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Micro-computer-tomographic mineralogical and textural evaluations of Egyptian Blue Spheres

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Egyptian Blue was the first synthetic pigment by humankind. It consists of cuprorivaite, which is a calcium-copper-silicate (CaCuSi4O10). This study reports the results of a mineralogical and computer tomographic study of Egyptian Blue finds from Aguntum in East Tyrol along with Retznei and Wagna (formerly Flavia Solva) from southern Styria in Austria. The present work aims to extend our understanding of the processes involved in the production of the artificial pigment Egyptian Blue. The samples were investigated with respect to their elemental composition and spatial distribution of the calcium-copper-silicate cuprorivaite CaCuSi4O10 and then compared with data from previous studies. Thin sections of an Egyptian Blue sphere from Aguntum was examined using optical microscopy (OP), micro-X-ray fluorescence analysis (µ-XRF) and scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM-EDX). The pigment's initial mixture as well as the manufacturing process seem to be the decisive factor for the quality of the final product. A relationship between the presence of trace iron (Fe), titanium (Ti), and sulfur (S) with the quartz and copper source of the initial mixture is discussed. In addition, micro-computed tomography (µCT) of the Egyptian Blue finds (Aguntum, Retznei, Wagna-Flavia Solva) was performed. Hence revealing several concise differences between the samples. Texture and volumetric results show a distinctive difference in cuprorivaite content and particle size. To better analyse the spatial distribution, µCT-3D images of the individual mineral phases identified within each sample were obtained. The clear differences in the results may not only enable a differentiation of the production process but also show another potential of non destructive µCT for assessment of archaeological and geological findings.

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