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EVIDENCE OF CHEMICAL REACTIVITY USING SCANNING ELECTRON MICROSCOPY OF SEVENTEENTH-CENTURY OIL PAINTINGS

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Traditional oil paint is an extremely dynamic system, much more dynamic than is usually thought. Paintings undergo all kinds of chemical and physical processes that over time (eventually) change the original appearance of the work of art.

The apparent formation of metal (lead) and alkali soaps and their subsequent migration through the paint layers plays an important role in many of these degradation processes, such as the formation of so-called protrusions (metal soap aggregates), the formation of whitish hazes and surface crusts, the increased transparency of oil paints and the (occasional) whitening of the bone black pigment.

The study of paint cross-sections with the scanning electron microscope has proven to be a very informative tool to visualize the chemical reactivity of traditional oil paints, as will be shown in several case studies presented. The samples include mechanically dry polished cross-sections from seventeenth-century oil paintings and ion-milled (CP) cross-sections, which allow even higher resolution images (50,000x). Generally, particle morphology is a good indicator of whether a compound is formed in the paint as a result of degradation or is an original paint constituent. It may also show that a pigment is in the process of alteration. Backscattered-electron images reveal the dissolution of the lead white pigment and the formation of new lead-containing degradation products as well as the migration flows of mobile paint constituents through the paint layers. The conclusions are supported by other analytical techniques, FTIR (single-point and imaging) and mass-spectrometry (DTMS).