



## ERYTHRAE : Metabolomic analysis of amphora organic content



Ribarska str., 19, Apollonia pontica. 5th c. BC

First fairly concentrated lipid extract. We identify:

- conifer pitch: free and methylated dehydroabietic acid, associated with retene and its degradation products by natural oxidation;
- an animal fat (abundant cholesterol, with chol/sito ratio 9.27). The distribution of fatty acids (even acids 14:0 - 18:0 in the majority, odd linear and branched acids 15:0 and 17:0, TMTD and phytanic isoprenic acids, short-chain acids 5:0 - 12:0) points to a dairy product. The wide distribution of diglycerides (DAG 20:0 - 36:0) and monoglycerides (MAG 10:0 - 18:0) confirms this identification.

Vegetable waxes and plastic pollutants are negligible.

The second extract is highly concentrated and characterized by :

- very abundant tartaric acid, associated with malic acid (cTar 30.76  $\mu\text{g/g}$ , Mal/Tar 0.08), with no syringic acid present, corresponding to white grape;
- conifer pitch;
- itaconic acid, no other acid from alcoholic fermentation. According to our analyses of modern products, this acid could be a sign of lactic fermentation, and therefore of cheese.

Conclusion. - The amphora was waterproofed with conifer pitch and contained a large quantity of white grapes. Fermentation markers were not detected and do not suggest a white wine. If these were never present, it would have been white raisins or white grape juice concentrated into syrup by evaporation (ancient defrutum or modern-day petimezi in Crete). A dairy product is also present, in significant quantities, potentially a cheese. The contents may be successive

