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Modeling mammalian food webs in the Orce sites

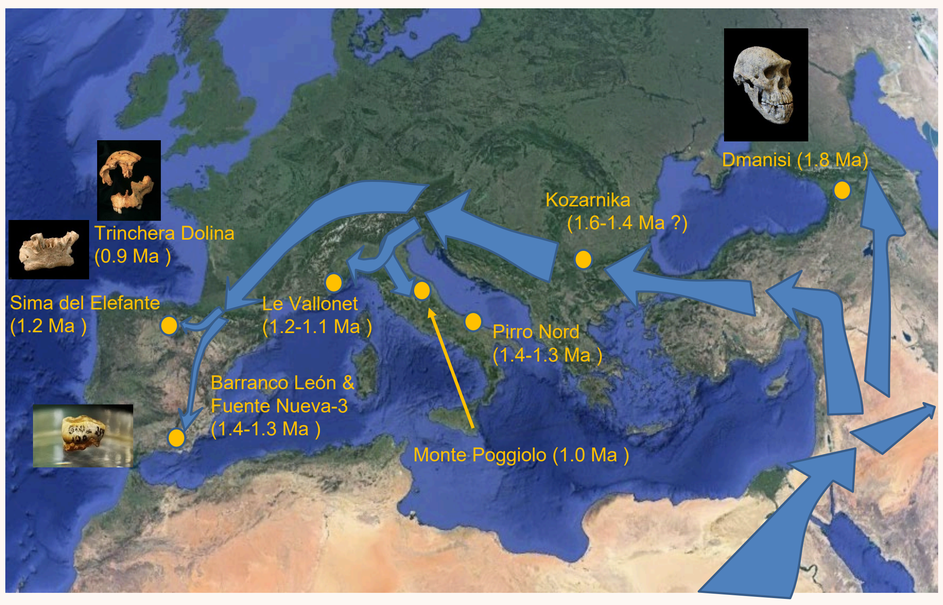
A quantitative reconstruction of prey-predator relationships in the first hominin settlements of Western Europe

Guillermo Rodríguez-Gómez [1,*]; Paul Palmqvist [1]; Jesús A. Martín-González[2]; M. Patrocinio Espigares [1]; Sergio Ros-Montoya [1]; Manuel Salvador de Lara[3]; Bienvenido Martínez-Navarro [4,5]

[1] Universidad de Málaga, Málaga, Spain; *guillerwilson@gmail.com; [2] Universidad de Burgos, Burgos, Spain; [3] University of Surrey, Guilford, United Kingdom; [4] Area de Prehistoria, Universitat Rovira i Virgili (URV), Avda. Catalunya 35, 43002 Tarragona, Spain; [5] ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Spain

INTRODUCTION

On the chronology of the first human peopling of Western Europe

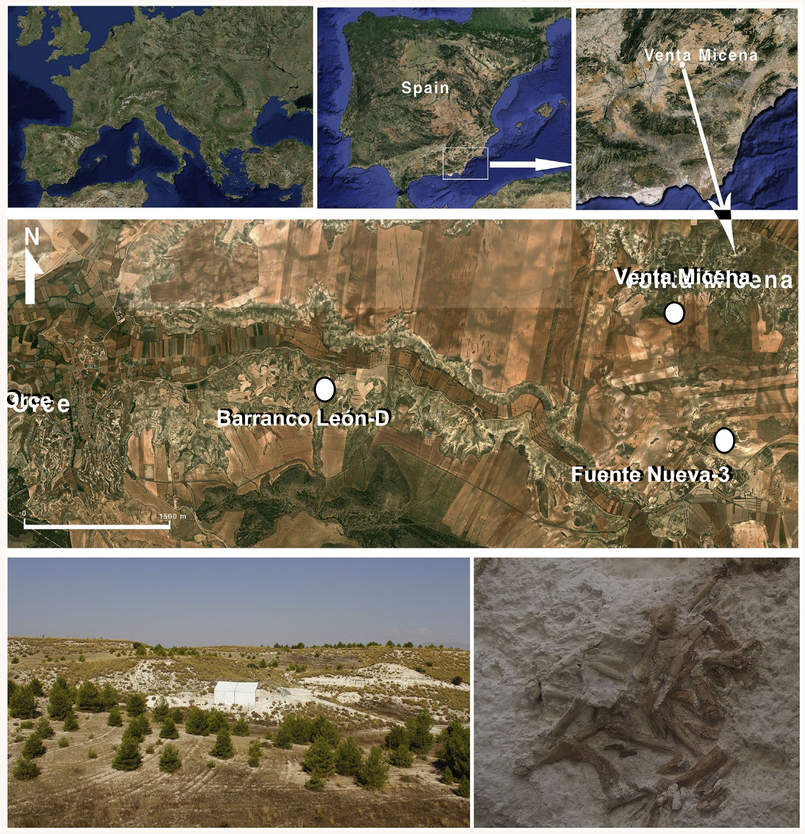


Meat was a relevant resource for the first hominins that dispersed in Europe during Early Pleistocene times and competition with other carnivores could have conditioned their presence.

The Early Pleistocene sites of Orce (Baza Basin, SE Spain) provide the ecological scenery before the initial peopling (Venta Micena (VM), dated at ~1.6-1.5 Ma) and preserve the oldest evidence of hominin presence in Western Europe (Barranco León (BL) and Fuente Nueva-3 (FN-3), dated at ~1.4 Ma).

Huge large mammals assemblages with an excellent state of preservation have been unearthed from these sites. For this reason, they offer a unique opportunity to analyze the food webs of the mammalian paleocommunities before and after the earliest hominin arrival in Europe.

Orce sites



MATERIAL AND METHODS

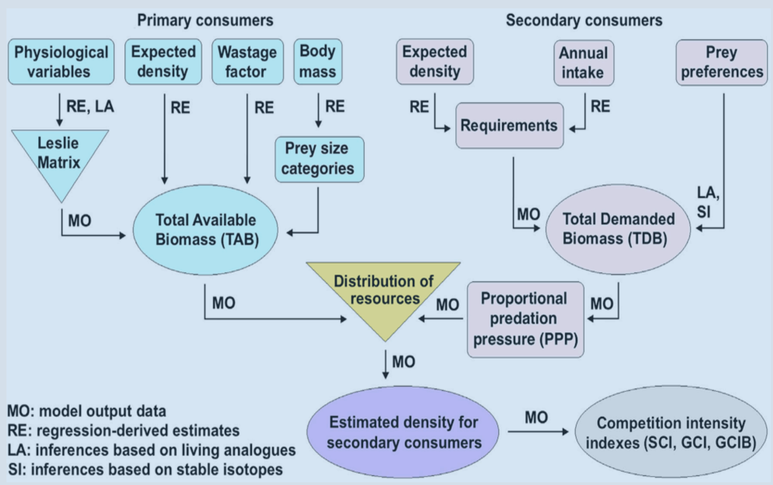
Synecological reconstruction of these Early Pleistocene faunas was performed using a mathematical model in VM, BL-D and FN-3 for estimating:

(1) The biomass produced each year by the species of primary consumers

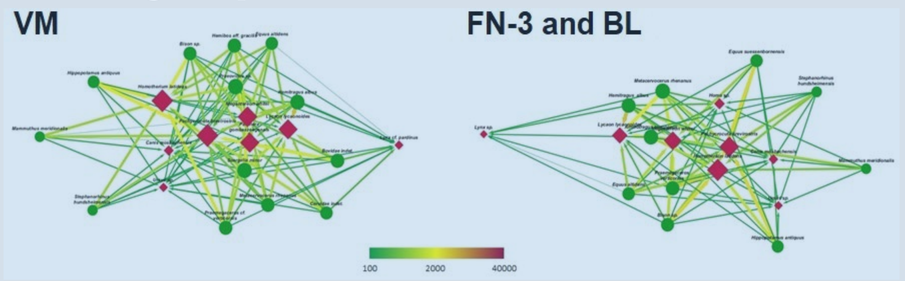
(2) The nutritional needs of the secondary consumers (primary predators and scavengers, including hominins if present)

(3) Resource partitioning among the members of the carnivore guild, according to their prey size preferences and metabolic requirements

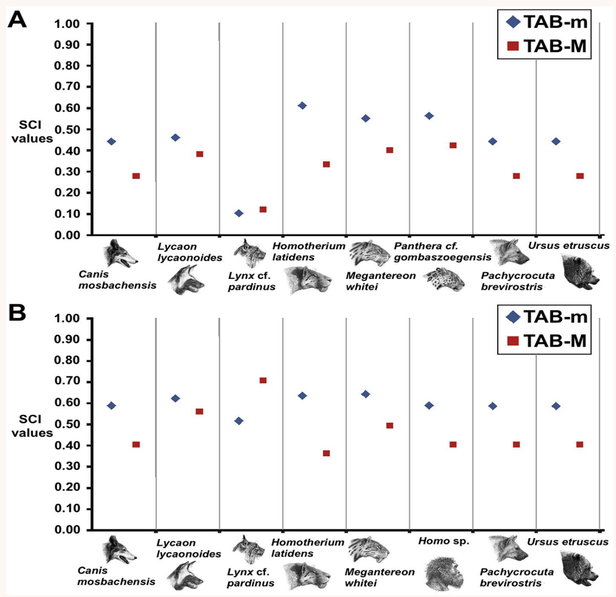
(4) Population densities and intensity of ecological competition among carnivores (and, eventually, *Homo*).

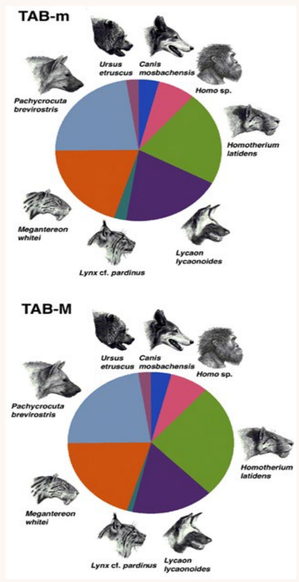


We reconstructed the food web architecture of Venta Micena, Fuente Nueva-3 and Barranco León with Cytoscape, an open source software platform for visualizing complex networks.



RESULTS





1. The biomass available for the members of the carnivore guild of VM is 25-30% higher than the estimates obtained for BL and FN-3

2. The sustainable population of secondary consumers was also higher in Venta Micena than in Fuente Nueva-3 and Barranco León

3. The level of competition intensity estimated in the carnivore guild of VM was lower than in the other two sites of Orce

Model inferences	Scenario	VM (~1.6-1.5 Ma)	BL, FN-3 (~1.4 Ma)
Total available biomass (TAB, kcal/km² per year)	m	584,030	410,904
	M	779,118	575,454
Carnivore population density (individuals/100km²)	m	81	65
	M	100	76
Global competition index (GCI)	m	0.39	0.58
	M	0.28	0.50

CONCLUSSIONS

The results obtained show that meat was not a limiting factor to hominin presence in Europe before 1.4 Ma.

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