Organic chemistry and high resolution mass spectrometry to decipher ancient material

Caroline Tokarski

Miniaturisation pour l'Analyse, la Synthèse & la Protéomique (MSAP), USR CNRS 3290,

Université de Lille 1 Sciences et Technologies, 59655 Villeneuve d'Ascq, France

E-Mail : Caroline.Tokarski@univ-lille1.fr

Cultural Heritage material is challenging to study. Most pieces are made of more than one material, each containing many chemical components. The manufacturing process, artist's use, time and travel as well as exposure to light, humidity, heat and conservation treatments all affect these materials. How an artwork appears to us today is not the same as its original appearance: it is a culmination of all of the chemical changes driven by these events. Moreover, the change will continue, although more slowly, under museum conditions. To understand these chemical changes and how they relate to the conservation and preservation, the organic material has to be accurately identified and characterized.[1]

Until recently, the organic compounds from Cultural Heritage samples were analyzed *via* their constitutive moieties (e.g. amino acids, fatty acids, monosaccharides) inducing a loss of information. In the early 2000s, we have successfully adapted proteomic and lipidomic methodologies to the study of few micrograms of historic art paintings and archaeological samples allowing for the first time the accurate structural identification as well as the identification of the biological species. These methodologies are currently used in the most famous international museums (e.g. Metropolitan Museum of Art, New York).

This conference will show how organic chemistry combined with very high resolution mass spectrometry address the current challenges for analysis of Cultural Heritage samples. For example structural elucidation of biopolymers of unknown structures and/or their chemical modifications will be shown (e.g. historic art paintings and watercolors; historic animation cels…). Another example is the combination of soft depolymerization experiments and very high resolution mass spectrometry to unravel the 3D networks formed by insoluble lipidic films (e.g. historic oil-paintings). The conference will be illustrated by the study of various outstanding samples from art but also from archaeological and paleontological sciences from the most famous museums and institutes of the world.

[1] *Dallongeville S., Garnier N., Rolando C., Tokarski C.* Chemical Reviews 2016, 116, 2−79*