UCL INSTITUTE OF ARCHAEOLOGY

ARCL 2020 PYROTECHNOLOGY

2014-15 Year 2/3 Option, 0.5 unit

Turnitin Class ID: 783198
Turnitin Password IoA1415

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Please see the last page of this document for important information about submission and marking procedures, or links to the relevant electronic pages.

The course is introductory and does not assume any previous knowledge of pyrotechnology. Although the course has a significant scientific content, it will not assume a formal scientific background: it is intended to be comprehensible to non-scientists.

AIMS
The course aims to make the student familiar with the range of techniques used by man in the pre-modern era to use fire to modify naturally occurring materials, to create new materials and to create artefacts out of these modified and new materials. The course will also aim to illustrate ways in which physiochemical analytical techniques can be used to yield information about the nature, manufacture, provenance and date of pyrotechnological artefacts.

OBJECTIVES
On successful completion of this course a student should:

Be familiar the nature of fire, the physical and chemical processes that occur during combustion;

Be aware of how fire may be controlled and manipulated pre-modern circumstances;

Be aware how mankind may have used fire to modify his immediate environment;
Be aware of how fire has been used to modify natural materials and make new materials;
Be aware of how fire has been used to modify materials such as food and flint;
Understand how pyrotechnology has been used to create lime cements; clay based ceramics; glazes, enamels, faience and glass; and metals and metal objects.
Have an overview of how analytical methods can provide information on the nature, manufacture, provenance and date of the products of pre-modern pyrotechnology.
Be able to assess in a broad manner the applicability of various methods of physicochemical analysis to improving understanding of ancient pyrotechnological processes and products;
Be able critically to evaluate published work relating to ancient pyrotechnological processes and products;
Be able to devise an effective research plan for the analysis of ancient pyrotechnological products.

SYLLABUS
The range of topics covered by the title of this course is particularly broad. The depth of coverage of different topics in the lectures will vary considerably. Although all uses of fire may be considered to be within the syllabus (and coursework may be chosen to cover any aspect of interest to the student), the lectures will focus primarily on the nature of fire, analytical techniques used to elucidate the uses of fire by mankind in past times and the pyrotechnology of cements, clay-based ceramics, glazes, glass and metals.

The course content can be considered under several main headings:
   i) the nature of fire and how it may be controlled and manipulated;
   ii) the techniques used in investigating artefacts made with the use of fire in order to learn what they are made of, how they were made, where they came from and what science-based dating techniques can be applied to them; and
   iii) the use of fire to modify existing materials and to create new materials;

Topics lying within the syllabus include but are not limited to:

NATURE & CONTROL OF FIRE

CAPTURE OF FIRE

MAKING FIRE
Friction
Sparks

ANALYSIS OF PYROTECHNOLOGICAL ARTEFACTS

USES OF FIRE (not in any intended chronological order)
Warmth

Light
- Bonfires
- Torches
- Lamps
- Tapers & candles

Ceremony
- Cremation
- Burnt barrows & mounds
- Ceremonial fires

Modification of materials
- Cooking for tenderness and flavour, destruction of toxins
- Brewing and distillation
- Modification of mechanical properties e.g. of chert or metals
- Changing colour, e.g. of pigments or stones

Land clearance
- Slash and burn

Defence
- Deterring predators
- Vitrified forts

Attack
- Hunting
- Setting fire to structures
- Gunpowder

Communication
- Beacons
- Smoke signals

Mining
- Fire setting
- Lighting in galleries
- Drainage

Making new materials
- Gypsum and lime cements
- Clay based ceramics
- Glazes, faience and glass
- Metals

Mechanical power
- Steam
- Internal combustion engines
- Jet and rocker engines

COURSE COMPONENTS
The course will include lectures on Tuesday mornings during the September to December 2014 term.
Tutorials will be arranged on request: please send an e-mail to explain what you would like to discuss and to arrange a time.

Depending on availability and interest, it may be possible to arrange voluntary practical or demonstration sessions.

**There will be no lecture session in reading week.**

By far the major part of the course workload will involve private learning from books and journals: the Friday sessions are intended to be an introduction and a guide to various topics and an opportunity to discuss aspects of pyrotechnology within the class.

**ASSESSMENT**

The course will be assessed on the basis of TWO equally weighted items of coursework. Written coursework submissions should be comprehensive in coverage within the bounds of the titles chosen. Care must be taken to address the topics of coursework exactly as the title requires: simply writing generally about the subject is not acceptable.

The length of a piece of written coursework is not a major criterion in the assessment of this course provided the subject is dealt with appropriately. The essential aspect is the quality of the work. Submitted work should have a clear structure. Ideas should be as concisely and eloquently expressed as possible but exactitude of expression is essential and should not be sacrificed simply to achieve brevity. A rough guide of what is expected is less than 3,000 words for each item of coursework. There is no word limit for the assessments of this course but you need to be aware that your effort needs to be spread appropriately between the two items of assessment on this course and the different units that you are taking for your degree.

Please read the guidance on coursework given in degree handbook and on the Institute intranet. These are summarized at the end of this handbook.

The source of all information (not just direct quotations) presented in a candidate’s written work should be clearly indicated and the text should be written in a way that makes it wholly clear to the reader what the candidate is expressing as his or her own idea or synthesis and what is being reported from other sources. In addition to supporting intellectual honesty and rigour, this style of writing will ensure that candidates get full credit for their own work. It also protects candidates from being criticized for ideas or errors that are in fact the responsibility of others. One may wish to refer to the work of others without necessarily agreeing with it.

Although stringing together a series of quotations will not constitute plagiarism if the sources are correctly cited, this will not generally achieve a good mark. This would be deemed to constitute over-dependence on sources. Figures or long direct quotations can be scanned or photocopied if this saves time provided there is clear indication of their source. Figures drawn by the candidate, if they are not entirely original, should be described as being redrawn from or based upon the original source. The modifications or additions made by the candidate should be clearly indicated.

Please number the pages of your coursework. Please use double line spacing and leave ample margins for comments. After reading your coursework, I will give comments and
indicate to you a provisional mark. It is emphasized that the mark I give will be provisional: the final mark will also depend on the views of a second internal examiner and the external examiner.

**DEADLINE DATES**

Unless otherwise agreed in advance, the latest times for coursework submission will be:

1st item of coursework 50% of marks Friday 12th December 2014
2nd item of coursework 50% of marks Friday 23rd January 2015

**SUGGESTED COURSEWORK TITLES** are listed below. The topics chosen for each item of coursework should not overlap significantly with the topics of other items of coursework on this or other courses. Consult the course co-ordinator if in doubt. I am willing to comment on plans and outlines for coursework if given good notice well before the submission deadline.

I am open to other suggestions for titles but these must be approved by me in writing. Please submit any alternative proposals for titles by e-mail but please do not commence major work until you have my approval.

**Suggested titles**

Outline the nature of fire. Discuss how different fuels and different designs of hearth, kiln and furnace have been used in the past to achieve desired conditions of firing.

Critically review the literature on the technology of the production and use of plasters, mortars, cements and concrete in antiquity. How may the examination of archaeological samples help to elucidate this technology?

Write a critical literature review on the methods of assessing the conditions of firing of archaeological ceramics. What is the significance of these studies?

What archaeologically recoverable evidence might one seek in an attempt to discover how pottery was made at a given site?

What technological and/or provenance studies of ceramics can be undertaken during fieldwork or excavation? Note the types of techniques that might be employed and the advantages and disadvantages of conducting the investigations while in the field as opposed to conducting them at a later date in a laboratory.

What processes occur in a ceramic fabric during firing and how can the conditions of firing affect the appearance of plain and decorated vessels?

Review the current state of knowledge on the technology and occurrence of faience? What work should be undertaken to further our knowledge and understanding of this material?
What is meant by the term “glass”? What sorts of raw materials have been used in the production of glass objects in antiquity? Discuss the differences in the making of glass from raw materials, making glass from raw materials and cullet, and making glass objects from glass made elsewhere.

What is the nature of a ceramic glaze? Discuss the technological evolution of ceramic glazes in a context of your choice e.g. in Chinese ceramics.

Discuss the properties and varieties of refractory materials used in antiquity, explaining how particular features of their constitution suited them for their function. (You may address this question in a general way or discuss in more detail the refractories used in a particular area of technology.)

Discuss the variety of technological processes that were part of the goldsmith’s art in pre-industrial society. What might be learned about this technology from the analysis of material remains?

What approaches have been used in the archaeological investigation of the technology of copper alloy production and use?

Discuss the meaning of the term “slag”. How can studies of slags yield information on the technological processes that produced them?

Discuss the different techniques used to make steel. How might the technology of production be inferred from examination of workshop remains and artefacts?

Review the use of analytical electron microscopy in determining how a chosen type of pyrotechnological artefact was made.

**DRAFT TIMETABLE**
Lectures are held 9-11 on Tuesdays of the first term in room 412

1 30th September  
   **Overview.**  
   The nature of fire. Making and controlling fire  
   Analytical techniques used in studying pyrotechnology.  

2 7th October  
   **Heat treatment of flint**  
   **Gypsum and lime cements: plaster, mortar and concrete**  

3 14th October  
   **Clay based ceramics: raw materials and the clay water system**
4  21st October
Clay based ceramics: forming, drying, firing processes and kilns
DRG

5  28th October
Glazes, faience, enamel and glass
DRG

READING WEEK  3rd-7th November
No lecture

6  11th November
Archaeology of extractive metallurgy
MC

7  18th November
Metalworking
MC

8  25th November
Archaeometallurgical remains
MM-T

9  2nd December
Experimental archaeometallurgy
JFM

10  9th December
Course review and additional topics
DRG

Key to initials:  DRG=Dafydd Griffiths, MC=Mike Charlton, MM-T = Marcos Martinon Torres, JFM=John Merkel.

INSTITUTE OF ARCHAEOLOGY COURSEWORK PROCEDURES
General policies and procedures concerning courses and coursework, including submission procedures, assessment criteria, and general resources, are available in your Degree Handbook and on the following website: http://wiki.ucl.ac.uk/display/archadmin. It is essential that you read and comply with these. Note that some of the policies and procedures will be different depending on your status. If in doubt, please consult your course co-ordinator.