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Multidisciplinary analysis of wild cereals from the Holocene archaeological site of Takarkori (central Sahara)

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Pollen and plant macroremains from central Sahara archaeological sites give information about the environmental conditions during the Holocene and the adaptive strategies of human groups living in the area (Fig. 1, 2). Wild cereals have been exploited for long time and are the prevalent taxa among those selected and transported to shelters and caves [1]. The extraordinary state of preservation of the organic materials found at Takarkori allowed the morphological and molecular analyses of seeds/fruits belonging to the Poaceae family [2, 3].

Fig. 1 *– Seeds/fruits accumulations mainly composed of wild cereals.*

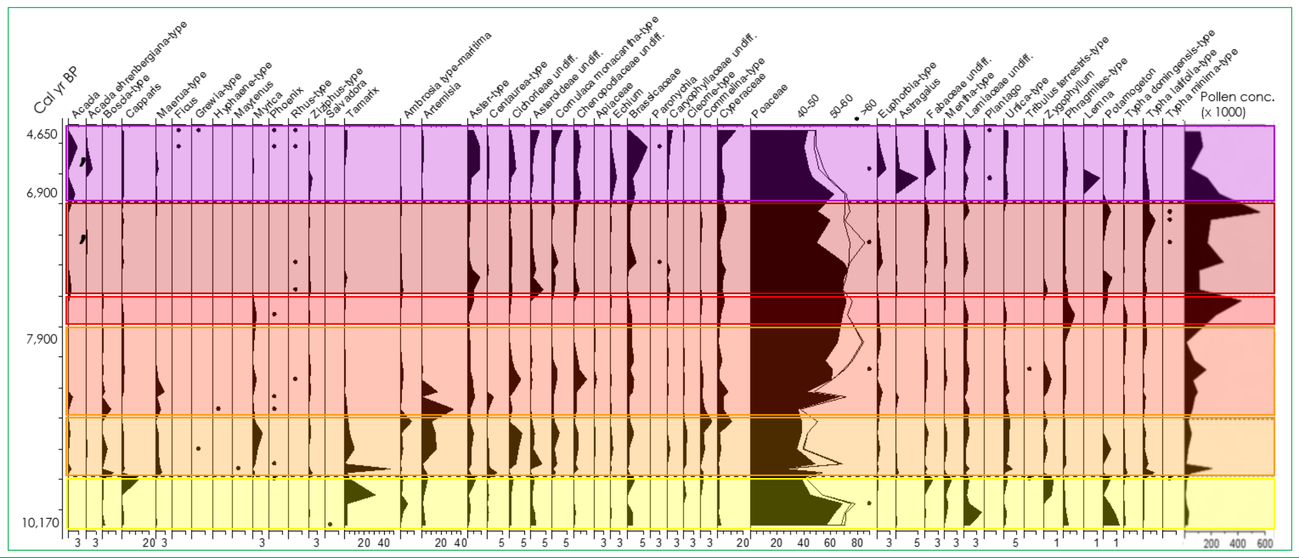
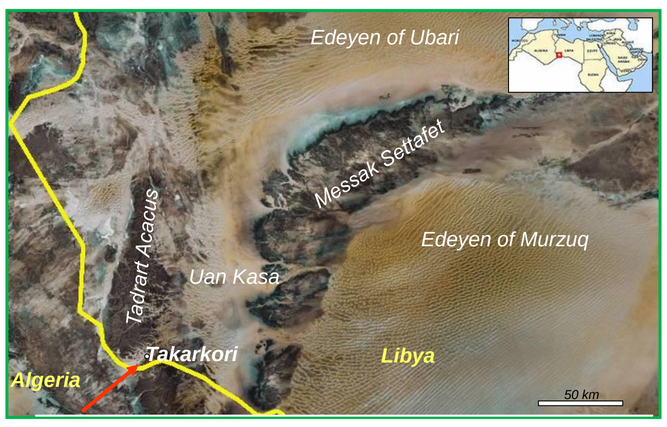


Fig. 2 *– Percentage pollen diagram describing the 6 main environmental transformations of the Takarkori area during Early and Middle Holocene (Cremaschi et al. [1]).*

Takarkori was excavated by the Italian – Libyan Archaeological Mission in the Acacus and Messak (directed by S. di Lernia – Sapienza University of Rome). It includes stone structures, fireplaces, plant accumulations, dung layers and a burial area (Fig. 3). Layers were deposited by groups of hunter-gatherers first and by pastoral communities later. Chronology ranges from *ca.* 10,200 to 4,600 cal yr BP [4].



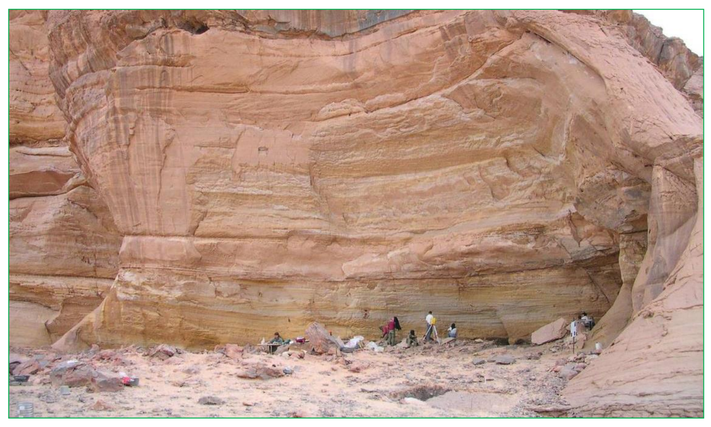


Fig. 3 *– The Tadrart Acacus massif (800-1400 m a.s.l.) is the easternmost relief of the central Saharan mountains - SW Libya. The Takarkori rock shelter is located not far from the Algerian border.*

Systematic morphometric analysis was carried out on 1600 dried spikelets of *Panicum*, *Echinochloa* and *Sorghum* mainly found as plant accumulations (Fig. 4). Twenty samples were selected as representative of different cultural contexts. The record show uniform size in each genus. Principal Component Analysis (PCA) displays a relation between the specimens from the accumulations and the modern species, while the specimens found scattered in the excavation grid are isolated (Fig. 5) [2]. This suggest a difference in the collection of the spikelets.

Fig. 4 *– Fertile spikelets in dorsal and ventral view of* Sorghum bicolor *subsp.* verticilliflorum, Echinochloa colona *and* Panicum laetum.

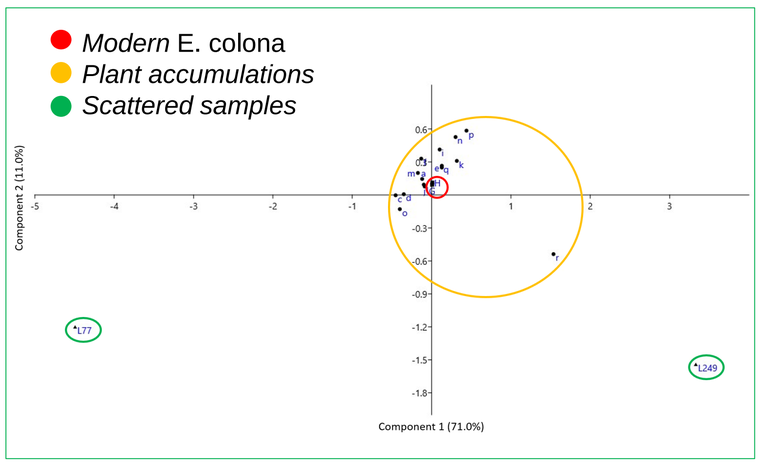


Fig. 5 *– PCA of Dmax/dmin ratio of* E. colona *specimens.*

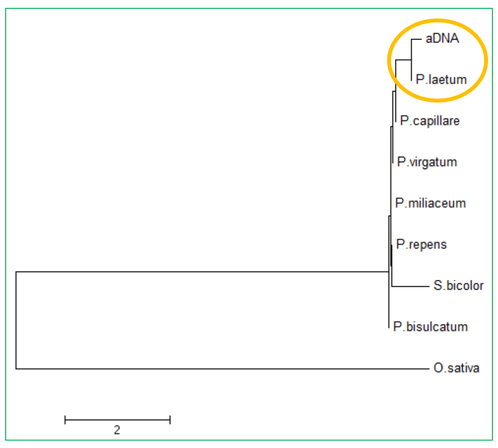


Fig. 6 *– Evolutionary relationships of taxa based on the combination of the DNA barcode sequences (MEGA7, Neighbor-Joining method; Fornaciari et al. [3]).*
Fig. 7 *– Current* Panicum *sp. vegetation in central Sahara, SW Libya.*

Ancient DNA (aDNA) was extracted from *Panicum* testing different protocols and then DNA barcoding was performed. The sequencing of specific chloroplast regions (rbcL, matK and trnH-psbA) allowed the investigation of the evolutionary relationships between ancient samples and modern species. The phylogenetic tree shows a close genetic relationship between aDNA and *P. laetum*, supporting the morphological identification (Fig. 6) [3]. The well preservation of the spikelets of *Sorghum* allowed the Next Generation Sequencing (NGS) approach (in progress). The aim is to better understand the origin, development and possible domestication of those still harvested African cereals (Fig. 7).

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