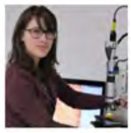
Photo: Microscopic plant remains trapped in the crevices of prehistoric tools reveal their use: grounded, pounded and thrashed plants to make flour.

STONE TOOLS STUDY REVEAL THE LONG WAY . . . TO PIZZA!

When our ancestors spread across Eurasia, about 40.000 years ago, finding harsh climatic conditions causing the rarefaction of big size fauna, they competed with ***Neanderthals*** for food supply. However in a few thousand years, ***Homo sapiens*** (HS) became the only species alive. Why? The success of HS over Neanderthals is still a debated topic. Among the various hypotheses, this research investigates the technological skills (coupled with biological capability) of HS to get nutrients also from plants, which might have given them an advantage for survival.

A RESEARCH TALE BY



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This story began around 40.000 years ago, at the down of ***Homo sapiens*** (HS) occurrence in Eurasia that was already inhabited by other Archaic humans, ***Neanderthals*** and ***Denisovans***, since about 300.000 years.
The cold and arid environment was attested in the territory covered by steppe grassland and evergreen forests. These conditions were affecting the fauna resources with the demise of big size mammals, a very rich source of fats and proteins, while lean animals like horses, deers and bisons, became reliable sources of meat supply. Considering the challenge to find and hunt fast prey, whose fat stock in winter was depleted, the energy resources may have been not enough to guarantee the subsistence of Palaeolithic hunter-gatherers.
Although considered low-ranking food, plants are also energetic resources, and their starch content, stored mainly in the fruits or in the underground storage organs (roots, tubers, bulbs, rhizomes), represents a reliable source of calorific food available the whole resources, and their starch content, stored mainly in the fruits or in the underground storage organs (roots, tubers, bulbs, rhizomes), represents a reliable source of calorific food available the whole year round. The biology of HS allowed us to get nutrients also from plants, while scientific data supports that the diet of Archaic humans was mainly carnivore. This may have provided our direct ancestors with a decisive nutritional advantage, while the other two species become extinct after a few thousand years of coexistence.

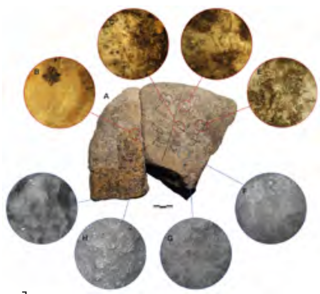

Fig. 1

Fig. 2

However, investigating plant processing is not an easy task! Plants are very unlikely to be preserved in archaeological sites. Therefore, we are studying the stone tools used to process these floral resources, by grinding and pounding different parts of the plants (roots, tubers, bulbs, seeds, kernels that need a pre-treatment prior to consuming). The focus of the research is the study of the wear traces that processing of plants leave on the stones surface (Fig. 1) and the microscopic plant residues that can be entrapped in the crevices of the stones (Fig. 2).
This study involved several international research teams from Italy, France, Moldova, and Russia. My activity focuses on the stone tools used for plants tenderization in order to get flour, which will be revealed through the multilayered investigative approach I am setting. The name of the project is *REtrieVE A noveL: new multi-scale surface texture analysis of ground stone tools* (REVEAL).
The first step in this long way ... to Pizza (!) is to get closer to our ancestors' behaviour, and to replicate the gesture that they may have done to produce flour by strategically applying experimental archaeology (Fig. 3): 1) the collection of slabs and pebbles to be used as grinding stones (lower stationary tool) and pestles (the active movable tool), 2) the gathering and preparation of vegetable resources, 3) to be finally grounded, pounded and thrashed to soften starchy organs making them easy to chew and to be digested (Fig. 4).


Fig. 3

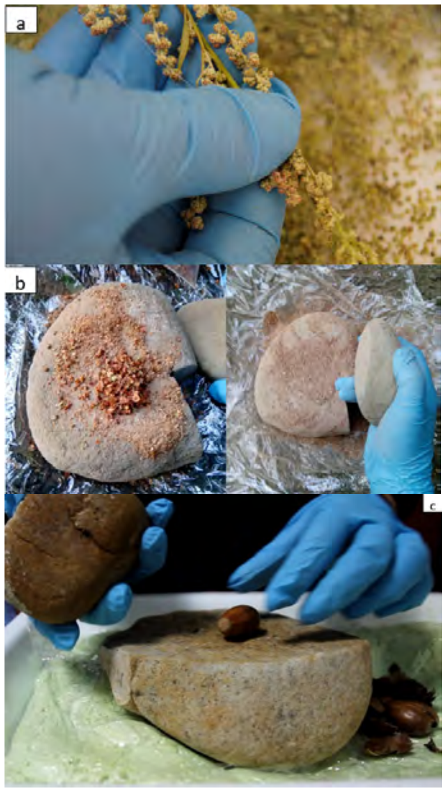
Fig. 4

The aim is to create a reference collection of stone tool replicas and possible vegetable resources to be compared with the archaeological tools and residues.
A fundamental step to demonstrate the intentional modification of the stone surface is to establish the parametric features that enable the recognition of human intentional plant transformation during the Early Upper Palaeolithic.
In order to do so I designed my research considering techniques with increasing magnification power to analyse the stones, starting with the overall geometry and then moving to the scanning of its surface roughness and use-related features at macro and micro-scale (Fig. 5).
The 3D documentation creates a digital model of the artefacts (usually preserved in museums and other research institutions), and allows a survey of the entire surface of the tool and to identify areas that are potentially modified by usage.
These putative functional areas are then further analysed with different microscopes including *Scanning Electron Microscope* (SEM, a special microscope that uses electrons as energetic sources enabling observation down to the nanoscopic level, therefore overcoming the limit of optical microscopy resolution).

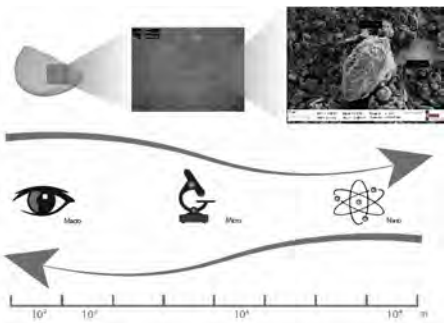
Fig. 5

These analyses allowed us to confirm the presence of use-related wear traces associated with putative residues. The use of a microscale profilometer allowed us to measure, compare and further evaluate the single feature, enabling the comparison of the different wear-traces , providing indication about the mechanical stress and consequently another suggestion of the way the artefacts were used.

Finally, in order to correctly classify the identified traces, and to make inferences on the function and the transformations of different resources the data from the archaeological artefacts are compared with the experimental replicas (Fig. 6).

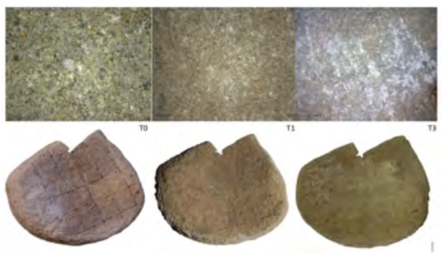
Fig. 6

Studying the *Homo sapiens* food strategy which includes plants processing and hunting , may finally give an answer on the origin of our rich diet and spread new light on the survival success of our species.