

Programma di “**Archaeomaterial Chemistry**” (9 CFU)  
Corso di Laurea Magistrale in “**Scienze Chimiche**”  
Curriculum **Industria, Ambiente e Beni Culturali**  
**a.a. 2019/2020**  
Prof. Enrico Ciliberto

**Teoria (6 CFU) + Attività di Laboratorio (3 CFU)**

Ceramics: definition and history. Fillosilicates and natural clays. Technologies of mixing and shaping throughout history. Technologies of furnace processes and related chemical reactions. Equivalent temperature of firing, the Maggetti’s model. Determination of the equivalent temperature of firing. Stoneware and porcelain. Decoration of the pottery, Egyptian faiences, Attic vases, majolica. Pottery degradation. Pottery dating.

Glasses: ores and technologies of glasses. Former oxides, modifiers oxides, chromatic elements and particles. Glass degradation: devitrification, leaching and corrosion.

Metal and alloys: a short history of their uses. Copper and copper alloys: bronze, phase diagram copper-tin; the roles of tin, lead and arsenic; the bronze disease. Brass and the role of zinc. Iron and steel, ores and early technologies. Iron corrosion. Lead and its uses, the lead pest. Lead isotopes and origins of the ores. Gold, silver and their alloys.

Lithic and pseudolithic materials. An overview of the most important natural rocks used in the historic architecture. Mortars and concretes: lime, technologies and hardening process. Hydraulic limes: technologies and uses. Gypsum and plaster. Concretes and problems of deterioration in modern buildings.

Paint materials and painting techniques. The colour of the materials. Pigments and dyes. Different binders in different painting techniques: fresco, tempera and oil. Interactions and compatibility between pigments and binders. Varnishes and their uses. Degradations of paint layers. Gilding techniques.

The Organic Materials: Papyrus, papers and parchments: chemistry of the raw materials; analytical and microscopic methods in order to identify them. Ambers: different origins and related methods of investigation. Mummies and mummification techniques. Embalming and petrification of human bodies. Wood and its deterioration. Dating of biological samples by  $^{14}\text{C}$ .

Laboratory:

Synthesis of different pigments and their characterisation by SEM/EDX, FTIR, XRD: red lakes, Egyptian blue, Prussian blue.

Synthesis and characterisation of a coloured glass sample.

Paint layer cross sections and characterisation by OM and SEM/EDX

-Mark Pollard and Carl Heron, *Archaeological Chemistry*. The Royal Society of Chemistry (2008), ISBN 978-0-85404-262-3.

- K.J. Rao, *Structural Chemistry of Glasses*, Elsevier, 2002, ISBN 0080439586.

-P.T. Nicholson and I. Shaw, *Ancient Egyptian Materials and Technology*, Cambridge University Press, 2006, ISBN 0521452570

- M.J. Aitken, *Science-based Dating in Archaeology*, Longman Archaeology Series, ISBN 0582054982.

- W.S. Taft, J.W. Mayer, *The Science of Paintings*, Springer-Verlag ISBN 0387987223