

GEOARCHAEOLOGY - ASM 548/494

Fall 2017, Wednesdays @3:05 pm, Stauffer A13

Michael Barton, instructor

TEXTS

Birkeland, P.W., 1999. Soils and Geomorphology, 3rd ed. Oxford University Press, New York.

Goldberg, P., Macphail, R., 2006. Practical and Theoretical Geoarchaeology. Blackwell Publishing, Malden, MA.

Stein, J.K., Farrand, W.R. (Eds.), 2001. Sediments in Archaeological Context. University of Utah Press, Salt Lake City.

Optional but useful:

Goldberg, P., Holliday, V.T., Ferring, C.R., 2001. Earth Sciences and Archaeology. Kluwer Academic/Plenum, New York.

Holliday, V.T., 2004. Soils in archaeological research. Oxford University Press, New York.

COURSE OBJECTIVES, ORGANIZATION, AND GRADING

Students should gain a solid understanding of the concepts and practices of applying earth science methods and concepts to archaeological deposits and materials. Emphasis will be on field rather than laboratory methods, so that archaeologists can identify macro-scale processes that created and/or modified the deposits that form the context of archaeological materials.

Class sessions will generally be divided between a presentation/lecture section and a seminar discussion section, where we will discuss how earth science concepts and methods have been applied in different research programs.

Students will also gain hands on experience with in-field analysis of sedimentary deposits, soils, and archaeological features during three Saturday field labs.

Readings for each class session include:

General methodology and application from a couple of textbooks. These are references for methods and their applications. We won't plan to discuss these explicitly, but can talk about them in class when there are questions.

Articles that exemplify geoarchaeological application, which we will discuss in class. These will be the basis for the seminar-like discussion. You will need to read the assigned articles so as to not feel embarrassed in front of your peers who DID read them. Discussions will be led by students from the class.

Course grades will be based on the following:

1. Three projects (25% each for projects 1 and 2, and 35% for project 3)
2. Class participation (15% of the grade).

Field labs:

Three field labs will be required. These will take place on Saturdays (provisionally scheduled for October 14, October 28, and November 18). Data gathered during these field labs will be the basis for the three projects. Hence, these cannot be made up if you miss the field trip. If, for some unavoidable reason, you must miss a field lab, you must see me immediately to plan some form of equivalent, alternate assignment.

STUDENT STANDARDS FOR ACADEMIC INTEGRITY AND BEHAVIOR

Student Standards: Students are required to read and act in accordance with university and Arizona Board of Regents policies, including:

- **The Academic Integrity Policy:** <https://provost.asu.edu/index.php?q=academicintegrity>
- **The Student Code of Conduct:** Arizona Board of Regents Policies 5-301 through 5-308: <https://students.asu.edu/srr/code>
- **The Computer, Internet and Electronic Communications Policy:** <http://www.asu.edu/aad/manuals/acd/acd125.html>

If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, school, and/or dean. Academic dishonesty includes borrowing ideas without proper citation, copying others' work (including information posted on the internet), and failing to turn in your own work for group projects. If you follow an argument closely or quote a source directly, you must provide a citation to the publication, including the author, date and page number. If you directly quote a source, even in an assignment, you must use quotation marks and a page number citation for each quoted sentence or phrase.

You may discuss assignments with other students. However, **all work that you do and writing that you turn in must be done independently**. If you have any doubt about whether the form of cooperation you contemplate is acceptable, **ask the instructor in advance of turning in an assignment**.

Prohibition of Commercial Note Taking Services: In accordance with ACD 304-06 Commercial Note Taking Services, written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the notetaker's name as well as the instructor's name, the course number, and the date.

Sexual Violence/Harassment: Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <http://sexualviolenceprevention.asu.edu/faqs/students>.

SYLLABUS AND READING LIST

Introduction

WEEK 1, Aug 23: Introduction: geologic context and archaeology

Readings from texts

Goldberg & McPhail. Introduction, Chapter 1

Stein, J. K. (2001). Archaeological sediments in cultural environments. In *Sediments in Archaeological Context*. Edited by J. K. Stein and W. R. Farrand. Salt Lake City, University of Utah Press pp. 1-28.

Papers

Canti, M., Huisman, D.J., 2015. Scientific advances in geoarchaeology during the last twenty years. *Journal of Archaeological Science, Scoping the Future of Archaeological Science: Papers in Honour of Richard Klein* 56, 96–108. doi:10.1016/j.jas.2015.02.024

Friesem, D.E., 2016. Geo-ethnoarchaeology in action. *Journal of Archaeological Science* 70, 145–157. doi:10.1016/j.jas.2016.05.004

WEEK 2, Aug 30: Quaternary chronology and stratigraphy

Readings from texts

Goldberg & McPhail. Chapter 2

Holliday, V. T. (2001). Quaternary Geoscience in Archaeology. In *Earth Sciences and Archaeology*. Edited by P. Goldberg, V. T. Holliday and C. R. Ferring. New York, Kluwer Academic/Plenum , pp. 3-36.

Stein, J.K. (1990). Archaeological stratigraphy. In *Archaeological Geology of North America*, edited by N.P. Lasca and J. Donahue, pp. 513-523. Geological Society of America, Centennial Special Volume 4, Boulder, CO.

Sedimentary environments and depositional processes

WEEK 3, Sept 6: Alluvial and colluvial environments

Readings from texts

Goldberg & McPhail. Chapters 4 and 5

Huckleberry, G. (2001). Archaeological sediments in dryland alluvial environments. In *Sediments in Archaeological Context*. Edited by J. K. Stein and W. R. Farrand. Salt Lake City, University of Utah Press pp. 67-125.

Gladfelter, B. (2001). Archaeological sediments in humid alluvial environments. In *Sediments in Archaeological Context*. Edited by J. K. Stein and W. R. Farrand. Salt Lake City, University of Utah Press pp. 93-125.

Papers

Grana, L., Tchilinguirian, P., Hocsman, S., Escola, P., Maidana, N.I., 2016. Paleohydrological Changes in Highland Desert Rivers and Human Occupation, 7000-3000 Cal. Yr B.P., South-Central Andes, Argentina. *Geoarchaeology* 31, 412–433. doi:10.1002/gea.21559

Tolksdorf, J.F., Turner, F., Kaiser, K., Eckmeier, E., Stahlschmidt, M., Housley, R.A., Breest, K., Veil, S., 2013. Multiproxy Analyses of Stratigraphy and Palaeoenvironment of the Late Palaeolithic Grabow Floodplain Site, Northern Germany. *Geoarchaeology* 28, 50–65. doi:10.1002/gea.21429

WEEK 4, Sept 13: Lacustrine, shoreline, and aeolian environments

Readings from texts

Goldberg & McPhail. Chapters 6 and 7

Papers

Bernasconi, M.P., Stanley, J.-D., 2011. Coastal margin evolution and postulated “basin-shipyard” area at ancient Locri-Epizephiri, Calabria, Italy. *Geoarchaeology* 26, 33–60. doi:10.1002/gea.20341

Fisher, C. T., Pollard, H. P., Israde-Alcántara, I., Garduño-Monroy, V. H., & Banerjee, S. K. (2003). A reexamination of human-induced environmental change within the Lake Pátzcuaro Basin, Michoacán, Mexico. *Proceedings of the National Academy of Sciences of the United States of America*, 100(8), 4957–4962. doi: 10.1073/pnas.0630493100.

Sherwood, S.C., Windingstad, J.D., Barker, A.W., O’Shea, J.M., Sherwood, W.C., 2013. Evidence for Holocene Aeolian Activity at the Close of the Middle Bronze Age in the Eastern Carpathian Basin: Geoarchaeological Results from the Mureş River Valley, Romania. *Geoarchaeology* 28, 131–146. doi:10.1002/gea.21434

WEEK 5, Sept 20: Caves, rock shelters, and springs

Readings from texts

Goldberg & McPhail. Chapter 8

Ashley, G. (2001). Archaeological sediments in springs and wetlands. In *Sediments in Archaeological Context*. Edited by J. K. Stein and W. R. Farrand. Salt Lake City, University of Utah Press pp. 183–210.

Farrand, W. R. (2001). Archaeological sediments in caves and rockshelters. In *Sediments in Archaeological Context*. Edited by J. K. Stein and W. R. Farrand, pp. 29–66. Salt Lake City, University of Utah Press.

Papers

Allen, M.S., Morrison, A.E., 2013. Modelling site formation dynamics: geoarchaeological, chronometric and statistical approaches to a stratified rockshelter sequence, Polynesia. *Journal of Archaeological Science* 40, 4560–4575. doi:10.1016/j.jas.2013.06.008

Bravard, J.-P., Mostafa, A., Garcier, R., Tallet, G., Ballet, P., Chevalier, Y., Tronchère, H., 2016. Rise and Fall of an Egyptian Oasis: Artesian Flow, Irrigation Soils, and Historical Agricultural Development in El-Deir, Kharga Depression, Western Desert of Egypt. *Geoarchaeology* 31, 467–486. doi:10.1002/gea.21566

Villagran, X.S., Strauss, A., Miller, C., Ligouis, B., Oliveira, R., 2017. Buried in ashes: Site formation processes at Lapa do Santo rockshelter, east-central Brazil. *Journal of Archaeological Science, Geoarchaeology in the Humid Tropics: Practice, Problems, Prospects* 77, 10–34. doi:10.1016/j.jas.2016.07.008

Soils

WEEK 6, Sept 27: Soil features

Readings from texts

Goldberg & McPhail. Chapter 3

Birkeland, P.W. (1999). Soils and Geomorphology. Oxford University Press, New York. [chapters.1]

Papers

Beeton, J.M., Mandel, R.D., 2011. Soils and late-Quaternary landscape evolution in the Cottonwood River basin, east-central Kansas: Implications for archaeological research. *Geoarchaeology* 26, 693–723. doi:10.1002/geo.20367

Mandel, R. D. and E. A. Bettis, III (2001). Use and analysis of soils by archaeologists and geoscientists. In *Earth Sciences and Archaeology*. Edited by P. Goldberg, V. T. Holliday and C. R. Ferring. New York, Kluwer Academic/Plenum pp. 173-204.

WEEK 7, Oct 4: Soil development under different environmental conditions

Readings from texts

Birkeland, P.W. (1999). Soils and Geomorphology. Oxford University Press, New York. [Chapters. 3,5,6, 9-10]

Papers

Denham, T., Grono, E., 2017. Sediments or soils? Multi-scale geoarchaeological investigations of stratigraphy and early cultivation practices at Kuk Swamp, highlands of Papua New Guinea. *Journal of Archaeological Science, Geoarchaeology in the Humid Tropics: Practice, Problems, Prospects* 77, 160–171. doi:10.1016/j.jas.2016.07.007

Khomutova, T. E., Demkina, T. S., Borisov, A. V., Kashirskaya, N. N., Yeltsov, M. V., & Demkin, V. A. (2007). An assessment of changes in properties of steppe kurgan paleosoils in relation to prevailing climates over recent millennia. *Quaternary Research*, 67(3), 328-336. doi: 10.1016/j.yqres.2007.01.001.

Payton, R.W., Bonsall, C., 2016. Soil Paleocatenas, Prehistoric Land Use, and Coastal Landscape Dynamics at Druridge Bay, Northeast England. *Geoarchaeology* 31, 388–411. doi:10.1002/geo.21551

Dating and chronology

WEEK 8, Oct 11: Non-radiometric dating methods

<p>***Saturday field trip OCTOBER 14***</p>
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Readings from texts

Birkeland, P.W. (1999). Soils and Geomorphology. Oxford University Press, New York. [Chapt. 8, 11]

Papers

Bettis, III, E.A. (1992). Soil morphologic properties and weathering zone characteristics as age indicators in Holocene alluvium in the upper Midwest. In *Soils in archaeology : landscape evolution and human occupation*, edited by V.T. Holliday, pp. 119-144. Smithsonian Institution Press, Washington.

Fernández-López de Pablo, J., Barton, C.M., 2013. Bayesian Estimation Dating of Lithic Surface Collections. *Journal of Archaeological Method and Theory*. doi:10.1007/s10816-013-9198-z

Lowe, J., Barton, N., Blockley, S., Ramsey, C.B., Cullen, V.L., Davies, W., Gamble, C., Grant, K., Hardiman, M., Housley, R., Lane, C.S., Lee, S., Lewis, M., MacLeod, A., Menzies, M., Muller, W., Pollard, M., Price, C., Roberts, A.P., Rohling, E.J., Satow, C., Smith, V.C., Stringer, C.B., Tomlinson, E.L., White, D., Albert, P., Arienzo, I., Barker, G., Boric, D., Carandente, A., Civetta, L., Ferrier, C., Guadelli, J.-L., Karkanas, P., Koumouzelis, M., Muller, U.C., Orsi, G., Pross, J., Rosi, M., Shalamanov-Korobar, L., Sirakov, N., Tzedakis, P.C., 2012. Volcanic ash layers illuminate the resilience of Neanderthals and early modern humans to natural hazards. *Proceedings of the National Academy of Sciences* 109, 13532–13537. doi:10.1073/pnas.1204579109

Field methods preparation: sediments and stratigraphy

Goldberg & McPhail. Chapters 15-17

WEEK 9, Oct 18: Radiometric dating methods (Arjun Heimsath, SESE)

Papers

Roberts, R.G., Jacobs, Z., Li, B., Jankowski, N.R., Cunningham, A.C., Rosenfeld, A.B., 2015. Optical dating in archaeology: thirty years in retrospect and grand challenges for the future. *Journal of Archaeological Science, Scoping the Future of Archaeological Science: Papers in Honour of Richard Klein* 56, 41–60. doi:10.1016/j.jas.2015.02.028

Williams, A.N., 2012. The use of summed radiocarbon probability distributions in archaeology: a review of methods. *Journal of Archaeological Science* 39, 578–589. doi:10.1016/j.jas.2011.07.014

Wood, R., 2015. From revolution to convention: the past, present and future of radiocarbon dating. *Journal of Archaeological Science, Scoping the Future of Archaeological Science: Papers in Honour of Richard Klein* 56, 61–72. doi:10.1016/j.jas.2015.02.019

Formation processes and anthropogenic deposits

WEEK 10, Oct 25: Cultural deposits and site formation

*****SATURDAY FIELD TRIP OCTOBER 28*****
Readings from texts

Goldberg & McPhail. Chapters 10, 12, 13

Papers

- Byers, D.A., Hargiss, E., Finley, J.B., 2015. Flake Morphology, Fluvial Dynamics, and Debitage Transport Potential. *Geoarchaeology* 30, 379–392. doi:10.1002/gea.21524
- Shillito, L.-M., Matthews, W., 2013. Geoarchaeological Investigations of Midden-Formation Processes in the Early to Late Ceramic Neolithic Levels at Çatalhöyük, Turkey ca. 8550–8370 cal BP. *Geoarchaeology* 28, 25–49. doi:10.1002/gea.21427
- Ullah, I.I.T., 2012. Particles from the past: microarchaeological spatial analysis of ancient house floors. In: Parker, B.J., Foster, C.P. (Eds.), *New Perspectives in Household Archaeology*. Eisenbrauns, Winowna Lake, pp. 123–138.

Field methods preparation: soils

- Birkeland, P.W. (1999). *Soils and Geomorphology*. Oxford University Press, New York. [Appendix 1 & 2].

WEEK 11, Nov 1: • Human impacts

*****PROJECT 1 DUE*******Readings from texts**

- Goldberg & McPhail. Chapter 9

Papers

- Bevan, A., Conolly, J., Colledge, S., Frederick, C., Palmer, C., Siddall, R., Steliatou, A., 2013. The Long-Term Ecology of Agricultural Terraces and Enclosed Fields from Antikythera, Greece. *Human Ecology* 41, 255–272. doi:10.1007/s10745-012-9552-x
- Maselli, V., Trincardi, F., 2013. Man made deltas. *Scientific Reports* 3, srep01926. doi:10.1038/srep01926
- Wilkinson, T.J., French, C., Ur, J.A., Semple, M., 2010. The geoarchaeology of route systems in northern Syria. *Geoarchaeology* 25, 745–771. doi:10.1002/gea.20331

Geoinformatics: remote sensing, gis, and modeling

WEEK 12, Nov 8: Remote sensing and geophysical methods

Papers

- Fassbinder, J.W.E., 2015. Seeing beneath the farmland, steppe and desert soil: magnetic prospecting and soil magnetism. *Journal of Archaeological Science, Scoping the Future of Archaeological Science: Papers in Honour of Richard Klein* 56, 85–95. doi:10.1016/j.jas.2015.02.023
- Lanzarone, P., Garrison, E., Bobe, R., Getahun, A., 2016. Examining Fluvial Stratigraphic Architecture Using Ground-Penetrating Radar at the Fanta Stream Fossil and Archaeological Site, Central Ethiopia. *Geoarchaeology* 31, 577–591. doi:10.1002/gea.21584
- Roman, A., Ursu, T.-M., Lăzărescu, V.-A., Opreanu, C.H., Fărcaș, S., 2017. Visualization techniques for an airborne laser scanning-derived digital terrain model in forested steep terrain: Detecting archaeological remains in the subsurface. *Geoarchaeology* 32, 549–562. doi:10.1002/gea.21621

WEEK 13, Nov 15: Geographic information systems

<p>***SATURDAY FIELD TRIP NOVEMBER 18**</p>
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<p>***PROJECT 2 DUE***</p>

Papers

- Hill, J.B., 2004. Land Use and an Archaeological Perspective on Socio-Natural Studies in the Wadi Al-Hasa, West-Central Jordan. *American Antiquity* 69, 389–412.
- Jasiewicz, J., Stepinski, T.F., 2013. Geomorphons — a pattern recognition approach to classification and mapping of landforms. *Geomorphology* 182, 147–156. doi:10.1016/j.geomorph.2012.11.005
- Orengo, H.A., Ejarque, A., Albiach, R., 2014. Water management and land-use practices from the Iron-Age to the Roman period in Eastern Iberia. *Journal of Archaeological Science* 49, 265–275. doi:10.1016/j.jas.2014.05.005
- Vogel, S., Märker, M., Esposito, D., Seiler, F., 2016. The Ancient Rural Settlement Structure in the Hinterland of Pompeii Inferred from Spatial Analysis and Predictive Modeling of Villae Rusticae. *Geoarchaeology* 31, 121–139. doi:10.1002/gea.21560

<p>Field methods preparation: site formation processes</p>

Goldberg & McPhail. Chapter 13

WEEK 14, Nov 22: Modeling (Kelin Whipple, SESE)

- Clevis, Q., Tucker, G. E., Lock, G., Lancaster, S. T., Gasparini, N., Desitter, A., et al. (2006). Geoarchaeological simulation of meandering river deposits and settlement distributions: A three-dimensional approach. *Geoarchaeology*, 21(8), 843-874.
- Barton, C.M., Ullah, I.I.T., Bergin, S.M., Sarjoughian, H.S., Mayer, G.R., Bernabeu-Auban, J.E., Heimsath, A.M., Acevedo, M.F., Riel-Salvatore, J.G., Arrowsmith, J.R., 2016. Experimental socioecology: Integrative science for Anthropocene landscape dynamics. *Anthropocene* 13, 34–45. doi:10.1016/j.ancene.2015.12.004.

OTHER TBA?

WEEK 15, Nov 29: Landscapes

<p>***Project 3 due on DECEMBER 6***</p>

Papers

- Carson, M.T., 2014. Paleo-Terrain Research: Finding the First Settlement Sites of Remote Oceania. *Geoarchaeology* 29, 268–275. doi:10.1002/gea.21457
- Nials, F.L., Gregory, D.A., Hill, J.B., 2011. The stream reach concept and the macro-scale study of riverine agriculture in arid and semiarid environments. *Geoarchaeology* 26, 724–761. doi:10.1002/gea.20371
- Siart, C., Bakti, B.B., Eitel, B., 2013. Digital Geoarchaeology: An Approach to Reconstructing Ancient Landscapes at the Human-Environmental Interface. In: Bock, H.G., Jäger, W., Winckler, M.J. (Eds.), *Scientific Computing and Cultural Heritage*. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 71–84.