ARCHAEOMETRIC ANALYSIS

This portion of the bibliography deals with the determination of the chemical properties and composition of beads of all materials from around the world, as well as their dating and sourcing.

Adrimi-Sismani, Vassiliki, Maria Filomena Guerra, and Philippe Walter
2009 La tombe mycénienne de Kazanaki (Volos) et le mythe de la Toison d’or [The Mycenaean Tomb of Kazanaki (Volos) and the Myth of the Golden Fleece]. *ArcheoSciences* 33.
Reports on the compositional analysis of gold necklaces and necklace beads found at a new Mycenaean tholos tomb discovered in Greece and dated to 1350 B.C.

Angelini, Ivana
On the evolution of faience to glass in Italy during the Bronze Age. The study is based mainly on the analysis of ornamental beads of faience and glass.

Angelini, I., G. Artioli, P. Belliantani, and A. Polla
On the evolution of faience to glass during the Bronze Age. Many of the samples were beads.

Angelini, Ivana and Paolo Bellintani
Reports on the infrared spectroscopic investigation of 57 bead samples from 16 Italian sites, DRIFT technique. Most samples were Baltic but a small amount of non-Baltic amber was used in both the Bronze and Iron ages, probably from as yet unidentified local deposits. A unique case is Poggiomarino (Naples area), where 7 of the 12 samples were not Baltic (p. 1489). Summaries in French and English.

Angelini, I., C. Nicola, G. Artioli, R. DeMarinis, M. Rapi, and M. Uboldi
2008 Chemical, Mineralogical and Textural Characterisation of Early Iron Age Vitreous Materials from the Golasecca Culture (Northern Italy). In *Proceedings of the 37th International Symposium*

Aims at defining the chemical chronology for vitreous materials during the transition from the Bronze Age to the Iron Age in northern Italy. Beads constituted the samples tested.

Angelini, I., A. Polla, and G. Artioli

Chemical analysis of beads from the Bronze Age pile dwellings of Lavagnone in northern Italy.

Arletti, Rossella, Erica Bertoni, Giovanna Vezzalini, and Davide Mengoli

Fifteen blue, turquoise, and dark green glass beads of the 8th-7th centuries B.C. were analyzed. Chemical analyses of major and minor elements were obtained by EMPA, whereas trace elements were determined on selected samples by LA-ICP-MS.

Arletti, Rossella, Daniela Ferrari, and Giovanna Vezzalini

Presents the results of an archaeological investigation performed on a series of opaque pre-Roman glass objects including beads, pendants, and a spindle-whorl dating from the 6th-4th centuries B.C. All were found to be silica-soda-lime glass produced with natron. Opaque decorations were made by using Sb-based opacifiers.

Arletti, Rossella, C. Maiorano, D. Ferrari, G. Vezzalini, and S. Quartieri

Samples of highly decorated beads, spindle whorls, and vessels of the “Mediterranean Group I” from Etruscan contexts (Bologna and Spina [FE] necropoleis) dating between the 6th and 4th centuries B.C. were analyzed to determine whether these different artifacts were produced at the same manufacturing site. While the vessels almost certainly originate from Greece, the beads could derive from a more ancient local production ascertained at the site of Frattesina (Rovigo, Italy) and dated to the Bronze Age.

Astrup, E.E. and Arnfinn G. Andersen

On the structure and composition of beads from Kaupang and Birka, Sweden, examined by Scanning Electron Microscope and chemical analysis (ICP).

Bajnóczi, Bernadett, Gabriella Schöll-Barna, Nándor Kalicz et al.

Stable isotope analysis combined with cathodoluminescence microscopy was performed on ornaments (beads, bracelets) made of Spondylus shells excavated at the Aszód-Papi Földek site in Hungary to define their origin.
Basa, K.K, I.C. Glover, and J. Henderson  
Includes new analytical results comparing early Indian glass beads and those from Ban Don Ta Phet, Thailand, and Sembiran, Bali, Indonesia.

Basilia, Pauline A.  
2013 Application of Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray Spectroscopy (EDS or EDX) on Archaeological Residue from Microperforated Cut Shell Beads. International Conference on Southeast Asian Archaeology, Burapha University, Thailand. 
This project analyzes microperforated cut shell beads to reconstruct the manufacturing process based only on the final form of the artifact and surviving traces from the production process. The shell beads are from the Intensive Burial Phase (ca. 2000-200 B.P.) at the Ille Site, Northern Palawan, Philippines.

Bayley, Justine  
Glass beads; Scotland.

Beck, Curt W.  
Mycenaean beads described as “black resin” proved on analysis to be Baltic amber, probably exposed to fire. Greece.

Beck, Curt W. and Y. Lily  
The beads are nearly all Baltic amber but a few are probably Sicilian simetite.

Beck, Curt W., Raquel Vilaça, and E.C. Stout  

Bellintani, Paolo  
On the chemical composition of glass and faience beads dating to the 21st-9th centuries B.C. Also discusses Bronze Age “glass routes” in the central Mediterranean

Bertini, Martina  
A collection of beautiful glass beads discovered in Scotland was analyzed. The results point “to an ancient form of glass recycling between the Romans and the Iron Age Caledonians.”
Bertini, Martina, Andrei Izmer, Frank Vanhaecke, and Eva M. Krupp
Describes a fully quantitative method used for the investigation and characterization of a large set of Roman and late Iron Age glasses used in the making of Iron Age British beads (see Bertini et al. 2011).

Bertini, Martina, Andrew Shortland, Karen Milek, and Eva M. Krupp
Class 13 and 14 Iron Age Scottish glass beads are a group of highly decorated beads of British origin or design, dating indicatively to the 1st and 2nd centuries A.D. Their distinctive stylistic characteristics and geographical segregation render them ideal for the investigation of whether the glasses employed in their manufacture were imported rather than produced locally, and for the assessment of the technology used in the production of the deep colors. Scotland, United Kingdom.

Bertolotti, Giulia, Maria Secchi, Maurizio Mattarelli, Roberto Dal Maschio, and Stefano Gialanella
Attempts to determine if a glassy bead recovered from the Palaeolithic rockshelter of Riparo Dalmeri in Italy is of artificial or natural origin.

Bhardwaj, H.C. (ed.)
1987  *Archaeometry of Glass*. Indian Ceramic Society, Calcutta.
A basic source for analytical data on Asian glass beads, especially for India.

Bichlmeier, S.
Reports on the investigation of Merovingian glass beads of different color groups and localities by means of x-ray fluorescence spectroscopy to determine the glass matrix.

Bichlmeier, S., M. Heck, and P. Hoffmann
On Merovingian glass bead composition.

Biek, Leo
How gold- and silver-in-glass beads were identified using neutron activation when too decayed to be identified as such, even using a microscope.
**Billaud, Y. and B. Gratze**


**Blanco, J., M.A. Lopez Alonso, M. Edo, and J.L. Fernandez Turiel**

1996 Estudio analítico de determinación y de composición químico de las cuentas de collar de calaíta y otras materia del yacimiento de La Peñas (Quiruelas de Vidriales, Zamora). *Rubricatum* 1:227-237. On the chemical composition of callainite necklace beads and other materials from the site of La Peñas, Spain.

**Blasco, A. et al.**

1992 Aplicación de técnicas geológicas al estudio de materiales arqueológicos: el ejemplo de las cuentas variscita catalanas y el complejo minero Neolítico de Can Tintorer (Gava, Barcelona). *Cuaternario y Geomorfología* 6:71-80. The present work shows the advantages of the application of geological methods to the study of archaeological materials, in this case the study of Catalanian variscite beads and their relationship to the Neolithic mining complex at Can Tintore, Spain.

**Bonneau, Adéline, Réginald Auger, and Jean-François Moreau**

2013 Rapport d’analyses sur les perles blanches de ClFi-10. *Revue des Laboratoires d’archéologie de l’Université Laval, Vol. 1*, under the direction of Anne-Marie Faucher and Stéphane Noël, pp. 1-40. Analysis of ten white glass beads from an Amerindian site in Quebec, Canada, dating to the period ca. 1600-1830 using microscopy, Raman spectroscopy, LA-ICP-MS, and neutron activation have proved to be complementary and brought new perspectives for understanding the manufacture of glass beads and their dissemination on the North American continent.

**Bonneau, Adélinne, Jean-François Moreau, Réginald Auger, R.G.V. Hancock, and Bertrand Émard**

2013 Analyses physico-chimiques des perles de traite en verre de facture européenne: quelles instrumentations pour quels résultats? Association des archéologues du Québec, *Archéologiques* 26:109-132. Presents the findings of previous bead studies as well as the results of an analysis of white glass beads from site ClFi-10 in Quebec, Canada, carried out by microscope, SEM-EDS, X-ray florescence, Raman spectrometry, neutron activation, and LA-ICP-MS.

Bonneau, Adelphine, Jean-François Moreau, and R.G.V. Hancock
Neutron activation studies of monochrome and bichrome royal blue, turquoise, black, and red beads from the trading post at Chicoutimi, Quebec, Canada, were conducted to determine if they are of the same time period (early 17th century) as the white beads excavated at the site.

Bonneau, Adelphine, Jean-François Moreau, Ron G.V. Hancock, and Karlis Karklins
Reviews the most common analytical techniques used to study glass beads – optical microscopy, scanning electron microscopy (SEM), x-ray fluorescence (XRF), instrumental neutron activation analysis (INAA), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and Raman spectroscopy – and discusses their potential, limitations, and what results may be expected.

Breschini, Gary S. and Trudy Haversat
2001 AMS Radiocarbon Dates on Type G1 and K1 Olivella Shell Beads from CA-MNT-1701, Carmel Valley, Monterey County, California.

Brill, Robert H.
Results of a lifetime’s research on glass from all areas and periods. Invaluable database for all interested in glass technology.

Brill, Robert H. and John H. Martin (eds.)
An important contribution to our knowledge of the chemical composition of ancient Chinese glass, including beads. Contains 12 papers presented during the Archaeometry of Glass Sessions of the 1984 International Symposium on Glass in Beijing, plus 7 supplementary papers.

Brill, Robert H., S. Shap Chow Tong, and Zhang Fukang
Found in Shaanxi Province, China, the blue faience bead dates to the 11th-10th centuries B.C.

Brill, Robert H., Robert D. Vocke, Jr., Wang Shixiong, and Zhang Fukang
A follow-up to the previous article.
Bulbeck, F.D., Bagyo Prasetyo, J.N. Miksic, D. Barham, and R.G.V. Hancock

Presents a thorough neutron activation analysis of 58 glass samples, mostly beads, which date to the 1st-17th centuries.

Burgess, Laurie E. and Laure Dussubieux

The Sullivans Island (Washington) glass bead collection contains over 56,000 beads which date from the late 18th to late 19th centuries. Many of the beads conform to varieties that have been attributed to Bohemia, Venice, and China, three of the main bead-producing centers for this time period. Over 100 beads were subjected to LA-ICP-MS analysis to see if the chemical composition of the glass would be correlated with a place of origin. The results revealed several distinct compositional groups, some of which could be linked to geographical areas.

Cagno, Simone et al.

The collected data show that a change in the black-glass production process occurred about A.D. 150, involving coloration of raw glass made with iron in the secondary workshops. Furthermore, from the 4th century on there is a change in the type of raw glass used, while the coloring process was maintained.

Callmer, Johan and Julian Henderson

Examines the beadmaking technology and chemical composition of the recovered beads.

Carter, Alison K.

Presents the results of compositional analysis of glass beads from six Iron Age sites in Cambodia. Using LA-ICP-MS, it was possible to determine the presence of at least two glass bead-trading networks in Cambodia during the Iron Age.


Focuses on the analysis of two distinct types of garnet beads found at Iron Age sites in Cambodia. SEM examination and LA-ICP-MS analysis reveal that the two types are distinct from one another.

Examines beads from 12 sites in Cambodia and Thailand. Morphological and compositional analyses using LA-ICP-MS resulted in the identification of different bead types that were circulated in distinct exchange networks.

**Carter, Alison K. and Laure Dussubieux**


The study reveals that many of the beads were produced from raw material derived from the Deccan Traps, India, and that there is not yet strong evidence for bead production using a Southeast Asian source.

**Carter, Alison K., Laure Dussubieux, and Nancy Beavan**


LA-ICP-MS analysis of 74 beads revealed the presence of several glass types, including two subtypes of high-alumina mineral soda glass, and lead-potash glass.

**Carter, Alison and James Lankton**


Examines the glass beads from two Iron Age sites in northeast Thailand.

**Castelo Ruano, R., C. Gutiérrez Neira, J. Barrio Martín, J. Hurtado Aguña, A.I. Pardo Naranjo, A. López Pérez, and R. García Giménez**

2011-2012  Estudio arqueohistórico y analítico de un conjunto de vidrios de la villa romana de El Saucedo (Talavera La Nueva, Toledo). *CuPAUAM* 37-38: 687-703.

A group of selected glasses, including several distinctive beads, from the early and late imperial, and Visigoth epochs at a site in Spain, were analyzed using MEB-EDX to determine their composition.

**Cavalieri, Marco and Alessandra Giumlia-Mair**


Reports on the chemical composition of glass beads found in a glass workshop of the 6th-7th centuries in Tuscany, Italy.

**Černá, Eva, Václav Hulinský, Kateřina Tomková, and Zuzana Cílová**


**Chafe, Anne, Ron Hancock, and Ian Kenyon**


The beads formed two groups, those colored with cobalt and those colored with copper.
Cheng Qian, Guo Jin-Long, Wang Bo, and Cui Jian-Feng

Glass beads dating between the 1st and 6th centuries A.D. found in the Zagunluke tomb in Xinjiang, China, had chemical composition very similar to typical soda-lime glass which indicates they were imported from the West. The glasses formed two groups based on flux source: natron glass and plant ash glass.


Chemical composition of objects uncovered in Xinjiang, China.

Childs, S. Terry

One of the objects is a rolled copper bead from a prehistoric site in Massachusetts.

Ciarlo, Nicolás C., Patricia Solá, and Cristina Bellelli

https://www.academia.edu/5536198/Caracterizaci%C3%B3n_de_cuentas_l%C3%ADticas_provenientes_del_valle_del_r%C3%ADo_Manso,_Provincia_de_R%C3%ADo_Negro_, accessed 1 January 2015.

Presents the results of physicochemical analysis of two prehistoric stone beads from Río Negro province, Argentina.

Conte, Sonia, Ilaria Matarese, Simona Quartieri, Rossella Arletti, Reinhard Jung, Marco Pacciarelli, and Bernard Gratuje

Presents the results of an archaeometrical investigation of a set of samples (9 faience beads, 1 glassy bead) from approximately 1200 BCE (Recent Bronze Age).

Cui Jianfeng, He Chuankun, Liu Kehong, and Wu Xiaohong

Eighteen ancient glass beads unearthed from Taiwan Province are analyzed using laser ablation.
Cui Jianfeng, Xiaohong Wu, and Baoling Huang

Analysis reveals that all samples are PbO-BaO-SiO$_2$ glasses; i.e., traditional ancient Chinese glasses. The results suggest that all Bi wares may either share a common source or were produced according to similar recipes. In turn, the eye beads tested have a different chemical composition.

Claassen, Cheryl

Presents an introduction to the sourcing of shell on the basis of its geochemical signature. Sources of chemical variation in shell are explored, and it is suggested that species, age, and locale of collection can be determined by chemical signatures.

Cosyns, Peter and Bernard Gratuzé

On the chemical composition of glass beads from the necropolis at Neufchâteau-Sart, Belgium.

d’Ambrosio, Beatrice and S. Sfrecola

Analysis of Eneolithic beads by x-ray diffraction identified 12 raw materials (mostly stone) and suggests possible provenance in and around Liguria, Italy.

Daszkiewicz, Malgorzata and Miriam Lahitte

Davis, Mary, Fraser Hunter, and Alec Livingstone

Discusses a two-strand necklace of lead and cannel coal beads found around the neck of a small child in southeast Scotland. The beads represent the earliest known use of metallic lead in Britain and Ireland.

Dekówna, Maria
1993 Les perles en verre de la nécropole du 7$^{e}$me au 9$^{e}$me siècle à Zalakomar (Hongrie). *Annales 12e Congrès AIHV*, pp. 271-278.

On the composition of glass beads from a necropolis in Hungary of the 7th-9th centuries.

Dekówna, Maria and Tomasz Purowski
Presents detailed chemical analyses of a variety of glass beads recovered from contexts ranging from the prehistoric period to the Early Middle Ages at a site in northern Poland.

Demarchi, Beatrice, Sonia O’Connor, Andre de Lima Ponzoni, Raquel de Almeida Rocha Ponzoni, Alison Sheridan, Kirsty Penkman, Y. Hancock, and Julie Wilson

Worked shell beads lose taxonomic clues to identification and this may be compounded by taphonomic alteration. This article reports the use of bulk amino acid composition of the stable intra-crystalline proteins preserved in shell biominerals to demonstrate that taxonomic identification can be achieved at the genus level. The study is based on beads discovered at the Early Bronze Age site of Great Cornard, United Kingdom.

Denbow, J., K. Klehm, and L. Dussubieux

Using compositional analysis of glass beads from an Iron Age site in the central Kalahari Desert, Botswana, the authors argue that the site exemplifies the role of heterarchy and indigenous agency in the evolving political economy of the subcontinent.

Dominguez-Bella, Salvador

Reports on the analytical study of necklace beads accompanying Chalcolithic burials of the central Iberian Peninsula, Spain.

Dominguez-Bella, Salvador, M.A. Álvarez Rodríguez, and J. Ramos Muñoz

Presents the analytical study of an amber bead necklace from the Alberite dolmen, Villamartin, Cádiz, Spain.

Dominguez-Bella, Salvador and María José Bóveda

Presents the results of the archaeometrical analysis of a necklace composed of variscite and amber beads that accompanied a female Galician-Neolithic burial in Spain.

Dominguez-Bella, S., J. Ramos Muñoz, M.A. Álvarez, and M. Forteza
Dong Junqing, Yang Yiming, and Feng Enxue
2007 Study on Glass Beads of Six Dynasties from Leijiaping Site. *Jianghan Kaogu (Jianghan Archaeology)* 3(104):79-86.

Presents the results of XRD and XRFS analysis of the fine glass beads of the Six Dynasties excavated from the Leijiaping site in China and discusses their features as well as material. In Chinese.

Duckworth, Chloë N., A. Cuénod, and D.J. Mattingly

Reports on the composition of imported Roman glass beads from sites in Libya.

Duckworth, Chloë N., Julian Henderson, Frank J.M. Rutten, and Kalliopi Nikita

Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS) was used to study four samples of opaque glass, two derived from beads.

Duckworth, Chloë N., David J. Mattingly, and Victoria C. Smith

Presents the results of electron microprobe analysis of 124 samples of glass (including eight beads) from surface collection survey or unstratified contexts at two sites in the Fazzan region of Libya, most from the Saharan oasis belt of the Wadi al-Ajal.

Dunster, Joanna

On the composition of beads found with an Early Bronze Age burial in southwestern England associated with an unparalleled range of artifacts. United Kingdom.

Dussubieux, Laure

Presents the chemical analysis of a small group of glass beads, buttons, and small ornaments found in Rouen, France.


Discusses the chemical composition of glass (including beads) from Singapore.


In South and Southeast Asia, between the 4th century B.C. and the 3rd century A.D., two main types of glass dominate and were used in bead manufacture: mineral soda-alumina (m-Na-Al) and potash. This article stresses the latter as it has not been well discussed previously.
Dussubieux, Laure and Bernard Gratuze


Reports on the chemical composition and origin of glass objects, including glass beads, from two sites which were occupied between the 2nd century B.C. and the 2nd century A.D.


Reports on the chemical analysis of glass beads and vessel fragments from 14th-century contexts in Singapore using LA-ICP-MS.


Reports on the chemical composition of ancient glass. Data from beads are included.


Dating from the 16th to 18th centuries, 63 glass artifacts (mostly beads) recovered from two sites in Paris, France, were investigated using LA-ICP-MS analysis in an attempt to determine their source. Although provenance attribution was difficult due to a lack of comparative data, it was possible to identify an increasing variety of glass recipes after the 16th century.


After describing the origins of glass in South Asia, the dominant compositions encountered among the glass artifacts (mostly constituted of beads, bangles and other personal ornaments) of this region are described and attention is devoted to the finds encountered at Arikamedu and related archaeological sites. India, Pakistan, and Sri Lanka.

Dussubieux, L., B. Gratuze, and M. Blet-Lemarquand


Data obtained using LA-ICP-MS compositional analysis on a large corpus of artifacts (486) shows that at least five sub-groups of m-Na–Al glass can be identified using the concentrations of calcium, magnesium, uranium, barium, strontium, zirconium, and cesium.


Discusses the composition of red and orange glass which was primarily used for the production of beads and bracelets in Southeast Asia between the 4th century B.C. and 5th century A.D.
Dussubieux, Laure and Karlis Karklins
Compares the bead chemistries of glass beads recovered from 17th-century production sites in London, England, and Amsterdam, Netherlands.

Dussubieux, L., C.M. Kusimba, C.M., and V. Gogte, et al.
The occurrence of similar glass beads at archaeological sites in Africa and South Asia bears witness to the trade relationship between the two continents. This paper reports elemental analysis results from an in-depth LA-ICP-MS study of a group of archaeological glass beads with a specific alumina-rich composition from East Africa, India, and Sri Lanka.

Dussubieux, L., J.W. Lankton, B. Bellina-Pryce, and B. Chaisuwan

Dussubieux, Laure and Thomas Oliver Pryce
Presents a regionally-original combination of elemental and isotopic analyses from glass and copper-base metal grave goods (including glass beads) excavated at a series of Iron Age cemeteries in the Samon Valley of central Myanmar.

Dussubieux, L., P. Robertshaw, and M.D. Glascock

Eerkens, Jelmer W., Gregory S. Herbert, Jeffrey S. Rosenthal, and Howard J. Spero
This study examines the potential of stable carbon and oxygen isotopes to source Olivella beads from the Pacific coast.

Compares two methods for tracking the geographic source of *Olivella biplicata* shell beads along the California and Oregon Pacific coast: bulk element composition by inductively coupled plasma-mass spectrometry (ICP-MS) and stable carbon and oxygen isotopes by isotope ratio-mass spectrometry (IR-MS).

2009  
Analysis focused on a small sample of beads from an Early Horizon (ca. 4000 B.P.) site on Marsh Creek in the California Delta as a test case. Results suggest production not on the Pacific Coast, but in a protected bay or estuary with significant influx of freshwater.

2010  
Stable Isotope Provenance Analysis of *Olivella* Shell Beads from the Los Angeles Basin and San Nicolas Island. *Journal of Island and Coastal Archaeology* 5:105-119.  
Examining the spatial distribution of bead types is one way to track beads to their locus of production. Chemical and stable isotopic methods provide an additional and independent means of testing hypotheses generated by spatial distributions. This study uses stable oxygen, carbon, and strontium isotope data to reconstruct provenance zones for 18 *Olivella biplicata* beads from southwestern California.

**Eliyahu-Behar, A., S. Elbaz, I. Shai, A.M. Maeir, and H.J. Greenfield**
2015  
Faience Beads from Early Bronze Age Contexts at Tell es-Safi/Gath, Israel. *Journal of Archaeological Science: Reports*, in press.  
A group of faience beads securely dated to the Early Bronze Age III were subjected to analysis by FTIR spectrometry in order to identify the mineralogy and materials used in their manufacture.

**Fenn, Thomas R., Peter Robertshaw, Marilee Wood, John Chesley, and Joaquin Ruiz**
2011  
The three analytical datasets presented suggest that the raw glass and beads were produced in several regions: the Eastern Mediterranean/Levant, Middle East, and India.

**Fischer, A. and W.P. McCray**
1999  
Concentrates on glass vessels but Sepphoris also made glass beads and bracelets of a soda-lime-silica type with manganese as a decolorizer. There is much consistency of composition over long periods.

**Fischer, P.M., M. Bichler, and V.M.F. Hammer**
2008  
Describes the results of various analytical methods applied to the glass and shell beads comprising a necklace.
Fitzgerald, Richard T., Terry L. Jones, and Adella Schroth
Eleven *Olivella biplicata* spire-lopped shell beads from six inland in southern California produced AMS dates between 11,200 and 7860 cal BP. These findings represent some of the earliest unequivocal evidence for long-distance trade in western North America and push the antiquity of this important form of inter-group interaction back several thousand years earlier than previously thought.

Flensborg, G. and C. Wagner
Presents the results of the morphological, microstructural and chemical analyses of glass beads recovered from two archaeological sites on the lower Colorado River, Argentina, which constitute the first record of this kind of evidence in the area.

Fórizs, István
Reviews glassmaking (including glass beads) in Hungary from its beginnings until the 18th century as regards the raw materials and colorants used. In Hungarian with English abstract.

Fórizs, I., A. Pásztor, G. Nagy, and M. Tóth
On x-ray diffraction and electron microprobe analysis of inclusions in Avar glass beads, Hungary.

Reports on the x-ray diffraction and electron microprobe study of Avar glass beads; basic data on how they were made and of what. Hungary.

Avar and Sarmatian glass beads from Csongrád County, Hungary: are only the styles different or the material as well?

Concerns the chemical composition of reused Avar and Sarmatian beads in Hungary.
Reports on the basic characteristics of Avar glass beads in Hungary using x-ray diffraction and electron microprobe analysis.

Reports on the composition of opaque red Avar glass beads in Hungary determined by x-ray diffraction and electron microprobe analysis.

Artifacts of Lake Superior native copper (15th-17th centuries) are compared with assemblages of reworked European copper from 16th-century Ontario sites in an effort to determine the degree of paradigmatic continuity evidenced in the manipulation of these materials.

Includes results of analyses of 21 yellow beads with stratified blue/white eyes (Late Hallstatt - Early La Tène Period) and 2 ring beads (Late La Tène Period).

Investigates the use of LA-ICP-MS analysis to source carnelian using beads and raw material from Gujarat, India, and beads from Mali.

Reports on the SEM analysis of several Anglo-Saxon yellow glass beads of the 5th-7th centuries from Eriswell, Suffolk, England, United Kingdom.
Frey, Annette and Susanne Greiff
On gold-glass beads recovered from an early medieval graveyard in Tiengen, near Freiburg, Germany. Includes chemical analyses.

Furiihata, Junko and Takayasu Koezuka
Japan; ca. 3rd-6th centuries.

Galibin, Valentin A.

Gan, Fu-Xi
Concentrates on the origin of materials and production technology related to ancient Chinese glasses including glass beads. The earliest glass beads unearthed from the Kiziltur cemetery in Xinjiang Province, China, dating to the time of the West Zhou to Spring and Autumn periods (1100-800 B.C.), were made locally; the glassmaking technology was obtained from West Asia.

Provides data on the chemical composition of faience beads, tubes, and pendants recovered from various sites in China.

Gan, FuXi, Cheng HuanSheng, Hu YongQing, Ma Bo, and Gu DongHong
The structure and the chemical composition of the eye beads were analyzed by X-ray diffraction (XRD) and the Proton Induced X-ray Emission (PIXE) technique. The results show that they belong to the soda-lime silicate system (Na2O-CaO-SiO2). Comparing the decorative design and the chemical composition of the samples with those from ancient Babylon and ancient Egypt, the likelihood is that these ancient eye beads from Xichuan were imported from the West.

Gan, Fuxi, Li Qinghui, Gu Donghong, Zhang Ping, Cheng Huansheng, Zhang Bin, and Ma Bo
Dating to around 1100 B.C.-500 B.C., the glass beads could be sorted into two groups: Na$_2$O-CaO-SiO$_2$ and Na$_2$O-CaO-PbO-SiO$_2$. In Chinese.

**García Heras, M., J.M. Rincón López, A. Jimeno Martínez, and M.A. Villegas Broncano**
Reports on the archaeometric study of glass beads from the necropolis of Numantia (5th century B.C.), Spain.

Prepresents results derived from a chemical and microstructural study of a representative sample of glass beads from the 2nd-century-B.C. Celtiberian necropolis of Numantia (Upper Duero Valley, Spain). The evidence suggests that Numantine glass beads were the result of trade or exchange practices rather than locally produced.

**Géza, Nagy, Pásztor Adrien, Fórizs István, and Tóth Mári**
Nearly 200 glass beads found in Sarmatian (2nd-4th centuries A.D.) and Avar (6th-8th centuries A.D.) graves in Hungary were subjected to instrumental analysis. English abstract.

**Gibson, Robert O. and Henry C. Koerper**
Accelerator mass spectrometry (AMS) dates for nine shell beads and two shell ornaments are used to test the application to Orange County of a temporal sequence developed for the Santa Barbara Channel region.

**Giumlia-Mair, Alessandra**
XRF analysis of some of the faience and gold beads comprising the necklace indicates an Egyptian origin for both the material and the production technique.

**Giumlia-Mair, Alessandra and Jeffrey Soles**
A Mycenaean necklace found in a tomb at Mochlos, Crete, consists of faience beads and a central gold bead, and is dated to the LM IIIA period (ca. 1400-1300 B.C.). Analysis of the beads reveals a strong Egyptian technological influence.

**Gliozzo, E., D.J. Mattingly, F. Cole, and G. Artioli**
Fragments of chert, carnelian, and amazonite found at the two sites in the Fazzan region and identified as raw materials associated with beadmaking were analyzed using LA-ICP-MS combined with mineralogical data obtained by X-ray powder diffraction and Raman spectroscopy.

**Glover, I.C. and J. Henderson**


Includes new analyses and argues, inter alia, for an early tradition of making high-potassium glass in Southeast Asia and/or southern China.

**Gonçalves, A.P. and A.M. Monge Soares**


Presents the results of X-ray diffraction analysis of stone beads. Portugal.

**Gonçalves, A.P., A.M. Monge Soares, A.C. Silva, and L. Berrocal-Rangel**


**Gonçalves, A.P., P. Valério, A.M.M. Soares, and M.F. Araújo**


Portugal.

**Gratuze, Bernard**

1999  Étude des perles protohistoriques en verre de l’inhumation de Marmilhat (Lempdes 63). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.

A study of the glass beads associated with a Protohistoric burial at Marmilhat, France.

2000  Étude des perles protohistoriques en verre des dolmens de la Planaise de Sampzon (07) conservées au Museum d’Histoire Naturelle de Lyon. IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.

A study of the Protohistoric glass beads from the dolmens at Planaise Sampzon (07) and held by the Museum of Natural History, Lyon, France.

2001  Étude des perles protohistoriques en verre de tumulus de Mons (Saint Georges, 15). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.

A study of the Protohistoric glass beads found in the tumulus of Mons, France.
A study of the Protohistoric glass beads found in the dolmens at Eyne and Bragnoli, Eastern Pyrenees, France.

A study of the glass beads from the sepulture at Haute-Grève, France.

A study of Bronze Age beads of glass and faience.

A study of the Protohistoric glass beads found in the tumulus at Courtesoult, France.

2005  Étude des perles protohistoriques en verre du Puech des Mus (Sainte-Eulalie-de-Cernon, Aveyron). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.
A study of the Protohistoric glass beads from Puech des Mus, France.

Objects studied include polychrome and gold- and silver-foil beads.

Glass trade beads.

in press  Étude des perles protohistoriques de l’Aveyron. IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.
A study of the Protohistoric glass beads from Aveyron, France.

in press  Étude des perles protohistoriques en verre conservées au Musée de d’archeologie de Lons-le-Saunier: – Grotte des Planches (Arbois) – Champ-de-Mont (Quitigny). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.
A study of the Protohistoric glass beads held by the Archaeology Museum of Lons-le-Saunier, France.

A study of the Protohistoric glass beads held by the Chambéry Museum, France.

in press  Étude des perles protohistoriques en verre de la nécropole de Ventavon (tumulus 7 des Mollards). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.

A study of the Protohistoric glass beads from the Ventavon necropolis, southeastern France.

Gratuze, B. and Y. Billaud

On the chemical analysis of Late Bronze Age glass beads from the Rhône-Alpes region of France.


The circulation of glass beads in the Mediterranean Basin from the Bronze Age to the Hallstatt period.

Gratuze, B. and P. Cosyns

The chemical composition of glass beads from a LaTène necropolis in France using LA-ICP-MS.

Gratuze, B. and Laure Dussubieux

Reports on the analysis of glass beads from an Iron Age site in northern Thailand.

Gratuze, B., L. Dussubieux, and O. Bopearachchi

A study of glass beads found in Sri Lanka which date from the 3rd century B.C. to the 2nd century A.D.


On the movement of glass ornaments in the Mediterranean Basin during the Protohistoric period with emphasis on the origin of beads found at Bronze and Iron age sites on Corsica, Italy.
Gratuze, B., Marie-Pierre Koenig, Suzanne Plouin, and Jean-Michel Treffort  
On the archaeological contexts and analysis of Bronze Age faience and glass beads from Alsace and Lorraine, France.

Gratuze, B. and Koen Janssens  
Describes a number of different case studies from various historical contexts and geographical areas to illustrate the manner in which the chemical analysis of historical glasses can provide information on trade and the provenance of glass artifacts (including beads) in different historic periods.

Gratuze, B. and Françoise Lorenzi  
Occupied from the Early Neolithic until modern times, the settlement at Lumaca, Upper Corsica, France, produced eight glass beads. Analyses reveal that they were all manufactured with Near-Eastern soda glass and likely date to the Iron Age.

Gratuze, B., C. Louboutin, and Y. Billaud  
Protohistoric glass beads at the National Archaeological Museum, France.

Gratuze, B., J.N. Soulier, and J.N. Barrandon  
This study of the glass beads from a 14th-century glass works in southern France demonstrates the usefulness of the chemical analysis of glass to show the relationship between the chemical composition of glasses and the chronology of objects, glass trade, and glass recipes. It also indicates that fast neutron analysis using a cyclotron and laser ablation ICMS complement each other. La Seube was remarkable for its variety of glass, including beads.

Gregerová, M., M. Hložek, and P. Sulovský  
Presents the results of analyses of a faience bead found in an Early Bronze Age woman’s grave of the Nitra Culture near Slatinice, Czech Republic. The results point to Egyptian import, not local manufacture.

Greiff, Susanne and A. Banerjee  
Describes the non-destructive method used to analyze the bead of Italian dolomite found with the mumified Chalcolithic Ice Man in the Ötztal Alps between Austria and Italy. Chemical analysis might pin down the source more exactly.

Greiner-Wronowa, Elżbieta, Dominika Zabiegał, and Paolo Piccard
Contributes to the investigations on history, technology, and degradation of Middle Age objects (metallic rings with mounted glass beads) recently excavated under the Main Square in Krakow, Poland.

Groza, Randall G.

Guerra, M.F.

Guillaïne, J., B. Gratuze, and J.N. Barrandon
Analysis of glass beads of the Chalcolithic and Bronze Age found in France.

Hall, Mark E. and Leonid Yablonsky
The chemical compositions of 14 glass beads from two Early Sarmatian-period burials were determined. All the beads can be classed as low-magnesia soda-lime-silica glasses. The blue glass beads examined in this study were colored with Co and Cu containing minerals. Cluster analysis and principal-component analysis suggest that two distinct glass recipes were used to manufacture these beads.

The chemical composition of 18 glass beads from Early Sarmatian period burials were determined using electron probe microbeam analysis and energy dispersive X-ray fluorescence. Multivariate analysis of the major oxides suggests that there are five distinct glass recipes. These indicate the involvement of the Sarmatians in exchange/trade networks linking the Eastern Mediterranean, the Indian subcontinent, and China.

Hancock, R.G.V.
Provides a good description of neutron activation analysis and summarizes the findings to date.

**Hancock, R.G.V., S. Aufreiter, and I. Kenyon**  
1996 Preliminary Chemical Survey of White Glass Beads from the Rochester Museum and Science Center. https://www.academia.edu/25807191/, accessed 2 June 2016. Eighty beads were analyzed to obtain maximum diversity of bead forms and to blanket the period 1650-1690 in order to determine the earliest occurrence of Sb-rich white glass beads.


**Hancock, R.G.V., S. Aufreiter, I. Kenyon, and M. Latta**  
1999 White Glass Beads from the Auger Site, Southern Ontario, Canada. *Journal of Archaeological Science* 26(8):907-912. A sample of 94 glass beads from the early 17th century was analyzed by instrumental neutron activation. Four different glass chemistries were found, some shape specific. The beads are tin-rich.

**Hancock, R.G.V., S. Aufreiter, J.-F. Moreau, and I. Kenyon**  

**Hancock, R.G.V., A. Chafe, and I. Kenyon**  

**Hancock, R.G.V., C. Garrad, M. Sempowski, A.W. Nohe et al.**  
2000 What the Elemental Analysis of Red Glass Trade Beads Can or Cannot Tell Us About Trading Patterns of their Owners. Manuscript report.

**Hancock, R.G.V., J. McKechnie, S. Aufreiter, K. Karklins, M. Kapches, M. Sempowski, J.-F. Moreau, and I. Kenyon**  
Chemical analyses were performed on royal blue glass trade beads from two early-17th-century archaeological sites in southern Ontario, Canada, and from a glass beadmaking house in Amsterdam, The Netherlands. The results confirm that these beads were all mixed alkali-lime-silica glasses, colored with Co and with opaque variants opacified with Sn.


Neutron activation analysis of native copper samples from the Lake Michigan/Lake Superior region, European copper artifacts (including beads) from 16th-17th-centuries archaeological sites in Ontario, and modern copper wire reveals that the three groups can be distinguished on the basis of their composition.


Analysis of two faience beads of blue and green color, respectively, reveals that the coloring element in both beads is copper with +2 valence, and the color divergence of these two beads may originate from different local chemical environments of Cu2+. It is suggested that the faience in this period is the earliest glaze with copper colorant in China.


The investigated collection of glass beads and bracelets represents a cross-section of the most important glass types found for the Bronze Age and Iron Age in Central Germany. Among the artifacts are examples of different chemical compositions, colors, and varying degrees of opacity. The artifacts date from the 14th-1st centuries B.C.


Describes and illustrates the pyrolysis-gas chromatography method of determining the provenance of amber.


Several different analytical methods were used to determine the chemistry and structure of ca. 1,500 variously colored beads found in female tombs of the Merovingian (early medieval) period.


Several analytical methods were used to throw light on glass technology during an important period of cultural transition.

On the raw materials for coloring Merovingian glass beads.


Analysis of monochrome Merovingian (5th-7th cent. A.D.) glass beads reveals that oxidized metals, alloys (lead, copper, bronze, brass and mixtures of them), and iron smelting slag were used as raw materials to color the soda-lime-glass.


Reports on the use of x-ray fluorescence analysis to determine the composition of inhomogeneous, small, and irregularly shaped ancient glass beads.


Characterizes yellow Merovingian glass beads.


On the archaeometrical study of yellow and brown Merovingian glass beads.


Reports on the analysis of mammoth ivory artifacts (beads included) from four Palaeolithic sites (Abri Castanet, Vogelherd Cave, and Grottes de la Verpillière I and II) in France and Germany in order to assess the effectiveness of this approach to material older than 30,000 y BP.

Chemical analysis of the beads using X-ray fluorescence suggests that some Iron Age beads that look alike come from different glassworking centers. England, United Kingdom.


The study centers on beads of transparent blue and opaque yellow glass from 4th-1st-centuries-B.C. archaeological contexts in Britain. The beads are from Wetwang Slack, North Humberside, Meare, Somerset, and lump yellow glass from Hengistbury Head, Dorset, England, United Kingdom.


The Meare and “Loughey” sites are discussed with specific reference to the recovered glass. Chemical analysis shows that beads of the same “type” can have entirely different chemical compositions, suggesting different sources. England, United Kingdom.


Includes chemical analysis of glass beads from Bronze Age Rathgall, Co. Wicklow, Ireland. Discussion of why the compositions are quite different from contemporary Near Eastern glass.


Provides the results of chemical analyses of European Bronze Age glasses, including beads. One color plate.


Reviews glass analysis, glass technology, and the chemical characterization of glass and beads.


Chemical analyses of Iron Age glass beads, England, United Kingdom.


Mixed-alkali glass beads from a Bronze Age Swiss lake village.

Very unusual Late Bronze Age and Early Iron Age glass bead compositions, Greece.


Important, mainly Late Iron Age Site in southern England, United Kingdom. Chemical analyses provide supporting evidence for a Late Iron Age glass bead technology.


2013 *Ancient Glass: An Interdisciplinary Exploration*. Cambridge University Press, Cambridge. Provides an in depth consideration of glass as a material, the raw materials used to make it, and its wide range of chemical compositions in both the East and the West from its invention to the 17th century A.D. Highly recommended.

**Henderson, J. and J. Callmer**

1991 Glassworking at Åhus, S. Sweden (eighth century AD). *Laborativ Arkeologi* 5:143-154. Discussion of the chemical analyses of raw materials, glass beads, etc.

**Henderson, J. and I. Holand**


**Henderson, J. and R. Ivens**


**Henderson, J. and S.E. Warren**


**Herzog, A. and J.-F. Moreau**

Heyworth, Michael P.
A group of 65 glass beads from a Pagan Saxon cemetery were qualitatively analyzed to identify the colorants and decolorants used. England, United Kingdom.

A bead fragment of colorless glass from a late medieval context contained small fragments of colored glass and millefiori. It appears to be in the Venetian style and to date from the 16th century. Colorants were identified by qualitative analysis. England, United Kingdom.

Hložeka, M. and T. Trojek
Non-destructive X-ray fluorescence micro-analysis was used to describe the elemental composition and the production technology of a unique millefiori bead that was found in a burial ground in Kyjov (Hodonin district, Czech Republic) dating back to the Migration Period.

Hoffmann, Peter
About determining the coloring agents used in ocher beads and other Merovingian color groups using non-destructive means.

Hoffmann, P., S. Bichlmeier, M. Heck, C. Theune, and J. Callmer
On the composition of the glass beads from Merovingian women's graves at Eichstetten and Endingen, Germany.

White, orange, green, and brown glass beads from women's burials of the Merovingian period were scientifically characterized by x-ray fluorescence analysis, scanning electron microscopy, electron probe microanalysis, and x-ray diffraction.

Hoffmann, P., M. Heck, and C. Theune
The chemical and mineralogical study of Merovingian glass beads leads to an understanding of their production.
Holzer, Veronika

Presents the results of Energy dispersive X-Ray Fluorescence analysis of large, decorated, yellow glass beads of the Late Hallstatt/early La Tène periods from Vicenice, Bohemia, Czech Republic.

Höppner, B., M. Bartelheim, M. Huijsmans, R. Krauss, K.-P. Martinek, E. Pernicka, and R. Schwab
2005  Prehistoric Copper Production in the Inn Valley (Austria) and the Earliest Copper in Central Europe. Archaeometry 47(2):293-315.

Analyses of very early copper material from a critical region. A small bead of rolled sheet copper may indicate contact with the Carpathian Basin (pp. 311-312).

Horsley T. and C. Mortimer

Presents analyses by XRF and EDX of a range of beads from 6th-7th centuries burials. Beads were soda-lime-silica glass. England, United Kingdom.

Huisman, D.J., B.J.H. van Os, J. van der Laan, D.J.M. Ngan-Tillard, I. Joosten, and H.A.C. Fermin

A group of small blue-green glass beads containing numerous bubbles appear to be the result of local, inexpert, reworking of imported glass objects. The air bubbles could be the result of re-melting of the glass fragments or objects.

Hulínský, V. and E. Černá

Hulínský, V., Š. Jonášová, and K. Tomková

On the chemical composition of glass beads from cemeteries in the Žalov cadastral, Czech Republic.

Iizuka, Yoshiyuki

Reports on SEM-EDS analysis of not only glass beads, but copper and stone (agate) as well.
Ilon, Gábor and Zsolt Kasztovszky
2016 Untersuchung spätbronzezeitlicher Glasperlen aus West-Ungarn / Analysis of Late Bronze Age Glass Beads from Western Hungary. *Archeometria Múhely* XIII(1):55-68.
The beads studied represent the Late Tumulus–Early Urnfield culture (Bz C2–Ha A1). In German with English summary.

Insoll, Timothy and Kuldeep Bhan
Short article on collecting carnelian samples from western India for geochemical analysis to help identify trade patterns of beads from the area.

Insoll, Timothy, David A. Polya, Kuldeep Bhan, Duncan Irving, and Kym Jarvis
2004 Towards an Understanding of the Carnelian Bead Trade from Western India to Sub-Saharan Africa: The Application of UV-LA-ICP-MS to Carnelian from Gujarat, India, and West Africa. *Journal of Archaeological Science* 31:1161-1173.
Outlines the results of chemical analysis and subsequent principal component analysis undertaken in an attempt to differentiate Gujarati and West African carnelian samples, and thus begins to allow inferences to be made regarding a possible trade in carnelian between these two regions primarily in the medieval period, based upon more objective data.

Jacobson, L., C.A. Pineda, D. Morris, M. Peisach, and A.E Pillay
Ostrich eggshell beads were used both in Hxaro exchange networks as well as more commercial trade relationships. By sourcing Ostrich eggshell to different geological substrates it will be possible to reconstruct the extent and identity of these networks thus enabling a poorly understood aspect of San history to be written.

Janssens, Koen H.A. (ed.)
2013 *Modern Methods for Analysing Archaeological and Historical Glass*. John Wiley and Sons, Chichester, United Kingdom.
Members of the Association Internationale pour l’Histoire du Verre and other scholars present a comprehensive overview of current techniques for the analysis of glass composition for both archaeological and historical glass, including beads.

Jeunesse, Christian
On shell ornaments (including beads and pendants) and the evolution of symbolic systems in the Danubian Neolithic.
Jian Zhu, Yimin Yang, Wei Xu, Dongliang Chen, Junqing Dong, Lihua Wang, and Michael D. Glascock
2012 Study of an Archaeological Opaque Red Glass Bead from China by XRD, XRF, and XANES. X-Ray Spectrometry 41:363-366.
A rare archeological find of red glass beads (A.D. 300–400) discovered in Leijiaping, Badong County, Hubei, China, was subjected to an advanced structural analysis using micro synchrotron X-ray near-edge absorption spectroscopy. This study reveals that this form of analysis is an advanced and nondestructive technology to study ancient glass objects.

Johnson, Diane, Joyce Tyldesley, Tristan Lowe, Philip J. Withers, and Monica M. Grady
Tube-shaped beads excavated from grave pits at the prehistoric Gerzeh cemetery, ca. 3300 B.C.E., represent the earliest known use of iron in Egypt. Using a combination of scanning electron microscopy and micro X-ray microcomputer tomography, the authors show that microstructural and chemical analysis of a Gerzeh iron bead is consistent with a cold-worked iron meteorite.

Junqing Dong, Yunling Han, Jiwang Ye, Qinghui Li, Song Liu, and Donghong Gu
Beads from the beryl and quartz groups were identified with some thoughts on their origin. The present research provides valuable information on the early trade between south China and South Asia.

Kang, Hyung-tae and Eun-young Yun
Of the four beads analyzed, three were found to be of lead glass (PbO-SiO2) and one was of potash-lead glass (K2O-PbO-SiO2). The latter is dated to the end of the 10th century. South Korea.

Kang, H.T., E.Y. Yun, and J.Y. Ahn
South Korea.

Kanungo, A.K. and R.H. Brill
Reports on the analysis of glass (including beads) recovered from Kopia, a major glassmaking site in Uttar Pradesh, which was occupied from 700 B.C. to around A.D. 600.

Karches, Barbara
On determining the elemental composition of late La Tène to early Imperial period glass beads using instrumental neutron activation analysis.

Karklins, Karlis, Laure Dussubieux, and Ron G.V. Hancock

Excavations in West London uncovered the remains of two glass furnaces with associated wasters relating to the manufacture of drawn glass beads during the second quarter of the 17th century. The site is significant as it represents the first archaeological evidence for the production of glass beads in post-medieval England. Comparisons of the chemical compositions of the Hammersmith beads with those of beads from a contemporary Amsterdam factory reveal a number of similarities as well as differences.


Karklins, K., J. Kottman, R.G.V. Hancock, M.L. Sempowski, A.W. Nohe, J.-F. Moreau, S. Aufreiter, and I. Kenyon

Analysis of beads likely produced in Middelburg, The Netherlands, in the 17th century.

Katsuhiko, Ōga

Reports on the chemical composition of the beads from the temple in Japan. Text is in Japanese. See also Tomomi (2011).

Kelly, Gwendolyn O.

Reports on the composition of six Indo-Pacific glass beads dating to ca. 1200-1400 C.E.

Kenyon, I., R.G.V. Hancock, and S. Aufreiter

An early attempt to identify a time frame for distinctive glass bead chemistries using elemental composition.
Kenyon, Ian, Susan Kenyon, Ron Hancock, and Susan Aufreiter

Kim, Christopher F.
A detailed discussion of lead-barium glass which was most commonly used to produce beads during the period under discussion.

Kim, Na-Young and Gyu-Ho Kim
Analysis of 141 samples from 12 sites of the Three Kingdom Period reveals that the red-brown beads may be divided into three types according to the chemical composition of the stabilizers (CaO and Al₂O₃) and soda raw materials (MgO and K₂O).

Klysubun, W., Y. Thong kam, S. Pongkrapan, K. Won-in, J. T-Thienprasert, and P. Dararatana
Reports for the first time an advanced structural analysis of Thai ancient glass beads using synchrotron X-ray absorption spectroscopy (XAS) and energy-dispersive X-ray (EDX) spectrometry.

Koch, Leonie C.
On the possible import of glass beads to Germany from Greece or elsewhere to the east during the late Bronze Age based on the Late Urnfield hoard at Allendorf. Includes chemical analysis.

Attempts to answer the question of the origin of Bronze Age glass by means of chemical analysis and the problem of their interpretation. Faience and glass beads are among the items analyzed.

Koh, Min Jeong, Hyung Tae Kang, Na Young Kim, and Gyu Ho Kim
The analyzed material also included beads which were found to be soda glass of two sub-groups: soda-lime glass and high-alumina soda glass.
Towards Refining the Classification of Glass Trade Beads Imported into Southern Africa from the 8th to the 16th Century AD.

Glass trade beads excavated at 11 sites along the upper reaches of the Limpopo River in Botswana are visually classified according to their morphological properties (color, size, etc.) and analyzed with Raman spectroscopy and portable X-ray fluorescence (XRF). Energy Dispersive Spectroscopy (EDS) of one bead shows that two types of glass were sintered together to form a recycled product.

Using visual observations and chemical analyses, it is possible to distinguish a separate type of Early Medieval glass bead designated “G-beads” on their composition. Finds of these beads are typical for the horizon of Early Medieval burial sites in Bohemia. In Czech with English summary. Czech Republic.

Archaeomaterialogical studies of prehistoric artifacts from the territory of Bulgaria reveal a variety of decorative minerals and materials such as nephrite, malachite, serpentinite, turquoise, jadeite, coal (jet), carnelian, agate, and jasper (including heliotrope), all of which have been used to produce beads.

Reports on the analysis of jade objects (including several beads) from a Classic Maya site.


Lambert, Joseph B. et al.
 Samples from two sites in Thailand were analyzed for 17 elements. Most have a mixed-alkali matrix. Cluster analysis of single-color groups suggests that the people of the sites were of different origin or culture.

Lankton, James W.
A detailed technical study of four groups of larger glass beads from eastern Java: Bird-Star, translucent hexagonal bicone, opaque monochrome, and Jatim. Complex patterns of manufacture and trade are indicated despite the relative lack of good dated evidence.

Reviews the most important glass chemical compositional groups found at archaeological sites in India, with passing reference to when and where these glasses might have been made. The findings are primarily based on the analysis of beads.

Lankton, James W., Ch. Amartuvshin, B. Gratuze, and W. Honeychurch

Lankton, James W. and Laure Dussubieux
The archaeological glasses found in Southeast Asia are discussed on the basis of 1,500 chemical analyses, including beads, mostly obtained with LA-ICP-MS. Thailand, Malaysia, and Cambodia.

Lankton, James W., L. Dussubieux, and B. Gratuze
Beads are among the items studied. Thailand.

Lankton, James W., Laure Dussubieux, and Thilo Rehren
Concentrates on the chemical composition of bird star, hexagonal bicone, opaque monochrome, and Jatim glass beads.

**Lankton, James W., B. Gratuze, G.-H. Kim, and L. Dussubieux**


Glass beads were included in the study. Korea.

**Lankton, James W., O.A. Ige, and Th. Rehren**


Fragmentary glass-working crucibles, drawn glass beads, and ritual glass objects (*aje ileke*) from Ile-Ife, southwestern Nigeria, were analyzed using scanning electron microscopy (SEM-EDS), electron probe microanalysis (EPMA), and X-ray fluorescence (XRF).

**Latinis, K.**


**Lee, Insook**


**Lee, Insook, R.H. Brill, and P. Fenn**


Reports on the quantitative chemical analysis of 27 glass specimens, mostly beads, from archaeological contexts dating from the 1st century B.C. to the 7th century A.D.

**Lee, Insook and M.T. Wypyski**


Presents evidence of contact between the eastern Indian Ocean region and Iron Age Korea through microprobe analyses of 18 glass trade beads.

**Li Fei, Li Qinghui, Gan Fuxi, Zhang Bin, and Cheng Huansheng**


Reports on the composition of faience and glass beads of the Han, Yuan, and Northern Wei dynasties unearthed from the Neimenggu area and Boshan, China. In Chinese.

**Li Fei, Li Qinghui, Gan Fuxi, Zhang Bin, Cheng Huansheng, and Shen Shifang**

2007  Analysis of Some Ancient Glass Samples Unearthed in Sichuan Area by PIXE. *Nuclear Techniques* 2.
The proton induced X-ray emission (PIXE) technique was used to determine the composition of glass beads and other objects dating from the Warring States Period (770-476 B.C.) to the Six Dynasties Period (220-589 A.D.). In Chinese.

Li Qinghui, Dong Junqing, Su Bomin, Chen Gangquan, Liu Song, and Gu Donghong
The glass samples could be divided into two glass groups: PbO-BaO-SiO₂ and Na₂O-CaO-SiO₂. China. In Chinese.

Li Qinghui, Huang JiaoZhen, and Gan Fuxi
The samples include monochromatic glass beads and compound eye beads and represent three kinds of glass (Na₂O-CaO-SiO₂, K₂O-SiO₂, and PbO-BaO-SiO₂) that coexisted in Xinjiang, China, during the Warring States period. In Chinese.

Li Qinghui, Song Liu, Bomin Su, Hongxia Zhao, Qiang Fu, and Junqing Dong
The beads, dating from 1st century B.C. to the 10th century A.D., were excavated in the Xinjiang and Guangxi provinces of China. Two kinds of tin-based opacifiers/colorants including crystalline cassiterite and lead-tin yellow types II were first found in these soda-lime beads.

Li Q.H., S. Liu, H.X. Zhao, F.X. Gan, and P. Zhang
At least two different types of glass were present in the two cemeteries. For the first time, antimony-based colorant/opacifier was systematically identified in some beads of plant-ash type soda-lime glass dated to about 1000-500 B.C. The limited number of potash glass beads from the Kizil reservoir cemetery, which were dated to about 500-300 B.C., used tin oxide as an opacifier.

Li Q.H., J.C. Yang, L. Li, J.Q. Dong, H.X. Zhao, and S. Liu
Most of the specimens tested were glazed polychrome pottery beads dating from the 4th century B.C. to the 3rd century A.D. They are composed of vitreous PbO-BaO-SiO₂ material.

Li Qinghui, Zhou Hongzhi, Huang Jiaozhen, Gan Fuxi, and Zhang Ping
2005 Yipi zhungguo gudai xiangqian bolizhu huaxue chengfen fenxi de jiance baogao (Chemical Composition Analytic Results of Ancient Chinese Compound Eye Beads). Jianghan kaogu (Jianghan Archaeology) 4.
The beads were unearthed at Xinjiang, Hubei, Sichuan, and Guangdong, China. In Chinese.
Libiete, Jana and Indra Tuña
Not only discusses the conservation process for the recovered beads but also provides information on the chemical composition of 10 of them. The site is located in Latvia and the beads date mostly to the 10th-17th centuries.

Lilyquist, C. and R.H. Brill
Compositional analyses and discussion include some beads and provide important evidence for Egyptian relations with the Near East and Mesopotamia. The material is believed to come from the tomb of three foreign wives of Tuthmosis III (ca. 1479-1425 B.C.).

Lițescu, Simona C. et al.
2010 Non-Destructive Analysis of Amber Artefacts from the Prehistoric Cioclovina Hoard, Romania.
Amber beads from the transitional period between the Late Bronze Age and the Iron Age were analyzed to determine the source of the amber. The results strongly suggest that a large part of the amber has a Romanian origin and, thus, no connection with the Amber Route.

Liu, S., Q.H. Li, Q. Fu, F.X. Gan, Z.M. Xiong
Reports on the composition of 37 glass beads excavated from Han Dynasty tombs in Hepu county, Guangxi, China.

Liu, S., Q.H. Li, F. Gan, P. Zhang, and J.W. Lankton
Explores the chemistry of 65 glass beads from 18 oasis sites both north and south of the Taklamakan Desert, the ancient center of the Silk Routes linking East and West. The samples date from the Warring States period (475-2211 B.C.) to the Tang Dynasty (A.D. 618-907).

López, Mariel Alejandra
2011 Estado de conservación y caracterización tecnológica de las cuentas de vidrio de Pintoscayoc 1, Quebrada de Humahuaca, Jujuy, Argentina. Conserva 16:55-68.
Reports on the archeometric analysis of glass beads found in different depositional and post-depositional conditions at a site in Argentina dated between 450 and 370 B.P.

Luedtke, Barbara
Presents descriptive data and results of chemical analysis of a copper bead from a late prehistoric site on an island in Boston Harbor. Includes a discussion of similar beads from other sites in the region.
Lyubomirova, V., Ž. Šmit, H. Fajfar, and I. Kuleff
The concentration of 25 elements in the earliest glass materials (5th-3rd centuries B.C.) in Bulgaria is determined and discussed.

Magee, R.W.
Analyses of beads from Bronze Age Ireland to trace their affinities with beads from other parts of the British Isles.

Magnavita, Sonja
Discusses the recovered beads of glass, stone, and baked clay, as well as cowries, dating to the 1st to early 2nd millenia A.D. The chemical composition of the glass beads is also provided.

Mangou, Helen

Marchetti, Marie-Laurence and Bernard Gratasse
Analysis of glass beads excavated at Grotta Piatta, a protohistoric funerary site on the coast of Balagne, Corsica, revealed the Near-Eastern origin of the glass used as raw material.

Martínez Mira, Isidro and Eduardo Vilaplana Ortego
Describes and presents compositional data for stone and faience necklace beads of the period 850-550 B.C. from southeastern Spain.

Mascelloni, M.L., G. Cerichelli, and S. Ridolfi
The assemblage includes 7 beads and 1 bead/spiral.
Matthes, C., M. Heck, C. Theune, P. Hoffmann, and J. Callmer
Discusses the production mechanisms of early medieval glass beads. Includes data concerning their chemical composition.

Mazzieri, Paola and Roberto Micheli
Deals with the beads and pendants recovered from Square Mouth Vase Culture contexts in Italy.

McGovern, Patrick E.
The composition of silicate beads and pendants from Beth Shan in Israel and the Baq'ah Valley of Jordan was determined to elucidate the technological innovations and interaction between different industries in the region during the Late Bronze and Early Iron ages (ca. 1550-1050 B.C.).

McGovern, Patrick E., Stuart J. Fleming, and Charles P. Swann
Analyses of a limited corpus of Egyptian silicate artifacts (including beads) from the 18th to the 20th Dynasty shown that the batch recipes and colorants of the el-Amarna group, except for cobalt blue, are very distinct chemically from glasses and glazes produced a century later at other Egyptian sites.

Mecking, Oliver
On the composition of metal-foil beads found in Germany.

Meek, Andrew and Sonja Marzinzik

Melgar Tísoc, Emiliano R. and José Luis Ruvalcaba
Analysis of several green calcite beads reveals similarities to Huastec pieces, both at mineralogical and technological levels. It is proposed that these pieces could be objects looted during the Aztec campaigns against Huastec sites.

Melgar Tísoc, Emiliano R., José Luis Ruvalcaba, Kilian Laclavetine, and Estela Martínez Mora
On the origin and manufacture of turquoise objects (including beads and pendants) from central Mexico.

**Melgar, Emiliano, Reyna Solís, and José Luis Ruvalcaba**
The aim of this work is to measure the composition of the recovered stone beads and other artifacts for provenance study and to establish the manufacturing technique and tools used to produce them.

**Micheli, Roberto**
On beads and pendants recovered from Square Mouth Vase Culture contexts in Italy.

**Miksic, John**
Reports on the compositional analyses of 14th-century beads, bangles, and vessel fragments. Three glass groups were identified.

2013  *Singapore and the Silk Road of the Sea, 1300-1800*. NUS Press, Singapore.
Chapter 8 concentrates on glass beads recovered from sites in Singapore and Indonesia including their chemical composition.

**Miksic, John N., F.D. Bulbeck, K. Karklins, J.-F. Moreau, and R.G.V. Hancock**
A small sampling of 12th-14th-centuries red glass beads from Riau, Indonesia, and blue glass beads from Singapore were analyzed using instrumental neutron activation analysis and the results compared to European beads of the 17th-18th centuries.

**Miksic, J., C.T. Yap, and Hua Younan**
Glass beads from Singapore, the nearby Riau Archipelago, and Palembang (South Sumatra, Indonesia) were analyzed by XRFD and the results, combined with historic data, indicate that Riau obtained beads from India, perhaps via Palembang before A.D. 1200, and later Chinese beads, perhaps from Singapore.

**Miller, D.E. and J. Kinahan**
Several beads from three site areas in Namibia were subjected to metallographic and chemical analysis. All appear to date to the 18th century.

**Moreau, J.-F., B. Gratuze, R.G.V. Hancock, and M. Blet Lemarquand**
Moreau, Jean-François and R.G.V. Hancock

Using neutron activation analysis to compare several series of white glass beads uncovered at the Chicoutimi trading post site in Quebec, Canada, with a series of other collections whose dates are well established has lent support to the hypothesis, based on bead typology, that the site contains an Amerindian layer dating from the contact period (1600-1650).

Moreau, Jean-François, R.G.V. Hancock, Susanne Aufreiter, and Ian Kenyon

Moreau, J.-F., R.G.V. Hancock, Susanne Aufreiter, and Ian Kenyon


Neutron activation analysis of the beads was used to test the temporal assignment of the bag as well as the anthropological interpretation of the beads as pertaining to a decorative pattern on the bag.

Moreau, J.-F., R.G.V. Hancock, and M. Mousse
t

The INAA analysis of glass beads recovered from two sites in Quebec City, Canada, has helped to determine the chronometric trend for specific elements in beads of the third quarter of the 18th century.

Moretti, C. and B. Gratuz

Samples of copper-red glasses from the Roman period to the 19th century were analyzed using modern techniques, also a sample of aventurine glass. These results were compared, when possible, with formulae found in Venetian recipe manuscripts dating from the 14th-19th centuries.
Presents Fourier-transform infrared spectroscopy (FTIR) characterization of archaeological amber from three Iberian prehistoric sites, including a necklace recovered from the megalithic site of Palacio III (Almadén de la Plata, Sevilla) and a necklace from the Muricecs de Cellers cave (Llimiana, Pallars Jussà, Lleida).

Nagy, Géza
Reports on the electron microprobe examination of Avar glass beads, Hungary.

Nagy, Géza, Adrien Pásztor, István Fórizs, and Mária Tóth
Nearly 200 glass beads found in Sarmatian (2nd-4th centuries) and Avar (6th-8th centuries) graves in Hungary were subjected to instrumental analysis. In Hungarian with English abstract.

Nakai, Izumi, Yanase Kazuya, Matsuzaki Mayumi, Sawamura Daichi, and Nagahama Koji
Japan; in Japanese but images of the beads are provided and the analytical tables are partially in English.

Nakai, Izumi and Yokos Shindo
Discusses glass beads from ancient tombs in Japan.

Nakai, Izumi and Junko Shirataki
Reports on the chemical analysis of glass beads excavated from 10 different *Kofun* (megalithic tombs or tumuli) in Kumamoto and Okayama prefectures in Japan to determine origins and the colorants used.

Nakai, Izumi, K. Tantrakarn, Y. Abe, and S. Omura
2013  *Study on Western Asiatic Cast Ribbed Rectangular Beads from Kaman-Kalehöyük, Turkey by Using Portable XRF.* *Open Journal of Archaeometry* 1(1):109-114.
This study provides the first scientific material evidence that shows the possibility of culture flow from the Mesopotamia region to Kaman-Kalehöyük during Middle-Late Bronze Age (16th-15th centuries B.C.).
Nakai, Izumi, Kriengkamol Tantrakarn, Norihiro Kato, N. Kawai, A. Nishisaka, and S. Yoshimura
2009 XRF Analysis of 16th Century BC Transparent Glass Beads Excavated from a Hillside in
Northwest Saqqara, Egypt. *Annals of the 17th Congress of the International Association for the

Nakamura, D. and T. Warashina
2009 Physicochemical Analysis of Beads and its Distribution on the Korean Peninsula. In *Graphical
Archaeological Association, Tokyo.
In Japanese.

Nikita, Kalliopi and Julian Henderson
2006 Glass Analyses from Mycenaean Thebes and Elateia: Compositional Evidence for a Mycenaean
Chemical analyses of glasses (including beads) from Thebes and Elateia have radically changed earlier
views about a Mycenaean glass industry dependent on Eastern glass-producing centers for the
procurement of raw glass and operating solely as a secondary glass production zone for the manufacture
of jewelry.

Nikita, Kalliopi, Julian Henderson, and Georg Nightingale
2009 An Archaeological and Scientific Study of Mycenaean Glass from Elateia-Alonaki, Greece. In
*Annals of the 17th Congress of the International Association for the History of Glass, 2006,
Presents and discusses the results of the archaeological and scientific study of 81 simple and relief glass
beads from the Mycenaean chamber-tomb cemetery at Elateia-Alonaki, Greece. The beads date from the
beginning of the Late Helladic IIIA period (about 1425/1390 B.C.) to the Early Protogeometric period
-about 1000/950 B.C.), and their chemical composition was determined using electron probe
microanalysis.

Odriozola, Carlos P.
2015 A New Approach to Determine the Geological Provenance of Variscite Artifacts Using the P/Al
Reports on a technique which helps link variscite artifacts (including beads) recovered from Iberian sites
of the 4th-2nd millennia to source mines. Spain.

Odriozola, Carlos P. and J.A. Linares-Catela
2012 Cuentas de variscita: Producción, circulación y presencia en contextos funerarios del suroeste
Uses XRD and XRF analysis of variscite beads coming from different megalithic contexts in
southwestern Spain to determine the source of the material.

Odriozola, Carlos P., J.A. Linares-Catela, and V. Hurtado-Pérez
Discusses the exploitation and exchange of variscite at the Pico Centeno mining district during the Copper Age. XRF, XRD, and FTIR analyses of the minerals recovered there during archaeological survey provide a baseline mineral signature for the source and sub-sources, which were then compared to other Iberian sources and to 44 green beads from 8 megalithic tombs from two different regions, in order to test “provenance postulate” and distribution models.

Odriozola, Carlos P., Luis Benítez de Lugo Enrich, Rodrigo Villalobos García, José M. Martínez-Blanes, Miguel A. Avilés, Norberto Palomares Zumajo, and María Benito Sánchez

A sample of stone beads and pendants were analyzed using XRD, micro-Raman, and XRF in order to contribute to the current distribution map of green-bead body ornaments on the Iberian Peninsula. Most of the beads from Castillejo del Bonete (late 3rd millennium cal. BC) were made from variscite or green phyllosilicates, while those from Cerro Ortega (late 4th millennium cal. BC) were made of fossil wood or clinohlore.

Oga, Katsuhiko and Tomomi Tamura

Most ancient glass beads in Japan were brought there by long-distance ocean trade in the BCE-CE transition. This study categorizes the beads on the basis of chemical composition.

Olmeda, Giulia, Ivana Angelini, Gianmario Molin, Stefano Boaro, and Giovanni Leonardi

Reports on the chemical and mineralogical analyses of eight vitreous material ornaments (beads included) with a poorly defined chronology, coming from a protohistoric and Roman site in Cordignano-Colle Castelir (Treviso, northeastern Italy).

Panei, Liliana, Gilberto Rinaldi, and Maurizio Tosi

Discusses the mineralogical composition of the recovered stone (heat-hardened steatite) beads and the technology used in their production.

Peake, James R.N.

SEM-EDXA analysis of approximately 400 beads has shed new light on the production technology of certain colors, most notably red glass, as well as chronological and typological variations in technology relating to particular types and colors of bead produced during the early medieval period. United Kingdom.
2013 Early Anglo-Saxon Glass Beads: Composition and Origins Based on the Finds from RAF Lakenheath, Suffolk. Ph.D. thesis. Cardiff University. Reports upon the compositional analysis of early Anglo-Saxon (5th-7th centuries A.D.) glass beads from a cemetery complex at Eriswell, Suffolk, England. Major element analysis was undertaken using energy-dispersive x-ray spectrometry in the scanning electron microscope (SEM-EDS) on 537 samples from a total of 380 monochrome and polychrome beads. Restricted to repository staff.


Pickard, Catriona and Ulf-Dietrich Schoop 2013 Characterization of Late Chalcolithic Micro-Beads from Çamlıbel Tarlası, North-Central Anatolia. Archaeometry 55(1):14-32. Analysis revealed that the beads were made from three distinctive materials; namely, bulk talc (i.e., synthetic enstatite precursor), apatite, and mineral-rich clay pastes. Turkey.


Polikreti, Kyriaki, Joanne M.A. Murphy, Vasilike Kantarelou, and Andreas Germanos Karydas 2011 XRF Analysis of Glass Beads from the Mycenaean Palace of Nestor at Pylos, Peloponnese, Greece: New Insight Into the LBA Glass Trade. Journal of Archaeological Science 38(11):2889-2896. Aims to identify the technology and source for the glass beads found at the Palace of Pylos and thus to ascertain how it was connected to the broader Mycenaean and Mediterranean economies. The presented data support the hypothesis that Pylos was receiving foreign-produced glass via internal Greek trade routes during the Late Bronze Age.
Pollo, A., I. Angelini, G. Artioli, P. Belliantani, and A. Dore

Presents the results of the chemical analysis of an assortment of glass beads from Villanovian graves in Bologna, Italy, dating to the 9th-7th centuries B.C.

Popelka, Rachel S., Michael D. Glasscock, Peter T. Robertshaw, and Marilee Wood

Surveys the results of the analysis of glass beads recovered from sites in Egypt, Botswana, Zambia, South Africa, and Sri Lanka.

Prinsloo, Linda C.

Chapter 4 reports on “A Raman Spectroscopic Study of the Mapungubwe Oblates: Glass Trade Beads Excavated at an Iron Age Archaeological Site in South Africa.” See also Prinsloo and Colomban (2008).

Prinsloo, Linda C. and Philippe Colomban

A profile of the glass technology used to produce the Mapungubwe oblates, small trade beads from the “royal burials” on Mapungubwe hill was determined and quite a few unique characteristics of the beads may eventually help to establish their provenance.

Prinsloo, Linda C., Aurélie Tournié, and Philippe Colomban

Reports on the analysis of 175 glass trade beads from two archaeological sites in the Limpopo valley, South Africa. Using Raman spectroscopy, the glass matrix was classified into two main sub-groups. Seven pigments or chromophores were identified. Some pigments were manufactured after the 13th century. This conflicts with the last occupation date (A.D. 1290) of the site obtained by carbon dating.

Purowski, Tomasz

The examination of petrographic thin sections of five glass beads from the Wicina stronghold have demonstrated beyond doubt the usefulness of the method in determining beadmaking techniques attributed to the Halstatt period. English summary.

2008 Problemy badań wyrobów szklanych znanych ze stanowisk kultury lużyckiej na przykładzie pracy J.T. Matysiaka i T. Prokopa (2005) (Questions Concerning Research on Glass Products
The author points out errors in the description and interpretation of a glass bead from a site in Poland and points out what is needed for the proper description of beads and the interpretation of the results of chemical composition analyses.

2013 Wyroby ze szkła i „szklistego fajansu” odkryte na cmentarzysku kultur łużyckiej i regionalnej grupy kręgu halsztańskiego w Domasławiu, pow. wrocławski (Glass and “Glassy Faience” Products from a Cemetery in Domaslaw, Wroclaw District,attributed to Lusatian Culture and a Local Province of the Hallstatt Culture). *Archeologia Polski* LVIII(1-2):23-87.

Describes the beads and provides their chemical composition. Poland. English summary.


Provides descriptions of the beads as well as their chemical composition. Poland. English summary.

**Purowski, T., P. Dzierżanowski, E. Bulska, B. Wagner B., and A. Nowak**


Recovered from sites of the Lusatian culture, the beads were analyzed by EPMA and LA-ICP-MS.

**Purowski, Tomasz, Barbara Wagner, Ewa Bulska, Olga Syta, and Piotr Dzierżanowski**


Beads and pin heads made of glassy faience, often decorated with true glass, discovered at seven different cemetery sites in Poland and dated chiefly to the Hallstatt C period (ca. 750/700-600 BC), are examined by the LA-ICP-MS and EPMA methods.

**Qin Ying, She Lingzhu, Li Xiaoli, and Huang Jianxun**

2009 Composition and Structure of Warring States Period Glasses from Tomb Number Two at the Leigudun Site of Shuizou County, Hubei Province, China. *Journal of the Chinese Ceramic Society* 4.

The glass beads belong to the CaO-Na2O-SiO2 system, with higher composition of Sb2O3 and the Cu and Fe ions as the main coloring elements, and a glass tube belongs to the K2O-SiO2 system. In Chinese.

**Querré, G., T. Calligaro, S. Domínguez-Bella, and S. Cassen**


Analysis of archeological variscite beads and pendants excavated in Spain, Portugal, and France and of variscite geological references samples from European occurrences were carried out in order to trace the circulation of this precious gemstone over three millennia.
Querré, Guirec, Salvador Domínguez-Bella, and Serge Cassen

Presents analytical results derived from the study of variscite beads from two megalithic sites: one in the province of Cadiz, southwest Spain, and the other on the coast of Morbihan in Brittany, France. The results confirm the existence of long-distance transport from the geological source areas to the archaeological sites where they were deposited.

Ragazzi, E. et al.

Ambers of the same age may have differing chemical compositions. This study attempts to evaluate amber using thermal analysis; detecting changes in weight in a sample when heated in controlled conditions. It concludes that thermal analysis provides an additional way to characterize fossil resins.

Ramli, Zuliskandar, Nik Nik Abdul Rahman, and Abdul Samian

The analysis revealed that Sungai Mas produced its own Indo-Pacific beads during the 6th-13th centuries.

Rehren, T. and S. Nixon

Analysis of the glass adhering to crucible fragments found in a goldsmith’s workshop and glass beads found in association suggests that the Tadmekka goldsmiths were processing gold using crushed glass beads as a flux, rather than working glass as a material in its own right.

Rehren, Thilo and Edgar Pusch

On glassmaking during the Late Bronze Age in the Middle East. Of particular interest is the finding that some green glass beads from Ancient Egyptian contexts were once actually ruby red (pp. 220-221).

Rick, Torben C., René L. Vellanoweth, and Jon M. Erlandson

Discrepancies in 14C dates for shell artifacts appear to be due to the use of old shells by humans to make beads and other items, including shells collected from fossil deposits, older archaeological sites, and beaches. The problems caused by the use of old shells to make beads and other artifacts are surmountable through careful sample selection, analysis of multiple 14C dates on a variety of materials, and proper calibration procedures.

Robertshaw, Peter, N. Benco, M. Wood, L. Dussubieux, E. Melchiorre, and A. Ettahiri
Reports the results of elemental analysis, using LA-ICP-MS, of 30 glass beads from an assemblage of beads excavated at medieval al-Basra. Six chemical glass types are represented and their characteristics and geographical origins are discussed, with reference also to the techniques used to make the beads.

Robertshaw, Peter, M.D. Glascock, M. Wood, and R.S. Popelka

Presents the results of the chemical analysis of 156 glass beads from sites in southern Africa using LA-ICP-MS. Almost all of these beads can be grouped in two chemical types based on oxide compositions and glass recipes. Glasses of these types were manufactured in South and/or Southeast Asia. These are the first results of a project that will analyze about 1,000 beads from African archaeological sites.

Robertshaw, Peter, S. Magnavita, M. Wood, E. Melchiorre, R. Popelka-Filcof, and M. Glascock

Chemical analysis, using LA-ICP-MS, of 37 glass beads from the cemetery of Kissi 13 in Burkina Faso revealed the presence of three main types of glass. Soda-lime-silica glass, manufactured using plant ash as the flux, was the glass type from which almost all the beads were made.

Robertshaw, P., B. Rasoaifetra, M. Wood, E. Melchiorre, R.S. Popelka-Filcof, and M.D. Glascock

Chemical analysis of 31 glass beads from the sites of Mahilaka and Sandrakatsy in Madagascar, which date to approximately the 9th-15th centuries, reveals the presence of two main types of glass: mineral-soda glasses and plant-ash glasses. Most of these glasses were probably made in South Asia.

Robertshaw, Peter, Constanze Weise, Laure Dussubieux, James Lankton, Rachel Popelka-Filcof, and Michael D. Glascock

Reports the results of the first chemical analyses of the products of the masagá glass-working guild resident in Bida (Nupe), Nigeria. The items, including beads, date to the period 1914-2003.

Robertshaw, Peter, M. Wood, Anne Haour, Karlis Karklins, and Hector Neff

Garumelé, also known as Wudi, is reputed to have been a capital of the Kanem-Borno “empire,” but its date of settlement and occupation remain unclear. To help rectify this situation, a sample of 44 glass beads recovered during excavations were chemically analyzed using LA-ICP-MS. The results indicate that the beads are of European origin, probably Venetian and/or Dutch, and that most belong to the late 17th or 18th century.

Robertshaw, Peter, M. Wood, E. Melchiorre, Rachel S. Popelka-Filcof, and Michael D. Glascock
A sample of 360 glass beads from 19 archaeological sites in southern Africa dating between about the 8th and 16th centuries A.D. were analyzed using LA-ICP-MS, determining 47 chemical elements. The eight different bead series, previously defined on morphological characteristics, possess different glass chemistries. Zhizo series beads of the late 1st millennium A.D. were probably made from Iranian glass. Later bead series were made of glass probably manufactured in South Asia.

Rojo, M.A., G. Deubes de Castro, M. Edo, and J.L. Fernández
Analysis of eight green beads (calaite) excavated at several dolmens at Burgos, Spain, revealed the great mineralogical variety that exist under this generic denomination.

Rösch, C., R. Hock, U. Schüssler, P. Yule, and A. Hannibal
Examines stone, glass, metal, Egyptian blue, and synthetic enstatite beads from the Iron Age Samad Culture of Oman and the 4th-century B.C. site at Tissamahara, Sri Lanka.

Roumiantseva, Olga
This study focuses on the chemical composition of glass beads containing cobalt. The 42 samples examined are from Migration Period cemeteries located in the Oka and Volga basins in Central Russia.

Rousaki, Anastasia, Alessia Coccato, Charlotte Verhaeghe, Bernard-Olivier Clist, Koen Bostoen, Peter Vandenabeele, and Luc Moens
Micro-Raman spectroscopy and chemometrics on handheld XRF results were used to characterize beads found during archaeological excavations in the Congo. Metallic objects, organogenic materials, and glass beads were studied. The glassy materials seem to be of European production.

Ruvalcaba Sil, J.L., A. Daneels, M. Vaggi, and M. Aguilar Franco
Several green-stone beads and other adornments of the Classic period were analyzed using Raman and Mid-FTIR spectroscopies in order to identify the mineral composition, while PIXE and ionoluminescence were applied to contribute to the mineral identification and to determine probable provenance.

Ruvalcaba Sil, J.L., E. Melgar Tisoc, J.F. Curado, K. Laclavetine, and T. Calligaro
2013 Caracterización y procedencia de piedras verdes de las ofrendas del Templo Mayor de Tenochtitlan. In Técnicas analíticas aplicadas a la caracterización y producción de materiales.
On the composition and origin of green-stone offerings (including beads) at Tenochtitlan.

**Saitowitz, Sharma J. and David L. Reid**


Plasma mass spectrometry was used to assess the rare earth trace element content of beads from Egypt and Malaysia. Egyptian beads dating to A.D. 800-900 were compared to Malaysian beads from the same time period, yielding virtually identical glass recipes. The data shed new light on ancient trade between Egypt and Malaysia.


**Saitowitz, Sharma J., David L. Reid, and N.J. van der Merwe**


Plasma mass spectrometry was used to determine the rare earth element contents of glass beads excavated in the former northern and eastern Transvaal. They were found to be identical with those of beads made in al-Fustat (Old Cairo), and document the existence of a trade link with the Mediterranean via the Red Sea 1,000 years ago.

**Samek, Lucyna, Maciej Karwowski, Sylwester Czopek, Jerzy Ostachowicz, and Zdzisław Stęgowski**


Poland.

**Santopadre, P. and M. Verità**


Analyses of beads from Frattesina and other sites reveal a complex situation: several recipes, including a soda-lime composition previously unknown in Bronze Age glass. Italy.

**Sarah, G.**


Reports on the LA-ICP-MS analysis of glass beads from South India.

**Schierhold, Kerstin and Gisela Woltermann**

2011 Aktuelle Analysemethoden an Bernsteinperlen: Zwei Neufunde aus dem spätneolithischen Galeriegrab II von Erwitte-Schmerlecke (Kr. Soest) / Recent Methods of Analysis on Amber

Western Germany.

Schüssler, U., C. Rösch, and R. Hock
Presents EPM, XRF analyses of glass and stone beads from Tissamaharama and Akurugoda. Some distinctive red opaque glass disc beads with a very high copper content were locally made as may be some of the other glass with some glass and semi-precious stone beads probably being imported from India.

Schvoerer, Max, Richard Boyer, Francoise Bechtel, Stephan Dubernet, Jean L’Helgouac’h, and Jean Courtin
Since the mid-1970s, a bead found in the Crottes hypogeum at Roaix (Vaucluse) has been considered to be the oldest and best dated glass artifact in southern France. A re-examination of the bead reveals that the material is not glass but turquoise.

Scott, David A.
Discusses the microstructure of an 18th-century French cut-steel bead and a gold necklace bead from Colombia.

Seventeenth-century opaque red (redwood) glass trade beads were made of mixed alkali (mainly soda)-lime glasses and were colored with Cu, presumably as cuprous oxide or as finely dispersed elemental Cu. During the early 17th century, beads were opacified with Sn. By the mid-17th century, cored tubular beads were being opacified with a combination of Sn and Sb, a technological change similar to that observed in white glass trade beads, while uncored redwood beads appear not to have been opacified with either Sn or Sb.

Sempowski, M., A.W. Nohe, J.-F. Moreau, I. Kenyon, K. Karklins, S. Aufreiter, and R.G.V. Hancock
In an attempt to define more closely the transition from Sn-rich to Sb-rich white beads, the researchers analyzed 198 beads from a number of archaeological sites in western New York state. This revealed that
the arrival of Sb-white soda-glass trade beads began in this region during the period from approximately A.D. 1625-1640, and that they had completely replaced Sn-white beads by A.D. 1675. Specific bead chemistries link a number of the archaeological sites.

Shephard, Christopher

Presents the results of a study aimed at assessing the viability of laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) for identifying shell bead production locales throughout the southern Middle Atlantic. Maryland, Virginia, and North Carolina.

Shi Meiguang, He Ouli, and Zhou Fuzheng

Analysis of different kinds of glass beads, glass ear pendants, and glass cups revealed that most of them belonged to the $K_2O-SiO_2$ glass system. China. In Chinese.

Shi Meiguang and Zhou Fuzheng

Reports the analysis of 12 glass beads and groups them into 3 types: lead-barium, soda-lime, and potash glass. The first is thought to be local, the soda-lime glass may be Western, and the potash glass, which is common in South China, may be local or imported. In Chinese.


The chemical composition of five glass bead samples and the corrosion products of a lead-barium glass rod were analyzed. Two compositional systems were identified: PbO-BaO-SiO$_2$ glasses and soda-lime glasses. China.

Shimada, I., K.B. Anderson, Herbert Haas, and Jean H. Langenheim

Many large amber beads were found in two Middle Sicán shaft tombs at Huaca Loro, Peru. Technical analyses and characterization (figs. 4-5) indicate the amber is probably from a source in Upper Amazonia.

Shortland, A.

Presents an analysis of a rare antimony bead from 3rd millennium B.C. levels at Jerablus Tahtani, near Carchemish in Syria.

Shortland, A.J. and H. Schroeder
Polychrome glass beads found with burials dating to the late 5th century B.C. were analyzed revealing both natron- and plant ash-based flux with distinct rare earth compositions, indicating multiple sites of production, some of which were probably either in the Middle East or on the Indian subcontinent.

**Shugar, Aaron N. and Ariel O’Connor**  
An assemblage of 445 glass trade beads excavated at Old Fort Niagara, Youngstown, New York, were analyzed to determine their manufacturing technology and elemental composition. Analytical techniques included reflected light microscopy, handheld X-ray fluorescence (XRF), and scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDS). Elemental analysis revealed a new turquoise-blue bead composition.

**Siqin, Bilige, Qinghui Li, and Fuxi Gan**  
The beads, dating mainly from the Han Dynasty to the Jin Dynasty, were recovered from several provinces of both China and Vietnam. They were divided into three glass subgroups.

**Smirniou, Melina, T. Rehren, V. Adrymī-Sismani, E. Asderaki, and B. Gratuze**  
Presents the results of LA-HR-ICP-MS analysis of the glass beads (including relief beads) from a Late Bronze Age tholos tomb in Eastern Thessaly, Greece.

**Šmit, Žiga**  
The analysis involves glass artifacts (including beads) dating all the way from the first centuries B.C. up to the early 20th century. Historical questions like the origin of raw materials and classification of glass compositional groups according to individual workshops are addressed.

**Šmit, Žiga, Timotej Knific, David Jezeršek, and Janka Istenič**  
Glass beads from graves excavated in Slovenia and dated archaeologically to the 7th-10th centuries are analyzed using the combined PIXE–PIGE method.

**Sokaras, D., A.G. Karydas, A. Oikonomou, N. Zacharias, K. Beltsios, and V. Kantarelou**  
Focuses on the analysis of an Archaic glass bead collection recently excavated from Thebes, mainland Greece, in order to suggest an optimized and synergistic analytical methodology for similar studies and to
assess the reliability of the quantification procedure of analyses conducted in particular by portable XRF spectrometers.

**Song, Sophy**  

LA-ICP-MS analysis of 75 beads revealed three groups of glass: high alumina glass (m-Na-Al); potash glass (K); and soda-lime glass beads (m-Na-Ca). This reveals that Phum Snay belongs to the Iron Age period which dates from the 4th century B.C. until the 3rd century A.D.

**Starynowicz, M.**  

This site in Poland yielded ca. 900 glass beads, some with zigzag decoration. Plant ash was used as a flux in some, soda in others. The tables are captioned in Polish and English; summary in English.

**Staššíková-Štukovská, Danica and Martin Hložek**  

Microscopic and chemical analysis of the non-metal parts of a bead necklace found with a child interred at the end of the 10th or the 11th century in west-central Slovakia identified the following materials: glass, ceramic, carnelian, and realgar.

**Staššíková-Štukovská, Danica and Alfonz Plško**  

Presents the results of chemical analysis of over 2,000 segmented glass beads.

**Stolyarova, Ekaterina K.**  

Reports on the analyses of vitreous beads from Catacomb (mostly) and North Caucasus graves. Most are faience, probably Egyptian imports. The one glass bead is possibly of double batch glass, soda-lime-silica, made with ash from the roots of *Calidium caspicum* (Russian thistle), dolomitic limestone (?), and copper oxide as a colorant. English summary (pp. 183-184).


A study of the beads of the Late Scythian Culture in the southwestern Crimea; Ukraine.
A female burial was accompanied by a hair adornment composed of glass seed beads and other components. The chemical composition of the beads is provided.

Sugihara, K., M. Satoh, Y. Hayakawa, A. Saito, and T. Sasaki
On the analysis of glass beads made by the Ainu of Japan in the 1800s.

Swann, C.P., P.E. McGovern, and S.J. Fleming
Presents the results of PIXE analysis of multi-colored pendants and beads from the Syro-Palestinian Bronze Age site of Beth Shan, Israel.

Tamura, Tomomi
Japan.

Tamura, Tomomi and Yasuharu Hoshino
Japan.

Tamura, Tomomi and Katsuhiko Oga
Examines the chemical compositions, colorants, and beadmaking techniques of natron glass beads excavated in Japan. The glass is grouped into seven main types, as well as other minor types.

Taniguchi, Yoko, Yoshimitsu Hirao, Yoshiko Shimadzu, and Akira Tsuneki
Three turquoise-blue beads were analyzed by various means. The results indicate that the beads were an alternative to and an imitation of natural turquoise. They have an apatite core with the turquoise color obtained probably by the heating of manganese or iron compounds. The structure suggests mammal tooth or tusk.

Tapia, Alicia H. and Virginia Pineau
Presents the results of morphologic, functional, micro-structural, and chemical analysis of glass beads excavated at the “Cementerio Indígena” site which is connected with the Franciscan mission of Santiago del Baradero founded in 1615 in Buenos Aires, Argentina. In Spanish with English abstract.


Describes the 29 types of European glass beads found with burials at the Cementerio Indígena, Baradero, Argentina. They are attributed to the period from the end of 16th century to the first half of the 17th century. The results of MEB-EDX analysis of 14 of the bead types are also presented.


Amber beads from the hoard, dating from the transitional period between the Late Bronze Age and the Iron Age, were analyzed by Fourier transform infrared spectroscopy-variable angle reflectance (FTIR-VAR) and Fourier transform Raman spectroscopy (FT-Raman). All applied analyses strongly suggest that a large part of the amber from the hoard has a Romanian origin, and no connection with the Central Europe Amber Route.

Thanik Lertcharnrit and A.K. Carter

In Thai.

Then-Obluskaa, Joanna and Laure Dussubieux

Reports on an interdisciplinary study of 35 beads found mostly at Quseir port sites in Egypt; Roman Myos Hormos (1st-3rd c. A.D.) and Late Ayyubid-Mamluk Quseir el-Qadim (13th-14th c. A.D.) periods.

Theune, C., P. Hoffmann, S. Bichlmeier, M. Heck, and J. Callmer

On the determination of the glass matrix of Merovingian glass beads.

Theunisson, R., P. Grave, and G. Bailey

Discusses the use of non-destructive geochemical techniques to source carnelian and agate beads from Southeast Asia and raw material from India and Thailand. Preliminary results suggest that some early beads excavated in Thailand were made from local materials.
Thondhlana, T.P. and M. Martinón-Torres

This investigation introduces a new dimension to the previous typological analyses of the metal bead assemblages from Zimbabwean archaeological sites. It presents the microstructural and chemical characterization of 50 copper-based beads, most of them from Later Farming Community period sites in northern Zimbabwe (A.D. 1000-1900). The analytical study employed optical microscopy, ED-XRF, and SEM-EDS.

Tite, M.S., Y. Maniatis, D. Kavoussanaki, M. Panagiotaki, A.J. Shortland, and S.F. Kirk

The microstructures and chemical compositions of some 15 faience objects from Crete spanning the period from Middle Minoan IIIA through to Late Minoan IA were determined using analytical scanning electron microscopy. These data are useful for inferring the original color of Minoan faience, most of which has suffered severe weathering during burial.

Toffolo, Michael B., Eugenia Klein, Rivka Elbaum, Adam J. Aja, Daniel M. Master, and Elisabetta Boaretto

The microstructure and chemical composition of 8 faience beads from an early Iron Age (12th century B.C.) assemblage found in the ancient port city of Ashkelon are determined by means of FTRI spectrometry, pXRF, microRaman, and SEM-EDS analysis.

Tomková, K., V. Hulínský, and J. Košta

On olive beads and their chemical composition.

Tomková, Katerina and Natalie Venclová

On the archaeology and chemical composition of Bohemian glass jewelry (mostly glass beads) from the Bronze Age to the Early Middle Age.

Tomomi, Tamura

Japan; Iron Age.

Reports on the chemical composition of the beads from the temple in Japan. Numerous macro photographs. Text is in Japanese. See also Katsuhiro (2011).

**Tournié, Aurélie, Linda C. Prinsloo, and Philippe Colomban**


Analysis revealed at least seven different chromophores or pigments, many of which were only manufactured after the 13th century which confirms the presence of modern beads in the archaeological record. This calls for further research to find a way to reconcile the carbon dating of the hill, which currently gives the last occupation date on the hill as 1280 A.D., with the physical evidence of the modern beads.

**Towle, Andrew C.**


This study examines a wide selection of glass artifacts (including beads) recovered from archaeological contexts in northern and central Italy dating to ca. 1200-200 B.C. The chemical analysis reveals a complex picture of glass production which defies the expected pattern, and there is evidence for new compositional types which may yet prove to be diagnostic of highly localized production.

**Towle, Andrew C. and J. Henderson**


Chemical analyses of several objects including Etruscan vessels and glass beads from British collections suggest that a diagnostic Etruscan glass technology was used to make beads rather than the ornate vessels. Italy.

**Towle, Andrew C., Julian Henderson, Paolo Bellintani, and Giovanna Gambacurta**


Discusses the data from the chemical analysis of a group of glasses (beads included) from Final Bronze Age and Iron Age sites in the Po Valley of Italy.

**Vandiver, Pamela and K. Ashhan Yener**


The beads from Nippur, Iraq, are very important early examples (3rd millennium B.C.) of glass technology. The manufacturing process, compositional analysis, color chemistry, and microstructure are discussed.

**Vanhaeren, M., F. d’Errico, I. Billy, and F. Grousset**

Applies 87Sr/86Sr isotope dating to identify the origin of Upper Palaeolithic *Dentalium*-shell beads found with the La Madeleine child burial, Dordogne, France, dated to 10,190±100 B.P.

*Middle Palaeolithic Shell Beads in Israel and Algeria*. *Science* 312:1784-1788.  
Perforated marine gastropod shells at the western Asian site of Skhul and the North African site of Oued Djebbana indicate the early use of beads by modern humans in these regions. Elemental and chemical analyses of sediment matrix adhering to one shell bead from Skhul indicate it dates to 100,000 to 135,000 years ago, about 25,000 years earlier than previous evidence for personal decoration by modern humans in South Africa.

Vanna, L. 2007  

Varberg, Jeannette, Bernard Gratuze, and Flemming Kaul 2015  
Chemical analysis of glass beads found in Denmark reveals surprising evidence for contact in the 14th-12th centuries B.C. between Egypt, Mesopotamia, and Denmark, indicating a complex and far-reaching trade network.

Veiga, J.P. and M.O. Figueiredo 2002  
Reports the results of a photon microprobe (synchrotron radiation XRF) study of blue glass beads of the Nueva Cadiz type uncovered in the center of Lisbon, Spain, aiming ultimately at ascertaining their provenance and place of manufacture.

Vellanoweth, René L. 2001  
Direct AMS radiocarbon dating can be used effectively to examine the stylistic evolution of shell beads and ornaments. As an example, eight *Olivella* grooved rectangle beads, collected from archaeological sites throughout western North America, were dated using the AMS technique. The results produced a consistent suite of dates, clustering between 4400 and 5400 cybp.

Venclová, Natalie, V. Hulínský, J. Henderson, S. Chenery, L. Šulová, and J. Hložek 2011  
*Late Bronze Age Mixed-Alkali Glasses from Bohemia/Skla typu mixed alkali mladší doby bronzové v Čechách*. *Archeologické rozhledy* LXIII:559-585.  
Besides monochrome blue-green glass beads, polychrome beads appear for the first time in Bohemian prehistory in Late Bronze Age contexts of the Knoviz culture (Ha A, 12th-early 11th centuries B.C.). They are formally similar to the beads made in glass workshops in northern Italy. On the basis of chemical analyses, the beads from Bohemia correspond to the North Italian products because they have a
mixed alkali composition, a compositional type unique for its time, thus providing evidence of a likely provenance. Czech Republic.

Vercoutère, C., K. Müller, L. Chiotti, R. Nespolu, A. Staude, H. Rieseimier, and I. Reiche
The Final Gravettian level (level 2) of the abri Pataud (Dordogne, France) yielded a large assemblage of body ornaments that consists essentially of 85 quite standardized rectangular beads. Synchrotron and laboratory X-ray microtomography analysis revealed that most of them were made of ivory.

Verità, Marco
Reports on the chemical composition of 13 glass and faience beads excavated at Fewet.

Virgili, V. and M.F. Guerra
Provides a comparative compositional study of ancient (6th century B.C.) and modern (19th century) gold beads.

von Wedell, Christopher R.
Concludes that morphological and chemical characteristics of glass beads in dated contexts can be used to estimate the age of glass beads in undated contexts using linear regression. The results of this thesis demonstrate that morphological characteristics are currently more accurate and precise than chemistry (LA-ICP-MS analysis) although both methods hold potential for revision and improvement as more dated sites become available to supplement the statistical models.

Wajda, Sylwia
Describes a wide range of drawn, wound, and sintered glass beads from an early medieval site. Includes the results of detailed chemical analysis. In Polish with English summary.

Walder, Heather
Indigenous people of the Upper Great Lakes region crushed and refired glass trade beads to produce new adornment forms during the late 17th and 18th centuries. LA-ICP-MS was used to assess the chemical composition of refired glass pendants and refired fragments from four archaeological sites, as well as glass beads from these and other sites in the region.


To investigate regional differences among bead compositions, 87 turquoise-blue glass beads and 2 remelted glass pendants from five different 17th-century and early-to-mid-18th-century sites were analyzed nondestructively using LA-ICP-MS.


*Walton, M.S., A. Shortland, S. Kirk, and P. Degryse*

The origins of the raw glass used to fashion Mycenaean beads are explored using trace elements analyzed by laser ablation ICP-TOFMS. Some of the beads have compositions that are consistent with an Egyptian origin while others conform to the composition of Mesopotamian glass. These data are the first to demonstrate direct and clear evidence for the trade of raw glass to the Mycenaean states.

*Walz, Jonathan R. and Laure Dussubieux*

Comments on the beads of glass, stone, shell, copper, and ostrich egg shell recovered from contexts attributed to the period from the mid-8th to the mid-10th century.

*Wang, Kuan-Wen*

SEM-EDS and EPMA analysis was conducted on glass beads from four sites in Taiwan: Kiwulan (A.D. 700-1200), Kueishan (A.D. 400-700), Taoyeh (A.D. 200-600), and Wuchientso (A.D. 600-1000).

*Wang, Kuan-Wen and C. Jackson*

Reviews the chemical compositions of glass in Taiwan, Southeast Asia, and southern China, in an attempt to understand the potential relationships between the three regions.
Wang Bo and Lu Lipeng

On the glass beads recovered from the two cemeteries in western China including chemical analysis.

Warashina, T.

Japan. In Japanese.


Japan. In Japanese.

Wärmländer, Sebastian K.T.S., Davide Zori, Jesse Byock, and David A. Scott

Includes x-ray diffraction (XRD) analysis of several glass beads.

Watts, S., A. Pollard, and A.M. Pollard

The aim was to distinguish between jet, cannel coal, lignite, and torbanite, all materials used to make black shiny ornaments, including beads. Analyses were on a single geological sample of each material type but research demonstrates the potential for characterizing jet and other workable black lithic material.

Welter, N., U. Schüssler, and W. Kiefer

Ancient colored glass beads from Sri Lanka and Oman were analyzed by Raman microspectroscopy for identification of inorganic pigments in the glass. Calcium phosphate (Ca₃(PO₄)₂), cassiterite (SnO₂), cuprite (Cu₂O), and a Pb(Sn,Si)O₃-type lead tin oxide were found to be used as coloring agents. Moreover, a distinction between lead-based and alkali-based glass matrices could be made. Electron microprobe analysis and X-ray diffractometry were performed to show the capability of Raman microspectroscopy in comparison to these methods for answering archaeological questions.

Various analytical techniques were utilized to characterize the composition of glass eye beads with a black body and dark blue/ocher/white eyes.

Won-in, K., Y. Thongkam, T. Kamwanna, and P. Dararutana

Compositional analysis revealed that copper was the principal colorant. Titanium, a common impurity in sand, was also present.

Wood, Marilee, Laure Dussubieux, and Peter Robertshaw

LA-ICP-MS analysis of glass beads, vessel shards, and wasters from the site has brought to light a new bead series for the region that may push trade there back to the 7th century.

Wood, Marilee, Serena Panighello, Emilio F. Orsega, Peter Robertshaw, Johannes T. van Elteren, Alison Crowther, Mark Horton, and Nicole Boivin

A sample of the beads recovered from the 7th-10th-century sites of Unguja Ukuu and Fukunchi on Zanzibar Island was analyzed by LA-ICP-MS to determine the origins of the glass, and potential trade relationships are considered.

Xiaqi Wang, Yun’ao He, and Yuan Lin

The site produced glass beads dated to the 3rd-10th centuries A.D. They were mostly monochrome dark red, translucent blue, opaque yellow and translucent green, many of them remarkably tiny, and composed of Na₂O-Al₂O₃-CaO-SiO₂ glass, but their origin remains unclear.

Yamasaki, K.

Yang Ju, Zhao Hong-Xia, and Yu Pu

Belonging to the Qing Dynasty, the beads belong to the Na₂O-CaO-SiO₂ glass type with Cu and Co as the major coloring elements.

Yimin Yang, Lihua Wang a, Shuy a Weia, Guoding Song, J. Mark Kenoyer, Tiqiao Xiao, Jian Zhu, and Changsui Wang
Dragonfly-eye beads are considered to be the earliest types of glass objects in China, and in the past have been considered as evidence of culture interaction or trade between West and East Asia. However, synchrotron radiation microcomputed tomography and μ-probe energy dispersive x-ray fluorescence analysis of four dragonfly-eye beads indicates that these beads were not imported from the West.

**Ying-San Liou, Shih-Chung Wang, and Yi-Chang Liu**


Micro-Raman spectroscopy, μXRF, and XPS analysis are used in combination to examine ten ancient glass beads excavated from the Chungde site, Hualien, Taiwan, dated back to 1500-1800BP, to determine the mineralogical and chemical compositions.

**Yuryeva, Tatyana V. and Vladimir A. Yuryev**


Explores the internal microstructure of degrading blue-green historical beads and its evolution in the process of bead deterioration. Possible physical factors resulting in the destruction of the beads are discussed.

**Zerboni, Andrea and Pietro Vignola**


The first archaeometric study carried out on green stone beads found at Garamantian archaeological sites in the central Sahara.

**Zhang Fu-Kang, Cheng Zhu-Hai, and Zhang Zhi-Gang**


This study reveals that beads excavated from tombs of the West Zhou Dynasty are not glass but composed of quartz granules fused together by a small amount of flux. Thus it appears that the original belief that Chinese glass manufacture originated during the West Zhou Dynasty is incorrect.

**Zhang Zhiguo and Ma Qinglin**


Discusses the chemical composition and manufacturing technology.

**Zhao, Hongxia, Huansheng Cheng, Qinghui Li, and Fuxi Gan**


The samples were primarily plain and eye beads recovered from sites in Henan, Hubei, and Jiangsu, China. They are assigned to three glass systems.
Zhao, Hongxia, Qinghui Li, S. Liu, L. Li, and F.X. Gan
2014 In Situ Analysis of Stratified Glass Eye Beads from the Tomb of Marquis Yi of the Zeng State in Hubei Province, China Using XRF and Micro-Raman Spectrometry. X-Ray Spectrometry 43(6). Dating to the Warring States Period, most of the beads belong to the typical soda-lime-silicate glasses with low amounts of MgO and K₂O.

Zhao, H.X., Q.H. Li, S. Liu, and F.X. Gan
2013 Characterization of Microcrystals in Some Ancient Glass Beads from China by Means of Confocal Raman Microspectroscopy. Journal of Raman Spectroscopy 44(4):643-649. The beads were excavated from different regions of China, including Xinjiang, Henan, Hubei, and Guangxi provinces, and date mainly to the 10th century B.C. to the 9th century A.D.

Zhou Gu, Jian Zhu, Yaoting Xie, Tiqiao Xiao, Yimin Yang, and Changsui Wang
2014 Nondestructive Analysis of Faience Beads from the Western Zhou Dynasty, Excavated from Peng State Cemetery, Shanxi Province, China. Journal of Analytical Atomic Spectrometry 29:1438-1443. The beads could be divided into two types: glazed faience and glassy faience. It is inferred that these beads were first formed on an organic cylinder and then glazed using the direct application method. They appear to have an indigenous origin in China.

Zuliskandar Ramli and Kamaruddin Zakaria

Zuliskandar Ramli, Nik Hassan Shuhaimi, Nik Abdul Rahman, and Abdul Latif Samian