Babylonian Blues: Studying the blue and turquoise-green glazes of the Ishtar Gate and the Processional Way

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INTRODUCTION

The Ishtar Gate and Processional Way of Babylon, two glazed-brick structures, were both erected by King Nebuchadnezzar II reigning from 604 to 562 BCE. The Ishtar Gate was adorned with dragons and bulls in relief on a deep-blue background resembling the gemstone lapis lazuli. The gate was reached via the Processional Way which was lined with lapis lazuli on relief in deep-blue and turquoise-green backgrounds. The remains of this monumental structure are among the most impressive and best preserved from antiquity. Yet, remarkably little scholarly attention has been paid to its renowned glazes.3-4 The Ny Carlsberg Glyptotek (NCG) in Copenhagen is in possession of three glazed-brick reliefs from the Babylonian en- trance group (Fig. 1-3), acquired by the museum in 1930 from the Vorderasiatisches Museum, Berlin. Representing the Ishtar Gate as well as the Processional Way, these reliefs offer a good opportunity to identify the colouring components in the glazes of the architectural structure as a whole.

CONCLUSION AND AVENUES OF FURTHER RESEARCH

The blue and turquoise-green glazes differ considerably structurally as well as chemically. The blue glazes are rather homogenous, whereas the greenish glazes are highly hetero- geneous (Fig. 4-5). Cobalt and copper appear to be responsible for the deep blue associated with lapis lazuli. Compositionally, the turquoise-green glazes appear more similar to the yellow glaze than the blue ones. Seemingly, the greenish colour has been obtained by mixing a compo-nent similar, if not identical, to the yellow glaze with a copper-rich component.

METHODS AND MATERIALS

Bulletproof elemental analyses of the glazed bricks reliefs at all reliefs were performed using a handheld XRF analysis. Information from the preliminary in-vestigation, a trial of ten samples measuring 1-2 mm, were collected from blue and greenish glazes for further analysis. These sections of six samples were examined with polarized light microscopy (Nikon Eclipse E800, OLYMPUS BX53, ZEISS Axioplan II) and SEM-EDS (Philips XL30, FEI Sirocco, NIKON D610). The analytical data were compared to ancient glassmaking texts from Mesopotamia5 as well as published data on ancient glass and lapis lazuli from the Assyrians and Egyptians6.

RESULTS

Elemental composition

The preliminary XRF analyses indicate that the blue glaze contains a significant amount of lead, copper, and cobalt, all capable of adding a blue tint to the glass. The turquoise-green glass contains rather large amounts of lead, copper, tin, iron, strontium, antimony and zinc but no cobalt. The elemental compositions in the greenish glazes are much higher in Pb than in the blue ones. The elemental composition of the yellow glaze is similar to the turquoise-green ones except for copper and tin. Lead and zinc levels are similar, whereas the remaining trace elements are significantly more abundant in the greenish compared to the yellow glaze. Qualitative LA-ICP-MS analysis agree with XRF findings and further indicate that copper and cobalt strongly correlate (+0.95, p < 0.05) for blue glaze.

Visual examination

Polarized light microscopy revealed that the blue glass consist of a transparent, homogenous matrix without distinguishable grains (Fig. 4). However, one of the samples (NCG 159) the glass matrix appears to contain clusters of a vitreous material. In contrast to the blue glass, the greenish glazes are more opaque and heterogeneous. They contain multiple grains of different colours including green, yellow, and red as well as cobalt, pyrrhotite grains (Fig. 5).

DISCUSSION

In our investigations into the compo-sition of the blue and turquoise-green glazes, we endeavoured to gen-erate as detailed data as possible. We aim to identify the ingredients that went into the melt as well as their sources. We also search for clues that may have influenced the manufacture of the glaze. In turn, the interpretation of the compiled data will yield information on the trading and costs involved in the embel-lishment of Nebuchadnezzar II among a complex as well as add to our knowledge of ancient glass production in general.

At this point, it is still uncertain whether iron, copper and cobalt all contributed to the blue colour or not. It is, however, clear that all three elements are present in concentration sufficient to impart a distinct colour to the glazes. The apparent correlation between cobalt and copper lends in the glass indicates that the two elements were mixed, perhaps painted, and then added to the melt. In order to produce a blue glaze, copper re-quires enabling conditions in the kiln, whereas iron requires reducing conditions. Thus, if all these elements were added as blue col-ourants and, indeed, function as such, it would have had implications for the firing temperatures and times of the final melt. However, this is not supported by the thin sections whose heterogeneity indicates rather through firing.

The content of cobalt in the blue glazes is not rivaled by the turquoise-green ones suggesting that the two glazes are somewhat different. Considering the XRF data as well as the thin sections, the greenish glazes seem to have been obtained by mixing a component similar, if not identical, to the yellow glaze with a copper-bearing component containing lead, antimony, arsenic, and tin.

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