

Evaluating different methods for the analysis of survey-pottery

Pottery meeting, February session

10 people online, 3 in person

Presentation by Antonia Höhne: Evaluating different methods for the analysis of survey-pottery from the middle-Euphrates (Syria)

Bibliography

- Studied conversation at the HTW Berlin
- Has been working on a number of excavations since 2005 in SE Europe and West Asia
- From 2010-2012 worked at HTW, where she learned about portable XRF
- Researched on her PhD (with a longer break due to laboratory work and child care)
- Started again to work at PhD 2022 and plans to have raw version ready by end of April

Research

- Cooperative doctorate HTW and FU Berlin (Main supervisor: Reinhard Bernbeck)
- Focus area: northern Syria
- Analysing material from survey conducted in 1983/84, covering an area of 150 km along the central Euphrates valley. In total 130 main sites and 87 sub sites
- Data consists of 3340 pottery fragments – stored in Berlin
- Chronology of the area: Middle Acheulean until Islamic times (end of 1st mill CE)
- Selected pottery material: 7000 BCE – 100 CE

Main question: To what extent can ceramic complexes be differentiated with p-ED-XRF?

Theoretical model

- Developed together with TOPOI 2 research group on economic spaces (A-6-3)
- Investigating how to get from a range of scientific methods – source filter – to interpretation based on theoretical premises (References: Sinopoli and Costin)
- Variability in chemical components – equal and diverse sources, manufacturing technique and functional properties (shape/form analysis)
- Technology information can be inferred from scientific methods (kinds of ovens, firing temperature, wheel thrown or not, clay, temper, etc)
- From this one can derive at: standardisation, specialisation, modes of production, distribution systems, etc.
- Matrix grouping by refiring, thin section analysis, WD-XRF (lab), and portable ED-XRF

Technological characterization

- 70 random samples measured by the two different XRFs methods for comparison

Results:

- Effect of distance from sample to measurement window → samples have to be directly on the measurement window!
- Determination of optimal measurement time → optimal are 180s for light, respective 120s for heavy elements!
- Effects of sampling → you need three measurements on planed breaks for each fragment!

Material needs to be well prepared.

Precision of the results → XRF is – in the studied area - not sufficient to differentiate between samples to answer main question!

✦ That's a geo-chemical „problem“: clay from Euphrates are similar from all over the area, raw material is not differentiated enough between the sites. Also, the temper does not influence the results.

To overcome this issue, Antonia needed other data from the material

→ Decided on an object biography-approach

1. Raw material
2. Processing of raw material
3. Shaping
4. Finish/surface treatment
5. Decoration
6. Burning process
7. Consumption
8. Deposition
9. Finding and handling

Analysis with thin sections, microscopic and macroscopic analysis offers more possibilities than chemical analysis

- 227 pottery fragments analysed with XRF + matrix grouping refining results
- Sites date to different phases and sometimes just to one phase
- Huge database created with all details of the ceramics
 - site information, geo-information, etc.
 - laboratory information
- Nice data sheets for entry
- Data collection is done
- Information is on different scales and levels

Current stage: Now trying to find clusters and look how they can be explained: Time? Space? Vessel category?

• Will do this through Principal Components Analysis and by plotting these categories to analyse correlations

Discussion

Was the chronology done by the project or did you date the sherds yourself?

- Just a rough dating from the survey project
- Bianca d'Anna helped to date the material more precisely
- It's a problem, the methodological work of the PhD is the focus, because the archaeological data is not precise enough
- Aim: to publish the data, so other can use the data for their own work and e.g. re-date the material as needed

Comment: It's especially hard to use some-one else's data, because you have to re-do some of the classification, but the uncertainty is uncertain – good solution to publish the data so other people can re-use it and rethink it

Do you have preliminary positive results of the comparison of grouping and the factors?

- Talked to Georg Roth: A redundancy analysis could be a good idea, because you already have the groups and this shows how well they fit to the data

- It took a long time to decide, which data is useful for the purpose and which is not needed

Do you use all information for this analysis or more the macroscopic analysis?

- First idea was to use XRF and compare the two methods to see which to use, but noticed: XRF can't do it
- therefore created additional macroscopic information
- now uses all the information for the statistical analysis

XRF didn't work because of the particular region. When do you think it makes sense to use XRF?

- There are examples, where the sites are from different valleys with different clay materials, where p-ED-XRF worked very well
- Hope the local recipes (temper) would be enough to differentiate the sites
- Thin sections are a lot of work → but results don't say so much about ceramic manufacturing

Was there no temper added or was the temper just so generic, because the geology is too similar everywhere?

- Don't know yet, still analysing the temper
- Looked preliminary at diversity index about type of temper → changes with the time

Comment: Maybe only higher concentration of temper can be shown, if the geology is everywhere the same?

- Yes - and sometimes hard to decide whether temper was added intentionally or whether something is a natural inclusion
- Ask if someone is interested in looking at Antonias thin sections?
- Giulia interested in comparing the data with her thin-section studies of the same region/period

Now your data is: 227 samples from 12 sites. Do you have thin section for all?

- No only some samples to check the different macro-scopic defined temper groups

Comment: Giulia had good results with doing the macroscopic analysis first and then select samples for petrography. Especially good for checking size of organic inclusions – there can be chronological and site specific choices (sometimes really small, below 1 mm, sometimes very big organic inclusions, quantity changes as well) – macroscopic observation is enough

- Reply: yes, organic temper and its size has been recorded

Do you check traces of manufacture?

- Yes, surface treatment, but also hand-made or thrown on a small wheel
- but not sure about this, because Antonia is not a potter: Do we read the traces right?
- Especially hard with small pieces of the rim (6% or so): a lot is recorded with a question mark
- very detailed information on the fragments: ½ hour work per fragment, but do I see everything important?
- Used an article by Gerwulf Schneider (1999) as a basis to check her observations

How did you draw your sample? Chronology and ... also morphology? Because if yes, you could check for correlation between temper and morphology through time

- Took sherds from 5th and 4th mill BC to look at the very detailed information, and then took all the sherds from this time

- Survey collection: therefore mostly rim fragments, and a few bottoms, few body sherds – only diagnostic sherds collected
- Sometimes very hard to define a type from just the rim sherd → used open/closed, with neck, without neck etc
- These types will be statistically checked against all the other information (correlation analysis)

Do you think you can say something about social organisation on the survey-pottery data?

- In summary, yes, about the production system, but even on the technological level it is hard to get very clear results. To „level up” to the social level can be theories, but it needs to be checked whether the data can support it

Comment: Bianca D’Anna recommends this book

- V. Roux: *Ceramics and Society - A Technological Approach to Archaeological Assemblages* (<https://doi.org/10.1007/978-3-030-03973-8>)

Comment: Probably not representative with 12 sites and 227 sherds

- The sample is one for the evaluation of the methods → a goal is to find the methods!
- Sample size matters for realising production methods. But this is not related to the research question, because for methodological analysis is good.
- Time slices are also a topic: if the slice gets bigger you may be statistically more relevant, but then the archaeological question is very rough
- Survey material is always a problem, because of lack of information

Comment: Always important to be aware of the research biases. If you discuss them in the beginning, that’s a good start.

As it’s survey data, did surface residues influence the pXRF?

- Yes it did - eg. lime, was also recorded. If you do lab XRF: surface is cut away to reduce the residue influence, trace phosphor content, etc.
- One result of methodological comparison shows that pXRF on the surface is really bad
- On fresh break: better, but then, parts of the sample are not close enough to the window, you have to „plane” the break surface first

Did you try any alcohol or so to clean the surface?

- No.