

Archaeogeophysical Survey (3240:410/510; 3350:409/509; 3370:407/507)
Spring 2012

Instructor: Dr. Timothy Matney
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Class Meetings: MW 1:10-2:00pm, F 1:10-2:50pm
Classroom: Olin 101

Prerequisites

One of the following courses: Introduction to Archaeology (3240:100), Physical and Environmental Geography (3350:310), Introductory Physical Geology (3370:101)

Course Description and Objectives

Subsurface geophysical surveying techniques represent one of the major growth areas within ge archaeology. These techniques are more cost-effective than excavation and, because of the large areas that can be quickly surveyed, they open up new avenues for archaeological research. By training our students in the theory and practice of cutting-edge subsurface mapping technology, this course will provide students with the skills necessary to pursue a career in cultural resource management, where the greatest number of job opportunities exist in archaeology. Students will learn two archaeogeophysical survey techniques: magnetic gradiometry and electrical resistivity survey. This course is based on the pedagogical technique of inquiry-based learning in which students formulate real-world research projects and apply the principles and skills taught in the classroom to solve them.

Expected Outcomes

Students will be able to:

- design and implement an archaeological research project.
- develop a site history from a stratigraphic and geomorphic point of view.
- identify different properties of rocks, soils, and archaeological materials in order to learn what to expect from surface materials.
- differentiate and distinguish between the various geophysical methods used in archaeological surveying and identify the appropriate method for a specific site.
- process raw magnetic and resistivity data, clean data, filter out systematic errors and enhance resulting images.
- develop interpretable maps from the imagery.
- interpret the underlying archaeology from the datasets.

Required Textbook

Gaffney, Chris and John Gater (2003) *Revealing the Buried Past: Geophysics for Archaeologists*. Stroud, UK: Tempus Publishing Ltd. ISBN 0-7524-2556-0.

Prof. Matney will provide access to additional readings.

Notes on Registration, Enrollment & Dropping Classes

Effective in fall 2011, a new withdrawal policy is now in force at the University of Akron. Details can be found at: <http://www.uakron.edu/ogc/UniversityRules/pdf/20-05.1.pdf>. The last date to withdraw from this course is February 26.

Disabilities Accommodation

If you require accommodation you should contact the Office of Services for Students with Disabilities at 972-7928, as well as make arrangements with me during the first week of the semester.

Requirements & Grading

Your grade is determined on a 500 point scale. Roughly 40% of your grade is based on group work and 60% is based on individual assessments. The real-world application of geophysical surveys in archaeology is a collaborative undertaking and your ability to work within a group setting is fundamental to success. I have built into the course a number of evaluation tools which allow me to accurately and fairly assess each individual's contribution towards the group projects. In other words, when I evaluate group work, not all group members necessarily receive the same grade.

Grades are determined by the following scale:

A	465-500 points	C	365-384 points
A-	450-464 points	C-	350-364 points
B+	435-449 points	D+	335-349 points
B	415-434 points	D	315-334 points
B-	400-414 points	D-	300-314 points
C+	385-399 points	F	299 & fewer points

Grades will be determined through the following:

INDIVIDUAL COMPONENTS (300 points total)

- written lab exercises (7 @ 20 points each) **140 pts.**
- written equipmentation examination, Feb. 13 (take-home) **60 pts.**
- written final examination, Mar. 7 (in class) **100 pts.**

GROUP COMPONENTS (200 points total)

- completion of fieldwork activities **150 pts.**
(including "driver's tests", surveying, data collection, and processing)
- project presentation **50 pts.**

Graduate Credit

Students who have enrolled for graduate credit (i.e., you are taking the 500-level course) will be given additional work during the semester. This work will be scheduled in consultation with the instructor and may include additional leadership, field, and presentation responsibilities

Syllabus

This syllabus does not represent a formal contract. I will make every effort to cover all the material listed below, but I reserve the right to make changes, as necessary, to this syllabus at any time. Students are responsible for tracking any changes in the syllabus that are announced in class.

IMPORTANT: PLEASE COMPLETE THE READINGS PRIOR TO CLASS.

Week 1 (Jan 9 - 13) Introduction to course, expectations, and field sites

- Topics: Geophysical applications in archaeology: an archaeologist's toolkit
Fieldtrip to geophysical survey field sites (Friday, January 13)

Readings: Gaffney/Gator (2003), chapters 1-3
White (1984) *Glacial Geology of Summit County, Ohio* (pp. 1-25)
Park (n.d.) "ArchaeoGeophysical Mapping and Subsurface Surveying Field Trip..."
Barrett (n.d.) "Notes on Ohio's Bedrock Geology"

Week 2 (Jan 16 - 20) Archaeological concerns

No class on Monday, January 16 in observance of Martin Luther King, Jr. Day

Topics: Overview of the archaeology of northeastern Ohio
Archaeogeophysical survey case studies: realistic expectations for survey
Survey design in archaeology, site and method selection

Readings: Gaffney/Gator (2003), chapters 4-9
Lepper, ch. 3, The Early Woodland Period (pp. 78-107)
Lepper, ch. 4, The Middle Woodland Period (pp. 108-169)
Lepper, ch. 5, The Late Woodland Period (pp. 170-193)

Week 3 (Jan 23 - 27) Basic Electrical Resistance Survey

Topics: Electricity and resistivity
Equipmentation: GeoScan RM-15
LAB #1: Basic electrical properties for resistivity surveys

Readings: Somers (2006) "Resistivity Survey" (pp. 109-130)
Clark (1990) "Resistivity" (pp. 27-63)

Week 4 (Jan 30 – Feb 3) Advanced Electrical Resistance Survey

Topics: Electricity and resistivity case studies
Advanced Equipmentation: Multiplexer (MPX15)
LAB #2: Electrical Resistivity Tabletop Demonstration

Readings: Burger/Sheehan/Jones (2006) "Electrical Resistivity..." (pp. 265-347)
selection from RM-15 User's Manual

Week 5 (Feb 6 - 10) Basic Magnetic Gradiometry Survey

Topics: Magnetism and magnetic gradiometry
Equipmentation: GeoScan FM-256
LAB #3: Basic magnetic properties
Written Equipmentation Exam (take home, due Mon., Feb. 13)

Readings: Kvamme (2006) "Magnetometry: Nature's Gift to Archaeology" (p. 205-234)
Witten (2006) "Magnetometry: Finding Buried Magnets..." (pp. 73-116)

Week 6 (Feb 13 - 17) Advanced Magnetic Gradiometry Survey

Topics: Magnetic gradiometry case studies
Advanced Equipmentation: Balancing the FM-256
LAB #4: Magnetic Gradiometry Field Demonstration

Readings: Burger/Sheehan/Jones (2006) "Exploration Using the Magnetic..." (pp. 429-498)
Witten (2006) "Case Studies in Magnetometry" (pp. 117-125)
selection from FM-256 User's Manual

Week 7 (Feb 20 - 24) Data Processing and Mapping

Topics: Statistics, digital images, signals, noise and data quality
LAB #5: Basic Image Processing

Readings: Jensen (1996) "Initial Statistics Extraction" and "Image Enhancement" (pp. 139-165)
Clarke (2001), ch. 3, Maps as Numbers (pp. 66-99)

Week 8 (Feb 27 – Mar 2) Basic GeoPlot 3.0

Topics: GeoPlot 3.0 basics: file structure, downloading data, processing

LAB #6: GeoPlot Processing Algorithms
Readings: selection from the GeoPlot 3.0 User's Manual

Week 9 (Mar 5 - 9) Advanced GeoPlot 3.0

Topics: GeoPlot processing algorithms, feature enhancement, publishing
Written Final Exam (in class, Wednesday, Mar. 7)
LAB #7: Advanced GeoPlot Processing Algorithms
Readings: selection from the GeoPlot 3.0 User's Manual

There are no class meetings the week of March 12-16 for spring break.

Week 10 (Mar 19 - 23)

Student equipmentation practical examination (in field)
Organizational meeting of field teams
Return and discuss final exams

Week 11 (Mar 26 - 30)

Note that Prof. Matney will be lecturing at Musée du Louvre in Paris, March 29-30.
No formal class; student research team collection and processing of data

Week 12 (Apr 2 - 6)

No formal class; student research team collection and processing of data

Week 13 (Apr 9 - 13)

No formal class; student research team collection and processing of data

Week 14 (Apr 16 - 20)

Note that Prof. Matney will be lecturing at SAA conference in Memphis, April 19-20.
No formal class; student research team collection and processing of data

Week 15 (Apr 23 - 27)

Presentation of class data
Course summary and evaluation

There is no exam scheduled during final exam week.

BIBLIOGRAPHY

- Barrett, L. (n.d.) "Notes on Ohio's Bedrock Geology" Unpublished manuscript. (8 pp.)
- Burger, H.R., A.F. Sheehan, and C.H. Jones (2006) *Introduction to Applied Geophysics: Exploring the Shallow Subsurface*. New York: W.W. Norton & Company.
- Clark, A. (1990) *Seeing Beneath the Soil: Prospecting Methods in Archaeology*. London: Routledge.
- Clarke, K. (2001) *Getting Started With Geographic Information Systems*. Upper Saddle River, NJ: Prentice Hall.
- Gaffney, Chris and John Gater (2003) *Revealing the Buried Past: Geophysics for Archaeologists*. Stroud, UK: Tempus Publishing Ltd.
- Jensen, J. (1996) *Introductory Digital Image Processing: A Remote Sensing Perspective*. Upper Saddle River, NJ: Prentice Hall.
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- Lepper, Bradley T. (2005) *Ohio Archaeology: An Illustrated Chronicle of Ohio's Ancient American Indian Cultures*. Wilmington, OH: Orange Frazer Press.
- Park, L.E. (n.d.) "ArchaeoGeophysical Mapping and Subsurface Surveying Field Trip to the Cuyahoga" Unpublished manuscript. Valley" (7 pp.)
- Somers, L. (2006) "Resistivity Survey" In, J. K. Johnson, ed., *Remote Sensing in Archaeology: An Explicitly North American Perspective*. Tuscaloosa: University of Alabama Press. (pp. 109-130)
- White, G.W. (1984) *Glacial Geology of Summit County, Ohio*. Report of Investigations No. 123. Columbus: State of Ohio, Department of Natural Resources. (pp. 1-25)
- Witten, Alan J. (2006) *Handbook of Geophysics and Archaeology*. London: Equinox Publishing.