Collaborating with SESAME:

Potential, Questions, Problems, and Future of Cultural Heritage Studies in Turkey

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Basic calculations for the Potential

2021

- **146** excavations (Universities from Turkey)
- **29** excavations (Universities abroad)
- **53** excavations (Museum directed)
- **186** rescue excavations
- **120 + 6** surveys (Universities + Museums from Turkey)
- **9** surveys (Universities abroad)
- **4** underwater archaeology surveys
- **6** underwater archaeology excavations
- **12** Dam projects (rescue excavations-private funding)
- **68** drillings at archaeological sites

639 CULTURAL HERITAGE-RELATED PROJECTS

if each team is composed of min 5 members

=**3195** faculty, specialists, students involved in cultural heritage studies (excludes conservatory work)

even %1 of CHR-people work on SESAME proposals

we should have **32 cultural heritage related applications**

https://kvmgm.ktb.gov.tr/TR-309272/2021-yili-kazi-ve-yuzey-arastirma-faaliyetleri.html

Archaeological + Scientific Questions

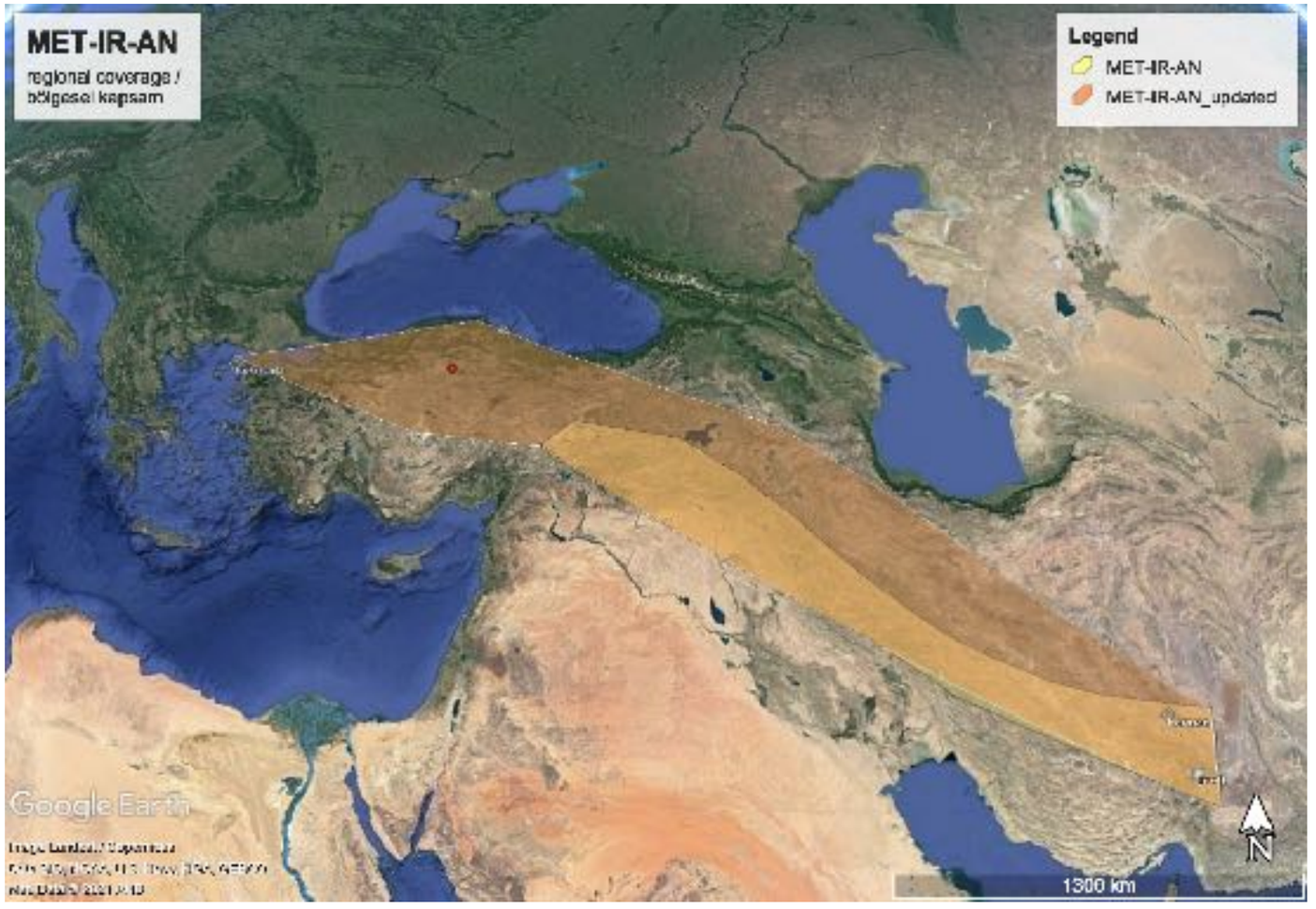
Why do we need synchrotron light?

- from archaeologists' perspectives:
    - lack of knowledge on how to use synchrotron (which techniques could be used on what kind of research questions)
    - a wide acceptance of science (or one single analytical method) as a magic pill of all archaeological problems
- from scientists' point
    - lack of knowledge on specific archaeological questions so that data produced is out of context
- solution: interdisciplinary research agendas & teams

Case study I: origins of arsenical copper

Project MET-IR-AN: METallurgy of IRan and ANatolia

- TUBITAK & MSRT recently cofounded: “EMERGENCE OF ARSENIC-COPPER METALLURGY IN SOUTH EASTERN IRAN AND EASTERN ANATOLIA: INTERPRETING ANCIENT METAL TECHNOLOGY AND METAL ROUTES THROUGH A MULTI-ANALYTICAL APPROACH”
- Mohammadamin Emami (Art University of Isfahan) & Gonca Dardeniz (Istanbul University)+ 2MA students
- the emergence of arsenical copper alloys in the raw material-rich zones between 4000-2000 BC / whether same ores have been used / possibly technology & technological knowledge transfer
- archaeological & geological sampling
- primary analysis (OM, XRD, EPMA, SEM-EDX)
- next stage: synchrotron



Project MET-IR-AN: METallurgy of IRan and ANatolia

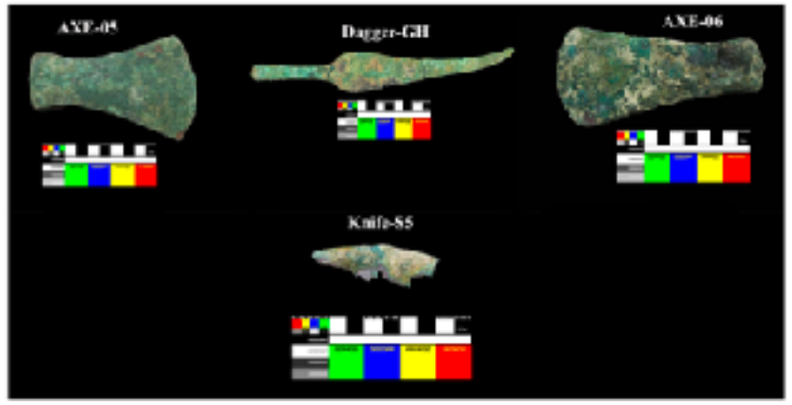
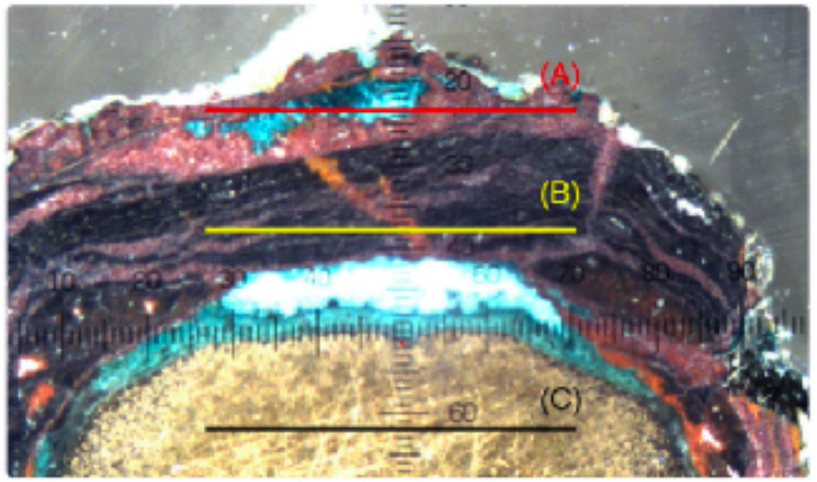


FIGURE 8 Results from the synchrotron μXRD of the dagger-GH. Measured areas are marked with rectangles on the top photograph and the respective powder patterns with the phase analysis are shown below



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RESEARCH ARTICLE

SURFACE AND INTERFACE ANALYSIS WILEY

Towards a deeper understanding of the third millennium BC Iranian metallurgy: Use of synchrotron light for characterizing arsenic-bearing minerals in metal objects from Espidej

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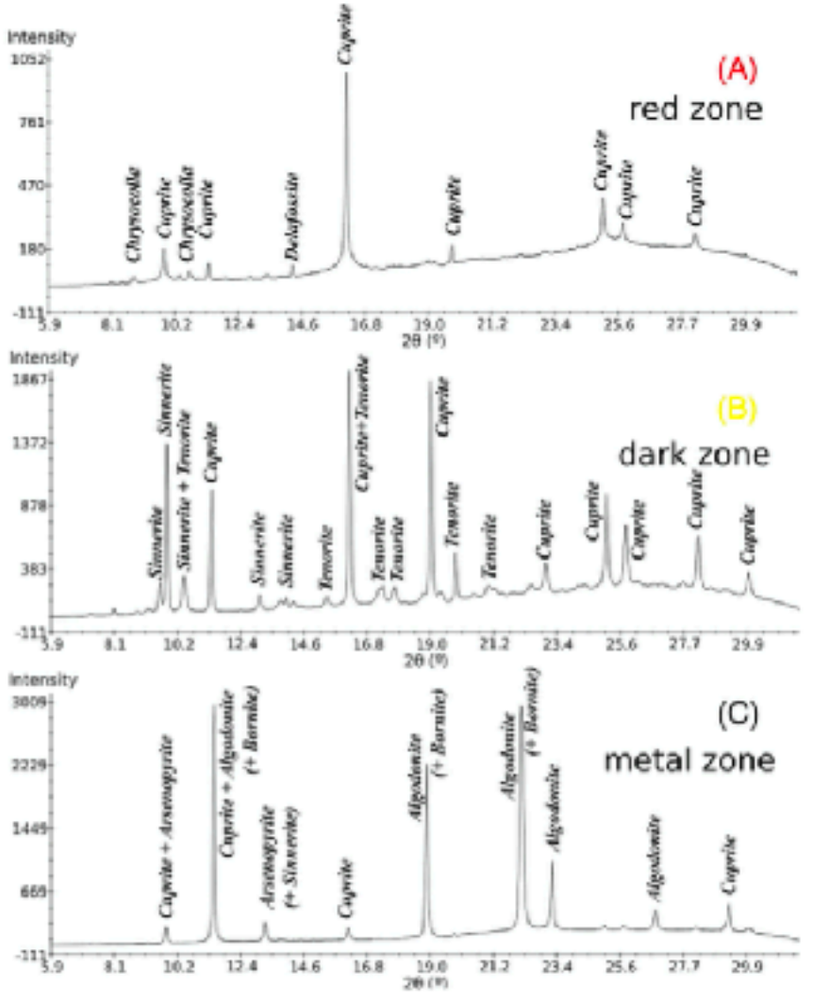
New excavations at Espidej in the Kerman Province of the Halil Basin corridor in Iran offer a unique opportunity to reconsider the third millennium BC (i.e. Bronze Age) metallurgical practices related particularly to arsenical copper (Cu-As) alloying and to explore arsenic-bearing raw materials. This paper presents results of optical microscopy and environmental scanning electron microscopy (ESEM) on a selected group of copper-based artefacts from Espidej. Additionally, we have benefited from synchrotron light for further investigations on a dagger sample. The scientific examinations on metal corpora adds new information regarding the microchemistry and production techniques of metals of the south-eastern cultural zone of Iran. Synchrotron micro X-ray diffraction (SR-μXRD) data of the sample demonstrates traces of arsenic-bearing minerals in the corrosion products indicative of types of ores used in alloying processes. Preliminary research on copper ores indicates possible extraction of local ore deposits that were outcropped along the south-east Makran orogeny zone of Iran. This area is part of hydrothermal mineralization zone consisting of arsenopyrite ($FeAsS$), simmerite ($Cu_4As_4S_9$), bornite (Cu_5FeS_4) and algodonite (Cu_6As). Noticeable arsenic-bearing phases within the metallic core of the sample were frequently characterized as simmerite and algodonite.

KEYWORDS
archaeometallurgy, arsenical copper production, Iran, metallography, petrology, synchrotron micro X-ray diffraction



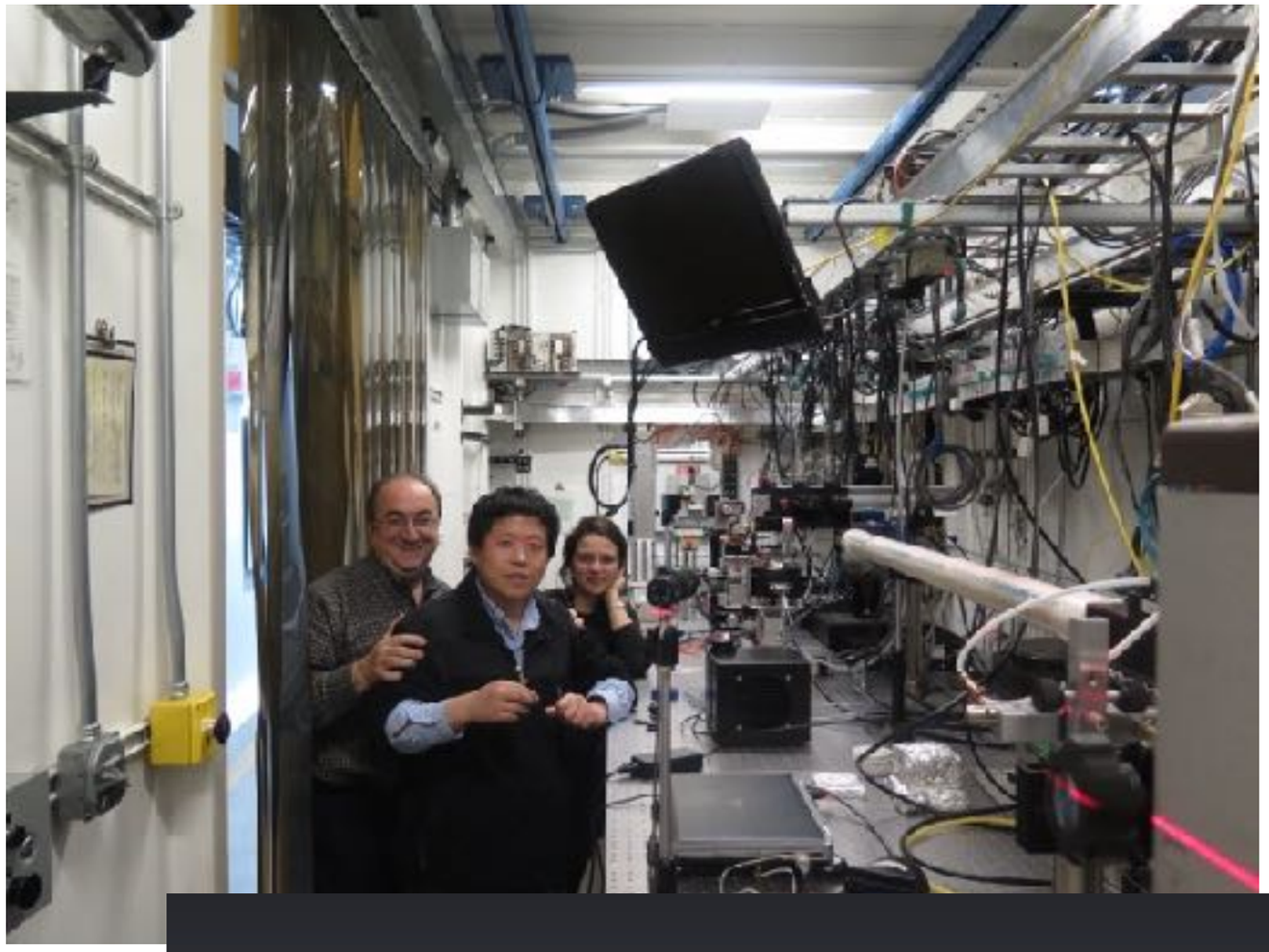
Case study II: origins of glass

collaboration with ARGONNE

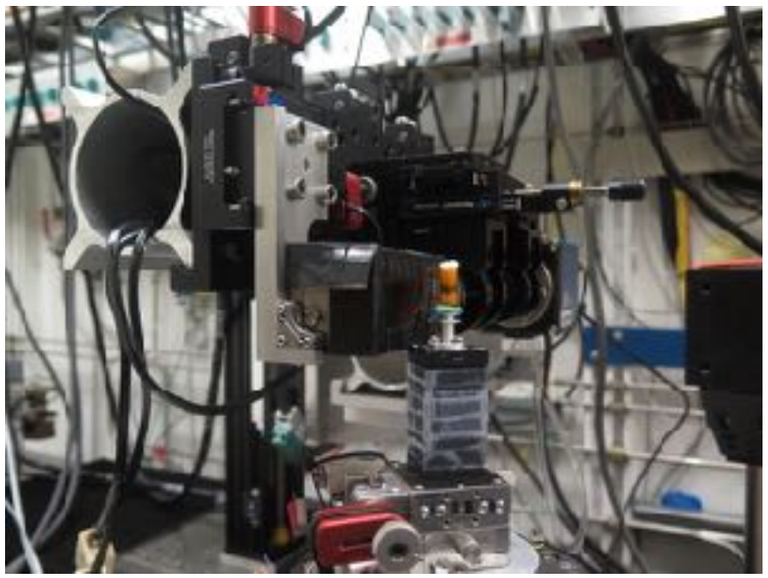
- origins of glassmaking: producing glass from silica+soda+lime (2nd millennium BC)
- Egypt? Mesopotamia? the Levant?
- how can we identify it: through production remains
- justify production remains are really production remains.

Fig. 5. Find 02/0339.0022: jar fragment with semi-reacted raw glass. The width of the object is ~4 cm. Note the residual quartz grains trapped in the fused glass and the limited wetting of the underlying parting layer by the glass.

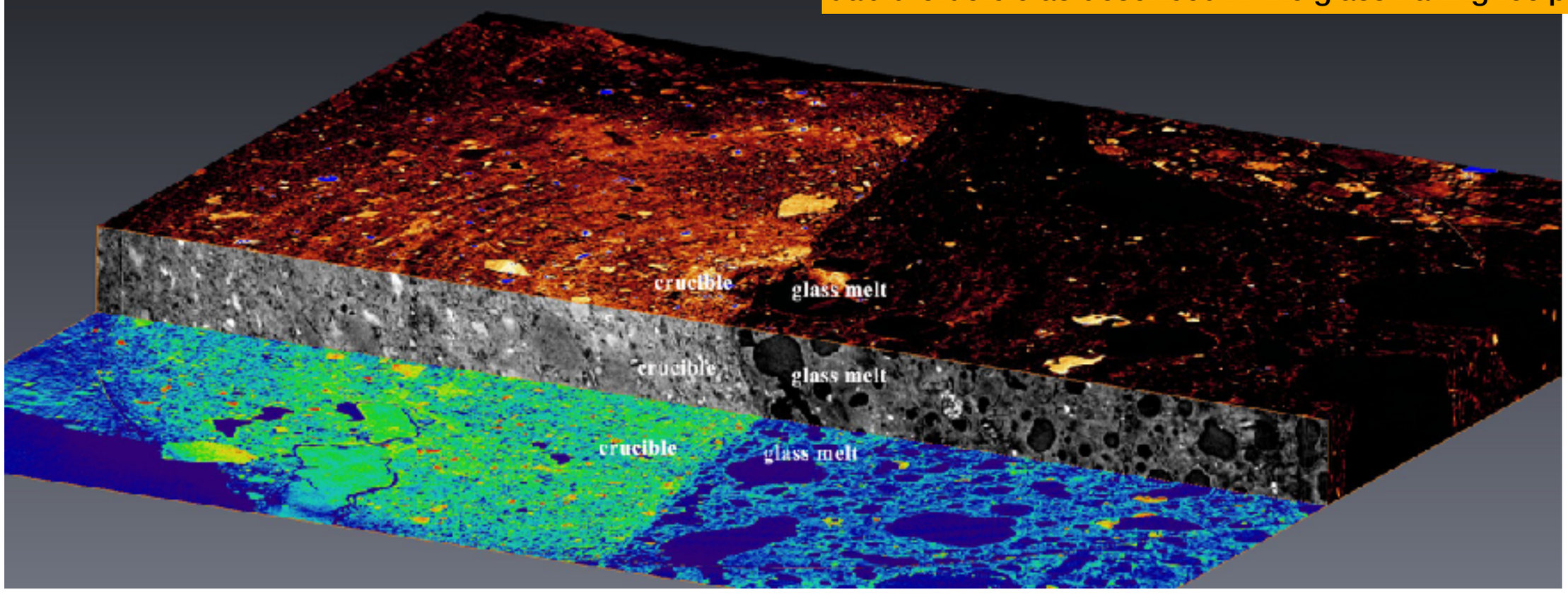
Rehren & Pusch
2005
Science
https://www.science.org/doi/10.1126/science.1110466



2-BM-XOR Beamline
3D tomography



dabtu crucible as described in the glassmaking recipes



Problems
Future of Cultural Heritage studies

Why we could not facilitate from synchrotron light as much as we can?

- insufficient knowledge on how to benefit from synchrotron light (which techniques could be used on what kind of research questions)

- insufficient interdisciplinary training (both researchers & students)

- practical problems: language barrier, proposal writing, etc.