ARCHAEOMETRIC ANALYSIS

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

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.

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

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.

Allen, Lindy, Sarah Babister, Elizabeth Bonshek, and Rosemary Goodall
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.
Angelini, Ivana

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

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

On the evolution of faience to glass during the Bronze Age. Many of the samples were beads.

Angelini, Ivana and Paolo Bellintani

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

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

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.

Arai, Saki, Shinsuke Baba, Izumi Nakai, Kazuyuki Nakamura, Naoya Tsukad
2018   Chemical Composition Analysis of Glass Beads Excavated from Sites in Southern Part of Hokkaido at Ainu Cultural Period. *Research Reports of National Institute of Technology, Hakodate College* 52:20-38; https://doi.org/10.20706/hakodatekosen.52.0_20

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.

Ashkenazi, D., H. Gitler, A. Stern, and O. Tal

This report gives us a better understanding of technological abilities in the late Persian-period province of Samaria as regards the production of beads and other ornaments. 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).

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**

2017  

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, Susan Keech McIntosh, and Thilo Rehren**

2018  

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**

2017  

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**

2016  
https://www.researchgate.net/publication/306017012

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.

**Babalola, Abidemi Babatunde, Thilo Rehren, Akinlolu Ige, and Susan McIntosh**

2018  

Provides an in-depth examination of numerous crucible fragments recovered from 11th-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 glass beads from the excavations indicates that the crucibles were used to melt the glass used for the beads.

**Bagdzevičienė, J., C. Niaura, E. Garškaitė, J. Senvaitienė, J. Lukšienienė, and S. Tautkus**

2011  

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, 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.

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

Baron, Anne, Adrian L. Burke, Bernard Gratu ze, 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.

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

Bayley, Justine
Glass beads; Scotland.

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

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

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

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**  

Reports on the composition of 70 samples that date to the late seventh century BC. They were found in a wine vessel of the wild goat style which dates back to the Late Archaic period.

**Bertini, Martina**  
A collection of beautiful glass beads discovered in Scotland was analyzed. The results point “to an ancient form of glass recycling between the Romans and the Iron Age Caledonians.”

**Bertini, Martina, Andrei Izmer, Frank Vanhaecke, and Eva M. Krupp**  
Describes a fully quantitative method used for the investigation and characterization of a large set of Roman and late Iron Age glasses used in the making of Iron Age British beads (see Bertini et al. 2011).

**Bertini, Martina, Andrew Shortland, Karen Milek, and Eva M. Krupp**  
Class 13 and 14 Iron Age Scottish glass beads are a group of highly decorated beads of British origin or design, dating indicatively to the 1st and 2nd centuries 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.
Bhardwaj, H.C. (ed.)
1987  *Archaeometry of Glass*. Indian Ceramic Society, Calcutta.
A basic source for analytical data on Asian glass beads, especially for India.

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

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

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

Billaud, Y. and B. Gratuze
Chemical analysis of Late Bronze Age glass beads of the Rhodano-Alpine area of France.

On Protohistoric glass and faience beads of France.

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 in Syria.

Blair, Elliot H.
XRF analysis of 783 specimens of four varieties of drawn white glass beads from burial contexts at the mission demonstrate that “opacifier-dating” is applicable to Spanish colonial sites in the southeastern United States.
Blanco, J., M.A. Lopez Alonso, M. Edo, and J.L. Fernandez Turiel

On the chemical composition of callainite necklace beads and other materials from the site of La Peñas, Spain.

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.

Analysis of the beads – indicative of direct or indirect Spanish contact – revealed they were manufactured from a lead-bismuth alloy plated with silver.

Blasco, A., M. Edo, J.L. Fernandez-Turiel, D. Gimeno, Feliciano Plana Llevat, and María Josefa Villalba

The present work shows the advantages of the application of geological methods to the study of archaeological materials, in this case the study of Catalanian variscite beads and their relationship to the Neolithic mining complex at Can Tintore, Spain.

Bonneau, 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 ClFi-10 in Quebec, Canada, carried out by microscope, SEM-EDS, X-ray florescence, Raman spectrometry, neutron activation, and LA-ICP-MS.

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.

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.

Uses µCT scans of pristine shells to create a 3-D model of shell thickness in *Tritia* (*Nassarius*) *gibbosula* in order to identify structurally weak zones that would be prone to natural perforations.

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.

AMS Radiocarbon Dates on Type G1 and K1 Olivella Shell Beads from CA-MNT-1701, Carmel Valley, Monterey County, California.

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.
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 neutron 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.)

Brill, Robert H., S. Shap Chow Tong, and Zhang Fukang
1989  The Chemical Composition of a Faience Bead from China. *Journal of Glass Studies* 31:11-15. 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

Buc, Natacha, Romina Silvestre, Alejandro Acosta, and Daniel Loponté
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.

Bulbeck, F.D., Bagyo Prasetyo, J.N. Miksic, D. Barham, and R.G.V. Hancock
Presents a thorough neutron activation analysis of 58 glass samples, mostly beads, which date to the 1st-17th centuries.
Burgess, Laurie E. and Laure Dussubieux
The Sullivans Island (Washington) glass bead collection contains over 56,000 beads which date from the late 18th to late 19th centuries. Many of the beads conform to varieties that have been attributed to Bohemia, Venice, and China, three of the main bead-producing centers for this time period. Over 100 beads were subjected to LA-ICP-MS analysis to see if the chemical composition of the glass would be correlated with a place of origin. The results revealed several distinct compositional groups, some of which could be linked to geographical areas.

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. Özbak, R. Özbak, G. Şimşek, B. Yaşcı, C. Yılmaz Akkaya, and E. Baysal
Reports on the analysis of turquoise-blue beads found at the 7th-millennium Neolithic site of Barçın 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.

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, Stuart and Elizabeth Healey**


While technological analysis suggests that 105 beads found in a tomb of the Early Dynastic period (ca. 2700 BC) in Kish, southern Iraq, were made locally and have limited stylistic variation, pXRF analysis showed 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.

**Cardoso, João Luis, S. Domínguez-Bella, and J. Martinez López**


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.


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 K., Barbie Campbell Cole, Quentin Lemaasson, 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, 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 and James Lankton
Examines the glass beads from two Iron Age sites in northeast Thailand.

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. AD 1575-1600) Mohawk site in east-central New York state.

Castelo Ruano, R., C. Gutiérrez Neira, J. Barrio Martín, J. Hurtado Aguña, A.I. Pardo Naranjo, A. López Pérez, and R. García Giménez
2011-2012   Estudio arqueohistórico y analítico de un conjunto de vidrios de la villa romana de El Saucedo (Talavera La Nueva, Toledo). *CuPAUAM* 37-38:687-703.
A group of selected glasses, including several distinctive beads, from the early and late imperial, and Visigoth epochs at a site in Spain, were analyzed using MEB-EDX to determine their composition.

**Cavalieri, Marco and Alessandra Giumlia-Mair**
Reports on the chemical composition of glass beads found in a glass workshop of the 6th-7th centuries in Tuscany, Italy.

**Černá, Eva, Václav Hulínský, Kateřina Tomková, and Zuzana Ciňová**

**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 to define 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**
The beads formed two groups, those colored with cobalt and those colored with copper.

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

Cherel, Anne-Françoise, Bernard Gratuze, 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.

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.

Coccatò, 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.

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).

**Costa, Mafalda, Ana Margarida Arruda, Luis Dias, Rui Barbosa, José Mirão, and Peter Vandenabeele**


The proposed methodology facilitates the determination of the composition of the beads including the colorants and opacifiers, as well as the manufacturing techniques employed in their production.

**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.

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


Eighteen ancient glass beads unearthed from Taiwan Province are analyzed using laser ablation.

**Cui Jianfeng, Xiaohong Wu, and Baoling Huang**


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

**Claassen, Cheryl**


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

**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).
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 beads) recovered from the Meier and Cathlapotle archaeological sites, two Chinookan sites occupied from approximately AD 1400-1820 and AD 1450-1833, respectively.

Cosyns, Peter and Bernard Gratze

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

Cruz, Mario da and Bernard Gratze

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.

Daggett, Adrianne, Marilee Wood, and Laure Dussubieux

Presents the results of LA-ICP-MS analysis of an assemblage of glass beads from, an Early Iron Age site in northeast Botswana.

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.

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.
Daszkiewicz, Malgorzata and Miriam Lahitte

Davis, Mary and Ian C. Freestone
Reports on the chemical composition of a unique assemblage of glassy materials (including beads) from Culduthel, an Iron Age site in northeast Scotland.

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

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.

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
2012 Glass and Quartz Finds from Janów Pomorski Site 1. In Studia nad Truso/Truso Studies I, edited by Mateusz Bogucki and Beata Jurkiewicz, pp. 244-260. Museum of Archaeology and History in Elbląg, Poland.
Presents detailed chemical analyses of a variety of glass beads recovered from contexts ranging from the prehistoric period to the Early Middle Ages at a site in northern Poland.


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

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

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 Raczky, pp. 437-448. Pytheas, Budapest.

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

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

d’Errico, F., M. Vanhaeren, K. Van Niekerk, C.S. Henshilwood, and R.M. Erasmus

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.
Domínguez-Bella, Salvador

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

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

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, S., J. Ramos Muñoz, M.A. Álvarez, and M. Forteza

Dong, Junqing, Yunling Han, Jiwang Ye, Qinghui Li, Song Liu, and Donghong Gu

Beads from the beryl and quartz groups were identified with some thoughts on their origin. The present research provides valuable information on the early trade between south China and South Asia.

Dong, Junqing, Yang Yiming, and Feng Enxue

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

Douka, Katerina, Christopher A. Bergman, Robert E. M. Hedges, Frank P. Wesselingh, and Thomas F. G. Higham
2013  Chronology of Ksar Akil (Lebanon) and Implications for the Colonization of Europe by Anatomically Modern Humans. PLoS ONE 8(9):e72931.
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**


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.

**Dussubieux, Laure and Bérénice Bellina**


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 c. BCE. This article discusses the recovered material using typological observation as well as elemental analysis using LA-ICP-MS.

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


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 5th century AD.

**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 Gratuche**


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 (486) shows that at least five sub-groups of m-Na–Al glass can be identified using the concentrations of calcium, magnesium, uranium, barium, strontium, zirconium, and cesium.

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


Dussubieux, Laure and Thomas Oliver Pryce

Presen ts a regionally original combination of elemental and isotopic analyses from glass and copper-base metal grave goods (including glass beads) excavated at a series of Iron Age cemeteries in the Samon Valley of central Myanmar.

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


**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.

**Dussubieux, Laure and Ery Soedewo**


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.

**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.


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


This study examines the potential of stable carbon and oxygen isotopes to source *Olivella* beads from the Pacific coast.


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


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.

**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.

**Eremin, Katherine, Patrick Degryse, Nathaniel Erb-Satullo, Monica Ganio, Joseph Greene, Andrew Shortland, Marc Walton, and Lawrence Stager**

Presents the analysis of glass beads recovered from funerary urns at the Tophet of Carthage, Tunisia. They date to the 8th-4th centuries BC.

**Erlands on, 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.

**Falci, Catarina Guzzo**
2015   Stringing Beads Together: A Microwear Study of Bodily Ornaments in Late pre-Colonial North-Central Venezuela and North-Western Dominican Republic. M.A. thesis. Faculty of Archaeology, Leiden University.

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., Peter Robertshaw, Marilee Wood, John Chesley, and Joaquin Ruiz
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

Figueiredo, M.O., J. P. Veiga, and J. P. Mirão
A non-destructive X-ray absorption study was undertaken on the red layer from a singular “rosette”-type archaeological glass bead dated as pre-17th century.

Fioretti, Anna Maria, Ivana Angelini, Maurizio Battisti, and Fabiana Zandonai
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
2016 Beads Excavated from Antsiraka Boira Necropolis (Mayotte Island, 12th-13th Centuries):
Colouring Agents and Glass Matrix Composition Comparison with Contemporary Southern
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, A. and W.P. McCray
1999 Glass Production Activities as Practiced at Sepphoris, Israel (37 BC - AD 1516). *Journal of
Concentrates on glass vessels but Sepphoris also made glass beads and bracelets of a soda-lime-silica type
with manganese as a decolorizer. There is much consistency of composition over long periods.

Fischer, P.M., M. Bichler, and V.M.F. Hammer
2008 Early Bronze Age Necklace from Tell Abu al-Kharaz, Jordan Valley. In *Tell Abu al-Kharaz in
the Jordan Valley, Volume 1: The Early Bronze Age*, by P.M. Fischer, pp. 387-390. Austrian
Academy of Sciences Press, Vienna.
Describes the results of various analytical methods applied to the glass and shell beads comprising a
necklace.

Fitzgerald, Richard T., Terry L. Jones, and Adella Schroth
2005 Ancient Long-Distance Trade in Western North America: New AMS Radiocarbon Dates from
Eleven *Olivella bипlicata* spire-lopped shell beads from six inland in southern California produced AMS
dates between 11,200 and 7860 cal BP. These findings represent some of the earliest unequivocal
evidence for long-distance trade in western North America and push the antiquity of this important form
of inter-group interaction back several thousand years earlier than previously thought.

Flensborg, G. and C. Wagner
2015 Cuentas vítreas asociadas a entierros humanos en el curso inferior del río Colorado (transición
pampeano-patagónica oriental) (Glass Beads Associated with Human Burials in the Lower
Course of the Colorado River, Eastern Pampa-Patagonian Transition). *Intersecciones en
Antropología* 16:481-489.
Presents the results of the morphological, microstructural and chemical analyses of glass beads recovered
from two archeological sites on the lower Colorado River, Argentina, which constitute the first record of
this kind of evidence in the area.

Főrizs, István
2008 Üvegkészítés Magyarországon a kezdetektől a XVIII. századig. *A Miskolci Egyetem Közleménye
A sorozat, Bányászat* 74:113-136.
Reviews glassmaking (including glass beads) in Hungary from its beginnings until the 18th century as
regards the raw materials and colorants used. In Hungarian with English abstract.
Fórizs, I., A. Pásztor, G. Nagy, and M. Tóth
On x-ray diffraction and electron microprobe analysis of inclusions in Avar glass beads, Hungary.

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

2001  Avar és szarmata gyöngyök Csongrád megyébő Az anyaguk is különbözik vagy csak a típusuk?
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
Reports on the basic characteristics of Avar glass beads in Hungary using x-ray diffraction and electron microprobe analysis.

Fórizs, I., M. Tóth, G. Nagy, and A. Pásztor
Reports on the composition of opaque red Avar glass beads in Hungary determined by x-ray diffraction and electron microprobe analysis.

Fox, William A., R.G.V. Hancock, and L.A. Pavlish
Artifacts of Lake Superior native copper (15th-17th centuries) are compared with assemblages of reworked European copper from 16th-century Ontario sites in an effort to determine the degree of paradigmatic continuity evidenced in the manipulation of these materials.
Frána, J., A. Maštalka, and N. Venclová
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).

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, Alina and Claudia Stihi
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

Proposes a non-destructive multi-stage approach to identify archaeological corals amongst 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.

Galibin, Valentin A.

Gan, Fu-Xi

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


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

Gan, FuXi, Cheng HuanSheng, Hu YongQing, Ma Bo, and Gu DongHong

The structure and the chemical composition of the eye beads were analyzed by X-ray diffraction (XRD) and the Proton Induced X-ray Emission (PIXE) technique. The results show that they belong to the soda-lime silicate system (Na$_2$O-CaO-SiO$_2$). Comparing the decorative design and the chemical composition of the samples with those from ancient Babylon and ancient Egypt, the likelihood is that these ancient eye beads from Xichuan were imported from the West.
Gan, Fuxi, Li Qinghui, Gu Donghong, Zhang Ping, Cheng Huansheng, Zhang Bin, and Ma Bo

Dating to around 1100-500 BC, the glass beads could be sorted into two groups: Na₂O-CaO-SiO₂ and Na₂O-CaO-PbO-SiO₂. In Chinese.

García Heras, M., J.M. Rincón López, A. Jimeno Martínez, and M.A. Villegas Broncano

Reports on the archaeometric study of glass beads from the necropolis of Numantia (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.

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.

Gibson, Robert O. and Henry C. Koerper

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

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

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

**Gonçalves, A.P. and A.M. Monge Soares**
Presents the results of X-ray diffraction analysis of stone beads. Portugal.

**Gonçalves, A.P., A.M. Monge Soares, Maria José Oliveira, Luís Cerqueira Alves, Pedro Valério, and João Luís Cardoso**
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.

Gratuze, Bernard
1999 Étude des perles protohistoriques en verre de l’inhumation de Marmilhat (Lempdes 63). IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.
A study of the glass beads associated with a Protohistoric burial at Marmilhat, France.

2000 Étude des perles protohistoriques en verre des dolmens de la Planaise de Sampzon (07) conservées au Museum d’Histoire Naturelle de Lyon. IRAMAT (Institut de Recherche sur les ArchéoMATériaux), Centre E. Babelon, Orléans.
A study of the Protohistoric glass beads from the dolmens at Planaise Sampzon (07) and held by the Museum of Natural History, Lyon, France.

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, B. and Y. Billaud


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


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


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, B. and P. Cosyns


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

Gratuze, B. and Laure Dussubieux

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

Gratuze, B., L. Dussubieux, and O. Bopearachchi
A study of glass beads found in Sri Lanka which date from the 3rd century 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, B., Marie-Pierre Koenig, Suzanne Plouin, and Jean-Michel Treffort
On the archaeological contexts and analysis of Bronze Age faience and glass beads from Alsace and Lorraine, France.

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

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

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

Gratuze, B., 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, B., J.N. Soulier, and J.N. Barrandon**  
1997  
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  
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.

**Gregor, Miloš, Lubomír Vančo, Magdaléna Kadlecíková, and Juraj Breza**  
2013  
Stone beads from two necklaces found in ancient graves attributed to the 11th-12th centuries in Slovakia were subjected to Raman and X-ray analyses.

**Greiff, Susanne and A. Banerjee**  
1993  
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 Zabiega, and Paolo Piccard**  
2013  
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.**  
2002  
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.

Gu, Zhou, J.M. Kenoyer, and Yimin Yang
Analysis confirms that the production of Harappan faience beads utilized the efflorescence glazing method.

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.

Hadden, Carla S., Alexander Cherkinsky, Geoffrey M. Smith, Aaron P. Ollivier, and Hai Pan
Expands upon and re-examines the incremental carbon (ΔC and δ13C) and oxygen (δ18O) 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 ΔR, and 2) the ΔC 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.

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

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

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.

The opacifiers in the glass used to manufacture white trade beads from the early 17th to 20th centuries changed through time, making it potentially possible to date otherwise nondescript “seed” beads by means of nondestructive chemical analysis.

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 C., Kim Cullen Cobb, Harriet F. Beaubien, Paul Jett, and Julia Mayo  
Hartmann, Gerald, Irene Kappe, 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.

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. 1,500 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.

On the raw materials for color Merovingian glass beads.

Analysis of monochrome Merovingian (5th-7th cent. AD) 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.

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.


Presents descriptions of the beads, with electron microprobe analyses. England, United Kingdom.


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


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


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


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

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

**Henderson, J., J. An, and H. Ma**  
2018  *The Archaeometry and Archaeology of Ancient Chinese Glass: A Review.*  *Archaeometry* 60(1):88-104. 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, J. and J. Callmer**  

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

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

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

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

**Heyworth, Michael P.**  
A selection of glass beads from a Pagan Saxon cemetery were qualitatively analyzed to determine their composition. England, United Kingdom.

A selection of glass beads from a Pagan Saxon cemetery were qualitatively analyzed to determine the colorants and decolorants used. England, United Kingdom.


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

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

Hložeka, Martin
2013 Chemická analýza vybraných halštatských korálků pomocí SEM-EDX. In Skleněné korálky doby bronzové a halštatské na Moravě, by Michaela Kršová, pp. 283-286. B.A. thesis. Department of Archaeology and Museology, Masaryk University, Brno, Czech Republic.
Reports on SEM-EDX chemical analysis of selected Hallstatt beads recovered from sites in Moravia.

Hložeka, M. and T. Trojek
Non-destructive X-ray fluorescence micro-analysis was used to describe the elemental composition and the production technology of a unique millefiori bead that was found in a burial ground in Kyjov (Hodonin district, Czech Republic) dating back to the Migration Period.
Hoffmann, Peter
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 \( \text{Pb}_2\text{SnSbO}_{6.5} \) for the yellow beads and as \( \text{Cu}_2\text{O} \) 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
Schweizerbart, Stuttgart.
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., B.J.H. van Os, J. van der Laan, D.J.M. Ngan-Tillard, I. Joosten, and H.A.C. Fermin  

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

Hulínský, V. and E. Černá  

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

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

Hull, Sharon Kaye  

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
Reports on SEM-EDS analysis of not only glass beads, but copper and stone (agate) as well.

Ilon, Gábor and Zsolt Kasztovszky
2016 Untersuchung spätbronzezeitlicher Glasperlen aus West-Ungarn / Analysis of Late Bronze Age Glass Beads from Western Hungary. Archeometria Mühely XIII(1):55-68.
The beads studied represent the Late Tumulus-Early Urnfield culture (Bz C2-Ha A1). In German with English summary.

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

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

Institute of Archaeology
2017 VITREA. Academy of Sciences of the Czech Republic, Prague.
VITREA is a database of chemical analyses of archaeological glasses (beads included) conducted in the Czech Republic.

Jackson, Caroline M.
Four blue glass beads 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.

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

**Janssens, Koen H.A. (ed.)**
2013  *Modern Methods for Analysing Archaeological and Historical Glass.* John Wiley and Sons, Chichester, United Kingdom.

Members of the Association Internationale pour l’Histoire du Verre and other scholars present a comprehensive overview of current techniques for the analysis of glass composition for both archaeological and historical glass, including beads.

**Janz, Lisa, James K. Feathers, and George S. Burr**

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.

**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.
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.

Kadlečiková, Magdaléna, Juraj Breza, Lubomír Vanco, Miloš Gregor, and Igor Bazovský  

Violet and red-to-orange beads from a necklace and bracelet dated from the 11th and 12th centuries that were found in an ancient cemetery near Bratislava, Slovakia, 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 Z iota  

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.

Kalsbeek, Nicoline and Knud Boffeldt  

Twenty museum objects – mostly beads – were analyzed to distinguish those of Baltic amber from amber imitations.

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

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

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


Karklins, 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, Christoph Jokubonis, and Shokufeh Zamini  
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.

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

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

Kenoyer, Jonathan Mark  


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.

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


An early attempt to identify a time frame for distinctive glass bead chemistries using elemental composition.

**Kenyon, Ian, Susan Kenyon, Ron Hancock, and Susan Aufreiter**


**Kim, Christopher F.**


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

**Kim, Na-Young and Gyu-Ho Kim**


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


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

**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.
Klysubun, W., Y. Thongkam, S. Pongkrapan, K. Won-in, J. T-Thienprasert, and P. Dararutana
2011 XAS Study on Copper Red in Ancient Glass Beads from Thailand. Analytical and Bioanalytical Chemistry 399(9):3033-3040.
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.

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.

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 beads from the late 10th - early 11th centuries found in Wolin, Poland.

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/, accessed 8 August 2016.
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 the beads.

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.
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
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.

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

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, serpentine, 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.

Krueger, I. and K.H. Wedepohl

Kwiatkowska, Katarzyna and Dariusz Manasterski
2016 Model wieloaspektowej analizy artefaktów bursztynowych z przełomu neolitu i epoki brązu na przykładzie wybranych zabytków z Podlasia i Mazowsza / Model of a Multi-Aspect Analysis of Amber Artefacts from the Late Neolithic and the Early Bronze Age on the Basis of Selected Artefacts from Podlachia and Mazovia. In Studia i Materiały do Badań nad Neoitem i Wczesną Epoką Brązu na Mazowszu i w Podlasiu VI, edited by Ryszard F. Mazurowski, Dariusz Manasterski, and Katarzyna Januszek, pp. 23-51. Instytut Archeologii Uniwersytetu Warszawskiego, Warsaw.

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. In Polish with substantial English abstract.

Kwok, Fanny

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.

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

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

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

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

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

Lankton, James W., Laure Dussubieux, and Thilo Rehren
Concentrates on the chemical composition of bird star, hexagonal bicone, opaque monochrome, and Jatim glass beads.
Lankton, James W., B. Gratuze, G.-H. Kim, and L. Dussubieux
Glass beads were included in the study. Korea.

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

Latinis, K.

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
2008 Nondestructive Pb Isotope Sampling and Analysis of Archaeological Silver Using EDTA and ICP-MS. American Laboratory September.
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
The study includes a set of carnelian beads of unknown archaeological provenance.

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.

Lefranc, Philippe, Rose-Marie Arbogast, Fanny Chenal, Erwin Hildbrand, Matthias Merkl, Christian Strahm, Samuel Van Willigen, and Marie Wörle  
Two necklaces composed of copper beads were found with a Neolithic burial in northeastern France. Compositional data are provided.

Lei, Yong and Yin Xia  
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).

Li Fei, Li Qinghui, Gan Fuxi, Zhang Bin, and Cheng Huansheng  
Reports on the composition of faience and glass beads of the Han, Yuan, and Northern Wei dynasties unearthed from the Neimenggu area and Boshan, China. In Chinese.

Li Fei, Li Qinghui, Gan Fuxi, Zhang Bin, Cheng Huansheng, and Shen Shifang  
2007 Analysis of Some Ancient Glass Samples Unearthed in Sichuan Area by PIXE. *Nuclear Techniques* 2.
The proton induced X-ray emission (PIXE) technique was used to determine the composition of glass beads and other objects dating from the Warring States Period (770-476 BC) to the Six Dynasties Period (220-589 AD). In Chinese.

Li Qinghui, Dong Junqing, Su Bomin, Chen Gangquan, Liu Song, and Gu Donghong  
The glass samples could be divided into two glass groups: PbO-BaO-SiO₂ and Na₂O-CaO-SiO₂, China. In Chinese.
Li Qinghui, Huang Jiao Zhen, and Gan Fuxi
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 Q.H., S. Liu, H.X. Zhao, F.X. Gan, and P. Zhang
At least two different types of glass were present in the two cemeteries. For the first time, antimony-based colorant/opacifier was systematically identified in some beads of plant-ash type soda-lime glass dated to about 1000-500 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 Q.H., J.C. Yang, L. Li, J.Q. Dong, H.X. Zhao, and S. Liu
Most of the specimens tested were glazed polychrome pottery beads dating from the 4th century BC to the 3rd century AD. They are composed of vitreous PbO-BaO-SiO$_2$ material.

Li Qinghui, Zhou Hongzhi, Huang Jiaozhen, Gan Fuxi, and Zhang Ping
2005  Yipi zhongguo gudai xiangqian bolizhu huaxue chengfen fenxi de jiance baogao (Chemical Composition Analytic Results of Ancient Chinese Compound Eye Beads). *Jianghan kaogu* (Jianghan Archaeology) 4.
The beads were unearthed at Xinjiang, Hubei, Sichuan, and Guangdong, China. In Chinese.

Livibete, Jana and Indra Tuña
Not only discusses the conservation process for the recovered beads but also provides information on the chemical composition of 10 of them. The site is located in Latvia and the beads date mostly to the 10th-17th centuries.

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

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.

Liu, Nian, Yimin Yang, Yongqiang Wang, Wanglin Hu, Xiaochenyang 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 3,000 years ago.

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

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

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 archеometric analysis of glass beads found in different depositional and post-depositional conditions at a site in Argentina dated between 450 and 370 B.P.

Luedtke, Barbara

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 (5th-3rd centuries BC) in Bulgaria is determined and discussed.

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

Magnavita, Sonja

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

Mândescu, Dragoș, Maria Mihalache, Ioana Stănculescu, and Mihai Constantinescu

The study of small kaolin beads found at a site in Romania includes compositional analysis.

Mangou, Helen

Marchetti, Marie-Laurence and Bernard Gratuce

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

Martínez Mira, Isidro, 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.

Martíñón-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.

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

The assemblage includes 7 beads and 1 bead/spiral.

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.

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

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

Meek, Andrew and Sonja Marzinzik  

Medici, Teresa, Giulia Foradori, Francesco Carrer, Roberto Dal Maschio, Stefano Gialanella, Maurizio Montagna, Annaluisa Pedrottì, and Diego E. Angelucci  
Discusses a “gooseberry” glass bead attributed to the 16th-18th centuries from a high-altitude pastoral context at Trento, Italy. Includes chemical analysis.

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

Melgar Tísoc, Emiliano R., José Luis Ruvalcaba, Kilian Laclavetine, and Estela Martínez Mora  
On the origin and manufacture of turquoise objects (including beads and pendants) from central Mexico.
Melgar, Emiliano, Reyna Solís, and José Luis Ruvalcaba
The aim of this work is to measure the composition of the recovered stone beads and other artifacts for provenance study and to establish the manufacturing technique and tools used to produce them.

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

Micheli, Roberto and Federico Bernardini
The processes for producing beads and pendants from Spondylus shell eliminate the natural characteristics of the shells that allow taxon 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
The analysis of the stone beads from two gold necklaces found in a Romano-British grave near Gillingham, Kent, England, United Kingdom, reveals that the beads are of composed of garnet, emerald, and variscite.

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.

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 XRF 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, 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

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.

**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.

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


The colonies of micro and nanocrystallites of orthorhombic KSnO$_3$ (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.

**Moreau, Jean-François**


On beads of the early fur trade.

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


**Moreau, Jean-François and R.G.V. Hancock**


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

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


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

1997 Taphonomical and Chronological Studies of a Concentration of European Glass Trade Beads from Ashuapmushuan, Central Quebec (Canada). In *Proceedings of the Seventh Nordic
Neutron activation analysis of the beads was used to test the temporal assignment of the bag as well as the anthropological interpretation of the beads as pertaining to a decorative pattern on the bag.

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

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.

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.
Murillo-Barroso, Mercedes and Marcos Martinón-Torres

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 Murcecs de Cellers cave (Llimiana, Pallars Jussà, Lleida).

Murillo-Barroso, Mercedes, Marcos Martinón-Torres, Leonardo García Sanjuán, David Wheatley, Mark A. Hunt Ortiz, Matilde Forteza González, and María Jesús Hernández Arnedo

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.

Murillo-Barroso, Mercedes, Enrique Peñalver, Primitiva Bueno, Rosa Barroso, Rodrigo de Balbin, and Marcos Martinón-Torres

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.

Muros, Vanessa and Nikolaos Zacharias

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 Főrizs, and Mária Tóth

Nearly 200 glass beads found in Sarmatian (2nd-4th centuries) and Avar (6th-8th centuries) graves in Hungary were subjected to instrumental analysis. In Hungarian with English abstract.
Nakai, Izumi, Yanase Kazuya, Matsuzaki Mayumi, Sawamura Daichi, and Nagahama Koji
Japan; in Japanese but images of the beads are provided and the analytical tables are partially in English.

Nakai, Izumi and 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, D. and T. Warashina
In Japanese.

Neri, Elisabetta, Bernard Gratuze, and Nadine Schibille
Corrects minor errors in Table2 (samples K_013, K_018, K_019 and Lz_012).

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.

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
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.

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. 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.


Discusses the provenance of green beads from Perdigões in southwestern Spain by means of XRF and XRD analyses.


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.


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., 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, Carlos P., Joaquina Soares, Carlos Tavares da Silva, and Paulo E. Fonseca
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 Rodriguez, José María Martínez-Blanes, Miguel Ángel Avilés, Joan Daura, Montserrat Sanz, and José Antonio Riquelme
2017 Amber, Beads and Social Interaction in the Late Prehistory of the Iberian Peninsula: An Update. Archaeological and Anthropological Sciences; https://doi.org/10.1007/s12520-017-0549-7
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. Martínez-Blanes, and Joao Luís 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.

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.

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

Olmeda, Giulia, Benedetta Prosdocim, Ivana Angelini, Michele Cupitò, Gianmario Molin, and Giovanni Leonardi
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
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
Presents a study of the glass and amber beads recovered from a Merovingian site in the southern Netherlands. Includes compositional analysis.

Osanai, Yasuhiro, 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 Mezőtúr, 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.

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 their utility to determine 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.

Panei, Liliana, Gilberto Rinaldi, and Maurizio Tosi
Discusses the mineralogical composition of the recovered stone (heat-hardened steatite) beads and the technology used in their production.

Peake, James R.N.
SEM-EDXA analysis of approximately 400 beads has shed new light on the production technology of certain colors, most notably red glass, as well as chronological and typological variations in technology relating to particular types and colors of bead produced during the early medieval period. United Kingdom.

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, southeastern England, has provided further insights into the production and technology of opaque red glass.

**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.

**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.

**Pion, Constantin and Bernard Gratuze**


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

**Pitarch Martí, Africa, Yi Wei, Xing Gao, Fuyou Chen, and Francesco dErrico**


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 Eastern Asia of a communication technology (the production of artificially coloured 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 site in 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.

**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.

**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

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

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

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

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

The author points out errors in the description and interpretation of a glass bead from a site in Poland and points out what is needed for the proper description of beads and the interpretation of the results of chemical composition analyses.


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

2014 Bursztynowy rozdzielacz i szklane paciorki odkryte w obiektach kultury lużyckiej w Targowisku, pow. wielicki (An Amber Spacer Bead and Glass Beads Discovered at Lusatian Culture Features in Targowisko, the Wieliczka District). In Via Archaeologica: Źródła z badań wykopalskich na trasie autostrady A4 w Małopolsce, pp. 289-306. Kraków.

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.

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


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

Purowski, T., L. Kępa, and B. Wagner


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
2015 Badania składu chemicznego szkla pacie rków z cmentarzyska z wczesnej epoki żelaza w Modlnicu (The Examination of the Chemical Composition of the Glass from the Beads Discovered in the Early Iron Age Cemetery at Modlnicz). In Modlnicz, stan. 5 – od późnej epoki brązu po czasy średniowiecza, edited by Karol Dziegielewski, Agata Sztyber, Magdalena Dziegielew ska, pp. 239-254. Wydawnictwo Via Archeologica, Kraków.

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 and Barbara Wagner

Beads were included in the study. In Polish with English abstract.

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

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

Qin Ying, She Lingzhu, Li Xiaoli, and Huang Jianxun
2009 Composition and Structure of Warring States Period Glasses from Tomb Number Two at the Leigudun Site of Shuizou County, Hubei Province, China. Journal of the Chinese Ceramic Society 4.

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

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

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

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

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

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.

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

Rehren, T. and S. Nixon
Analysis of the glass adhering to crucible fragments found in a goldsmith’s workshop and glass beads found in association suggests that the Tadmekka goldsmiths were processing gold using crushed glass beads as a flux, rather than working glass as a material in its own right.

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

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. Rasoirifetra, 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 masagâ 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.

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

**Robertshaw, Peter, M. Wood, E. Melchiorre, Rachel S. Popelka-Filcoff, and Michael D. Glascock**
A sample of 360 glass beads from 19 archaeological sites in southern Africa dating between about the 8th and 16th centuries 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.

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

**Rolland, Joëlle and Laurent Olivier**
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.

**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 Tissamaharâ, Sri Lanka.
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.

Rumyantseva, Olga

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.

Ruvalcaba Sil, J.L., A. Daneels, M. Vaggi, and M. Aguilar Franco

Several green-stone beads and other adornments of the Classic period were analyzed using Raman and Mid-FTIR spectroscopies in order to identify the mineral composition, while PIXE and Ionoluminescence were applied to contribute to the mineral identification and to determine probable provenance.

Ruvalcaba Sil, J.L., E. Melgar 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 Lynneth S. Lowe, pp. 163-178. Universidad Nacional Autónoma de México, México, D.F.

On the composition and origin of green-stone offerings (including beads) at Tenochtitlan.

Saitowitz, Sharma J. and David L. Reid

Plasma mass spectrometry was used to assess the rare earth trace element content of beads from Egypt and Malaysia. Egyptian beads dating to 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 1,000 years ago.

**Salvatori, S., M. Vidale, G. Guida, and E. Masioli**
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 Stękowski**
Poland.

**Saminpanya, Seriwat, N. Bavornyospiwat, S. Homklin, S. Danyutthapolchai, and P. Bupparenoo**
Discusses drawn beads dating to the 3rd-6th centuries.

**Sánchez De La Torrea, Marta, F. Xavier Oms, François-Xavier Le Bourdonnec, Sara Aliaga, Oriol Mercadal, Artur Cebrìà, and Xavier Mangado**
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.

Sato, Yuuki, Takashi Takeuchi, and Kazuyuki Nakamura
2018 Chemical Analysis of the Glass Beads from Fukuyama Castle Town Site in Matsumae Town, Hokkaido. Research Reports of National Institute of Technology, Hakodate College 52:61-65; https://doi.org/10.20706/hakodatekosen.52.0_61

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.

Schierhold, Kerstin and Gisela Woltermann

Western Germany.

Schüssler, U., C. Rösch, and R. Hock

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

Schvoerer, Max, Richard Boyer, Francoise Bechtel, Stephan Dubernet, Jean L’Helgouac’h, and Jean Courtin

Since the mid-1970s, a bead found in the Crottes hypogaeum at Roaix (Vaucluse) has been considered to be the oldest and best dated glass artifact in southern France. A re-examination of the bead reveals that the material is not glass but turquoise.
Scott, David A.
Discusses the microstructure of an 18th-century French cut-steel bead and a gold necklace bead from Colombia.

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

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

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

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

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


The chemical composition of five glass bead samples and the corrosion products of a lead-barium glass rod were analyzed. Two compositional systems were identified: PbO-BaO-SiO₂ 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.

Shortland, A.

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

Shortland, A.J., N. Shishlina, and A. Egorkov

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. and M.S. Tite

Shugar, Aaron N. and Ariel O’Connor

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

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 Canindê 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.

Siqin, Bilige, Qinghui Li, and Fuxi Gan

The beads, dating mainly from the Han Dynasty to the Jin Dynasty, were recovered from several provinces of both China and Vietnam. They were divided into three glass subgroups.

Smirniou, Melina, T. Rehren, V. 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 Istenič

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.

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

**Sprague, Roderick**

**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**

In Slovak with English summary.


On the form and chemical composition of a glass bead recovered from the interior of the Church of St. Margity in Kopčany in western Slovakia. The bead dates to the early middle ages and is composed of potash-lime glass.

**Staššíková-Štukovská, Danica and Martin Hložek**
2009  *Materiál korálkov z hrobu číslo 79 z Kostolians pod Tribečom (Material of Beads from Grave No. 78 at Kostoľany pod Tribečom).* *Monumentorum Tutela* 21:73-90.

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. In Slovak with English summary.

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

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

**Stolyarova, Ekaterina K.**
2000  *Sireviye materiali i proiskhozhdenie bus epokhi bronzi zapadnoi chasti evraziiskikh stepei (Raw Materials and the Origins of Beads Dating to the 3rd Millennium B.C. from the Western Eurasian...*

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


A study of the beads of the Late Scythian Culture in the southwestern Crimea; Ukraine.


A female burial was accompanied by a hair adornment composed of glass seed beads and other components. The chemical composition of the beads is provided.

**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.

**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 (K$_2$O-PbO-SiO$_2$). In Japanese.
Tamura, Tomomi
Japan.

Tamura, Tomomi, Tomoya Aono, 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
Japan.

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

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

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

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

Thanik Lertcharnrit and A.K. Carter
In Thai.

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

Theune, C., P. Hoffmann, S. Bichlmeier, M. Heck, and J. Callmer
On the determination of the glass matrix of Merovingian glass beads.

Theunisson, R., P. Grave, and G. Bailey
Discusses the use of non-destructive geochemical techniques to source carnelian and agate beads from Southeast Asia and raw material from India and Thailand. Preliminary results suggest that some early beads excavated in Thailand were made from local materials.

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

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.

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 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, Katerina and Natalie Venclová
On the archaeology and chemical composition of Bohemian glass jewelry (mostly glass beads) from the Bronze Age to the Early Middle Age.
Tomomi, Tamura
Japan; Iron Age.

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

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

Tournié, Aurélie, Linda C. Prinsloo, and Philippe Colomban
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 J. Henderson
Chemical analyses of several objects including Etruscan vessels and glass beads from British collections suggest that a diagnostic Etruscan glass technology was used to make beads rather than the ornate vessels. Italy.
Towle, Andrew C., Julian Henderson, Paolo Bellintani, and Giovanna Gambacurta
Discusses the data from the chemical analysis of a group of glasses (beads included) from Final Bronze Age and Iron Age sites in the Po Valley of Italy.

One of the tasks of the study was to determine the chemical composition of the beads.

Truffa Giachet, Miriam
Presents preliminary results of the analysis of glass beads recovered from seven sites in West Africa dating to the 7th-20th centuries.

Truffa Giachet, Miriam, Bernard Gratuze, Sylvain Ozainne, Anne Mayor, and Eric Huyscom
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. In Bulgarian with English abstract.

Uboldi, Marina, Marta Rapi, and Ivana Angelini
Expounds upon protohistoric (IX-IV 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, Mannohar 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.

Valiulina, Svetlana
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
Presents a comprehensive analysis of the beads of glass, earthenware, and stone recovered from a burial ground of the 11th-14th centuries in Central Siberia. Includes chemical analysis. In Russian.

Van Strydonck, Mark, Bernard Gratuzé, 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.
Dating from the 3rd millennium until the early Roman period, the beads fall into three main groups based on their chemical composition.

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. Ashvan 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.

Vanna, L.

Varberg, Jeannette, 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.

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.

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.

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.

Archeologický ústav AV ČR, Prague.
Offers a detailed analysis of the glass beads recovered from the Něměice 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 Knoviz 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. Czech Republic.

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.

Virgili, V. and M.F. Guerra 
Provides a comparative compositional study of ancient (6th century BC) and modern (19th century) gold beads.
von Wedell, Christopher R.
2011 Methods of Dating Glass Beads from Protohistoric Sites in the South Platte River Basin, Colorado. M.A. thesis. Department of Anthropology, Colorado State University, Fort Collins. 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
2016 Neandertals made Jewelry, Proteins Confirm. Science 353(6306):1350. 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 Neandertal 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 Neandertal bone fragments from the site for direct radiocarbon dating finds that the link between the archaic humans and the artifacts is real.

Wajda, Sylwia

Walder, Heather
2013 Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) Analysis of Refired Glass Pendants from the North American Upper Great Lakes. In Archaeological Chemistry VIII, edited by Ruth Ann Armitage and James H. Burton, pp. 365-395. ACS Symposium Series 1147. 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.

2013 Stylistic and Chemical Investigation of Turquoise-Blue Glass Artifacts from the Contact Era of Wisconsin. Midwest Journal of Archaeology 38(1):119-142. 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.

2018 Small Beads, Big Picture: Assessing Chronology, Exchange, and Population Movement through Compositional Analyses of Blue Glass Beads from the Upper Great Lakes. *Historical Archaeology* 52(2):

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.

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

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

Walz, Jonathan R. and Laure Dussubieux

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

Wang, Kuan-Wen

SEM-EDS and EPMA analysis was conducted on glass beads from four sites in Taiwan: Kiwulan (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, Yoshiyuki Iizuka, Yi-Kong Hsieh, Kun-Hsieu 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 and Caroline Jackson
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.

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 Na$_2$O-Al$_2$O$_3$-CaO-SiO$_2$ glass, but their origin remains unclear.

Wang, Y., H. Ma, K. Chen, X. Huang, J. Cui, Z. Sun, and Q. Ma
2018  Identification of PbO (BaO) Faience from an Early and Middle Warring States Period Cemetery at Zhaitouhe, Northern Shaanxi, China. Archaeometry
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 Bo and Lu Lipeng
On the glass beads recovered from the two cemeteries in western China including chemical analysis.

Warashina, T.
1997  Source Analysis of the Jade Comma-Shaped Beads and Jasper Tubular Beads Excavated at Uikunden Site. Saga Prefecture Museum Research Library 22:3-64.
Japan. In Japanese.

Japan. In Japanese.
Wärmänder, Sebastian K.T.S., Davide Zori, Jesse Byock, and David A. Scott
Includes x-ray diffraction (XRD) analysis of several glass beads.

Warner, Richard
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
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 (Ca$_5$(PO$_4$)$_2$), cassiterite (SnO$_2$), cuprite (Cu$_2$O), and a Pb(Sn,Si)O$_3$-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, Zhao Zhi-qiang, Ma Jian, and Wang Jian-xin
Analysis was conducted on glass beads from the tomb M011 at the Shirenzigu site and the tomb M1 at the Xigou site which can be dated to the late Warring States and early Western 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
2010  Aplicación geo-arqueológica de microscopía electrónica y microsonda en piezas metalográficas y
líticas del cementerio regimiento Chorrillos de Calama. In Actas XVII Congreso Nacional de
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, FL.
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.

2017  Sixteenth Century European Artifacts from the Confirmed 8MR03538 De Soto Encampment Site
Florida Department of State, Bureau of Archaeological Research, Master Site File MR03538, 2017.
Provides descriptions and images of the chevron and Nueva Cadiz beads and carnelian pendants found at
the White Ranch/De Soto site in northern Florida (one of Hernando de Soto’s 1539 camps) with x-ray
fluorescence analysis of the chevron beads.

Wilmsen, Edwin, Laure Dussubieux, Thomas Huffman, and Marilee Wood
2018  Chemical Analyses of Glass Beads from Two Early Iron Age Sites in Zimbabwe: Zhizo Hill and
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, Somruede Satitkune, Natthapong Monarumit, and Nontarat Nimsuwahn
2017  Ancient Glass Bead from U-Thong Ancient City Site, Central Thailand. Key Engineering
Materials 737:590-594.
Discusses the chemical composition of 30 samples and 12 colors from a site of the Dvaravati Period (6th-
13th centuries).

Won-in, K., Y. Thongkam, W. Dhammanonda, J. Dutchaneephet, T. Kamwanna, S. Intarasiri, S.
Tancharakorn, W. Tanthanuch, and P. Dararutana
2013  Characterization on Eye Glass Bead Found at Khao Sri Vichai (Surat Thani), Thailand. Physics
Various analytical techniques were utilized to characterize the composition of glass eye beads with a
black body and dark blue/ocher/white eyes.

Won-in, K., Y. Thongkam, T. Kamwanna, and P. Dararutana
2012  Characterization of Prehistorical Glass Beads Excavated from Khao Sam Kaeo (Chumphon,
Thailand) Using PIXE and SEM-EDS. Journal of Radioanalytical and Nuclear Chemistry
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.

Wood, Marilee, Laure Dussubieux, and Peter Robertshaw

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

Wood, Marilee, 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.

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

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

Yamasaki, K.

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.
Yan g Ju, Zhao Hong-Xia, and Yu Pu
Belonging to the Qing Dynasty, the beads belong to the Na₂O-CaO-SiO₂ glass type with Cu and Co as the major coloring elements.

Yimin Yang, Lihua Wang a, 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.

Ying San Liou and Yi Chang Liu
Provides a summary of the findings. The beads date to ca. 1850-310 BP.

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

Yuryeva, Tatyana V., I.B. Afanasyev, E.A. Morozova, I. Kadikova, and V.S.Popov
Proposes that individual precipitates of KSbSiO₄ and 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. Kadikova, E.A. Morozova, I.B. Afanasyev, I.A. Balakhnina, N.N. Brandt, and V.A. Yuryev
Concludes that KSbOSiO₄ (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.

https://www.researchgate.net/publication/321913281

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. Yaprintsev, M.V. Frolenkova, S.A. Malykhin, I.A. Grigorieva, and V.A. Yuryev


Microcrystallites of orthorhombic K$_2$SbO$_5$SiO$_4$ (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.

Zerboni, Andrea, Sandro Salvatori, Pietro Vignola, and Abd el Rahman Ali Mohammed


Geochemical analyses of North and East African raw amazonite outcrops and artifacts found at the Neolithic cemetery of R12 in the Sudanese Nile Valley reveals southern Ethiopia as the source of the R12 amazonite.
The first archaeometric study carried out on green stone 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 serpentine and amazonite.

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

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

Zhang Zhiguo and Ma Qinglin

Discusses the chemical composition and manufacturing technology.

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

The samples were primarily plain and eye beads recovered from sites in Henan, Hubei, and Jiangsu, China. They are assigned to three glass systems.

Zhao, Hongxia, Qinghui Li, S. Liu, L. Li, and F.X. Gan

Dating to the Warring States Period, most of the beads belong to the typical soda-lime-silicate glasses with low amounts of MgO and K₂O.

Zhao, H.X., Q.H. Li, S. Liu, and F.X. Gan

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

Zuliskandar Ramli and Nik Hassan Shuhaimid Nik Abdul Rahman  

Zuliskandar Ramli, 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.

Zuliskandar Ramli, 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.

Zuliskandar Ramli, 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.

Zuliskandar Ramli, 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.

Zuliskandar Ramli, 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.