

Archaeological Sciences

Course Syllabus

Graduate Program and Number:16:070:579

Course Number and Title: Archaeological Sciences

Credits: 3

Instructor(s): Dan Cabanes

Course description

Archaeological Sciences is a course designed to highlight the importance of Natural Sciences in current archaeological research. The course is proposed as an intersection between Natural (hard) Sciences and Social Sciences. The interpretation of archaeological remains is a complex exercise that requires an analytical framework of thought. Commonly, this interpretation is based on our knowledge of human behavior based on Social Sciences approaches. However, the reliability of the data upon we base the archaeological inference has become a major debate among the Archaeological community. This course aims to explain how archaeological remains are recovered and analyzed using an interdisciplinary approach, what are the principles of the analytical techniques used, how we can calculate the uncertainty of the results and predictions, which experiments can be set to further understand the archaeological record, and how we can integrate different lines of evidence to support a scientific argument. This course will cover a very needed gap in the Evolutionary Anthropology track of the Anthropology graduate program and will expose our students to the latest innovations in the field of Archaeological Sciences.

Course Structure

The course will be divided into 5 blocks. The first block will include an introduction to the Archaeological Sciences and to the excavation methods. The second block will be dedicated to the study of inorganic remains. The third block will be used to learn about the Biomineral record, between the inorganic and organic record. The fourth block will be dedicated to the organic remains. The fifth work will include an introduction to experimental design in Archaeology, but also will discuss publishing and career strategies. Each week two or three papers will be assigned for discussion in class. One of the papers will be a "classic" paper on the pertinent subject and the other papers will be recent or highly controversial publications. The aim is to get students familiarized both with the main literature and the recent developments. Additional texts from Weiner's book will be assigned to complement the aspects studied in class.

1ST Block. Weeks 1 and 2.

Title: **Between Social Sciences and Natural Sciences**

Main objective: *To discuss the intersection of natural sciences and social sciences, including the dichotomy between fieldwork and laboratory work in Archaeology.*

List of topics to be included: *How natural sciences can provide information to social sciences. The complexity of the interpretation in social sciences. Understanding the uncertainty in natural sciences. The diversity of the archaeological record. The importance of the excavation methods. Sampling strategies. Field and laboratory workflow: maximizing results with precious samples. Dating techniques and quantitative analyses.*

2nd Block. Weeks 3 to 6.

Title: **The inorganic record**

Main objective: *To understand the properties of the inorganic record in Archaeology and the methods used to study the context and the materials.*

List of topics to be included: *The geological context. Soil sciences in Archaeology. Mineralogical analyses of sediments. Pottery and metals. Provenience analyses. Diagenesis of the sedimentary record and implications for the preservation of archaeological remains. Pigment determination. The isotopic composition of the sedimentary record. Use-wear analyses and lithic tools.*

3rd Block. Weeks 7 and 9

Title: **Biominerals in the Archaeological record**

Objectives: *To understand the complexity of biominerals in the archaeological record, the information that they could provide, and their preservation in different conditions.*

List of topics to be included: *Biomineralization, inorganic materials produced by living beings. Bone and teeth, the material. Shells and other carbonate remains. Opaline microfossils, quantification and identification.*

4th Block. Weeks 10 to 12.

Title: **The organic record**

Objectives: *To understand the techniques used to recovery organic remains, at macro and micro scale, and their preservation biases.*

List of topics to be included: *Ancient DNA studies and sampling techniques for aDNA. Lipid and residue analyses in pottery and stone-tools. Proteomics. Phosphate concentrations. The study of faunal and plant remains.*

5th Block. Weeks 13 and 14

Title: **Experimental designs in Archaeological Sciences, publishing strategies, projects, and career perspectives.**

Objectives: *To learn how to produce an efficient experiment in archaeology and to give a professionalizing education to future archaeological scientist.*

List of topics to be included: *Simulating the past or studying the past. Field experiments. Laboratory experiments. Multidisciplinarity and collaboration networks. Publishing a scientific paper in Archaeology. Projects and grants. Career options for archaeological scientists.*

Suggested text: Weiner, S., 2010. Microarchaeology : beyond the visible archaeological record, Cambridge University Press, New York.

Learning goals assessment

The aims of this course are three folded. First, it aims to familiarize the students with the different scientific approaches used to study the Archaeological record. Second, it focuses on the use of critical thinking to evaluate the quality of the data and the value of the information in scientific and archaeological publications. Third, the course aims to promote scientific curiosity, innovation, and creativity to study our past.

The course learning outcomes will be evaluated using the following exercises.

Exercise 1. Using a randomly chosen element from the archaeological record (i.e. pottery fragment, lithic tool, bone, etc.) the student will write an essay of 1000 words maximum listing the methods that can be used to study this object and the expected outcomes. This exercise will evaluate the first objective of the course.

Exercise 2. A publication in a scientific paper will be assigned for review. The students will evaluate the quality of the data presented, the methods used, and the significance of the interpretation in an essay of 1000 words. This will cover the second objective.

Exercise 3. A hypothetical situation will be presented to the students. They will have to design an experimental approach to solve the problem, including an experiment schedule, methods of analyses, expected outcomes and contingency plans. This will cover the third objective of the course.

In class participation and discussions will be assessed separately during the weekly paper discussion.

Practicum. Depending on the installation's availability and the budget a laboratory section can be provided to have hands-on in actual Scientific research. By Spring 2019 the construction works for the Microarchaeological wet laboratory in the department of Anthropology should be concluded and the laboratory should be functioning. A small laboratory section will be included to teach hands-on phytolith analyses and FTIR spectroscopy. Their skills on the lab will be evaluated with a mini project. For this project, they would choose three-samples from any archaeological site available or from references materials and they will analyze them using the abovementioned techniques. A summary of the results of one page will be submitted for evaluation.

Grading scheme:

Exercise 1: 20%

Exercise 2: 20%

Exercise 3: 20%

In class participation: 20%

Practicum: 20%

Academic integrity

"Academic Integrity: Cheating lowers the value of a Rutgers degree and the learning experience for all students. No form of cheating, including plagiarism, will be tolerated. One commits plagiarism when one represents the text or ideas of others as one's own creation. Please visit the website of the Rutgers Office of Academic Integrity (<http://academicintegrity.rutgers.edu>) for a fuller explanation of plagiarism and of the penalties for it. Convicted plagiarists may receive a disciplinary F in the course and possibly face expulsion from the University.

Student Absences: Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me. Unjustified absences during the presentation days will affect your final grades. For absence periods longer than one week you will be directed to see a Dean of Students for assistance to help verify these circumstances. For any other circumstances please contact me."