

[Brass Particles on the Turin Shroud: Optical Microscopy Studies and SEM-EDX Analyses](#) by **G rard Lucotte and Thierry Thomasset** (Open Access) - *International Journal of Sciences* – December 2024, 13(12):10-32 – Abstract: We have explored by optical microscopy and scanning electron microscopy coupled with energy-dispersive X-ray twenty-two particles and formations of brass located in a sample of the Face area of the Turin Shroud. They differ by the proportions of copper and of zinc in the alloys. The nineteen brass particles are micro-sheets or micro-balls, generally of yellow colour. The p5 formation is representative of the cementation process of brass production, and the k15 formation is representative of the direct process. These brasses were loaded on the Turin Shroud surface at different times during history, to imitate gold powder.

[Optical Microscopy And SEM-EDX Characterization Of Some Little MicroOrganisms Having Chemical Formulas Similar To Those Of Clays, Deposited On The Turin Shroud Surface](#) by **G rard Lucotte** (Open Access) - *Journal of Multidisciplinary Engineering Science and Technology*, May 2024, 11(5):16838-16847 – Abstract: We have studied by optical microscopy and SEM-EDX particles corresponding to small micro-organisms and having chemical formulas similar to those of clays, located on the surface of a small sticky tape triangle corresponding to the Face area of the Turin Shroud. Fifty-two of these particles correspond to individual microorganisms; of typical triangular forms, their dimensions are comprised between 2 and 5.5  $\mu\text{m}$ ; they are alumino-silicates, with some contents of iron and phosphorous. These micro-organisms have a tendency to self-associate (between at least two linked individuals in particles comprised between 3.5 and 5.5  $\mu\text{m}$ ). We described here in details the special case of some particles (h3-h11) corresponding to a group of micro-organisms linked together. Eleven of such particles correspond to closely linked individuals, microorganisms; they are greater (up to 23  $\mu\text{m}$ ) than those of individual micro-organisms, and are generally of yellow colour. In some cases (particles b4, b5, e7, e14, e53, f47 and i16) there are visible micro-organisms – or their reliefs (b74, d18, d15 and g37) – on its surfaces. All these particles correspond to some form of phosphorites, similar to those already described in some regions of the Middle-East.

[Iron-Rich Red Clays on the Turin Shroud: Optical Microscopy Studies and SEM-EDX Analyses](#) by **G rard Lucotte et al.** (Open Access) - *Archaeological Discovery*, 12(1):66-81 – Abstract: We have explored by optical microscopy and scanning electrons microscopy coupled with energy dispersive X-ray fifteen particles located in a sample of the Face area of the Turin Shroud. They have the following peculiarities: they are alumino-silicate clays, with an elevated content (up to 56%) of iron; their sides are comprised between 1.5  $\mu\text{m}$  and 19  $\mu\text{m}$ ; their forms are rounded or more elongated, but more often with angular outlines. When observable, their colours are red or red-brown. All these particles have a little quantity of the phosphorous element (up to 5%) in their compositions. The biggest ones show some morphological heterogeneity on their surfaces, suggesting that they are chipboards of some micro-organisms.

[SEM-EDX Characterization Of The Little Clays Particles Deposited On The Turin Shroud Surface](#) by **G rard Lucotte** (Open Access) - *Journal of Multidisciplinary Engineering Science and Technology*, April 2023, 10(4):15842-15847 – Abstract: We have studied by SEM and EDX the montmorillonite, illite and kaolinite particles located on the surface of a small sticky tape triangle corresponding to the Face area of the Turin Shroud. Twenty-four montmorillonite, twenty-one illite and nine kaolinite particles were detected. Montmorillonite and illite particles

came from the different soils on which the Turin Shroud was exhibited. We suppose that kaolinite particles are micro-fragments of pottery which was put down on the Face of the Turin Shroud.

[Lapis Lazuli Particles on the Turin Shroud: Microscopic Optical Studies and SEM-EDX Analyses](#) by **G rard Lucotte and Thierry Thomasset** (Open Access) – *Archaeological*

*Discovery*, 2023, 11:107-132 – Abstract: We have studied by optical microscopy and SEM-EDX lapis lazuli particles adhering to a sample of the Turin Shroud. A total number of seventy lapis lazuli particles (and sub-particles) were found on the surface of this sample, and were characterized in details: they are little particles (of between 0.1 and 15  $\mu\text{m}$  of maximal length), of blue colour, and with a spectrum of chemical elements identical to that of the lapis Lazuli mineral. We hypothesize that these particles are residues of painting layers of lapis lazuli that covered initially the Turin Shroud.

[Gold and Silver Particles on the Turin Shroud, Studied by Scanning Electron Microscopy and Elemental Analysis](#) by **G rard Lucotte** (Open Access) – *Archaeological Discovery*, 2022,

10(4):262-281 – Abstract: We have studied by optical microscopy and by SEM-EDX some metallic particles of gold and silver adhering to a sample of the Turin Shroud. A total number of eighteen particles (and sub-particles) containing these two elements were characterized in details. Three of them (e49, b22 and h28-0) are parts of gold scales, and six (l38-1, 2, 3, 4, 7' and 12) are micro-grains of a gold powder. The three a23-1, 2 and 3 sub-particles are the metallic parts of a spot of painting. The e27 particle (of electrum) is possibly some part of a coin of a Byzantine money; possibly also, the m10 particle could be parts of a billion (a coin of money used during the Roman Antiquity).

[An Osseous Remain on the Face of the Turin Shroud](#) by **G. Lucotte and T. Thomasset** (Open

Access) - *Journal of Anthropology and Archaeology*, June 2017, 5(1):2334-2439 – Abstract: Turin Shroud is a well-known Christ relic on which a body image is imprinted. We had access to a sticky-tape that was applied directly to one blood spot of the Face. This sticky-tape contains very numerous microscopic particles, that were studied by optical microscopy and SEM-EDX analysis. One of these particles, named e58, is a bone/cartilage remain; it was intensively studied for its aspect, colour, thickness, surface morphology and ultrastructure, and for its organic and mineral compositions. Presence of such an osseous remain on the Face adds new substantial material (other than red blood cells, skin debris and one hair, already published) to the knowledge of the Man whose body is imprinted on the Turin Shroud.