Analytical Methods in Archaeology and Conservation
Anthropology 689

Instructor: Christopher Dostal
Time: Friday 9:00 AM – 12:00 PM
Location: Anthropology 108
Office: Anthropology 107D
Office Hours: Friday 1:00 PM – 3:00PM
Contact: dostalc@tamu.edu

Prerequisites:
None

Textbook:

Scientific Methods and Cultural Heritage: An Introduction to the Application of Materials Science to Archaeometry and Conservation Science by Gilberto Artioli (2009)
*Other readings can be found on the class website:
http://nautarch.tamu.edu/class/anth489/501/Analyticalmethods/index.html

Course Description

This course is designed to introduce students to a variety of analytical methods used in archaeology and archaeological conservation. The class is separated into two sections: artifact material analysis, and artifact documentation. Material analysis is the way that we study artifacts, both in structure and elemental composition. Classifying an artifact by use is often only just the beginning of an archaeological study; knowing that a projectile point is a projectile point can only tell us so much, but knowing what that point is made of can often tell us where it is from and can suggest trade routes and habitation patterns. Artifact documentation is one of the most important aspects to any archaeological project, but doubly so in archaeological conservation. Proper documentation can allow for studies to be completed without demanding that the artifacts be present, and often details not readily observable become apparent during the documentation process. This class will cover the traditional methods of artifact documentation, photography and sketches, as well as 3D computer modeling and digitization of artifacts and 3D printing. Though this course will emphasize existing equipment and techniques used in the anthropology department, capabilities available elsewhere on campus, like neutron activation analysis and scanning electron microscopes, will be included.

Learning Outcomes

Upon completing the course, students will be able to:

1. Identify which analytical methods are appropriate for studies on a variety of artifacts.
2. Demonstrate a basic understanding of portable X-Ray fluorescence (XRF) operations and be able to produce and interpret usable XRF data
3. Describe the basic goals of archaeological artifact documentation
4. Produce 3D models of artifacts with different techniques

Class Format
Class meets for 3 hours once per week. Each class will be a combination of lecturing accompanied by PowerPoint and hands-on demonstrations of the equipment being discussed that day. Students will be responsible for all material covered in the text, in the supplementary assigned readings, and all material covered in the lectures.

Grading
There will be two exams, each worth 30% of your grade. There will be an analysis project and an associated report worth 15% of the total grade. There will also be a critical response paper worth 15% of your grade, and a writing assignment where each student 'translates' a current scientific article from an archaeological journal into an article for a popular magazine worth 10%.

Exams (2) – 60%
Analysis Project and Report -15%
Critical Response - 15%
Scientific Literacy Paper - 10%

Grading Scale

90-100%	A
80-89%	B
70-79%	C
60-69%	D
0-59%	F

Make-up exams will be made available with an approved excuse per the University rules (http://student-rules.tamu.edu/rule07).

Exams
Each exam is worth 30% of your final grade. Each exam will consist of 25 multiple choice questions worth 3 points each, and 15 short answer questions worth 5 points each. I will provide the exams, you do not need to buy a blue book. Exams are non-cumulative.

Exam 1: February 22nd
Exam 2: May 4th

Assignments

Analysis Project and Report – (15% of Grade)
Due by April 30th at 5pm

Each student will choose one of the provided artifacts and analyze it with a variety of the methods learned in class. You can bring an external artifact to analyze, but we will have to review it beforehand to be sure that it will fit the objectives of the project. Each student will individually analyze their artifact with the XRF and optical microscope, the artifact will need to be photographed and drawn, and then it will be scanned with the FARO arm, the NextEngine 3D laser scanner, and it will be modelled using photogrammetry. Graduate students will additionally be expected to create a 3D animation with their models. The FARO arm model will then be 3D printed and compared to the original. Along with the images and files, a project report will be handed in, describing the techniques used and weighing in on the benefits of using one or the other for this particular objet. More information about this project can be found on the class website.

Critical Response (15% of Grade) – Due March 8th

Each student will write a 5 page critical response to one of the pre-selected academic papers provided. The review should include a brief summary of the article, your thoughts on the strengths and weaknesses of the study, how the study could be improved, and suggestions for future work. All sources should be cited in text, and the format of the citation should be stated on the bottom of the first page. (e.g. 'This paper follows the APA citation format'). Papers MUST use Times New Roman, 12pt, double spaced, with 1" margins. Papers need to be submitted as a .doc or .docx file.

Scientific Literacy Paper (10% of Grade) – Due March 29th

Graduate students will write a paper that 'translates' a scientific journal article about archaeology or conservation into a popular magazine-style article, like what one might find in *National Geographic* or *Popular Science*. Despite their best intentions, the authors typically doing the translating are rarely experts in the field they are describing, and so it is imperative that we as scholars are familiar with the types of shortcuts and metaphors that might be used to correctly or incorrectly convey complex scientific ideas and results to a lay-person audience. The length of this paper will be dependent on the length of the article assigned, but 10 pages is an estimated baseline. Forget about citations for this one paper! Papers MUST use Times New Roman, 12pt, double spaced, with 1" margins. Papers need to be submitted as a .doc or .docx file.

Last day to drop classes on Howdy without a fee is January 18th! The last day to Q-drop is April 15th!

Academic Honor:
"An Aggie does not lie, cheat, or steal or tolerate those who do."
Find the Student Honor Council rules and procedures here: http://aggiehonor.tamu.edu

Americans with Disabilities Act (ADA) Policy:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit http://disability.tamu.edu.

Plagiarism Statement
(From http://writingcenter.tamu.edu/Faculty/Teaching-Writing-or-Public-Speaking/Developing-Your-Method-of-Instruction/Citation-Documentation Accessed 9/8/15)

According to the Texas A&M University Definitions of Academic Misconduct, plagiarism is the appropriation of another person's ideas, processes, results or words without giving appropriate credit (aggiehonor.tamu.edu). You should credit your use of anyone else's words, graphic images, or ideas using standard citation styles. If I should discover that you have failed to properly credit sources or have used a paper written by someone else, I will recommend that you receive an F in this course. The Aggie Honor System Office processes for adjudication and appeals can be found at http://aggiehonor.tamu.edu

Title IX and Statement on Limits to Confidentiality
Texas A&M University and the College of Liberal Arts are committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws provide guidance for achieving such an environment. Although class materials are generally considered confidential pursuant to student record policies and laws, University employees — including instructors — cannot maintain confidentiality when it conflicts with their responsibility to report certain issues that jeopardize the health and safety of our community. As the instructor, I must report (per Texas A&M System Regulation 08.01.01) the following information to other University offices if you share it with me, even if you do not want the disclosed information to be shared:

Allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus.

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In many cases, it will be your decision whether or not you wish to speak with that individual. If you would like to talk about these events in a more confidential setting, you are encouraged to make an appointment with the Student Counseling Service (https://scs.tamu.edu/).

Students and faculty can report non-emergency behavior that causes them to be concerned at http://tellsomebody.tamu.edu.

Attendance
Texas A&M views class attendance as an individual student responsibility. Students should attend all classes and complete all assignments if they wish to make a good grade. Please refer to Student Rule #7 for details concerning reasons for excused absences and protocols for making up work missed during excused absences (http://student-rules.tamu.edu/rule07).

Anthropology Department Diversity Statement
Respect for cultural and human biological diversity are core concepts of Anthropology. In this course, each voice in the classroom has something of value to contribute to class discussion. Please respect the different experiences, beliefs and values expressed by your fellow students and instructor, and refrain from derogatory comments about other individuals, cultures, groups, or viewpoints. The Anthropology Department supports the Texas A&M University commitment to Diversity, and welcomes individuals of all ages, backgrounds, citizenships, disabilities, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences (See http://diversity.tamu.edu/).

Safety Precautions
During this course, students will be expected to adhere to strict safety protocols while in the presence of equipment that produces X-Rays. The policy in this class is to keep exposure 'As Low as Reasonably Allowed' (ALARA). All students will be required to complete the *General Radiation Producing Device Training (Online)* at https://ehsd.tamu.edu/Pages/EHS_Training.aspx

Students will only work with X-Ray producing equipment under the direct supervision of the instructor of this course.

Schedule

Readings assigned are to be read prior to class.

Week 1 – January 18th **- Last day to add/drop classes for the fall semester**

Introduction, Description, and Syllabus
Material Analysis – What do we look for?
Read Artioli p. 1-15
Activities: Distribution of artifacts for project and the articles to be reviewed.

Week 2 – January 25th
Artifact photography
Read Smith (2009): *Surefire Techniques for Archaeological Photography in Dark Places*
And Smith (2010): *Expanded Spectrum Photography and Archaeological Conservation*

Week 3 – February 1st
3D Modelling: Using documentation to recreate an artifact.
Activities: Introduction to 3D printing
Read: Boehler and Marbs (2004) *3d Scanning and Photogrammetry for Heritage Recording: A Comparison.*
Read: Cook and Compton (2018) *Canadian Digital Archaeology: On Boundaries and Futures*

Week 4 – February 8th
3D Digitization using Photogrammetry
Read: McCarthy (2014): *Multi-Image Photogrammetry as a Practical Tool for Cultural heritage Survey and Community Engagement*
Read Pacheco-Ruiz (2018) *4D modelling of low visibility Underwater Archaeological excavations using multi-source photogrammetry in the Bulgarian Black Sea*
Read**:** *Cyber Archaeologists Rebuild Destroyed Artifacts* from NPR http://www.npr.org/sections/alltechconsidered/2015/06/01/411138497/cyber-archaeologists-rebuild-destroyed-artifacts

Week 5 – February 15th
3D Digitization using the FARO Arm and NextEngine HD Scanner
Read Dostal (2017) p. 29-84
Read Zhou et al. (2012) *Fundamentals of Digital Preservation of Cultural Heritage*. From Digital Preservation Technology for Cultural heritage

Week 6 – February 22nd

*****Exam I*****

Week 7 – March 1st

X-Ray Fluorescence

Read Artioli p. 29-37

Read PDF of Moens et al. (2000). *X-Ray Fluorescence in Modern Analytical Methods in Art and Archaeology*

Read PDF of Ferguson (2012). *X-Ray Fluorescence of Obsidian: Approaches to Calibration and the analysis of small samples*

Week 8 – March 8th

X-Ray Fluorescence

Read: Bruker's X-Ray Radiation Safety: Manual for Operator Training

Read: PDF of Aimers et al. (2012) *Handheld XRF Analysis of Maya Ceramics: A Pilot Study Presenting Issues Related to Quantification and Calibration.*

Activities: Hands on with the XRF

Critical Response Paper Due

Week 9 – March 15th

Spring Break

Week 10 – March 22nd

X-Ray Diffraction, Mass Spectroscopy, NAA

Read Artioli p. 50-52, 178-180, 214- 216

Read Evrin et al. Stone Anchors from the Mediterranean coasts (2002)

Week 11 – March 29th

Tour of Nuclear Science Center (Tentative)

Scientific Literacy Paper due

Week 12 – April 5th

Artifact Documentation: Importance and methods, and introduction to X-Ray radiography

Read: *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation*

Read Dostal: 13-17

Read English Heritage: *The Guidelines on the X-radiography of archaeological metalwork*

Week 13 – April 12th

Optical and SEM Microscopy, scope photography, Image processing
Artifact Sketching, guest lecture by Dr. Helen DeWolf

Read: Collett (2012) *Introduction to Drawing Archaeological Pottery*

Week 14 – April 19th

Reading Day, no classes

Week 15 – April 30th – Tuesday (redefined day)

Interpreting artifact condition vs. design intent, and the publication and sharing of 3D models

Read: Barrett et al (2008) *Artifacts and Original Intent: A Cross-cultural Perspective on the Design Space*

Read Koller et al (2009) *Research Challenges for Digital Archives of 3D Cultural Heritage Models*

Analysis Project and Report due April 30th

Final Exam Date May 4th, 8:00-10:00am