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# Stable carbon and nitrogen isotope analysis on human remains from the Early Mesolithic site of La Vergne (Charente-Maritime, France)

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**Abstract**

We report here the results of stable carbon and nitrogen isotope analysis of human and faunal remains from La Vergne (Charente-Maritime, western France), a rare Early Mesolithic burial site (ca. 8500–8000 cal BC). The results for nine humans (average $\delta^{13}C = -19.3‰$; $\delta^{15}N = 9.4‰$) indicate a strongly terrestrial diet, dominated by animal protein, with the possibility of, at best, a slight contribution of marine-derived protein. Given lower sea-levels in the early Holocene, the site would have been some 60–80 km from the sea at the time of its use; nevertheless, contacts with the coast are shown by the presence of numerous marine shell beads in the graves. In the light of the stable isotope results, it is suggested here that such contacts most likely took the form of exchange with coastal communities whose remains now lie underwater.


*Keywords:* Early Mesolithic; France; Stable carbon and nitrogen isotopes; Palaeodiet; Territoriality

## 1. Introduction

Human remains dating to the Early Mesolithic are rare in many parts of Europe, and are important in that they provide information concerning a period of transition, both environmental—from the Preboreal to the Boreal—and cultural—from the Epipalaeolithic to the Mesolithic. La Vergne falls within this timeframe, being an Early Mesolithic burial site (ca. 8500–8000 cal BC), located in Charente-Maritime in western France (Courtaud and Duday, 1995; Courtaud et al., 1999; Duday and Courtaud, 1998). Moreover, what is of particular interest at La Vergne is the presence of abundant marine shell beads, indicating some form of contact with the coast, which at this time would have been many tens of kilometres distant. This raises the question of whether the individuals buried at La Vergne were highly mobile, systematically making use of a very large territory that included the coast, or, alternatively, whether the shells were obtained through trade, or through occasional forays to the coast for primarily non-subsistence purposes. The presence of a number of individuals at the site provides the opportunity to undertake a palaeodietary study using stable carbon and nitrogen isotope analysis to address this question. In addition, fauna from La Vergne together with previously published faunal values from a near-contemporary site, enable an investigation of aspects of the terrestrial economy,

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and in particular the balance between plant and animal sources of protein, as well as the degree of variability in isotopic values within this group. The measurements provided here add to the growing body of isotopic data available for prehistoric human diets, and contribute towards a greater understanding of their temporal and spatial variability.

### 1.1. The site of La Vergne

The site of La Vergne is located near the town of Saint-Jean-d'Angely, Charente-Maritime, on a slope of the valley of the river Boutonne (Fig. 1; the site itself is also known by the name of La Grande-Pièce, but we use the more common place-name as it appears in the titles of the primary publications). The site was discovered during an archaeological salvage operation in 1995; the presence of Mesolithic graves was completely unexpected, as these underlay a Gallo-Roman site, which was responsible for much disturbance, and possible destruction of part of the earlier site (Courtaud and Duday, 1995; Courtaud et al., 1999). Three surviving grave structures contained the remains of 10 individuals, including adults of both sexes and young children, with the very fragmentary and partial remains of an additional five individuals likely deriving from two disturbed graves of the same period. Grave 10 contained the massive horn cores of two aurochs interred with the deceased (Courtaud et al., 1999, Photo 3). This grave and another contained large numbers of marine shells, many perforated for use as ornaments, as were a number of fox, deer and human teeth.

## 2. Materials and methods

Stable carbon and nitrogen analysis was undertaken on bone collagen extracted from 13 human and five faunal bone samples from La Vergne, in order to provide information concerning palaeodiet at the site. The human samples were analysed at two different laboratories, Bradford and Montpellier. The faunal samples were analysed at Bradford only; unfortunately very limited faunal samples are available from the site, as no associated settlement has as yet been found, and the graves themselves contained only a few species (red deer and aurochs) as part of the funerary rite. The majority of the samples are associated with three complex graves, directly dated on human bone to early in the Holocene, with three AMS estimates ranging from 9215 to 9070 BP, calibrating to the second half of the ninth millennium BC (Table 1). These three determinations derive from bone in graves with multiple individuals, and so provide good dated contexts for seven of the sampled individuals. Samples from two individuals are from disturbed contexts (lv4 and lv5), but are tentatively suggested to be of comparable age, due in part to close physical proximity to the dated Mesolithic graves, and in part to the presence of red ochre staining on at least some bones from each context (Courtaud, personal communication). The remaining four individuals are thought to considerably post-date the Mesolithic interments, and may belong to the Iron Age (lv3, lv7, lv8, lv13).

### 2.1. Stable isotope analysis

Stable isotope analysis has been successfully applied to both human and faunal remains from an increasing number of Palaeolithic and Mesolithic sites across Europe (e.g., Bocherens et al., 1997, 2006, 2007; Drucker and Célérier, 2001; Drucker and Henry-Gambier, 2005; Lillie and Richards, 2000; Richards et al., 2000; Schulting and Richards, 2001). Stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in bone collagen can yield information about protein sources in both human and non-human animal past populations, providing a direct record of long term diet, over a period of some 5–10 years in adult humans (Schwarcz and Schoeninger, 1991). In the absence of $C_4$ plants, which do not feature in the diet of earlier prehistoric humans in northwest Europe, $\delta^{13}C$ values reflect the level of marine input into the diet, with endpoints of ca. −21 to −20‰ for purely terrestrial protein to ca. −12‰ for purely marine protein. The $\delta^{15}N$ values provide information on the trophic level at which an organism is operating: human and non-human consumer values are elevated by ca. 3–5‰ over the values of their diets (Bocherens and Drucker, 2003; DeNiro and Epstein, 1981; Schoeninger and DeNiro, 1984). More comprehensive local values for the major herbivores and carnivores would ideally be available to aid in the interpretation of the human data; unfortunately few data are available. Of relevance, however, are faunal values from the early Holocene component at Pont d'Ambon, Dordogne, especially the material from layer 2, dated to the Preboreal Azilian period (Drucker, 2001; Drucker and Célérier, 2001).

### 2.2. Methods 1, Bradford

Bone samples of 200–300 mg in weight were cleaned using an air abrasion system. These were demineralised at 4 °C in 0.5 M HCl. Once demineralised, the samples were rinsed three times with de-ionised water. They were then introduced to a pH 3 solution and placed in a heater block at 70 °C for 48 h. The samples were first filtered in a 8 μm filter and then ultrafiltered, with the >30 kDa fraction taken to be frozen and freeze-dried (Brown et al., 1988). Between 0.3 and 0.5 mg of the resulting collagen was weighed into tin cups for analysis in a ThermoFinnigan Flash EA coupled to a Delta Plus XL mass spectrometer. A number of blank samples and internal standards, including three randomly assigned methionine samples of known weight (0.6–0.7 mg) were introduced with the samples to ensure instrument integrity (see Richards and Hedges, 1999). Standard measurement errors are ±0.2‰ for $\delta^{13}C$ and ±0.3‰ for $\delta^{15}N$.

### 2.3. Methods 2, Montpellier

Bone samples of 200–300 mg in weight were cleaned and ground to a powder sieved through a 0.7 mm mesh. These were demineralised at room temperature in 1 M HCl for 20 min, filtered through a 5 μm Millipore® filter and the insoluble residue was soaked in a 0.125 M NaOH solution for 20 h at room temperature to remove humic components. After