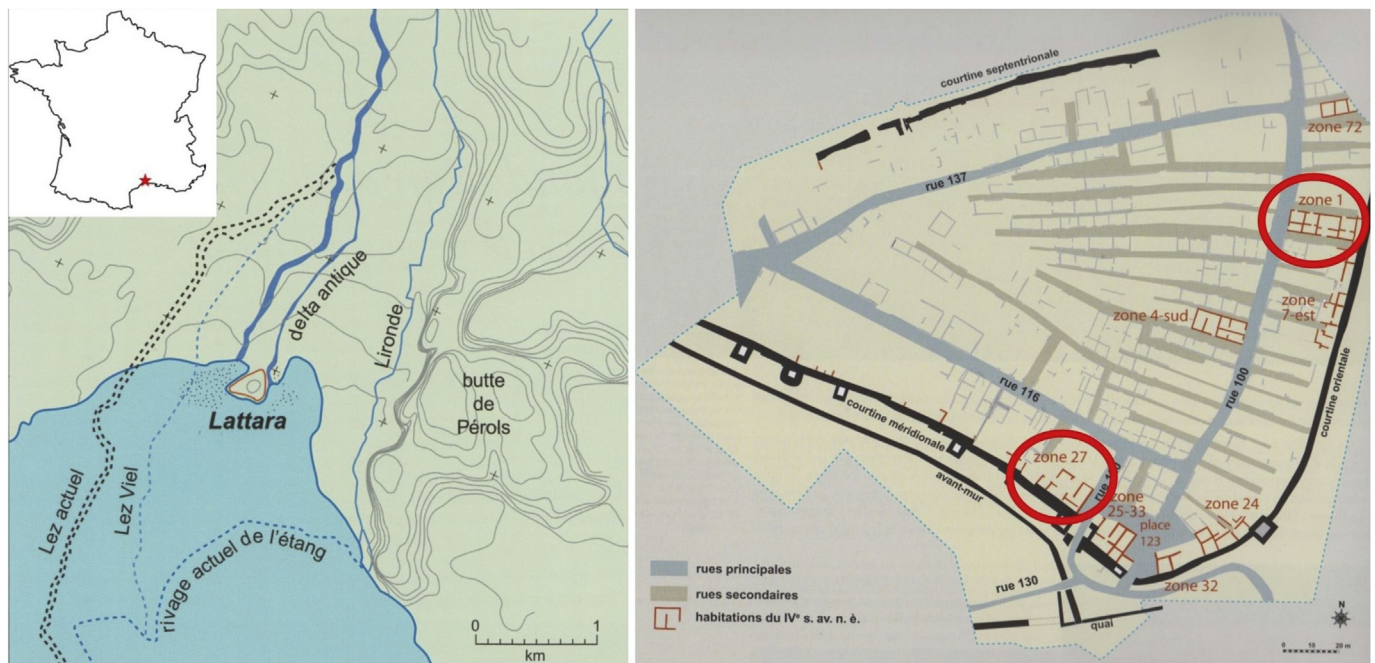


Fig. 1. Location of Lattara and settlement layout with the two zones examined in this paper circled (after Py, 2009).

associated with major changes in agricultural technology, especially the use of iron. Pulses served an essential role, as did the increasing cultivation of perennial trees, shrubs or climbing plants producing edible fruits (such as vines and olive trees), in addition to the expanded spectrum of backyard animals (e.g. chickens; Columeau, 1997). These are the beginnings of the formation of an agrarian system which blossomed during Roman times, organised in three levels of land exploitation: the *ager*, the *saltus* and the *silva*. However, as we will argue, agropastoral production during the Iron Age was not the exclusive domain of the countryside but was intimately connected to urban life.

Finally, a third feature of this period is thought to be the development of trade and a market economy that goes beyond the local or even the regional scale (Dietler, 2010; Py, 2012; Wells, 2011). This must be examined in connection with two aspects of food production: the level of agricultural yields and the development of speculative production of crops and livestock for trade, and access to these foodstuffs. During the Iron Age, the northwestern Mediterranean also witnessed the accomplishment of a process already underway at least since the Bronze Age in some regions, which is the establishment of long-distance trade with foreign societies (Etruscans, Greeks, Phoenicians, Iberians, Celts, among others) (Sherratt, 1993). This process in some cases takes the form of colonial settlements and in others of *emporía* or trading posts, with greater or lesser degrees of influence from foreign and indigenous communities. In all cases, new animal and plant products, production strategies, food processing and consumption techniques emerged in the northwestern Mediterranean, particularly from the 6th–5th centuries BCE onwards. Of the many questions that these inter-cultural contacts raise, we are particularly interested here in how the origin and the quality or diversity of food can reveal the implementation of particular agropastoral production strategies (including some that could be allochthonous), as well as the identity and social status of the people who produce and/or consume them, especially in urban settings.

Here we present an investigation of agricultural strategies under urbanisation in Mediterranean France (ca. 750–25 BCE), a region which witnessed the development of substantial long distance trade networks, especially after the founding of the Phocæan Greek colony of Massalia in 600 BCE (Dietler, 2010). These mercantile connections are evidenced by the quantity of wine amphorae and other imports at sites across the region. One such site is the coastal city of Lattara (in modern day

Lattes), where local agricultural production is believed to have assumed a reciprocal role in this trade (Dietler, 2010; Py, 2009, 2012).

To this end, this study presents the first foray into the stable carbon and nitrogen isotope analysis of plant and faunal remains from the Mediterranean French Iron Age. Taking advantage of stable isotopes' ability to elicit subtle spatiotemporal changes in past agricultural systems, we set out to investigate farming practices at 5th century BCE Lattara, complementing crop stable isotope measurements with functional weed ecology to ascertain the intensity of crop cultivation (cf. Bogaard et al., 2016). In particular, we examine the extent to which agricultural production strategies differed between two neighbourhoods that have produced significantly different material culture, architecture and food remains, suggesting that their residents also differed socio-economically and did not have access to the same foodstuffs. Considering that the onset of urbanism in Mediterranean France and its rapid growth during this period gave rise to new social classes that were not all involved in subsistence agriculture (García, 2005), we hypothesise that these two distinct neighbourhoods should reveal some divergent attributes in production of the food they consumed.

## 2. Background

### 2.1. Lattara during the 5th century BCE

Founded ca. 500 BCE, Lattara was situated on a small headland on the Lez river delta by a large likely freshwater lagoon with access to the sea (Fig. 1; Bagan et al., 2010). The area today is characterised by a subhumid Mediterranean climate with dry summers, mild winters and rainfall occurring primarily during spring and autumn (Ambert and Chabal, 1992). The botanical, faunal, palynological and dendrological evidence recovered from excavations at Lattara indicate the presence of wetlands, salt marshes, drylands and closed-canopy forests in the vicinity of the city in antiquity (Alonso and Rovira, 2010; Alonso et al., 2008; Chabal, 2005; Gardeisen, 2008; Loublie, 1992; Puertas, 1998; Rovira and Alonso, 2010).

In addition to a section of its fortification wall, two residential areas within Lattara have been excavated down to 5th century levels, zones 1 and 27, providing the earliest glimpses of urban life here. At the city's

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