Egyptian blue: modern myths, ancient realities

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Colours containing bright and saturated blue hues were popular for painterly effects in most of the Mediterranean cultures dating from the Bronze Age to the fall of the Roman Empire. Pigments providing the desired blue were produced from precious minerals such as azurite and lapis lazuli, but bright blue hues also came from pigments produced by merging other naturally occurring sources. This large group of synthetically-generated blue frits is referred to as Egyptian blue. Egyptian blue is a calcium copper tetrasilicate compound, a synthetic pigment made by heating a calcium compound (such as powdered limestone and sand rich in calcium carbonate) together with copper and quartz (fig. 1),[1] although synthetic blue pigments based on cobalt are also known, so far mainly in Egypt (such as "Amarna-blue").[2] The hue[3] of Egyptian blue pigments ranges from a saturated, almost black blue to light blue, bluish-green, and purple, each being dependent on the materials employed for its production and manufacturing process.[4] Its material properties are crystal-like, resembling finely shattered glass. It ranges in saturation and brightness (which can be enhanced by secondary heating), and it has a relatively low covering power.[5] It seems to have ceased being widely applied sometime after the fall of the empire, which added a certain mystery to it.

The early manufacture of Egyptian blue pigment

Following the first successful identification of the pigment by Sir Humphrey Davy in 1814 from samples taken from a small pot from Pompeii that contained blue pigment, scholarly knowledge on use of the synthetic pigment has increased rapidly. Recent work,

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1 N. Eastaugh *et al.*, *Pigment compendium. A dictionary of historical pigments* (Oxford 2004) 147; T. Pradell *et al.*, "Physical processes involved in production of the ancient pigment, Egyptian Blue," *J. Am. Ceramic Soc.* 89.4 (2006) 1426; G. D. Hatton, A. J. Shortland and M. S. Tite, "The production technology of Egyptian blue and green frits from second millennium BC Egypt and Mesopotamia," *JArchSci* 35 (2008) 1591-1604; I. Kakoulli, "Egyptian blue in Greek painting from 2500 to 50 BC," in A. J. Shortland, I. C. Freestone and T. Rehren (edd.), *From mine to microscope. Advances in the study of ancient technology* (Oxford 2009) 79-92.

2 M. S. Tite and A. J. Shortland, "Production technology for copper- and cobalt-blue vitreous materials from the New Kingdom site of Armarna — a reappraisal," *Archaeometry* 45.2 (2003) 285-312.

3 We follow the terminology proposed by C. P. Biggam, *The semantics of colour. A historical approach* (Cambridge 2012). Biggam (1-8) describes colour according to 4 major properties: *hue* (the principal constituent of a colour which refers to the visible light that causes colours to separate themselves to the human eye); *saturation* (which refers to how the hue is perceived by the naked eye according to the amounts of grey it contains; the smaller amounts of grey, the more saturated is the hue); *tone* (described as levels of admixtures of white and black in a colour, ranging from pale to dark); and *brightness* (the property which relates only to the level of light reflected by the colour).

4 S. Pagès-Camagna, S. Colinart and C. Coupry, "Fabrication processes of archaeological Egyptian blue and green pigments enlightened by Raman microscopy and scanning electron microscopy," *J. Raman Spectroscopy* 30 (1999) 313-17; P. Bianchetti *et al.*, "Production and characterization of Egyptian blue and Egyptian green frit," *J. Cultural Heritage* 1 (2000) 179-88.

5 V. Daniels, R. Stacey and A. Middleton, "The blackening of paint containing Egyptian blue," *Studies in Conservation* 49.4 (2004) 217; L. Lazzarini and M. Verità, "First evidence for 1st century AD production of Egyptian blue frit in Roman Italy," *JArchSci* 53 (2015) 579.