# Accepted Manuscript


Ancient glass: from kaleidoscope to crystal ball

Thilo Rehren, Ian Freestone

PII: S0305-4403(15)00059-X

DOI: 10.1016/j.jas.2015.02.021

Reference: YJASC 4351

To appear in: *Journal of Archaeological Science*

Received Date: 15 December 2014

Revised Date: 2 February 2015

Accepted Date: 8 February 2015

Please cite this article as: Rehren, T., Freestone, I., Ancient glass: from kaleidoscope to crystal ball, *Journal of Archaeological Science* (2015), doi: 10.1016/j.jas.2015.02.021.

# Ancient glass: from kaleidoscope to crystal ball

Thilo Rehren[1] and Ian Freestone[2]

[1] UCL Qatar and UCL Institute of Archaeology
[2] UCL Institute of Archaeology

***Abstract***

Research over the last few decades has greatly enhanced our understanding of the production and distribution of glass across time and space, resulting in an almost kaleidoscopically colourful and complex picture. We now recognise several major 'families' of glass composition, including plant-ash based glass in Late Bronze Age Egypt and Mesopotamia, and the Islamic World; mineral natron glass in the Greek, Roman and Byzantine Empires; mineral-based lead- and lead-barium glass in Han period China and medieval Europe; and wood-ash and ash-lime glass in medieval Europe. Other glass groups include a peculiar granite-based glass in medieval Nigeria, and probably mineral-based glass in Bronze Age southern Europe. However, despite two centuries of research, we know very little about the actual production locations and technologies for most of these glass groups, and how and where glass making was invented.

The early literature reflects the comparatively limited number of individuals and research groups working on glass; only recently there is a significant broadening of the research community and expansion and refinement of the data base. This enables us now to take stock of our current understanding and identify major lacunae and areas where additional work may make the most significant contributions to our understanding of the complex picture. Hopefully this will help moving from the traditional descriptive and often fragmented opportunistic data-gathering phase (asking 'what', 'where' and 'when') to a more interpretative period looking with fresh eyes at the 'why' and 'how' of compositional and technical developments. This opening of the research field includes addressing the relationship of the different glass industries to the societies that used glass, and how they organised its production and distribution. A major overarching issue remains the question of the initial invention of glass, and how the idea as well as the material itself spread. Major debates should ask whether there were multiple inventions of glass making; how best to identify and interpret long-distance trade; how to ensure data compatibility and quality; and how to integrate different types of data, from archaeology through craftsmanship and typology to chemistry and optical properties.

## 1. Introduction

The scientific analysis of glass has a relatively short history, despite some very early work going back to the late 18$^{th}$ century (Caley 1962). The first meaningful analyses were those published in the 1950s in two series of papers by W.E.S. Turner in *Glass Technology* and by