Pact 33 - I.a.3 : Carmen Hoyas, Jordi Juan and Enric Villate

Airborne Particles : an Approach to Calcium Oxalate Phytoliths

Abstract

Organic matter from plants is destroyed during combustion, but mineral particles present in plants — phytoliths — remain in the soil. In this case, calcium oxalate phytoliths which are transformed to calcite (pseudomorphs). These particles are transported by the winds and deposited in sediments. We are particularly interested in using these crystal forms to identify plants at a family level, or in some cases, genus level.

Airborne particles from forest fires include phytoliths, especially calcium oxalate phytoliths. These are formed by higher plants when oxalic acid is converted to crystal form in cells.

Calcium oxalate phytoliths are transformed during combustion to calcium carbonate (calcite) at a temperature between 430 and 510° C. The original forms are preserved, but not the chemical properties (pseudomorphs). This change to calcite is a major factor contributing to the preservation of calcium oxalate phytoliths in sediments.

Calcium oxalate phytoliths present the same problem for identification as opal phytoliths do with respect to multiplicity and redundancy, as has been shown by Rovner (1972). Each species produces many different crystal forms of different sizes, and the same forms are present in different plants.

Some families produce distinctive phytoliths and genus level identification is already clearly possible, in a significant number of cases (e.g. *Pinus*). Statistic analysis of the frequency of different types within an assemblage can give the probability for the presence of one species typeset over another. In opal phytolith studies the value of cross-body to bilobate ratios separating cultivated maize (*Zea* sp.) from wild teosinte confirms the validity, if not the necessity of this approach.

The durability and representativity of calcium oxalate phytoliths is worth special attention. The effects of the nature of the soil and the water circulation on calcium oxalate or calcite is unknown. Our studies indicate that the dissolution processes are inhibited by the presence of charcoal. There is a high accumulation of calcium oxalate phytoliths on the hearth bottoms of domestic fires. Because of this we believe that the presence of phytoliths will be rarer in the accumulated silt fractions of ashes from open-air settlements than in those of caves or cave entrances.

At the moment we are in the process of determining calcium oxalate phytoliths frequencies in plants and the influence of different types of soils on their preservation.

The Palaeoecological Laboratory of the Archaeological Museum in Barcelona applies oxalate phytolith studies to palaeoecological reconstruction. At the moment, similar results concerning phytolith taxonomy are provided by J.E. Brochier and M. Thinon from the University of Provence (Marseille, France).

The construction of a modern phytolith collection for archaeological study regions is one of the most important and indispensible parts of calcium oxalate phytolith research. At present we are preparing a specific collection of Mediterranean species.

Fig. 1. Pinus halepensis. *x 515. Calcium oxalate phytolith (pseudomorph in calcite).*

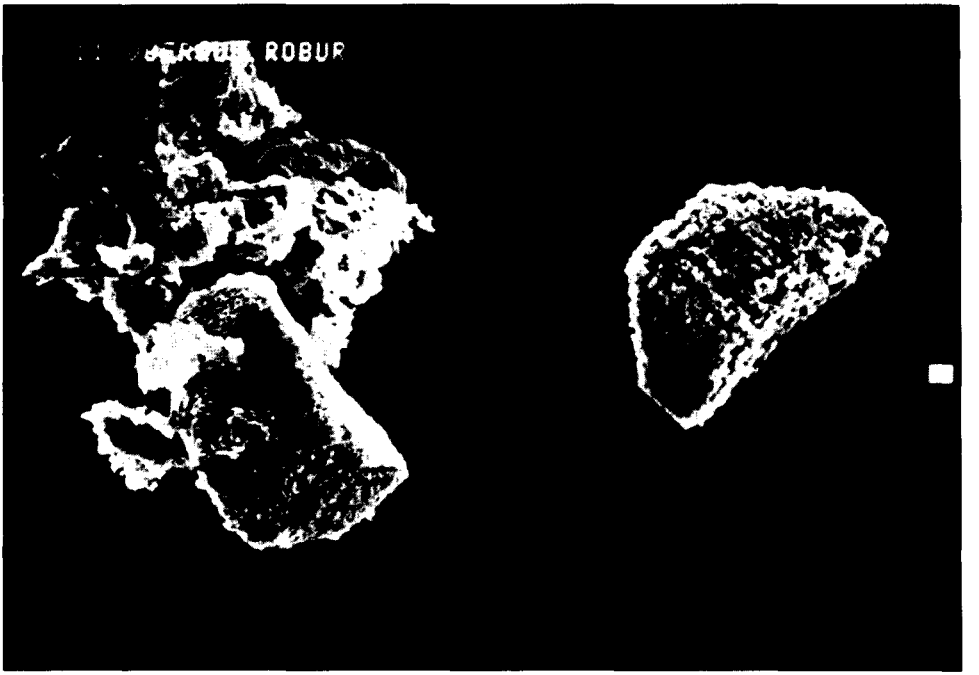

Fig. 2. Quercus robur. *x 1380. Calcium oxalate phytolith (pseudomorph in calcite).*

Fig. 3. Salix eleagnus. *x 3400. Calcium oxalate phytolith (pseudomorph in calcite).*

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REFERENCES

BROCHIER, J.E., 1983, *Bergeries et feux de bois néolithiques dans le Midi de la France*, in *Quartär*, 33/34, p. 181-193.

BROCHIER, J.E., 1983, *Combustion et parcage des herbivores domestiques. Le point de vue du sédimentologue*, in *Bulletin de la Société Préhist. de France*, 80, n. 5, p. 142-145.

BROCHIER, J.E., 1985, *Ce que nous apprennent les sédiments*, in *Les Dossiers. Histoire et Archéologie*, 96, p. 16-18.

HOYAS, C., JUAN, J., PALET, A. and VILLATE, E. (in press), *Análisis de fitolitos en ópalo y de oxalato de calcio en calcita como indicadores arqueobotánicos*, in *Revista Cuaternario y Geomorfología*, Madrid.

ROVNER, J., 1972, *Potential of Opal Phytoliths for Use in Palaeoecological Reconstruction*, in *Quaternary Research*, 1, p. 343-359.