

**COURSE SYLLABUS: Human Behavior through Bone Chemistry (ASM 494/591)**

**Arizona State University, Spring 2009**

**Day and Time: T 3:05-5:55 pm**

**Room Number: Anthropology 303**

**Professor: Kelly J. Knudson, Ph.D.**

**Email: Kelly.Knudson@asu.edu**

**Office Phone: 480-727-0767**

**Office Location: Anthropology 312**

**Office Hours: W 3:00-4:00 pm**

**Course Description**

This course will focus on the many ways that biogeochemical analyses of archaeological bone and teeth can inform our understanding of past human behavior. Some of the topics covered include migration and residential mobility, paleodiet, post-depositional contamination and dating methods. Students will learn through lectures, discussions, student presentations, and hands-on laboratory projects.

**Required Texts**

1. Pollard, AM, Batt CM, Stern B and Young SMM 2007. Analytical Chemistry in Archaeology, Cambridge University Press, New York.
2. Additional required readings, including journal articles and book chapters, are listed in the class outline. These readings will be available online via Blackboard.

**Recommended Texts**

1. Lambert JB (1998) Traces of the Past: Unraveling the Secrets of Archaeology through Chemistry. Reading, MA: Perseus Books.
2. Wright LE (2006) Diet, Health, and Status among the Pasi3n Maya: A Reappraisal of the Collapse. Nashville, TN: Vanderbilt University Press.

**Course Requirements**

The required readings will serve as the main material for the course, which will be supplemented by the lectures and discussions. The required readings should be completed before attending class so that you can participate in class discussions and laboratory work. In addition, students are required to complete five assignments, participate in class discussions and laboratory work, and complete a final project. Participation points will be determined by class attendance and completion of a series of short, mostly in-class, assignments.

**Student Evaluation**

Final project	100 points
Assignment 1: Presentation	50 points
Assignment 2: Diagenesis	50 points
Assignment 3: Paleodiet	50 points
Assignment 4: Trace Elements	50 points
Assignment 5: Essay	50 points
Participation	50 points
Total	400 points

**Grade Scale**

A+	98-100%	B+	88-89%	C+	78-79%	D	61-69%
A	92-97%	B	82-87%	C	72-77%	E	60% or below
A-	90-91%	B-	80-81%	C-	70-71%		

## **Course Policies and General Information**

### ***Research Project in Bone Chemistry***

In order to develop skills in archaeological chemistry, students will work in pairs to complete a semester-long research project. Students will design a research project and then develop the analytical skills necessary to generate, analyze, and interpret their data. This research project will culminate in a final paper that demonstrates independent, critical thought.

The final paper for this course will be due at 3:05 pm on Tuesday May 5, 2009. Late papers will be subject to a loss of 10 points (10%) per day, including weekends, and will not be accepted after Monday, May 11, 2009. Electronic copies of the papers will NOT be accepted and hard copies can be time-stamped in the Anthropology Office and placed in the professor's mailbox in the Anthropology Building. Students should use the editorial style used by the *American Journal of Physical Anthropology*, which can be found at <http://www3.interscience.wiley.com/cgi-bin/jabout/28130/ForAuthors.html>. The paper should be formatted as an article submission for the *American Journal of Physical Anthropology* research article following their guide to authors, which can also be found at <http://www3.interscience.wiley.com/cgi-bin/jabout/28130/ForAuthors.html>. Note that the maximum paper length is 25 pages, including references. Finally, the Writing Center at Arizona State University is an excellent resource for students who want to improve and refine their writing skills; information is available at <http://www.asu.edu/duas/wcenter/>.

### ***Academic Integrity***

Each student is responsible for preparing her or his own work. Cheating on exams or quizzes, plagiarizing other sources, or engaging in any form of academic deceit will not be tolerated. Students who do so will be subject to full disciplinary action by Arizona State University. The following websites are useful resources if you have questions about the Arizona State University policies on academic integrity or if you have questions about how to avoid plagiarism:

[http://www.asu.edu/studentaffairs/studentlife/judicial/academic\\_integrity.htm](http://www.asu.edu/studentaffairs/studentlife/judicial/academic_integrity.htm)

[http://owl.english.purdue.edu/handouts/research/r\\_plagiar.html](http://owl.english.purdue.edu/handouts/research/r_plagiar.html)

<http://www.rbs2.com/plag.htm>

### ***In-Class Behavior***

Students are expected to treat others in the classroom with respect and common courtesy. Cellular phones are not permitted to be used in any way. Laptop computers are to be used only to take notes. Late arrival will not be tolerated and repeated lateness will result in a lower participation grade for the course.

### ***Late Assignments***

Late assignments will be docked 10% of the total point value for each day they are late, and will not be accepted more than five days late, including weekends. Students will be allowed to turn in late assignments without losing points only in the case of medical or family emergencies. In either case, the professor must be notified *before* the due date and a written excuse from an appropriate source must be provided, such as a doctor.

### ***Special Accommodations***

If you need special accommodations because of a disability, please notify the instructor within the first two weeks of class. Grades for course assignments will normally be available after one week has elapsed. Extra credit is not available for this course.

**HUMAN BEHAVIOR THROUGH BONE CHEMISTRY:  
CLASS OUTLINE AND ASSIGNED READINGS**

The assigned readings that are listed for each week should be completed before  
class each week.

**WEEK 1, January 20: Human Behavior through Bone Chemistry**

**ACTIVITIES:**

- Course introduction in Anthropology 303
- Tour of Archaeological Chemistry Laboratory and the W.M. Keck Foundation Laboratory for Environmental Biogeochemistry

**RECOMMENDED READINGS (ASM 494/591):**

Lambert, JB. 1998. Chapter 8 in *Traces of the Past: Unraveling the Secrets of Archaeology through Chemistry*. Reading, MA: Perseus Books.

**WEEK 2: January 27: The Use of Chemical Techniques in Anthropology**

**ACTIVITIES:**

- Class discussion in Anthropology 341
- Research project meetings in Anthropology 312

**REQUIRED READINGS (ASM 494):**

Chamberlin TC. 1890. The Method of Multiple Working Hypotheses. Reprinted in *Science* 148: 754-759.

Killick D, and Young SMM (1997) *Archaeology and Archaeometry: From Casual Dating to a Meaningful Relationship?* *Antiquity* 71:518-524.

Pollard AM. 1995. Why Teach Heisenberg to Archaeologists? *Antiquity* 69:242-247.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 1 and 2 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

**REQUIRED READINGS (ASM 591):**

Chamberlin TC. 1890. The Method of Multiple Working Hypotheses. Reprinted in *Science* 148: 754-759.

Killick D, and Young SMM (1997) *Archaeology and Archaeometry: From Casual Dating to a Meaningful Relationship?* *Antiquity* 71:518-524.

Pollard AM. 1995. Why Teach Heisenberg to Archaeologists? *Antiquity* 69:242-247.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 1 and 2 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

Trigger BG. 1989. *Archaeology's Relations with the Physical and Biological Sciences: A Historical Review: Archaeometry Proceedings*. Toronto, pp. 1-9.

Wylie A. 2000. Questions of Evidence, Legitimacy, and the (Dis)unity of Science. *American Antiquity* 65:227-237.

**WEEK 3, February 3: Ethics and Current Debates in Archaeological Science**

**ACTIVITIES:**

- Class discussion in Anthropology 341
- Research project meetings in Anthropology 312

**REQUIRED READINGS (ASM 494):**

Hackett, Edward J. 2005. Introduction to the Special Guest-Edited Issue on Scientific Collaboration. *Social Studies of Science* 35(5):667-671.

Larsen, C. S., and P. L. Walker. 2004. "The Ethics of Bioarchaeology," in *From Repatriation to Genetic Identity: Biological Anthropology and Ethics*. Edited by T. Turner, pp. 111-119. Albany, NY: State University of New York Press.

Ledford, H. 2009. Collaborations: With All Good Intentions. *Nature* 452:682-684.

Lynott, M. J. 2002. "Ethics in Archaeology," in *Archaeology: Original Readings in Method and Practice*. Edited by P. N. Peregrine, C. R. Ember, and M. Ember, pp. 245-260. Upper Saddle River, New Jersey: Prentice Hall.

**REQUIRED READINGS (ASM 591):**

Hackett, Edward J. 2005. Introduction to the Special Guest-Edited Issue on Scientific Collaboration. *Social Studies of Science* 35(5):667-671.

Hackett, Edward J. 2005. Essential Tensions: Identity, Control, and Risk in Research. *Social Studies of Science* 35(5):787-826.

- Larsen, C. S., and P. L. Walker. 2004. "The Ethics of Bioarchaeology," in *From Repatriation to Genetic Identity: Biological Anthropology and Ethics*. Edited by T. Turner, pp. 111-119. Albany, NY: State University of New York Press.
- Ledford, H. 2009. Collaborations: With All Good Intentions. *Nature* 452:682-684.
- Lynott, M. J. 2002. "Ethics in Archaeology," in *Archaeology: Original Readings in Method and Practice*. Edited by P. N. Peregrine, C. R. Ember, and M. Ember, pp. 245-260. Upper Saddle River, New Jersey: Prentice Hall.
- Pollard AM. 1995. Why Teach Heisenberg to Archaeologists? *Antiquity* 69:242-247.
- Walker, P. L. 2000. "Bioarcheological Ethics: Considerations in the Forensic Applications of Human Skeletal Biology," in *Biological Anthropology of the Human Skeleton*. Edited by M. A. Katzenberg and S. R. Saunders, pp. 3-40. New York: Wiley-Liss.

#### **WEEK 4, February 10: Laboratory Safety in the Archaeological Chemistry Laboratory**

##### ACTIVITIES:

- Laboratory safety orientation, including fire safety and hazardous waste management in Anthropology 341
- Research project meetings in Anthropology 312

##### REQUIRED READINGS (ASM 494/591):

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 10, 11, 12, and 13 and Appendices I through X in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

#### **WEEK 5, February 17: Dating**

##### ACTIVITIES:

- Student presentations in Anthropology 341
  - Assignment 1: Presentation DUE at 3:05 pm on Tuesday, February 17, 2009
- Class discussion in Anthropology 341
- Laboratory training in sample collection in Anthropology 303

##### REQUIRED READINGS (ASM 494):

Libby, W. F. 1960. Radiocarbon Dating, Nobel Lecture, December 12, 1960.

Ramsey, C. B. 2008. Radiocarbon Dating: Revolutions in Understanding. *Archaeometry* 50(2): 249-275.

##### REQUIRED READINGS (ASM 591):

Gaschen, A.A.-M., M. Döbeli, A. Markwitz, B. Barry, S. Ulrich-Bochsler, and U. Krähenbühl. 2009. Restrictions on Fluorine Depth Profiling for Exposure Age Dating in Archaeological Bones. *Journal of Archaeological Science* 35(3):535-552.

Libby, W. F. 1960. Radiocarbon Dating, Nobel Lecture, December 12, 1960.

Ramsey, C. B. 2008. Radiocarbon Dating: Revolutions in Understanding. *Archaeometry* 50(2): 249-275.

#### **WEEK 6, February 24: Identifying Diagenesis and Pathological Samples**

##### ACTIVITIES:

- Lecture in Anthropology 341
- Laboratory training in chemical cleaning in Anthropology 303

##### REQUIRED READINGS (ASM 494):

Hedges REM 2002. Bone Diagenesis: An Overview of Progress. *Archaeometry* 44:319-328.

Lee-Thorp, J. and J. Sealy 2008. Beyond Documenting Diagenesis: The Fifth International Bone Diagenesis Workshop. *Palaeogeography, Palaeoclimatology, Palaeoecology* 266(3-4): 129-133.

Lee-Thorp J, and Sponheimer M. 2003. Three Case Studies Used to Reassess the Reliability of Fossil Bone and Enamel Isotope Signals for Paleodietary Studies. *Journal of Anthropological Archaeology* 22:208-216.

##### REQUIRED READINGS (ASM 591):

Budd, P., J. Montgomery, et al. 2000. Differential Diagenesis of Strontium in Archaeological Human Dental Tissues. *Applied Geochemistry* 15: 687-694.

Hedges REM 2002. Bone Diagenesis: An Overview of Progress. *Archaeometry* 44:319-328.

Kohn, M. J., M. J. Schoeninger, et al. 1999. Altered States: Effects of Diagenesis on Fossil Tooth Chemistry. *Geochimica et Cosmochimica Acta* 63(18): 2737-2747.

Lee-Thorp J 2002. Two Decades of Progress towards Understanding Fossilization Processes and Isotopic Signals in Calcified Tissue Minerals. *Archaeometry* 44:435-446.

Lee-Thorp, J. and J. Sealy 2008. Beyond Documenting Diagenesis: The Fifth International Bone Diagenesis Workshop. *Palaeogeography, Palaeoclimatology, Palaeoecology* 266(3-4): 129-133.

Lee-Thorp J, and Sponheimer M. 2003. Three Case Studies Used to Reassess the Reliability of Fossil Bone and Enamel Isotope Signals for Paleodietary Studies. *Journal of Anthropological Archaeology* 22:208-216.

### **WEEK 7, March 3: Human Behavior through Non-Human Samples**

#### ACTIVITIES:

- Assignment 2: Diagenesis DUE at 3:40 pm on Tuesday, March 3, 2009
- Student presentations in Anthropology 341
  - Assignment 1: Presentation DUE at 3:40 pm on Tuesday, March 3, 2009
- Class discussion in Anthropology 341
- Laboratory training in sample collection in Anthropology 303

#### REQUIRED READINGS (ASM 494):

Balasse M (2002) Reconstructing Dietary and Environmental History from Enamel Isotopic Analysis: Time Resolution of Intra-Tooth Sequential Sampling. *International Journal of Osteoarchaeology* 12:155-165.

Kohn MJ, and Law JM (2006) Stable Isotope Chemistry of Fossil Bone as a New Paleoclimate Indicator. *Geochimica et Cosmochimica Acta* 70:931-946.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapter 8 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

#### REQUIRED READINGS (ASM 591):

Balasse M (2002) Reconstructing Dietary and Environmental History from Enamel Isotopic Analysis: Time Resolution of Intra-Tooth Sequential Sampling. *International Journal of Osteoarchaeology* 12:155-165.

Balasse M, Ambrose SH, Smith AB, and Price TD (2002) The Seasonal Mobility Model for Prehistoric Herders in the South-western Cape of South Africa Assessed by Isotopic Analysis of Sheep Tooth Enamel. *Journal of Archaeological Science* 29:917-932.

Bryant JD, Luz B, and Froelich PN (1994) Oxygen Isotopic Composition of Fossil Horse Tooth Phosphate as a Record of Continental Paleoclimate. *Paleogeography, Paleoclimatology, Paleoecology* 107:303-316.

Gat JR. (1996) Oxygen and hydrogen isotopes in the hydrologic cycle. *Annual Review of Earth and Planetary Sciences* 24: 225-262.

Kirsanow, K., C. Makarewicz, et al. (2008). Stable Oxygen ( $\delta^{18}O$ ) and Hydrogen ( $\delta^2D$ ) Isotopes in Ovicaprid Dentinal Collagen Record Seasonal Variation. *Journal of Archaeological Science* 35(12): 3159-3167.

Kohn MJ, and Law JM (2006) Stable Isotope Chemistry of Fossil Bone as a New Paleoclimate Indicator. *Geochimica et Cosmochimica Acta* 70:931-946.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapter 8 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

### **WEEK 8, March 10: Spring Break (no class)**

### **WEEK 9, March 17: Migration and Residential Mobility**

#### ACTIVITIES:

- Class discussion in Anthropology 341
- Laboratory training in sample preparation in Anthropology 303

#### REQUIRED READINGS (ASM 494):

Bentley RA (2006). Strontium Isotopes from the Earth to the Archaeological Skeleton: A Review. *Journal of Archaeological Method and Theory*. **13**: 135-187.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 8 and 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

Price, T. D., Johnson, C. M., Ezzo, J. A., Ericson, J. and Burton, J. H. (1994). Residential Mobility in the Prehistoric Southwest United States: A Preliminary Study Using Strontium Isotope Analysis. *Journal of Archaeological Science* 21: 315-330.

Montgomery, J., Evans, J. A., Powlesland, D. and Roberts, C. A. (2005). Continuity or Colonization in Anglo-Saxon England? Isotope Evidence for Mobility, Subsistence Practice, and Status at West Heslerton. *American Journal of Physical Anthropology* **126**: 123-138.

#### REQUIRED READINGS (ASM 591):

Bentley RA (2006). Strontium Isotopes from the Earth to the Archaeological Skeleton: A Review. *Journal of Archaeological Method and Theory*. **13**: 135-187.

- Ericson JE. (1985). Strontium isotope characterization in the study of prehistoric human ecology. *Journal of Human Evolution* **14**: 503-514.
- Montgomery, J., Evans, J. A., Powlesland, D. and Roberts, C. A. (2005). Continuity or Colonization in Anglo-Saxon England? Isotope Evidence for Mobility, Subsistence Practice, and Status at West Heslerton. *American Journal of Physical Anthropology* **126**: 123-138.
- Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 8 and 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.
- Price, TD, et al. (2008).  $^{87}\text{Sr}/^{86}\text{Sr}$  Ratios and the Study of Human Mobility in Ancient Mesoamerica. *Latin American Antiquity* **19**: 167-180.
- Price, T. D., Johnson, C. M., Ezzo, J. A., Ericson, J. and Burton, J. H. (1994). Residential Mobility in the Prehistoric Southwest United States: A Preliminary Study Using Strontium Isotope Analysis. *Journal of Archaeological Science* **21**: 315-330.
- Richards, M., K. Harvati, et al. (2008). Strontium Isotope Evidence of Neanderthal Mobility at the Site of Lakonis, Greece using Laser-Ablation PIMMS. *Journal of Archaeological Science* **35**(5): 1251-1256.
- White, C. D., Spence, M. W., Longstaffe, F. J. and Law, K. R. (2004). Demography and Ethnic Continuity in the Tlailotlacan Enclave of Teotihuacan: The Evidence from Stable Oxygen Isotopes. *Journal of Anthropological Archaeology* **123**: 385-403.
- Wright, L. E. (2005). Identifying Immigrants to Tikal, Guatemala: Defining Local Variability in Strontium Isotope Ratios of Human Tooth Enamel. *Journal of Archaeological Science* **32**: 555-566.

### **WEEK 10, March 24: Paleodiet, Weaning, and Stable Isotope Analysis**

#### ACTIVITIES:

- Student presentations in Anthropology 341
  - Assignment 1: Presentation DUE at 3:05 pm on Tuesday, March 24, 2009
- Class discussion in Anthropology 341

#### REQUIRED READINGS (ASM 494):

- Ambrose SH (2006) ANTHROPOLOGY: Enhanced: A Tool for All Seasons. *Science* **314**: 930-931.
- Jahren, AH and Kraft, RA (2008). Carbon and Nitrogen Stable Isotopes in Fast Food: Signatures of Corn and Confinement. *Proceedings of the National Academy of Sciences* **105**(46): 17855-17860.
- Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 8 and 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.
- Richards MP, Fuller BT, and Hedges REM (2001) Sulphur Isotopic Variation in Ancient Bone Collagen from Europe: Implications for Human Paleodiet, Residence Mobility, and Modern Pollutant Studies. *Earth and Planetary Science Letters* **191**:185-190.
- Richards MP, Mays S, and Fuller BT. 2002. Stable Carbon and Nitrogen Isotope Values of Bone and Teeth Reflect Weaning Age at the Medieval Wharram Percy Site, Yorkshire, UK. *American Journal of Physical Anthropology* **119**:205-210.
- White CD (2005) Gendered Food Behaviour among the Maya: Time, Place, Status and Ritual. *Journal of Social Archaeology* **5**:356-382.

#### REQUIRED READINGS (ASM 591):

- Ambrose SH (2006) ANTHROPOLOGY: Enhanced: A Tool for All Seasons. *Science* **314**: 930-931.
- Jahren, AH and Kraft, RA (2008). Carbon and Nitrogen Stable Isotopes in Fast Food: Signatures of Corn and Confinement. *Proceedings of the National Academy of Sciences* **105**(46): 17855-17860.
- Lee-Thorp J and Sponheimer M (2006) Contributions of Biogeochemistry to Understanding Hominin Dietary Ecology. *American Journal of Physical Anthropology* **131**: 131-148.
- Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapters 8 and 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.
- Richards MP, Fuller BT, and Hedges REM (2001) Sulphur Isotopic Variation in Ancient Bone Collagen from Europe: Implications for Human Paleodiet, Residence Mobility, and Modern Pollutant Studies. *Earth and Planetary Science Letters* **191**:185-190.
- Richards MP, Mays S, and Fuller BT. 2002. Stable Carbon and Nitrogen Isotope Values of Bone and Teeth Reflect Weaning Age at the Medieval Wharram Percy Site, Yorkshire, UK. *American Journal of Physical Anthropology* **119**:205-210.
- Sponheimer M, Passey BH, de Ruiter DJ, Guatelli-Steinberg D, Cerling TE and Lee-Thorp, JA. (2006) Isotopic Evidence for Dietary Variability in the Early Hominin *Paranthropus robustus*. *Science* **314**: 980-982.

White CD (2005) Gendered Food Behaviour among the Maya: Time, Place, Status and Ritual. *Journal of Social Archaeology* 5:356-382.

Wright LE, and Schwarcz HP. 1998. Stable Carbon and Oxygen Isotopes in Human Tooth Enamel: Identifying Breastfeeding and Weaning in Prehistory. *American Journal of Physical Anthropology* 106:1-18.

**RECOMMENDED READINGS (ASM 591):**

Wright LE (2006) *Diet, Health, and Status among the Pasión Maya: A Reappraisal of the Collapse*. Nashville, TN: Vanderbilt University Press.

**WEEK 11, March 31: AAPAs in Chicago**

**ACTIVITIES:**

- Work on Assignment 5
- Laboratory work on final projects

**WEEK 12, April 7: Trace Element Concentrations: Paleodiet, Residential Mobility, and Disease**

**ACTIVITIES:**

- Assignment 3: Paleodiet DUE at 3:40 pm on Tuesday, April 7, 2009
- Class discussion in Anthropology 341
- Laboratory training in trace element analysis in Anthropology 303

**REQUIRED READINGS (ASM 494):**

Aufderheide, A. C., J. L. Angel, et al. (1985). "Lead in Bone III: Prediction of Social Correlates from Skeletal Lead Content in Four Colonial American Populations (Catoctin Furnace, College Landing, Governor's Land, and Irene Mound)." *American Journal of Physical Anthropology* 66(4): 353-361.

Ezzo JA (1994) Putting the 'Chemistry' Back Into Bone Chemistry Analysis: Modeling Potential Dietary Indicators. *Journal of Anthropological Archaeology* 13:1-34.

Mays, S. 2003. Bone Strontium: Calcium Ratios and Duration of Breastfeeding in a Mediaeval Skeletal Population. *Journal of Archaeological Science* 30(6):731-741.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapter 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

Rasmussen, K. L., J. L. Boldsen, et al. (2008). Mercury Levels in Danish Medieval Human Bones. *Journal of Archaeological Science* 35(8): 2295-2306.

**REQUIRED READINGS (ASM 591):**

Aufderheide, A. C., J. L. Angel, et al. (1985). "Lead in Bone III: Prediction of Social Correlates from Skeletal Lead Content in Four Colonial American Populations (Catoctin Furnace, College Landing, Governor's Land, and Irene Mound)." *American Journal of Physical Anthropology* 66(4): 353-361.

Burton JH, and Price TD (2000) The Use and Abuse of Trace Elements for Paleodietary Research. In SA Ambrose and MA Katzenberg (eds.): *Biogeochemical Approaches to Paleodietary Analysis*. New York: Kluwer Academic/ Plenum Publishers, pp. 159-171.

Burton, J. H., Price, T. D., Cahue, L. and Wright, L. (2003). The Use of Barium and Strontium Abundances in Human Skeletal Tissues to Determine their Geographic Origins. *International Journal of Osteoarchaeology* 13: 88-195.

Ezzo JA (1994) Putting the 'Chemistry' Back Into Bone Chemistry Analysis: Modeling Potential Dietary Indicators. *Journal of Anthropological Archaeology* 13:1-34.

Humphrey, L.T., et al. 2008. Unlocking Evidence of Early Diet from Tooth Enamel. *Proceedings of the National Academy of Sciences* 105(19):6834-6839.

Mays, S. 2003. Bone Strontium: Calcium Ratios and Duration of Breastfeeding in a Mediaeval Skeletal Population. *Journal of Archaeological Science* 30(6):731-741.

Pollard, AM, Batt CM, Stern B and Young SMM 2007. Chapter 9 in *Analytical Chemistry in Archaeology*, Cambridge University Press, New York.

Rasmussen, K. L., J. L. Boldsen, et al. (2008). Mercury Levels in Danish Medieval Human Bones. *Journal of Archaeological Science* 35(8): 2295-2306.

Sillen A, Sealy JC, and van der Merwe NJ (1989) Chemistry and Paleodietary Research: No More Easy Answers. *American Antiquity* 54:504-512.

**WEEK 13, April 14: Final Projects**

**ACTIVITIES:**

- Laboratory work on final projects in Anthropology 303

**WEEK 14, April 21: SAAs in Atlanta**

ACTIVITIES:

- Assignment 4: Trace Elements DUE at 3:40 pm on Tuesday, April 21, 2009
- Work on Assignment 5
- Laboratory work on final projects in Anthropology 303

**WEEK 15, April 28: Final Projects**

ACTIVITIES:

- Laboratory work on final projects in Anthropology 303

**WEEK 16, May 5: Last day of classes**

ACTIVITIES:

- Class discussion and student evaluations in Anthropology 341
- Assignment 5: Essay DUE at 3:40 pm on Tuesday, May 5, 2009
- Final paper DUE at 3:40pm on Tuesday, May 5, 2009