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Ancient Glass of South Asia: Archaeology, Ethnography and Global Connections. Alok Kumar Kanungo and Laure Dussubieux, eds. Singapore: Springer, 2021. xxvi + 557 pp., 59 b&w + 245 colour illustrations. Hardcover US $160, ISBN 9789811636554; softcover US $140, ISBN 9789811636578; ebook US $109, ISBN 9789811636561.

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The marked expansion in the archaeometry of glass which took place in the first decade of the twenty-first century has led to an explosion of interest in glass beads and bangles. Desirable, robust, and portable, they hold important information on trade and connectivity which can be revealed by the analysis of their chemical constituents. While this potential of chemical analysis has been understood for decades (e.g., Basa et al. 1991; Brill 1987; Singh 1989), it is only recently that it has been fully realized, largely due to the application of the technique of laser ablation inductively-coupled mass spectrometry (LA-ICP-MS). This method allows a rapid, accurate, and precise analysis of around 60 elements in glass artifacts and, critically, is essentially non-destructive, leaving only a sub-millimetre scar on the surface of the artifact. Where earlier typological work inferred likely long-distance connections (Francis 1990), chemistry has confirmed them.

The resultant growth in understanding has served to emphasise the important role of the Indian sub-continent, which was arguably the major producer of glass beads in the last two millennia. Indian beads are found as far afield as eastern Africa and northwestern Europe and are also widely distributed in southeastern and southern Asia. Furthermore, the continuation into the modern period of traditional methods of making and working with

glass and glazes allows important insights into the methods and organization of the production of glass ornaments through ethnographic observation and literary accounts.

The present book brings together recent and ongoing work on the archaeology, archaeometry, and ethnoarchaeology of South Asian glass, edited by two leading researchers in their respective areas. The chapters are developed from lectures delivered by the eminent list of authors at a conference in Gandhinagar in 2019 and may be considered a good reflection of the state of the art. However, this substantial 550-page book is far from a standard conference volume. It strives not only to provide a comprehensive coverage of its subject matter, but also to serve as an introduction to the study of glass by including a number of chapters by established researchers on broader issues; by and large, it is very successful.

The book opens with several chapters providing introductory and background information. Rehren opens with a summary of the current state of play in our understanding of the origins of glass in Egypt and Mesopotamia. In the context of the present volume, Rehren's chapter in particular brings home how important the analysis of glass and manufacturing debris from Late Bronze Age production sites has been to current understanding, although at present evidence from production sites in South Asia is largely lacking.

The following chapter by Gratuze, Schibille, and Pactat covers the radical changes in glassmaking technology that occurred in Europe and West Asia in the later first millennium C.E., in particular the transition from the use of soda from the Natron lakes of Egypt to soda obtained from the ashes of halophytic plants. Not only is this an outstanding example of the application of chemical analysis to a technical change, focusing on chronological and regional variations, but it also provides a good introduction to the major glass types which moved along the silk road from West to East and which are encountered later on in the volume.

Kenoyer provides a long, comprehensive review of major importance on the faience and glazed steatite of the Indus tradition, focusing on Harappa. This brings together new work and insights with a substantial but dispersed literature, much of which has been generated by the author and his collaborators and which is not always easily accessible. Kenoyer is skeptical about the identification of so-called "steatite faience" or glazed crushed steatite. He calls for more detailed examination of samples removed from objects to elucidate their technology and more experimental work. The possibility that Late Harappan faience may have been a transitional technology to glassmaking is briefly discussed, but more evidence is needed to evaluate this idea.

In another substantial chapter, Kanungo provides an account of bead and bangle production in Uttar Pradesh and Andhra Pradesh, where craftspeople continue to work in a very long technological tradition. Perhaps most striking, for those who are not familiar with it, is the method of production of Indo-Pacific beads known as the *lada* technique, which involves the continuous drawing out of a glass tube from the furnace; other methods of manufacture are also discussed. Looking at the vividly informative illustrations in this chapter caused me to reflect on the developments in our knowledge since the 1980s, when the dustcover of the book *Ancient Indian Glass* (Singh 1989) featured a well-known illustration of a medieval Bohemian glass workshop that had no relevance to traditional Indian technologies at all.

The next two chapters are concerned with analytical data and their generation. The first by Dussubieux concerns elemental analysis. It focuses on the comprehensive data produced by LA-ICP-MS and uses the compositions of a small string of beads from Kish in Iraq as a case study to illustrate the value of this method. These beads had previously been labelled "Sumerian," but the trace element concentrations rule out a near eastern origin and clearly point to an origin in South or Southeast Asia. The following chapter by Dussubieux, Cloquet, and Pryce concerns the application of the measurement of isotopic ratios, which may be considered as providing a fingerprint that is largely independent of the elemental composition. Thus, two glasses

produced in different locations may have been made with a similar recipe, so their elemental compositions appear very similar. However, the isotopic ratios reflect the geological ages of the raw materials, which may be very different. The authors demonstrate the application of strontium and neodymium to test and constrain the origins of several types of Indian glass and use lead isotopes to suggest more distal origins for lead-containing pigments.

A concise chapter by Koob outlines generally accepted principles and practices of the conservation of glass objects. This is followed by a contribution by Then-Obłuska, who provides a very well-illustrated account focused on the technical and typological descriptions of beads. The standardized descriptive approach outlined is very welcome and will be especially useful for those encountering a glass bead assemblage for the first time, as well as in teaching.

Kanungo reviews the earlier literature on glass in India and provides a gazetteer of sites that have yielded evidence for glass in the form of a series of maps ordered by chronology, a summary of the evidence for glass furnaces, and a summary of the written evidence for glass in the historical Indian and colonial literatures. Vikrama then provides an account of a coating of a vitreous appearance on a copper alloy pot dating to 2300 B.C.E., suggesting that this represents an enamel coating. Although he speculates on this basis that the story of glass in India may begin in the early second millennium B.C.E., scientific analysis of the coating on the bowl is required. It is a vivid blue, which is the colour of many copper corrosion products. Selvakumar takes a broad approach to reviewing the history of glass ornaments in Tamil Nadu, covering aspects from elemental composition through cultural significance. The sections on the relationship between craft specialization and caste are fascinating.

Kock and Sode revisit and expand upon their earlier work on the production of lead-backed mirrors in a workshop in Gujarat and the uses of the mirrored glass. The technique, which involves pouring molten lead into a blown glass bubble, is a survival of a method that was widely used in medieval Europe. Similar mirrors dating to the Roman and Byzantine periods may be seen in museums in the Mediterranean region and must surely have been produced using the same technique.

The following four chapters largely concern typologies of glass artifacts from a regional or site perspective: Chakraborty on beads in eastern India; Abraham on beads from Pattanam in Kerala; Trivedi on the fabrication methods and forms of glass bangles; and Dalal and Mitra-Dalal on medieval West Asian glass vessels excavated at Sanjan in Gujarat. These well-illustrated and informative accounts contain new information and insights. Gill next considers the interaction between the manufacture of glass and the glazes on ceramic tile in Mughal India, demonstrating a close relationship between regional glass and ceramic glaze types.

The final five chapters concern the diffusion of South Asian glass. Gupta provides a review of the movement of glass along the maritime Silk Route in the millennium centred on the B.C.E. to C.E. transition and brings together a diverse range of evidence for the first time. Then-Obłuska provides a chapter on Indian beads in Egypt and Nubia based upon her extensive work in the region. Gratuze, Pion, and Sode discuss the analytic evidence for drawn beads made of Indian glass from Merovingian graves in France, Belgium, and Switzerland, as well as glass from seventh to eighth century Viking contexts that shows Indian affinities, although the compositions of the glass do not present precise parallels at the present time. Dussubieux and Wood review the extensive evidence for Indian beads in eastern Africa, where chronological shifts in composition relate to shifts in procurement patterns. Dussubieux, in the chapter entitled "Indian Glass in Southeast Asia," provides significant insights into the chronology of the compositional types of Indian glass and origins of drawn bead technology. As she observes, the situation is "way more complicated" (p. 504) than was implied by the pioneering work of Francis (1990) just a few decades ago.

The value and potential of scientific analysis is made clear throughout this book and the need for much more such research is made clear in many of its chapters. This raises once again the issue of how the techniques of modern archaeological science, so dependent on complex and sensitive instrumentation,

can be made more readily accessible to archaeologists in regions that do not at present possess the infrastructure of on-call service engineers, spare parts, rare gases, or other essentials required to keep the machines running. Unfortunately, there appears to be no easy solution at the present time.

In broad terms, the volume demonstrates how a development in an analytical technology can revolutionise our understanding of a category of artifact and its archaeological potential. Just as petrography and trace element analysis allowed for major advances in the use of ceramics as indicators of trade and connectivity in the 1970s and 1980s, so laser ablation mass spectrometry is transforming the study of glass. In a parallel manner, the re-evaluation of the archaeological value of the material leads to investigation of broader aspects of production and technology and spurs further interest in ethnographic and ethnoarchaeological studies. In the case of South Asian glass, we must be grateful for the pioneering work of Laure Dussubieux and Bernard Gratuze, who established the analytical method and demonstrated its potential in an abundance of case studies, as well as to Alok Kumar Kanungo, Jan Kock, and Torben Sode who have pushed forward the ethnoarchaeological agenda.

The editors and authors are to be thanked and congratulated for the production of this well-illustrated and comprehensive volume. Not only is there an abundance of new information, the literature covered is vast. It will be an essential reference on South Asian glass for years to come, invaluable to researchers in adjacent areas, and informative for anyone with an interest in archaeological glass. Only rarely does a volume of conference proceedings live up to expectations; this one exceeds them. This is a great book. I strongly recommend it.

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