INTRODUCTION

Abundant charred and often broken olive stones recovered from Bronze Age layers of Tell Tweini (ancient Gibala) at the Syrian coast (Figure 1) raised the question whether the olives found were actually crushed in the course of processing for oil or just charred and broken post-depositionally. It is suggested that olive fragments with fractures rounded along the edges (Figure 2) were broken during ancient oil production, while sharp edges testify to the sharp edges of the broken faces of the stones. So rounded fractures, but also dull fragmentation faces have been said to be indicative of breakage prior to deposition (Simchoni 2004).

Simulation of carbonization processes of plant materials (i.e. seeds and fruits), in order to aid the archaeobotanical analyses and interpretations of charred remains, can be achieved using modern experimental techniques (Braudbaart 2008). However, the taphonomy of charred plant remains has yet to be investigated in detail.

The current study included experimentally charred olive stones with the aim to observe the differences between olive stones broken before or after charring. The changes appearing on level of tissue and cell structure were observed with Scanning Electron Microscopy (SEM). The experimentally obtained structures were next compared with the archaeological olive stones from Tell Tweini with recent and supposedly old fractures in order to discern their criteria for differentiation on their archaeological origin.

MATERIALS AND METHODS

SAMPLE COLLECTION

Fresh olives (from cultivars for oil production) were harvested by hand from Syrian and Italian groves. The fresh olive fruits were washed with distilled water and then experimentally burned in muffle furnace. Such units achieve high temperatures in a short time, allowing rapid processing, and their temperature is easily controlled. Heating was fixed at 220, 330 and 430 °C byoxic and anoxic conditions. The conditions inside the muffle furnace are not really anoxic, so various methods should be used to prevent the supply of air to the material. For the current study they were placed in containers covered by sand. Duration of heating was fixed at approximately three hours. The conditions were chosen mainly with the aim to simulate conditions resembling domestic fires. Treated (i.e. salted) olives were air-dried the same way.

ULTRASTRUCTURAL COMPARISON

First the objects were selected by viewing them under a JEOL JSM 6400 microscope. They were lightly coated with gold. A JEOL JSM 6400 microscope was used for the actual analysis and digital pictures were generated with SemAfore.

RESULTS

On the SEM images produced from the experimental and archaeological olive stones we first identified the most relevant cell layers and compared differences visible.

The experiments (Figure 3) consisted of three layers: (1) outer stone cells (at), which are large, isodiametric or transversely elongated, often oval or ovoidal in shape and covered by sand. Duration of heating was fixed at approximately three hours. The conditions were chosen mainly with the aim to simulate conditions resembling domestic fires. Treated (i.e. salted) olives were air-dried the same way.

In order to determine the degree of fracture of the fraxtal tissu...