p-XRF analysis of lapis lazuli for provenance studies

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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 [1]. Recently we have proposed and successfully applied to lapis lazuli objects a protocol to identify the provenance of the raw material by means of micro-analytical non-invasive but not portable techniques [2-4].

In this study, portable X-Ray Fluorescence (p-XRF) analysis was carried out on lapis lazuli to search provenances markers, then overcoming the problem of the not portable instruments used in the current protocol. Until now, 55 lapis lazuli rocks of known provenance from 5 quarry districts have been analysed, creating a database that, to the best of our knowledge, is probably the widest in provenance studies on this material using p-XRF. Our database is composed by: 20 samples from Badakhshan in Afghanistan, 4 samples from Liadjura-Dara in Tajikistan, 11 samples from Lake Baikal area in Siberia, 8 samples from Coquimbo region in Chile and 12 samples from Mogok in Myanmar. Samples from Tajikistan and Siberia are georeferenced, i.e. GPS coordinates are known. On the basis of trace element contents it was possible to distinguish some of the origins of the lapis lazuli.

Data obtained by means of p-XRF were compared with those obtained on carved lapis lazuli artefacts kept at the Egyptian Museum of Florence, the second most important Egyptian museum in Italy. The collection in Florence has a great historical value and includes several lapis lazuli pendants, scarabs, small statuettes and amulets ascribable mainly to the 1st millennium BC. In particular, 14 of these artefacts were analysed by means of p-XRF technique.

[1] G. Hermann, Lapis Lazuli: the early phases of its trade, Iraq 30(1), 1968, 21-57
[2] A. Lo Giudice et al., Archaeol Anthropol Sci (2016) DOI: 10.1007/s12520-016-0430-0
[3] D. Angelici et al., Microsc Microanal 21, 2015, 526-533
[4] A. Re et al., Nucl Instrum Meth B 348, 2015, 278-284