On the route of lapis lazuli trade in ancient time: a multi-technique provenance study of the raw material used for carved artefacts

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Lapis lazuli is a blue semi-precious stone that has been used since Neolithic Era (VII millennium B.C.) for the manufacturing of precious carved artefacts. The possibility to associate the raw material to man-made objects could help historians and archaeologists to reconstruct trade routes especially for the ancient time when written testimonies are scanty or absent at all. Despite the Badakhshan Province (Afghanistan) remains the most plausible hypothesis for the lapis lazuli used in antiquity, alternatives proposed in literature are worth to study to confirm or disprove their historical reliability. To solve the issue we started in 2008 a long-term research, involving an interdisciplinary team, and only recently we presented a protocol for determining the provenance of lapis lazuli rocks used for carved artefacts by means of non-invasive techniques (Angelici et al., 2015; Re et al., 2015; Lo Giudice et al., 2017). Markers for the univocal attribution of the raw material to a source were identified analysing 45 rocks of known provenance from 4 quarry districts. The research has been focused in searching markers on single mineral phases using microscopic techniques, which allow to observe and to analyse single crystals. In particular it was verified that all the markers found (presence of a mineralogical phase, trace elements, luminescence bands) are simultaneously detectable by means of ion beam analysis (IBA), in particular micro-PIXE (Proton Induced X-ray Emission) and micro-IL (IonoLuminescence), or X-ray techniques, in particular micro-XRF (X-Ray Fluorescence) and XRL (X-Ray Luminescence). These techniques are non-invasive and applicable in air, allowing to analyse artworks and rocks of practically any shape and dimension without sample preparation.
The protocol was successfully applied to determine the provenance of raw material used for carved lapis lazuli artefacts kept in different museums in the northern Italy. The studied collections have a great historical value and include objects ranging from the first millennium B.C. to the XVIII Century. Following the protocol, a total of about 40 artefacts were analysed and results ascribe the raw material to the Afghan quarry district.

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