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L'archéobotanique et les débuts de l'agriculture en Égypte
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Sommaire
Béatrix Midant-Reynes
Avant-propos 3

Christian de Vartavan
Introduction 5
Flore de l'Égypte prédynastique (20000-5000 BP) 9

Gordon Hillman
The Principal Plant Food available to Predynastic Populations and their Exploitation 17

Wilma Wetterstrom
La chasse-cueillette et l'agriculture en Égypte : la transition de la chasse et de la cueillette à l'horticulture dans la vallée du Nil 29
L'apparition de l'agriculture en Égypte 52

Arlene Miller Rosen
Phytoliths in the Predynastic: a Microbotanical analysis of Plant Use at HG, in the Hu Semaineh region, Egypt 79

Frances S. McLaren
Infrared Analysis of Chaff from Adaima 83

Stan Hendrickx
Bibliography of the Prehistory and the Early Dynastic Period of Egypt and Northern Sudan — 1996 addition 87
Topographical index 121

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Infrared Analysis of Chaff from Adaima

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The Use of Infrared Analysis

Infrared (IR) analysis was selected as an ideal technique with which to begin examination of archaeobotanical material primarily because it is non-destructive and both the sample and the chemical extracts survive and are available for further study. IR spectra are unique for each different type of organic or inorganic compound. The technique is rudimentary in that it looks at the overall patterns of the specimen and not the fine detail of each individual component. Consequently, problems associated with archaeological material, such as diagenesis and modern contaminants such as plasticizers, do not generally affect the general IR formations as could be the case with the more sensitive techniques such as Gas Chromatography-Mass Spectroscopy (GC-MS). Like most chemical analyses the main problem are associated with the interpretation of the generated spectra but, the morphology limits the possible options in the case of single seeds or plant fragments: for example, the gross morphology will indicate whether the material under analysis is part of a plum stone or a cereal grain (McLaren 1995).

Chemical Analysis of the Adaima Char

Four chaff fragments from Adaima were recently examined. The samples were extracted in hexane, chloroform and propan-2-ol (McLaren et al., 1990) and compared to the library of cereal IR spectra built up mainly from Gordon Hillman’s collections of wheats from the 1970’s held at the Institute of Archaeology, UCL. The Adaima chaff fragments were amongst the smallest samples yet investigated by IR. Generally the best quality and the most diagnostic spectra are obtained from the propan-2-ol extracts. Unfortunately, the Adaima samples produced very poor spectra. Indeed one sample IRFM 423 produced no usable spectra from any of the solvent extractions.

Results

Sample number IRFM 424: The propan-2-ol extract of this spikelet fragment has no clear modern parallel at present. It’s closest affinity is with wild einkorn (Triticum boeoticum Boiss. — following Miller’s

Figure 1. Light: Propan-2-ol extract of ancient wheat from Neolithic Blackwater (IRFM 407/78). Dark: Propan-2-ol extract of chaff from Adaima, Egypt (IRFM 1671/424)
nomenclature, 1987) and a group of apparently free threshing wheats from Northern Europe as exemplified by a grain from Neolithic Blackwater (Murphy 1989) (see figures 1 and 2). This group of as yet unidentifed wheats is distinct from the classic hulled emmers (see figure 3) and hopefully a modern analogue will be traced soon. Therefore at present it must be assumed that this spikelet fork probably represents a wild einkorn wheat *Triticum boeoticum* Boiss.

Sample numbers IRFM 443 and 444: The pan-02-ol extracts of these two spikelet fragments were closest in match with a bread wheat (*Triticum aestivum* L.) collected during the 1970’s from a crop at Asvan, in Turkey (see figure 4).

**Discussion**

Prior to modern farming practices, wheat crops generally consisted of mixed land races, which often included not only different varieties but also wheats of different ploidy levels. Archaeological evidence suggests that eummer wheat, a readily identifiable glume wheat, was the stallwart of a predynastic Egyptian wheat crop assemblage (Zohary and Hopf, 1993).

Wild einkorn is not readily regarded as an element of ancient Egyptian crops but as a segital (secondary) plant. Wild einkorn has an extensive distribution range throughout western Asia. Climatically, einkorn is quite tolerant because it primary habitats include the summer-dry foothills of the north Euphrates basin as well the bitterly cold, elevated plateaux of Central and Eastern Anatolia (Zohary and Hopf, 1993). It is therefore probable that Egyptian eummer fields included a number of other wheat species including the wild wheats.

It is now recognised that there were three wild wheat species that played a part in the history of wheat domestication. The two wild diploid wheats are called *Triticum boeoticum* Boiss. and *Triticum urartu* Tum. while the other wild wheat is a tetraploid wheat known as *Triticum dicocoides* Korn. The separation by botanists of the diploid wheats into two distinct species is a relatively recent occurrence. Both cyto- genetic investigations and DNA analysis have now confirmed the existence of the two wild diploid wheats. These analyses have also shown that it was the little
known *T. urartu* and not *T. boeoticum* that was the ancestor of most domesticated wheats, *i.e.* emmer (*T. dicoccum* [Schrank.] Schübl.) and bread wheat (*T. aestivum* L.) (Waines and Barnhart, 1992; Dvorak et al., 1993; Mukai et al., 1993). *T. boeoticum* is now only regarded as the ancestor of *T. monococcum* L. (better known as einkorn) (Nishikawa, 1992; Dvorak et al., 1993).

The effect of high temperature stress on wild and spring wheats was studied by (Waines, 1994) at Riverside, California, from June to October. Heat stress at both the vegetative and reproductive stages was investigated, under high temperatures (280°/150°C day/night). The test samples originated from the same geographic area in the Levant but were not selected for heat tolerance.

Waines used modern Mexican cultivars of *durum* and bread wheats as comparative standards which have no problems under high field temperatures. All the Levantine spring *durum* and bread wheats tested flowered and set seed. In comparison many of the wild diploid species did not grow well during the vegetative stage but some still managed to produce seed.

Hopf (Zohary and Hopf, 1993) postulated on the possible presence of a free-threshing wheat with the emmer in the assemblage from the Early Neolithic site of Beni Salame in the Western Nile Delta that she examined. Bread wheat is the most variable aggregate of all the wheats and it presence should not be surprising in Predynastic Adaima.

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**Bibliography**


