ARCHAEOMETRIC ANALYSIS

This portion of the bibliography deals specifically 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.

Abe, Yoshinari, Ayana Nakamura, Shusaku Suzuki, Kriengkamol Tantrakarn, Izumi Nakai, Judit Zöldföldi, and Peter Pfälzner
Analysis of a number of greenstone objects identified several beads and pendants as being made of variscite. This is the first scientific evidence of the use of this material for personal ornaments during the Lower Bronze Age in the Middle East.

Abel, Timothy J., James W. Bradley, and Lisa Anderson
XRF analysis of four copper beads – some of which were believed to be European – revealed that they are all made of native copper, confirming that there is no verifiable evidence of European trade goods among the precontact Iroquoian people of northern New York.

Abel, Timothy J. and Adrian L. Burke
Concludes that, while not precise enough to source native coppers, XRF is a cheap, nondestructive method for differentiating native copper from its European counterparts at 16th- and 17th-century Late Woodland sites. The analyzed material included beads and pendants.
Acevedo, Natalia, Marion Weber, Antonio García-Casco, Joaquín Antonio Proenza, Juanita Sáenz, and Agustín Cardona
Archaeometric analyses (Raman Spectroscopy Analysis, X-Ray Diffraction, and Electron Microprobe Analysis) of greenstone beads have revealed that they are made of variscite-group minerals.

Acevedo, Natalia, Marion Weber, Joaquín Antonio Proenza, Antonio García-Casco, and Juanita Sáenz-Samper
Provides a detailed characterization of the texture, mineralogy, and chemical composition of variscite beads which belong to the Nahuange (AD 100-1000) and Tairona (AD 1000-1600) societies of the Sierra Nevada de Santa Marta region of northern Colombia.

Adrimi-Sismani, Vassiliki, Maria Filomena Guerra, and Philippe Walter
Reports on the compositional analysis and production techniques of gold necklace beads found at a Mycenaean tholos tomb at Volos, Greece, and dated to 1350 BC.

Agha-Aligol, Davoud, Moslem Jafarizadeh, Mehdi Rahbar, and Mahmoud Moradi
Reports on the composition of bead and glass vessel fragments from a site in Iran. In Arabic with English summary.

2017  Chemical-Physical Characterisation of Early Iron Age Glass Beads from Central Europe. *Boletín de la Sociedad Española de Cerámica y Vidrio* 56(3).
The main objective was to attain information on the production technology and conservation state of mostly decorated beads from sites (6th-4th centuries BC) in west Poland and south Germany.
Aguilar-Melo, Valentina, Alejandro Mitrani, Edgar Casanova-Gonzalez, Mayra D. Manrique-Ortega, Griselda Pérez-Ireta, José Luis Ruvalcaba-Sil, Alejandro Tovalín-Ahumada, Julia Leticia Moscoso-Rincón, Alejandro Seshenña-Hernández, and Josuhé Lozada-Toledo
2019 Molecular and X-ray Spectroscopies for Noninvasive Characterization of Mayan Green Stones from Bonampak, Chiapas. Applied Spectroscopy; https://www.academia.edu/40386033/. Several spectroscopic techniques were used in a complementary way to characterize a number of greenstone beads found with a burial of the classical period (4th-9th centuries AD) located in the southern state of Chiapas, Mexico.

Aldenderfer, Mark and Laure Dussubieux

Allen, Lindy, Sarah Babister, Elizabeth Bonshek, and Rosemary Goodall
2018 Finding the Signatures of Glass Beads: A Preliminary Investigation of Indigenous Artefacts from Australia and Papua New Guinea. Journal of the Anthropological Society of South Australia 42:48-80; https://www.academia.edu/38426780/. Presents the results of chemical analysis of a sample of beads on objects from the collections at Museums Victoria in Melbourne, as well as a comparative set of beads on objects from neighboring Papua New Guinea. Done to gain a broader understanding of possible pathways along which beads and beaded objects made their way into the Pacific during the colonial and pre-colonial eras, and to consider the possibility of common origins with those found in Aboriginal objects.

Amrein, Heidi and Sophie Wolf

Anderson, K.B. and W. Bray
Geochemical analysis of pre-Columbian beads collected from a lake in central Colombia establishes that they are fabricated from Class Ib amber, possibly from a unique local or regional source.

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. Bellintani, Valeria Diella, Mauro Gemmi, A. Polla, and Antonella Rossi

Reports on the chemical composition of glass scrap and beads recovered from Frattesina. They represent the only evidence of Final Bronze Age (1200-1000 BC) glass working processes in Europe.

Angelini, I., G. Artioli, P. Bellintani, V. Diella, A. Polla, G. Recchia, and G. Residori

A typological and archeometric study of the glass and faience beads recovered from two sites in southern Italy within the context of the Italian Bronze Age civilization. Much comparative material.

Angelini, I., G. Artioli, P. Bellintani, 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

Analysis of amber beads from sites dating from the Middle Bronze Age to the Iron Age in northern and southern Italy reveals that all but five of the 35 specimens are composed of Baltic succinite amber.
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, Ivana, Cinzia Bettineschi, and Bernard Gratuze
Analysis of 56 glass ornaments (beads included) from the necropolis of Montabone (late 3rd-late 2nd century BC) in northern Italy revealed they comprise glasses of Celtic typologies.

Angelini, Ivana, Cinzia Bettineschi, Alessandra Menegazzi, Gianmario Molin, and Paola Zanovello
Analysis of a sample of beads recovered from Tebtynis, a city in Lower Egypt established during the 12th dynasty, revealed that most of them were made of faience.

Angelini, Ivana, Bernard Gratuze, and Gilberto Artioli
2019 Glass and Other Vitreous Materials through History. EMU Notes in Mineralogy 20(Chapter 3):87-150; https://www.academia.edu/68841446/.
The nature and properties of vitreous materials are summarized briefly, with an eye to the historical evolution of glass production in the Mediterranean world. Focus is on the evolution of European, Egyptian, and Near East materials. The most common techniques of mineralogical and chemical characterization of vitreous materials are also described.

Angelini, I., C. Nicola, G. Artioli, R. DeMarinis, M. Rapi, and M. Uboldi
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.

Angelini, Ivana, Cinzia Bettineschi, and Bernard Gratuze
Reports on the compositional analysis 56 glass beads and bracelets recovered from the necropolis of Montabone, northern Italy, and dated from the end of the 3rd to the end of the 2nd century BC. The collection comprises glasses of Celtic typologies.

Angelini, I., A. Polla, B. Giussani, P. Bellintani, and G. Artioli
Analysis of glass ingot fragments, beads, and other ornamental objects found at Frattesina reveals the glass invariably belongs to the low-magnesium, high-potassium (LMHK) mixed-alkali glass group that is generally considered typical of protohistoric European glass production.

Anikeeva, O.V., R.R. Ruslanova (Tamimdarova), and R.Kh. Khramchenkova
Describes a wide variety of stone, amber, glass, and coral beads. The chemical composition of some of the glass beads is provided.

Apolinarska, Karina and Aldona Kurzawska
This study aims to determine the origin of disc shell beads excavated in Poland by analyzing, for the first time, their carbon and oxygen stable isotope compositions and comparing the results with C and O isotope ratios in modern shells sampled in central Poland.
Arai, Saki, Shinsuke Baba, Izumi Nakai, Kazuyuki Nakamura, and Naoya Tsukad
Dating to the 15th-19th centuries, the beads can be classified into two types: lead-potash-silicate glass (K2O-PbO-SiO2) and potash-lime-silicate glass (K2O-CaO-SiO2). Japan. In Japanese.

Arletti, Rossella, Erica Bertoni, Giovanna Vezzalini, and Davide Mengoli
Fifteen blue, turquoise, and dark green glass beads of the 8th-7th centuries BC 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 archaeometrical investigation performed on a series of opaque pre-Roman glass objects including beads, pendants, and a spindle-whorl dating from the 6th-4th centuries BC. 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 BC 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.

Arnoldussen, Stijn, Hans Huisman, Pepijn van de Geer, Jos Kleijne, and Bertil van Os
Contextualizes glass ornaments from Dutch later prehistory (2000-12 BCE; Bronze Age up to the Late Iron Age) with special attention to chronology, the ways in which glass was used in ornament traditions, the state and context of their deposition, and shifts in composition and glass technology.
Ashkenazi, D., H. Gitler, A. Stern, and O. Tal
This report gives us a better understanding of technological abilities in the province of Samaria during the late Persian period as regards the production of beads and other ornaments. Includes compositional data. Israel.

Ašperger, Danijela, Sena Jorgić, Anita Rapan Papeša, Stjepko Fazinić, and Marija Trkmić
Reports the results of two different methods used for analyzing selected glass beads from an Avar-period cemetery at the Nuštar Dvorac site in Croatia.

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).

Atasayar, Z., Ö.O. Öztürk, M. Bakiler, and O. Destanoğlu
Aims to identify the recipe used to make glass beads recovered from the Mound of Van Fortress in Urartu, eastern Turkey, using ICP-MS technology.

Aurisicchio, Carlo, Alessia Corami, Sylvana Ehrman, Giorgio Graziani, and Stella Nunziante Cesaro
EPMA and microFTIR analysis of the emerald beads, dating from the 1st century AD, suggests they are of Egyptian origin.

Azemar R., Y. Billaud, G. Costantini, and B. Gratuze
On the chemical analysis of protohistoric glass beads found at Aveyron in southern France.
Baba, Shinsuke, Kazuya Yanase, Aiko Imai, Izumi Nakai, Yasukazu Ogawa, Kenichiro Koshida, and Kazuyuki Nakamura
Belonging to the period from the mid 14th to the 19th century AD, the beads are of two types: lead-potash silicate glass and potash-lime silica glass. In Japanese with English abstract. Japan.

Babalola, Abidemi Babatunde
Drawing from archaeological and historical evidence from Ile-Ife, in tandem with the result of compositional analysis, this article examines the first recognized indigenous Sub-Saharan African glass technology dated to early 2nd millennium AD or earlier.

Babalola, Abidemi Babatunde, Laure Dussubieux, and Susan Keech McIntosh
Provides new data supporting the case for primary glass production at Igbo Olokun, Nigeria, and summarizes what is known of the regional and trans-regional distribution of this high-alumina glass.

Babalola, Abidemi Babatunde, Laure Dussubieux, Susan Keech McIntosh, and Thilo Rehren
Analysis of 52 beads has revealed that none matched the chemical composition of any other known glass-production area in the Old World, including Egypt, the eastern Mediterranean, the Middle East, and Asia. Rather, the beads have a high-lime, high-alumina (HLHA) composition that reflects local geology and raw materials.

Babalola, Abidemi Babatunde, Susan Keech McIntosh, Laure Dussubieux, and Thilo Rehren
The recovery of glass beads and associated production materials from a site in Nigeria has enabled compositional analysis of the artifacts and preliminary dating of the site, which puts the main timing of glassworking between the 11th and 15th centuries AD.
Babalola, Abidemi and Thilo Rehren
Presents the results of the classification, macro/microstructural, and compositional analyses carried out on glass-working and possibly glassmaking crucibles excavated at Igbo Olokun, Ile-Ife. Drawn-bead production waste was also recovered.

Introduces and outlines the five articles on research (including elemental analysis) on glass beads in Sub-Saharan Africa which appear with this article.

Babalola, Abidemi Babatunde, Thilo Rehren, Akinlolu Ige, and Susan McIntosh
Provides an in-depth examination of numerous crucible fragments recovered from 11th to 15th-century deposits in order to understand the quality of the crucibles, their typology, and their functions in glassworking/making. Compositional analysis of a sample of the thousands of excavated glass beads indicates that the crucibles were used to melt the glass used for their production.

Baehre, Oliver, Gert Kloess, Dietrich Raue, Tom Muenster, and Alexandra Franz

Bagdzevičienė, J., C. Niaura, E. Garškaitė, J. Senvaitienė, J. Lukšienienė, and S. Tautkus
Various analytical methods were used to identify the chemical composition and characterize the pigments of glass beads dating back to the 13th-14th centuries.

Bagherpour Kashani, Natascha
https://www.academia.edu/74606881/.
A special rural sanctuary of pre- and early Zoroastrian cults yielded a variety of glass, stone, amber, and metal beads and pendants. Their typology, production techniques, and chemical composition are discussed.
Bagherpour Kashani, N., K. Roustaei, and T. Stöllner
2011 Iron Age Amber Beads from Vešnave/Iran. Archäologische Mitteilungen aus Iran und Turan 43:71-78.
Various bead forms were recovered. Infrared spectroscopy revealed that the beads originated in the Baltic region.

Bahadori, Roya and Davoud Agha-Aligol
Reports on the chemical composition of glass beads forming personal ornaments recovered from Tepe Hissar, Damghan (3rd millennium BC) and Tepe Nesfi, Gilan (1st millennium BC).

Bajnóczi, Bernadett, Krisztián Fintor, Máté Szabó, and Mária Tóth
Analysis revealed that the glass beads were produced, at least partially, using a plant-ash alkali flux.

Bajnóczi, Bernadett, Gabriella Schöll-Barna, Nándor Kalicz, Zsuzsanna Siklósi, George H. Hourmouziadis, Fotis Ifantidis, Aikaterini Kyparissi-Apostolika, Maria Pappa, Rena Veropoulidou, and Christina Ziota
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.

Bandama, Foreman
Despite the title, this thesis also deals with the beads of glass, mollusc shell, ostrich eggshell, and bone recovered from two sites: Rhenosterkloof 1 and Tembi 1. The glass specimens are attributed to the Khami Series (14th-17th centuries). Compositional analysis is included.
Bandama, Foreman, Shadreck Chirikure, Simon Hall, and Christel Tinguely
Reports on 25 glass beads dating to the 15th-19th centuries recovered from two sites: Smelterskop and Rhenosterkloof 1.

Bărbat, Ioan Alexandru, Tudor Tămaș, and Simona Cîntă Pînzaru
Analysis of a greenish stone bead using X-ray diffraction and Raman spectrometry revealed the object is carved from a metamorphic rock, probably a green schist or chlorite schist.

Barfod, Gry H., Claus Feveile, and Søren M. Sindbæk
Reports on the LA-ICP-MS analysis of glass recovered from two bead-making workshops in the 8th-century trading emporium of Ribe.

Baron, Anne, Adrian L. Burke, Bernard Gratuze, and Claude Chapdelaine
LA-ICP-MS analysis revealed the use of steatite from only carbonate rocks and not steatite hosted in ultramafic rocks, which is different from most previous studies. Moreover, relationships between a limited number of sources and some archaeological artifacts have been identified.

Barroso Bermejo, Rosa, Carlos P. Odriozola, Primitiva Bueno Ramírez, Rodrigo Villalobos García, Rodrigo Balbín Behrmann, and José María Martínez Blanes
This study reports on the morphology and mineral composition of a quadrangular pendant and 341 stone beads, most of which are made of variscite, a mineral that became especially important for adornments on the Iberian Peninsula in the 3rd millennium BC.
Bar-Yosef Mayer, Daniella E. and Naomi Porat
Describes the typology of the stone and shell beads and assesses their possible sources. Includes archaeometric analysis.

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.
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 BP) at the Ille Site, Northern Palawan, Philippines.

Four Metal Age shell beads exhibiting unique residues (black, yellow, red, and high-fiber) were examined using Scanning Electron Microscopy (SEM), revealing that the appliqués included plant fibers and were applied as a viscous material and allowed to dry.

Bassett, Madeleine Gunter, Christopher M. Stevenson, and Laure Dussubieux
The data suggest that much of the native copper that circulated through interior trade networks came from more-distant deposits (e.g., Michigan), rather than from sources in the Blue Ridge Mountains of Virginia.

Bayley, Justine
Glass beads; Scotland.

Becerra, María Florencia, Beatriz N. Ventura, Patricia Solá, Mariana Rosenbusch, Guillermo Cozzi, and Andrea Romano
2021 Arqueomineralogía de cuentas de los valles orientales del norte de Salta, Argentina. 
Boletín del Museo Chileno de Arte Precolombino 26(1):93-112; 
https://www.academia.edu/49999662/.
On the archaeomineralogy of beads from the Eastern Valleys of Northern Salta, Argentina. 
Beads made of turquoise, sodalite, opal tuff, slate, glass, and shell. Includes the archaeometric analysis of 27 stone beads using SEMK-EDX and XRD.

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
Greek, Roman and Byzantine Studies 36(2):119-135.
The beads are nearly all Baltic amber but a few are probably Sicilian simetite.

Beck, Curt W. and S. Shennan
Definitive and indispensable study with a catalog of the beads (with many drawings and sections), spectrographic analysis results, and a discussion of manufacturing techniques, social significance, and chronology.

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

Behar, Adi Eliyahu, Shira Albaz, Itzhaq Shai, Aren M. Maeir, and Haskel J. Greenfield
The beads were subjected to analysis by FTIR spectrometry in order to identify the mineralogy and materials used for their production. The materials identified include faience, carnelian, steatite, and shell.
**Bellintani, Paolo**
On the chemical composition of glass and faience beads dating to the 21st-9th centuries BC.
Also discusses Bronze Age “glass routes” in the central Mediterranean.

**Bellintani, Paolo, Ivana Angelini, Gilberto Artioli, and Angela Polla**
 Presents the archaeometrical characterization of an amber bead (Baltic succinite) and a glass bead (high-magnesium glass) found in layers dated to the beginning of the Middle Bronze Age at a site at Lago di Albano, Rome, Italy.

**Beltsios, Konstantinos G., Artemios Oikonomou, Nikolaos Zacharias, and Pavlos Triantafyllidis**
 SEM-EDS analysis was used for the compositional characterization of two ancient glass bead collections, a late 7th-century BC Archaic collection from Rhodes Island and an Archaic to Hellenistic collection from mainland Greece (Thebes).

**Bente, Klaus, Christoph Berthold, Melanie Keuper, Axel Gerdes, Jörg Ansorge, and Andreas König**
 Analysis of a coral necklace from a medieval Hanseatic town in Germany revealed it was genuine red coral from the Mediterranean Sea, and corresponding trade routes towards central Europe can therefore be suggested. See also Ansorge and Kaute (1999) in the Europe section.

**Bente, Klaus, Christoph Berthold, Richard Wirth, Anja Schreiber, and Andreas König**
 Analysis confirms that the beads are made of red precious coral, identical with modern *Corallium rubrum* from the Mediterranean.
Bente, Klaus, Marco Schrickel, Jörg Frase, and Alexandra Franz  

Analysis of a bead-decorated fibula (called Mitteldeutsche Korallenfibeln and dating to the Early Iron Age) excavated near Hänichen in east-central Germany, reveals that the beads may be fossil material and not necessarily coral.

Bentz, Marc, Frank Falkenstein, Christoph Herbig, Ulrich Himmelmann, Christof Kneisel, Stephanie Mildner, and Nils Ostermeier  

Section 5 reports on the chemical composition of the glass beads recovered from a hilltop settlement of the Urnfield culture in southwestern Germany.

Berón, Mónica Alejandra  

Investigates the raw materials, contexts, and significance of green necklace beads recovered from a hunter-gatherer cemetery in central Argentina.

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, Rajmund Mokso, and Eva M. Krupp**
The innovative application of X-ray micro-computed-tomography (µCT) with synchrotron light permitted the identification of characteristic features and markings typical of specific low temperature glass working techniques, and also added to the evidence for local manufacture.

**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 AD. 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.

**Bettineschi, Cinzia, Ivana Angelini, Elisabetta Malaman, and Bernard Gratuze**
Discusses the forming techniques, the raw materials, and the provenance of the base glass of beads recovered from Tomb 9 at the Punic Nora Cemetery on Sardinia, Italy.

**Bettineschi, Cinzia, Alessandra Menegazzi, Gianmario Molin, and Paola Zanovello**
Reports on the identification of the materials composing beads recovered from Tebtynis (Fayyum) in Ancient Lower Egypt. Most of the specimens are made of faience but there are also examples of stone and shell beads.

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.

Biermann, Felix, Andreas Kieseler, Ernst Pernicka, and Jasper von Richthofen
Hacksilver material from the Oder-Neisse area of Lower Silesia, Germany, includes filigree beads which are examined from an archaeological and archaeometric perspective.

Billaud, Y. and B. Gratucze
Chemical analysis of Late Bronze Age glass beads of the Rhodano-Alpine area of France.
Billeck, William T. and Meredith P. Luze
Glass trade beads recovered at nine sites in Brazil and Guyana during the 1940s-1950s can be readily dated using bead chronologies developed in North America. The assemblages date to multiple time periods ranging from the early 17th to the mid-20th century. Compositions were determined using pXRF.

Billeck, William T. and Kendra McCabe
A pXRF study of 485 beads from 14 sites demonstrates that while white beads look highly similar, their chemical composition changes over time due to the use of different opacifiers.

Biron, Isabelle, Valérie Matoïan, Julian Henderson, and Jane Evans
On the composition of glass beads discovered in a ceramic jug from a Late Bronze Age context.

Blackwell, Alice and Susanna Kirk
Reconsiders glass beads that have hitherto been regarded as early medieval in date and proposes a manufacture date for them between the 17th and 19th centuries on the basis of typological parallels and XRF and SEM-EDS surface analysis of the glass composition.

Blair, Elliot H.
XRF analysis of 783 specimens of four varieties of drawn white glass beads from burial contexts at the mission demonstrate that “opacifer-dating” is applicable to Spanish colonial sites in the southeastern United States.

Blair, Elliot H. and Laure Dussubieux
Discusses the results of LA-ICP-MS analysis of 20 type IIa40 beads recovered from 17th-century Mission Santa Catalina de Guale, St. Catherines Island, Georgia, considering the temporality and origins of these artifacts.


Blankenship, Sarah A., Bruce Kaiser, and Michael C. Moore 2013 X-Ray Fluorescence Analysis of Two Metal Beads from the David Davis Farm Site (40HA301), Hamilton County, Tennessee. Tennessee Archaeology 7(1):78-82; https://www.academia.edu/9714058/. Analysis of the beads – indicative of direct or indirect Spanish contact – revealed they were manufactured from a lead-bismuth alloy plated with silver.


The combined use of multiple analytical techniques allowed the elemental and isotopic characterization of a sample of polychrome and colorless glass artefacts (beads included) in order to examine their provenience.

Bo, Ma, Gan Fuxi, Feng Xiaoni, Gao Menghe, and Shen Shifang
Reports the results of PIXE analysis of glass beads from sites in southwestern China that date from the Warring States to the Six Dynasties period.

Bo, Wang and Lipeng Lu
On the glass beads recovered from two cemeteries in western China including chemical analysis.

Bondár, Mária, Attila Demény, Péter Németh, Máté Karlik, Krisztián Fintor, and Mária Tóth
2021 Különleges „gagát” gyöngy egy különleges késő rézkori sírból / Special “Jet-Like” Bead from a Special Late Copper Age Grave. Archeometriai Műhely XVIII(2):143-156; https://www.academia.edu/89902379/.
The burial of an 8/9-year-old child uncovered in southwestern Hungary was accompanied by a bracelet of almost pure copper, a black bead at the neck, and a bead hammered from sheet copper. Archaeometric analysis of the black bead indicates it is made from a carboniferous coal, most likely from Spain or France.

Bonneau, Adelphine, Réginald Auger, and Jean-François Moreau
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, Adelphine, Jean-François Moreau, Réginald Auger, R.G.V. Hancock, and Bertrand Émard
Presents the findings of previous bead studies as well as the results of an analysis of white glass beads from site CI-Fi-10 in Quebec, Canada, carried out by microscope, SEM-EDS, X-ray fluorescence, Raman spectrometry, neutron activation, and LA-ICP-MS.


Ten beads recovered from an Amerindian site in Quebec were analyzed using microscopy, Raman spectroscopy, and instrumental neutron activation analysis to evaluate possible impacts of neutron activation on glass, and to assess the feasibility of Raman analyses after INAA.

**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.

**Bonomo, Mariano, Edgardo D. Cabanillas, and Ricardo Montero**


Concludes that the metal pendants and beads recovered from 12th-15th-century sites in the Paraná Delta were manufactured from copper by casting in open molds and hammering.

**Boonruang, C., K Won-in, and P. Dararutana**

Analysis of several colors of glass beads revealed that most of them have alkali-based matrices.

**Boschetti, Cristina, Bernard Gratuze, Marco Cavalieri, Sara Lenzi, and Nadine Schibille**

A glass-recycling furnace at the site in northern Italy was originally interpreted as a bead workshop. A detailed study of the typology, technology, and chemical composition of the associated beads clearly excludes local production.

**Boschetti, Cristina, Bernard Gratuze, and Nadine Schibille**

Discusses the provenance, economic value, and social significance of glass beads from a cemetery in northern Italy utilized from ca. 570 to the end of the 7th century AD. The different chemical compositions and specific forming technologies have identified European, Egyptian, Mesopotamian and Asian specimens.

**Bottman, Tobin C.**

**Braje, Todd J., Torben C. Rick, and Jon M. Erlandson**

Direct accelerator mass spectrometry (AMS) radiocarbon dating of one giant rock scallop ornament and two beads from San Miguel Island extends the use of this shell for personal adornment to at least 8000 cal BP.

**Brasser, Jan Paul**

Attempts to source the jet used to produce various ornaments, including beads, and to determine whether the polish on these objects is intentional or the result of use. Netherlands.

**Braziewicz, Janusz, Maciej Karwowski, and Marian Jaskóla**
Applies X-ray fluorescence analysis to the determination of element concentrations in Celtic glass artifacts from Poland, beads included. English summary.

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.

Breukel, T.W. and C.G. Falci
Reports on the experimental replication of techniques used for splitting, abrading, carving, and perforating a variety of shell species and rock types using tools made of flint, bone, coral, coarse and fine-grained sandstone, and shell.

Brill, Robert H.
Reports on the chemical composition of glass samples (mostly beads of the 200 BC-AD 200 period) recovered from sites in India.

http://d3seu6qyu1a8jw.cloudfront.net/sites/default/files/collections/50/5052FA17-E769-478E-A9B4-0F89C6458478.pdf.
Results of a lifetime’s research on glass from all areas and periods. Invaluable database for all interested in glass technology.

Brill, Robert H., I. Lynus Barnes, Stephen S.C. Tong, Emile C. Joel, and Martin J. Murtaugh
Presents the results of compositional analysis of the small green-glass beads recovered from a site possibly visited in 1492 by Christopher Columbus.
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 seven supplementary papers. See Sprague (1992) for a review.

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 BC.

Brill, Robert H., Robert D. Vocke, Jr., Wang Shixiong, and Zhang Fukang
A follow-up to the previous article.

Bruni, Y., F. Hatert, P. George, and D. Strivay
Dating to the early 15th century, the bust is adorned with various stones and glass beads. The latter have a soda-lime composition, confirming that they are contemporary with the bust and imported from Venice.

Buc, Natacha, Romina Silvestre, Alejandro Acosta, and Daniel Loponte
https://www.academia.edu/34829945/.
Aims to geochemically characterize green lithic beads made by Late Holocene hunter-gatherer groups in order to determine if they are made of copper-rich rocks and to evaluate their sources.

Bugoi, Roxana, Andrei Măgureanu, Despina Măgureanu, and Quentin Lemasson
Reports the PIXE-PIGE data obtained at AGLAE accelerator on 135 glass beads discovered at Sărata Monteoru and Bratei, Romania, dated to 6th-7th centuries AD.
Bugoi, R., A. Târlea, V. Szilágyi, I. Harsányi, L. Cliante, and Z. Kasztovszky
2022 Colour and Beauty at the Black Sea Coast: Archaeometric Analyses of Selected Small Finds from Histria. *Romanian Reports in Physics* 74(1).

Reports on the chemical composition of a small group of glass beads of various dates from a site in Romania.

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.

Buntem, Radchada, Blythe McCarthy, and Chawalit Khaokhiew

Various glass beads dating to around 2500-1200 BP housed in the Banraiprachasawan museum were studied to determine their elemental compositions and morphology.

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.

Burns, Gregory Robert

Isotopic evidence suggests most *Olivella* beads used in Central California during the Middle/Late Transition (930-685 BP) were manufactured at small, dispersed production centers from local shell sources.

Bursalı, A., H. Özbal, R. Özbak, G. Şimşek, B. Yaşcı, C. Yılmaz Akkaya, and E. Baysal
2017 Investigating the Source of Blue Color in Neolithic Beads from Barçın Höyük, NW Turkey. In *The Exploitation of Raw Materials in Prehistory: Sourcing, Processing and
Reports on the analysis of turquoise-blue beads found at the 7th-millennium Neolithic site of Barcin Höyük in northwestern Anatolia (Turkey), and explores the way in which the social desire for ownership of the color blue in the seemingly egalitarian and homogenous Neolithic period may have functioned.

Cagno, Simone, Peter Cosyns, Veerle Van der Linden, Olivier Schalm, Andrei Izmer, Isolde Deconinck, Frank Vanhaecke, Anna Nowak, Barbara Wagner, Ewa Bulska, Karin Nys, and Koen Janssens
The collected data show that a change in the black-glass production process occurred about AD 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.

Calo, Ambra, Peter Bellwood, James W. Lankton, Andreas Reinecke, Rochtri A. Bawono, and Bagyo Prasetyo
Excavations at a stone sarcophagus burial site on Bali, Indonesia, have yielded the largest collection of Roman gold-glass beads in early Southeast Asia found to date. Analyses of these finds and comparison with others from across the region provide insights into the early to mid 1st-millennium AD trans-Asiatic networks that linked Southeast Asia to South Asia, the Roman world, and China.

Provides data on the composition of both glass and gold beads recovered from burials dated to the late 2nd century BC. The findings suggest strong links with the Indian subcontinent and
Mainland Southeast Asia from the late first millennium BC, some 200 years earlier than previously thought.

Campbell, Roberto, Hugo Carrión, Valentina Figueroa, Ángela Peñaloza, Maria Teresa Plaza, and Charles Stern 2018 Obsidianas, turquesas y metales en el sur de Chile. Perspectivas sociales a partir de su presencia y proveniencia en Isla Mocha (1.000-1.700 d.C.) [Obsidian, Turquoise, and Metals in Southern Chile. Social Perspectives from their Presence and Provenance in Mocha Island (AD 1000-1700)]. Chungara Revista de Antropología Chilena; https://www.academia.edu/36494575/.

Compositional analyses performed on obsidian pieces, turquoise beads, and metallic artefacts from Mocha Island suggest a high mobility scenario for these goods for the last 1000 years in Southern Chile.


While technological analysis suggests that 105 obsidian beads found in a tomb of the Early Dynastic period (ca. 2700 BC) at Kish, southern Iraq, were made locally and have limited stylistic variation, pXRF analysis shows that the beads were made of obsidian that originated from four different and diverse sources. Other exotic raw materials such as carnelian and lapis lazuli are also discussed.


Reports on the composition of faience beads used as personal ornaments and coffin decoration at a settlement of the Zhou period (1046-221 BCE) in northwestern China.


Analysis of Faience beads from the Gebusailu site in western Tibet dating back as far as the second half of the 2nd millennium BC revealed that their structure was formed on a cylindrical core and glazed by cementation. Their composition suggests that they were imported from Egypt or somewhere impacted by Egyptian faience production technology.
Examination of a large bead from the Chalcolithic settlement of Leceia (Oeiras) by estereomicroscopy and direct X-ray diffraction revealed it is made of fluorite.

**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.


Two different types of garnet beads have been identified at several Iron Age sites across Southeast Asia. Analysis of a representative sample as well as geological source samples from a variety of places confirm that the material for two bead types came from distinctly different sources, although their locations remain unknown.

**Carter, Alison, Elliot H. Blair, Carla Klehm, and Lee M. Panich**

Reviews a variety of case studies that demonstrate how glass beads in particular have been used to examine trade and economic systems, intercultural interactions and colonialism, social identity, and technological practices.

Carter, Alison Kyra, Barbie Campbell Cole, Quentin Lemasson, and Willemijn van Noord
Aims to determine the types of glass used to produce the beads and contextualize them within the broader bead exchange taking place within the region.

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, Laure Dussubieux, Thomas R. Fenn, Thanik Lertcharnrit, and T.O. Pryce
The composition of glass beads from a multi-component site occupied from the Late Bronze Age through the mid/late 1st millennium is used to begin connecting Phromthin Tai to existing glass exchange networks.
Carter, Alison, Laure Dussubieux, Martin Polkinghorne, and Christophe Pottier

Presents the results of an analysis of 81 glass beads and artifacts from the 9th-century royal capital of Hariharālaya and later (12th-14th centuries) contexts from the walled city of Angkor Thom, Cambodia.

Carter, Alison Kyra, Laure Dussubieux, Miriam T. Stark, and H. Albert Gilg

Reviews data from earlier studies and adds new data on glass and stone beads from the Vat Komnou cemetery in Cambodia, as well as glass compositional analyses from the nearby site of Oc Eo, Vietnam.

Carter, Alison and James Lankton

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

Carter, Alison, Dougal O’Reilly, Louise Shewan, and Laure Dussubieux

Discusses the beads recovered from burial contexts dating to the Iron Age or protohistoric period (500 BCE-500 CE), including their typology, production technology, and chemical composition. The latter reveals that most of the glass beads are made from a high-alumina mineral-soda glass, while the stone beads were likely produced from Indian raw materials using South Asian production techniques.

Cassedy, Daniel F., Paul A. Webb, and James Bradley

Presents a detailed analysis of a rolled-copper bead derived from Basque sources in Europe found at a protohistoric (ca. 1575-1600) Mohawk site in east-central New York state. The composition is compared to 28 other yellow-metal samples.
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.

Cattin, Florence, Philippe Curdy, Barbara Guénette-Beck, Adrian Wichser, Andrea Utrich, Vera Hubert, Katja Hunger, Marie Wörle, Kathrin Hametner, Detlef Günther, Carmela Chateau-Smith, Igor M. Villa, and Marie Besse
2014 The Copper-Based Artefacts from Sion/Petit-Chasseur (Valais, Switzerland) during the Late Neolithic, the Bell Beaker Period and the Early Bronze Age (3200–1550 BC). In Around the Petit-Chasseur Site in Sion (Valais, Switzerland) and New Approaches to the Bell Beaker Culture, edited by Marie Besse, pp. 59-75. Archaeopress Archaeology, Oxford. https://www.academia.edu/9599396/.
Reports on the analysis of various artifacts, including tubular beads.

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.

Cerdeño, M.ª Luisa, José Antonio Martínez, Fernando Agua, Teresa Sagardoy, and Manuel Monasterio
2013 Ámbar en la Meseta Oriental durante el Bronce Final: yacimientos locales e importaciones bálticas / Amber in East Meseta during the Late Bronze Age: Local Sites and Baltic Imports. Trabajos de Prehistoria 69(2):375-384.
Analysis reveals that two amber beads of the Late Bronze Age from the Herrería II cemetery at Molina de Aragón, Guadalajara, Spain, are of Baltic origin.

Černá, Eva, Václav Hulínský, Kateřina Tomková, and Zuzana Cílová

Černá, Eva, Kateřina Tomková, and Václav Hulínský
Addresses the transformation of glassworking and glassmaking technology between the 11th and 13th centuries, in comparison with that of the 10th century. The use of non-destructive EPMA – SEM-EDS enabled the definition of several chemical types which testify to the divergent technologies and provenance of both the raw glass and artifacts, including beads. In Czech with English summary.

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

2009  
https://www.academia.edu/39087830/.  
The beads formed two groups, those colored with cobalt and those colored with copper.

**Chapon, Linda, Juan Jesús Padilla-Fernández, Alberto Dorado-Alejos, and Antonio Blanco-González**

2024  
Macroscopic and chemical analyses demonstrate that faience beads and a Hathor amulet recovered from a 7th-century BC village in northwestern Spain were likely manufactured in Egypt during the Middle and New Kingdoms (2nd millennium BC), attesting to a far-reaching Phoenician maritime network that connected both ends of the Mediterranean.

**Chase, Brad, Randall Law, Franklin Hobbs, and Huifang Xu**

2021  
Analysis suggests that several beads that look like typical whitened steatite beads are actually made of unfired smectitic clay (perhaps nontronite) containing quartz and anatase.

**Chen, Dian, Qingshuo Zeng, Chao Li, Baotong Qiao, and Wugan Luo**

2024  
Analysis of glass beads decorated internally with gold and silver foil applied through foil-fusion revealed that the gold beads originated from different sources, whereas the silver ones likely originated from the Central Plains region.

**Cheng, Qian, Jin-Long Guo, Bo Wang, and Jian-Feng Cui**

2012  
Glass beads dating between the 1st and 6th centuries AD found in the Zagunluke tomb in Xinjiang, western China, had chemical composition very similar to typical soda-lime glass which indicates they were imported from the West. The glasses form two groups based on the flux: natron glass and plant ash glass. In Chinese.


Chemical composition of objects uncovered in Xinjiang, China.

Cheng, Qian, Jin-Long Guo, Huajie Zhang, and Bo Wang

Analysis revealed three different types of glass: natron and plant-ash types of soda-lime-silica glass from the West and a high-potash glass with a potassium-rich flux.

Cheng, Qian, Xueyan Zhang, Jinlong Guo, Bo Wang, Yong Lei, Guangzhao Zhou, and Ya’nan Fu

Demonstrates how CT technology contributes to the study of the manufacture of archaeological glass beads based on the study of two polychrome specimens.

Cherel, Anne-Françoise, Bernard Gratuzé, and Patrick Simon

Presents new data on faience and glass beads of the Bronze Age found in Brittany, France, including typo-chronological and compositional evidence.


A typo-chronological and composition study of glass beads of the first Iron Age and the beginning of the second Iron Age in Brittany, France.
Childs, S. Terry

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

Chung, Kwang Yong, Hyung Tae Kang, Min Jeong Koh, and Hwa Jung Kim

Beads of the Joseon dynasty (Korea) were found to belong to the potash-glass system (K₂O-CaO-SiO₂) with HCA (High CaO and Al₂O₃) and a high concentration of MgO.

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

Microscopic and analytical examination reveal that two prehistoric stone beads found in central Argentina are made of a fine-grained metamorphic rock, possibly phyllite or slate.

Cissé, Mamadou

Dating to the period AD 700-1100, the site yielded a variety of ceramic, stone (mostly carnelian), bone, faience, and glass beads. Two appendices by Laure Dussubieux present LA-ICP-MS analysis of the glass beads.

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.
Coccato, Alessia, Mafalda Costa, Anastasia Rousaki, Bernard Olivier Clist, Karlis Karklins, Koen Bostoen, Ana Manhita, Ana Cardoso, Cristina Barrocas Dias, António Candeias, Luc Moens, José Mirão, and Peter Vandenabeele

Various analytical techniques were used to determine the chemical composition of glass beads recovered from archaeological excavations in the Democratic Republic of the Congo.

Colomban, Philippe

In that colorants used in the production of glass beads vary chemically and/or technologically over time and according to the productions site, their identification can be used as a chronological marker or exchange-network tracer. In this study, glass beads from Late Iron Age sites in the upper Limpopo Valley of South Africa are assessed.

Colomban, Philippe, Grégory March, Léo Mazerolles, Tijani Karmous, Naceur Ayed, Abdelmajid Ennabli, and Hédi Slim

Beads, rings, and mosaic tessarae from Tunisia (Carthage and Utica, 1st centuries BC and AD; El Djem, 2nd-3rd centuries; and Mahdia, 10th century) were analyzed by Raman spectroscopy to differentiate the various types of glasses (most have Si- and Na/Ca-rich compositions, some others contain lead).

Colomban, Philippe, Gulsu Simsek Franci, and Farahnaz Koleini
Carnelian and glass trade beads were analyzed using a mobile Raman spectrometer. The results are compared with those obtained from beads excavated at different sites in Southern Africa and on Mayotte Island, and it appears that most of the beads come from southern Asia and Europe.

Conte, Sonia, Rossella Arletti, Julian Henderson, Patrick Degryse, and Annelore Blomme

Presents the results of an archaeometrical investigation performed on 75 black-glass beads dated to the 9th-5th century BC coming from sites in Italy and Slovakia. The analysis provides
evidence for two different production technologies in Iron Age black glass found in Italy (natron glass, probably produced in Egypt) and Slovakia (wood ash glass, probably produced in Europe).

Conte, Sonia, Rossella Arletti, Francesca Mermati, and Bernard Gratuze
Analysis of 72 glass beads from Sarno, Cuma, and Capua (Campania, southern Italy), dated to the 9th-6th centuries BC, reveals a complex picture as regards both the chemical composition of the glass and the trade routes of Early Iron Age Campania.

Conte, Sonia, Ilaria Matarese, Simona Quartieri, Rossella Arletti, Reinhard Jung, Marco Pacciarelli, and Bernard Gratuze
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).

Conte, Sonia, Ilaria Matarese, Giovanna Vezzalini, Marco Pacciarelli, Teodoro Scarano, Alessandro Vanzetti, Bernard Gratuze, and Rossella Arletti
Presents physical-chemical data for 61 vitreous beads and pendants from 11 southern Italian sites dated from the beginning of the Bronze Age up to the Archaic period (22nd-6th centuries BC).

Cooper, Anwen, Duncan Garrow, Catriona Gibson, Melanie Giles, and Neil Wilkin
Beads are mentioned throughout the volume which deals with the period from ca. 4000 BC to AD 43. See “Beads” in the index.

Cooper, H. Kory, Kenneth M. Ames, and Loren G. Davis
Portable X-ray fluorescence (XRF) was used to determinere the chemical composition of yellow-metal specimens (including tubular copper beads) recovered from the Meier and Cathlapotle archaeological sites, two Chinookan sites occupied from approximately AD 1400-1820 and AD 1450-1833, respectively.
Costa, Mafalda, Ana Margarida Arruda, Luís Dias, Rui Barbosa, José Mirão, and Peter Vandenabeele
Proposes a new nondestructive methodology that combines micro Raman spectroscopy and micro-X-ray diffraction (μ-XRD), complemented by variable pressure scanning electron microscopy coupled with energy dispersive X-ray spectrometry, to determine the composition of glass artifacts and the manufacturing techniques employed in their production.

Costa, Mafalda, Pedro Barrulas, Ana Margarida Arruda, Rui Barbosa, Peter Vandenabeele, and José Mirão
Thirty faience beads recovered from the Iron Age necropolis of Vinha das Caliças 4 (Beja, Portugal) were analyzed to identify their production technology and provide insights into their possible provenance.

Costa, Mafalda, Pedro Barrulas, Ana Margarida Arruda, Luís Dias, Rui Barbosa, Peter Vandenabeele, and José Mirão
Analysis of the Iron Age beads revealed that all were composed of soda-lime-silica natron-based glass. This suggests the beads may have originated in glass workshops in the Levant and Egypt.

Costa, Mafalda, Pedro Barrulas, Luís Dias, Maria da Conceição Lopes, João Barreira, Bernard Clist, Karlis Karklins, Maria da Piedade de Jesus, Sónia da Silva Domingos, Luc Moens, Peter Vandenabeele, and José Mirão
Trace element analysis, and rare earth element pattern analysis in particular, established that most of the European trade beads were produced in Venice, and the glass beads from types 26 and 28 have been assigned to the Bohemian glass industry.
Costa, Mafalda, Pedro Barrulas, Luís Dias, Maria da Conceição Lopes, João Barreira, Bernard Clist, Karlis Karklins, Maria da Piedade de Jesus, Sónia da Silva Domingos, Peter Vandenabeele, and José Mirão


Analysis revealed the various colorants and opacifiers used in the production of the glass as well as suggesting the place of manufacture of some of the bead types.

Costa, Mafalda, Pedro Barrulas, Maria da Conceição Lopes, João Barreira, Maria da Piedade de Jesus, Sónia da Silva Domingos, Peter Vandenabeele, and José Mirão


A multi-analytical study suggests that this gold-colored talc bead constitutes the first evidence of local production of personal ornaments in the Kongo kingdom and one of the first examples of craft specialization for such purposes in central and southern Africa since prehistoric times.

Costa, Marcondes Lima da, Anna Cristina Resque Lopes da Silva, Rômulo Simões Angélica, Herbert Pöllmann, and Walter Schuckmann


Mineralogical and chemical analyses of ten muiraquitãs (frog-shaped talisman pendants) from the lower Amazon reveal they are made of a variety of local stones, disproving the belief that the stones originated in Asia.

Cosyns, Peter and Bernard Gratuze


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

Courcier, A., A. Gasanova, and A. Hauptmann

2008 Ancient Metallurgy in the Caucasus during the Chalcolithic and Early Bronze Age: Recent Results from Excavations in Western Azerbaijan. Metalla (Bochum) 15(1):21-34.

Reports the chemical composition of beads composed of silver and gold from the Soyq Bulaq kurgan in western Azerbaijan. One of the silver examples had a steatite bead as its core.

Craig, Jennifer

2021 Refining the Chronology and Distribution of Mid-Fifteenth to Mid-Seventeenth Century Indian Ocean World Glass. Antiquity 95(384); https://doi.org/10.15184/aqy.2021.155.
Reports on the morphological and compositional analysis of glass beads from three shipwrecks located off the Philippines: Pandanan (1460-1487), Santa Cruz (1488-1505), and Royal Captain Shoal Wreck 2 (1573-1620).

Craig, Jennifer and Laure Dussubieux
Compositional analysis of 85 glass beads recovered from three shipwrecks is combined with an examination of the ceramic and glass cargo patterns of the wrecks to help recreate ancient exchange routes.

Cruz, Mario da and Bernard Gratuze
Presents the chemical analysis of a group of pre-Roman glass beads found at a major Roman settlement in Portugal. They date from the Iron Age to the 1st century AD.

Cui, Jianfeng, Chuankun He, Kehong Liu, and Xiaohong Wu
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-SiO₂ 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.

Cultraro, Massimo
Surveys the finds (mostly beads) of Sicilian amber (simetite) and reports on its chemical composition.
Dadiego, Danielle Lynn
Explores the effectiveness of Spanish economic institutions in a borderland region based on archival research, traditional artifact analysis, and LA-ICP-MS isotopic analysis of glass beads.

Explores the elemental composition of black seed beads from three 18th-century sites in Pensacola, Florida, and compares the assemblage to a small sample of similar glass beads recovered from three sites in the United States as well as four potential glass production locations in Europe.

Dadiego, Danielle L., Alyssa Gelinas, and Tsim D. Schneider
Focuses on the morphometric and elemental analysis of white glass beads collected from an adobe structure at Mission Santa Cruz which operated between 1791 and the 1830s in the colonial province of Alta (upper) California.

Daggett, Adrianne, Marilee Wood, and Laure Dussubieux
Reports the results of recent laser ablation-inductively coupled plasma-mass spectrometry analysis (LA-ICP-MS) of an assemblage of glass beads from an Early Iron Age site in northeast Botswana. The indication that the site participated in some of the earliest manifestations of the vast Indian Ocean trade network.

Dalton-Carriger, Jessica N.
Examines new fields of evidence and employs new dating methods in order to fully understand the protohistoric period in East Tennessee. Using both pXRF and LA-ICP-MS analyses of the glass trade beads, this study creates a chronological sequence of chemical patterns corresponding to Native American habitation.
Dalton-Carriger, Jessica N. and Elliot H. Blair

Analysis of 282 glass trade beads from eastern Tennessee and surrounding states has revealed trends in their chemical composition which can be correlated to date ranges.


LA-ICP-MS analysis of a small sample of IIa40 glass beads from the site suggests a significant 17th-century occupation of the site, a finding that does not conform to the standard ideas of abandonment and Cherokee re-occupation and instead hints at a continued 17th-century occupation of the lower East Tennessee Valley.

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.

Damick, Alison and Marshall Woodworth

SEM/EDX and XRD analysis of seven small stone beads revealed that six were made from fired steatite (synthetic enstatite) while the seventh was formed of quartz-based faience or frit.

Dardeniz, Gonca and Aliye Öztan

Elemental analysis of faience beads and other objects suggests at least two different workshops for the Acemhöyük vitreous materials during the early 2nd Millennium BC. In Turkish with an English abstract.
Analysis of the microstructure and chemical compositions of 26 morphologically similar, colored beads revealed local faience bead production using efflorescence and cementation glazing techniques.

Analysis of beads of various materials revealed that pXRF results could be used to group the beads, but additional analyses, such as XRD and SEM-EDX, are required to accurately determine what materials are.

SEM-EDS and Raman Spectroscopy analyses of 10 red-stained shell beads enabled the detection of a colorant made of *Rubiaceae* plant roots to color personal adornments by the first sedentary hunter-gatherers in the Levant.

Reports on the chemical composition of a unique assemblage of glass beads and glass fragments from Culduthel, an Iron Age site in northeast Scotland.

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.

Davri, Konstantina A., Yorgos Facorellis, and Georges P. Mastrotheodoros
https://www.academia.edu/107104461/.
The beads analyzed were of stone and shell.

Dayet, Laure, Rudolph Erasmus, Aurore Val, Léa Feyfant, Guillaume Porraz
The ostrich-eggshell, giant land-snail, and marine-shell beads recovered from the site were subjected to a technological and use-wear study with chemical analyses (SEM-EDS and Raman analyses) of the colored residues they bear.

Děd, Jiří, Estelle Ottenwelter, and Ludmila Šejvlová
Presents a detailed study of an openwork silver bead found with the burial of a wealthy female interred during the 9th century. Czechia.

de Ferri, Lavinia, Francesco Mezzadri, Roberto Falcone, Valeria Quagliani, Fabio Milazzo, and Giulio Pojana
Provides new insights into the composition of glass beads recovered from sites along Italy’s Adriatic coast that have not been investigated previously from an archaeometric perspective.

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

Delves into the origins of lead-silica glass in early medieval Europe, spurred by the finding of a bead made of high-quality PbO-SiO₂ glass found at a medieval (9th century) stronghold in eastern Germany.


Discusses distinctive wound beads found at sites of the late Roman and early medieval times in central Europe. Includes chemical analysis.

**Dekówna, Maria and Tomasz Purowski**


Presents a detailed study of the forms and chemical composition of glass beads from contexts ranging from the Hallstatt period to the Early Middle Ages at a site in north-central Poland.


Discusses the glass beads recovered from an early medieval cemetery in west-central Poland, including their chemical composition. English summary.

**Delgado Robles, Alma A., Jose Luis Ruvalcaba Sil, Pieterjan Claes, Mayra D. Manrique Ortega, Edgar Casanova González, Miguel Ángel Maynez Rojas, Martha Cuevas García, and Sabrina García Castillo**

2015 Non-Destructive in Situ Spectroscopic Analysis of Greenstone Objects from Royal Burial Offerings of the Mayan Site of Palenque, Mexico. *Heritage Science* 3(20); https://www.academia.edu/57382334/.

Several spectroscopic techniques, such as Raman, Fourier transform infrared (FTIR), X-ray fluorescence (XRF), and color measurements, were used to identify specific minerals used to create beads and pendants during the period AD 600-850 and their sources.
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.

Demény, Attila, Bernadett Bajnóczi, Sándor Kele, István Fórizs, Gabriella Barna, and
Zoltán Siklósy
2009  Stable Isotope Analysis of Carbonatic Ornaments from the Late Copper Age Cemetery at
Budakalász. In The Copper Age Cemetery at Budakalász, edited by Mária Bondár and Pál
Concludes that stable isotope geochemistry, especially if used in combination with
cathodoluminescence microscopy, can be a useful tool for provenance studies. In the case of the
Budakalasz samples, analysis enabled the secure identification of the limestone and shell beads.
Hungary.

Denbow, James, Carla Klehm, and Laure Dussubieux
2015  The Glass Beads of Kaitshàa: New Insights on Early Indian Ocean Trade into the Far
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.

Denbow, James, Jeannette Smith, Nonofho Mathibidi Ndobochani, Kirsten Atwood, and
Duncan Miller
2008  Archaeological Excavations at Bosutswe, Botswana: Cultural Chronology, Paleo-
https://www.academia.edu/3776224/.
Reports the chemical composition of the copper and bronze beads recovered from Lose period
(AD 1200-1650) contexts.

d’Errico, Francesco, L. Doyon, J. Zilhão, and J. Baker
2023  Tooth in the Spotlight: Exploring the Integration of Archaeological and Genetic Data to
An international team of researchers question the results of the extraction of human DNA from a
deer-tooth pendant discovered in Denisova cave, Siberia, published by Essel et al. (2023).

Comparing modern shells experimentally heated in oxidizing and reductive atmospheres with shell beads from the 72-ka-old Middle Stone Age levels of Blombos Cave, South Africa, reveals that although some shell beads were heated, intentional heat treatment of shell beads is not demonstrated.


A set of burned beads of uncertain composition were found to be made of shell.


Focuses on the Caucasus as a case study by applying mineralogical, geochemical, and isotopic analysis to Georgian ores (mainly from the Racha-Lechkumi district) and Late Bronze Age (15th-10th centuries BCE) metallic Sb objects (including beads) found at the sites of Brili and Chalpiragorebi.


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


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

Domínguez-Bella, Salvador and Morat-Céspedes

Reports on the composition of stone beads (variscite) recovered from the Alberite dolmen in southwestern Spain. They date to the 5th millennium BC.

Domínguez-Bella, S., J. Ramos Muñoz, M.A. Álvarez, and M. Forteza

Domínguez-Bella, Salvador, Guirec Querré, Thomas Calligaro, and Javier Martinez López

Domínguez-Bella, S. and M. Marta Sampietro Vattuone

Discusses the composition of stone beads from sites in northwestern Argentina and their probable source.

Dong, Junqing, Yunling Han, Jiwang Ye, Qinghui Li, Song Liu, and Donghong Gu
2014 In Situ Identification of Gemstone Beads Excavated from Tombs of the Han Dynasties in Hepu County, Guangxi Province, China Using a Portable Raman Spectrometer. *Journal of Raman Spectroscopy* 45(7); https://www.academia.edu/7558305/.

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.
**Dong, Junqing, Yongqing Hu, Song Liu, and Qinghui Li**


SEM-EDX analysis of 11 beads provided information on their chemical composition and microstructure, as well as the formation and glazing methods.

**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 eastern China and discusses their features as well as material. In Chinese.

**Douka, Katerina, Christopher A. Bergman, Robert E. M. Hedges, Frank P. Wesselingh, and Thomas F. G. Higham**


The remains of two anatomically modern humans found at Ksar Akil are estimated to date between 40.8-39.2 ka cal BP (68.2% prob.) and between 42.441.7 ka cal BP (68.2% prob.), respectively, based on radiocarbon dates derived from marine shell beads.

**Duckworth, Chloë N.**


ToF-SIMS is used to investigate the origin of the colorant-opacifiers used in Egyptian glass production, beads and amulets included. ToF-SIMS is used to investigate the origin of the colorant-opacifiers used in Egyptian glass production, beads and amulets included. Also examines color in Egyptian thought, the relative value of Lower Bronze Age glass, the significance of the material properties of glass, and beadmaking technology.

**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**

Discusses the LA-ICP-MS analytical process and its application to the study of glass (beads included) from sites in Central, Southern, and Southeast Asia. The time span covered extends from the 4th century BC to beyond the first millennium AD.


Presents the chemical analysis of a small group of glass beads, buttons, and small ornaments found in Rouen, France, and compares them to beads from glassmaking factories in Holland.


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


In South and Southeast Asia, between the 4th century BC and the 3rd century AD, 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.
A group of glass beads from the ancient city of Kish in Iraq with an uncertain chronology and provenience was analyzed using LA-ICP-MS. Based on the elemental composition of the glass, they are attributed to the 2nd-1st centuries BCE with South or Southeast Asia as the source.

Kish was occupied from the Ubaid (6500-3800 BCE) to the Abbasid (750-1258 CE) period. The compositions of the drawn glass beads excavated there confirm their South Asian origin and reveal that bead circulation between India and the Middle East occurred over a long period, showing a sustained glass connection between the two regions.

LA-ICP-MS analysis of glass beads and bracelets excavated at Khao Sam Kaeo, Thailand, revealed two main glass types: a mineral soda-alumina glass and a potash glass.

Khao Sek, located in the Upper-Thai Peninsula, yielded an impressive quantity of glass waste and ornaments suggesting that glass bracelets and beads were manufactured at the site as early as the 4th century BCE. This article discusses the recovered material using typological observation as well as elemental analysis using LA-ICP-MS.
Gyi, while at Maliwan the glass types are more diversified with some of them found generally during the 4th-2nd centuries BC. It is possible that the beads are of local manufacture.

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

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 BC and the 5th century AD.

**Dussubieux, Laure, Thomas R. Fenn, Shinu Anna Abraham, and Alok Kumar Kanungo**

To determine a more precise provenience attribution and the identification of regionally distinct production centers for drawn Indo-Pacific beads in India, raw material samples were collected from selected regions within the subcontinent and analyzed using LA-ICP-MS.

**Dussubieux, Laure and Mark Golitko**

Explains the different analytical methods used to determine the chemical composition of stone beads, using lapis lazuli from sites around the world as a case study.

**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 BC and the 2nd century AD.


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 (including beads) 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.

**Dussubieux, Laure, Charles F.W. Higham, and T.O. Pryce**


Glass compositions show strong similarities with results from the neighboring sites of Ban Non Wat and Noen-U Loke, and seem to share a strong connection during the Late Iron Age with South India/Sri Lanka.

**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, and V. Gogte, S.B. Kusimba, B. Gratuze, and R. Oka

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

The composition of glass artifacts (beads included) recovered from Phu Khao Thong (ca. 2nd century BC-4th century AD) is compared to that of beads from contemporary sites, especially Arikamedu.

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, Laure, P. Robertshaw, and M.D. Glascock

Dussubieux, Laure, Katharina Schmidt, Yorke M. Rowan, Alexander M.R. Wasse, and Gary O. Rollefson

Discusses the chemistry of two blue-glass beads found in a tomb in eastern Jordan tentatively dated to the Late Bronze Age IIA period (ca. 14th century BC). The composition corresponds to an Iron Age glass quite probably using mineral soda.
Glass beads dating from the 11th-14th centuries were analyzed using LA-ICP-MS. Results show that the vast majority were produced in western India; some others in northeastern India and a few in the Middle East.

Dussubieux, Laure and Heather Walder (eds.)
Provides a wide range of case studies in the investigation and interpretation of glass bead composition, production, and exchange since ancient times. The individual articles are annotated elsewhere in this bibliography.

Dussubieux, Laure, Menno Welling, Potiphar Kaliba, and Jessica C. Thompson
LA-ICP-MS analysis of beads from rock shelters revealed that all but one originated in Europe. The exception had a composition typical of South Asia during the 15th-17th centuries.

Dussubieux, Laure and Marilee Wood
The elemental analysis via LA-ICP-MS of ancient glass beads from archaeological sites in Kenya, Tanzania, and on the island of Mayotte revealed the presence of two different types of mineral soda/high alumina (m-Na-Al) glasses that likely originated in India.

Eddy, John J.
Reports the preliminary results of southern California chlorite schist and soapstone/steatite LA-ICP-TOFMS chemical composition analysis as it relates to Middle to Late Holocene beads.

Explores southern California early Middle period gifting and reciprocal exchange networks and the underlying motivations responsible for the creation, maintenance, and possible rejection of
social relationships. LA-ICP-MS was used to identify soapstone source locations used in the production of stone beads (Sierra Pelona).

**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.

**Eerkens, Jelmer W., Jeffrey S. Rosenthal, Howard J. Spero, Ryoji Shiraki, and Gregory S. Herbert**

Two methods are used to track the geographic source of *Olivella biplicata* 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).


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.


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.

**Ehrhardt, Kathy, Samuel K. Nash, and Charles P. Swann**
A sample of 64 copper-based metal artifacts (including beads and pendants) excavated at the Haas/Hagerman Site, Clark County, Missouri, were examined metallographically to determine their composition and identify manufacturing techniques and technical processes employed by the Illinois to produce these new forms.

Ekmen, H., C. Diker, F.G. Ekmen, and C. Tunoğlu
SEM-EDS analysis of seven beads was performed to understand steatite bead production techniques during the Chalcolithic Age in western Turkey.

Eliyahu Behar, A., S. Elbaz, I. Shai, A.M. Maeir, and H.J. Greenfield
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.

Elson, Mark D.
Uses XRD analysis to determine the source of argillite beads from prehistoric sites in Gila County, Arizona.

Eremin, Katherine, Patrick Degryse, Nathaniel Erb-Satullo, Monica Ganio, Joseph Greene, Andrew Shortland, Marc Walton, and Lawrence Stager
https://www.academia.edu/6475727/.
Presents the analysis of glass beads recovered from funerary urns at the Tophet of Carthage, Tunisia. They date to the 8th-4th centuries BC.

Erlandson, Jon M., Michael E. Macko, Henry C. Koerper, and John Southon
AMS analysis of the spire-removed Olivella beads produced a consistent series of Early Holocene dates that includes some of the oldest securely dated shell beads in North America.

Application of a non-destructive method for the gradual release of DNA trapped in ancient bone and tooth artefacts to an Upper Palaeolithic deer-tooth pendant from Denisova Cave, Siberia, resulted in the recovery of ancient human and deer mitochondrial genomes, which allowed the estimation of the age of the pendant at approximately 19,000-25,000 years BP. See d’Errico et al. (2023) for a critique.

Falci, Catarina Guzzo

A *chaîne opératoire* approach is integrated in order to assess technological choices, gestures, techniques, toolkits, and skill levels.

Falci, Catarina Guzzo, Annelou Van Gijn, M. Magdalena Antczak, Andrzej T. Antczak, and Corinne L. Hofman

Microwear analysis is used to assess production technologies and use-wear of figurative shell beads and pendants from north-central Venezuela.

Fenn, Thomas R.

Lead and strontium isotope analysis were made on archaeological materials from three different contexts in both the Old and New Worlds including glass beads from late 1st millennium AD Igbo-Ukwu, Nigeria.

Fenn, Thomas R., Laure Dussubieux, Heather Walder, and Douglas D. Anderson

Summarizes the results of compositional analysis of 13 glass beads recovered from the site of Igliqtiqsiuŋvigruaq near Kiana, northwestern Alaska, and places them within a historical context.
Fenn, Thomas R., Peter Robertshaw, Marilee Wood, John Chesley, and Joaquin Ruiz
2011 Glass Beads from Igbo-Ukwu, Nigeria: Provenance and Long-Distance Trade in the Late
First Millennium AD. In Applications of Heavy Isotope Research to Archaeological
Problems of Provenance and Trade: Cases from Africa and the New World, by T.R.
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.

Fertelmes, Craig M. and Chris Loendorf
2012 EDXRF Analysis of Disk Beads and Turquoise Artifacts from AZ U:9:90 (ASM),
Maricopa County, Arizona. Material Science Laboratory, Gila River Indian Community,
https://www.academia.edu/43698161/.
Compositional analysis of shell and turquoise beads recovered from a Hohokam site in south-central Arizona was used to verify visual identification of the raw materials.

Figueiredo, M.O., J.P. Veiga, and J.P. Mirão
2006 Modelling the Size of Red-Colouring Copper Nanoclusters in Archaeological Glass
A non-destructive X-ray absorption study was undertaken on the red layer from a singular five-layered, twisted, square-sectioned chevron bead from a 16th-century archaeological context in Lisbon, Portugal.

Figueiredo, M.O., J.P. Veiga, and Teresa P. Silva
2012 Chromophore Behaviour of Iron, Copper, Cobalt and Antimony in Ancient Tile, Faience
and Porcelain Glazes Plus Archaeological Glass Beads: An Overview on X-ray
Absorption Near-Edge Spectroscopy Studies. Ciência & Tecnologia dos Materiais
Includes the chemical analysis of a five-layered, twisted, square-sectioned chevron bead from a 16th-century archaeological context in Lisbon, Portugal.

Fioretti, Anna Maria, Ivana Angelini, Maurizio Battisti, and Fabiana Zandonai
2016 18. Perlina anulare di enstatite: Caratterizzazione mineralogica e chimica e ipotesi su
tecnica di produzione e zona di provenienza. In Ricerche archeologiche a sant’andrea di
loppio (Trento, Italia) il castrum tardoantico-altomedievale, edited by Barbara Maurina,
Micro-FTIR, micro-Raman, and XRD analyses indicate that a problematic bead is made of
synthetic enstatite. While found in a stratigraphic layer that may be dated to 5th-6th centuries
AD, based on comparisons with other prehistoric artefacts found in Loppio and the surrounding
areas the bead is likely to date ca. 3300-2300 BC.
Fischbach, Noémi, Anh-Tu Ngo, Philippe Colomban, and Martial Pauly
Provides the chemical composition of glass beads excavated on Mayotte Island in the Indian Ocean off the east coast of Africa. Most of the beads can be classified as “Indo-Pacific.”

Fischer, Alysia and W. Patrick McCray
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
https://www.academia.edu/21753487/.
Describes the results of various archaeometric methods applied to the glass and shell beads comprising the 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 7,860 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.

Fleming, S.J., L.A. Bedal, and C.P. Swann
Reports on the chemical analysis of blue glass beads exhibiting surface devitrification.
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. 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.
Fórizs, I., A. Pásztor, M. Tóth, and G. Nagy

Fórizs, I., M. Tóth, G. Nagy, and A. Pásztor

Fox, William A., R.G.V. Hancock, and L.A. Pavlish
1995 Where East Met West: The New Copper Culture. The Wisconsin Archaeologist 76(3-4):269-293; https://www.academia.edu/853346/. Artifacts (beads included) 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.

Frána, J., A. Maštalka, and N. Venclová
1987 Neutron Activation Analysis of Some Ancient Glasses from Bohemia. Archaeometry 29(1):69-89. 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).

Francis, Peter, Jr.

Franjić, Ana
Franjić, Ana, Ian C. Freestone, Borut Križ, and Petra Stipančić
This study indicates that raw glass was imported to Novo Mesto from eastern Mediterranean centers and corroborates the existence of long-distance trade during the 1st millennium BCE.

Frantz, Tony, Dorothy H. Abramitis, Linda Borsch, and Mark T. Wypyski

Fraser, Sharon, Dave Polya, Paul Lythgoe, and Timothy Insoll
Investigates the use of LA-ICP-MS analysis to source carnelian using beads and raw material from Gujarat, India, and beads from Mali.

Freestone, Ian C.

Freestone, I.C. and J.R.N. Peake
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 unusual glass beads with a copper-tube core recovered from an early medieval graveyard in Tiengen, near Freiburg, Germany. Includes chemical analyses.

Frînculeasa, Alin and Claudia Stîhi
Discusses the chronological position and chemical composition of beads recovered from a funerary complex in Romania.
Furihata, Junko and Takayashu Koezuka
Japan; ca. 3rd-6th centuries.

Fürst, Sebastian, Katharina Müller, Liliana Gianni, Céline Paris, Ludovic Bellot-Gurlet, Christopher F.E. Pare, and Ina Reiche
2016 Raman Investigations to Identify *Corallium rubrum* in Iron Age Jewelry and Ornaments. *Minerals* 6(2), article 56; https://www.academia.edu/48533313/.
Proposes a non-destructive multi-stage approach to identify archaeological corals among other biominerals used as ornament during the central European Iron Age with emphasis on optical examination and mobile Raman spectroscopy.

Fusco, Maria and Robert J. Speakman
Discusses the potentials and limitations of XRF analysis in glass compositional analyses, coating identification, and the detection of pesticide residue on ethnographic art.

Gak, E.I., R.A. Mimokhod, and A.A. Kalmykov
Discusses the various forms of metallic antimony beads and pendants and their distribution, as well as their chemical composition. English summary.

Galibin, Valentin A.

Gallaga Murrieta, Emiliano and Emiliano Ricardo Melgar Tísoc
Reports on the composition, possible sources, and manufacturing techniques of 14 turquoise pieces (including pendants, beads, and raw material) recovered during an archaeological survey in northern Mexico. In English.
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 BC), were made locally; the glassmaking technology was obtained from West Asia.

Gan, FuXi, HuanSheng Cheng, YongQing Hu, Bo Ma, and DongHong Gu
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, Qinghui Li, Donghong Gu, Ping Zhang, Huansheng Cheng, Bin Zhang, and Bo Ma
Dating to around 1100-500 BC, the glass beads could be sorted into two groups: Na₂O-CaO-SiO₂ and Na₂O-CaO-PbO-SiO₂. In Chinese.

Garbacz-Klempka, Aldona, Józef S. Suchy, Janusz Kozana, Marcin Piękoś, Stanisław Wilk, and Małgorzata Perek-Nowak
https://www.academia.edu/32052739/.
Reports on the metallographic analysis of copper ornaments including two rolled copper beads. *See also* Wilk and Garbacz-Klempka (2016).
García González, Julia, Alberto Dorado Alejos, Luis Mª Cobos Rodríguez, and Víctor López López

Presents a thorough analysis of a set of beads that comprised a necklace, including their chemical composition. Included are glass eye beads and faience melon beads.

García-Heras, Manuel, Fernando Agua, Hilario Madiquida, Víctor M. Fernández, Jorge de Torres, María-Ángeles Villegas, and Marisa Ruiz-Gálvez

The chemical composition of the glass beads and their chromophores, and the shell and fishbone materials, are studied to understand the local and trading provenance of these items. They are dated to the 11th and 12th centuries AD.

García-Heras, Manuel, Fernando Agua, Hilario Madiquida, Víctor M. Fernández, María-Ángeles Villegas, and Marisa Ruiz-Gálvez
2022 Archaeometric Characterization of Glass and a Carnelian Bead to Study Trade Networks of two Swahili Sites from the Ibo Island (Northern Mozambique). *Boletín de la Sociedad Española de Cerámica y Vidrio*; https://www.academia.edu/90301828/.

Four different glass types were identified: mineral-soda alumina glass from Western India, vegetal-soda alumina glass from Central Asia, a conventional soda-lime silicate glass coming probably from Europe, and a lead silicate glass of the PbO-SiO₂ binary system most likely from Venice.

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 (2nd century BC), Spain.


Presents results derived from a chemical and microstructural study of a representative sample of glass beads from the 2nd-century BC Celtiberian necropolis of Numantia (Upper Duero Valley, Spain). The evidence suggests that Numantian glass beads were the result of trade or exchange practices rather than locally produced.
Garrido-Cordero, J.A., C.P. Odriozola, A.C. Sousa, and V.S. Gonçalves
Reviews the use and social significance of translucent stone beads in the study area and provides the results of their chemical analysis.

Gaut, Bjarne
Small-scale beadmaking took place at this market town in southern Norway during the first decade(s) of the 9th century. While no in situ workshop floors or furnaces have been preserved, the waste material indicates that glass beads were made from imported soda glass, blocks of raw glass, tesserae, and semi-manufactured rods.

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

Ghervase, Luminiţa, Ioana Maria Cortea, Roxana Rădvan, and Corina Borş
The highly heterogenous bead, found together with numerous bronze and iron objects, appeared to be a variety of chalcedony rich in iron and copper impurities, still preserving clay minerals from the sedimentary matrix in some of the areas.

Gianfrancisco, Maria Soledad
Physical and chemical analyses of stone necklace beads from Alamito sites in northwestern Argentina suggest that these ornamental goods were acquired through trade, like many other products that circulated through the interregional flow of goods in the southern Andes.
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.

Gilg, H. Albert, Joanna Then Obluska, and Laure Dussubieux
Offers a mineralogical and geochemical characterization of 34 garnet beads from Lower Nubian cemeteries in Sudan dating from late A-Group to Post-Meroitic (3200 BCE-600 CE).

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, Philip P. Betancourt, Susan C. Ferrence, and James D. Muhly
Reports the results of XRF analyses of silver beads and pendants from an Early Minoan I - Middle Minoan IIA cemetery.

Giumlia-Mair, Alessandra, Susan C. Ferrence, Philip P. Betancourt, and James D. Muhly
Presents the results of X-ray fluorescence on silver beads, pendants, and other objects from three cemeteries dated to ca. 3000 to 2800 BC: Hagia Photia Siteias, Kephala Petras, and Livari Skiadi.

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 BC). 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.

Glover, Lauren and J.M. Kenoyer

Analyses of a sample of 68 carnelian and agate beads from Korea’s late Proto-Three Kingdoms and Three Kingdoms period (C.E. 100-668) provide evidence for long distance exchange with South Asia. Three Kingdoms period elites were rejecting locally made stone beads made of local materials for stone beads obtained from long distance trade and made of non-local materials.

Gonçalves, A.P., Luís Cerqueira Alves, António M. Monge Soares, and José M. de Matos Martins

A black bead initially believed to be made of glass was identified as stone. This raises the question whether other black beads from the proto-historical period that are identified as glass are in fact made of that substance.

Gonçalves, A.P. and A.M. Monge Soares
X-ray diffraction analysis of stone necklace beads from a proto-historical village in southern Portugal identifies them as carnelian.

Gonçalves, A.P., A.M. Monge Soares, Maria José Oliveira, Luis Cerqueira Alves, Pedro Valério, and João Luís Cardoso
2012 Caracterização de uma conta de vidro proveniente do povoado fortificado calcolíico da Moita da Ladra (Vila Franca de Xira) [Characterization of a Glass Bead from the Chalcolithic Fortified Settlement of Moita da Ladra (Vila Franca de Xira)]. Estudos Arqueológicos de Oeiras 19:291-300.

A bead recorded as being from a Chalcolithic context was found to be glass and consequently must be ascribed to the Late Bronze Age occupation recorded nearby and resulting from the early Phoenician trade.

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.

Gradmann, Rena, Marianne Hasenmayer, Christoph Berthold, and Ulrich Schüssler

Investigates the probable origin of seven-layer chevron bead production canes and beads as well as blue canes with round and square sections likely dating to the 16th century found at two glassworks in the Heilbronn district of southwestern Germany.

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 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.


The accurate determination of archaeological glass sample composition is challenging due to possible heterogeneity and post-production chemical alteration. Here, depth profiling using the time resolved signal generated by LA-ICP-MS (DP-LA-ICP-MS) is applied to two case studies. The first concerns corroded Late Bronze Age glass beads. While many varieties of ancient glass beads are corrosion resistant, some recipes are particularly impacted by devitrification, and depth profiling allows for analysis of un-corroded material reflecting original glass composition.

Gratuze, Bernard 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.


Presents an inventory of the Bronze Age glass and faience beads originating from the workshops of the Frattesina region in France. Includes the results of LA-ICP-MS analysis.

Gratuze, Bernard and P. Cosyns
The chemical composition of glass beads from a LaTène necropolis in France using LA-ICP-MS.

Gratuze, Bernard and Laure Dussubieux
Reports on the analysis of glass beads from an Iron Age site in northern Thailand.

Gratuze, Bernard, L. Dussubieux, and O. Bopearachchi
A study of glass beads found in Sri Lanka which date from the 3rd century BC to the 2nd century AD.

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

Gratuze, Bernard, Inès Pactat, and Nadine Schibille
2018 Changes in the Signature of Cobalt Colorants in Late Antique and Early Islamic Glass Production. *Minerals* 8(6); https://doi.org/10.3390/min8060225
Aims to characterize the chemical composition of cobalt colorants used during the 1st millennium C.E. Compositional variations indicate the use of different raw materials and/or production processes, which in turn has implications for the underlying exchange networks. Merovingian and Viking glass beads are included in the analysis.

Gratuze, Bernard, Constantin Pion, and Torben Sode
Chemical analyses of glass beads recovered from late Antique and Early Middle Age sites in western and northwestern Europe have revealed the presence of two groups of glass beads with unexpected compositions for these periods and geographic areas which exhibit several similarities with South Asian glasses.

Gratuze, Bernard, 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 2006 Přírodovědné analýzy fajánsového korálku z hrobu nitranské kultury ze Slatinice, okres Olomouc [Die naturwissenschaftlichen Analysen der Fayenceperle aus dem Grab der Nitraer Kultur aus Slatinice, Bezirk Olomouc]. Slovenská Archeológia LIV(1):33-40. 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 1993 Mineralogische Untersuchungen am Amulett der Ötztaler Gletscherleiche mit Hilfe der Diffusen IR-Reflexionsspektroskopie. Archäologisches Korrespondenzblatt 24(3):461-467. Describes the non-destructive method used to analyze the bead of Italian dolomite found with the mummified Chalcolithic Ice Man in the Ötztal Alps between Austria and Italy. Chemical analysis might pin down the source more exactly.

Greiner-Wronowa, Elżbieta, Dominika Zabiegaj, and Paolo Piccard 2013 Glass-Metal Objects from Archaeological Excavation: Corrosion Study. Applied Physics A 113(4):999-1008. 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., Jeffrey S. Rosenthal, John Southon, and Randall T. Milliken

Based on the direct accelerator mass spectrometry (AMS) dating of 140 stylistically distinct *Olivella* shell beads, this report presents a refined late Holocene cultural chronology for central California that replaces Bennyhoff and Hughes’ Scheme B.

Gruber, Christian, Sophie Hüdepohl, and Martin Mach

Discusses the archaeometric analysis of coral beads from Late Roman graves at *Guntia* (Günzburg in southern Germany).

Gu, Zhou, J.M. Kenoyer, and Yimin Yang

Analysis confirms that the production of Harappan faience beads utilized the efflorescence glazing method.

Gu, Zhou, Wugan Luo, Xiaochenyang Jiang, Nian Liu, Yanan Fu, Lili Zhang, Min Yang, and Yimin Yang

Five tiny opaque red beads found in Muyi Cemetery were analyzed to determine their production technology and to explore their possible provenance. Chemical analysis revealed they are composed of potash glass with higher CaO and Al₂O₃.

Gu, Zhou, Jian Zhu, Yaoting Xie, Tiqiao Xiao, Yimin Yang, and Changsui Wang

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.

Guerra, M.F.

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

Guilaine, Jean, Guirec Querré, Serge Cours, Jacques Coularou, Hélène Vergély, Jean Vaquer, and Muriel Gandelin
A set of 17 variscite beads excavated in a cave in southeastern France constitutes a unique Middle Neolithic ornament. PIXE (Particle Induced X-ray Emission) chemical analysis of the beads and reference samples from possible sources indicates a mineral origin from the Gava mines situated near Barcelona, Spain.

Gupta, Sunil
Presents chemical composition data on twelve micro-bead and waste-glass samples surface collected at Arikamedu in southeastern India.

Hadden, Carla S., Alexander Cherkinsky, Geoffrey M. Smith, Aaron P. Ollivier, and Hai Pan
Expands upon and re-examines the incremental carbon ($^{14}$C and $\delta^{13}$C) and oxygen ($\delta^{18}$O) isotope data from two shell beads from the LSP-1 Rockshelter, Oregon, to address two common problems in dating marine shell trade goods: 1) the source region is large, adding to uncertainty regarding the appropriate specification of $\Delta R$, and 2) the $^{14}$C activity within individual specimens is variable.

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.

Han, Min Su
Chemical analysis of 11 glass beads recovered from a site in Korea reveal that they represent a soda-glass group with high contents of SiO₂ and Na₂O; this can be further subdivided into soda-alumina groups (Na₂O-Al₂O₃-CaO-SiO₂).

Han, Min Su, Han Hyoung Lee, and Eun Jung Moon
Excavated in the southwest region of the Korean Peninsula, the beads date to the 4th-5th centuries. In Korean with English abstract.

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

Summarizes the chemical data for beads in the region and postulates origins.

Hancock, R.G.V., S. Aufreiter, and I. Kenyon
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
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
Reports on instrumental neutron activation analysis of 80 beads from 3 sites. Comparison with the composition of well-dated beads from elsewhere now helps to date these sites.

Hancock, R.G.V., A. Chafe, and I. Kenyon
Reports the results of the analysis of both cobalt- and copper-colored beads. There seem to be chemical differences between the copper-colored specimens of the 16th century and those of the 17th century.

Hancock, R.G.V. and Elizabeth Graham
The findings are consistent with the proposal that most of the European goods were brought to Tipu during the active mission period that began in the mid-16th century and largely ended with the Belize Maya rebellion of 1638-1641.
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.

Hao, Wentao, Yimin Yang, Jian Zhu, Zhou Gu, Yaoting Xie, Jing Zhang, and Lihua Wang

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.

Harrison, Ainslie

Investigates the technology, as well as the elemental composition, of gold beads recovered from sites in Panama. Comparisons are made with beads from other sites in Central and South America.

Harrison, Ainslie C., Kim Cullen Cobb, Harriet F. Beaubien, Paul Jett, and Julia Mayo
Hartmann, Gerald, Irene Kappel, Klaus Grote, and Betty Arndt

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 BC.

Hawkins, Alicia and Heather Walder

Presents an analysis of Nueva Cadiz beads from Huron-Wendat sites in southern Ontario.

Heaser, Sue

A quantity of Roman glass cullet from English sites was put to a range of tests, including compositional analysis and beadmaking, to investigate the behavior of the glass in the flame.

Heck, G.

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

Heck, Martin

Several different analytical methods were used to determine the chemistry and structure of ca. 1500 variously colored beads found in female tombs of the Merovingian (early medieval) period.

Heck, M. and P. Hoffmann

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

2000 Rohstoffe für die Farbgebung merowingerzeitlicher Glasperlen. In *Archäometrie und Denkmalpflege: gemeinsame Jahrestagung des Arbeitskreises Archäometrie der GDCH*
On the raw materials for coloring Merovingian glass beads.


Analysis of monochrome Merovingian (5th-7th centuries) 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.

**Heck, M., P. Hoffmann, and H.M. Ortner**


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

**Heck, M., P. Hoffmann, P. Streitwolf, C. Theune, and J. Callmer**


Characterizes yellow Merovingian glass beads.

**Heck, M., P. Hoffmann, C. Theune, and J. Callmer**


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


Reports on the color characteristics of Merovingian glass beads.

**Heckel, C., K. Müller, R. White, H. Floss, N.J. Conard, and I. Reiche**


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.
Heckel, C., K. Müller, R. White, S. Wolfe, N.J. Conard, C. Normand, H. Flosse, and I. Reiche

Presents the results of two series of micro-PIXE/PIGE analysis on mammoth ivory samples (including beads and pendants) from four Aurignacian sites in France (Abri Castanet, Grotte d’sturitz) and Germany (Hohle Fels, Vogelherd).

Helmi, Fatma M. and Nagwa S. Abdel-Rehim

Using various analytical processes, investigates why there is color change in ancient Egyptian artifacts, including beads (blue to pale green and red to nearly white).

Henderson, Julian

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-BC 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.


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


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


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


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


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

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 AD. Highly recommended.

**Henderson, Julian, J. An, and H. Ma**  
This paper provides a new review of archaeometric research carried out on glass found in China, set in an archaeological context, from its earliest occurrence to the Song dynasty. It discusses chemical and isotopic compositional contrasts in glasses from different periods found in different parts of China, the glasses that were almost certainly made in China and those that were imported.

**Henderson, Julian and J. Callmer**  
Discussion of the chemical analyses of raw materials, glass beads, etc.

**Henderson, Julian, Simon Chenery, Kimiyoshi Matsumuraki, Jane Evans, and Sachihiro Omura**  
Provides one of the first scientific investigations of Hittite glass beads from Kaman Kalehöyük, dating mainly to phase IIIB (1650 and 1400 BCE), and a pendant from Büklükale, dating to the 16th century BC. Both sites are in central Anatolia.

**Henderson, Julian, S. Chenery, S. Omura, K. Matsumuraki, and E. Faber**  
Presents the first global results from electron probe microanalysis of glass beads found in Hittite and early Iron Age contexts from sites in central Anatolia, performed in order to determine if they were made in Turkey or not.

**Henderson, Julian and I. Holand**  
Presents an analysis of the beads and glass sherds recovered from a 1st millennium site.

**Henderson, Julian and R. Ivens**  
Reports evidence for glass working and the modification of raw glass by adding colorants. Finds include glass strands used for decorating beads, malformed beads, and crucible fragments with glass adhering.

**Henderson, Julian, Alison Sheridan, Simon Chenery, Jane Evans, Simon Timberlake, Andy Towle, Mark Knight, Rob Wiseman, and Lore Troalen**

2024  

Over 56 beads, most of them monochrome glass, were recovered from this Bronze Age site in Cambridgeshire, United Kingdom. Other materials include amber, siltstone, shale, tin, and faience. The chemical composition of some of the beads is presented.

**Henderson, Julian, Torben Sode, and Yvette Sablerolles**

2019  

Considers the possibility of the use of tesserae for glass bead production in Scandinavia and the Netherlands during the 8th-9th centuries, from both archaeological and compositional points of view.

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

1986  

On glass beads of the 12th and early 13th centuries AD excavated in the Shambles, York, England, United Kingdom.

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

2006  

Analyzes the beads recovered from a Basque settlement on Petit Mécatina Island, off the Lower North Shore of Quebec. The site is assigned to the period ca. 1675-1750.

**Heyworth, Michael P.**

1987  

1988 Examination and Analysis of Glass Beads from Great Chesterford, Essex. English Heritage, Ancient Monuments Laboratory Report 137/88. A selection of glass beads from a Pagan Saxon cemetery were qualitatively analyzed to determine the colorants and decolorants used. England, United Kingdom.


1990 Examination and Analysis of Glass Beads from Empingham, Leicestershire. English Heritage, Ancient Monuments Laboratory Report 120/90. A group of 65 glass beads from a Pagan Saxon cemetery were qualitatively analyzed to identify the colorants and decolorants used. England, United Kingdom.

1990 Examination of a Glass Bead from Winchester, Hampshire. English Heritage, Ancient Monuments Laboratory Report 6/90. 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, Martin

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.

Hoard, Robert J.
Discusses the prehistoric use of turquoise in the study area and provides the results of neutron activation analysis of turquoise from more than 40 source areas and 28 archeological sites. Beads are included in the study. Calibrated 14C dates for features associated with the turquoise are also provided.

Hoferitza, Michele
Statistical analysis of three categories of elements was performed to determine whether the creation of a model of glass recipes for Prosser beads might be possible using XRF.

Hoffmann, Peter
Monochrome beads excavated at three Merovingian sites in Germany were examined by non-destructive methods. The coloring compounds at the surface of the glass beads can be characterized as Pb2SnSbO6.5 for the yellow beads and as Cu2O for the ochre beads.

Essentially the same as the previous report.

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 has led 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.

Horvath, Judith
On the composition of gold beads in the collection of Burmese artifacts held by the Department of Mineralogy of the Eötvös Loránd University and at the Hungarian Southeast Asian Research Institute.

Hrubý, Petr, Petr Hejhal, Karel Kašák, Karel Malý, and Jiří Valkony
This glassworks is important in that it was the only one east of the Šumava Mountains, Czech Republic, to produce an assortment of glass jewelry typical for the Šumava Mountains glassmaking circle of the 17th-18th centuries: furnace-wound glass rosary beads. Information is provided re: chemical composition.

Huisman, D.J., J. van der Laan, G.R. Davies, B.J.H. van Os, N. Roymans, B. Fermin, M. Karwowski
Hand-held XRF analyses of Late Iron Age Celtic (La Tène) bracelet fragments from the Netherlands and Austria and Early Iron Age beads from the Netherlands revealed they were all composed of soda-silica-lime glass, which has a presumed origin in the Eastern Mediterranean.

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.

Huisman, Hans, Marion Aarts, Mirjam Kars, Fardau Mulder, Dominique Ngan-Tillard, and Bertil van Os
Presents a chemical analysis of Merovingian beads from the Sittard-Kemperkoul burial ground in the Netherlands.

Hulínský, V. and E. Černá
Hulínský, Václav, Šárka Jonášová, and Kateřina Tomková

2012  
Skleněné korálky z pohřebišť na katastru Žalova z pohledu jejich chemického složení  
[Glass Beads from the Burial Grounds in the Žalov Municipal Cadastre Based on their  
Chemical Composition]. In Levý Hradec v zrcadle archeologických výzkumů. Pohřebiště.  
Díl I [Levý Hradec in the Mirror of Archaeological Excavations. Cemeteries. Part I],  
edited by Kateřina Tomková, pp. 336-341. Institute of Archaeology of the Czech  
Academy of Sciences, Prague. https://www.academia.edu/45581640/.  

Reports the results of the chemical analysis (SEM-EDS) of glass beads from two burial grounds  
of the 9th-10th centuries in the Czech Republic. German summary.

Hull, Sharon Kaye

2012  
of Anthropology, University of Manitoba, Winnipeg.  
Sixty-two turquoise artifacts (including beads and pendants) recovered from several sites in the  
American Southwest were analyzed using Secondary Ion Mass Spectrometry (SIMS). Their  
compositions were compared to those of geological samples from 21 turquoise resource areas in  
the region, with the result that the likely turquoise source for 35 of the artifacts could be  
determined.

Iizuka, Yoshiyuki

2012  
Analytical Report of Glass Beads from Hoa Diem Site, Khanh Hoa, Viet Nam. In The  
221-225. Bulletin of Institute of International Culture, Showa Women’s University 17.  
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. Archeometriai Műhely XIII(1):55-68;  
https://www.academia.edu/25100221/.  
The beads studied represent the Late Tumulus-Early Urnfield culture (Bz C2-Ha A1). In German  
with English summary.

Imai, Aiko, Yanase, Shinsuke Baba, Izumi Nakai, Kazuyuki Nakamura, Ogawa, and Ken-  
ichiro Koshida

2017  
Archaeochemical Study of Ancient Glass Beads in Epi-Jomon Period Excavated from  
The beads represent three glass groups: high alumina-soda-lime-silica (Na₂O-Al₂O₃-CaO-SiO₂),  
soda-lime-silica (Na₂O-CaO-SiO₂), and potash-silica (K₂O-SiO₂).
Insoll, Timothy
Carnelian samples from 10 different workings/locations in western India were elementally analyzed so they could be compared with beads from archaeological contexts in West and West-Central Africa.

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, Nadia Khalaf, Rachel MacLean, Hannah Parsons-Morgan, Nicholas Tait, Jane Gaastra, Alemseged Beldados, Alexander J.E. Pryor, Laura Evis, and Laure Dussubieux
Beads appear to have been an important commodity at Harlaa, with evidence for agate, glass, and shell beadmaking. LA-ICP-MS analysis of four beads from the workshop complex indicates the importation of some beads from Central Asia, the Middle East (possibly Mamluk Egypt), and Sri Lanka/South India.

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; https://www.academia.edu/9812453/.
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.

Ivanova, Silviya and Ivelin Kuleff
Discusses relevant amber finds (mostly beads) and provides compositional data.

Jackson, Caroline M.
Four blue glass bead fragments from a prehistoric site (either Bronze Age or Iron Age) in the upland area of the Peak District of central England were analyzed to determine their composition, date, and origin.

**Jackson, Caroline M. and Sarah Paynter**
2022  
Discusses the possible types and sources of trade glass, the challenges of recycling mono- and polychrome glass in different colors, and the unconventional methods used by glassworkers on the periphery of Roman influence to extend and modify colored glass to produce distinctive items in order to express their identity.

**Jacobson, L., C.A. Pineda, D. Morris, M. Peisach, and A.E Pillay**
1996  
https://www.academia.edu/1842943/.  
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.

**Janz, Lisa, James K. Feathers, and George S. Burr**
2015  
New radiocarbon and luminescence dates on collections from the Gobi Desert of Mongolia and China reveal that Accelerator Mass Spectrometry and luminescence are highly complementary methods and produce results consistent with expected archaeological ages, while ostrich eggshell dates (derived from beads and shell fragments) were older than the associated site assemblages.
Jeunesse, Christian
On shell ornaments (including beads and pendants) and the evolution of symbolic systems in the Danubian Neolithic.

Jia, Yanqin, Jianfeng Cui, and Chenming Cao
2024 Analysis of Two Glass Eye (Jatim) Beads Unearthed from the Northern Wei Tomb Complex in Dongxin, Datong. Heritage Science; https://www.researchgate.net/publication/379016049.
The authors examined the beads’ manufacturing techniques, including matrices, eye patterns, and perforations. Composition analysis revealed that the beads belong to the Na₂O-CaO-SiO₂ glass system. China.

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 (AD 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 BCE, 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.

Jones, Travis W., Jennifer Birch, Ronald F. Williamson, Timothy J. Abel, Robert J. Speakman, and Louis Lesage
Provides compositional data from an assemblage of 100 steatite beads and pipes deriving from 11 Northern Iroquoian sites in southern Ontario and New York.
Kaal, Joeri, María Martín Seijo, Cesar Oliveira, Ewa Wagner-Wysiecka, Victoria E. McCoy, Monica M. Solorzano Kraemer, Alexander Kerner, Philip Wenig, Carlos Mayo, and Julia Mayo
The figurines and beads found with a burial were found to be formed from *Hymenaea* resin.

Kadikova, Irina F., Ekaterina A. Morozova, Tatyana V. Yuryeva, Irina A. Grigorieva, and Vladimir A. Yuryev
Examines the cause of the fatal corrosion of glass beads on 19th-century beadwork in museum collections.

Kadikova, Irina F., Tatyana V. Yuryeva, Ekaterina A. Morozova, Irina A. Grigorieva, Ilya B. Afanasyev, Vladimir Y. Karpenko, and Vladimir A. Yuryev
Reveals that the corrosion is caused by several mutually connected processes developing in parallel and intensifying one another.

Kadikova, I.F., T.V. Yuryeva, E.A. Morozova, I.A. Grigorieva, M.V. Lukashova, I.B. Afanasyev, and V.A. Yuryev
Some types of 19th-century glass beads (translucent turquoise, green, red-white and some others) are subject to more intense destruction than others, apparently due to the presence of nano and micro crystals in the glass.

Kadlečíková, Magdaléna, Juraj Breza, Ľubomír Vančo, Miloš Gregor, and Igor Bazovský
Violet and red-to-orange beads from a necklace and bracelet dated to the 11th-12th centuries were found to be fluorite (previously described as amethyst) and carnelian, respectively.
Kalicz, Nándor, Zsuzsanna Siklósi, Gabriella Schöll-Barna, Bernadett Bajnóczí, George H. Hourmouziadis, Fotis Ifantidis, Aikaterini Kyparissi-Apostolika, Maria Pappa, Rena Veropoulidou, and Christina Ziota  
Beads and bracelets of *Spondylus* shell excavated at a Late Neolithic site in central Hungary were analyzed to help interpret exchange systems and the social role of shell ornaments during that time period.

Kalkreuth, Wolfgang, Claus Andreasen, Henrik I. Petersen, and Lars Stemmerik  
Coal petrographic techniques were used to trace the origin of the coal used to produce two large 15th-century perforated pendants or amulets. One is in the form of a female figure; the other is oval in form. The coal was found to be of local origin and not imported from known “mines” in Arctic Canada.

Kalsbeek, Nicoline and Knud Botfeldt  
Twenty museum objects – mostly beads – were analyzed to distinguish those of Baltic amber from amber imitations.

Kang, Hyung-Tae, Nam-Chul Cho, Min-Su Han, Woo-Hyun Kim, and Ji-Youn Hong  
The beads are mainly potash glass (K₂O-CaO-SiO₂) and potash-lead glass (K₂O-PbO-SiO₂), while some appear to be quartz. South Korea. In Korean with English abstract.

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, Alok K. and Robert 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 BC to around AD 600.

Kaparou, Maria and Artemios Oikonomou
2022 Mycenaean through Hellenistic Glass in Greece: Where Have We Got to? Archaeological and Anthropological Sciences 14, 92; https://www.academia.edu/78123058/.
Aims to consolidate aspects of how glass was produced, traded, and used from the Late Bronze Age through Hellenistic times. Beads enter into the discussion.

Kaparou, Maria, K. Tsampa, N. Zacharias, and A.G. Karydas
Investigates the chemical composition of 11 glass beads and relief plaques from three tombs in the area of Palaia Epidavros, Argolid, Greece, to determine aspects of the technology and provenance of Mycenaean glass jewelry dating to the 15th-11th centuries BC.

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.


Presents the results of INAA analysis of a large sample of variously colored beads recovered from the wasters of a glassworks in Amsterdam. Initially believed to have operated from 1601 to 1610, that date was subsequently revised to 1621-1657.

Karklins, Karlis, Alicia Hawkins, Heather Walder, and Scott Fairgrieve

Discusses three faceted rock-crystal beads generally termed Florida Cut-Crystal which were found in the legacy collections of two 17th-century Huron-Wendat sites in southern Ontario. Includes details about their manufacture and chemical composition.

Karklins, Karlis, Sibylle Jargstorf, Gerhard Zeh, and Laure Dussubieux

The Fichtelgebirge bead and button industry is especially notable for two things: 1) the utilization of furnace-winding technology which, based on our current knowledge, was not employed to a significant degree elsewhere in Europe during the post-medieval period, and 2) the localized use of Proterobas, a greenish igneous rock, to produce opaque black beads and buttons without any additives until the early 19th century. This article presents a history of the industry and describes the products and the technology involved. It also provides a preliminary assessment of the chemical composition of the various products.

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.

Karwowski, Maciej
2006 Major Questions Concerning Celtic Glass from the Eastern Regions of La Tène Culture. Analecta Archaeologica Ressoviensia 1:133-159.
Discusses glass bracelets, ring-beads, and tiny rings, including their elemental composition.

**Karwowski, Maciej, Christoph Jokubonis, and Shokufeh Zamini**


Reports on the composition of two glass beads from La Tène graves excavated in northern Austria.


On the composition of glass beads of the Oksywie culture recovered from a cemetery in Podwiesk, north-central Poland.

**Karwowski, Maciej, Christoph Jokubonis, Shokufeh Zamini, Peter Wobrauschek, and Grehard Trnka**


Energy-dispersive X-ray fluorescence analysis (EDXRF) was used to determine the composition of glass beads and bracelets recovered from sites in Austria and Poland dated ca. 250-50 BC.

**Karwowski, Maciej, Katarzyna Trybała-Zawiślak, and Lucyna Samek**


Reports on the archaeometric analysis of glass beads from a cemetery of the Tarnobrzeska Culture at Kłyżów, Poland.

**Kassianidou, Vasiliki and Andreas Charalambous**


Analysis of the faience beads recovered from cemetery sites of the Chalcolithic period on Cyprus reveals they are imported good rather than the products of local workshops.
Kasztovszky, Zsolt, Veronika Szilágyi, and Istvá Sajó
Reports on the condition of a unique copper-bead necklace recovered from a site of the Neolithic Csőszhalom Culture (5000-4400 BC) in Hungary.

Kelly, Gwendolyn O.
Reports on the composition of six Indo-Pacific glass beads dating to ca. 1200-1400 CE.

Kemp, V., A. McDonald, F. Brock, and A.J. Shortland
The beads were colored by copper and the trace element concentrations were compositionally consistent with glasses from Mesopotamia rather than from Egypt. Therefore, they represent a rare example of Mesopotamian glass to be discovered in Egypt.

Kemp, V., A. McDonald, and A.J. Shortland
LA-ICP-MS analysis of a scaraboid blue glass bead excavated at Gurob, Egypt, revealed that it likely originated in Mesopotamia.

Kemp, V., K. Schmidt, W. Brownscombe, K. Soennecken, D. Vieweger, J. Häser, and A. Shortland
LA-ICP-MS analysis of 14 glass objects (beads and pendants included) revealed that the composition of glasses manufactured in the Late Bronze Age and the Iron Age are distinctly different. Major element analysis can, therefore, be used to distinguish between the groups relatively easily.
Kenoyer, J. Mark


2017 Using SEM to Study Stone Bead Technology. In *Stone Beads of South and Southeast Asia: Archaeology, Ethnography and Global Connections*, edited by Alok Kumar Kanungo, pp. 409-438. Indian Institute of Technology, Gandhinagar. Presents a detailed discussion of the use of scanning electron microscopy to garner details regarding bead production techniques and how to prepare specimens for study. Also provides an overview of the various recorded drilling techniques with SEM images of each.

Kenoyer, J. Mark, Asa Cameron, Dashzeveg Bukhchuluun, Chunag Amartuvshin, Batdalai Byambatseren, William Honeychurch, Laure Dussubieux, and Randall Law

The technological, stylistic, and chemical analyses of carnelian beads from several sites in Mongolia provide evidence for local production and use of such beads from the Late Bronze Age (ca. 1400-1000 BCE) through the Xiongnu period (ca. 250/200 BCE-CE 150). Beads dating to the historical Mongol Empire (ca. 12th-14th centuries) demonstrate expanding trade networks that link eastern Eurasia to South Asia and beyond.

Kenoyer, J. Mark, Chapurukha M. Kusimba, Akshay Sarathi, Jonathan R. Walz, Randall W. Law, and Laure Dussubieux

The shapes and manufacturing technology of beads from three sites in East Africa correlate with those produced at contemporary workshops in ancient South Asia. Geochemical analysis using LA-ICP-MS indicates that the carnelian raw material came primarily from the regions of Gujarat and Maharashtra in modern India.
Kenyon, Ian, 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.
2012 Early Chinese Lead-Barium Glass: Its Production and Use from the Warring States to Han Periods (475 BCE-220 CE). Brown University, Providence, RI.
A detailed discussion of lead-barium glass which was commonly used to produce beads in China during the period under discussion.

Kim, Eun A and Gyu Ho Kim
Investigates the chemical composition of the 171 gold and silver foil beads found on the queen’s chest. The tomb dates to the 6th century AD.

Kim, Eun-A, Gyu Ho Kim, Ji Won Kang, and Cheon Su Yun
Discusses the form, color, manufacturing techniques, and chemical composition of the beads that date to the late 2nd and early 3rd centuries. In Korean with English abstract.

Kim, Eun-A, Je Hyun Lee, and Gyu Ho Kim
Describes glass beads recovered from Geumgwan Gaya (AD 43-532) and reports their chemical composition. In Korean with English abstract.
Kim, Gyu-Ho
Analysis of glass beads from the site revealed a change in their composition over time. A potash and soda glass group was present in the 4th century while a potash and mixed-alkali group marked the 17th century. In Korean with English abstract.

Kim, Gyu-Ho, Woo Young Huh, and Dong Won Kim
Reports the composition of ancient beads from a site in South Korea.

Kim, Gyu-Ho and Eun-A Kim
Reports the results of both chemical compositional and lead isotope analyses of the glass beads recovered from a 7th-century workshop area in South Korea. The glass is among the earliest lead-silica glass type in East Asia. In Korean with English abstract.

Kim, Jiyoung, Chan Hee Lee, and Jin Young Kim
The beads are composed of SiO$_2$, Al$_2$O$_3$, MgO, and FeO as major components and trace amounts of K$_2$O, CaO, and Na$_2$O. In Korean with English abstract.

Kim, Na-Young and Gyu-Ho Kim
Glass beads excavated from Mahan tombs consist of potash glass (20%) and soda glass (80%). In Korean with English abstract.

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 Al$_2$O$_3$) and soda raw materials (MgO and K$_2$O). In Korean with English abstract.

Analysis of 281 potash-glass beads from 30 sites revealed that three types could be identified based on the stabilizer content. In Korean with English abstract.

**Kirk, Susanna**


Focused on the vitreous objects (beads being the most common items) from Nuzi, a mid-2nd millennium BC site in Iraq, this project presents the first large-scale study of the preservation and alteration of Late Bronze Age vitreous materials from the Near East. Includes the results of compositional analysis.

**Kivisto, Sarah A.**


Isotope analyses were performed ostrich eggshell beads and shell fragments to assess climatic changes and where hunter gatherers might have been using the landscape for subsistence and risk moderating strategies.

**Klehm, Carla and Laure Dussubieux**


Discuss Indian Ocean glass beads found in east-central Botswana, their chemical composition, the relationship to known typologies, and how these bead types relate to the sociopolitical and economic changes taking place in the southern African interior from the 7th-17th centuries.

**Klehm, Carla E., Mark A. Helper, Elisabeth Hildebrand, Emmanuel Ndiema, and Katherine M. Grillo**


Describes the archaeomineralogy of strikingly colorful and mineralogically diverse stone-bead assemblages in northwestern Kenya where, ca. 5000-4000 cal B.P., a novel tradition of personal adornment occurs in tandem with new monumental mortuary traditions.
Klochko, Viktor and Barbara Stopiak  
Presents the results of the chemical analysis of several glass beads recovered from a site in the eastern Ukraine which dates to the first half of the 3rd millennium BC.

Klysubun, W., Y. Thongkam, S. Pongkrapan, K. Won-in, J. T-Thienprasert, and P. Dararutana  
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.

Knaf, Alice C.S., Catarina Guzzo Falci, Habiba, Casper J. Toftgaard, Janne M. Koornneef, Annelou van Gijn, Ulrik Brandes, Corinne L. Hofman, and Gareth R. Davies  
Demonstrates that the pan-Caribbean exchange of jade raw materials, pre-forms, or finished objects (including beads and pendants) during the Ceramic Age (400 BC to AD 1492) occurred on a more complex scale than previously thought involving jade sources in Guatemala, eastern Cuba, and the northern Dominican Republic.

Knific, Timotej and Žiga Šmit  
A combined method of proton-induced X-ray and gamma-ray emission (PIXE, PIGE) was used to analyze glass beads and other glass items from early medieval sites in Slovenia. In Slovenian and English.

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.

2020  The Large Glass Beads of Leech Fibulae from Iron Age Necropoli in Northern Italy. Beads: Journal of the Society of Bead Researchers 32:3-14; https://www.academia.edu/45187054/.
Provides an overview of these adornments as well as insights into their production technology, chemical composition, and origin. The wide variety of these objects suggests the existence of several local glass workshops.

Discusses the composition and likely sources of faience and glass beads and buttons.

Sums up the state of research on faience and glass beads, faience buttons, and imported faience objects from the Eastern Mediterranean in Italy during the Bronze and Early Iron ages. Includes information about glass composition.

https://www.academia.edu/101502181/.
This article investigates monochrome glass beads and those decorated with dot or ring eyes recovered from sites of the 8th–7th centuries BC in Italy and beyond, including their chemistries.

Koch, Leonie C. and Oleh Yatsuk
With a parallel on Rhodes, two types of distinctive beads found especially in west-central Italy seem to have been imported from the Aegean. However, the similarity in trace elements with typical Italian Final Bronze Age beads of the LMHK glass group suggests their production in Italy.

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.

Kokora, Karolina
Discusses the composition of a decorated glass bead from the late 10th or early 11th century excavated in Wolin, Poland.

Discusses the glass beads – both locally made and imported – excavated in Wolin, Poland. Includes information regarding their chemical composition. In Polish and English.

Koleini, Farahnaz, Philippe Colomban, and Innocent Pikirayi
Analysis identified six identified glass groups: soda-based plant ash (61%), potash-rich wood ash (14%), synthetic soda (8%), mixed alkali (4%), lead-soda (22%), and natron (4%). Except for soda-based plant ashes and natron (outliers), all the groups date back to the 19th century.

Koleini, Farahnaz, Philippe Colomban, Innocent Pikirayi, and Linda C. Prinsloo
This review addresses the history of glass production, the methodology of identification (morphology, color, elemental composition, glass nanostructure, coloring and opacifying agents and secondary phases) by means of various laboratory-based instruments. Attention is paid to the problems neglected such as the heterogeneity of glass (recycled and locally reprocessed glass).
Koleini, Farahnaz, L.H. Machiridza, I. Pikirayi, and P. Colomban
Fourteen glass beads from five Khami period (AD 1400-1830) sites in Zimbabwe were analyzed with the intention of correlating the results with associated radiocarbon dates.

Koleini, Farahnaz, Innocent Pikirayi, and Philippe Colomban
2016 Raman (RS) and XRF Classification of Glass Trade Beads from Baranda (16-17th c. AD), Northern Zimbabwe. https://www.academia.edu/26869716/.
A multi-analytical study of the beads reveals information about their composition, origin, and distribution.

Compositional analysis of a large assemblage of imported glass beads from the trading site of Baranda reveals a South Asian origin for the majority of them.

Koleini, Farahnaz, Linda C. Prinsloo, Wim M. Biemond, Philippe Colomban, Anh-Tu Ngo, Jan C.A. Boeyens, and Maria M. van der Ryst
2015 Towards Refining the Classification of Glass Trade Beads Imported into Southern Africa from the 8th to the 16th Century AD. Journal of Cultural Heritage 16(2):159-172; https://www.academia.edu/28183566/.
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.

Koleini, Farahnaz, Linda C. Prinsloo, Wim M. Biemond, Philippe Colomban, Anh-Tu Ngo, Jan C.A. Boeyens, Maria M. van der Ryst, and Koos van Brakel
2016 Unravelling the Glass Trade Bead Sequence from Magoro Hill, South Africa: Separating Pre-Seventeenth-Century Asian Imports from Later European Counterparts. Heritage Science 4(43); https://www.academia.edu/77101024/.
Demonstrates the use and archaeological application of Raman and XRF measurements to separate earlier imported beads from later counterparts by identifying glass nanostructure, as well as pigments and opacifiers, which were not used in bead series pre-dating the 17th century.

A summary version of the previous article.
Koleini, Farahnaz, Linda C. Prinsloo, Philippe Colomban, Jan C.A. Boeyens, Maria M. van der Ryst, and Wim M. Biemond
The comparative analysis of the long bead sequence from Magoro Hill, South Africa, sheds new light on changing patterns in the availability, range, consumption, and origin of glass trade beads imported into the northern interior of South Africa over a period of about a thousand years.

Kolesnychenko, Anzhelika and Dmytro Kiosak
Discusses glass beadmaking at a Greek settlement of the Archaic Period in southern Ukraine, including their chemical composition.

Kolesnychenko, Anzhelika, Sabrina Molinaro, Oleh Yatsuk, Patrizia Davit, Stanislav Zadnikov, Iryna Shramko, Lorena Carla Giannossa, Annarosa Mangone, Giulia Berruto, Roberto Giustetto, and Monica Gulmini
Compositional analysis of a sample of glass and faience beads identified several sources for the silica and, consequently, several production centers for the items, leading to a better understanding of the trade networks that operated in the Bilsk region between the 7th and 4th centuries BCE.

Kolesnychenko, Anzhelika and Oleg Yatsuk
Reports the results of various compositional analyses performed on glass beads recovered from a workshop dating to the 6th century BC in the southern Ukraine. English summary.

Koroleva, E.P. and A.N. Egor’kov
Optical emission spectrography of glass beads found at a site in east-central Belarus that was occupied during the late 10th and early 11th century revealed three glass types: that manufactured with 1) halophytic ash, 2) natural natron, and 3) lead.
Košta, J., K. Tomková, V. Hulínský, and J. Zavřel
2011  G-korály v raně středověkých náhrdelníčích z Čech v kontextu evropské sklářské produkce přelomu 9. a 10. století [G-Beads on Early Medieval Necklaces from Bohemia in the Context of European Glass Production at the Turn of the 10th Century].
*Archeologické rozhledy* 63:586-607.
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. Czechia.

Kostov, Ruslan I.
Archaeomineralogical 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.

Kovacevich, Brigitte, Hector Neff, and Ronald L. Bishop
Reports on the analysis of jade objects (including several beads) from a Classic Maya site.

Kozáková, Romana, Viktoria Čišťakova, and Ing. Šárka Jonášová
Poster on the chemical composition of 13 monochrome and polychrome beads selected from the Hallstatt collections of the National Museum, Prague, Czechia.

Kristmanson, Helen, Erin Montgomery, Karlis Karklins, and Adelphine Bonneau
Among the glass and bone specimens are black beads decorated with undulating yellow lines around the middle, commonly called “rattlesnake” beads. Semi-quantitative analysis (SEM-EDS) revealed that they are not typical “black” glass but formed by melting an igneous rock
called “proterobas” to form a totally opaque black glass, indicating an origin in the Fichtelgebirge region of northeastern Bavaria. This is the first recorded instance of proterobas beads in North America.

Křížová, Šárka, Natalie Venclová, Tomá Vaculovič, and Veronika Dillingerová

All samples of the La Tène ring beads were found to be made of natron-based glass, comparable with glass produced in the Syro-Palestinian area.

Krueger, I. and K.H. Wedepohl

Kuhn, E. Elora H., MinJoo Choi, Elizabeth Wuellner, Lisa R. Brody, and Ellery Frahm

Analysis of the amber beads indicates a previously unestablished connection between Dura-Europos and northern Europe during the first two centuries CE through long-distance exchange networks stemming from the Mediterranean basin.

Kwiatkowska, Katarzyna and Dariusz Manasterski

Analysis of several amber beads and pendants from two sites in Poland was conducted to determine the type of raw material, its source, and the technology involved in their manufacture. Substantial English abstract.

Kwok, Fanny
This study attempts to identify trading activity between the Dutch and the Ontario Petuns and New York Iroquois based on the INAA analysis of 124 red beads from archaeological contexts in Amsterdam, Ontario, and New York.

Kwon, Yoon-mi, Gyu-ho Kim, and Yong-min Shin
Discusses the chemical properties of blue and white glass beads from a site in South Korea.

Lababidi, Lesley, Abidemi Babatunde Babalola, Bernard Gratuze, Joëlle Rolland, Emmanuel Véron, and Aurélien Canizares
Analysis of raw glass and beads made by Masagá glassmakers provides new compositional and technological data for the history of glass and its techniques.

Laffoon, Jason E., Reniel Rodríguez Ramos, Luis Chanlatte Baik, Yvonne Narganes Storde, Miguel Rodríguez Lopez, Gareth R. Davies, and Corinne L. Hofman
Explores the feasibility of using combined strontium and oxygen isotope analyses of culturally modified teeth (pendants) of animals such as the jaguar, peccary, and tapir that are not native to the Antilles to determine their geographic origins.

Lambert, Joseph B., Suzanne C. Johnson, Robert T. Parkhurst, and Bennet Bronson
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.

Lambert, Shawn P., D. Shane Miller, Matthew C. Sanger, Olivia Baumgartel, Madeleine Hale, Tiffany Raymond, Hector Neff, and Laure Dussubieux
Excavated in southern Mississippi at a site occupied between 3990-3340 BP, the bead shows a significant elemental relationship to copper from the Great Lakes region.
Lambri, Melania Lucila, Nélida De Grandis, Ana María Rocchietti, Griselda Irene Zelada, Federico Guillermo Bonifacich, Fernando Daniel Lambri, and Osvaldo Agustín Lambri
Reports the results of the preliminary compositional analysis of three glass beads (a seven-layer chevron, a Nueva Cadiz type, and a striped specimen) recovered from the 17th-century site of San Bartolomé de los Chaná, northeastern Argentina.

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 1500 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

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

Lankton, James W., O.A. Ige, and T. Rehren

Lankton, James, Sam Nixon, Peter Robertshaw, and Laure Dussubieux

Larson, Katherine A. and Laure Dussubieux

Latinis, K.
Law, Randall
Reveals how X-ray diffraction (XRD) analysis of a small red bead believed to be glass proved it was actually made from indurated hematitic kaolinite.

Law, Randall and James H. Burton
Discusses the results of the analysis of silver beads from Mohenjo-daro and Alladino in Pakistan and the possible origins of the silver.

Law, Randall, Alison Carter, Kuldeep Bhan, Arun Malik, and Michael D. Glascock
https://www.academia.edu/355169/.
The study includes a set of carnelian beads of unknown archaeological provenience.

Lee, Insook
Summarizes the types of glass utilized and discusses several distinctive bead types/forms.

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 BC to the 7th century AD.

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.
Lee, Min-hee, Na-young Kim, and Gyu-ho Kim  
*Journal of Conservation Science* 33(5):331-344;  
https://doi.org/10.12654/JCS.2017.33.5.02.  
Reports the chemical composition of beads of the 4th century representing ten color groups. In Korean with English summary.

Lefranc, Philippe, Rose-Marie Arbogast, Fanny Chenal, Erwin Hildbrand, Matthias Merkl, Christian Strahm, Samuel Van Willigen, and Marie Wörle  
2012  Inhumations, dépôts d’animaux et perles en cuivre du IVe millénaire sur le site Néolithique récent de Colmar « Aérodrome » (Haut-Rhin).  
Two necklaces composed of copper beads were found with a Neolithic burial in northeastern France. Compositional data are provided.

Lei, Yong and Yin Xia  
2015  Study on Production Techniques and Provenance of Faience Beads Excavated in China.  
Twenty faience beads from several cemeteries in northern China were studied chronologically and typologically, based on the results of scanning electron microscopy (SEM) with energy dispersive X-ray spectrometry (EDX).

Leventhal, Alan and Rosemary Cambra  
2011  The Dating and Chronological Placement of the Clareño Muwékma Ya Túnnešte Nómmo [Where the Clareño Indians are Buried] Site (CA-SCL-30/H).  
A small amount of human bone from two of the burials and a sample of Type H series disk *Olivella* shell beads were subjected to Accelerator Mass Spectrometry (AMS) dating. The results corroborate the 1781-1818 date for the inhumations. Also discusses previously dated Type H series beads from CA-SCL-30/H, and describes all the shell beads recovered from the site.

Li, Fei, Qinghui Li, Fuxi Gan, Bin Zhang, and Huansheng Cheng  
2005  Chemical Composition Analysis for Some Ancient Chinese Glasses by Proton Induced X-Ray Emission Technique.  
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, Qinghui Li, Fuxi Gan, Bin Zhang, Huansheng Cheng, and Shifang Shen
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 BC) to the Six Dynasties period (AD 220-589). In Chinese.

Li, Jingyu, Feng Sun, Yanglizheng Zhang, Wenhui Ha, Haihong Yan, and Congwen Zhai
Various analytical techniques were used to determine the chemical elements, valence states, and compositions of the glass matrix and its weathering products of two beads dating to the Warring States period at a site in southeastern China.

Li, Qinghui, Junqing Dong, Bomin Su, Gangquan Chen, Song Liu, and Donghong Gu
The glass samples could be divided into two glass groups: PbO-BaO-SiO$_2$ and Na$_2$O-CaO-SiO$_2$. China. In Chinese.

Li, Qinghui, JiaoZhen Huang, and Fuxi Gan
The samples include monochromatic glass beads and compound eye beads and represent three kinds of glass (Na$_2$O-CaO-SiO$_2$, K$_2$O-SiO$_2$, and PbO-BaO-SiO$_2$) 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 BC to the 10th century AD, 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, Qinghui, 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 BC. The limited number of potash glass beads from the Kizil reservoir cemetery, which were dated to about 500-300 BC, used tin oxide as an opacifier.

Li, Qinghui, 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 BC to the 3rd century AD. They are composed of vitreous PbO-BaO-SiO₂ material.

Li, Qinghui, Hongzhi Zhou, Jiaozhen Huang, Fuxi Gan, and Ping Zhang  
The beads are from the Kizil Cemetery in Baicheng, Xinjiang, and date to the Western Zhou dynasty to the Spring and Autumn period. In Chinese.

Li, Xiaoguang, Haozhong Xue, Xinhua Wu, Dahai Qin, Daiming Chen, Jiangyan Yuan, and Zihua Tang  
The mineral structure of eight ancient agate beads from the Xinjiang Uygur Autonomous Region of northwestern China was analyzed using a variety of analytical techniques to determine the intricate techniques employed to color them.

Liang, Haida, Margaret Sax, and David Saunders  
The non-invasive nature of OCT and its speed of acquisition make it possible to image the subsurface microstructure of large volumes of objects such as faience beads to yield an overview of the microstructure associated with each specific production technique.

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.
Likhter, Julia A.
Discusses the beads recovered from excavations in Moscow; Mangazeya, a trade settlement founded in the 1570s in northwestern Siberia; and Volochyok Vyazemskiy, an Old Russian hill fort of the late 17th-18th centuries. Includes information concerning glass composition.

Likhter, Julia A., Alexander G. Veksler, Nikolay I. Sudarev
Reports on a workshop which produced wound beads. Composition analysis shows the presence of two chemical types of glass: K-Ca-Pb-Si, and K-Ca-Si.

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 BC).

Lin, Yi-Xian, Thilo Rehren, Hui Wang, Xiao-Yan Ren, and Jian Ma
Combines published and new results of chemical analysis, morphology, and chronology of the earliest faience beads uncovered from Xinjiang, Qinghai, Gansu, Shaanxi, and Shanxi in China to determine how, where, and by whom this technology began. See Yang (2020) for a comment.

Linares Catela, José Antonio and Carlos Patricio Odriozola Lloret
Investigates the production, distribution, and presence in funerary contexts of necklace beads made from variscite and other green stones in megalithic tombs in the southwest of the Iberian peninsula. Includes compositional analysis.
Liou, Ying San and Yi Chang Liu  
Provides a summary of the findings. The beads date to ca. 1850-310 BP.

Liou, Ying-San, 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 1500-1800 BP, to determine the mineralogical and chemical compositions.

Lisowska, Ewa, Kinga Zamelska-Monczak, Justyna Kolenda, Piotr Gunia, and Barbara Łydżba-Kopczyńska  
Presents the first multidisciplinary provenance study of archaeological amber objects – beads and a pendant included – dated to the period of the Middle Ages in Poland.

Liu, Nian, Yimin Yang, Yongqiang Wang, Wanglin Hu, Xiaochen Yang Jiang, Meng Ren, Min Yang, and Changsui Wang  
The beads are the earliest (1050-300 BCE) faience artifacts uncovered in China to date. Two glazing methods – direct application and efflorescence – were used in their production. Their chemistry suggests they come from the West. Thus, it is suggested that there was a faience road from Western Asia through Xinjiang to central China about 3000 years ago.

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

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 BC) to the Tang dynasty (AD 618-907).


Presents a micro-analytical study of an array of gold pendants excavated from the burial site at Dongtalede (9th-7th centuries BCE) in the Altai region of Xinjiang, northwestern China. Includes information re: chemical composition and manufacturing techniques.


LA-ICP-MS analysis of Nueva Cadiz beads from the namesake site in Venezuela and those collected from an unknown site or sites near Tiahuanaco, Bolivia, provides chemical compositions of their glasses. There are chemical similarities with glasses made in Venice, identifying it as a candidate to consider when searching for the origin of Nueva Cadiz beads.


The beads are made of natron glass, characterized by high Zr and low Sr values typically ascribed to the use of Egyptian sands. A comparison of the results of previous studies from the same site clearly demonstrates at least two geochemical provenances for Phoenician-traded glass beads: the Levantine region and Egypt.
Lonçarić, Valentina and Mafalda Costa
2023 Known Glass Compositions in Iron Age Europe – Current Synthesis and Emerging Questions. Heritage 6:3835-3863; https://www.researchgate.net/publication/370234751. Reviews the current state of research into Iron Age (1st millennium BCE) glasses in Europe by examining the available published data on glass compositions to critically assess some practical and theoretical issues stemming from this heterogenous field of research. Key questions are addressed, and future lanes of research are proposed. Beads enter into the discussion.

López, Gabriel E.J., Juan P. Orsi, Sonia Araya, Silvina Seguí, Mariana Rosenbusch, and Patricia Solá

López, Mariel Alejandra
2010 Análisis arqueométrico de las cuentas de vidrio de Pintoscayoc 1, Quebrada de Humahuaca, Jujuy, Argentina. In La Arqueometría en Argentina y Latinoamérica, edited by S. Bertolino, R. Cattáneo, and A. Izeta, pp. 373-378. Editorial de la Facultad de Filosofía y Humanidades, Universidad Nacional de Córdoba. Investigates the composition of corroded glass beads recovered from a site in northwestern Argentina that dates to the 16th-17th centuries.

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 BP.

Lozada-Mendieta, Natalia, Philip Riris, and José R. Oliver
2022 Beads and Stamps in the Middle Orinoco: Archaeological Evidence for Interaction and Exchange in the Atures Rapids from AD 1000 to 1480. Latin American Antiquity; https://doi.org/10.1017/laq.2022.73. Presents an archaeometric analysis of stone beads and ceramic roller stamps, items previously associated with trade practices, from two recently excavated sites in Venezuela, Picure (AD 1030-1480) and Rabo de Cochino (AD 1000-1440); it assesses their provenance, production, and value.
Lü, Qin-Qin, Julian Henderson, Yongqiang Wang, and Binghua Wang

After establishing the compositional types and technological sequence of Mediterranean natron glass (8th-2nd centuries BCE) using trace elements, the authors report the analysis of a mid-1st millennium BCE glass bead from Xinjiang, China, which was likely made with Levantine raw glass, and identify common types of stratified eye beads in Eurasia based on a compositional and typological comparison.

Lü, Qin-Qin and Youjin Wu

Based on the analysis of three corroded Indo-Pacific beads, discusses the issues that may be involved when observing signal curves of highly inhomogeneous archaeological glass, as well as provide chemical characterization for the intact pristine body.

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.

Ly, Suw Young, Kyung Lee, Hyung Tae Kang, and Hai Soo Yoo

Voltammetric analysis of trace cobalt (Co) using modified carbon nanotube sensors in cyclic voltammetry (CV), square wave (SW) stripping voltammetry, and chronoamperometry modes was conducted on glass beads from an ancient tomb recently found in Sachang Dong, Cheongju City, South Korea, and dated to the 17th century (ca. Joseon period). It was found that the sensor can be used in trace analysis of archeological materials.

Lyubomirova, V., Ž. Šmit, H. Fajfar, and I. Kuleff

The concentration of 25 elements in the earliest glass materials in Bulgaria is determined and discussed.
Ma, Qian, A. Mark Pollard, Yifan Yu, Zhuanjie Li, Linling Liao, Long Wang, Man Li, Luwu Cai, Li Ping, and Rui Wen
Analysis of Indo-Pacific glass beads recovered from several sites in China dating to the Warring States period and the Han dynasty (202 BC-AD 220) revealed that they were likely produced in northeastern India or Southeast Asia and exported through the Maritime Silk Road.

Macâne, Aija, Kerkko Nordqvist, and Elena Kostyleva
Presents 15 new AMS and stable bulk isotope measurements of animal bones and teeth from ritual contexts. Russia.

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 AD. The chemical composition of the glass beads is also provided.

Magnavita, Sonja, Brandi L. MacDonald, Carlos Magnavita, and April Oga
2024 LA-ICP-MS Analysis of Glass Beads from Tié (12th-14th Centuries), Kanem, Chad: Evidence of Trans-Sudanic Exchanges. *Archaeometry* 66(1):100-118; https://www.academia.edu/105254808/.
The composition of the beads largely matches assemblages from along the East African coast, indicating that most of them entered the region via a hitherto undocumented east-west Sudanic route linking Northeast Africa with Lake Chad.
Malaman, E., C. Bettineschi, I. Angelini, B. Gratuze, J. Bonetto, and M. Salvadori
2024 Phoenician Head Pendants: Contextualizing Archaeological and Collection Pieces. In DAT@MI, It’s all a Matter of Time, Convegno Tematico, Milano, 7-9 febbraio 2024, Associazione Italiana di Archeometria, p. 36.
https://iris.unito.it/bitstream/2318/1960470/2/BoA_DataMI2024.pdf#page=36.
Stylistic, typo-chronological, and archaeometric analyses are combined to reconstruct the manufacturing techniques, identify the raw materials used, and potentially determine the origin of the two pendants of the Phoenician-Punic cultural period, Italy.

Mândescu, Dragoș, Maria Mihalache, Ioana Stânculescu, and Mihai Constantinescu
The study of small kaolin beads found at a site in Romania includes compositional analysis.

Mangou, Helen

Manning, Sturt W. and John P. Hart
Bayesian chronological modeling of a large set of radiocarbon dates indicates that European iron and cuprous metals (some in the form of beads) arrived in the Mohawk River Valley of New York earlier than previously thought – by the beginning of the 16th century. Also mentions find sites of copper beads in the region.

Manrique-Ortega, M.D., P. Claes, E. Casanova-González, J. L. Ruvalcaba-Sil, Ma. A. García-Bucio1, and L. Lowe
Characterizes and identifies the minerals that compose the various green stone ornaments found with two elite burials of the Formative Period in southeastern Mexico and attempts to determine their source.
Maran, Joseph

The contextual analysis of the appearance of amber objects (beads included) in Early Mycenaean graves points to a striking variation in how the various components were selected, combined, and deposited, thereby contradicting the hitherto predominant notion of a uniform use of such objects as necklaces.

Marchetti, Marie-Laurence and Bernard Gratuze

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.

Marín-Aguilera, Beatriz and Laure Dussubieux

LA-ICP-MS analysis of glass beads recovered from Shay Culture tombs reveals how the Shay communities benefitted from the Islamic global trade routes during the 9th-14th centuries, particularly the Middle East, Egypt, and the Indo-Pacific networks.

Martin Pruvot, Chantal and Bernard Gratuze

Analysis of tiny opaque green glass beads found with female burials of the Early Middle Ages at the necropolis of Clos d’Aubonne at La Tour-de-Peilz, Switzerland, reveal that they bear witness to trade between South India or Sri Lanka and the Merovingian West.

Martínez Mira, Isidro, O. Cornejo Navarro, and E. Vilaplana Ortego

Presents the results of archaeometric analysis of several glass paste beads and seals of the 6th-4th centuries BC from a burial ground in Spain.
Martínez Mira, Isidro and Eduardo Vilaplana Ortego

Presents information concerning the form, composition, production, dating, origin, and the cultural significance of several beads recovered from a tomb in southern Spain.


Describes and presents compositional data for stone and faience necklace beads of the period 850-550 BC from southeastern Spain.

Martinón-Torres, Marcos, Roberto Valcárcel Rojas, Jago Cooper, and Thilo Rehren

Discusses the composition of beads and small metal objects found with Taino burials. The items analyzed include beads made of placer gold exploited locally, gold-copper-silver pendants brought from continental South America and, above all, tubular brass lacetags from European clothing that were perceived as sacred metals.

Martinón-Torres, Marcos, Roberto Valcárcel Rojas, Juanita Sáenz Samper, and María Filomena Guerra

Presents the results of the first analytical program focused on metal artifacts (beads and pendants included) recovered from a range of Taino sites in Cuba. Includes compositional analysis and observations on production processes.

Mascelloni, M.L., G. Cerichelli, and S. Ridolfi

The assemblage includes 7 beads and 1 bead/spiral.
Mathis, François, Bernard Gratuzé, and Olivier Vrielynck  

A study of the composition and provenance of Merovingian glass beads from the Bossut-Gottechain cemetery (Belgium-Wallonia).

Mathis, François, Olivier Vrielynck, Amandine Leroy, Hélène Tregouet, and David Strivay  

Reports on the typo-chronology and composition of glass beads recovered from one of the largest Merovingian necropolises in Belgium.

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.

McCabe, Kendra and William T. Billeck  

This poster documents change in the opacifiers (tin, antimony, and arsenic) used in the production of drawn white glass beads during the 17th-19th centuries.

McCoy, T.J., A.E. Marquardt, John T. Wasson, Richard D. Ash, and Edward P. Vicenzi  

Delves into the composition and manufacture of the beads, as well as the source of the material.
McGovern, Patrick E.
1987 Silicate Industries of Late Bronze-Early Iron Age Palestine: Technical Interaction between Egypt and the Levant. In Early Vitreous Materials, edited by Mavis Bimson and Ian C. Freestone, pp. 91-114. British Museum Occasional Papers 56. 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 BC).

McGovern, Patrick E., Stuart J. Fleming, and Charles P. Swann
1993 The Late Bronze Egyptian Garrison at Beth Shan: Glass and Faience Production and Importation in the Late New Kingdom. Bulletin of the American Schools of Oriental Research 290/291:1-27. 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.

McIntosh, Susan Keech, Marilee Wood, Laure Dussubieux, Peter Robertshaw, Timothy Insoll, and Mamadou Cissé
2020 Glass Beads from Medieval Gao (Mali): New Analytical Data on Chronology, Sources, and Trade. Journal of African Archaeology; https://www.academia.edu/43403866/. Reports on the results of compositional analysis by LA-ICP-MS of 100 glass beads recovered from several archaeological sites in and around Gao dating to the 8th-14th centuries.

Mecking, Oliver

Medici, Teresa, Giulia Foradori, Francesco Carrer, Roberto Dal Maschio, Stefano Gialanello, Maurizio Montagna, Annaluisa Pedrotti, and Diego E. Angelucci
Advances in archaeological science now allow a better understanding of the sources of the materials used to make beads and therefore offer a new way of analyzing ancient circulation patterns and appreciating the true significance of these tiny objects.

Meek, Andrew and Sonja Marzinzik

Meirelles, Anna Cristina Resque

Investigates a group of frog-shaped pendants and plain beads of various stones from the lower Amazon, including their morphology, production technology, and chemical composition. In Portuguese and English.

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 Tísoc, Emiliano R. and Reyna Beatriz Solís Ciriaco
2018 Caracterización mineralógica y tecnológica de lapidaria de Teopancazco. In *Teopancazco como centro de barrio multiétnico de Teotihuacan. Los sectores funcionales y el...*
Reports on the chemical analysis and manufacturing techniques of stone ornaments recovered from a neighborhood of Teotihuacan, central Mexico.

**Melgar, Emiliano, Reyna Solís, and José Luis Ruvalcaba**


Reports on the composition and production technology used to produce greenstone beads, pendants, and other ornaments recovered from the Teopancazco area of Teotihuacan, Mexico.


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.

**Meyer, Carol, Joan M. Todd, and Curt W. Beck**


Compositional analysis of a small pendant recovered from a grave near the Northern Palace at Tell Asmar, ancient Eshnunna, Iraq, and dated as “Protoimperial” (ca. 2500-2400 BC), revealed that it is copal and not amber, as formerly believed. More specifically, a copal from the Zanzibar, Madagascar, Mozambique region of East Africa.

**Michelaki, Kostalena, Ronald G.V. Hancock, Gary Warrick, and Dean H. Knight**


Over 400 yellow-metal samples (including several beads and pendants) were analyzed using INAA to determine the number of kettles that had reached the village, explore the chronology of their arrival, and examine patterns in their discard within the site.

**Micheli, Roberto**


On beads and pendants recovered from Square Mouth Vase Culture contexts in Italy.
The processes for producing beads and pendants from *Spondylus* shell eliminate the natural characteristics of the shells that allow taxa identification. This article investigates a technique that may permit such identification.

Middleton, Andrew, Susan La niece, Janet Ambers, Duncan Hook, Richard Hobbs, and Guy Seddon

Seven green beads on a gold necklace found in a Romano-British grave near Gillingham, Kent, have the appearance of weathered green glass but X-ray fluorescence analysis indicates they may be variscite. This study emphasizes the need for analytical investigation of finds of “weathered green glass” from Roman contexts, beyond visual examination.

Middleton, Sinéad

XRF analysis is used to determine the composition of glass beads and other artifacts recovered from various sites across Ireland that date from the Iron Age through to modern times.

Mihaylov, Philip and Nikoleta Tzankova

Investigates the beads (including eye beads) recovered from a necropolis in Bulgaria, including their chemical composition. They are attributed to the 6th-4th centuries BC.

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 AD 1200, and later Chinese beads, perhaps from Singapore.

**Mildner, Stephanie**


Presents initial results of an archaeological investigation of glass beads from the Tumulus and Urnfield cultures of Middle Europe.

**Mildner, Stephanie, Frank Falkenstein, Jens-Peter Schmidt, and Ulrich Schüssler**


Presents the results of the analysis of Bronze-Age glass beads from a hoard in northeastern Germany.

**Mildner, Stephanie, Ulrich Schüssler, Frank Falkenstein, and Helene Brätz**


Chemical analysis of blue glass beads of the Middle and Late Bronze Ages (14th-9th centuries BC) recovered from graves, hoards, and settlements in western Central Europe has identified a new glass group. Its composition is based on a different alkali source with significantly higher potassium content.

Reports on the archaeometric investigation of Bronze Age glass beads from sites in Central Europe.

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.

Miller, Jennifer M. and Pamela Rae Willoughby

Three of the samples date to the MSA, and represent the earliest directly radiocarbon dated OES beads currently known. This new data demonstrates that the tradition of OES beadmaking is not unique to the LSA, but began sometime during the terminal stages of the MSA.

Mirtsou, E.M., Vavelidis, D. Ignatiadou, and M. Pappa

Seeks to determine the chemical composition of the beads and the method of their manufacture. In Greek with an English abstract.

Miśta-Jakubowska, Ewelina, Renata Czech Błońska, Władysław Duczko, Aneta M. Gójska, Pawel Kalbarczyk, Grzegorz Żabiński, and Krystian Trela

SEM-EDX analysis of silver beads and pendants from three hoards found in Poland that date to AD 900-1039 provides information concerning granulation techniques used for ornaments and the source of the raw silver. See Pernicka (2020) for a critique and Miśta-Jakubowska et al. (2020) for a response.

Referring to Professor Pernicka’s remarks, the authors clarify doubts concerning the appropriateness of the use of laser ablation coupled with a quadrupole mass spectrometer in archaeometry.

**Molist, M., I. Montero-Ruiz, X. Clop, S. Rovira, E. Guerrero, and J. Anfruns**
Numerous burials were accompanied by beads and pendants of shell, stone, bone, and copper. A detailed compositional analysis is presented of the copper specimens.

**Monterrosa Desruelles, Hervé Victor**
Provides a technological analysis of Mayan imperial-green jadeite objects (including beads and pendants) recovered from the Great Temple of Tenochtitlan in central Mexico.

**Moreau, Jean-François**
On beads of the early fur trade in Quebec, including their chemical composition.

**Moreau, Jean-François, 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**
2002 Late French (1700-1750) to Early English (1750-1800) Regime White Glass Trade Beads from a Presumed Decorated Bag Found at the Ashuapmushuan Site (Eastern Central

Moreau, Jean-François, 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, Jean-François, R.G.V. Hancock, and M. Moussette

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. Gratuze

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.

Morozova, E.A., I.F. Kadikova, T.V. Yuryeva, and V.A. Yuryev

The colonies of micro and nanocrystallites of orthorhombic K$_2$SbOSiO$_4$ (KSS) detected in blue-green glass beads play a key role in the corrosion process that starts internally rather than from the surface as is common for glass objects.
Morris, Don P. and Jon M. Erlandson
Reports a suite of radiocarbon dates for the burial which had five small *Olivella biplicata* beads in the thorax region. California.

Moutsiou, Theodora, Demetrios Ioannides, Andreas Charalambous, Sebastian Schöder, Sam M. Webb, Mathieu Thoury, Vasiliki Kassianidou, Zomenia Zomeni, and Christian Reepmeyer
The artifacts studied include one bead, three pendants, and two small pebbles that are probably pendant preforms.

Moutsiou, Theodora and Vasiliki Kassianidou
Analysis suggests multiple origins for the carnelian raw material and, more significantly, demonstrates that occasionally other materials, visually indistinguishable from carnelian, were used in bead manufacture. The authors consider the symbolic role of these raw material choices and propose that these early island communities engaged in a system of linked values with their mainland counterparts dependent on the materials exchanged objects were made of.

Mukherjee, Anna J., E. Roßberger, M.A. James, P. Pfälzner, C.L. Higgitt, R. White, D.A. Peggie, D. Azar, and R.P. Evershed
Analysis of amber beads and a unique vessel in the form of a lion found in a royal tomb revealed that they were likely fashioned in Syria from raw amber imported from the Baltic via the Aegean.

Murillo-Barroso, Mercedes
The tholos yielded the largest collection of amber objects of Iberian Late Prehistory found so far with over 250 beads and pendants. Fourier transform infra-red spectroscopy (FTIR) analysis shows that the samples resemble Sicilian simetita. Spain.
Fourier transform infrared spectroscopy revealed that an amber bead recovered from a Late Neolithic funerary cave (3634-3363 cal BC) in northeastern Iberia it was made of Baltic succinite. This is the earliest evidence for the arrival of Baltic amber in the Mediterranean and Western Europe, before the Bell Beaker phenomenon and more than a millennium earlier than traditionally thought.

Provides archaeometric data on an amber bead or pendant found in Neolithic contexts in a cave in southern Spain. It was the only ornament found among a minimum number of 41 inhumations.

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).

Presents the contextual, morphological, and analytical study of an exceptional hoard that includes a necklace of dark red amber beads, a circular carnelian bead, and a tongue-shaped silver pendant. Compositional analysis reveals the sources of the materials.

Presents new standardized FTIR analyses of 22 archaeological (beads included) and geological samples from a large number of contexts across Iberia, as well as a wide scale review of all the legacy data available.
Analysis of four glass beads dated to the 12th-10th centuries BC revealed they were made using a plant-ash-based alkali and colored with an iron containing chromophore which gave the glass its dark green color. Calcium antimonate was the predominant white opacifier used though sodium antimonate was found as the opacifier in one sample.

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. 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 Yoko 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**
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 BC).

**Nakai, Izumi, Kriengkamol Tantrakarn, Norihiro Kato, N. Kawai, A. Nishisaka, and S. Yoshimura**

**Nakamura, Daisuke, Tomomi Tamura, Tetsuo Warashina, and Dilmaajav Erdenebaatar**
2021 Scientific Analysis on the Glass and Stone Artifacts in Ulaanbaatar State University. *Saitama University Minutes (Faculty of Liberal Arts)* 56(2):105-116; https://www.researchgate.net/publication/359055723.
Reports on the X-ray fluorescence analysis of glass and stone artifacts (including beads) from several sites of the Bronze Age and Xiongnu period in Mongolia.

**Nakamura, D. and T. Warashina**
In Japanese.

**Nándor, Kalicz, Zsuzsanna Siklósi, Gabriella Schöll-Barna, Bernadett Bajnócz, George H. Hourmouziadis, Fotis Ifantidis, Aikaterini Kyparissi-Apostolika, Maria Pappa, Rena Veropoulidou, and Christina Z iota**
Reports on the composition of shell beads and bracelets from a Late Neolithic site in Hungary and compares the findings to *Spondylus* artifacts from Neolithic sites of Greece, modern shells
from the Aegean and Adriatic seas, as well as fossil *Spondylus* and *Ostrea* shells from the Carpathian Basin. English abstract.

**Napolitano, Matthew F., Elliot H. Blair, Laure Dussubieux, and Scott M. Fitzpatrick**
Analysis of 38 glass beads recovered from Chelechol ra Orrak revealed that most of them were manufactured in Europe, with many originating in Bohemia ca. AD 1830-1850.

**Natuniewicz-Sekuła, Magdalena**
Discusses the chemical composition and production techniques of gold, silver, and copper-alloy beads and pendants from sites in northern Poland.

**Navarro, Alexandre Guida, Marcondes Lima da Costa, Abrahão Sanderson Nunes Fernandes Silva, Rômulo Simões Angélica, Suyanne Santos Rodrigues, and João Costa Gouveia Neto**
Analysis of a frog-shaped amulet pendant from the Boca do Rio pile dwelling in northeastern Brazil revealed that the artifact was made of tremolite/actinolite, a mineral lacking in Maranhão. A possible operational sequence in the manufacture of the *muiraquitã* is proposed, as well as the possible regional networks to which it belonged. English abstract.

**Neri, Elisabetta, Bernard Gratuze, and Nadine Schibille**
Explores the impact of the Byzantine-Slavic transition on the use and, by extension, trade of glass beads in the Balkans from the 7th to the 9th century C.E. A series of 48 glass beads from two sites in Albania analyzed morphologically, technologically, and chemically by LA-ICP-MS provide the evidence.

Corrects minor errors in Table 2 (samples K_013, K_018, K_019, and Lz_012).
Newman, Richard, Emily Kaplan, and Maria Cecilia Álvarez-White
2023  The Story of *Elaeagia* Resin (Mopa-Mopa), So Far. *Heritage* 6, 4320-4344; https://www.academia.edu/102194566/.
The resin was used to create beads, mostly tubular, during the pre-Hispanic period in the southwestern part of present-day Colombia. Includes a section on the analytical identification of *Elaeagia* resins.

Ngan-Tillard, D., H. Huisman, F. Corbella, and A. van Nass
Explores the potential of desktop micro-CT scanners for inspecting and quantifying the microstructure of glass beads from two sites in the Netherlands to determine manufacturing techniques.

Nikita, Kalliopi

Nikita, Kalliopi and Julian Henderson
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
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 BC) to the Early Protogeometric period (about 1000/950 BC), and their chemical composition was determined using electron probe microanalysis.

Nikita, Kalliopi, Georg Nightingale, and Simon Chenery
2017  Mixed-Alkali Glass Beads from Elateia-Alonaki: Tracing the Routes of an Alien Glass Technology in the Periphery of Post-Palatial Mycenaean Greece. In *Hesperos. The*
The glass presents a composition that is alien to the well-established technological tradition of the plant-ash glass production in the Eastern Mediterranean and the Near East during the Late Bronze Age. The appearance of glass beads that belong to a technology typical of glass production in Northern Italy and Central Europe is a unique phenomenon in the post-palatial Mycenaean periphery.

Novotná, Miroslava

Four of five amber bead and V-perforated button samples from Bell Beaker Culture sites in Moravia, Czechia, are identified as Baltic amber; the exception is identified as simetite, a form of amber originating in Italy. English summary.

Odriozola, Carlos P.

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., 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 clinochlore.

Odriozola Lloret, Carlos P. and Leonardo García Sanjuán
2013 Las cuentas de collar de piedra verde de Matarrubilla (Valencina de la Concepción (Sevilla)). In *El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla)*,
The analysis of a group of green-stone necklace beads excavated at Matarrubilla (part of the Copper Age site of Valencina de la Concepción-Castilleja de Guzmán (Seville, Spain) has revealed the possible origin of the stone.

Odriozola, Carlos P., José Ángel Garrido Cordero, Joan Daura Luján, and Montserrat Sanz

A group of beads from the artificial cave of La Molina (Lora de Estepa, Sevilla) and Cova del Gegant (Sitges, Barcelona) were made from biogenic raw material and intentionally covered by a layer of resin. This is the first time this type of treatment has been documented on elements of adornment in the Late Prehistory of the Iberian Peninsula. The composition and nature of the coatings are analyzed and the symbolic role of such alterations and imitations of prehistoric adornments is discussed.

Odriozola, Carlos P., José Ángel Garrido-Cordero, Cláudia Santos, Elisabete Barradas, and Ana Catarina Sousa

Offers a characterization of the raw materials and the chronology of a bead assemblage found with a burial in Portugal by means of X-Ray Fluorescence (p-XRF) and the radiocarbon dating of a tibia directly associated with the beads under study.

Odriozola, Carlos P. and J.A. Linares-Catela

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

Characterizes the variscite from the Pico Centeno mines in north-central Spain and compares them to specimens from other sources and to 50 green beads from megalithic tombs from two different regions.

2010 Variscite Source and Source Analysis: Testing Assumptions at Pico Centeno (Encinasola, Spain). *Journal of Archaeological Science* 37(2):3146-3157. 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.

2013 Provenancing Variscite Beads: Pico Centeno (Encinasola, Spain) Outcrop Case Study. *Open Journal of Archaeometry* 1(e17):80-84. Comparing the composition of variscite samples from the Pico Centeno mining district utilized during the Copper Age to variscite samples and beads from other Iberian sources revealed that the concentrations of trace elements do not allow establishing a provenance for the beads, as traditionally claimed.

**Odriozola, Carlos P., Rui Mataloto, Jesús Moreno-García, Rodrigo Villalobos-García, and José María Martínez-Blanes**

2012 Producción y circulación de rocas verdes y sus productos en el sw peninsular: el caso de Anta Grande do Zambujeiro. *Estudos Arqueológicos de Oeiras* 19:125-142; https://www.academia.edu/49481557/. XRF and XRD analysis of green beads from megalithic structures and settlements of the 3rd millennium BCE in southwestern Iberia identified several minerals (variscite, muscovite, talc, chlorite). Comparisons with mineral data from mining complexes in the region shows that the raw materials for beadmaking were exchanged as exotics on a regional and supra-regional scale.

**Odriozola, Carlos P., Joaquina Soares, Carlos Tavares da Silva, and Paulo E. Fonseca**

2016 Iberian Southwest Middle Bronze Age. Reading Social Complexity in Greenstone Beads from the Cist Necropolis of Sines. In *Social Complexity in a Long Term Perspective*, edited by Joaquina Soares, pp. 131-152. Setúbal Arqueológica 16. Chemical and mineralogical analysis of a group of greenstone beads from the cemeteries of Provença and Pessegueiro in southwestern Portugal showed that they were not made out of variscite, but of raw material available in the geological structure of Serra do Cercal.
Odriozola, Carlos P., Ana C. Sousa, Rui Mataloto, Rui Boaventura, Marco Andrade, Rodrigo Villalobos García, José Ángel Garrido-Cordero, Eugenio Rodríguez, José María Martínez-Blanes, Miguel Ángel Avilés, Joan Daura, Montserrat Sanz, and José Antonio Riquelme
Approaches the analysis of Iberian Peninsula amber artifacts from the 6th to 2nd millennia BCE by considering their provenance (based on FTIR characterization), chronology, and spatial relationship with other exotica.

Odriozola, Carlos P., Rodrigo Villalobos García, Rui Boaventura, Ana Catarina Sousa, J.M. Martinez-Blanes, and Joao Luis Cardoso
On the production of personal adornments (beads included) of green stone at three Chalcolithic villages in Portugal. Compositional analysis is provided.

Odriozola, Carlos P., Rodrigo Villalobos García, Primitiva Bueno Ramírez, Rosa Barroso Bermejo, Raúl Flores Fernández, and Pedro Díaz-del-Río
Stone body ornamentation in the middle Tagus Basin, Spain, is approached through the study of variscite bead production variability at 4th-2nd millennium BC sites with particular focus on the spatial variability of raw materials and their chronological and contextual patterning. Includes archaeometric analysis.

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

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.
Oga, Katsuhiko, Tomomi Tamura, Shinta Inagaki, and Kazuyuki Nakamura
Examines the beadmaking technique and chemical composition of wound glass beads. They are made of plant-ash soda glass colored by cobalt, and they can be classed into two groups. In Japanese with English abstract. Japan.

Ogundiran, Akinwumi and O. Akinlolu Ige
Compositional analysis of crucibles, glass cullet, and glass beads excavated at Osun Grove (Osogbo, Nigeria) reveals that the Yoruba of West Africa developed a unique glassmaking technology that lasted till the 17th century.

Oikonomoua, Artemios, Konstantinos Beltsios, and Nikolaos Zacharias
Thirty-seven samples, mostly beads, ranging from the Archaic to the Hellenistic period, were analyzed to determine their composition and processing temperatures.

Oikonomoua, Artemios, Maria Kaparou, Vid S. Šelih, Johannes T. van Elteren, Nikolaos Zacharias, Simon Chenery, and Julian Henderson
The aim is to assess some technological aspects of the assemblage, provide a chemical fingerprint for it, and suggest a likely provenance to facilitate a discussion of the issues of glass consumption and trade during a given era.

Oikonomoua, A. and P. Triantafyllidis
Both major/minor and trace-element analysis of 86 beads indicates a Mesopotamian origin.

Oikonomoua, A., P. Triantafyllidis, K. Beltsios,, N. Zacharias, and M. Karakassides
Twenty-five glass artifacts, mostly fragmented beads, recovered from the Kameiros citadel of Rhodes (Greece) and dating to 640-600 BC were analyzed to determine essential compositional trends and glass processing temperatures.

**Olmeda, Giulia, Ivana Angelini, Gianmario Molin, Stefano Boaro, and Giovanni Leonardi**
2015  
Reports on the chemical and mineralogical analyses of eight vitreous material ornaments (four beads included) with a poorly defined chronology, coming from a protohistoric and Roman site in Cordignano-Colle Castelir, northeastern Italy.

**Olmeda, Giulia, Benedetta Prosdocim, Ivana Angelini, Michele Cupitò, Gianmario Molin, and Giovanni Leonardi**
2015  
Discusses the composition of glass beads recovered from a cemetery in northern Italy that is attributed to the Middle Iron Age (6th-4th centuries BC). English abstract.

**Ono, Rintaro, Fadilah Aziz, Adhi Agus Oktaviana, Dyah Prastiningtyas, Marlon Ririmasse, Nurachman Iriyanto, Irwansyah Zesse, Yoichiro Hisa, and Minoru Yoneda**
2017  
Development of Regional Maritime Networks during the Early Metal Age in Northern Maluku Islands: A View from Excavated Glass Ornaments and Pottery Variation. *The Journal of Island and Coastal Archaeology* 13(1); https://doi.org/10.1080/15564894.2017.1395374.  
Presents the results of compositional analysis of glass beads and other ornaments from a site in Indonesia dating to ca. 2100-1900 years B.P. These date, combined with variable pottery, indicate the possible development of maritime and cross-regional networks to the Northern Maluku Islands.

**Os, B.J.H. van, R.M. Vogelzang, J.W. de Kort, D.J. Huisman, M. Kars, D.J.M. Ngan-Tillard, W. Verwaal, and E. Meijvoge**
2014  
Presents a study of the glass and amber beads recovered from a Merovingian site in the southern Netherlands. Includes compositional analysis.
Osanai, Yasuhito, Tatsuro Adachi, Kazuhiro Yonemura, and Kazuo Miyamoto
Based on instrumental analyses, a tubular bead and a round bead found at a stone-slab grave at the Daram Site were identified to be talc and microcrystalline silica phase like agate and chalcedony, respectively.

Osváth, Zsófia, Istvá Fórizs, Máté Szabó, and Bernadett Bajnóczi
On the composition of three Scythian stratified eye beads with bosses from Mezõtúr and two Celtic bobbin beads and one Celtic simple eye bead from Vác-Kavicsbánya using handheld X-ray fluorescence (hXRF), micro-X-ray diffraction (μ-XRD), and electron microprobe analysis (EMPA) methods.

Ottenwelter, Estelle, Jiří Děd, and Ludmila Barčaková
Investigates the composition, construction, and decorative techniques of various metal ornaments including hollow spherical pendants with and without enamel inlays (gombiky) and beads. Czechia.

Palomar, T., J. Peña-Poza, and J.F. Conde
Reviews chemical analyses carried out on glass beads dating to the 4th-1st millennia BC from sites in the northeastern portion of the Iberian Peninsula to assess their quality and utility in determining technological patterns and geographical areas of provenience.

Panagiotaki, Marina
Concentrating primarily on vitreous materials (including beads) held by the Heraklion Museum in Crete, this study involves: 1) analytical work; 2) conservation; 3) replication, using local raw materials; and 4) macroscopic examination of all vitreous materials artifacts.
Panagiotaki, Marina, Yannis Maniatis, and Mike Tite
Traces the contribution of Bronze Age Aegean vitreous-materials artisan/pyrotechnologist to ancient technology, based on compositional analysis and replication experiments.

Panagiotaki, Marina, Mike Tite, and Yannis Maniatis
Identifies possible production centers of Egyptian blue during the Bronze Age by comparing the results of analytical work performed on Egyptian-blue artifacts from the Aegean with those from Egypt and the Near East, concentrating especially on the alkali flux used in the production of Egyptian blue.

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.

Panich, Lee M., Laure Dussubieux, Tsim D. Schneider, Christopher Canzonieri, Irenne Zwierlein, Christopher Zimmer, and Michelle Zimmer
Analysis of a sample of 70 beads from three colonial contexts dating from 1786 to 1870 suggests a relatively late (ca. 1840) introduction of lead-glass white beads using arsenic opacifiers into the region, as well as some potentially meaningful differentiation among the more common antimony-opacified soda-lime glass beads found at all three sites.

Pankiewicz, Aleksandra and Sylwia Siemianowska
Archaeological evidence indicates that a glassworks existed in southwestern Poland that produced glass beads, among other things. Extensive compositional analysis of the recovered glass.

**Pankiewicz, Aleksandra, Sylwia Siemianowska, and Krzysztof Sadowski**

2017 *Wczesnośredniowieczna biżuteria szklana z głównych ośrodków grodowych Śląska (Wrocław, Opole, Niemcza)* [Early Mediaeval Glassjewellery from Main Silesian Stronghold Complexes (Wrocław, Opole, Niemcza)]. In pago Silensi. Wrocławskie studia wczesnośredniowieczne 3; https://www.academia.edu/34505921/.

Presents a detailed catalog of the recovered glass beads with chemical compositions. Poland.

**Paulsson, Bettina, Serge Cassen, Carlos Rodriguez-Rellán, António Carvalho, Jean-Sebastien Vaquer, Miguel Montaña, Josep Argilagós, and Mònica Poveda**


https://www.academia.edu/40957155/.

Presents the results of a Bayesian statistical analysis of 406 currently available radiocarbon dates from variscite and turquoise (callaïs) contexts in Europe, along with the results of provenience analyses, undertaken to investigate the fine-grained temporal pattern for the exploitation, circulation, and deposition of callaïs artifacts, such as beads and pendants, during the Neolithic period.

**Paynter, Sarah**


https://doi.org/10.1080/10572414.2022.2159722.

The *Rooswijk*, wrecked in 1740, and an unidentified vessel known as the Bead Wreck carried drawn lead-glass beads such as are found mainly in 17th- and 18th-century contexts. United Kingdom.

**Paynter, Sarah and Caroline M. Jackson**


Analyses of 17 annular transparent blue glass beads and one cylindrical glass bead with opaque grey-white decoration revealed they are made of low-magnesium/high-potassium (LMHK) glass of the type prevalent in Europe between ca. 1200 and 900 BC.
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.

Reports upon the compositional analysis of early Anglo-Saxon (5th-7th centuries AD) 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.

Peake, James R.N. and Ian C. Freestone
SEM-EDS analysis of glass beads from the early Anglo-Saxon cemetery complex at Eriswell, south-eastern England, has provided further insights into the production and technology of opaque red glass.

Among the objects analyzed using SEM were several beads dating to the 5th-7th centuries from the Anglo-Saxon cemetery at Eriswell, Suffolk, England.

Peche-Quilichini, Kewin, Ludovic Bellot-Gurlet, Eleonora Canobbio, Joseph Cesari, Bernard Gratuze, Franck Leandri, Céline Léandri, Paul Nebbia, and Céline Paris
Analysis of the components of a late Iron Age necklace revealed that the amber originated in the Baltic region while the raw materials for the glass specimens came from the Near East.
Peche-Quilichini, Kewin, Joseph Cesari, Franck Leandri, Ludovic Bellot-Gurlet, Eleonora Canobbio, Bernard Gratuze, Céline Leandri, and Céline Paris

In a natural shelter at Campu Stefanu, Corsica, the Middle Bronze Age levels yielded a necklace composed of vitreous and resinous beads. Radiocarbon dating indicates these artifacts were deposited during the 13th century BC (last part of the Middle Bronze Age). LA-ICP-MS analysis of the glass beads indicates a Mesopotamian origin of the raw glass.

Peng Zi-cheng, Li Ping, Zhou Tai-xi, Li Xue-ming, Lu Lian-cheng, and Hu Zhi-sheng

Believed to be made of real glass, analysis revealed that the Yu Guo beads are actually composed of clastic quartz with a small admixture of clay.

Pernicka, Ernst

Points out flaws in the article by Miśta-Jakubowska et al. (2019).

Pickard, Catriona and Ulf-Dietrich Schoop

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.

Pinto, J., A.C. Prieto, J.C. Coria-Noguera, C. Sanz-Minguez, and J. Souto

Reports on the composition of glass beads recovered from the site of Pintia (Padilla de Duero, Valladolid, Spain).
Pion, Constantin and Bernard Gratuze  

Discusses the technological, typological, and chemical characteristics of the beads.

Pion, Constantin, Bernard Gratuze, Patrick Périn, and Thomas Calligaro  

Among the evidence for trade between India and the Mediterranean world during the early Middle Ages are small beads of green-colored glass found in Merovingian-period graves. Their chemical composition and specific method of manufacture reveal they were produced in southern India and Sri Lanka and are called Indo-Pacific beads.

Pitarch Martí, Africa, Yi Wei, Xing Gao, Fuyou Chen, and Francesco d’Errico  

Analysis of six beads dated to ca. 31 kyr cal BP which exhibit well-preserved red pigment residues indicates that they are intentionally colored body ornaments. This is the earliest evidence from East Asia of a communication technology (the production of artificially colored beads) that has allowed humans to further complexify the messages conveyed by personal ornaments, and associate, to some extent, the performance characteristics of beads and pigment.

Plahter, Unn  

Beads are among the items analyzed from a market town in southern Norway.

Plouin, S., M.-P. Koenig, and B. Gratuze  

On the Bronze Age glass beads of Alsace-Lorraine, France. Includes chemical data.

Polikreti, Kyriaki, Joanne M.A. Murphy, Vasilike Kantarelou, and Andreas Germanos Karydas  
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.

**Polla, 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 BC.

**Pomberger, Beate Maria, Karina Grömer, Jörg Mühlhans, and Dan Topa**

Several caged balls and rectangular pendants with jingle bobs from an Iron Age sacrificial cave site near Brno in the Moravian Karst, Czechia, were investigated with regard to their metallurgical composition, acoustics, psychoacoustics, and effect on human hearing.

**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.

**Poulain, Dominique, Christian Scuiller, and Bernard Gratuze**

Reports on the composition, chronology, and technology of glass and amber beads from the Merovingian necropolis of Saint-Laurent-des-Hommes in southwestern France.

**Poulin, Jennifer Anne and Kate Helwig**
2016 The Characterisation of Amber from Deposit Sites in Western and Northern Canada. *Journal of Archaeological Science: Reports* 7(155-168).

Twelve distinct amber specimens from 11 deposit sites in Canada were studied in order to determine their subclass and other distinguishing chemical features. Amber beads recovered from three Thule sites in the Canadian arctic were then compared to these to determine their likely place of origin.
Pozo, M., J. Casas, and J.A. Medina  
2002 Estudio mineralógico de componentes ornamentales pétreos procedentes de un yacimiento de la Cultura del Argar (Fuente Álamo, Almería) [Mineralogical Study of Stony Implements Sourced in an Argaric Culture Site (Fuente Álamo, Almería)]. *Boletín Geológico y Minero* 113(2):131-142.

On the chemical composition and likely source of stone objects from an Early Bronze Age site in southern Spain. Includes beads of variscite, muscovite, chlorite, fluorite, and quartz.

Prasad, Ravi, V.N. Prabhakar, and Vikrant Jain  

Přichystalová, Renáta and Jindřich Štelcl  

On the composition of drawn beads from graves in Moravia, Czechia, dated to the turn of the 9th and 10th centuries.

Přichystalová, Renáta, Jindřich Štelcl, and Václav Vávra  
2011 Chemické složení raně středověkých skleněných korálků z jižního předhradí velkomoravského hradiska Břeclav-Pohansko [Chemical Composition of Early Medieval Glass Beads from the Southern Part of the Stronghold at Břeclav-Pohansko]. *Geologické výzkumy na moravě a ve slezsku* 2:187-190; https://www.academia.edu/1618042/.

Czechia.


A variety of glass beads, including segmented foil beads, was found in graves attributed to the 9th century in Czechia. Includes chemical analyses.

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
2008 A Raman Spectroscopic Study of the Mapungubwe Oblates: Glass Trade Beads Excavated at an Iron Age Archaeological Site in South Africa. *Journal of Raman Spectroscopy* 39(1):79-90; https://www.academia.edu/15107191/. 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
2011 A Raman Spectroscopic Study of Glass Trade Beads Excavated at Mapungubwe Hill and K2, Two Archaeological Sites in Southern Africa, Raises Questions about the Last Occupation Date of the Hill. *Journal of Archaeological Science* 38(12):3264-3277; https://www.academia.edu/15107190/. 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 (AD 1290) of the site obtained by carbon dating.

Purowski, Tomasz


A thorough study of the beads recovered from 89 archaeological sites in Poland including classification, chemical composition, and manufacturing techniques. In Polish with substantial English summary.


Describes beads excavated in western Poland and investigates their chemical composition. Detailed English summary.


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


Reports the chemical composition of two Bronze Age beads excavated in Legnica, Poland. They were probably made in production centers in the area of the River Po Plain. In Polish with English summary.


Reports on the composition of 12 faience beads recovered from a cemetery in Poland, tested using the EPMA method.


Discusses the chemical composition, production technology, and form of Bronze Age glass beads found in the territory of present-day Poland.

2022  Ozdoby wykonane z “tworzywszklistych” odkryte na cmentarzysku w Świębiku [Ornaments Made of “Glassy Materials” from the Cemetery at Świdbie]. In Cmentarzysko w wczesnej epoki żelaza w Świębiku na Górnym Śląsku, Vol. 2, edited by Monika Michnik

Discusses the beads made of vitreous materials uncovered at the Early Iron Age cemetery in Świbie, southern Poland. Includes the results of compositional analysis. 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. Some glass was made using mineral soda and some using plant ash rich in sodium.

Purowski, Tomasz and Petras Jokubauskas

Twelve beads made of “vitreous material” recovered from a site in northern Poland, and attributed to the beginning of Period II of the Bronze Age, are unique for this time period in the entirety of Central Europe. Based on their chemical composition, it is believed that they were manufactured in the Eastern Mediterranean areas, possibly Egypt.

Purowski, T., L. Kępaa, and B. Wagner
2016 Glass on the Amber Road: The Chemical Composition of Glass Beads from the Bronze Age in Poland. Archaeological and Anthropological Sciences; https://www.academia.edu/103928553/.

Two groups were distinguished based on a comparison of the MgO to K₂O ratio in glass: 1) high magnesium glass (HMG) - 23; and 2) low magnesium and high potassium glass (LMHK) - 33 (29 matrix glass specimens and 4 decorative).

Purowski, T., A. Nowak, E. Bulska, and B. Wagner

Analysis revealed that the bead found in a grave which was part of an early medieval cemetery in Lubień, Poland, can be claimed to have been manufactured during the Hallstatt D period.

Purowski, T., A. Nowak, and B. Wagner
The physico-chemical examination of two beads has demonstrated that the glasses from Modlnica (Poland) have close analogies among 7th-6th century BC materials known from the North Pontic zone.

Purowski, Tomasz, Olga Syta, and Barbara Wagner
2016 Italian Leech-shaped Glass Fibula Bow from the Hallstatt Period, Discovered in Poland. *Archeologické rozhledy* LXVIII:109-118; https://www.academia.edu/25232794/. Reports the chemical composition of a leech-shaped glass slider (bead) on a fibula bow. It originated in Italy and dates to the end of the 8th or the 7th century BC.


2020 Between East and West: Glass Beads from the 8th-3rd Century BC from Poland. *Archaeometry*; https://www.academia.edu/42799491/. Discusses the chemical composition of glass beads from 20 archaeological sites in Poland that date to Hallstatt C to early La Tène (about 800/750-260/250 BC).

Purowski, Tomasz and Barbara Wagner
2015 Badania składu chemicznego szkła odkrytych na osadzie kultury latenej w podleżu koło Krakowa [Chemical Analyses of Glass from the Settlement of the La Tène Culture in Podleże near Kraków]. *Przegląd Archeologiczny* 63:125-146; https://www.academia.edu/25233101/. Beads were included in the study. English abstract.

Purowski, Tomasz, Barbara Wagner, Ewa Bulska, Olga Syta, and Piotr Dzierżanowski
2014 Glassy Faience from the Hallstatt C Period in Poland: A Chemico-Physical Study. *Journal of Archaeological Science* 50:288-304; https://www.academia.edu/23200421/. 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.

Putsadee, Rodcharoen and Tanongsak Lerdpipatwrrakul
Putzgruber, E., M. Verità, K. Uhlir, B. Frühmann, M. Griesser, and G. Krist

Provides information concerning the chemical composition of some of the pieces in the 16th-century glass jewelry collection of Archduke Ferdinand II which includes necklaces composed of decorated blown beads and chains formed of interconnected wound ring beads.

Qian, Cheng, Guo Jinlong, Wang Bo, and Cui Jianfeng

The results of the compositional analysis of four glass beads and a glass cup from numerous cemeteries in western China are used to prove that communication and exchange existed between the ancient Qiemo kingdom and Central China, West Asia, Southwest Asia, and even the eastern Mediterranean.

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

Queffelec, Alain, Ludovic Bellot-Gurlet, Eddy Foy, Yannick Lefrais, and Emmanuel Fritsch
2021 First Identification of Sudoite in Caribbean Ceramic-Age Lapidary Craftsmanship. *Gems & Gemology* 57(3); https://www.gia.edu/gems-gemology/fall-2021-first-identification-sudoite.

Exhaustive analysis of archaeological beads and pendants from the French islands of the Lesser Antilles has revealed a green lapidary material used for the production of nine artifacts from five archaeological sites: sudoite.

Querré, Guirec, Thomas Calligaro, and Serge Cassen

A large group of beads and pendants in *callaïs* from 27 Neolithic occupations in northern France were analyzed by PIXE to determine their mineralogical nature and provenance.
Querré, Guirec, Thomas Calligaro, Serge Cassen, Marie-Pierre Dabard, and Salvador Domínguez-Bella

Determining the provenience of European Neolithic ornaments made of variscite using an elaboration of a chemometric model.

Querré, Guirec, Thomas Calligaro, Serge Cassen, and Salvador Domínguez-Bella

Sources the green-stone beads and pendants deposited in the large grave mounds in Brittany, France.

Querré, Guirec, 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.

Querré, Guirec, F. Herbault, and T. Calligaro

The analysis of mostly green beads from the large grave mounds in the Carnac region in Brittany reveals they are variscite and originated from the Iberian Peninsula.
Raad, Danielle and Cheryl A. Makarewicz  
Investigates raw material selection and bead manufacture at the PPN settlement of el-Hemmeh, Jordan.

Rădvan, R, C. Borş, and L. Ghervase  
Examines the corrosion layer of several beads made of ternary bronze alloys from a site in Romania.

Ragazzi, E., Guido Roghi, Aurelio Giaretta, and Piero Gianolla  
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.

Rahman, Nur Qahirah Abdul, Zuliskandar Ramli, Azimah Hussin, Muhamamad Nu’Man Mohd Nasir, Nur Sarahah Mohd Supian, and Hossein Sarhaddi Dadian  
Analysis of 17 beads from a 2nd-century site revealed a composition high in silica (52.0-78.0%), aluminum (9.0-20%), and sodium (3.0-19.0%), a key feature of South East Asia’s Indo-Pacific glass beads.

Reports the multi-elemental content of 16 glass beads and 8 glass samples dating from the 5th-14th centuries.

Ramdani, Yamna  
2023  Analysis of Glass Beads from the “Roten Schmelzzimmer” in Arnstadt and Glass Tableware from the Grafschaft Schwarzburg-Sondershausen Dating from the 17th and 18th Century. Ph.D. Dissertation. Faculty of Geosciences, Geotechnics, and Mining,
The glass beads from the Roten Schmelzzimmer were identified as soda-lime- and high-lead-silicate glasses, which were made using pure sands and halophytic plant ash as a fluxing agent. These recipes are characteristic of the Mediterranean region.

**Ramli, Zuliskandar and Zakaria Kamaruddin**

On the composition of Indo-Pacific glass beads found at Kampung Sunagi Mas (Site 32), Kota Kuala Muda, Kedah, Malaysia. In Malay.

**Ramli, Zuliskandar and Nik Hassan Shuhaimid Nik Abdul Rahman**

**Ramli, Zuliskandar, Nik Hassan Shuhaimi Nik Abdul Rahman, Sharifah Nur Izzati Sayed Hasan, Ros Mahwati Ahmad Zakaria, Mohd Rohaizat Abdul Wahab, Norlelawaty Haron, and Hasnira Hassan**


Includes information about the chemical composition of the beads. In Malay.

**Ramli, Zuliskandar, Nik Hassan Shuhaimi Nik Abdul Rahman, and Adnan Jusoh**

Compositional analysis reveals that Sungai Mas, Malaysia, and OC-EO, Vietnam, produced their own Indo-Pacific beads and they were two of the Indo-Pacific beadmaking centers in Southeast Asia from the 2nd to the 13th century CE.

**Ramli, Zuliskandar, Nik Hassan Shuhaimi Nik Abdul Rahman, Adnan Jusoh, and Yunus Sauman**
Compares the compositional data of Sarawak glass beads with that obtained from glass beads from Kuala Selinsing, Fort Canning, Singapore, and Sungai Mas, Kedah.

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


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

**Ramli, Zuliskandar, Nur Qahirah Abdul Rahman, Azimah Hussin, Sharifah Nur Izzati Sayed Hasan, and Azharudin Mohamed Dali**


Reports on the composition of Indo-Pacific glass beads recovered from three ancient port sites in Malaysia, 2nd-11th centuries AD.

**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).

**Reinhardt, Averie, Renfei Feng, Qunfeng Xiao, Yongfeng Hu, and Tsun-Kong Sham**


In a novel research project, X-rays from a synchrotron light source are used to determine the chemical composition of a Dzi bead to see if the pattern is natural or man-made and if the bead is genuine or a replica.
Resque Meirelles, Anna Cristina and Marcondes Lima Da Costa
Archaeometric analysis of 23 zoomorphic pendants and one bead revealed that most were made of that minerals commonly found in Brazil: quartz, albite, microcline, variscite, anorthite, and tremolite (the equivalent of nephritic jade). Four pieces, however, were made of jadeite (jadeitic jade) which is unknown in the Amazon basin or in other parts of Brazil.

Analysis of nine beads utilized by Africans and Afro descendants during the 19th century suggests that they originated in “Italy and China,” though the faceted specimens are the likely products of Bohemia.

von Richthofen, Jasper, Flemming Kaul, Bernard Gratuze, and Jeanette Varberg
Discusses the blue glass beads found with a cremation burial of the Middle Bronze Age C of the Lusatian culture in east-central Germany. Chemical analysis indicates the beads are imports from Mesopotamia.

Rick, Torben C., René L. Vellanoweth, and Jon M. Erlandson
Discrepancies in $^{14}$C 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 $^{14}$C 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-Filcoff, 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. Rasoarifetra, M. Wood, E. Melchiorre, R.S. Popelka-Filcoff, 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-Filcoff, 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 and Marilee Wood

All analyzed beads from burials 3 and 8 at Ingombe Ilede, Zambia, belong to the Khami series produced in India and traded into southern and south-central Africa from the mid-15th to mid-17th centuries. Some beads of an earlier type were present in other graves, and may have been kept as heirlooms.
Garumele, 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.

A sample of 360 glass beads from 19 archaeological sites in southern Africa dating between about the 8th and 16th centuries AD 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 AD were probably made from Iranian glass. Later bead series were made of glass probably manufactured in South Asia.

Analysis of eight green beads (calaite, a turquoise mineral) excavated at several dolmens at Burgos, Spain, revealed the great mineralogical variety that exists under this generic denomination.

Archaeometric, technological, and social approaches to the study of glass beads and bracelets in Celtic Europe during the second Iron Age.

LA-ICP-MS analysis of engraved beads from a site in Doubs, France, has refined the chronology for the manufacture of such rare artifacts, and increases our understanding of Late Iron Age ritual deposition practices.
Roman, Deborah V.

Presents initial results, including a suite of 20 dates, from three sites (Ven-852, -853, and -1029) in Ventura County that document a well-established occupation sequence including evidence of occupation prior to 9000 cal/bp near the important Late Period ritual site of CA-VEN-632. Shell beads enter into the discussion.

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 BC site at Tissamahara, Sri Lanka.

Rosenberg, Danny, Yael Elkayam, Yossi Garfinkel, Florian Klmscha, Vesna Vučković, and Yaakov Weiss
2022 Long-Distance Trade in the Middle Chalcolithic of the Southern Levant: The Case of the Olivine Beads from Tel Tsaf, Jordan Valley, Israel. *PloS ONE* 17(8), e0271547; https://www.academia.edu/84512546/.

Discusses the morphometric and technological characteristics, as well as the chemical composition, of eight olivine beads that are postulated to have originated in Ethiopia.

Rosenberg, Danny, Branden Cesare Rizzuto, Florian Klmscha, and Tristan Carter

This paper details the obsidian bead assemblage (the richest so far in the southern Levant), its morphometric and technological characteristics, and the raw material sources based on chemical compositions. It then discusses the assemblage’s broader socioeconomic significance, and the possible means through which members of the community came to procure the beads.

Roumiantsëva, 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.

Ruano Ruiz, E., P. Hoffman, and J.M. Rincón
Reports the chemical composition of pre-Roman glass necklace beads recovered from the Iberian necropolis of El Cigarralejo in southeastern Spain.

Ruiz-Galvez, Marisa, Alicia Perea, Carolina Gutierrez, Hilario Madiquida, Jorge de Torres, Víctor M. Fernandez, and Cezar Mahumane
2021 Quirimbas Islands (Northern Mozambique) and the Swahili Gold Trade. *Journal of Archaeological Science: Reports* 38, art. 102985; https://www.academia.edu/56279858/.
Reports on the archaeometric study (OM, SEM-EDS, and PIXE) of a gold bead recovered on Ibo island and its significance in the historical regional context.

Rumyantseva, Olga S.
Discusses glass beads of the Oka region and the Oka-Sura interfluve area in eastern Russia, late Roman to Migration period. Includes compositional analysis.

Reports on the composition of seven glass beads from a cemetery of the 5th-7th centuries in southern Russia, along with comparative material. Most of the beads were composed of plant-ash glass. The exception (a bead of the “Smolin” type) is made from natron glass.

Found in the southwestern part of central Russia and dating to the late 2nd and 3rd centuries, the hoard included flattened prismatic (brick-shaped) beads of opaque red enamel. Their chemical composition is discussed.

**Rumyantseva, O.S., A.A. Trifonov, and D.A. Khanin**


Reports on the chemical composition of glass beads and enamels of the Bryansk hoard, an outstanding assortment of eastern European enameled objects found in central Russia that date to the late 2nd and 3rd centuries.

**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., L. Manzanilla, E. Melgar, and R. Lozano Santa Cruz**


Three greenstone beads from a necklace discovered at the palatial structure of Xalla at Teotihuacan, Mexico, were analyzed using external beam PIXE to determine their elemental composition and to establish the sourcing, trade, and relationship between these regions. The offering corresponds to the early Miccaotli period (ca. AD 155).

**Ruvalcaba Sil, J.L., E. Melgar Tísoc, 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 arqueológicos en el Área Maya*, edited by Adrian Velazquez Castro and
On the composition and origin of greenstone offerings (including beads) at Tenochtitlan.

**Sağlamtimur, Haluk, Gonca Dardeniz, and Emma L. Baysal**

The composition of one stone and six faience beads was determined in order to determine possible source and production regions.

**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 AD 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 1000 years ago.

**Salisbury, Amy and Ian Glover**

Analysis of beads from several sites dating to the mid-late 1st millennium BC revealed three basic glass groups: 1) potassium glass, low in calcium and magnesia and variable levels of alumina; 2) soda-lime glass, high in calcium and more alumina and magnesia; and 3) soda glass, lower in calcium and magnesia, but with high alumina.
Salvatori, S., M. Vidale, G. Guida, and E. Masioli
2009 Ilgynly-Depe (Turkmenistan) and the 4th Millennium BC Metallurgy of Central Asia.

Surface finds include a number of copper beads as well as a silver example. Their production and composition are discussed.

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

Provides the chemical composition of five glass beads recovered from two sites in southeastern Poland that were occupied during the Late Bronze Age and Early Iron Age.

Saminpanya, Seriwat, N. Bavornyospiwat, S. Homklin, S. Danyutthapolchai, and P. Bupparenoo

Discusses drawn beads dating to the 3rd-6th centuries.

Saminpanya, Seriwat, Chatree Saiyasombat, Nirawat Thammajak, Chanakarn Samrong, Sirilak Footrakul, Nichanan Potisuppaiboon, Ekkasit Sirisurawong, Thumrongsak Witchanantakul, and Catleya Rojviriya

By investigating the coloring elements in ancient beads from sites in Thailand, concludes that the Dvaravati glasses in Southeast Asia may have been imported or technologically transferred to domestic manufacturers during trading on the Silk Road that connected the East and the West.

Sampietro Vattuone, María M., Susana Martínez Stagnaro, Rosario García Giménez, José L. Peña Monné, Jimena Roldán, and Mario G. Maldonado

ED-XRF analyses of stone beads recovered from a grave located within a Formative residential unit dating to 1560±35 BP revealed that they were made of chrysocolla, variscite, and turquoise, all of which are foreign to the area.
Sánchez, Alberto, José A. Tuñón, David J. Parras, Manuel Montejo, Miguel A. Lechuga, Bautista Ceprián, Marcos Soto, and Álvaro Luque  
Presents the results obtained from the physico-chemical analysis of the Orientalizing (7th century BC) archaeological materials, including several glass beads.

Sánchez de la Torrea, Marta, F. Xavier Oms, François-Xavier le Bourdonnec, Sara Aliaga, Oriol Mercadal, Artur Cebrià, and Xavier Mangado  
2018  Bone or Shell? Using ED-XRF to Determine the Nature of Prehistoric Ornaments.  
Presents a protocol to quickly and easily distinguish between shell and bone materials in a non-destructive manner.

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.

Sarathi, Akshay, Jonathan Walz, and Laure Dussubieux  
https://www.academia.edu/65018316/.  
Reports on the composition of a sample of the glass beads, and also preliminarily examines the roles of imported beads in relation to other beads and artifacts in the cultural context of use and meaning.

Sato, Yuuki, Takashi Takeuchi, and Kazuyuki Nakamura  
Examines the age of a glass bead based on the porcelain excavated at Fukuyama Castle Town site, Japan. XRF analysis shows it is composed of alkaline lime glass. In Japanese.

Sawamura, Daichi, Chisato Kato, Mayumi Matsuzaki, Kazuya Yanase, Yoko Taniguchi, and Izumi Nakai
Glass beads excavated from various archaeological sites in the Kanto region fall into three categories: potash glass, soda-lime glass, and high-alumina soda-lime glass. In Japanese with English captions and abstract.

Schibille, Nadine, James W. Lankton, and Bernard Gratuze
To determine the origins and distribution of early Islamic glasses from Iran, a set of 169 glass samples (including 15 beads) from five different sites was analyzed by LA-ICP-MS. The glasses were classified into six different plant-ash glass groups, three of which are attributed to a Mesopotamian origin, while the others are presumed to represent regional Iranian production.

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.

Schoop, Ulf-Dietrich
The chemical composition of the micro-beads indicates that they were made from three distinctive materials: bulk talc (i.e., synthetic enstatite precursor), apatite, and mineral-rich clay pastes.

Schrickel, Marco and Klaus Bente
Uses archaeometrical methods to examine the coral beads that decorate fibulae from Central Germany (so-called *Mitteldeutsche Korallenfibeln*) and compares them to typologically similar fibulae from southwestern Germany.

**Schrickel, Marco, Klaus Bente, Christoph Berthold, Wolfgang Grill, Ulrike Teschner, Claudia Sarge, and Thomas Hoppe**


Presents a comparative archaeometric study of fibulae that incorporate coral beads from Central Germany. These were especially popular during the late Hallstatt and early Latène periods.

**Schrickel, Marco, Klaus Bente, Felix Fleischer, and Alexandra Franz**


Attempts to determine the nature of the material comprising the beads of a *Mitteldeutsche Korallenfibeln*. Is it coral or an imitation?

**Schulze, M., R. Lehmann, C. Vogt, and D. Vieweger**


A group of medieval glass beads (including two striped chevron beads) uncovered at Tall Zirā’a, Jordan, were analyzed to determine their place of manufacture, the coloring components, and manufacturing techniques.

**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.

Seinfeld, Daniel M. and Munir Humayun
LA-ICP-MS analysis of seven-layer chevron beads from several early-16th-century contexts in Florida revealed that the composition of the base glass is consistent with the type of glass used in Venice in the 15th through 17th centuries.

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 AD 1625-1640, and that they had completely replaced Sn-white beads by AD 1675. Specific bead chemistries link a number of the archaeological sites.

**Shedrinsky, A.M., T.P Wampler, and K.V Chugunov**


Pyrolysis-gas chromatography/mass spectrometry of six beads from a site in the north of the Tuva Republic revealed that they are made of Baltic amber.

**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.

**Sheridan, Alison, Katherine Eremin, and Andrew Shortland**


https://www.academia.edu/39341376/.

Reports the results of archaeometric analysis of faience beads from Britain, Ireland, and adjacent parts of mainland Europe.

**Shi, Meiguang, Ouli He, and Fuzheng Zhou**


Analysis of different kinds of glass beads, glass ear pendants, and glass cups revealed that most of them belonged to the K₂O-SiO₂ glass system; China. In Chinese.

**Shi, Meiguang and Fuzheng Zhou**


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, Izumi., 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.

Shipe, Megan, Angela Scarpa, and Lauren Johnson

Reports on the X-ray fluorescence (XRF) analysis of beads from a 17th-century context at a plantation site in Northampton County, Virginia. The authors hypothesize that the beads are of Dutch origin.

Shortland, A.

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

2017 The Analysis of Late Bronze Age Glass from Nuzi and the Question of the Origin of Glass Making. Archaeometry 60(1); https://www.researchgate.net/publication/320635346.

Reanalysis of a considerable corpus of glass (beads included) from Nuzi in northern Iraq revealed that the glass technology there was subtly different from contemporary Egyptian sites, using different ways of opacifying and working glass.

Shortland, A.J. and H. Schroeder

Polychrome glass beads found with burials dating to the late 5th century BC 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.
Shortland, A.J., N. Shishlina, and A. Egorkov

Shortland, A.J. and M.S. Tite

Shugar, Aaron N. and Ariel O’Connor
2008 The Analysis of 18th Century Glass Beads from Fort Niagara: Insight into Compositional Variation and Manufacturing Techniques. Northeast Historical Archaeology 37(1)58-68. 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.

Siemianowska, Sylwia

Siklósi, Zsusanna, Eszter Horváth, Igor Maria Villa, Stefano Nisi, Viktória Mozgai, Bernadett Bajnóczi, Péter Csippán, Péter Hornok, and Péter Kiss
2022 The Provenance of the Raw Material and the Manufacturing Technology of Copper Artefacts from the Copper Age Hoard from Magyaregres, Hungary. PLoSONE 17(11):e0278116; https://www.academia.edu/97838334/. Found in a ceramic vessel, the hoard included 681 small copper beads, 264 limestone beads, 1 Spondylus bead, 19 tubular spiral copper coils, and two large spectacle spiral copper pendants.

Silva, Jaciara Andrade, Olivia Alexandre de Carvalho, and Albérico Nogueira de Queiroz
Beads and pendants (mostly from the 16th century) associated with burials at a site in Canindé de São Francisco, Sergipe state, Brazil, included those made of bone, animal teeth, shell, stone, and glass. Compositional data are provided for the glass specimens.

**Silvestre, Romina, Natacha Buc, Alejandro Acosta, and Daniel Loponte**

Aims to determine the primary sources of green lithic beads recovered at five Late Holocene sites in northern Argentina.

**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.

**Siu, Ieong, Julian Henderson, Dashu Qin, Yu Ding, and Jianfeng Cui**

LA-ICP-MS results reveal that all of the beads are soda-alumina-silica glass.

**Siu, Ieong, Julian Henderson, Dashu Qin, Yu Ding, Jianfeng Cui, and Hongjiao Ma**

The results show that all of the glass samples are soda-lime-silica glass and belong to the high alumina-plant ash glass type.

**Smirniou, Melina, T. Rehren, V. Adrymi-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 BC 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, David Jezeršek, Timotej Knific, and Janka Istenic  
Glass artifacts (including beads) excavated from the Late Roman and Carolingian site at Bašelj, Slovenia, were found to be composed of traditional Roman natron-type glass.

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.

Smith, Geoffrey M., Alexander Cherkinsky, Carla Hadden, and Aaron P. Ollivier  
Presents stable isotope data and accelerator mass spectrometer (AMS) radiocarbon dates for six *Callianax* (previously *Olivella*) *biplicata* beads from a rockshelter in south-central Oregon. Most of the beads were deposited during the early Holocene during a series of short-term occupations and the shells used to manufacture them were procured along the northern California, Oregon, or Washington coasts.

Smith, Geoffrey M., Christopher S. Jazwa, Richard L. Rosencrance, and Tobin C. Bottman  
Reports radiocarbon and stable isotope data for a *Callianax biplicata* bead from Oregon’s Hawksy Walksy Valley, the only bead that has so far been recovered from this archaeologically important region. These data indicate that the bead was conveyed ca. 400 km inland at 480-285 cal BP from somewhere along the Oregon or northern California coasts.

Sode, Torben, Claus Feveile, and Ulrich Schnell  
A substantial number of the glass beads excavated at Ribe are imported beads, especially prevalent in the late 8th and beginning of the 9th century. This article discusses some of these beads. Lead isotope and chemical analyses of a sample indicate they were manufactured in the Near East.

**Sode, Torben, Bernard Gratuze, and James W. Lankton**

Among nearly 200 glass samples from the Viking Age market in Ribe, Denmark, one red and two opaque orange barrel-shaped beads had a unique high-alumina composition that seems to be closely related to small, drawn, monochrome Indo-Pacific beads known to have been produced in South and Southeast Asia, but with trace elements different from any other known glass types.

**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.

**Solís Ciriacó, Reyna Beatriz**

This dissertation provides a comprehensive study of the numerous lapidary objects (including beads and pendants) recovered from structures surrounding the Great Temple of Tenochtitlan in Mexico City. It identifies the raw materials and the production techniques involved, and also addresses the theoretical concepts of production organization, production spheres, tradition, and style.


Archaeometric analysis of stone ornaments and other objects found in structures surrounding the Great Temple at Tenochtitlan, Mexico, is used to determine their provenience, and to see if their type and manufacture correspond to any style and/or technological tradition from Tenochtitlan or elsewhere.
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 BC until the 3rd century AD.

Song, Yu-na and Gyu-ho Kim

Beads of the Baekje period (first half of the 4th century) were found to represent several glass groups including lead-barium, soda, and potash. The beads include gold-foil examples, as well as tubular and round forms. In Korean with English abstract.

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

Aims at bringing more precise information about the origin, occurrence, and cultural ties of natron and plant-ash glasses, production technologies, and shapes of beads made of these glasses in the middle Danube territory during the Early Middle Ages.


Focuses on the selection of basic information that is essential for the archaeometric analysis of historical glass and is intended for researchers who have no experience in this field. English summary.

Excavated in western Slovakia, the bead dates to the early middle ages and is composed of potash-lime glass. German summary.

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. English summary.

Staššíková-Štukovská, Danica and Alfonz Plško

Presents the results of chemical analysis of over 2000 segmented glass beads.

Stewart, Brian A., Yuchao Zhao, Peter J. Mitchell, Genevieve Dewar, James D. Gleason, and Joel D. Blum

Analysis of ostrich eggshell beads from highland Lesotho reveals that since the late Middle Stone Age, networks connected ecologically complementary regions over minimal distances of several hundred kilometers.

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).
Glass beads were found adorning the braids of a female burial in Moscow Oblast. They date to the 17th and first half of the 18th centuries, and are associated with the Venetian and Dutch glassmaking schools. The chemical composition of the beads is provided.


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.


Focuses on beads from the Bronze Age to the 17th-18th centuries AD and their chemical composition.

The inventory of glass objects recovered from the Myakininsky burial ground in the Moscow Region of Russia includes a variety of glass and stone beads. The chemical composition of some of the glass beads is provided.

Includes the results of compositional analysis of glass seed beads from various sites in western Russia.
Stricker, Thomas, Karlis Karklins, Mark Mangus, and Thaddeus Watts

Chemical analysis of a unique black bead found in Turkey that depicts the four phases of the moon reveals it most likely originated in the Fichtelgebirge region of Bavaria at some time prior to the early 19th century.

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.

Szczepaniak, Małgorzata
2019  Zróżnicowanie mineralogiczne i chemiczne paciorków z kamieni półszlachetnych i szkła z obszaru wczesnośredniowiecznej nekropolii w Dziekanowicach [Mineralogical and Chemical Diversity of Beads Made of Semi-precious Stones and Glass from the Early Medieval Cemetery in Dziekanowice]. In *Groby z biżuterią wczesnośredniowiecznego cmentarzyska w Dziekanowicach*, edited by Jacek Wrzesiński, pp. 195-236. FONTES.

The site is in Poland. English summary.

Takahashi, Misuzushi, Kenichiro Koshida, Takashi Takeuchi, and Kazuyuki Nakamura
2018  Component Analysis of Glass Beads from Minamikawa 2 Site Setana Town, Hokkaido. *Research Reports of National Institute of Technology, Hakodate College* 52:66-74; https://doi.org/10.20706/hakodatekosen.52.0_66

Examines beadmaking (winding) techniques and the chemical composition of glass beads excavated from an archaeological site of the Ainu Cultural Period from the 16th-17th centuries in Japan. The glass is of the potash-lead-silica type (K₂O-PbO-SiO₂). In Japanese.

Tamura, Tomomi

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


Ancient glass beads from sites in Myanmar, Cambodia, Vietnam, and India are examined in terms of production techniques and chemical composition. Further, they are compared with clearly dated artifacts that have been excavated in Japan, whose chemical compositions have been relatively well determined.

**Tamura, Tomomi, Tomoya Aono, and Kazuyuki Nakamura**
Re-examination of glass beads from a site in Japan clarified that they are composed of potash-lime glass and potash-lead glass. In Japanese.

**Tamura, Tomomi and Yasuharu Hoshino**

**Tamura, Tomomi, Daisuke Nakamura, Jamsranjav Bayarsaikhan, Jean-Luc Houle, and Tumurbaatar Tuvshinjargal**
Examines the beadmaking techniques and chemical composition of glass beads unearthed from a site on the Mongolian plateau that was utilized during the Han Dynasty (206 BC-AD 220).

**Tamura, Tomomi, Daisuke Nakamura, and Dac Chien Truong**
The chemical compositions of glass beads belonging to the Dong Son and Sa Huynh cultures of Vietnam are compared to those of Yayoi-period beads from Japan.

**Tamura, Tomomi and Katsuhiko Oga**
Categorizes lead-barium beads and pendants from tomb of the Yayoi and Kofun periods based on form, manufacturing methods, and chemical composition, and discuss each production area and distribution route.

Examines the chemical compositions, colorants, and beadmaking techniques of natron glass beads. 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 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. 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.
Tate, Jim, Katherine Eremin, Lore G. Troalen, Maria Filomena Guerra, Elizabeth Goring, and Bill Manley
Describes the necklace and also provides information concerning its production techniques and the composition of the metal.

Templin, Robert B., III
Identifies diachronic patterns in the recipes that guided the manufacture of drawn black beads during the 17th century. The concentrations of temporally diagnostic opacifiers (i.e., tin and antimony found within beads assemblages from individual contexts are then used to refine the existing site chronology and contribute to ongoing studies of the occupation and use of the mission.

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.

Analysis of a 14th-century biconical glass bead excavated at the Rostislavl settlement in Moscow oblast, Russia, revealed that it differs significantly from all beads traditionally found in this region: the bead was made by combining separate layers of the base and decorating material from glasses of two classes, lead silicate and potash lead.

Thanik Lertcharnrit and A.K. Carter
In Thai.
Then-Obluska, Joanna


Presents the chronological and spatial distribution of Indian glass beads in the territories of ancient Egypt, Nubia, and Aksum during a time of intensive Indian Ocean trade. Chemical compositional analysis of selected samples confirms the provenience of monochrome and bichrome drawn and rounded beads to be of South Indian/Sri Lankan origin.

Then-Obluska, 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. AD) and Late Ayyubid-Mamluk Quseir el-Qadim (13th-14th c. AD) periods.


Analysis of 34 glass beads using LA-ICP-MS has identified four glass groups. The results provide scientific evidence for the northernmost presence of South Indian/Sri Lankan glass beads in the Nile Valley and hint at the Blemmyan participation in broader regional exchange networks in Northeast Africa during a time of intensive overseas trade.


Discusses the composition and provenience of two types of plant-ash soda-lime (v-Na-Ca) glass, two types of mineral soda-lime glass (m-Na-Ca), and two types of mineral-soda-high alumina (m-Na-Al) glass based on the LA-ICP-MS analysis of beads and pendants recovered from Qustul and Serra East contexts in northern Sudan.


Compositional analyses using LA-ICP-MS have identified glass belonging to a number of broad compositional groups, providing new evidence regarding the provenience and chronology of glass beads available in medieval Northeast Africa.

2023  Overseas Imports on the Blue Nile – Chemical Compositional Analysis of Glass Beads from Soba, Nubia. Archaeometry; https://www.academia.edu/99027377/.
LA-ICP-MS analysis of glass beads from the most prosperous capital of medieval Nubia has identified a number of broad glass compositional groups, leaving no doubt about Alwa’s (Alodia’s) intense transcultural connections.

**Then-Obluskaa, Joanna, Laure Dussubieux, J. Mark Kenoyer, and Randall Law**

2021  

Reports on a large collection of beads and pendants made of resin, ostrich eggshell, stone, faience, and glass recovered from a site in northern Sudan. Most of them were found in a pottery vessel dated to the 8th-10th centuries; others are attributable to the 6th/7th-14th centuries. Combined macroscopic and chemical compositional analyses reveal the sources of the raw materials.

**Then-Obluska, Joanna, H.A. Gilg, U. Schüssler, and B. Wagner**

2020  

LA-ICP-MS analysis of garnet beads from an elite tomb at the 4th-century cemetery of Hagar el Beida suggest possible sources in Portugal and Nigeria, and a connection to similar garnets from Merovingian contexts.

**Then-Obluska, Joanna and Barbara Wagner**

2019  

Presents a detailed elemental analysis of 64 glass beads and pendants dated to the Meroitic period (1st-3rd centuries AD) and the Nobadian period (4th-6th centuries) from burial sites in the Lower Nubian Nile Valley region.

**Then-Obluska, Joanna with Barbara Wagner**

2019  

Strings of colorful glass beads were a popular commodity traded throughout ancient Nubia during the first half of the 1st millennium AD. Combining macroscopic examination with laboratory analyses (LA-ICP-MS), the author breaks new ground in Nubian studies, establishing diagnostic markers for a study of trading markets and broader economic trends in Meroitic and post-Meroitic Nubia.

**Then-Obluska, Joanna, Barbara Wagner, and Luiza Kępa-Linowska**

2019  
Presents an in-depth examination of mosaic glass beads recovered from a child’s grave in the royal cemetery at Meroë (Bagrawiyah, Sudan). Their chemical composition reveals that the glass used in their manufacture was produced in Egypt.

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.

Thibodeau, Alyson Marie
Utilizes two geochemical tracers (lead and strontium isotopes) to identify the source of the turquoise used to produce beads recovered from the Redtail site in the Tucson Basin of Arizona.

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 (AD 1000-1900). The analytical study employed optical microscopy, ED-XRF, and SEM-EDS.

Tian, Chenxin, Yihang Zhou, Kai Wang, Jian Sun, Yong Cui, and Dongbo Hu
Analysis of coil beads dating to the Southern Song dynasty reveals they are all of K₂O-PbO-SiO₂ and PbO-SiO₂ glass systems which confirms their Chinese origin.

Timby, Jane R.
Reports on the beads and pendants recovered from a site in central Great Britain, including their chemical composition. Materials include glass, amber, coral, rock crystal, and metal.

**Tite, M.S.**

**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.

**Tite, M.S., P. Manti, and A.J. Shortland**
Presents the chemical compositions and microstructures of faience objects (beads included) from Egypt spanning the period from the Middle Kingdom through to the 22nd dynasty as determined using analytical scanning electron microscopy.

**Toffolo, Michael B., Eugenia Klein, Rivka Elbaum, Adam J. Aja, Daniel M. Master, and Elisabetta Boarettoa**
The microstructure and chemical composition of 8 faience beads from an early Iron Age (12th century BC) 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 glass olive beads and their chemical composition.

**Tomková, Kateřina, Šárka Jonášová, and Zuzana Zlámalová Cílová**
Concentrates on the archaeological and chemical variability of glass artifacts, especially jewelry, their provenance, and the question of continuity in the development of glass jewelry between the 10th and 11th centuries.

Tomková, Kateřina, Šárka Křížová, Veronika Faltusová, Nadine Schibille, and Tomáš Vaculovič

Olive and fusiform beads are found at sites in Bohemia, Moravia, Bavaria, and the surrounding area in the 8th-10th centuries. LA-ICP-MS analysis of a sample show that most of them were made from recycled soda-lime-silica natron glass of the older Roman tradition and the Late Antique tradition.

Tomková, Kateřina, Šárka Křížová, and Tomáš Vaculovič

Reports on the composition of glass beads from an early medieval village cemetery (10th century) in Zeleneč, Bohemia.

Tomková, Katerina and Natalie Venclová

Presents an overview of the different bead types utilized in Bohemia and Moravia from the Bronze Age to the early Middle Ages, including production technology and chemical composition.

Tomková, Katarina, Natalie Venclová, Šárka Křížová, Nadine Schibille, Veronika Faltusová, Tomáš Vaculovič, and David Daněček

Chemical analyses confirm that beads from central Europe reflect the principal transition from natron to plant-ash glass during the 8th-9th centuries. They also reveal that beads made from
natron glass were still distributed in the 9th-10th centuries when new types of beads were made from this glass.

**Tomková, Katarina, Natalie Venclová, Šárka Křížová, Tomáš Vaculovič, and Veronika Faltusová**

2021  
Sklo z doby stěhování národů ze Zálůži u Čelákovic: archeologie a archeometrie  
[Migration Period Glass from Zálůži (Central Bohemia): Archaeology and Archaeometry]. *Archeologické rozhledy* LXXIII:259-292;  
https://www.academia.edu/109307844/.  

SEM-EDS and LA-ICP-MS analysis of 24 beads indicated soda-lime glass of the natron type. An important result is the finding that translucent glasses belong to the “Intermediate group,” which was only recently identified in European archaeometric research. English summary.

**Tomomi, Tamura, Nakamura Daisuke, Bayarsaikhan Jamsranjav, Houle Jean-luc, and Tuvshinjargal Tumurbaatar**

2021  
Scientific Analysis on the Glass Beads from the Xiongnu Burial of Zamiin Utug.  
*Nomadic Heritage Studies* XXII-II(1-22):89-102; https://www.academia.edu/62292250/.  
Examines the beadmaking technique and chemical composition of glass beads found with burials in northwestern Mongolia.

**Tori, Luca, Biljana Schmid-Sikimic, Eva Carlevaro, and Lionel Pernet**

2010  
Located in Switzerland and utilized from the Bronze Age to mid-La Tène times, the necropolis yielded beads of amber, glass (including raised-eye beads), and bronze that were incorporated into necklaces and earrings. The chemical composition of a variety of the glass beads is provided.

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

2010  
https://www.academia.edu/15107217/.  
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 AD 1280, with the physical evidence of the modern beads.

2012  
Analysis revealed at least seven different chromophores or pigments (lazurite, lead tin yellow type II, Ca/Pb arsenate, chromate, calcium antimonate, Fe-S “amber,” and a spinel). Many of the pigments were only manufactured after the 13th century which confirms the presence of modern beads in contradiction to radiocarbon dating which indicates occupation of the hill ended in AD 1280.

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 BC. 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 Julian 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.

One of the tasks of the study was to determine the chemical composition of the beads.

Trivedi, Mudit and Laure Dussubieux
Analysis of 12 drawn beads recovered from Indor, a 2nd millennium CE site, has revealed hitherto unprecedented variation in drawn beads by compositional group.

Troalen, Lore G., Maria Filomena Guerra, Jim Tate, and Bill Manley
This preliminary study provides information about the evolution of alloy composition and the use of alluvial gold in such items as beads and pendants.

Trombetta, Lindsey, Laure Dussubieux, Agazi Negash, Daniel Dalmas, Metasebia Endalamaw, Mulugeta Feseha, Lawrence Todd, and John Kappelman
The majority of the beads from site GQ165, which dates to ca. 1337 cal CE, belong to the v-Na-Al glass type that is found at different sites on the east coast of Africa dating from the 14th to the 16th century. While their compositions are similar, their typologies are distinct.

Truffa Giachet, Miriam
Prepresents preliminary results of the analysis of glass beads recovered from seven sites in West Africa dating to the 7-20th centuries.

Reports the findings of an archaeometric study of 954 glass beads recovered from 10 archaeological sites in Mali, Senegal, and Ghana, from contexts dated between the 7th-5th centuries BC and the 18th-20th centuries AD.

Truffa Giachet, Miriam, Bernard Gratuze, Anne Mayor, and Eric Huysecom
Reports the results of LA-ICP-MS analysis of 16 glass beads found at three rural sites: the funerary site of Dourou-Boro and settlement sites of Sadia, in central Mali, as well as the settlement site of Djoutoubaya, in eastern Senegal, in contexts dated between the 7th-9th and the 11th-13th centuries CE. Results show that the raw materials used to manufacture the majority of the glass most probably originated in Egypt, the Levantine coast, and the Middle East.
Truffa Giachet, Miriam, Bernard Gratuze, Sylvain Ozainne, Anne Mayor, and Eric Huysecom
The bead is composed of soda-lime-silica glass fluxed with mineral soda, and colored and opacified with cobalt, copper, and antimony. This exceptional find this far south in Africa expands greatly the area of distribution of this bead form and suggests a very early indirect contact between sub-Saharan Africa and the Mediterranean Basin.

Tzankova, Nikoleta
Reports on the mineral composition and gemological properties of four beads made of copper ore (malachite and azurite) and serpentinite (ultrabasite) from a site in southeastern Bulgaria. English abstract.

Tzankova, Nikoleta and Philip Mihaylov
The analyzed beads are all classified as a low-magnesium type (LMG) except for one which is a high-magnesium glass (HMG). Also discusses the colorants and opacifiers.

Uboldi, Marina, Marta Rapi, and Ivana Angelini
Expounds upon protohistoric (9th-4th centuries BC) beads of faience, glassy faience, and glass from the Como area of northern Italy. Typological, technological, and archaeometric aspects are examined.

Uesugi, Akinori, Izumi Nakai, Manmohan Kumar, Kyoko Yamahana, Yoshinari Abe, Junko Shirataki, Kanae Toyama, and Vivek Dangi
Examines the morphological and compositional variations of faience objects (including beads) collected from several Indus sites in the Ghaggar Valley of India.
Vachadze, Gvantsa

Valdes Herrera, Alejandro

Valério, P., A.M.M. Soares, M.F. Araújo, and A.F. Carvalho
2017 Micro-EDXRF Investigation of Chalcolithic Gold Ornaments from Portuguese Estremadura. *Spectrometry* 46(4):252-258; https://www.researchgate.net/publication/315470523. Analysis of tubular and spiral gold beads revealed that they were composed of gold with 8.7-16.3 wt% Ag and <0.04 wt% Cu. A typologically uncommon biconical bead showed a lower Ag content (6.7 wt%).

Valiulina, Svetlana
2018 Chemické zloženie sklenených korálikov z Bolgaru (od obdobia vikingov po Zlatú Hordu) [The Chemical Composition of Bolgar Glass Beads (from Viking Age to the Golden Horde)]. In *The Historical Glass: A Multidisciplinary Approach to Historical Glass III*, edited by Danica Staššíková-Štukovská, pp. 165-185, 392-395. Slovak Arts Council, Bratislava. Aims to determine the origin of glass beads found at sites in Bolgar based on their chemical composition, while taking into regard their morphology and technology in each historical era of the Bolgar state. In Slovak with English summary.

Valiulina, S.I., P.V. Mandryka, P.O. Senotrusova, and A.A. Trifonov
Vallejo-Casas, Elena, Gisela Ripoll, Margarita Sánchez Romero, and Mercedes Murillo-Barroso

Presents the characterization of 52 amber beads from four necropolises in the province of Granada, Spain, using Fourier Transform Infrared Spectroscopy (FTIR).

Vandiver, Pamela, Mark Fenn, and T.A. Holland

Microprobe analyses and replicate melts revealed that the composition was 60% SiO2, 20% CuO and 20% flux, probably as soda, potassia, or a combination. This is unusual for ancient glasses and glazes because of its high copper oxide content, which may indicate a link with copper or malachite technology.

Vandiver, Pamela and K. Ashhan Yener

The beads from Nippur, Iraq, are very important early examples (3rd millennium BC) 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 BP.

Vanhaeren, M., F. d’Errico, C. Stringer, S.L. James, J.A. Todd, and H.K. Mienis

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.

Van Ham-Meert, Alicia, Sarah Dillis, Annelore Blomme, Nicholas Cahill, Philippe Claeys, Jan Elsen, Katherine Eremin, Axel Gerdes, Christian Steuwe, Maarten Roeffaers, Andrew Shortland, and Patrick Degryse
Presents a unique snapshot of developments in glass technology in Anatolia during the Middle Iron Age, when glass was still a relatively rare commodity, by focusing on black glass beads decorated with yellow trails, beads that are very rare during the 8th-7th centuries BCE. Turkey.

Vanna, L.

Van Strydonck, Mark, Bernard Gratuze, Joëlle Rolland, and Guy De Mulder
2018 An Archaeometric Study of Some Pre-Roman Glass Beads from Son Mas (Mallorca, Spain). *Journal of Archaeological Science: Reports* 17:491-499; https://www.academia.edu/83599646/.

Dating from the 3rd millennium until the early Roman period, the beads fall into three main groups based on their chemical composition.

Varberg, Jeanette

Glass beads from Danish and North German Bronze Age graves show surprising chemical parallels to glass from Egypt and Mesopotamia. It is argued that the Danish glass was part of the Mediterranean trade systems and that the Bronze Age glass network was able to bridge more than 5000 kilometers.

Varberg, Jeanette, Bernard Gratuze, and Flemming Kaul

Chemical analysis of glass beads found in Denmark reveals surprising evidence for contact in the 14th-12th centuries BC between Egypt, Mesopotamia, and Denmark, indicating a complex and far-reaching trade network.

Varberg, Jeanette, Bernard Gratuze, Flemming Kaul, Anne Haslund Hansen, Mihai Rotea, and Mihai Wittenberger
2016 Mesopotamian Glass from Late Bronze Age Egypt, Romania, Germany, and Denmark. *Journal of Archaeological Science*; https://www.academia.edu/25914525/.

Traces the movement of early glass from its origin in Mesopotamia and Egypt into the Mediterranean, including centers such as Mycenae, and further towards Northern Europe and the Nordic Bronze Age culture. Beads are among the analyzed specimens.
Varberg, Jeanette, Flemming Kaul, and Bernard Gratuze
2019 Bronze Age Glass and Amber: Evidence of Bronze Age Long Distance Exchange. 
Compositional analysis of glass beads from 39 Middle Bronze Age burials in Denmark connect Egypt and Mesopotamia with South Scandinavia.

Varsik, Vladimír, Ľudmila Illášová, and Ján Štubňa
The site yielded a variety of glass beads, as well as those made from rare materials (marble, carnelian) and materials that appear exotic in the barbarian territory north of the Danube (coral, jade). Absorption spectroscopy was used to analyze glass colorants. English abstract.

Veiga, J.P. and M.O. Figueiredo
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.

Reports on the composition of the blue (turquoise) layer of a “Nueva Cadiz” type tubular glass bead dated pre-17th century.

Velázquez Castro, Adrián, Norma Valentín Maldonado, and Belem Zúñiga Arellano
Reports on SEM analysis of manufacturing traces on the shell pendants and other ornaments excavated in the Teopancazco district of Teotihuacan, Mexico.

Vellanoweth, René L.
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.

Velliky, Elizabeth C., Patrick Schmidt, Ludovic Bellot-Gurlet, Sibylle Wolf, and Nicholas J. Conard

This is the first study confirming the presence of anthropogenic ocher on Aurignacian-aged ivory beads from Europe.

Venclová, Natalie

The VITREA database includes the results of available chemical analyses of archaeological glass (including beads) conducted in the Czech Republic: http://www.arup.cas.cz/VITREA/Index.htm.


Offers a detailed analysis of the glass beads recovered from the Němčice settlement and the oppidum of Staré Hradisko, Czech Republic, including the chemical composition of La Tène glass.

Venclová, Natalie, V. Hulínský, J. Henderson, S. Chenery, L. Šulová, and J. Hložek

Besides monochrome blue-green glass beads, polychrome beads appear for the first time in Bohemian prehistory in Late Bronze Age contexts of the Knovíz culture (Ha A, 12th-early 11th centuries BC). 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. Czechia.

Venclová, Natalie, Václav Hulínský, and Šárka Jonášová
Dating to the first half of the 6th century AD, the majority of samples are natron glass; two are made of rare lead oxide-silica glass, and one is made of a heterogeneous material, perhaps the result of recycling.

**Vercoutère, C., K. Müller, L. Chiotti, R. Nespoulet, A. Staude, H. Riesemeier, 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.

**Vilaça, Raquel and Francisco Gil**


Beads, the first glass artifacts to enter the territory of Portugal, appeared during the Bronze age. This article describes the beads recovered from various sites and reports their chemical composition.

**Villanueva Criales, Juan, Heidi Ruth Mamani Tola, Mishka Huanca Cirpa, Primitivo Alanoca Calcina, José Alfredo Campos Basagoitia, and Mario Blanco Cazas**


An analytical study of two prehispanic stone-bead necklaces from Bolivia using XRF-ED.

**Virgili, V. and M.F. Guerra**


Provides a comparative compositional study of ancient (6th century BC) and modern (19th century) gold beads.
Volkov, P.V., O.A. Mitko, Yu. S. Gubar, R.V. Davydov, and I.S. Polovnikov
2019   Технологический анализ украшений из бирюзы (по материалам находок из могильника скитского времени Ак-Дар I в Тыве) [Technological Analysis of Turquoise Jewelry (Based on Finds from the Scythian Burial Ground of Ak-Dag I in Tyva)]. Vestnik NGU. Series: History and Philology 18(7):74-86; https://www.academia.edu/100796579/.
Reports on the elemental composition and manufacturing technology of turquoise jewelry found in Barrow 1 of the Scythian Ak-Dag I burial ground in Tuva, southern Siberia.

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.

Wade, Lizzie
Beads of animal teeth, shells, and ivory no more than a centimeter long found in the Grotte du Renne cave at Arcy-sur-Cure in central France were reportedly uncovered in the same layers as Neanderthal fossils. Some have argued that Neandertals were incapable of the kind of symbolic expression reflected in jewelry and insisted that modern humans must have been the creators. Now, a pioneering study using ancient proteins to identify Neanderthal bone fragments from the site for direct radiocarbon dating finds that the link between the archaic humans and the artifacts is real.

Wajda, Sylwia
https://www.academia.edu/6783095/.
Discusses the chemical composition of several glass items including seven beads. English summary.

Describes a wide range of drawn, wound, and sintered glass beads from an early medieval site in northeastern Poland. Includes the results of detailed chemical analysis. English summary.
Reports on the types of glass beads recovered from Ciep³e, an elite early medieval necropolis in Eastern Pomerania, and their chemical composition.

Reports on the beads recovered from Site 4 at Radom, southeastern Poland, and their chemical composition.

Wajda, Sylwia and Pawe³ Gan
Reports on the chemical composition of glass beads from a cemetery in eastern Poland.

Wajda, Sylwia and Beata Marciniak-Maliszewska
https://www.academia.edu/47749840/.
Reports on the chemical composition of glass samples and four beads made of so-called Egyptian faience recovered from Żelazna Nowa site 2, a cemetery of the Przeworsk Culture in northeastern Poland.

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 associated glass beads from four archaeological sites in Michigan and Wisconsin.
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.


Addresses the timing of the introduction, exchange, and social implications of two complementary lines of evidence, reworked copper and brass objects and glass trade beads, from 38 archaeological sites in the Upper Great Lakes region dated to ca. 1630-1730. Includes compositional analysis.

Blue glass beads dating to AD 1630-1730 were analyzed using LA-ICP-MS analysis. Identified patterns of variation in glass bead composition reflect the timing and directions of trade among diverse communities, illustrating how a materials-science approach can reveal social and economic outcomes of intercultural interaction and colonialism.

Investigates Native American exchange relationships in North America’s western Great Lakes region based on the composition of glass trade beads excavated from a French ship that sank off the coast of what is now Texas in 1686.

Walder, Heather, Adelphine Bonneau, Benjamin Carter, Ruth Ann Armitage, and William A. Lovis

Various analytical methods were used to determine if small black and red beads found with the interment uncovered near La Paz, Bolivia, were glass or some other material.
Walder, Heather and Alicia Hawkins
Combines new and legacy compositional data to investigate how Indigenous communities in eastern North America, particularly Wendat confederacy members, obtained beads from European traders and connected to broader interregional exchange systems ca. AD 1600-1670.

Walder, Heather, Alicia Hawkins, Brad Loewen, Laure Dussubieux, and Joseph A. Petrus
Compares the chemical composition of beads from Bolivia and Ontario, Canada, to explore their provenience and technology.

Walder, Heather and Stéphane Noël
Determined using LA-ICP-MS, the compositions of drawn blue and white beads recovered from the site of a ca. 1673-1697 Huron-Wendat village are compared to those of similar beads from other 17th-century Wendat sites in the Western Great Lakes region and Southern Ontario.

Walder, Heather, J.A. Petrus, L. Dussubieux, R.G.V. Hancock, and A.L. Hawkins
Compares the results obtained by analyzing the same beads using INAA and LA-ICP-MS, and analyses undertaken at two LA-ICP-MS laboratories with differing data analysis protocols to determine if there is good comparability across methods and labs, which would make it possible to combine legacy and newly obtained data to explore interregional archaeological questions.

Walder, Heather and Alexander Woods
LA-ICP-MS analysis of two glass “seed” beads revealed a composition that compared favorably with recipes of Venetian glass embroidery beads of the 19th century.

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.
2021 Copper Alloy Artefacts from Northeastern Tanzania, 700-1700 CE. *Journal of Indian Ocean Archaeology* 17:90-99; https://www.academia.edu/72465764/.
The items include three beads, two of which were analyzed using portable X-ray Fluorescence (pXRF).

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.

Documents the chemical compositions of 62 glass beads from 11 archaeological sites to address their chronological associations and places of origin.

Wang, Dong, Rui Wen, Julian Henderson, Xingjun Hu, and Wenying Li
Located on the southern route of the Silk Road in western China, the Hetian Bizili site was a trade and cultural hub between the East and the West in ancient times. Analysis of a sample of beads recovered from 40 tombs revealed that all were Na₂O-CaO-SiO₂ glass with plant ash used as a flux. Lead antimonate and lead stannate were used as the opacifying agents.

Wang, Kuan-Wen
SEM-EDS and EPMA analyses were conducted on glass beads from four sites in Taiwan: Kiwulan (AD 700-1200), Kueishan (AD 400-700), Taoyeh (AD 200-600), and Wuchientso (AD 600-1000).
This research studies glass beads from seven Iron Age sites on Taiwan in an attempt to determine the provenance and hence the exchange, consumption, and production of glass beads during the 1st millennium AD in Taiwan and the interaction with the South China Sea network.

Wang, Kuan-Wen, Laure Dussubieux, Yoshiyuki Iizuka, Kuang-Ti Li, and Cheng-Hwa Tsang
LA-ICP-MS and SEM-EDS analysis of glass samples (including beads) from sites in southwestern Taiwan revealed the existence of multiple long-distance glass exchange networks that directly or indirectly connected Taiwan to Southeast Asia, South Asia, West Asia, and possibly the Mediterranean region. The samples cover a time span from the 1st-8th centuries.

Wang, Kuan-Wen, Yoshiyuki Iizuka, Yi-Kong Hsieh, Kun-Hsiu Lee, Kwang-Tzuu Chen, Chu-Fang Wang, and Caroline Jackson
The 44 samples analyzed do not show a compositional or structural match between the glass beads and the glass waste, suggesting that the beads may not have been produced at this site.

Wang, Kuan-Wen, Yoshiyuki Iizuka, and Caroline Jackson
SEM-EDS and EPMA were used to analyze red, orange, yellow, green, and blue m-Na-Al glass which is a common production group found around the Indo-Pacific region. In Iron Age Taiwan, its presence dates back to the early 1st millennium AD.

Wang, Kuan-Wen and Caroline Jackson
2014 A Review of Glass Compositions around the South China Sea Region (The Late 1st Millennium BC to the 1st Millennium AD): Placing Iron Age Glass Beads from Taiwan in Context. Journal of Indo-Pacific Archaeology 34:51-60; https://www.academia.edu/88702249/.
Reviews the chemical compositions of glass beads in Taiwan, Southeast Asia, and southern China in an attempt to understand the potential relationships between the three regions.
Wang, Kuan-Wen, Kun-Hsiu Lee, Kwang-Tzuu Chen, Yoshiyuki Iizuka, and Caroline Jackson
Analysis of glass beads and beadmaking waste recovered from an Iron-Age site on Taiwan reveals that there is not a complete match of the chemical composition and the microstructure of the finished beads and waste. Therefore local production of beads here is not supported by the evidence and the finished beads may have been imported from the South China Sea region. In Chinese with English abstract.

Wang, Kuan-Wen, Kuang-Ti Li, Yoshiyuki Iizuka, Yi-Kong Hsieh, and Caroline Jackson
2021 Glass Beads from Guishan in Iron Age Taiwan: Inter-Regional Bead Exchange between Taiwan, Southeast Asia and beyond. *Journal of Archaeological Science: Reports* 35, article 102737; https://www.academia.edu/44798935/.
Investigates the exchange of glass beads between Guishan, eastern Taiwan, and Southeast Asia by analyzing the styles, chemical composition, and microstructure of 64 glass beads using SEM-EDS, EPMA, and LA-ICP-MS. The results suggest that beads with an m-Na-Al glass and v-Na-Ca composition are the most common.

Wang, Xiaoqi, Yun’ao He, and Yuan Lin
The site produced glass beads dated to the 3rd-10th centuries AD. 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.

Wang, Y., H. Ma, K. Chen, X. Huang, J. Cui, Z. Sun, and Q. Ma
The lead (and barium) vitreous beads discussed here are some of the earliest lead vitreous materials discovered in China so far, and therefore important for the study of the development of lead vitreous technologies in ancient China.

Wang, Yingzhu, Thilo Rehren, Yuchen Tan, Dexin Cong, Peter Weiming Jia, Julian Henderson, Hongjia Ma, Alison Betts, and Kunlong Chen
Compositional analysis of six faience beads from Adunqiaolu, an Early Bronze Age site in western Xinjiang, China, reveals that they were all made of mixed-alkali flux with sodium oxide 8-10% and potassium oxide 5-9%. As the earliest faience objects discovered in China so far, the
Adunqiaolu beads set an essential starting point for the further discussion on the early exchange network evidenced by faience products and long-distance transmission of technologies and knowledge.

**Warashina, T.**


**Wärmländer, Sebastian K.T.S., Davide Zori, Jesse Byock, and David A. Scott**
2010 Metallurgical Findings from a Viking Age Chieftain’s Farm in Iceland. *Journal of Archaeological Science* 37:2284-2290; https://www.academia.edu/80955371/. Several glass beads were uncovered including black eye beads, beads with a metal-foil covering, and monochrome yellow. All were subjected to compositional analysis, revealing that the eye beads may have originated in Turkmenistan.

**Warner, Richard**
2014 The Gold Ornaments from Rathgall: The Analytical Evidence for their Date and the Sources of their Gold. *Journal of Irish Archaeology* 23:243-255. On the composition of six gold ornaments (including two beads) excavated from the middle/late Bronze Age hillfort in County Wicklow, Ireland. Analysis was by X-ray fluorescence spectrometry.

**Watts, S., A. Pollard, and A.M. Pollard**
1999 The Organic Chemistry of Jet: Porolysis-Gas Chromotography/Mass Spectrometry (PY-GCMS) Applied to Identifying Jet and Similar Black Lithic Materials: Preliminary Results. *Journal of Archaeological Science* 26(8):923-933. 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 \( \text{Ca}_3(\text{PO}_4)_2 \), cassiterite \( \text{SnO}_2 \), cuprite \( \text{Cu}_2\text{O} \), and a \( \text{Pb(Sn,Si)}_2\text{O}_5 \)-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 archaeometric questions.

Wen, Rui, Xueqing Hu, Shiyuan Cao, and Yongqiang Wang

Four tubular faience beads from a cemetery in northwestern China were examined by stereomicroscopy, synchrotron radiation micro-CT, and electron microprobe analysis. The beads, glazed by the application glazing method, are all potash-rich, consistent with the faience produced locally in China.

Wen, Rui, Zhi-qiang Zhao, Jian Ma, and Jian-xin Wang

Analysis was conducted on glass beads from the tomb M011 at the Shirenzigou site and the tomb M1 at the Xigou site which can be dated to the late Warring States and early West Han dynasty (3rd-1st century BC).


Compositional analysis of 15 beads dating from the late Warring States period to the early Western Han dynasty suggests that they belong to the soda-lime type, which was the typical glass type in the West, implying that the beads were not produced in the Central Plains of China.

Westfall, Catherine, Mauricio Belmar, and Carlos González

Discusses the results of geo-archaeological analyses applied to decorative gold objects and stone beads found at a Formative period cemetery in Calama, northern Chile, and their implications for local prehistory.
White, Fred A.
2013  X-Ray Fluorescence Analysis on Sixteenth Century Glass Beads from the 1539 Hernando De Soto Encampment. Florida Department of State, Bureau of Archaeological Research, Master Site File MR03538. Tallahassee. https://www.academia.edu/5430797. The purpose of this project was to build an accurate reference database for the elemental values of four 16th-century seven-layer chevron beads related to Florida’s First Spanish Cultural Period.


Whitford, Michelle F.

Whitford, Michelle F., Damian B. Gore, Mattias T. Johnsson, Ayse A. Bilgin, Ronika K. Powerd, Candace Richards, and Michael J. Withford
2021  A Complementary Validation of Egyptian Faience Jewellery Reconstruction Using Elemental and Statistical Analyses. Journal of Archaeological Science: Reports 38, 103087; https://doi.org/10.1016/j.jasrep.2021.103087. The elemental compositions of nine beaded faience artifacts were measured to determine whether or not it was possible to infer the original arrangements of separate, multicomponent objects.

Wilk, Stanisław and Aldona Garbcz-Klempka
2016  Eneolithic Copper Jewellery from Grave 7 of the Lublin-Volhynian Culture at Site 2 in Książnice, Świętokrzyskie Province, Poland. Typological and Physical Metallurgy Characteristic. L’Institut d’Archéologie de l’Université Jagellonne de Cracovie, Recherches Archéologiques N.S. 8:29-46; https://www.academia.edu/34277007/. Two tubular beads made of rolled sheet copper are included in the assemblage. Their chemical composition is discussed as is the distribution of these bead forms. See also Garbcz-Klempka (2017).
Wilmsen, Edwin, Laure Dussubieux, Thomas Huffman, and Marilee Wood  
Considers the implications of the results of LA-ICP-MS bead analysis coupled with new radiocarbon dates from Makuru in the interpretation of beads in southern Africa.

Won-in, Krit and P. Dararutana  
Analysis of blue and red glass beads reveals they are all composed of low-magnesia high-potash glass.

Won-in, Krit, Somruedee Satitkune, Natthapong Monarumit, and Nontarat Nimsuwan  
Discusses the chemical composition of 30 samples and 12 colors from a site of the Dvaravati Period (6th-13th centuries).

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, S. Intarasiri, T. Kamwanna, and P. Dararutana  
Analysis of blue glass beads from two different sites in Surat Thani Province revealed that they were both Na-Ka-silica glass colored with copper and/or cobalt, which was influenced by the presence of iron and manganese.

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
Based on glass chemistry and method of manufacture, glass beads excavated at Unguja Ukuu, Zanzibar, provide a good deal of insight into East African trade with the Indian Ocean during the second half of the first millennium.

Discusses the chemical composition of the glass beads found at archaeological sites up and down the eastern coast of Africa between the 7th and 17th centuries.

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 (Chibuene) for the region that may push trade there back to the 7th century.

Wood, Marilee, Laure Dussubieux, Mudit Trivedi, and Martial Pauly
https://www.academia.edu/112356611/.
Beads recovered from a graveyard on one of the islands in the Comoros Archipelago off the coast of Mozambique were analyzed using LA-ICP-MS to help determine the region where the glass was manufactured.

Wood, Marilee, Laure Dussubieux, and Lyn Wadley
This site in South Africa produced strings of various colors of glass beads, some copper beads, and also two perforated Conus ebraeus shells. A necklace of shell disc-beads interspersed with blue glass beads was also present. Sixteen of the beads were analyzed chemically using LA-ICP-MS. The results indicate the beads originated in India.
LA-ICP-MS analysis of 15th-century beads revealed the presence of four main glass types: mineral soda-high alumina (m-Na-Al), vegetable soda-high alumina (v-Na-Al), high lead glasses, and vegetable soda-lime (v-Na-Ca) glass. Among the high-lead glass beads are two types from China, while trail-decorated folded beads may have been made locally from imported v-Na-Al glass.

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

Some unusual Chinese ceramic beads produced in imitation of Western glass eye beads appear to represent extremely early examples of low temperature glazing.

Strontium, carbon, and oxygen isotopes extracted from ostrich eggshell artifacts show that some of them were imported while others are of local origin.

Present a comprehensive characterization of glazed/fired steatite beads unearthed at the Xiaohe Cemetery (1980-1450 BCE) in northwestern China using multi-analysis techniques. The findings indicate connections with the Indus Valley, thereby proposing a potential route for artifacts and technology from there to northwestern China.
Xu, Siwen, Baotong Qiao, and Yimin Yang  
Analysis of light-blue Indo-Pacific beads of the Han Dynasty reveals they have low Cu and high Pb concentrations and were probably produced in South China.

Xu, Siwen, Bo Wang, Bin Han, and Yimin Yang  
Compositional analysis of 15 beads from the Astana necropolis (ca. 4th-8th centuries CE) revealed that most of the beads share similar compositions with glassware from Veh Ardašîr, a famous Sasanian site in present-day Iraq.

Xu, Yiwen, Hassan Basafa, Xin Wu, Mohammad Sadegh Davari, and Rong Wang  
The varied compositions of 10 beads of the Yaz III period (550-300 BCE) indicate connections with Central or South Asia and the Mediterranean World.

Yamahana, Kyoko  
Discusses two necklaces of sulfur beads in the Ancient Egyptian and Near Eastern Collection at Tokai University, Japan, including their composition. In Japanese with English abstract.

Yamahana, Kyoko and Yasunobu Akiyama  
Reports on the compositional analysis of sulfur beads in the Ancient Egyptian and Near Eastern Collection at Tokai University, Japan, and investigates potential production techniques.

Yamahana, Kyoko  
Reports on the chemical composition and likely method of manufacture of early 20th-century beads comprising a necklace purportedly collected in the Andean region of South America. In Japanese with English summery.
Yamasaki, K.

**Yan, Haihong, Feng Sun, and Yuyao Zhang**
Analysis of five beads recovered from the Hejia Cemetery in Xianyang, Shaanxi Province, revealed that they are glazed pottery. The glaze material belongs to the lead-barium-silicate (PbO-BaO-SiO₂) system; the color component of the glaze is Chinese Blue (BaCuSi₄O₁₀).

**Yanase, Kazuya, Mayumi Matsuzaki, Daichi Sawamura, Izumi Nakai, Kazuyuki Nakamura, and Kenji Morioka**
The chemical compositions of the beads reveals two glass types: potash-silica (K₂O-SiO₂) and soda-lime-silica (Na₂O-CaO-SiO₂). In Japanese.

**Yang, Ju, Hong-Xia Zhao, and Pu Yu**
Belonging to the Qing Dynasty, the beads belong to the Na₂O-CaO-SiO₂ glass type with Cu and Co as the major colorant elements.

**Yang, Yimin**

**Yang, Yimin, Lihua Wanga, Shuya 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.
Yatsuk, Oleh  
2018  6th Century BC Glass Beads from Southern Ukraine: Raw Materials and Technology.  
A multi-analytical approach that compares the chemical and mineralogical composition of glass  
beads from a glass-making site at Yahorlyk Bay on the Black Sea with that of sand collected in  
the vicinity was used to determine the local or non-local origin of the beads.

Yatsuk, Oleh, Giacomo Fiocco, Marco Malagodi, Alessandro Re, Alessandro Lo Giudice,  
Cristiano Iaia, and Monica Gulmini  
2023  The Non-Invasive Characterization of Iron Age Glass Finds from the “Gaetano Chierici”  
  Collection in Reggio Emilia (Italy).  
  Heritage 6:5583-5606;  
Reports the composition of 48 glass objects (mostly beads) dating from the 5th century BCE to  
the 1st century CE recovered from several sites in northern Italy.

Yatsuk, Oleh, Astrik Gorghinian, Giacomo Fiocco, Patrizia Davit, Serena Francone,  
Alessandra Serges, Leonie Koch, Alessandro Re, Alessandro Lo Giudice, Marco Ferretti,  
Marco Malagodi, Cristiano Iaia, and Monica Gulmini  
2023  Ring-Eye Blue Beads in Iron Age Central Italy – Preliminary Discussion of Technology  
  and Possible Trade Connections.  
  Journal of Archaeological Science: Reports 47, 103763;  
  https://www.academia.edu/93798385/.  
Archaeometric analysis established that the beads are soda-lime-silica glass and the source of the  
cobalt colorant could be an ore from Egypt.

Yatsuk, Oleh, Leonie Koch, Astrik Gorghinian, Giacomo Fiocco, Patrizia Davit, Lorena  
Carla Giannossa, Annarosa Mangone, Serena Francone, Alessandra Serges, Alessandro  
Re, Alessandro Lo Giudice, Marco Ferretti, Marco Malagodi, Cristiano Iaia, and Monica  
Gulmini  
2023  An Archaeometric Contribution to the Interpretation of Blue-green Glass Beads from  
  Iron Age Central Italy.  
  Heritage Science 11, 113;  
  https://www.academia.edu/102100777/.  
Reports on the chemical composition of several types of blue-green beads determined using a  
variety of spectroscopic techniques. While a local origin for the raw glass of some of the beads is  
postulated, several production sites in the Near East are suggested for most of the beads.

Yi, Jeongeun, Hye R. Yang, and Chan H. Lee  
2021  Compositional Variation and Color Diversity of Glass Beads from the 4th Century Tomb  
  Complex in Korea.  
  Applied Sciences 11, 5233;  
  https://doi.org/10.3390/app11115233.  
Fragments in blue-green beads from Tomb 11 at the Suchonri site were identified as potash  
glass, whereas other samples were soda glass.
Yokoyama, Tomonori, Yasunobu Akiyama, Kyoko Yamahana, Takashi Asaka, Masashi Higuchi, and Masahi Sato
Reports on the method of manufacture, dating, and composition of the sulfur beads comprising a necklace in the Ancient Egyptian and Near Eastern Collection at Tokai University. In Japanese with English abstract.

Yong, Lei and Xia Yin
Faience beads excavated in China can be classified into two groups: soda-enriched made somewhere on the route from Egypt to central China (11-10th century BCE) and potash-enriched made in China (middle Western Zhou to Eastern Zhou).

Yu, Heisun and Jihyun Ro
2018  A Study on the Provenance of an Opacifying Agent (PbSnO₂) in Yellow and Green Glass Beads Excavated from the Korean Peninsula. *Journal of Archaeological Science* 34(4):305-311; https://doi.org/10.12654/JCS.2018.34.4.06.
Analysis determined that the lead provenience of the glass beads was Thailand (Kanchanaburi Province). In Korean with English abstract.

Yun, Ji Hyeon, Woo Rim Han, and Min Su Han
Glass beads of the Mahan-Baekje period were found to represent several glass groups: soda, potash, mixed alkali, and lead barium. In Korean with English abstract.

Yun, Ji Hyeon and Gyu Ho Kim
Five bead types are represented by soda glass, potash glass, and lead-barium glass. In Korean with English abstract.

Yuryeva, Tatyana V., I.B. Afanasyev, E.A. Morozova, I. Kadikova, and V.S.Popov
Proposes that individual precipitates of KSbSiO₄, especially their clusters, play a major role in the deterioration of blue-green glass beads as a result of slow internal corrosion.
Yuryeva, Tatyana V., I.B. Afanasyev, E.A. Morozova, I.F. Kadikova, V.S. Popov, and V.A. Yuryev
Presents the results of a study of the elemental and phase composition of deteriorating 19th-century blue-green beads from exhibits in Russian museums.

Yuryeva, Tatyana V., I. Kadikova, E.A. Morozova, I.B. Afanasyev, I.A. Balakhnina, N.N. Brandt, and V.A. Yuryev
Concludes that K$_2$Sb$_2$O$_5$ (KSS) precipitates and their clusters give rise to internal glass corrosion in 19th-century turquoise-colored beads. K and Sb being glass dopants form KSS crystallites during glass melt cooling; tensile strain arising in the glass matrix gives rise to glass cracking and eventually to its rupture and formation of heterogeneous grains.

Reveals what causes turquoise-colored glass beads to crack and deteriorate. Many examples are shown. In Russian with English abstract.

Discusses the degradation and decay of blue-green glass beads obtained from museum exhibits. In Russian.
Yuryeva, Tatyana V., E.A. Morozova, I. Kadikova, O.V. Uvarov, I.B. Afanasyev, A.D. Yaprinentsev, M.V. Frolenkova, S.A. Malykhin, I.A. Grigorieva, and V.A. Yuryev

Microcrystallites of orthorhombic KSbOSiO₄ (KSS) of sizes ranging from about 200 nm to several micrometers have been detected in turquoise-colored glass seed beads prone to glass disease on 19th-century beaded objects in museum collections.

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.


Considered as unique in terms of typological variety and time span, glass beads excavated at Thebes, Greece, were examined using luminescence techniques (thermoluminescence, optically stimulated luminescence). Additionally, X-ray fluorescence (XRF) was used to provide the elemental concentration profile of the samples.

Zacharias, Nikolaos, Maria Kaparou, Artemios Oikonomou, and Zs. Kasztovszky

Analysis of beads and plaques dating between 1600 and 1060 BCE identified two major compositional groups, with at least the one associated with artifacts originating in Egypt.

Zacharias, Nikolaos, Eleni Palamara, Rania Kordali, and Vanessa Muros

Highlights the complexity of corrosion phenomena and the effect of various parameters on the degradation of buried archaeological glass through the analysis of objects (beads included) from sites in Greece dating from the Late Bronze Age to the Ottoman period.
Zapatero Magdaleno, María Pilar and Mercedes Murillo Barroso
2017 Determinación de procedencia mediante análisis por Espectroscopía FTIR, del ámbar de una cuenta de collar del sepulcro megalítico de La Velilla (Osorno, Palencia). BSAA arqueología LXXXIII:71-94; https://www.academia.edu/36507836/.
On the determination of the provenience by FTIR Spectroscopy of an amber bead from the megalithic tomb of La Velilla in north-central Spain.

Zerboni, Andrea, Sandro Salvatori, Pietro Vignola, and Abd el Rahman Ali Mohammed
Geochemical analyses of North and East African raw amazonite outcrops and artifacts (beads included) found at Neolithic cemetery R12 in the Sudanese Nile Valley reveals southern Ethiopia as the source of the R12 amazonite.

Zerboni, Andrea and Pietro Vignola
The first archaeometric study carried out on greenstone beads found at Garamantian archaeological sites in the central Sahara.

Zerboni, Andrea, Pietro Vignola, Maria C. Gatto, Andrea Risplendente, and Lucia Mori
The composition of green-colored stone beads found at Fewet, a Garamantian site (2nd century BC-1st century AD) in the Libyan Sahara reveals they consist of serpentinite and amazonite.

Zhang, Fu-Kang, Zhu-Hai Cheng, and Zhi-Gang Zhang
1983 An Investigation of Ancient Chinese “Liuli.” Journal of The Chinese Ceramic Society 1. 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, Liangren, Chen Jianli, Ling Yong, Chang Xien, Liu Guorui, Kurban Rahman, Murat Esmayil, Yan Feng, and Ma Yuan
Examines the form and chemical composition of metal artifacts from three successive cultures of the Hami region in western China. The inventory includes several forms of beads.
Discusses the chemical composition and manufacturing technology of faience beads.

The samples were primarily plain and eye beads recovered from sites in Henan, Hubei, and Jiangsu, China. They are assigned to three glass systems.

Portable X-ray fluorescence spectrometry (pXRF) of eight samples revealed that seven were made of typical natron-type soda-lime-silicate glass with low MgO and K\(_2\)O content, while one was composed of plant-ash soda-lime-silicate glass.

The beads were excavated from different regions of China, including Xinjiang, Henan, Hubei, and Guangxi provinces, and date mainly to the 10th century BC to the 9th century AD.

Dating to the Warring States Period, most of the beads belong to the typical soda-lime-silicate glasses with low amounts of MgO and K\(_2\)O.

C isotope radiocarbon dating of saltwater natural pearls (some perforated) purportedly collected in Central or South America during the early 16th century corroborates their claimed age.
The workshop produced beads, pins, and other items, all found to be made of K$_2$O-CaO-SiO$_2$ glass.

Zhu, Jian, Yimin Yang, Wei Xu, Dongliang Chen, Junqing Dong, Lihua Wang, and Michael D. Glascock
Analysis revealed that the bead (excavated in Hubei province, eastern China, and dating to AD 300-400) was colored using metallic copper.

Zlámalová Cílová, Zuzana, Viktoria Čist’akova, Romana Kozáková, and Ladislav Lapčák
Discusses the opacifying agents, including the possible ways in which they entered the glass, as well as the techniques used to produce the beads which include monochrome and eye varieties.