

Archaeological Ceramic Analysis (ARCL0102)

MA/MSc Module

15 Credits

Dr. Patrick Sean Quinn

Handbook 2019/20

Times and Locations

Lectures: Tuesdays 14:00-16:00, Institute of Archaeology, Room B13

Practicals: Wednesday 14.00–16.00, Institute of Archaeology, Room 410. Except Wednesday 18 March, Room 501, Institute of Archaeology

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Deadlines: Assessment 1 (Essay) 5 pm Friday 27 March 2020. Assessment 2 (Unseen practical Test) 4 pm Wednesday 25 March 2020.

Marked work will be returned within four calendar weeks of the deadline.

Overview

This module provides a practical and theoretical introduction to the scientific analysis of archaeological ceramics. The module provides in-depth training in the principles of thin section ceramic petrography and its role alongside instrumental geochemistry, X-ray diffraction and scanning electron microanalysis in the interpretation of pottery provenance and manufacturing technology. The module will demonstrate how data on provenance and technology can be used to tackle archaeological questions such as trade and exchange, the organisation of craft production, tradition and social identity.

Module Schedule

Week 1 - Archaeological Ceramics and their Analysis. Introduction to Optical Mineralogy

Week 2 - Igneous Rocks: Their Classification and Identification in Thin Section

Week 3 - Sedimentary Rocks: Their Classification and Identification in Thin Section

Week 4 - Metamorphic Rocks: Their Classification and Identification in Thin Section

Week 5 - Clay, Soil and Weathering. Introduction to Thin Section Ceramic Petrography

Reading Week - No lectures or practicals

Week 6 - Classification and Characterisation of Ceramics in Thin Section

Week 7 - Interpreting Ceramic Provenance in Thin Section

Week 8 - Reconstructing Ceramic Technology in Thin Section

Week 9 - Instrumental Geochemical Analysis of Archaeological Ceramics

Week 10 - Scanning Electron Microscopy and X-Ray Diffraction Analysis of Archaeological Ceramics. Practical Assessment

Important Course Texts

Chernicoff, S. and Venkatakrisnan, R. 1995. *Geology: An Introduction to Physical Geology*. Worth Publishers.

Hunt, A. (Ed.) 2016. *Oxford Handbook of Archaeological Ceramic Analysis*. Oxford University Press.

MacKenzie, W. S. and Adams, A. E. 1994. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing, London.

Pollard, M., Batt, C. Stern, B and Young, M. M. 2007. *Analytical Chemistry in Archaeology*. Cambridge Manuals in Archaeology. Cambridge University Press.

Quinn, P. S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Archaeopress, Oxford.

Quinn, P. S. (Ed.) 2009. *Interpreting Silent Artefacts: Petrographic Analysis of Archaeological Ceramics*. Archaeopress, Oxford.

Reedy, C. L. 2008. *Thin-Section Petrography of Stone & Ceramic Materials*. Archetype, London.

Rice, P. M. 1987. *Pottery Analysis: A sourcebook*. University of Chicago Press.

Methods of Assessment

This module is assessed by means of a short 1900-2100 word critique and an unseen microscope-based practical test. These will each constitute 70% and 30% of the final mark of the module respectively. The topic of the critique will be set in Week 2 and should be submitted in Week 10. The practical assessment will be set in Week 10 during the weekly practical session and guidelines will be provided in the latter part of the course.

Teaching Methods

This module is taught by means of compulsory weekly lectures, demonstrations and microscope-based practical sessions.

Workload and Attendance

The module is composed of 10 two-hour lectures and 10 two-hour practical microscope sessions (total 40 contact hours). You will be expected to undertake 70 hours of private study for the module, reading the recommended texts and working on the critique. You should also spend up to 40 hours practicing for the practical assessment. The total workload for the module is 150 hours.

A register will be taken during each lecture and practical class. If you are unable to attend a class, please notify the module co-ordinator in advance by email. Because of the large number of new concepts introduced during the module, it is advised that participants make every effort to attend ALL classes.

Due to the busy teaching schedule of the IoA seminar rooms, extra practical sessions will NOT be set up for participants that do not make the allotted time each week.

Prerequisites

It is assumed that participants have completed the Interpreting Pottery module (ARCL0100) in Term 1 and are thus already familiar with the broader issues of pottery manufacture and the macroscopic analysis of archaeological ceramic assemblages.

Participants on the MSc or MA programmes wishing to undertake a dissertation on ceramic analysis must have completed and passed ARCL0102 and also hopefully ARCL0100. If you are interested in a dissertation that applies the skills that you will learn on this module, then please contact the course coordinator to discuss possible topics.

Aims and Objectives

The module aims to:

- Introduce participants to the scientific analysis of archaeological pottery and other ceramic materials.
- Demonstrate the types of microscopic, mineralogical and chemical signals discernible in archaeological ceramics and review how these contribute to broader issues in ancient material culture.
- Provide specific hands-on training in the principles of thin section ceramic petrography and its application to the determination of provenance and reconstruction of manufacturing technology.

On completing the module, participants will hopefully:

- Be able to evaluate the relevance and applicability of scientific methods of ceramic analysis.
- Be able to evaluate critically published work relating to archaeological ceramic analysis.
- Gain an appreciation of the role of ceramic analysis within the wider study of pottery and the application of scientific approaches alongside other archaeological data.
- Have gained a basic practical understanding of how to undertake thin section petrographic analysis on archaeological ceramics that can be further developed by independent research within an MSc/MA dissertation or PhD thesis.

Coursework

Critical Review of Archaeological Ceramic Analysis

You will be expected to write a short critique evaluating specific aspects of archaeological ceramic analysis. The topic of this critique will be announced at the lecture in Week 2. In order to tackle the assignment, you will need to have read the recommended reading, as well as undertaken additional

reading on the specific topic. The assignment will assess your understanding of the concepts introduced on the course and your ability to assess and synthesise published works on archaeological ceramic analysis. It will account for 70% of the final module grade.

The paper should be fully referenced using the Harvard System. It may contain illustrations and figures. It should be expressed in your own words giving the exact source of any ideas, information, images or figures that are taken from the work of others. Any direct quotations from the work of others must be indicated as such by being placed between inverted commas. Plagiarism is regarded as a very serious irregularity which can carry very heavy penalties. It is your responsibility to read and abide by the requirements for presentation, referencing and avoidance of plagiarism to be found in the IoA 'Coursework Guidelines' on the IoA website:

<http://www.ucl.ac.uk/archaeology/administration/students/handbook>

The paper must be between 1900-2100 words in length excluding title page, contents pages, lists of figure and tables, abstract, preface, acknowledgements, bibliography, lists of references, captions and contents of tables and figures, appendices, and wording of citations in the text. UCL-wide penalties will be applied to submissions exceeding the maximum length.

The paper should be handed in no later than 5 pm Friday 27 March 2020. You are required to submit hard copy to the course co-ordinator's pigeon hole via the Red Essay Box at Reception by the appropriate deadline. Coursework must be stapled to a completed coversheet (available from the web, from outside Room 411A or from the library). You should put your Candidate Number on the paper. This is a 5 digit alphanumeric code and can be found on Portico. It is different from your Student Number/ ID. Please also put your Candidate Number and course code on each page of the paper. It is also essential that you put your Candidate Number at the start of the title line on Turnitin, followed by the short title of the coursework – e.g. YBPR6 Archaeological Ceramic Analysis. Late submission will be penalised in accordance with the UCL-wide regulations unless permission has been granted and an Extension Request Form (ERF) completed. In addition to submitting hard copy, you must also submit your work to Turnitin by the midnight on the day of the deadline.

Participants who encounter technical problems submitting their work to Turnitin should email the nature of the problem to ioa-turnitin@ucl.ac.uk in advance of the deadline in order that the Turnitin Advisers can notify the Course Co-ordinator that it may be appropriate to waive the late submission penalty. If there is any other unexpected crisis on the submission day, you should telephone or (preferably) e-mail the Course Co-ordinator, and follow this up with a completed ERF. Please see the Coursework Guidelines on the IoA website (or your Degree Handbook) for further details of penalties.

<http://www.ucl.ac.uk/archaeology/administration/students/handbook/submission>

You can expect to receive your marked work within four calendar weeks of the official submission deadline.

Unseen Practical Test - Interpreting Archaeological Ceramics in Thin Section

You will be expected to study and characterise under the microscope five real archaeological ceramic thin sections and reconstruct aspects of their manufacturing technology. This will draw upon the skills that you learned from the entire module in terms of the composition and analysis of archaeological ceramics in thin section. In order to prepare for this assessment, you will be given the

opportunity to re-examine in your spare time the material from all relevant petrography practicals. This revision is an expected part of the module.

The five thin sections in the test have been selected to form a mock ceramic assemblage from a hypothetical archaeological site. Each thin section will have several multiple choice questions. Using the answers to these and a range of accompanying archaeological, geological and other scientific data, you will be required to determine the provenance of the pottery samples and interpret processes such as trade and exchange, local production, raw material procurement strategies and ceramic technology. The test will take place between 2-4pm on Wednesday 25 March 2020 in Room 410 under examination conditions. You will be allowed to use MacKenzie and Adams (1994) and other rock and mineral identification books for the test. Your answer sheets will be collected at the end of each assessment. The practical test will account for 30% of the final module grade.

You can expect to receive your marked work within four calendar weeks of the official submission deadline.

Detailed Outline of Module

Week 1

Lecture (14 January) - Archaeological Ceramics and their Analysis. Introduction to Optical Mineralogy

Following an introduction to the module, we will discuss the different types of ceramics and related artefact types that occur in archaeological contexts. We will then consider the ways in which archaeological ceramics can be studied and the types of information that we can gain from them. The various techniques of ceramic compositional analysis, including thin section petrography, instrumental geochemistry, scanning electron microscopy and X-ray diffraction analysis, will be briefly outlined and contrasted with other methods of studying ancient pottery.

In order to prepare you for the study of archaeological ceramics in thin section, an introduction to the basics of optical mineralogy and mineral identification with the polarising light microscope will be provided. The key features used to identify the most common rock forming minerals will be discussed. A demonstration of the process of thin section preparation will be given in basement laboratory B45 at a time to be arranged according to participants schedules.

Practical (15 January) - Identification of Minerals in Thin Section

In the practical session, we will familiarise ourselves with the polarising light microscope and get a brief first opportunity to see archaeological ceramics in thin section. We will then observe the main rock forming minerals in thin geological specimens and learn to recognise them down the microscope.

Recommended Reading:

MacKenzie, W. S. and Adams, A. E. 1994. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing, London (Pages 1-64).

Quinn, P. S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Oxford: Archaeopress. (Chapter 1. Introduction to Ceramic Petrography)

Quinn, P. S. and Burton, M. 2015. Ceramic Distribution, Migration and Cultural Interaction Among Late Prehistoric (ca. 1300–200 B.P.) Hunter-Gatherers in the San Diego Region, Southern California. *Journal of Archaeological Science Reports*, 5: 285-295.

Week 2

Lecture (21 January) - Igneous Rocks: Their Classification and Identification in Thin Section

We will go over the optical properties of the the main rock forming minerals encountered last week. The rock cycle and tripartite classification of rocks will then be introduced. The formation, classification and petrographic study of the main acidic, intermediate, basic and volcanoclastic igneous rocks will be explained in detail, including the mineralogical and textural features that are used to identify them in thin section.

Practical (22 January) - Identifying Igneous Rocks in Thin Section

In the practical session we will observe thin sections of the main igneous rocks and familiarise ourselves with their composition and classification under the polarising light microscope. This will also provide an opportunity to observe many of the main rock forming minerals in thin section.

Recommended Reading:

Chernicoff, S. and Venkatakrisnan, R. 1995. *Geology: An Introduction to Physical Geology*. Worth Publishers. (Chapter 3).

MacKenzie, W. S. and Adams, A. E. 1994. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing, London. (Pages 67-105).

Szilágyi, V. and Szakmány, G. 2009. Comparison of Volcanoclastic-Tempered Inca Imperial Ceramics from Paria, Bolivia with Potential Sources. in: Quinn, P. S. (ed.) *Interpreting Silent Artefacts: Petrographic Approaches to Archaeological Ceramics*: 211- 225.

Week 3

Lecture (28 January) - Sedimentary Rocks: Their Classification and Identification in Thin Section

We will go over the mineralogical and textural features of the main igneous rocks encountered last week. The formation, classification and petrographic study of the main clastic and carbonate sedimentary rocks will then be explained in detail, including the mineralogical and textural features that are used to identify them in thin section.

Practical (29 January) - Identifying Sedimentary Rocks in Thin Section

In the practical session we will observe thin sections of the main sedimentary rocks and familiarise ourselves with their composition and classification under the polarising light microscope. This will also provide an opportunity to observe many of the main rock forming minerals in thin section.

Recommended Reading:

Chernicoff, S. and Venkatakrisnan, R. 1995. *Geology: An Introduction to Physical Geology*. Worth Publishers. (Chapter 6).

Quinn, P. S., Zhang, S., Xia, Y., Li, X. 2017. Building the Terracotta Army: Ceramic Craft Technology and Organisation of Production at Qin Shihuang's Mausoleum Complex, China. *Antiquity*, 91: 966-979.

MacKenzie, W. S. and Adams, A. E. 1994. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing, London (Pages 107-151).

Week 4

Lecture (4 February) - Metamorphic Rocks: Their Classification and Identification in Thin Section

We will go over the mineralogical and textural features of the main sedimentary rocks encountered last week. The formation, classification and petrographic study of the main metamorphic rocks will then be explained in detail. The mineralogical and textural features of the main clastic and carbonate sedimentary rocks will be discussed, including the mineralogical and textural features that are used to identify them in thin section.

Practical (5 February) - Identifying Metamorphic Rocks in Thin Section

In the practical session we will observe thin sections of the main metamorphic rocks and familiarise ourselves with their composition and classification under the polarising light microscope. This will also provide an opportunity to observe many of the main rock forming minerals in thin section.

Recommended Reading:

Chernicoff, S. and Venkatakrisnan, R. 1995. *Geology: An Introduction to Physical Geology*. Worth Publishers. (Chapter 7).

Piovesan, R., Curti, E., Grifa, C., Maritan, L. and Mazzoli, C. 2009. Petrographic and microstratigraphic analysis of mortar-based building materials from the Temple of Venus, Pompeii, In: Quinn, P. S. (Ed.) *Interpreting Silent Artefacts: Petrographic Approaches to Archaeological Ceramics*. Archaeopress: 65-79.

MacKenzie, W. S. and Adams, A. E. 1994. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing, London (Pages 153-187).

Week 5

Lecture (11 February) - Clay, Soil and Weathering. Introduction to Thin Section Ceramic Petrography

We will go over the mineralogical and textural features of the main metamorphic rocks encountered last week. The mineralogy, formation and classification of clay and soil will then be introduced. The subject of ceramic petrography will be introduced in detail. We will consider the composition of archaeological ceramics in thin section, focussing on their three main components.

Practical (12 February) - Composition of Ceramics in Thin Section

In the practical, we will familiarise ourselves with the three main components of archaeological ceramics in thin section under the the polarising light microscope. We will also observe examples of archaeological ceramics with igneous, sedimentary and metamorphic rock inclusions.

Recommended Reading:

Chernicoff, S. and Venkatakrisnan, R. 1995. *Geology: An Introduction to Physical Geology*. Worth Publishers. (Chapter 5).

Quinn, P. S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Archaeopress, Oxford. (Chapter 3)

Rice, P. M. 1987. *Pottery Analysis: A sourcebook*. University of Chicago Press. (Pages 31-53).

Reading Week

No lecture or practical. Catch up with reading and practice mineral and rock identification on microscope.

Week 6

Lecture (25 February) - Classification and Characterisation of Ceramics in Thin Section

We will consider how archaeological ceramics can be classified and characterised in thin section in order to identify meaning compositional patterns within artefact assemblages. Visual and quantitative approaches to classification and grouping will be contrasted with one another in terms of their strengths and weaknesses and their application to particular types of ceramic assemblages.

Practical (26 February) - Classification and Characterisation of Ceramics in Thin Section

In the practical we will group real assemblages of archaeological ceramics thin sections and characterise them using recommended descriptive procedures. A demonstration of quantitative petrographic data collection will be given.

Recommended Reading:

Day, P. M., E. Kiriati, A. Tsoiakidou and V. Kilikoglou 1999. Group therapy in Crete: A comparison between analyses by NAA and thin section petrography of Early Minoan pottery in *Journal of Archaeological Science*, 26: 1025-1036.

Quinn, P. S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Archaeopress, Oxford. (Chapter 4)

Nodarou, E., Frederick, C. and Hein, A. 2008. Another (mud)brick in the wall: Scientific Analysis of Bronze Age Earthen Construction Materials from East Crete. *Journal of Archaeological Science*, 35: 2997–3015.

Whitbread, I. K. 1986. The Characterization of Argillaceous Inclusions in Ceramic Thin Sections. *Archaeometry*, 28: 79-88.

Week 7

Lecture (3 March) - Interpreting Ceramic Provenance in Thin Section

The application of petrographic data to the interpretation of ceramic provenance will be introduced, focussing on the methodology of provenance determination, the scale and the types of archaeological questions that it can be used to tackle, including trade and exchange, interaction and migration. Thin section petrography will be contrasted with geochemical approaches to ceramic provenance and a case will be argued for a combined approach. We will discuss several published case studies in which petrography has been used for provenance determination.

Practical (4 March) - Interpreting Ceramic Provenance in Thin Section

In the practical, we will work in groups and attempt to determine the provenance of several real assemblages of archaeological ceramic thin sections using geological maps and associated archaeological information. The outcome of this exercise will be discussed at the end of the practical class.

Recommended Reading:

Quinn, P. S. 2013. Ceramic Petrography: *The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Archaeopress, Oxford. (Chapter 5)

Quinn, P. S., Day, P. M. and Kilikoglou, V. 2010. Keeping An Eye on Your Pots: The Provenance of Neolithic Ceramics from Cyclops Cave on the Island of Youra, Greece. *Journal of Archaeological Science*, 37: 1042-1052.

Travé Allepuz, E. T., Quinn, P. S. and López Pérez, M. D. 2015. To the Vicinity and Beyond! Production, Distribution and Trade of Cooking Greywares in Medieval Catalonia, Spain. *Archaeological and Anthropological Sciences*, 6: 397-410.

Week 8

Lecture (10 March) - Reconstructing Ceramic Technology in Thin Section

The role of ceramic petrography in the reconstruction of ceramic technology will be outlined with reference to the *chaîne opératoire* of pottery production by examining the petrographic evidence for each step in the typical production process. The reasoning behind potters actions will then be considered with reference to ethnography of traditional pottery production. Finally, the value of technological data will be discussed in terms of wider archaeological themes such as beliefs, tradition, style and expression.

Practical (11 March) - Reconstructing Ceramic Technology in Thin Section

In the practical, participants will observe and familiarise themselves with the evidence for ancient ceramic technology in thin section using archaeological material from different periods and geographical regions worldwide.

Recommended Reading:

Quinn, P. S. 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Archaeopress, Oxford. (Chapter 6)

Quinn, P. S. and Burton, M. 2009. Ceramic Petrography and the Reconstruction of Hunter-Gatherer Craft Technology in Late Prehistoric Southern California. In: Quinn, P. S. (Ed.) *Interpreting Silent Artefacts: Petrographic Approaches to Archaeological Ceramics*. Archaeopress: 267-295.

Sillar B, and Tite, M. S. 2000. The Challenge of 'Technological Choices' for Materials Science Approaches in Archaeology. *Archaeometry*, 42:2-20.

Week 9

Lecture (17 March) - Instrumental Geochemical Analysis of Archaeological Ceramics

Bulk geochemical compositional characterisation of archaeological ceramics will be introduced. This will start with a consideration of the typical elemental signature of ceramics and sources of alteration and contamination. We will go through the main instrumental techniques used to analyse the chemical composition of ceramics, highlighting their relative strengths and weaknesses. The topics of standards, calibration and accuracy will be discussed. Statistical methods of dealing with the multivariate compositional data that is generated by these approaches and identifying meaningful patterns within them will be outlined. We will then look at the role of geochemistry in the determination of ceramic provenance, using case studies.

Practical (18 March) - Instrumental Geochemical Analysis of Archaeological Ceramics

In the practical session, which will take place in Room 501, we will analyse statistically a real multivariate dataset from the geochemical analysis of archaeological ceramics in order to identify the existence of compositional groups and the likely provenance of the material.

Recommended Reading:

Blomster, J., H. Neff and M. Glascock. 2005. Olmec Pottery Production and Export in Ancient Mexico Determined Through Elemental Analysis. *Science*, 307: 1068-1072.

Orton, C. and Hughes, M. 2013. *Pottery in Archaeology*. Second Edition. Cambridge Manuals in Archaeology. Cambridge University Press. (pages 168-182)

Pollard, M., Batt, C. Stern, B and Young, M. M. 2007. *Analytical Chemistry in Archaeology*. Cambridge Manuals in Archaeology. Cambridge University Press. (Pages 101-109, 123-136).

Week 10

Lecture (24 March) - Scanning Electron Microscopy and X-Ray Diffraction Analysis of Archaeological Ceramics

The application of scanning electron microscopy to the analysis of archaeological ceramics will be summarised, focussing on the determination of firing temperatures, the chemical characterisation of the clay matrix and the technological investigation of decorative treatments. We will also discuss X-ray diffraction and its roles in the investigation of clay mineralogy and the determination of ancient firing conditions.

Practical (25 March) - Practical Assessment

In the practical session, you will be expected to complete the unseen test on Interpreting Archaeological Ceramics in Thin Section. This will take place in Room 410 between 2-4pm.

Recommended Reading:

Trave, E., Quinn P. S. and Alvaro Rueda, K. 2019. Another One Bites The Dust: Quality Control And Firing Technology In The Production Of Medieval Greyware Ceramics In Catalonia, Spain. *Archaeometry*, doi: 10.1111/arcm.12495.

Pollard, M., Batt, C. Stern, B and Young, M. M. 2007. *Analytical Chemistry in Archaeology*. Cambridge Manuals in Archaeology. Cambridge University Press. (Pages 109-116).

Quinn. P. S. and Benzonelli, A. 2018. X-Ray Diffraction and Archaeological Materials Analysis. In: López Varela, S. L. (ed.) *The SAS Encyclopedia of Archaeological Sciences*, Volume 4. Wiley Blackwell, New Jersey: 1796–1800.

Tite, M. S. and Freestone I. C., Meeks, M. D. and Bimson, M. 1982. The use of scanning electron microscopy in the technological analysis of archaeological ceramics. In: Olin, J. S. and Franklin, A. D. (Eds.) *Archaeological Ceramics*. Smithsonian Institution Press: 109-20.