



Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

The introduction of South-Western Asian domesticated plants in North-Western Africa: An archaeobotanical contribution from Neolithic Morocco

Jacob Morales^{a, b, *}, Guillem Pérez Jordà^c, Leonor Peña-Chocarro^{c, d}, Youssef Bokbot^e, Juan C. Vera^f, Rafael M. Martínez Sánchez^c, Jörg Linstädter^g

^a Departamento de Geografía, Prehistoria y Arqueología, Universidad del País Vasco (UPV/EHU), F. Tomás y Valiente s/n, 01006 Vitoria-Gasteiz, Spain

^b Departamento de Ciencias Históricas, Universidad de Las Palmas de Gran Canaria, Pérez del Toro 1, 35003 Las Palmas de Gran Canaria, Spain

^c G.I. Arqueobiología, Instituto de Historia, CCHS/CSIC, Albasanz 26-28, 28037 Madrid, Spain

^d Escuela Española de Historia y Arqueología en Roma/CSIC, Sant'Eufemia 13, 00187 Rome, Italy

^e Institut National des Sciences de l'Archéologie et du Patrimoine (INSAP) Maroc, Angle Rues 5 et 7, Avenue Allal el Fassi, Madinat Al Irfane, Hay Riad, B.P. 6828 Rabat Instituts, Morocco

^f Departamento de Historia, Facultad Humanidades, Universidad de Huelva, Avenida de las Fuerzas Armadas S/N, 21071 Huelva, Spain

^g Deutsches Archäologisches Institut, Kommission für Archäologie Außereuropäischer Kulturen, Dürenstr. 35-37, 53173 Bonn, Germany

ARTICLE INFO

Article history:

Available online xxx

Keywords:

Neolithic
North Africa
Macro-botanical remains
Radiocarbon dating
Early farming
Crops

ABSTRACT

This paper focuses on the new macro-botanical evidence of South-Western Asian cultivated plants from northern Moroccan Neolithic sites. Due to the reduced presence of plant remains from previous excavations in the region, archaeological evidence of agriculture is rare and the arrival of domesticated plants and the role of farming in the Early Neolithic of North Africa are still poorly understood. Here we present results of the analysis carried out in three sites recently excavated: Kaf Taht el-Ghar, Khil, and Ifri Oudadane. Charred seeds of domesticated cereals (*Triticum dicoccum*, *Triticum monococcum/dicoccum*, *Triticum durum*, *Triticum aestivum/durum*, *Hordeum vulgare*, *Hordeum vulgare* var. *nudum*) and pulses (*Lens culinaris*, *Pisum sativum*, *Vicia faba*) have been recorded in all sites analyzed. Radiocarbon dating of crop seeds indicates that farming, along animal herding and pottery, was most probably introduced in the region at the interval between 5500 and 5000 cal. BC. Absence of evidence for Neolithic farming in other regions of North-Western Africa suggests that the first crops arrived into Morocco through a maritime route, more likely from the Central or Northern Mediterranean shores. Similarities in both radiocarbon dates and crop assemblages from early Neolithic sites in Northern Morocco and the south of the Iberian Peninsula point to an almost simultaneous East to West maritime spread of agriculture along both shores of the Western Mediterranean.

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1. Introduction

The introduction and spread of domesticated plants to North-Western Africa during the Neolithic period is a topic that has received little attention until very recently due to the lack of macro-botanical remains. Most of the Neolithic sites in this region were excavated during the first part of the 20th century, when systematic

recovery of plant remains and radiocarbon dating were not fully developed. As a result, archaeological evidence of agriculture is rare, and the arrival of domesticated plants and the role of farming in the Early Neolithic of North Africa are still poorly understood (Roubet, 1979; Barker, 2002, 2006; Marshall and Hildebrand, 2002; Garcea, 2004; Barich, 2014).

According to published data, agriculture in North Africa may have spread following different paths (Linstädter, 2008; Barich, 2014). In north-eastern Africa, domesticated plants were probably introduced from the Near East through Egypt during the 5th millennium cal. BC (Wendrich et al., 2010; Zohary et al., 2012), although evidence from recent phytoliths analysis from Sudan suggests that the arrival of Near Eastern cereals was probably

* Corresponding author. Departamento de Geografía, Prehistoria y Arqueología, Universidad del País Vasco (UPV/EHU), F. Tomás y Valiente s/n, 01006 Vitoria-Gasteiz, Spain.

E-mail address: jacobmoralesmateos@gmail.com (J. Morales).

<http://dx.doi.org/10.1016/j.quaint.2016.01.066>

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earlier, between 5000 and 4500 cal. BC (Madella et al., 2014), spreading much later (3rd millennium cal. BC) to Libya (Van der Veen, 1995; Pelling, 2008; Barich, 2014).

In North-Western Africa current data indicates that crops along domestic animals and pottery were introduced by a different route. Results from two recently published datasets from the sites of Ifri Oudadane (Morales et al., 2013) and Kaf Taht el-Ghar (Ballouche and Marinval, 2003), in northern Morocco, have yielded clear evidence of farming in the form of seeds of domesticated cereals and legumes, pointing to the practice of farming since the middle–late 6th millennium cal. BC. However, the available data comes from northern Morocco and cannot be applied to other countries of the region. From the rest of Morocco, Tunisia and Algeria remains of domesticated plants from Neolithic sites are absent, although domesticated animals and pottery are recorded in several sites (Linstädter, 2008; Linstädter et al., 2012; Aouadi et al., 2014; Kherbouche et al., 2014).

For the time being, three main hypotheses have been proposed regarding possible routes of arrival of agriculture and the Neolithic package to Morocco. The first states that crops along with domestic animals and pottery arrived initially to the Iberian Peninsula at ca. 5600 cal. BC, and from there they moved to north-western Africa through the Gibraltar Strait (Zilhão, 2014; Martins et al., 2015). This hypothesis is mostly based on the record of earlier dates for crops and domestic animals in the Iberian Peninsula, although lack of data in Neolithic sites of Morocco diminishes support to this thesis. A second hypothesis considers that some Neolithic innovations related to pottery, flint technology and bone tools, moved from North Africa to the Iberian Peninsula (Manen et al., 2007; Marchand and Manen, 2010; Cortés-Sánchez et al., 2012). Again, the paucity of well-dated sites in Morocco does not allow tracking the spread of those innovations in the region. The third hypothesis was already contemplated by A. Gilman (1974), who suggested that the Neolithic package was spread by seafarers who synchronously arrived to both the northern and southern shores of the Western Mediterranean. Radiocarbon dates of domestic plants and animals in recently excavated sites of northern Morocco have provided new support to this theory (Linstädter et al., 2012).

In this paper, we contribute to this interesting topic by presenting the results of the analysis of the macrobotanical remains (seeds and fruits) from three recently excavated Neolithic sites from Morocco: Kaf Taht el-Ghar (KTG from now on), Khil and Ifri Oudadane. Plant remains can be accurately identified and directly dated by radiocarbon methods, and they provide one of the most precise evidence of the presence of crops in archaeological sites. On the other hand, Morocco is located at the westernmost side of the Mediterranean shore and it represents a critical zone for understanding the spread of agriculture in North-Western Africa, with implications for surrounding areas including the European Mediterranean and the Sahara (Oliveira et al., 2012). Here we use this new dataset in order to answer the following research questions: (1) When did domesticated plants first appear in the region? (2) What was the route or routes of arrival of domesticated plants to the area?

2. Environmental setting and description of the sites

2.1. Environmental setting

The study area is located in Northern Morocco (Fig. 1). Ifri Oudadane and KTG are situated along the Mediterranean coast, while Khil is set in the Atlantic coast. The area occupied lies between the sea and the Rif Mountains. Present-day climate is Mediterranean with hot summers and mild winters, and a wet season between autumn and spring. The flora of the area belongs to the

maquia-forest type made of shrubs and small trees such as mastic trees (*Pistacia lentiscus*), pines (*Pinus halepensis*), araar (*Tetraclinis articulata*), junipers (*Juniperus* spp.) oaks (*Quercus* spp.) and wild olives (*Olea europaea*) (Charco, 2001; Fennane et al., 2007).

Environmental conditions have changed significantly during the Holocene in North Africa, especially in the Sahara (Mercuri et al., 2011; Garcea et al., 2013; Manning and Timpson, 2014). In Northern Morocco, pollen and charcoal analyses carried out in several Neolithic sites indicate that conditions were more humid during the early Holocene than at present time, with a wooded environment that included evergreen sclerophyllous oaks and riparian forests (Zapata et al., 2013; López et al., 2015). However, after 4600 cal. BC, conditions become drier and riparian taxa disappeared or decreased. After 4000 cal. BC, this process led to an arid or semi-arid environment, similar to that of the present-day. The impact of human activities, including agriculture and animal herding, is recorded since 5600 cal. BC, causing the decline of arboreal components and the increase of shrubs and grasses (Zapata et al., 2013; López et al., 2015).

2.2. Description of the sites

2.2.1. Kaf Taht el-Ghar

KTG is located in the Tangier region of Morocco, at 410 m above the sea level and 9 km from the current seashore. It is a large cave through limestone bedrock containing several chambers and channels (Fig. 2). The ‘main chamber’, of ca. 20 × 10 m, has been the focus of several seasons of excavation. The first works were undertaken in 1955 by the Spanish archaeologist M. Tarradell (Tarradell, 1957–1958), and later, between 1989 and 1994, by a Moroccan–French team (El Idrissi, 2001; Ballouche and Marinval, 2003; Daugas and El Idrissi, 2008; Daugas et al., 2008). The materials analyzed in this study come from the new excavations carried out at the ‘main chamber’ in 2012 within the framework of the AGRWESTMED project funded by the European Research Council. The work has been carried out by a Spanish–Moroccan team which includes the participation of the *Institut National des Sciences de l’Archéologie et du Patrimoine du Maroc* (INSAP) and the Spanish National Research Council (CSIC).

Three trenches were opened during the 2012 season. The first (26 A–B) covered Epipalaeolithic and Early Neolithic layers with Classic and Mediaeval levels in the upper part of the stratigraphy (Fig. 2). The second trench (26 G) spans from the Iberomaurusian (Later Stone Age) to the Early Neolithic. The third trench (26 HI–26 JK) records an occupation that initiates in the Epipalaeolithic and continues during the Middle Neolithic. The top layers contain materials from Chalcolithic and later periods.

Neolithic layers are separated from the previous Epipalaeolithic occupation by a layer of compact sediment made of clasts and other rocks of several sizes. Early Neolithic stratigraphic units show no gradient and present a dark-grey color and a large amount of biological remains such as land shells, bones of domestic fauna (goat and sheep) and charcoals, as well as lithic tools of lamellar technology and, Impressed-Cardial and Channeled ware. The few evidences of Cardial ware in the Middle Neolithic units suggest some vertical movements of artifacts within these layers as result of erosion and deposition of sediment within the cave. Nevertheless, radiocarbon dating of crops and pottery decoration styles confirm that stratigraphic units are in correct order.

2.2.2. Khil

Khil caves (Magharat el Khil) is a complex site comprising a group of small caves (Grotte A, B, and C) located in the mouth of the Oued Achakar, in the Atlantic coast of the Tangier area (Fig. 3). The caves were initially occupied during the Neolithic but they have

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