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Neutron techniques applied to better define conservation strategies of 16th –18th centuries Portuguese glazed tiles

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The city of Lisbon has in situ sixteenth-eighteenth -century tiles that sometimes were decontextualized of its original architectural framework and landscape, owing to the deep urban changes operated in the following centuries.
There are several examples in the various city gardens and ancient buildings all over Lisbon and other cities such as: (i) 16th century tile panel near the floor in the Madre de Deus Church (belongs to the National Tile Museum) in so advanced state of degradation that have been taken off and replaced by new ones; (ii) 17th century set of tiles in the Torel hill, near the Campo de Santana, with advanced state of degradation and in the rear part of a new condominium; and (iii) 18th century glazed tile from the "Nossa Senhora da Conceição dos Aflitos"Church (Elvas, Portugal).
These glazed tiles from different centuries have been placed in diverse environments along the last centuries. The 16th tiles were indoor close to the floor and given the proximity of the river and the low water level, they were seriously damaged by the effects of water ascendance by capillarity. The 17th tiles are outdoor exposed and without any kind of protection. The 18th tiles are indoor and are the less deteriorated.
The main objective of this work is to identify the degradation state and the main degradation processes of glazed tiles, so that they can be better overcome or at least reduced, giving tools to conservators so they can better choose the intervening strategy. So, in order to contribute to better design future actions of conservation/restoration of Portuguese glazed tiles, a study including diverse approaches has been performed, especially comprising neutron techniques, namely neutron tomography and neutron activation analysis. These methods were complemented with X-ray diffraction to identify the mineral phases of ceramic body.
The results obtained showed that geochemical patterns together with mineralogical assemblage became a useful approach for the knowledge of nature of these works of art, as they characterized the original materials and the alteration products. These results allowed identifying the chemical and physical conditions which favoured endogenous and/or exogenous processes of decay. The neutron tomography, enabling an inner visualization and the light elements content, particularly hydrogen, was particularly useful to evaluate the degradation state of each tile. NT also showed that brushing technique to apply consolidants appears to be more efficient than immersion technique, used in the National Tile Museum.
Thus this work allowed establishing a methodological approach to help conservators to select conservation practices of tiles in different environmental conditions. Brushing technique appears to be a suitable technique for consolidation, which favours the conservation procedures of the tiles in situ, like in the Quinta do Torel panel.

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