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Evidences for an Afghan provenance of lapis lazuli utilized for glyptic by ancient Egyptian combining micro-PIXE and XRF results

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Lapis lazuli is a semi-precious blue stone widely used for different purposes since the antiquity but, at present, there are still some lacking information about both its trade in ancient times and the quarries exploited from different civilisations. Due to the restricted compositional and physical constrains in which lapis lazuli can form, only few sources of this rock exist in the world [1], so that the possibility to associate the raw material to man-made objects is helpful to reconstruct trade routes. Historical sources are in hardly accessible places, such as Afghan and Pamir Mountains, and stones were transported for thousands of kilometres, during periods for which the knowledge of trade routes is still largely incomplete. This is especially true for ancient contexts where there is an absence or scarceness of written records. Although the Badakhshan quarries in Afghanistan (the most famous being Sar-e-Sang) are widely considered until now as the only source of lapis lazuli in ancient times [2], other sources have been considered: Tajikistan (Lyadzhuar Dara, Pamir Mountains), Pakistan (Chagai Hills), Siberia (Irkutsk, near Lake Baikal).
A systematic study of lapis lazuli rocks is carried out by our group since 2007 [3-5], using a protocol based on a multitechnique approach. We present here the analyses on archaeological finds from the Egyptian Museum of Firenze based on the characteristic markers for provenances found in previous experiments. We studied few carved objects made in lapis lazuli from the first millennium BC.
Using the combination of micro-PIXE and portable-XRF analysis we obtained a scientific indication that lapis lazuli used by ancient Egyptians in the first millennium BC presents the same chemical-physics characteristics of the Afghan rocks. In particular we compared the analysed objects with our database taking into account the trace elements content in pyrite crystals, determined by using the in air proton microbeam at the LABEC laboratory in Firenze, and the amount of some minor and trace elements in the whole object found by means of portable-XRF.

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