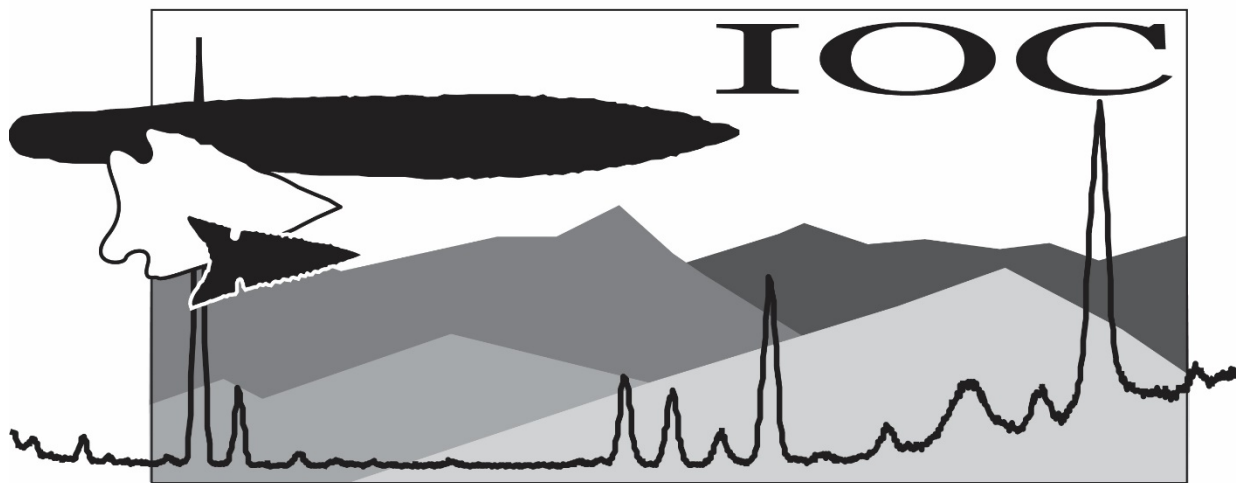


International Obsidian Conference 2021



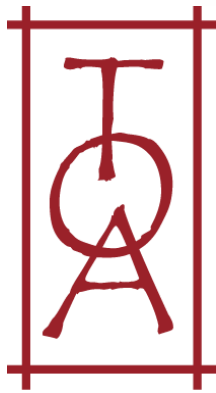
A Virtual Event

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IAOS

International Association for Obsidian Studies



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 **FAR WESTERN**
ANTHROPOLOGICAL RESEARCH GROUP, INC.

April 30 through May 2, 2021

Summary of meeting:

Welcome. This year's virtual conference includes presentations by specialists on a wide array of obsidian studies—from natural geologic sciences to anthropology. Following the goal of our prior conferences, we remain global in scope and showcase contributions from nearly all geographical regions. We have assembled three full days of presentations and posters on themes that include:

- Obsidian Sourcing Studies in Archaeology
- Analytical Methods
- Lithic and Technological Concerns
- Theoretical and Cultural Concerns

Link to virtual meeting:

- Start time: April 30, 2021 09:00 AM Pacific Time (US and Canada)
- Register in advance for this meeting:
- <https://zoom.us/meeting/register/tJlvdOmrrTksGt1u7Trb11MAk-pXmkXXUTR6>
- After registering, you will receive a confirmation email containing information about joining the meeting.

Organizing Committee:

- Kyle Freund – Far Western Anthropological Research Group, Inc.
- Lucas R. M. Johnson – Far Western Anthropological Research Group, Inc.
- Lisa Maher – University of California Berkeley, Dept. of Anthropology
- Tom Origer – Origer and Associates
- Nicholas Tripcevich – University of California Berkeley, Archaeological Research Facility

IOC Board:

- Katalin Biró – Hungarian National Museum, Budapest, Hungary
- Michael Glascock – University of Missouri, Columbia, MO, USA
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- András Markó – Hungarian National Museum, Budapest, Hungary
- Akira Ono – Meiji University, Tokyo, Japan
- Robin Torrence – Australian Museum, Sydney, Australia
- Robert Tykot – University of South Florida, Tampa, FL, USA
- Andrea Vianello – University of South Florida, Tampa, FL, USA

Virtual conference format:

The virtual conference format will include opening announcements and a keynote speech. From these opening events, we will proceed to each paper in turn starting with obsidian research in South America and concluding with theoretical and cultural concerns. Dispersed in between presentations we have arranged “coffee break-out rooms” for attendees to freely visit and talk openly. A longer “lunch break-out room” will allow for free visits too if desired. If you miss a presentation or an entire day, the conference will be recorded and hosted on the IAOS website and the UC Berkeley ARF YouTube Channel.

Special Awards and Recognitions in Archaeological Sciences:

- **International Association for Obsidian Studies (IAOS) Craig E. Skinner Best Poster Award of \$200 USD and a one-year IAOS membership.**

The best poster award is new this year and is named in honor of Craig E. Skinner, M.S. (University of Oregon, 1991), Laboratory Director Emeritus of the Northwest Research Obsidian Studies Laboratory (1996-2016), and Courtesy Research Associate, Museum of Natural and Cultural History, University of Oregon (2011-present). He is being recognized for his outstanding contributions in the use of geochemical characterization of archaeological and geological materials. Mr. Skinner’s significant contributions to the study of obsidian and fine-grained volcanics include President (1992-1993) and Webmaster (1995-present) of the IAOS, and the development of internet applications in archaeology, geology, and geography. Craig has approximately four decades of archaeological fieldwork and lab analysis experience for projects in the far western United States and Canada. His interest in obsidian research also spans several decades, with an emphasis on the discovery of quarries and element analysis. Although his 1983 thesis focused on Oregon obsidian, his interest in the subject is global. The IAOS was established in 1989, and Craig served as the organization’s fourth president during its fledgling years. Craig’s early contributions to the IAOS included collaborating with another early president, Kim Tremaine, creating what has grown into the association’s extensive on-line obsidian bibliography. Craig, now retired, is still doing research, and founded the Northwest Research Obsidian Studies Laboratory (NWROSL) in 1995.

Craig was also instrumental in the assembly of an annotated list of the many known worldwide obsidian sources, which is included on the NWROSL and IAOS websites. Craig's devotion to the study of obsidian is an inspiration to all, and his energy and dedication guided the IAOS to the place it now holds in the world of science.

All posters will be judged on the significance of the archaeological content, from the overall problem to the application of methods and the soundness of conclusions. Posters will also be evaluated by their overall display and oral presentation of the content.

- **Society for Archaeological Sciences (SAS) R.E. Taylor Student Poster Award of \$100 USD, a complementary SAS membership for the rest of the calendar year, and subscription to the SAS Bulletin. The awardee and their work will also be promoted through SAS social media channels.**

SAS has a longstanding program of awards for outstanding student conference posters in the realm of archaeometry. The prestigious R.E. Taylor Student Poster Award acknowledges innovative student contributions to archaeological research through the use of scientific methods and has enhanced the careers of prominent young scholars and professionals for more than two decades. The award is named in honor of Professor Emeritus R. Ervin Taylor of the University of California at Riverside for his outstanding contributions in the development and application of radiocarbon dating in archaeological research and his dedication to the founding of the Society for Archaeological Sciences, his leading role as President (1980) and General Secretary (1981-2002) of the Society, and his committed service as Editor of the SAS Bulletin. Professor Taylor's many valuable contributions were recognized by the SAA in 2004 with the Fryxell Award for Interdisciplinary Research.

Entries will be judged on the significance of the archaeological problem, appropriateness of the methods used, soundness of conclusions, quality of the poster display, and oral presentation of the poster by the student, who should be the first author in order to be considered. There is no formal application process for this particular competition; all students who submitted a poster to IOC 2021 will automatically be entered in the competition. More information about SAS award programs and members-only benefits can be found at socarchsci.org.

Day 1: April 30, 2021

(9am-5pm Pacific Daylight Time)

9:00 **Welcome and Introductions.**

9:30 **Keynote**, *Dr. Steven Shackley*, Professor Emeritus, UC Berkeley

Obsidian Sourcing in Archaeology: South America (10:30-11:50am)

10:30 The Charaña Obsidian Source and Its Role in the Prehispanic Exchange Networks of the Titicaca Basin. *Richard L. Burger, Martin Giesso, Vanessa Jimenez Balderrama, Paul Goldstein, Michael D. Glascock*

10:50 Obsidian Exchange among Hunter-Gatherers in Northwestern Patagonia. *Fernando Franchetti, Clara Otaola, Laura Salgán, Miguel Giardina*

11:10 (pre-recorded) Prehistoric Use of an Obsidian-Rich Ignimbrite Deposit, Northwestern Patagonia. *Raven Garvey, Ramiro Barbere, Agustina Rughini, M. Victoria Fernández, Guadalupe Romero Villanueva, Brandi MacDonald*

11:30 A 12,000-Year Sequence of Human Use of the Alca Obsidian Source, Peru. *Kurt Rademaker, David Reid, Michael Glascock, Bruce Kaiser*

11:50 **Lunch Break**

Obsidian Sourcing in Archaeology: Mesoamerica (1:00-2:50pm)

1:00 pXRF Obsidian Analysis of Two sites in the Southern Basin of Mexico: From Early to Late Postclassic. *Guillermo, Acosta-Ochoa, Berenice Jiménez-González*

1:20 Marketplaces and Market Exchange of Obsidian During the 8th – 10th Centuries at El Zotz, Guatemala. *Joshua Kwoka, Anna Bishop, Thomas Garrison, Hector Neff, Stephen Houston*

1:40 **Coffee break**

1:50 Obsidian Exchange Spheres in Late Postclassic Mesoamerica: New Perspectives from Tlaxcallan, Mexico, Utilizing an Olympus Vanta Portable X-Ray Fluorescence Spectrometer. *Marc Marino, Lane F. Fargher, Wesley D. Stoner*

2:10 Networks of Procurement and Provisioning: Geochemical Evidence from Late-Classic Cotzumalhuapa, Guatemala. *David McCormick*

- 2:30 New XRF Provenance Research on The Obsidian Jewelry from The Great Temple of Tenochtitlan, Mexico. *Emiliano Melgar-Tisco, Guillermo Acosta-Ochoa, Victor García-Gómez, Reyna Solís-Ciriaco, Luis Coba-Morales, Eder Borja-Laguna*

Obsidian Sourcing in Archaeology: North America (2:50-3:50pm)

- 2:50 (pre-recorded) Mesoamerican Obsidian in the American Southwest: What It Means for Southwest-Mesoamerican Connections and Coronado's Mexican Allies. *Sean Dolan*
- 3:10 Prehistoric Obsidian Procurement and Exchange in West-Central Arizona. *Michael Kellett*
- 3:30 Finding Obsidian Sources in Yellowstone National Park: Further Work. *Andrea Vianello, Robert H. Tykot*

Poster Session 1 (4:00-5:00pm)

- 1 What Determines the Chromatic Features of the Obsidian? The Example of Sierra de las Navajas (State of Hidalgo, Mexico). *Paola Donato, Luis Barba, Maria_Caterina Crocco, Mariano Davoli, Rosanna De_Rosa, Sandro Donato, Raffaele Filosa, Giancarlo Niceforo, Alejandro Pastrana, Gino Mirocle Crisci*
- 2 The Character and Use of Ferguson Wash Obsidian in Eastern Great Basin Prehistory. *Kyle P. Freund, Lucas R. Martindale Johnson, Daron Duke*
- 3 Morphology and Texture of Microlites in the Baekdusan and Kyushu Obsidian with Implication for the Different Cooling Condition of Rhyolitic Magmas. *Yong-Joo Jwa, Seonbok Yi*

Day 2: May 1, 2021

(9am-5pm Pacific Daylight Time)

Obsidian Sourcing in Archaeology: Asia and Europe (9:00-11:40am)

- 9:00 Exploitation of Obsidian at Psytuaje Rockshelter, North-Central Caucasus, Russia. *Ekaterina Doronicheva, Liubov Golovanova, Vladimir Doronichev, Galina Poplevko, Andrey Nedomolkin, Steven M. Shackley*
- 9:20 Obsidian Exploitation in Upper Paleolithic layer 1A-2 at Mezmaiskaya Cave, North-Western Caucasus, Russia. *Ekaterina Doronicheva, Steven M. Shackley, Liubov Golovanova, Vladimir Doronichev, Galina Poplevko*
- 9:40 The “Kozushima Obsidian Shuttle” across the Pacific and the Migration of *Homo sapiens* to the Japanese Archipelago. *Nobuyuki Ikeya*
- 10:00 Archaeological Research of Khrami Valley: Transportation of Obsidian in Neolithic-Chalcolithic Times (Preliminary Results of a New Archaeological Survey). *Saba Jokhadze*
- 10:20 **Coffee break**
- 10:40 Traditions of Obsidian Use at Körtik Tepe from the Late Epi-Palaeolithic to the Pre-Pottery Neolithic in the Upper Tigris Basin. *Rose Moir, Tristan Carter, Sarah Grant, Metin Kartal, Abu Bakar Siddiq, Vecihi Özkaya*
- 11:00 Obsidian Artefacts from Tell Hódmezővásárhely-Gorzsa (SE Hungary): Preliminary Results of a Provenance Study using pXRF. *Elisabetta Starnini, Ferenc Horváth, Barbara Voytek, Clive Bonsall*
- 11:20 A Timeline for the Utilization of the Carpathian Obsidian Sources. *Katalin T. Biró*
- 11:40 Geochemical and Technological Characterization of Obsidian Artefacts from the Neolithic Site of Opatów in Southeast Poland. *Dagmara H. Werra, Richard E. Hughes, Marcin Szeliga*

12:00 **Lunch Break**

Analytical Methods (1:00-4:00pm)

- 1:00 (pre-recorded) Cl/Na₂O As A Geochemical Index of Obsidian Aging. *Franco Foresta Martin, Enrico Massaro*

1:20 Confidence in Sourcing Small Obsidian Objects: Applying the Mahalanobis Distance Statistic in Ternary Diagrams with R. *Lucas R. Martindale Johnson, Kyle P. Freund, Kathy Davis, Daron Duke*

1:40 Portable X-ray Fluorescence for Non-Destructive Provenance Studies on Sardinian Obsidian. *Valentina Mameli, Carlo Lugliè, Carla Cannas*

2:00 Obsidian Hydration Dating by Infrared Transmission Spectroscopy. *Christopher Stevenson, Thegn N. Ladefoged, Alex Jorgansen, Alexander K. Rogers*

2:20 **Coffee break**

2:40 Archaeological Significances and Geochemical Characterizations of Obsidian Sources in the Central Highlands, Central Japan, by Wavelength-Dispersive XRF and LA-ICP-MS. *Yoshimitsu Suda*

3:00 Inter-Instrumental Calibration and Data Comparison for XRF Analysis of Obsidian. *Robert H. Tykot*

3:20 An SEM-based Micro-XRF and Portable XRF Spectrometry Study of Mesoamerican Obsidian Tablets. *Edward Vicenzi, Meredith Sharps Noyes, Maria Martinez, Michael Brandl, Thomas Lam*

Poster Session 2 (4:00-5:00pm)

4 The Carpathian Obsidian – Differences between C1, C2, and C3 Types. *Milan Kohút, A Biroň, F. Hrouda (AGICO Inc., Brno, Czech Republic), T. Mikuš,, S. Milovská, J. Šurka*

5 Lithic Raw Materials Procurement Networks in Corsica in the 2nd and 1st Millennia: The I Casteddi Case. *Arthur Leck, Cheyenne Bernier, Bernard Gratuze, H el ene Paolini-Saez, Fran ois-Xavier Le Bourdonnec*

6 Obsidian Maritime Interconnections in Early Holocene Eastern Mediterranean. *Theodora Moutsiou*

7 Annadel and Glass Mountain Obsidian Sources in Sonoma County, California. *Robert H. Tykot, Michelle Hughes Markovics*

Day 3: May 2, 2021

(9am-4pm Pacific Daylight Time)

Lithic and Technological Concerns (9:00-9:40am)

- 9:00 The Obsidian Jewelry from West Mexico: Technology Characteristics and Precedence. *Rodrigo Esparaza*
- 9:20 Getting to the Point: Wari Obsidian Distribution, Reduction, and Use on the Southern Frontier. *Donna Nash*

Theoretical and Cultural Concerns: Part 1 (9:40-11:20am)

- 9:40 Digitization and Preservation of Legacy Datasets: Continued Adventures in Salvage Archaeometry. *Matthew Boulanger, Nicholas Tripcevich, Richard Burger*
- 10:00 Building on a Repository of Obsidian Geochemistry for South America. *Nicholas Tripcevich, Michael D. Glascock, Eric Kansa*
- 10:20 **Coffee break**
- 10:40 Obsidian in the Near East: New Challenges and Future Directions. *Elizabeth Healy, Stuart Campbell, Osama Maeda*
- 11:00 (pre-recorded) Assembling Obsidian in the South of Calchaquíes Summits (Tucumán Province, Argentina) between 300 BC - 1450 AD. *Juan Montegu*
- 11:20 **Lunch Break**

Theoretical and Cultural Concerns: Part 2 (1:00-1:40pm)

- 1:00 Depositional Pattern of Obsidian Artefacts: Understanding the Diverse Value Concepts in the Neolithic Carpathian Basin. *Kata Szilágyi*
- 1:20 Obsidian Sourcing and the Study of Island Colonization. *Tristan Carter*

Poster Session 3 (2:00-3:30pm)

- 8 Obsidian and Salt in the Khoy Plain: Uncovering the Early Bronze Age Obsidian Procurement System of the Salt Mine of Tappeh Doozdaghi, North-Western Iran. *Marie Orange, Akbar Abedi, François-Xavier Le Bourdonnec, Afrasiab Garavand, Fatemeh Malekpour, Catherine Marro*

- 9 Provenance Study of Silicic Stone Tools from Hajdúság (E Hungary) by Using PIXE and PIGE Techniques. *Peter Rozsa, Árpád Csámer, Sándor Tóth, Zita Szikszai, Zsófia Kertész, Ákos Csepregi, Sándor Gönczy, Béla Rácz*
- 10 Measurement of Magnetic Susceptibility of Obsidian from Shirataki, Hokkaido, Japan, to Identify the Source of Obsidian Tools. *Kyohei Sano*
- 11 Imports and Outcrops: A Preliminary Characterization of the Baantu Obsidian Quarry, Wolyta, Ethiopia, Using Portable X-Ray Fluorescence. *Benjamin Smith*

Closing announcements and updates on the next IOC meeting by Dr. Akira Ono (3:30-4:30pm)

International Obsidian Conference 2021

Abstracts

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Title: pXRF Obsidian Analysis of Two sites in the Southern Basin of Mexico: From Early to Late Postclassic

Abstract: Aztec obsidian studies have been centered on procurement mechanisms and mining industries during the Triple Alliance period, but the political and economic implications linked to production, exchange, and control of a strategic resource such as obsidian have been scarcely addressed in the Basin of Mexico during the period preceding the Triple Alliance. The over-representation of Pachuca (Sierra de las Navajas) obsidian during Late Postclassic and its control by Tenochtitlan, has given the false idea that this was the main source of raw material for the manufacture of prismatic blades during the Postclassic in general, relegating the gray-black obsidian (Otumba and others) to a secondary role, mainly for bifacial knapping and flake industry. This study shows our results of the pXRF analysis of obsidian from two exemplary sites for Early and Late Postclassic periods in the Xochimilco area. Our results indicate that during the Early Postclassic period, Pachuca obsidian represent less than a fifth of the total obsidian industry, while Ucareo obsidian constitutes one third of the total sample, mainly in the form of obsidian blades. Otumba obsidian, on the other hand, is the dominant source in the manufacture of bifaces. On the other hand, during the Late Postclassic and under the political control of the Triple Alliance, the green obsidian of Pachuca dominates among the raw material used, mainly in the form of prismatic blades, and the obsidian of Otumba is represented in a much lower percentage, while Ucareo obsidian is absent from the record, because during this period the site is controlled by the Tarascan empire. This shows the control that the Triple Alliance maintained over this resource, particularly the green obsidian of Pachuca, and the cutoff of the obsidian exchange from Michoacán due to the conflict with Tarascan empire.

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Title: A Timeline for the Utilization of the Carpathian Obsidian Sources

Abstract: The obsidian sources in the Carpathian Basin, notably in the territory of Hungary, Slovakia, and the Ukraine have been in the center of research since the last third of the 19th century. Flóris Rómer started collection of evidence in the first volumes of the periodicals *Archaeológiai Közlemények* (1867) and *Archaeológiai Értesítő* (1868). At that time, the political situation favored distribution studies on a much larger geographical scale, i.e., the complete territory of the Austro-Hungarian monarchy, roughly corresponding to most of the distribution area of the obsidian sources currently referred to as “Carpathian” obsidian. The first archaeological distribution map on obsidian of the region was constructed by 1876, on the occasion of the VIIIth International Congress of Prehistoric Anthropology and Archaeology, Budapest. Missing, and still deficiently known, was the temporal dimension. The prehistoric chronology of the region was established much later, by the middle of the 20th century and is still being formed according to new finds and dates. Important collection of obsidian distribution data was made, on the regional level, in the 1930s and the 1950s of the last century. The author had the possibility to summarize existing data in 1981 and 2014, respectively, with temporal dimensions (1984) and quantitative data as well (1998a, 1998b). Moreover, several papers on instrumental analyses, starting with the classical NAA studies by O. Williams and co-authors (1984), including various analytical methods (EDS, XRF, PGAA, and FTD) completed the database with important information. The papers presented at IOC 2019 yielded new data that can be integrated into the system. There are still geographical regions with deficient information, and on many sites, we can only note the presence of obsidian without exact data on its role in the lithic assemblage. The present summary can be considered again as a state-of-art report, with many new data – but also open questions.

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Title: Digitization and Preservation of Legacy Datasets: Continued Adventures in Salvage Archaeometry

Abstract: Obsidian provenance research is now mainstream and commonplace. Widespread production of new archaeometric data, facilitated by ever-increasing ease of access to analytical devices, is beneficial to archaeology and to the study of obsidian geochemistry. Yet, for all of the excitement surrounding the latest generation of whiz-bang devices, there is a tendency to forget about data that were produced only a few years prior. Here, we discuss continued efforts at locating and digitizing legacy archaeometry datasets from the Lawrence Berkeley National Laboratory. Our experiences with these data provide insights that allow us to identify modern pitfalls, and suggestions on how to avoid them. Beginning from the standpoint that preservation of data is relevant to current and future research, and to an historical understanding of our discipline, we provide recommendations on protocols and strategies that will increase the probability that data generated today remains relevant tomorrow.

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Title: The Charaña Obsidian Source and Its Role in the Prehispanic Exchange Networks of the Titicaca Basin

Abstract: This paper identifies a geological deposit of obsidian located 14 km east of the village of Charaña, Pacajes Province, Bolivia as the source of Tumuku or Khonko Type obsidian. Reassessment of obsidian artifacts from sites in the southern Titicaca Basin on both sides of the modern Peru-Bolivia border demonstrate that the Charaña Source was exploited for over three millennia. While its utilization was generally restricted to the altiplano, obsidian from the Charaña Source reached the lowland Tiwanaku site of Omo in the Moquegua Valley during the Middle Horizon.

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Title: Obsidian Sourcing and the Study of Island Colonization

Abstract: Starting with the premise that obsidian sourcing studies are ‘a means to a larger anthropological end’, we here discuss how the history of obsidian source exploitation contributes to larger debates on seafaring, and island colonization processes globally. The ability to make a boat and successfully navigate open waters has long been viewed as an index of behavioral modernity, i.e., one of the evolutionary winning strategies that led to *Homo sapiens* outliving its various contemporaries, and ultimately resulted in the global spread of humanity (Gamble 1993). Obsidian characterization studies, with its ability to pinpoint raw material origin, provides a powerful means of contributing to models of maritime and insular exploration, whether that be the settlement of a source island (e.g., Corsardinia, Japan, Papua New Guinea), or islands where imported obsidian artefacts may help detail the timing and/or homeland of early visitors (e.g., Crete, Cyprus, Farasan Islands). It will be argued that the obsidian data globally continues to suggest that insular activity dates primarily to the Late Pleistocene – Early Holocene, and by extent associated exclusively with *Homo sapiens*. We end with one cautionary question: to what extent might one expect to see earlier populations targeting obsidian should they have reached source-bearing islands? While continental exploitation of obsidian sources extends to the Early Pleistocene (e.g., Rift Valley, Cappadocia), it might be argued that in general pre-sapiens populations tended to target more robust and/or immediately available resources better suited to percussive work, such as quartz, quartzites, and chert. The claimed exploitation of banded tuff on insular Lower Palaeolithic Melos – rather than the local obsidian sources – may represent a case in point, suggesting that in this larger debate obsidian sourcing studies may have its interpretative limitations.

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Title: Mesoamerican Obsidian in the American Southwest: What It Means for Southwest-Mesoamerican Connections and Coronado's Mexican Allies

Abstract: The connection between people in the United States Southwest/Northwest Mexico (SW/NW) and Mesoamerica is one of the most debated research topics in American archaeology. Scholars have discussed the scope and scale of interaction for over a century, but they have not used obsidian to address the nature of these complicated and long-distance relationships. If people in the SW/NW acquired objects from Mesoamerica, did obsidian also travel north? After geochemically analyzing tens of thousands of obsidian artifacts, archaeologists have yet to find Mesoamerican obsidian from confirmed pre-Hispanic contexts. However, here we discuss four green obsidian prismatic blades from New Mexico and Arizona, and EDXRF spectrometry confirms they originate from the Pachuca source in Hidalgo, Mexico. The blades were found at sites that the Spanish and their Mexican Indian allies used or potentially visited. Using lithic technological organization and historical narratives, we investigate two questions: Why is the total absence of Mesoamerican obsidian at pre-Hispanic sites significant for understanding SW/NW-Mesoamerican interaction and trade? Also, how can the limited presence of Pachuca obsidian after AD 1540 help archaeologists understand obsidian use by the Mexican Indian allies?

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Title: What Determines the Chromatic Features of the Obsidian? The Example of Sierra de las Navajas (State of Hidalgo, Mexico)

Abstract: Though most of the obsidian found all around the world are black, different colour varieties also occur, such as grey, mahogany, green, or “rainbow”. The different colours have been attributed to physical features (occurrence of inclusions, vesicles, microcrystals) or to chemical composition. Obsidian from Sierra de las Navajas (State of Hidalgo, Mexico) are unique throughout the world for their green colour and gold/silver hue. In order to relate these features with chemical composition we have carried out a microanalytical study by Electron Micro-Probe equipped with Wave Dispersion System (WDS- EMPA) on samples showing colour ranging from dark to light green and variable hue (concentric bands of different size, uniform hue, or no hue). The results of microanalyses suggest that the green colour of the obsidian is related to a high iron content; however, no significant difference in composition occurs between dark and light green samples, as well as between samples with different hue. Moreover, in order to test the importance of microtextural features, we have carried out Scanning Electron Microscope (SEM) observation on the surface of the obsidian and X-rays micro-tomographic analyses to have a sight on the internal microtexture of the samples. These investigations revealed the occurrence of vesicles of different size (from few to hundreds of micrometers), shape (from flat to elongated or irregular), and orientation only in the samples (or portions of the samples) showing a strong hue. The amount, shape, dimension, and orientation of the vesicles is therefore the main factor controlling the hue and, partly, the colour: non-vesiculated glass has no hue, and the colour appears darker, almost black; on the contrary, the occurrence of vesicles on the surface extols the green colour of the obsidian, making it lighter. In conclusion, both chemical composition and microvesiculation contribute to determine the chromatic features of Sierra de las Navajas obsidian.

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Title: Exploitation of Obsidian at Psytuaje Rockshelter, North-Central Caucasus, Russia

Abstract: Psytuaje Rockshelter is located ~70 km north-east of the highest Caucasian volcanic mountain peak of Elbrus Mount (5642 m asl) and 5-7 km south from the town of Zayukovo in the Baksan river valley (Terek river basin). The Rockshelter was discovered in 2018 and excavated in 2019. The dating results and archaeological comparisons suggest that Psytuaje rockshelter is a new final Epipalaeolithic site. Only two other Epipalaeolithic sites known in the region (Sosruko and Badynoko rockshelters) are located in a small area of the Baksan river valley (large tributary of Terek River). Lithic collections of Layer 2 at Psytuaje Rockshelter (2018-2019, 4 sq.m) comprises 634 mainly flint and obsidian artifacts. Our results show that local Zayukovo (Baksan) obsidian source was actively exploited by the inhabitants of Psytuaje Rockshelter. The lithic assemblage includes cores, CTEs, flakes, blades, bladelettes, microbladelettes, shatter, chips, and tools, as well as several other objects. Both flint and obsidian were knapped at the site in Ly. 2. Traceological studies of flint and obsidian artifacts suggest that different activities related to hunting prey and knapping of raw materials were performed at the site during the formation of Layer 2 at Psytuaje Rockshelter. This research was supported by the Russian Science Foundation grant No. 17-78-20082, "Human-nature interaction in ancient in the Central Caucasus: dynamics of environmental change and technological innovations, and adaptations of subsistence strategies."

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Title: Obsidian Exploitation in Upper Paleolithic layer 1A-2 at Mezmaiskaya Cave, North-Western Caucasus, Russia

Abstract: Mezmaiskaya cave is one of the well-known stratified Upper Paleolithic sites in the Caucasus. The cave was discovered by Dr. L.V. Golovanova in 1987 and excavated by her team till now. The stratigraphic sequence of the cave consists of three Holocene and 20 Pleistocene strata (Golovanova et al., 1998; 1999; 2010 a, b; Golovanova, Doronichev, 2003; Golovanova, 2015). Layers 1C-1A are dated to the Upper Paleolithic (39/38-21 kya). Most of the obsidian artifacts at Mezmaiskaya come from Layer 1A-2 (475 pieces; 2.4% of the total assemblage). Obsidian artifacts were analyzed using a ThermoScientific Quant'X EDXRF spectrometer in the Geoarchaeological XRF Laboratory, Albuquerque (USA). The results show that obsidian was transported from two sources: Zayukovo (Baksan) source located in the North-Central Caucasus (~200-250 km straight to southeast from Mezmaiskaya) and Chikiani (Paravani) source (~450 km southeast from Mezmaiskaya) located on the Javakheti Plateau in southern Georgia. The overall composition of the obsidian artifact assemblage, which includes cores, CTEs, cortical flakes, flakes, and numerous fragments and chips, suggests that a limited on-site flaking of obsidian took place. Laminar blanks are dominated by bladelets and microbladelets. The composition of retouched tools from obsidian is characterized by a predominance of backed and retouched bladelets and microbladelets. Also, a Gravette point and burins made on obsidian blanks were found. Traceological studies were performed with the use of the S.A. Semenov method (1957; 1964) with methodological additions by G.N. Poplevko (2007), which include the study of the relationship between typological, technological, and traceological definitions of artifacts. Our results show that in layer 1A-2 people were engaged in knapping obsidian and using obsidian for making various types of tools. The research was supported by grant No. 20-18-00060 from the Russian Science Foundation. "Trends of the cultural process during the Late Pleistocene in the North-Western Caucasus."

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Title: The Obsidian Jewelry from West Mexico: Technology Characteristics and Precedence

Abstract: In the 1990s, archaeologists Phil Weigand and John Clark carried out an investigation of obsidian crops in the Tequila Volcano Region in the state of Jalisco, Mexico. In that study, they described a kind of obsidian jewelry unique in Mesoamerica, which they called “obsidian lapidary without polishing” (Clark and Weigand, 2009:79). This type of jewelry is produced from thin sheets of obsidian from one or two millimeters thick which have a mirror finish, without a bulb of percussion and without the sharp edges found in prismatic blades. Each of the pieces contains one or two holes made with a drill. These characteristics did not fit with any previously known technology from Mesoamerica. The few examples of this jewelry which had been found came from looters or from private collections, so the origin of these pieces was unknown. Years later, it was possible to obtain some samples in situ, found in shaft tombs and burials excavated at the Guachimontones archaeological site, about 180 A.D to 100 B.C. The data obtained from these investigations reanimated the discussion about the importance of understanding the use and special characteristics of these materials. Hence our proposal to analyze this jewelry from different perspectives: its archaeological context, its provenance and the technology used to produce it. We know in advance that there will still be doubts, but our idea is to make a number of observations which we hope, with the passage of time, will either be confirmed or refuted.

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Title: Cl/Na₂O As A Geochemical Index of Obsidian Aging

Abstract: In a previous paper, Foresta Martin et al. (2020) proposed a new geochemical method to determine the provenance of the Italian obsidian sources widely exploited during prehistory: Monte Arci (Sardinia), Palmarola (Pontine Islands, Latium), Lipari (Aeolian Islands, Sicily), and Pantelleria (Sicily). The method is based on the amount of Cl, a minor element in igneous rocks, whose solubility in magmas increases with the content of network modifying cations, especially Na. The content of Cl and Na exhibits a good quantitative differentiation between the Italian obsidian sources, clearly discriminating them through Cl vs Na₂O scatter plot. In this work, we have investigated the geochemical ratio (wt%) Cl/Na₂O and found that it decreases according to the sequence: Lipari, Pantelleria, Palmarola, and Monte Arci, corresponding to their formation ages. We found that this relation can be well interpolated either by an exponential law, with an e-folding time of 3.16 Myr, or by a hyperbolic law with an initial halving time of 1.8 Myr. The latter one has the advantage of being less dependent on the initial condition for high ages. With our depletion curves, we estimated the ages of some obsidian subsources not yet radiometrically dated. Results: Lipari-Canneto Dentro \approx 21ka; M. Arci SA \approx 2Ma; M.Arci SB1, SB2 and SCV \approx 3.9Ma. Moreover, extrapolations of the hyperbolic law for very low values of the Cl/Na₂O ratio, as found in the Melos Island (Greece) obsidian, give an age of 7.6 Ma, in good agreement with an estimate by fission-track analysis (Durrani et alii 1971), while the much faster decay of the exponential law would imply a lower age.

We aim to extend this study to a larger group of samples to confirm these results and to validate the Cl/Na₂O ratio as an obsidian formation-age estimator. Under the methodological profile, we aim to study to what extent the time-decay of Cl/Na₂O ratio depends on the depletion rate due to weathering and devitrification phenomena.

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Title: Obsidian Exchange among Hunter-Gatherers in Northwestern Patagonia

Abstract: In this paper we explore the exchange of obsidian in the Diamante valley, northwestern Patagonia. Obsidian was rare in the Diamante valley, with high percentages of projectile points and bifaces, and little presence of cores and cortex—all signals of indirect access to sources. We conducted XRF sourcing analysis and technological analysis of nearly 180 obsidian specimens. We also explored least cost path analysis to discuss the access of obsidian from the Diamante valley. We found that Las Cargas was the main source used, followed by Maule 1 and 2, El Peceño, and Coche Quemado. In high contrast, the closest source, Laguna del Diamante, was the least used. We discuss that obsidian exchange had an important role through Highland villages to procure access to the rest of the valley. This also support the idea of the importance of obsidian to minimize risk at high altitude occupations. Finally, we determine the importance of obsidian and other raw materials at a macroscale to define lithic landscapes and their implications for mobility and exchange, by comparing northwestern Patagonia with the Great Basin of the US.

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Title: The Character and Use of Ferguson Wash Obsidian in Eastern Great Basin Prehistory

Abstract: This poster characterizes the geology of the Ferguson Wash obsidian source and contextualizes the prehistoric exploitation of its raw materials. The source is located on the Nevada-Utah border in Elko County, roughly 40 kilometers south of the town of Wendover. Prehistoric use of Ferguson Wash obsidian largely begins in the Early Archaic, being distributed over a relatively small area when compared to other sources in the region. Estimated to be of Miocene age, the primary deposition of Ferguson Wash obsidian extends along a canyon hillside roughly half a kilometer in length. Primary deposits take form as a striated white tephra matrix that includes pebbles of obsidian and pumice. Secondary deposition in the form of rounded and subangular obsidian pebbles can be found in the alluvial channels extending eastward from the mouth of the canyon. Although known as a source for lithic raw materials in prehistory, Ferguson Wash has not been well characterized, and to better understand the geochemistry of the source 60 geological samples were collected and analyzed using portable X-ray fluorescence (pXRF) spectrometry. The results of this study thus provide a much-needed assessment of the source and its place within the wider framework of eastern Great Basin prehistory.

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Title: Prehistoric Use of an Obsidian-Rich Ignimbrite Deposit, Northwestern Patagonia

Abstract: Volcanism in and adjacent to the Andes of northwestern Patagonia (36°–37° S) has produced several sources of volcanic glass. For roughly two decades, the prevalence of obsidian in the region's archaeological record has spurred a concerted effort to document and geochemically characterize these sources, and we now understand the region to be a complex "source-scape." Cueva Yagui is an important, serially-reoccupied cave site (ca. 8500 – 1850 cal BP) in the southern part of this region, located < 1 km from a recently identified obsidian-rich ignimbrite deposit (Cerro Huenul). Not surprisingly, X-ray fluorescence established that 86% of the site's obsidian artifacts are from this source. However, hydration rim measurements (optical and SIMS) suggest routine scavenging of Huenul obsidian, which has interesting implications for understanding Cueva Yagui inhabitants' stone consumption and related behaviors (e.g., subsistence and settlement patterns). Here, we present and contextualize the Cueva Yagui obsidian data to discuss the economics of immediately local Huenul obsidian, and an intriguing discrepancy between the hydration data and a several-thousand-year gap in the site's radiocarbon record.

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Title: Obsidian in the Near East: New Challenges and Future Directions

Abstract: The dissemination of exotic materials such as obsidian across much of the Near East as early as the Upper Palaeolithic (and perhaps before) has been largely understood by documenting its presence or absence; provenance analysis has often been restricted to a few, highly selective samples thus providing only a very generalized interpretation. However, exotic materials have an important role not only in helping us to understand the processes of resource acquisition, but they are also a tangible means through which we can obtain insights into inter-regional contact, social networking, and the changing meanings of materials. Methods of provenancing obsidian artefacts are of course well established but new techniques have made it possible to analyze many more artefacts from a greater variety of sites. This is beginning to transform our knowledge of the use of obsidian, placing a much greater emphasis on contextual and technological understanding; it has also demonstrated shorter term change in source use and the exploitation of minor sources, thus enabling new perspectives on how obsidian can be understood in a social context. Equally, however, the increased accessibility of obsidian source analysis emphasizes the need to better understand of the archaeology and geology of the source regions themselves as well as to develop greater methodological rigor. This paper particularly draws on recent examples of both prehistoric and historic obsidian use examined by the Manchester Obsidian Laboratory which has shown the interpretative potential of large-scale provenance analysis but at the same time has highlighted several lacunae, some of which we address in our paper.

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Title: The “Kozushima Obsidian Shuttle” across the Pacific and the Migration of *Homo sapiens* to the Japanese Archipelago

Abstract: It is a recently considered well accepted thought that *Homo sapiens* arrived at the Japanese archipelago not through a land-bridge, but across the sea about 38,000 years ago. Just after their arrival, the transportation of Kozushima Island obsidian across the Pacific started and continued until 34,000 years ago (Kozushima Obsidian Shuttle). Kozushima Island is a small volcanic island located in the Pacific Ocean, approximately 50 km from the southern tip of the Izu Peninsula, on the southern coast of the Japanese mainland. Even in the Last Glacial Maximum, this island was never connected to the present Japanese mainland; therefore, Kozushima obsidian that has been unearthed on the mainland indicates the existence of sea craft and seafaring technology in the Upper Paleolithic. This presentation will show examples of Kozushima obsidian artifacts identified by EDXRF and demonstrate the distribution of the obsidian along the axis of the early Upper Paleolithic chronology. The voyage between Kozushima Island and the Izu Peninsula during the Upper Paleolithic would have been possible only if three seafaring factors—knowledge, skill, and ship-building technology—had been obtained. The existence of the “Kozushima Obsidian Shuttle” suggests that modern humans had already acquired a certain level of systematized techniques that incorporated these complex factors in order to complete the long-distance voyage. On July 7, 2019, an approximately 8-meter-long dugout canoe left the southeast Taiwanese shore to examine the means and routes used by modern humans arriving on the Japanese Archipelago. After 45 hours and the passage of 200 km, the ship finally arrived at Yonagunizima Island, located in the easternmost part of Japan. The results of the experimental voyage indicate the possibility of long-distance sea crossing by paddling boats. Additionally, this presentation will refer to the relationship between this voyage and the “Kozushima Obsidian Shuttle.

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Title: Confidence in Sourcing Small Obsidian Objects: Applying the Mahalanobis Distance Statistic in Ternary Diagrams with R

Abstract: One of the most salient issues that arises when sourcing small and thin artifacts includes uneven Compton normalization across certain elements due to lower count rates, which tends to overestimate parts per million (ppm). Despite these complications, XRF analysts continue to analyze small samples, often expressing caveats with source assignments. To minimize error due to calibration assumptions, semi-quantitative photon count data or ppm can be transformed into elemental ratios or relative peak percentages. While data transformations can provide useful statistics for confidently sourcing small and thin samples, we expand on these methods by applying 95% confidence regions within ternary diagrams to encapsulate the full range of expected variation in a particular geological source regardless of sample size. This paper thus provides a detailed background on ternary diagrams along with a discussion of the requisite data needed to calculate sufficiently sized regions to assign both small and large samples to a source. We in turn argue that the use of confidence statistics in ternary diagrams is but one tool for obsidian sourcing and should be used in conjunction with other methods of assignment depending on regional geochemistry.

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Title: Archaeological Research of Khrami Valley: Transportation of Obsidian in Neolithic-Chalcolithic Times (Preliminary Results of a New Archaeological Survey)

Abstract: The South Caucasus, apart from other natural resources, is one of the wealthiest regions with obsidian, where the use of obsidian material begins from the Paleolithic period, and the demand for this material reaches the peak in the period of the Neolithic-Chalcolithic. This process takes place not only in the South Caucasus, but also in the Near East and Anatolian territory. After the physical characteristics of the obsidian material were strictly equated to the Neolithic daily life in the Near East, Anatolia, and South Caucasus wide regions, we see the first trading exchange relationships, with one of the most important natural resources - obsidian. For this reason, investigating the exploitation, production, and transportation of obsidian is a key factor in the research of the socio-economic condition of the ancient populations, which will enable us to learn more about their daily activities, migrations, and cultural attributes. Since the obsidian represents the leading lithic material in the Southern Caucasus Neolithic-Chalcolithic cultures, the population of this period had to have a permanent connection with obsidian sources. In the South Caucasus, the Chikiani obsidian source is one of the abundant northern outcrops, with a remarkable quality. From this source, obsidian was transported across the whole Caucasus. The process had been particularly organized in the Neolithic-Chalcolithic period of the Kwemo Kartli region, where since the middle of the 20th century there have been studied a lot of archaeological sites of this period and their obsidian industries. The PhD project (Shota Rustaveli National Science Foundation of Georgia – Grant PHDF-19-216) in a broad sense was oriented to study the mentioned problems. Within the range of the project, systematic archaeological survey was done in Khrami valley in the Lesser Caucasus, which gives us valuable information about the distribution of obsidian material in late prehistory.

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Title: Morphology and Texture of Microlites in the Baekdusan and Kyushu Obsidian with Implication for the Different Cooling Condition of Rhyolitic Magmas

Abstract: In South Korea, obsidian artifacts have been discovered at many prehistoric sites, and two provenances – Mount Baekdusan near Sino-Korean border and Kyushu of southwest Japan - are well known for them. We examined the morphological and mineralogical characteristics of the Baekdusan obsidian (hereafter BO) and the Kyushu obsidian (hereafter KO). Obsidian are of glassy material, but microlites are easily found in the host matrix: Fe-oxides are the most abundant microlite phase, with a lesser amount of clinopyroxene, feldspar, and biotite. According to the morphological discrimination of microlites, the most abundant features in the BO and the KO are trichites acicular and asteroidal, arcules, crenulites, ferculites, lath-crystals, scapolites, and so on, which are well observed under high magnification of the optical microscope. However, when we examine the microlites through a high-resolution scanning electron microscope, they show very distinct mineral assemblage and texture. For example, the microlites in the BO and the KO represent the different textural relationships. Early crystallized Fe-oxides in the BO occur within the oikocrysts of clinopyroxene, showing poikilitic texture. On the other hand, the clinopyroxene microlites in the KO are overgrowing around the Fe-oxides or interlocking with the Fe-oxides. This kind of texture between Fe-oxide and clinopyroxene would indicate the differing crystallization process of quenching rhyolitic magma. In general, microlites nucleate during the ascent of rhyolitic magma. Judging from the morphology and texture of microlites, the microlites from the BO were likely to have nucleated at conduit under high oxygen fugacity, whereas those from the KO at near conduit and/or surface under medium oxygen fugacity.

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Title: Prehistoric Obsidian Procurement and Exchange in West-Central Arizona

Abstract: This research investigates prehistoric obsidian acquisition in the Northern and Southern Sinagua, Prescott, and Cohonina culture areas to elucidate obsidian foraging and exchange patterns among prehistoric groups that inhabited west-central Arizona. The spatial distribution of prehistoric features and elements of material culture lend themselves to archaeological study for the purpose of discerning the interactions between an area's population and neighboring people and cultures. I analyze obsidian artifacts, including debitage, at 608 prehistoric sites in west-central Arizona using a portable X-ray fluorescence (XRF) spectrometer, identify the obsidian source provenance based on microchemistry, and map potential exchange routes between obsidian source areas and points of deposition. I use human behavioral ecology and landscape archaeology theory to generate testable hypotheses regarding the distribution of obsidian artifacts, potential foraging or exchange routes, and the influence of landscape connectivity on these patterns. I infer plausible foraging and exchange routes based on the spatial distribution of obsidian artifacts and least-cost path modeling that integrates slope, proximity to water, and vegetation community type. This research provides compelling evidence of wide-ranging foraging and exchange interactions among prehistoric groups that inhabited west-central Arizona.

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Title: The Carpathian Obsidian – Differences between C1, C2, and C3 Types

Abstract: The Carpathian obsidian: C1 – Zemplín area (SE Slovakia), C2 – Tokaj region (NE Hungary), and C3 – Zakarpattia province (W Ukraine) are matter of the obsidian sourcing studies for more than 40 years. However, the quantity and quality of various provenance data differ significantly within these areas. The present study has been realised by means of Electron Probe Micro-Analysis (EPMA) of glass + minerals, LA-ICP-MS from glass spots and WR, e^{-}CT , X-ray spectroscopy (XRD), Raman spectroscopy, and Magnetic susceptibility + thermomagnetic curves. The comprehensive research was realized on the following localities: C1 – Brehov, Cejkov, Hraň, Streda nad Bodrogom, and Viničky; C2 – Erdőbénye, Lebuj and Mád; C3 – Rokosovo 2x. Analytical study based on their chemical composition (EMPA + LA-ICP-MS glass + pulverized WR) support conventional discrimination between these groups of the Carpathian obsidian due to principal difference in the contents of SiO_2 , Au ($\text{C1} > \text{C2} > \text{C3}$); FeO, MgO, CaO, Ba, Co, Hf, Sr, Zr ($\text{C1} < \text{C2} < \text{C3}$); and K_2O , Rb, Ree's ($\text{C1} < \text{C2} > \text{C3}$). There were identified (EMPA + XRD) nearly all minerals e.g. plagioclase, biotite, alkali feldspar, quartz, pyroxenes, amphiboles, magnetite, Fe-Ti oxides, pyrrhotite, pyrite, olivine, zircon, apatite, monazite, uraninite and ilmenite in the form of minute phenocrysts, microlites, and trichites. Similarly, the volume contents of the principal mineral forms as well as distribution of micro- and nano-pores are almost identical within all groups of the Carpathian obsidian. Although there are considerable differences in chemical compositions, nonessential variances in magnetic susceptibility have been observed, because distribution of the main ferromagnetic (magnetite, pyrrhotite) and paramagnetic (biotite, pyroxenes) components are more or less similar within the studied groups. In spite of their compositional complexity, the Raman spectra of the studied Carpathian obsidian groups are surprisingly similar to each other, and obsidian of the western Mediterranean (Lipari, Palmarola) and/or the common dry silicate and aluminosilicate glasses.

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Abstract: Marketplaces and Market Exchange of Obsidian During the 8th – 10th Centuries at El Zotz, Guatemala

Title: The Classic Maya collapse of the 8th – 10th centuries was an era of dramatic transformation across the southern lowlands. Dynastic authority withered in the face of constant warfare, shifting political alliances, environmental stress, and perhaps external influences. While accurate, such broad strokes fail to capture localized experiences of and responses to these large-scale processes. This paper represents an effort to add nuance to the Late – Terminal Classic history of El Zotz, Guatemala, through a technological analysis of obsidian recovered from 16 residential compounds. Obsidian from one of the compounds – La Luna – was also analyzed via pXRF. The compositional data indicate that obsidian exchange networks were unaffected by the collapse of the El Zotz dynasty, a pattern antithetical to that found for ceramics. Distributional data align with expectations for market exchange, where households have equal access to obsidian based on need rather than status or rank. Furthermore, almost all obsidian is associated with core-blade technology, and few cores or production byproducts were recovered. These factors support a processed-blade trade model, whereby prismatic blade segments are acquired from a central marketplace.

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Title: Lithic Raw Materials Procurement Networks in Corsica in the 2nd and 1st Millennia: The I Casteddi Case

Abstract: I Casteddi (Tavera, Corse-du-Sud) was occupied continuously from the Middle Bronze Age to the second Iron Age. Among the artefacts unearthed, several hundred lithic obsidian and rhyolite pieces are attested. This evidence, in a protohistoric context, allows us to examine the continued use of stone tools and to interrogate these raw materials' procurement networks during a time when new circulation systems in the western Mediterranean become necessary.

The obsidian recovered at the site mainly originate from Sardinia. The SC type from Monte Arci represents the large majority, while two artefacts are still of uncertain origin. These results could attest to a continuity of exchanges within the Corsican-Sardinian block. The data obtained on the rhyolites indicate that this raw material could come from at least 25 different Corsican sources. This considerable diversity shows a high mobility of the community. The mountains in the centre of the island, with strong pastoral and hunting potential, seem to be a privileged procurement area.

The dichotomy between the lithic procurement patterns, exogenous and therefore maritime for obsidian and allochthonous and mountainous for the rhyolite, is interesting. Do we have two separate and contemporary networks, one linked to long-distance exchanges and the other to the mobility of the group within its territory? Or are those differences chronologically distinct and attest to the changes in the networks of the late Neolithic and Bronze Age? Further studies will have to be conducted to better define the evolution of the exchanges and mobilities on the island during the Bronze Age.

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Title: Portable X-ray Fluorescence for Non-Destructive Provenance Studies on Sardinian Obsidian

Abstract: The valorization of prehistoric artefacts passes through their chemical and mineralogical characterization in order to discover the source of the raw material used for their manufacture, i.e., their provenance, or identify the selection criteria. Although obsidian has been demonstrated to be a composite material, the similar glassy matrix is the requirement for comparable chemical measurements, whilst the presence of discriminating trace elements is the prelude for effective diagnostic methods for identifying the provenance source. In this work, low-cost, fast, non-destructive portable X-ray fluorescence (pXRF) was adopted to distinguish the local geo-sources of Sardinian obsidian. Sixteen milled and 43 intact geological samples were collected in four archaeologically relevant geochemical subsources of Monte Arci obsidian, named SA, SB1, SB2, SC,3,4 and were analyzed by pXRF together with four artefacts. The SA, SB and SC groups were successfully distinguished (92% of the geological samples and all artefacts were correctly attributed) whereas the sub-discrimination between the SB1 and SB2 groups was more difficult (8% error). The experimental conditions (analysis time, beamshutter aperture) for the analysis were carefully selected to improve the signal/noise ratio; the data elaboration was conducted by univariate and multivariate approaches on both discrete (i.e. intensity K lines ratios) and continuous variables (XRF spectra).

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Title: Obsidian Exchange Spheres in Late Postclassic Mesoamerica: New Perspectives from Tlaxcallan, Mexico, Utilizing an Olympus Vanta Portable X-Ray Fluorescence Spectrometer

Abstract: Portable X-ray fluorescence (pXRF) analysis of obsidian recovered from Late Postclassic Tlaxcallan indicated the principal Late Postclassic obsidian exchange spheres, noted by other authors, were not utilized to supply the city. Instead, pXRF analysis of site-wide obsidian collections previously identified El Parédon as the principal obsidian source consumed at Tlaxcallan. El Parédon, or more accurately the Aocolco Caldera in Hidalgo and Puebla, Mexico, was not under Aztec control during the Late Postclassic Period. Here, we examine localized household contexts to ascertain if the broader city-wide patterns of obsidian consumption fit the consumption practices at the household-scale. Importantly, we note if any of the primary obsidian sources, identified by previous researchers as playing key roles in supplying Late Postclassic Mesoamerica, were consumed in higher amounts among any households. We examine obsidian from five contexts of varying status with pXRF, including one possible high-status household, one public context, one household engaged in the surplus production of obsidian artifacts, and two other-status households. This new analysis, from five terraces distributed throughout the three districts of Tlaxcallan, allows us to examine the development of a new exchange sphere centered on the major market center of Tlaxcallan.

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Title: Networks of Procurement and Provisioning: Geochemical Evidence from Late-Classic Cotzumalhuapa, Guatemala

Abstract: Various contexts in the sector of El Baúl, at the site of Cotzumalhuapa have been the subject of recent excavations to better understand the obsidian procurement at this urban center. These sectors were chosen for excavation due to the large surface scatters of lithic material indicating areas of obsidian tool production. At the epicenter of each surface scatter is a workshop dump, indicated by the density and thickness of obsidian deposits found at considerable depth. Geochemical analysis via pXRF on obsidian from a variety of contexts throughout Cotzumalhuapa and its hinterland have demonstrated highly variable frequencies of obsidian sources throughout the polity. Geochemical data from workshop dump contexts suggests that workshops procured obsidian for tool production independently from one another. Furthermore, obsidian source frequency variability at non-dump contexts suggests that households were not provisioned by an open-market system. These data show a merging of two previously separate obsidian exchange networks at Cotzumalhuapa during the Late Classic.

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Title: New XRF Provenance Research on The Obsidian Jewelry from The Great Temple of Tenochtitlan, Mexico

Abstract: In the Great Temple of Tenochtitlan, archaeologists have recovered more than 1,000 artifacts of chipped obsidian, and 210 pieces of jewelry. Surprisingly, during 43 years of excavations, only one provenance study with NAA was carried out on seven objects (five blades, one flake, and one pendant). In this work, we will present the results of recent analysis with pXRF applied on 19 obsidian lapidary goods with different morphology, function, temporality, and color. The statistical study made by analyzing the main components (PCA) of the obsidian artifacts from the Great Temple, compared to geological samples, allowed us to define that five of the 10 elements analyzed (Y, Rb, Sr, Zr and Nb) are the most significant to define provenance. Based on that, we determined that most of the samples belong to the main deposits of the Basin of Mexico (Otumba and Pachuca); a common sourcing pattern among the assemblages of Central Mexico during the Postclassic period (AD 1200-1521). However, two distinct deposits were defined better by Hierarchical Cluster Analysis. Thus, three objects came from Pico de Orizaba in Veracruz and one piece from Ucareo in Michoacán. The interest of the Mexica on the Pico de Orizaba source was important because of the military garrisons located about 20 km from the mines. In contrast, the Ucareo material was an unexpected result because this source was unusual in the Basin of Mexico due, probably, to the dominance of the mine by the Tarascan Empire in West Mexico, one of the principal rivals of Tenochtitlan. This object could be a relic, obtained by looting ancient sites of the Basin of Mexico with prior occupation or as a gift or war prize. Finally, it would be the first reported material originating in that region in the Great Temple assemblage.

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Title: Traditions of Obsidian Use at Körtik Tepe from the Late Epi-Palaeolithic to the Pre-Pottery Neolithic in the Upper Tigris Basin.

Abstract: Körtik Tepe is located at the confluence of the Upper Tigris and Batman rivers in southeastern Turkey. The village was occupied by sedentary hunter-fisher-gatherers from the end of the 11th millennium BC (Terminal Pleistocene, with occupation beginning during the Younger Dryas climatic event) and into the 10th millennium BC (Early Holocene). Throughout the occupation sequence, obsidian comprised a common raw material for tool-production, despite the fact that the closest sources are located over 130 km linear distance in the upland volcanic region to the north/northeast. In 2013 the first characterization study using energy dispersive X-ray fluorescence (EDXRF) spectrometry of 120 artefacts from the later, Pre-Pottery Neolithic A occupation was published by our lab team. This presentation details the sourcing results of a further 54 artefacts that derive from earlier, Epi-Palaeolithic strata. The results of this second study suggest a change in procurement traditions over time, from a dominance of Nemrut Dağ products, to a reliance on Bingöl B obsidian. This paper considers the significance of this shift over time in the broader context of not only raw material preferences detailed at broadly contemporaneous sites in the region, but also through considering other practices at Körtik Tepe diachronically. Such changes include subsistence strategies, architecture, burial habits, and other forms of material culture that coincided with the mosaic development of the landscape during the transition from the Terminal Pleistocene to the Early Holocene in southwest Asia.

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Title: Assembling Obsidian in the South of Calchaquíes Summits (Tucumán Province, Argentine) between 300 BC - 1450 AD

Abstract: In the northwest of Argentina, obsidian was a lithic resource used by pre-Hispanic societies since the first hunter-gatherer occupations. The studies carried out so far on this materiality have allowed identifying sources, recording its presence in archaeological sites in different environments, and recognizing the existence of circulation spheres. Although these aspects have been a great contribution to understanding the provenance of obsidian, establishing the exact origin of the material, there is little research carried out to understand the use of obsidian artifacts in the archaeological contexts where they were recovered. Beyond narratives linking two geographically points in space (sources and archaeological sites), the aim of this presentation is to present the analysis of a set of obsidian artifacts recovered in sites from the south of Calchaquíes Summits (Tucumán province, Argentine), which cover a period from 300 BC to 1450 AD. For the study we focus on understanding the practices in which agents and obsidian artifacts were linked. Provenance analysis using X-ray fluorescence (XRF) and technological studies were applied, which allowed identifying the precedence, manufacture, and use of the artifacts. Taking into consideration the concept of assemblages of Manuel De Landa, the results allowed identifying a series of heterogeneous elements (people, objects, landscapes, memories, feelings, etc.) united in assemblages, which were multiscale, polyrhythmic, and dynamic.

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Title: Obsidian Maritime Interconnections in Early Holocene Eastern Mediterranean

Abstract: Small quantities of exotic obsidian have been documented from a number of Aceramic Neolithic (~8900-5300 cal BC) sites on the Eastern Mediterranean island of Cyprus. Obsidian artefacts are documented in archaeological sites located primarily along the coast, although examples also occur at inland sites locations. Obsidian does not naturally occur on Cyprus, with the nearest geological sources of obsidian located in Anatolia. Its introduction to the island would have necessitated the establishment of maritime exchange networks as the lack of any form of land bridge between Cyprus and the surrounding mainland precludes any terrestrial crossings. Around this time, obsidian is also a valued commodity exchanged at long distances in the Neolithic Near East, with several sources exploited simultaneously. This poster details the occurrences of obsidian in Cyprus and discusses likely sea routes for the introduction of the raw material to the island. Geochemistry provides a proxy for maritime interconnections, which are considered within a broader emerging regional social landscape.

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Title: Getting to the Point: Wari Obsidian Distribution, Reduction, and Use on the Southern Frontier

Abstract: Obsidian was mobilized in a special way by the Wari Empire (ca 600-1100 CE) during the Andean Middle Horizon. Previous research has identified the sources of obsidian that was used and distributed through imperial channels of circulation. Geochemical techniques can and have tracked the movement of obsidian across the Andes, but they cannot elucidate how this resource was managed and processed as it moved between quarries and its eventual users. Materials recovered from Cerro Baúl and Cerro Mejía, two settlements in Moquegua on the southern frontier, provide a perspective from the final link in this chain and demonstrate that some provinces in the empire received preforms, which were distributed to all provincial “citizens.” The Moquegua province provides a unique opportunity to study the imperial distribution system because very little obsidian entered the region prior to Wari incursion, when the distinctive and diagnostic “Classic Wari Laurel Leaf Point” appeared in Moquegua and in many regions throughout the Peruvian Andes. In this paper, I suggest that this diagnostic form derives its general shape from the processing of cores into preforms, which were distributed throughout the empire, whereas smaller triangular points were made from flakes removed from preforms used as multi-directional cores through efficient bifacial reduction. I use evidence from two production locales and household assemblages to demonstrate the manner in which preforms became points, how obsidian was distributed to colonists, and how it was used by those living on the southern frontier of the Wari Empire.

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Title: Obsidian and Salt in the Khoy Plain: Uncovering the Early Bronze Age Obsidian Procurement System of the Salt Mine of Tappeh Doozdaghi, North-Western Iran

Abstract: Located in the Khoy plain, in North-western Iran, the salt mine of Tappeh Doozdaghi lies at the crossroads of major interregional circulation routes linking the Urmiah and the northern Araxes basins. This area is rich in prehistoric and protohistoric settlements dating from the Late Neolithic to the Iron Age; a high concentration of pottery sherds related to the Early Bronze Age (3500–2500/2400 BC) is particularly noteworthy, which suggests that this region was fairly densely occupied during that time. Among the sites identified during the numerous surveys conducted in the area, Doozdaghi is one of the largest, extending over 16 hectares and culminating about 24 meters above the surrounding landscape. The first sounding campaign, led in 2016 under the aegis of the West Azerbaijan Province Cultural Heritage Organisation and the Iranian Centre for Archaeological Research (ICAR), has revealed a breadth of materials attributed to the Neolithic to the Early Bronze Age. The 40 obsidian artefacts that were collected in the later levels (EBA) have been geochemically characterised to identify their geological origin. The provenance results indicate a high diversity of obsidian sources, with the use of seven different outcrops located in both the Southern Caucasus and Eastern Anatolia (Arteni, Geghasar-Gegham, Gügürbaba-Meydan, Gutansar, Sevkar-Syunik, Sicaksu-Nemrut-Dag, and one unknown source). This diversity suggests that the Khoy plain during the EBA attracted populations from various horizons, probably drawn by the presence of salt and other numerous resources available in the area (e.g., arable land, winter pasturelands, abundant water sources). The dynamism that seems to characterise the Khoy plain during the EBA is akin to what has been observed on the salt mine of Doozdaghi in Nakhchivan for the same period; this highlights the key role of natural resources in creating central places where populations from diverse horizons have interacted with one another and thus participated in the redistribution of materials (e.g., salt and obsidian) at an intra- and inter-regional level.

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Title: A 12,000-Year Sequence of Human Use of the Alca Obsidian Source, Peru

Abstract: The Alca obsidian source in southern Peru was first discovered and used by hunter-gatherers at the end of the Pleistocene. It later became one of the three most economically important and widely distributed sources of obsidian in the Central Andes. Mapping and geochemical characterization efforts spanning 20+ years have revealed an extensive high-altitude source region composed of six geographically and compositionally distinct sub-sources within 2800 km². Prior investigations of archaeological artifacts show that the largest bedrock sub-source, Alca-1, was predominantly utilized by Andean complex societies. However, progressive accumulation of artifact provenance datasets, most recently using portable X-ray fluorescence (pXRF), has revealed a fascinating sequence of human use of the lesser-known Alca sub-sources. In this presentation we report recent pXRF data from a highland-coast corridor encompassing the Alca source region. Our findings reveal an early use of Alca outcrops by hunter-gatherer's resident at Cuncaicha rockshelter, located within the Alca source region, and transfer of obsidian 150 km to Quebrada Jaguay on the Pacific coast. Local highland use and highland-to-coast transfers were sustained over millennia. Longer-distance transfers beyond this corridor occurred with the domestication of camelids and the rise of llama caravans, as well as the first Andean states to unify the region.

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Title: Provenance Study of Silicic Stone Tools from Hajdúság (E Hungary) by Using PIXE and PIGE Techniques

Abstract: Sixteen pieces of chipped silicic stone tools were collected from the area of 21 non-excavated registered archaeological sites of the Southern Hajdúság and southern part of the Hajdúhát micro-regions (Hajdú-Bihar County, East Hungary) during pilot field-surveys. The collection area of approximately 560 square km is dominantly agricultural field, and the findings could be collected directly from the surface of the arable land. Six of the samples are obsidian, while the other tools were made of other (hydrothermal or limnic) silicic raw material. Major and trace element composition of the stone tools were analysed by Particle Induced X-ray Emission (PIXE) and Proton Induced Gamma-ray Emission (PIGE) techniques. The detected element spectrum includes alkali metals (Li, Na, K, Rb), alkali earth metals (Mg, Ca, Sr, Ba), metals (Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Y, Zr, Nb, Hf, Pb), metalloids (B, Si, Ge, As), non-metals (P, S, Se), halogens (F, Cl, Br), as well as lanthanides and actinides (Ce, Th, U), too. Silica concentrations of the obsidian samples range between 72 and 78%, and, in general, they can be characterized by relatively high Sr, Ba, and Cl content. The collected tools made of hydrothermal or limnic silicic material may have silica content as high as 99%. Comparing the major and trace elements composition and elemental ratios of the collected obsidian tools to literature data concerning the obsidian sources of the Carpathians can be made their provenance likely, while determination of origin of the samples of hydrothermal and limnic silicic material further studies have to be completed.

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Title: Measurement of Magnetic Susceptibility of Obsidian from Shirataki, Hokkaido, Japan, to Identify the Source of Obsidian Tools

Abstract: Magnetic susceptibility is often used to identify the source of tools and tombstones that are made from igneous rocks, such as obsidian and granite. This study reports on how the relationship between magnetic susceptibility and sample thickness of obsidian contributes to identifying the source of obsidian tools. Obsidian samples from Shirataki, Hokkaido, Japan, were analyzed, focusing on those from the lava flows of Tokachi-Ishizawa (TI), Akaishiyama (AK), and Horoka-Yubetsu (HY). The sample thickness ranges from 2.74 to 20.84 mm and the magnetic susceptibility ranges from 6.1×10^{-5} to 4.2×10^{-4} SI for the TI lava, from 2.52 to 13.78 mm and 3.3×10^{-5} to 2.1×10^{-4} SI for the AK lava, and from 2.05 to 23.28 mm and from 1.9×10^{-4} to 7.3×10^{-4} SI for the HY lava, depending on the thickness of the sample wafer. The results revealed that obsidian from the HY lava demonstrated the highest value of magnetic susceptibility among the analyzed samples; thus, obsidian from the HY lava could be identified by this characteristic. Concurrently, heterogeneity in the magnetic susceptibility within a single lava flow was observed in the AK lava. These results could contribute to the identification of the source of obsidian tools and development of non-destructive techniques for measurement of magnetic susceptibility.

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Title: Imports and Outcrops: A Preliminary Characterization of the Baantu Obsidian Quarry, Wolyta, Ethiopia, Using Portable X-Ray Fluorescence.

Abstract: Stone quarries are crucial nodes in the complex networks constituting hunter-gatherer economies. However, our knowledge of how these networks evolved in the late Pleistocene Horn of Africa is hindered by a paucity of well-studied quarries. The Baantu obsidian quarry in SW Ethiopia was exploited by the Pleistocene occupants of nearby Mochena Borago Rockshelter for over 50 thousand years and continues to be the preferred source of toolstone for Wolyta hideworkers today. It is composed of both in-situ outcrops and massive quantities of surface artifacts ranging from Early to Later Stone Age types. While the outcrops have clearly been mined, these surface materials may also have been a valuable source of toolstone. Distinguishing between the two geochemically is crucial when tracing the movement of this obsidian across the landscape. This poster describes the first geochemical characterization of these outcrops and some surface materials, using portable X-Ray Fluorescence (Bruker IIIeV Tracer +). Across most elements, simple cluster analysis reveals a distinct outcrop signature and a mix of imported and locally made obsidian artifacts on the surface. We must therefore consider both outcrop mining and recycling of non-local materials as important aspects of the behavioral variability associated with Pleistocene stone economies, particularly at sites like Mochena Borago with deep and prolonged occupational histories that span multiple periods of climatic and likely social change.

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Title: Obsidian Artefacts from Tell Hódmezővásárhely-Gorzsa (SE Hungary): Preliminary Results of a Provenance Study using pXRF

Abstract: We present the preliminary results of portable X-ray fluorescence (pXRF) analysis of obsidian artefacts from the Late Neolithic tell settlement of Hódmezővásárhely-Gorzsa. The work is part of ongoing multidisciplinary research into the provenance of raw materials represented in the entire lithic assemblage. Due to its location, in the floodplain of the Tisza River, every piece of stone must have been obtained from sources at least 60 km away and brought to the site either in the form of raw material or as a ready-made artefact. Therefore, the site represents an exceptional opportunity to infer the cultural connections and social organization of a Late Neolithic community (4900-4500 cal BC) through the scientific identification of the sources used for the manufacture of stone tools. From the entire sequence, about 400 obsidian artefacts have been collected. The assemblage comprises debitage wastes, cores, and retouched artefacts. A handheld pXRF analyzer was used to determine the geological source of the obsidian from the trace element composition. pXRF is a rapid, non-destructive, and relatively inexpensive means of analyzing the chemical composition of a wide range of archaeological materials. More importantly, handheld instruments allow objects to be analyzed in situ. The pXRF analyses were conducted only on samples of appropriate size and thickness, since very small, thin pieces can give unreliable results. The bulk of the obsidian originated from the Carpathian 1 source area in SE Slovakia, but a few pieces could not be matched to any known European source.

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Title: Obsidian Hydration Dating by Infrared Transmission Spectroscopy

Abstract: Obsidian hydration dating converts the amount of surface diffused molecular water (H₂O) to an age using a hydration rate calculated from the concentration of obsidian structural water (OH) within the glass matrix. Infrared transmission spectroscopy can measure both forms of water simultaneously by passing the infrared beam through a transparent archaeological artifact. A sampling procedure for quantitative measurement of the water species is presented.

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Title: Archaeological Significances and Geochemical Characterizations of Obsidian Sources in the Central Highlands, Central Japan, by Wavelength-Dispersive XRF and LA-ICP-MS

Abstract: The chemical characterization and discrimination of obsidian sources are significant in provenance studies of archaeological obsidian artefacts. While statistical discrimination based on chemical compositions is the basis of this study, theoretical considerations, such as magmatic histories, should be considered in improving the reliability and validity of such provenance analyses. We examined the geochemical compositions of 14 groups related to obsidian sources in the Kirigamine and Yatsugatake areas of Japan based on fractional crystallization processes and propose discrimination diagrams for these groups using wavelength-dispersive X-ray fluorescence spectrometry (WDXRF) data. We also analyzed obsidian by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) to provide new source discrimination diagrams. Provenance analyses for obsidian artefacts excavated at the Hiroppara prehistoric site are presented on the basis of these discrimination diagrams. We confirm there is no inconsistency between WDXRF and LA-ICP-MS data. The discrimination methods established here can be further applied to provenance studies based on non-destructive, semi-quantitative analysis by such techniques as handheld XRF and energy-dispersive XRF, as well quantitative analysis by LA-ICP-MS.

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Title: Depositional Pattern of Obsidian Artefacts: Understanding the Diverse Value Concepts in the Neolithic Carpathian Basin

Abstract: Stone tools, although being one of the most abundant find categories in the archaeological record, have in the past almost exclusively been considered with regards to the transmission of technological traditions or cultural habits, expressed in the presence of 'cultures' or 'technocomplexes', but not explicitly in its role in economic systems and systems of value. In the European Neolithic research tradition, studies of social organization usually focus on exotic materials, like obsidian, spondylus shells, early copper, or elaborate pottery. To systematically target the quantitative distribution and exchange of obsidian tools and to examine their integration into culture-specific systems of value is an approach, which will help to promote a better understanding of the social and economic role of obsidian in prehistory.

Value is a subjective concept which is determined by social interaction in real life contexts and thus variable and culture specific. Nevertheless, it is crucial to have an idea of how, in what ways, and what kind of values and value-systems governed prehistoric societies. There is a large amount of philosophical, anthropological, and economical literature on the value concept (summarized e.g., by Graeber 2001). For prehistoric archaeology, however, a practical approach needs to be built upon archaeological objects and their contexts. Several archeological works have emphasized different forms of value, and different social contexts have inspired very diverse ways to conceptualize values. I separate three dimensions of value, which are determined by their involvement in different interconnected spheres of human experiences, and which are archaeologically detectable: (1) economic transactions, (2) social interaction, and (3) ritual practices. For this reason, I focus on the appearance of obsidian artefacts in different archeological contexts, namely settlement features, burials, and depositions (depots or hoards) to measure the different forms of value and better understand the specific value systems of the communities in the Carpathian Basin.

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Title: Building on a Repository of Obsidian Geochemistry for South America

Abstract: This talk presents an open access repository of trace element concentrations for obsidian sources in South America. Two methods are demonstrated for comparing data from an empirically calibrated XRF instrument against the archived geochemical values. One method uses a simplified web-based interface based on R-Shiny and the other allows the user to pull data from the web repository directly into statistical software. The dynamic repository OpenContext provides a reliable archive of geochemical results as well as an open API that allows archaeological projects to develop an analytical workflow that builds on top of the archive framework.

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Title: Inter-Instrumental Calibration and Data Comparison for XRF Analysis of Obsidian

Abstract: The use of portable XRF instruments to conduct non-destructive elemental analysis of archaeological materials has increased tremendously in recent years. In some cases, however, no calibration of the raw data has been performed, while in many others different calibration software programs and standards have been used, limiting direct comparisons of numeric values between these studies. This is an issue not only between different XRF brands but also different models and even between batches or individual instruments. This study focuses on comparing both raw count data and calibrated values for analyses conducted over the past 13 years on the same obsidian samples using four different Bruker Tracer models (III-V+, III-SD, Vi, Vg) while also comparing with studies by other scholars. One major issue with XRF data is the need for matrix-matching calibration. There also are significant differences between XRF spectrometer models in their X-ray generator, detector windows, filters, and detectors, and therefore the raw data which is produced. Measurement of low-Z elements varies a lot between instruments. Calibration of each XRF instrument is accomplished by analyzing "standard" samples with known concentrations of elements of interest to create a calibration curve that relates those values to their raw counts. A large number of geological obsidian samples from different sources has been analyzed by INAA, LA-ICP-MS, and XRF at the University of Missouri. Theoretically, this would allow an archaeologist to make a direct comparison of the data for archaeological artifacts with the values for geological samples produced by others using similar or different instruments. Ideally, the combined data could be included in the same graphs and matches correctly made. This study specifically addresses how reliable this is by evaluating element concentrations, different element ratios, and multivariate statistical values using the data produced on the same samples by pXRF, INAA, LA-ICP-MS, and ED-XRF instruments.

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Title: Annadel and Glass Mountain Obsidian Sources in Sonoma County, California

Abstract: A non-systematic survey of two major obsidian sources in northern California was undertaken, followed by trace element analysis of these geological samples and a collection in the Pepperwood Museum. Specifically, more than 25 geological samples each from Annadel (in the Sonoma Valley) and from Glass Mountain (in the Napa Valley), both in the southern North Coast Ranges of California, were analyzed using a Bruker Tracer III-V portable X-ray fluorescence spectrometer, with a filter and time settings emphasizing results for the K-lines energy range of elements Fe through Nb. In addition, 28 artifacts in the Pepperwood Museum, from late prehistoric Native American sites in the region, were also analyzed non-destructively.

An X-Y graph of Rb/Nb vs. Sr/Nb provides a clear distinction between the Annadel and Glass Mountain geological obsidian samples. Sixty percent of the artifacts were assigned to Glass Mountain, and twenty-one percent to Annadel. Five other artifacts did not match with either, and must have come from at least three other geological sources. A total of twelve sources have been identified in this region, with notable differences in their quality, physical appearance, and selection for producing stone tools (Jackson 1989). Comparison of the calibrated concentration values and trace element ratios with analytical data from other studies is used to suggest what other sources are represented by these outliers, always an issue when dealing with data from different instruments and calibration software. The overall results are compared with other research on trade and exchange of obsidian in this region of California.

Jackson, T. L. (1989). Late prehistoric obsidian production and exchange in the North Coast Ranges, California. *Contributions of the Archaeological Research Facility* 48: 79-94. "

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Title: Finding Obsidian Sources in Yellowstone National Park: Further Work

Abstract: A study of nearly 700 obsidian artifacts from Yellowstone National Park using a Bruker 5i pXRF and encompassing several Native American prehistoric sites (ca. 10,000 BP to 1,000 BP) is revealing new patterns of source acquisition and trade of obsidian. In particular, the use of raw material from Obsidian Cliff is mapped across the park. The use of the park area in antiquity was mostly seasonal or periodic, largely due to the coldness of winters and abundance of snow, and it was shared among several tribes, as it is today. As a result, specific patterns of consumption are highly variable, but it is possible to track local procurement of obsidian vs. access to more distant sources. Obsidian Cliff was undoubtedly the major source for obsidian, and it was traded significant distances, including to Ohio and Maine. Yellowstone Park was inserted in existing trade networks as demonstrated by the presence of different sources, and it was a place for different tribes to meet, given the periodic occupation of the land and the vast spaces available. Tracking and mapping the movement of obsidian in different areas is of great value to identify the major routes in ancient exchange systems and identify areas possibly used by different tribes, such as the Shoshone and Black Feet that are known to have frequented the area before European contact. It is also an area of great significance for insights on craft specialization among mobile Native Americans and the development of very long-distance trade networks across America. This presentation will focus on further insights and the role of different American Native tribes in the obsidian trade.

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Title: An SEM-based Micro-XRF and Portable XRF Spectrometry Study of Mesoamerican Obsidian Tablets

Abstract: Six highly polished rectangular obsidian tablets held in the Smithsonian's National Museum of the American Indian (NMAI) collections have been examined by conventional portable XRF (pXRF), while three of the objects were additionally analyzed using co-located electron and micro-XRF beams. These highly crafted tablets are unusually large relative to most obsidian artifacts, reaching up to 41 cm in long dimension, and previous geochemical studies of similar objects suggest the tablets most likely originate from locations within the Aztec and Purépecha (Tarascan) Empires. As such, minor and trace element ratios acquired from the tablets were compared to reference obsidian collected from two centers within the Trans-Mexican Volcanic Belt: Sierra de Pachuca and the Los Azufres volcanic complexes. These reference materials are a part of the National Museum of Natural History's National Rock and Ore Collections with many originating from the Robert L. Smith obsidian collection. The SEM-based dual beam method enables both light (e.g., Na, Al, Si) and heavy elements (e.g., Rb, Y, Zr) to be quantitatively measured at each specimen location, providing a more complete analysis of major to trace elements relative to pXRF. Compositions from the obsidian references were then further used to train a multivariate statistical procedure and provided a targeted comparison to the NMAI tablets. Source determination for black and mahogany tablets will be discussed, along with an evaluation of the differences between pXRF and micro-XRF data sets.

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Title: Geochemical and Technological Characterization of Obsidian Artefacts from the Neolithic Site of Opatów in Southeast Poland

Abstract: The oldest traces of obsidian use by prehistoric societies in Poland can be dated to the Palaeolithic and Mesolithic, but, overall, volcanic glass artefacts are rarely found in Polish archaeological sites until later in time coincident with the arrival of the first Neolithic societies (Linear Pottery Culture, c. 5500-4900 calBC). This increase in obsidian use continued through the middle and late Neolithic (c. 5000 – 4000 calBC) but declined in the middle Eneolithic (c. 3700-3500 calBC). No natural outcrops of obsidian occur in Poland, so all of the obsidian artifacts present on archaeological sites must have been conveyed there by some means.

One of the most interesting archaeological sites from the middle Neolithic in Poland is Opatów in South-East Poland, which represents the Samborzec–Opatow group of the Lengyel culture (c. 4900-4700 calBC), defined by Zofia Podkowińska. The latter member of this group (the Opatów site) was investigated in the interwar period and again the 1960s. During those excavations, almost 300 obsidian artefacts were recovered. This presentation focuses on the technological, morphological, and chemical characteristics of the obsidian artifacts including their geochemical “source” (determined via non-destructive energy-dispersive X-ray fluorescence [EDXRF] spectrometry). Investigations financed by National Science Centre, Poland (OPUS 15 2018/29/B/HS3/01540).