Ruth Ann Armitage
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EDUCATION

PhD	Analytical chemistry, Texas A&M University, College Station, Texas, USA Dissertation title: Radiocarbon dating of charcoal-pigmented rock paintings Supervisor: Marvin W. Rowe	1998
BA	Chemistry, Thiel College, Greenville, Pennsylvania, USA Graduated Summa cum laude with Chemistry Departmental Honors Senior Orator, Dean's Key and Medal (for Dean's List all four years)	1993

POSITIONS HELD

Since 2011	Professor of Chemistry (full)
2014-2015	Visiting Researcher, University of Oxford, Research Laboratory for Archaeology and the History of Art
2006-2011	Associate professor (tenured), Department of Chemistry, EMU
2001-2006	Assistant professor, Department of Chemistry, EMU
1998-2001	Assistant professor, Department of Chemistry, St. Mary's College of Maryland, St. Mary's City, MD
1993-1998	Laboratory instructor, Department of Chemistry, Texas A&M University
1990-1993	Laboratory assistant, Department of Chemistry, Thiel College
1992	Summer researcher, Archaeological Field Workshop, Wolf Creek site (36BT82), Slippery Rock (PA) University, E. Skirboll, director.

GRANTS AND FUNDING

Principal Investigator Awards

National Science Foundation (NSF) Research at Undergraduate Institutions, Archaeometry, 2019, Award #1917310. "RUI: Evaluating the Limits and Capabilities of Plasma Chemical Oxidation for Accelerator Mass Spectrometric Radiocarbon Dating in Archaeology", $122,630.

NSF Major Research Instrumentation: Recovery and Reinvestment, Office of Integrative Activities, 2009, Award #0959621. "MRI-R2: Acquisition of a High-Resolution Time-of-Flight Mass Spectrometer for Research and Education", $207,708.

Collaborative Grant Funding

"Audace" Fonds de Recherch Société et Culture Quebec Grant, "DARQ : Dater l'Art Rupestre au Québec [Dating the Rock Art of Quebec], Principal investigators L. Paul Bédard and Erik Langevin, University of Quebec-Chicoutimi, CDN$99,999.

MU Materials Science and Engineering Institute seed funding program, "Novel Applications of FIB-SEM ToF-SIMS for Archaeological Chemistry", Principal investigator Brandi MacDonald, University of Missouri, $40,000.

Internal Funding

College of Arts & Sciences Dean's Faculty Professional Development Award, $3,600, 2020-21. $3,740, 2021-22.

James H. Brickley Endowment for Faculty Professional Development Award, $3,500, 2020-21.

Faculty Research Fellowship, EMU Provost's Office, $2000-$3000 and 12 hours of released time for research in each of the following academic years: 2021-22, 2019-20, 2017-18, 2015-16, 2013-14, 2011-12, 2009-10, 2006-07, 2004-05

Sabbatical Leave, $12,000 to support salary and research for a 2014-15 full-year leave at Research Laboratory for Archaeology and the History of Art at the University of Oxford.

Provost's Research Support Award, annual awards from 2012-present at ~$1500-$3000 each.

Sellers' Research Fund Grant, Eastern Michigan University Chemistry Department: approx. $77,000 over 19 years

HONORS AND AWARDS

Research Release, Fall 2022 through Winter 2027

Full Professor Salary Adjustment, Fall 2021

Culture of Research Excellence (CoRE) program, EMU Office of Research Development and Administration, Winter 2019

Nominated for the William Fennel Symposium Faculty Research Mentor Award, 2016

Sarah H. Huyvaert Research Mentor Award, McNair Scholars Program, 2014

Ronald W. Collins Distinguished Faculty Award, Research II, 2011.

Young Alumna Award, Thiel College, 2002.

Graduate Awards

Graduate Student Council 1997 Research Competition, First Place paper, Physical Sciences; U.S. Department of Education Graduate Assistantship in Areas of National Need Fellowship, 1994-97; Graduate Student Council Second Annual All-University Research Poster Competition, Third Place poster, Social Science/Humanities, 1995; Industry-University Cooperative Chemistry Program (IUCCP) Fellowship, 1993-94; Welch Fellowship, 1993-94

Undergraduate Awards

American Institute of Chemists Award, 1993; Irene Wintersteen Memorial Science Scholarship, 1992; Sigma Xi Richard L. Brown Award for Best Research Presentation, April 1992; Society of Analytical Chemists of Pittsburgh 1992 College Chemistry Award; ACS Penn-Ohio Border Section Junior Award, 1992; Undergraduate Award for Achievement in Organic Chemistry, 1991; Alpha Chi National Honorary (National Convention Theta Chapter Delegate 1993); Cary F. Yelin Award in Analytical Chemistry, 1991; ACS Student Affiliate Chapter Sophomore Award, 1991; CRC Press Freshman Chemistry Achievement Award, 1990; William A. Passavant Scholarship, 1989-1993

TEACHING EXPERIENCE

Eastern Michigan University, Ypsilanti, MI, USA — September 2001 to present
Assistant/Associate/Full Professor, Department of Chemistry — **9 contact hour teaching load (3/3)**

- Instrumental Analysis, lecture and laboratory, classes of 5-15 students per semester. Atomic and molecular spectroscopy, electrochemistry, chromatography, and mass spectrometry.
- Introductory Analytical/Quantitative Analysis, lecture (2 hours) and laboratory (6 hours), classes of up to 50 students per semester. Measurement basics, wet chemical methods, basic spectroscopy and a brief introduction to separations.
- Advanced Analytical Chemistry, graduate-level lecture, 10-25 students. In-depth applications of analytical chemistry methods including X-ray spectroscopies, Raman spectroscopy, radiometric dating of geologic and archaeological materials, surface analytical methods, and protein mass spectrometry.
- General Chemistry I and II, both lectures (3 hours) and laboratories (3 hours), up to 60 students per semester. Stoichiometry, periodicity, atomic and molecular structure and bonding, chemical equilibrium, kinetics, thermodynamics, gas laws, and electrochemistry.
- Archaeological Chemistry, graduate-level lecture, 6-12 students. All aspects of analytical chemistry as applied to questions in archaeology, following the RSC-published textbook, *Archaeological Chemistry*, now in a 3rd edition of which I am a co-author.
- Chemistry Seminar, graduate-level required lecture, approximately 10 students. How to prepare oral presentations as relevant to completing a research thesis.
- Introduction to Scientific Writing, graduate-level required lecture, approximately 6 students. Introduces students to the scientific literature relevant to their thesis projects and guided them in preparing a draft thesis introduction.

Masters Students Supervised, all in Chemistry

Current students, Fall 2022
Jeffrey Bond Clarneisha Burnside Haleigh Grewahn

- Chelsea Van Buskirk, M.S., thesis. "Molecular Analysis of Residue from an Egyptian Old Kingdom Mummy", August 2022
- Samantha Mahan, M.S., thesis. "Compositional Residue Analyses of a Collection of Greco-Roman Unguentaria: Identifying Scents of the Past", August 2022
- Jennifer Campos Ayala, M.S., thesis. "Purple Dyes from the Carlos Museum Pre-Columbian Textiles Collection: Direct Mass Spectrometry and HPLC Analyses", August 2019
- Christina Varney, M.S., thesis. "Characterizing Organic Colorants in Mock-Ups of a 15th-Century Iranian Timurid Qur'an by Direct Analysis in Real Time Time-of-Flight Mass Spectrometry", December 2013
- Badrinath Dhakal, M.S., thesis. "Carbohydrates in Rock Paintings: Development of GC-MS Methods", August 2011
- Ran Li, M.S., thesis. "Characterization of the Binders in the Rock Art of Cueva La Conga, Nicaragua", August 2010
- Joslyn Kirkland, M.S., thesis. "ATR-FTIR Studies of Plasma-Oxidized Surfaces: Implications for 'Nondestructive' Radiocarbon Dating", April 2009
- Mary Ellen Ellis, M.S., thesis. "The Development of a Novel and Potentially Nondestructive Pretreatment for the Radiocarbon Dating of Archaeological Artifacts", July 2008
- Jamie Brown, M.S., thesis. "Characterization of a Black Coating Overlying Rock Paintings Found in Little Lost River Cave, Idaho Using THM-GC-MS", June 2007
- Reshmi Perumplavil, M.S., thesis. "Surface Analysis of Rock Painting Samples Using X-ray Photoelectron Spectroscopy", June 2006
- Sarah Fezzey, M.S., thesis. "Characterization of Black Deposits Associated with the Little Lost River Cave Rock Paintings Using Pyrolysis GC-MS", December 2005

Non-thesis students: Sylvia Torres, August 2019; Steven Augustin, August 2016; Brenan Wilson, 2021

Undergraduate Research Students Advised

Imani Peterkin Alexandria Parsons

Former EMU students

Samantha Mahan	Chelsea Van Buskirk	Bennet Dunstan	Christin Nieman
Andrew Bower	Tara Fairchild	Precious Humphrey	David Bailey
Michaela Repaska	Sylvia Torres	Calvin Day	John Hopkins
Jordyn Geiger	Payge Shelton	Landrea Standfield	Jennifer Bates
Geneve Maxwell	William Malcolm	Andrew Livingston	Melissa Doolin
Janine Luesing	Deidre Hardemon	Christina Phillips	Christina Dean
Caitlin Van De Car	Khizer Sikander	Michael Dulbs	Tiffany Drane
Nan Houser	Zachary Pyles	Qiana Wilson	Tammy Worden
Carré Zalma	Susan Lesko	Michael Pratt	

St. Mary's College of Maryland, St. Mary's City, MD, USA September 1998 to May 2001
Assistant Professor, Department of Chemistry 12 contact hour teaching load (4/4)

Courses taught: Instrumental Analysis, Quantitative Analysis, General Chemistry I and II, Forensic Chemistry (undergraduate-level special topics lecture, to a groups of 8 students), Contemporary Chemistry (chemistry course for non-science majors, to classes of approximately 30 students, sometimes with laboratory)

Undergraduate Research Students Advised (St. Mary's Project Capstones)

Kathleen Crowley	Amy Leis Fowler	Jennifer Frahm	Preeya Kapur
Michelle Pignone	Ronald Thomas	Tori Seith	

PUBLICATIONS

Books

Armitage, R.A.; Fraser, D.M. (Eds.) *Chemistry in the Service of Archaeology*. ACS Symposium Series, in progress, 2023.

Pollard, A.M.; Armitage, R.A.; Makarewicz, C.M. (Eds.) *Handbook of Archaeological Sciences*. (2nd revised ed.). Wiley: Chichester. In press 2023.

Pollard, A.M.; Heron, C.; Armitage, R.A. *Archaeological Chemistry*, 3rd edition. Royal Society of Chemistry, 2017. ISBN 978-1-78262-426-4.

Armitage, R. A.; Burton, J. H. *Archaeological Chemistry VIII*. American Chemical Society: Washington, D.C., 2013.

Lang, P. L.; Armitage, R. A. *Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials*. American Chemical Society: Washington, DC, 2012; Vol. 1103.

Journal Articles **(student co-authors underlined)**

Campos Ayala, J.; Mahan, S.; Wilson, B.; Jakes, K.; Antúnez de Mayolo, K.; Stein, R.; Armitage, R. A., Characterizing the Dyes of Pre-Columbian Andean Textiles: Comparison of Ambient Ionization Mass Spectrometry and HPLC-DAD. *Heritage,* **2021**, *4*(3), 1639-1659. https://doi.org/10.3390/heritage4030091.

Armitage, R. A.; Arrazcaeta Delgado, R.; Torres, S.; Baker, S.; Fraser, D. Chemical Characterization and Radiocarbon Dating of the Rock Art of Las Charcas Caves, Cuba. *Archaeometry***, 2021,** *63* (4), 878-892. https://doi.org/10.1111/arcm.12639

Armitage, R. A.; Bueno-Ramírez, P.; de Balbín-Behrmann, R.; Martineau, R.; Carrera-Ramírez, F.; Fairchild, T.; Southon, J. Charcoal Painted Images from the French Neolithic Villevenard Hypogea: An Experimental Protocol

for Radiocarbon Dating of Conserved and In-situ Carbon with Consolidant Contamination. *Archaeological and Anthropological Sciences* **2020,** *12*, 123. https://doi.org/10.1007/s12520-020-01077-3

Kaktins, M.; Marquis, M.; Fraser, D.; Armitage, R. A., Mary Washington's Repaired Ceramics: Experimental Archaeology and Chemical Analysis. *Northeast Historical Archaeology*, **2019,** *48*, 96-110. (Invited, Special issue: Archaeology of Fredericksburg, VA).

Armitage, R. A.; Fraser, D.; Bonaduce, I.; Colombini, M. P., Analysis of the Saltzman Collection of Peruvian Dyes by Ambient Ionzation Mass Spectrometry and High Performance Liquid Chromatography. *Heritage Science* **2019**, *7,* 81. https://doi.org/10.1186/s40494-019-0319-1

Williams, P.R.; Nash, D. J.; Henkin, J.M.; Armitage, R.A. Archaeometric Approaches to Defining Sustainable Governance: Wari Brewing Traditions and the Building of Political Relationships in Ancient Peru. *Sustainability* **2019**, *11*, 2333. (Invited, Special issue: Natural Sciences in Archaeology and Cultural Heritage). https://doi.org/10.3390/su11082333

Armitage, R. A.; Jakes, K. A., Sequencing Analytical Methods for Small Sample Dating and Dye Identification of Textile Fibers: Application to a Fragment from Seip Mound Group, Ohio. *Midcontinental Journal of Archaeology* **2015,** *20* (1), 1-15. https://doi.org/10.1179/2327427115Y.0000000009

Armitage, R. A.; Jakes, K. A.; Day, C. J., Direct Analysis in Real Time-Mass Spectroscopy for Identification of Red Dye Colorants in Paracas Necropolis Textiles. *Science and Technology in Archaeological Research* **2015,** *1* (2). https://doi.org/10.1179/2054892315Y.0000000009

Armitage, R. A.; Day, C. J.; Jakes, K. A., Identification of Anthraquinone Dye Colorants in Red Fibers from an Ohio Hopewell Burial Mound by Direct Analysis in Real Time Mass Spectrometry. *Science and Technology in Archaeological Research* **2015,** *1* (2). https://doi.org/10.1179/2054892315Y.0000000010

Ruuska, A. K.; Armitage, R. A., Spider Man Cave: The Desecration of the Burnt Bluff Cultural Site and its Implications for Future Heritage Management. *Wisconsin Archaeologist* **2015,** *96* (1), 27-44.

Baker, S.; Armitage, R. A., Cueva la Conga: First Karst Cave Archaeology in Nicaragua. *Latin American Antiquity* **2013,** *24* (3), 309-329. https://doi.org/10.7183/1045-6635.24.3.309

Fraser, D.; Selvius DeRoo, C.; Cody, R. B.; Armitage, R. A., Characterization of blood in an encrustation on an African mask: spectroscopic and direct analysis in real time mass spectrometric identification of haem. *Analyst* **2013,** *138*, 4470-4474. https://doi.org/10.1039/C3AN00633F

Ruiz López, J. F.; Hernanz, A.; Armitage, R. A.; Viñas, R.; Gavira-Vallejo, J. M.; Rowe, M. W.; Rubio, A.; Gavrilenko, E.; Guilderson, T. A., Calcium oxalate AMS ^{14}C dating and chronology of post-Paleolithic rock paintings in the Iberian Peninsula. Two dates from Abrigo de los Oculados (Henarejos, Cuenca, Spain). *J. Archaeol. Sci.* **2012,** *39* (8), 2655-2667. https://doi.org/10.1016/j.jas.2012.02.038

Selvius DeRoo, C.; Armitage, R. A., Direct Identification of Dyes in Textiles by Direct Analysis in Real Time-Time of Flight Mass Spectrometry. *Anal. Chem.* **2011,** *83* (18), 6924. https://doi.org/10.1021/ac201747s

Livingston, A.; Robinson, E.; Armitage, R. A., Characterizing the binders in rock paintings by THM-GC–MS: La Casa de Las Golondrinas, Guatemala, a cautionary tale for radiocarbon dating. *Int. J. Mass Spec.* **2009,** *284* (1-3), 142-151. https://doi.org/10.1016/j.ijms.2008.12.008

Fezzey, S.; Armitage, R. A., Pyrolysis GC/MS and THM-GC/MS studies of a black coating from Little Lost River Cave, Idaho. *J. Anal. Appl. Pyrolysis* **2006,** *77*, 102–110. https://doi.org/10.1016/j.jaap.2006.02.005

Armitage, R. A.; Minc, L.; Hill, D. V.; Hurry, S. D., Characterization of bricks and tiles from the 17th-century brick Chapel, St. Mary's City, Maryland. *J. Archaeol. Sci.* **2006,** *33* (5), 615-627. https://doi.org/10.1016/j.jas.2005.09.016

David, B.; Armitage, R. A.; Rowe, M. W.; Lawson, E., Landscapes in Transition? New Radiocarbon Dates on Cave Drawings from the Mitchell-Palmer Limestone Belt (Northeastern Australia). *American Indian Rock Art* **2001,** *27*, 106-116.

Armitage, R. A.; Brady, J. E.; Cobb, A.; Southon, J. R.; Rowe, M. W., Mass spectrometric radiocarbon dates from three rock paintings of known age. *Am. Antiq.* **2001,** *66* (3), 471-480. https://doi.org/10.2307/2694245

Armitage, R. A.; Hyman, M.; Rowe, M. W.; Loendorf, L. L.; Southon, J. R., Dated Rock Paintings at Red Cliffs, Arizona. *The Kiva* **2000,** *65* (3), 253-266.

Hyman, M.; Sutherland, K.; Armitage, R. A.; Southon, J.; Rowe, M. W., Radiocarbon analyses of rock paintings: Hueco Tanks, Texas. *Rock Art Research* **1999,** *16* (2), 75-88.

David, B.; Armitage, R. A.; Hyman, M.; Rowe, M. W.; Lawson, E., How old is north Queensland's rock-art? A review of the evidence, with new AMS determinations. *Archaeology in Oceania* **1999,** *34*, 103-120. https://doi.org/10.1002/j.1834-4453.1999.tb00441.x

Armitage, R. A.; David, B.; Hyman, M.; Rowe, M. W.; Tuniz, C.; Lawson, E.; Jacobsen, G.; Hua, Q., Radiocarbon Determinations for Chillagoe Rock Paintings: Small Sample AMS. *Records of the Australian Museum* **1998,** *50* (3), 285-292. https://doi.org/10.3853/j.0067-1975.50.1998.1287

Armitage, R. A.; Hyman, M.; Southon, J.; Barat, C.; Rowe, M. W., Rock art image at Fern Cave, Lava Beds National Monument, California: not the A.D. 1054 supernova. *Antiquity* **1997,** *71* (273), 715-719. https://doi.org/10.1017/S0003598X00085446

Book Chapters

Armitage, R. A., Bonneau, A. Rock Paintings. In *Encyclopedia of Geoarchaeology*, Gilbert, A. S., Ed. Springer Netherlands: Dordrecht, In press, 2022.

Armitage, R. A.; Makarewicz, C.; Pollard, M. Shifting into a Higher Gear: Proteins, Small Molecules, and the Rise of Mass Spectrometry. In *Handbook of Archaeological Science* (2nd revised ed.), Pollard, A. M.; Armitage, R. A.; Makarewicz, C., Eds. Wiley: Chichester, In press, 2022.

Milek, K.; Heron, C.; Amitage, R. A.; Manoukian, N., Geochemical Prospection and the Identification of Site Activity Areas. In *Handbook of Archaeological Science* (2nd revised ed.), Pollard, A. M.; Armitage, R. A.; Makarewicz, C., Eds. Wiley: Chichester, In press, 2022.

Baldia, C. M.; Armitage, R. A., Archaeological Textiles as Secondary Plant and Animal Products. In *Handbook of Archaeological Science* (2nd revised ed.), Pollard, A. M.; Armitage, R. A.; Makarewicz, C., Eds. Wiley: Chichester, In press, 2022.

Armitage, R. A., Gas Chromatography. In *Encyclopedia of Geoarchaeology*, Gilbert, A. S., Ed. Springer Netherlands: Dordrecht, 2022.

Bonneau, A.; Armitage, R. A., Chapitre 10: Datation par le radiocarbone des restes osseux calcinés : une première tentative au Québec sur les carbonates de calcium, in C. Chapdelaine and E. Graillon (eds.), *Kruger 2: un site du Paléoindien récent à Brompton*, Collection Paléo-Québec no 39, Recherches amérindiennes au Québec: Quebec City, 2021; pp 219-230.

Armitage, R. A., Chemistry in Archaeology. In *The Encyclopedia of Archaeological Sciences*, López Varela, S. L., Ed. Wiley, 2018. https://doi.org/10.1002/9781119188230.saseas0087

Armitage, R. A., Gas Chromatography. In *Encyclopedia of Geoarchaeology*, Gilbert, A. S., Ed. Springer Netherlands: Dordrecht, 2017; pp 287-292.

Kaktins, M.; Marquis, M.; Armitage, R. A.; Fraser, D., Mary Washington's Mended Ceramics: A Study of Eighteenth-Century Glues. In *Ceramics in America*, Hunter, R., Ed. Chipstone Foundation: 2016.

DeRoo, C. S.; Armitage, R. A., Analysis of Organic Dyes in Textiles by Direct Analysis in Real Time–Time-of-Flight Mass Spectrometry. In *Textile Specialty Group Postprints*, 2014; Vol. 24, pp 113-115.

Fraser, D.; Kaktins, M.; Armitage, R. A., 18th-Century Glue Recipes: Towards Identifying Glue Residues from Ferry Farm, George Washington's Boyhood Home. In *Archaeological Chemistry VIII*, Armitage, R. A.; Burton, J. H., Eds. American Chemical Society: 2013; Vol. 1147, pp 109-121.

Dhakal, B.; Armitage, R. A., GC-MS Characterization of Carbohydrates in an Archaeological Use Residue: A Case Study from the Coahuila Desert. In *Archaeological Chemistry VIII*, Armitage, R. A.; Burton, J. H., Eds. American Chemical Society: 2013; Vol. 1147, pp 157-170.

Day, C. J.; Selvius DeRoo, C.; Armitage, R. A., Developing Direct Analysis in Real Time Time-of-Flight Mass Spectrometric Methods for Identification of Organic Dyes in Historic Wool Textiles. In *Archaeological Chemistry VIII*, Armitage, R. A.; Burton, J. H., Eds. ACS: Washington, DC, 2013; Vol. 1147, pp 69-85.

Li, R.; Baker, S.; DeRoo, C. S.; Armitage, R. A., Characterization of the Binders and Pigments in the Rock Paintings of Cueva la Conga, Nicaragua. In *Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials*, Lang, P. L.; Armitage, R. A., Eds. American Chemical Society: 2012; Vol. 1103, pp 75-89.

Hopkins, J.; Armitage, R. A., Characterizing Organic Residues on Ceramics by Direct Analysis in Real Time Time-of-Flight Mass Spectrometry. In *Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials*, Lang, P. L.; Armitage, R. A., Eds. American Chemical Society: 2012; Vol. 1103, pp 131-142.

Geiger, J.; Armitage, R. A.; Selvius DeRoo, C., Identification of Organic Dyes by Direct Analysis in Real Time-Time of Flight Mass Spectrometry. In *Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials*, Lang, P. L.; Armitage, R. A., Eds. American Chemical Society: 2012; Vol. 1103, pp 123-129.

Armitage, R. A.; Ellis, M. E.; Merrell, C., New Developments in the 'Nondestructive' Dating of Perishable Artifacts Using Plasma-Chemical Oxidation. In *Collaborative Endeavors in the Chemical Analysis of Art and Cultural Heritage Materials*, Lang, P. L.; Armitage, R. A., Eds. American Chemical Society: 2012; Vol. 1103, pp 143-154.

Armitage, R. A.; Bates, J.; Johnson, A. F.; Lindsay, H., A Creative Scientific Inquiry Experience in Organic Chemistry and Quantitative Analysis: Pharmaceuticals in the River Raisin. In *It's All in the Water: Studies of Materials and Conditions in Fresh and Salt Water Bodies*, Benvenuto, M. A.; Roberts-Kirchhoff, E. S.; Murray, M. N.; Garshott, D. M., Eds. ACS: 2011; Vol. 1086, pp 51-60.

Perumplavil, R.; Armitage, R. A., Surface Analysis of a Black Deposit from Little Lost River Cave, Idaho. In *Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation*, Glascock, M. D.; Speakman, R. J.; Popelka-Filcoff, R. S., Eds. American Chemical Society: Washington, DC, 2007; pp 152-166.

Armitage, R. A.; Minc, L.; Hurry, S. D.; Doolin, M., Characterization of building materials from the brick chapel at Historic St. Mary's City. In *Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation*, Glascock, M. D.; Speakman, R. J.; Popelka-Filcoff, R. S., Eds. ACS: Washington, DC, 2007; pp 364-375.

Armitage, R. A.; Hyman, M.; Rowe, M. W.; Southon, J. R.; Barat, C., Fern Cave Rock Paintings at Lava Beds National Monument, California: Not the AD 1054 Supernova. In *Current Studies in Archaeoastronomy: Conversations Across Time and Space*, Fountain, J.; Sinclair, R. M., Eds. Carolina Academic Press: Durham, N.C., 2005.

Conference Proceedings

Fraser, D.; Armitage, R. A., Clinical test strips for rapid identification of binder materials in rock paintings. In *Proceedings of the 37th International Symposium on Archaeometry*, Turbanti-Memmi, I., Ed. Springer: Berlin, 2011; pp 205-210.

Robinson, E.; Garnica, M.; Armitage, R. A.; Rowe, M. W. Los fechamientos del arte rupestre y la arqueología en la Casa de las Golondrinas, San Miguel Dueñas, Sacatepéquez. In *XX Simposio de Investigaciones Arqueológicas en Guatemala, 2006*, Laporte, J. P.; Arroyo, B.; Mejía, H., Eds. Museo Nacional de Arqueología y Etnología, Guatemala: 2007; pp 1193-1212.

Armitage, R. A.; Minc, L.; Hill, D. V.; Hurry, S. D., Characterization of Bricks and Tiles from 17th-Century Maryland. In *Proceedings of the 34th International Symposium on Archaeometry*, Perez-Arantegui, J., Ed. Institucion ‹‹Fernando el Catolico››: Zaragoza, Spain, 2006; pp 387-392.

Armitage, R. A.; Hyman, M.; Rowe, M. W., Plasma-chemistry for dating pictographs by AMS. In *Advances in Dating Australian Rock-markings: Papers from the First Australian Rock-Picture Dating Workshop*, Ward, G.; Tuniz, C., Eds. Australian Rock Art Research Association, Melbourne (Australia): Lucas Heights, Australia, 2000.

Publications in preparation

Arrazcaeta Delgado, R.; Baker, S. M.; Armitage, R. A.; Fraser, D. The Rock Art of Cuba: Radiocarbon Dating and Cultural Inferences. *Latin American Antiquity*, in preparation, 2022.

INVITED RESEARCH PRESENTATIONS (SEE COMMUNITY SERVICE FOR PRESENTATIONS TO ACS LOCAL SECTIONS AND OTHER COMMUNITY GROUPS)

"Ambient ionization mass spectrometry for the characterization of textile dyes from ancient Peru," Analytical Chemistry seminar series, Wayne State University, virtual seminar (19 October 2021)

"Archaeological Chemistry at EMU: Combining Chemical Analysis and Radiocarbon Dating," University of Michigan Museum of Anthropological Archaeology Brown Bag Lecture Series, Ann Arbor, MI (17 October 2019)

"Ambient Ionization Mass Spectrometry for Characterizing Archaeological Materials," 63rd International Conference on Analytical Sciences and Spectroscopy, Montreal, QC, Canada (28 June 2019)

"Investigating the Archaeological Chemistry of Everyday Life with Mass Spectrometry," ACS Central Regional Meeting, Midland, MI (6 June 2019).

"Ambient Ionization Mass Spectrometry for Characterizing Cultural Heritage Materials," AAAS National Meeting, Washington DC (15 February 2019), Mass Spectrometry: New Advances in Chemistry, Archeology and Paleontology Symposium organized by Smithsonian Museum Conservation Institute.

"The Fabric of the Past: Archaeological Chemistry of Ancient Textiles," ANACHEM Fall Speaker, Ypsilanti, MI (5 October 2016)

"Colors of the Past: Archaeological Chemistry of Natural Dyes," ACS Fall Scientific Meeting, Saginaw Valley State University, Saginaw, MI (24 October 2015)

"Direct Analysis in Real Time Mass Spectrometry for Characterizing Dyes and Residues" RLAHA Department Seminar, Research Laboratory for Archaeology and the History of Art, University of Oxford, Oxford, UK (5 February 2015)

"Plasma-Chemical Oxidation for Radiocarbon Dating Charcoal Rock Paintings," Gabinete de Arqueología, Oficina de la Historiador de La Ciudad de Habana, Havana, Cuba (June 2014)

"From Charcoal to Textiles: Archaeological Chemistry Research at Eastern Michigan University," 2014 Fryxell Award Symposium: Papers in Honor of Marvin W. Rowe, Society for American Archaeology National Meeting, Austin, TX (April 2014)

"Colors of the Past: Archaeological Chemistry of Natural Dyes," Columbia College Symposium Series, Chicago, IL (April 2014)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis," College of Wooster Chemistry Seminar, Wooster, OH (February 2014)

"Applications of Direct Analysis in Real Time – Time of Flight Mass Spectrometry to Cultural Heritage Materials" Anachem Award Special Session on Ambient Pressure Ionization Methods in Mass Spectrometry, Anachem Symposium, Livonia, MI (November 2012)

"DART-MS Applications for Analysis of Cultural Heritage Materials," Art and Chemistry Symposium, ACS Central Regional Meeting, Indianapolis, IN (June 2011)

"A Chemist's Adventures Outside the Lab: Chemistry and Archaeology of Rock Paintings," Illinois Institute of Technology Sigma Xi Research Day Speaker, Chicago, IL (April 2011)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis," Analytical Seminar, Wayne State University, Detroit, MI (November 2010)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis," Adrian College Chemistry Seminar Series, Adrian, MI (April 2010)

"A 'Nondestructive' Radiocarbon Dating Method for Microgram-Sized Samples," Michigan Archaeological Society Annual Meeting, Lansing, MI (April 2010)

"Cueva La Conga: First Cave Archaeology in Nicaragua," World Cave Archaeology Symposium, 75th Annual Meeting of the Society for American Archaeology, St. Louis, MO (April 2010)

"Plasmas for Radiocarbon Dating Microgram-Sized Samples," University of Michigan Museum of Anthropology Brown Bag Seminar Series, Ann Arbor, MI (November 2009)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis," Illinois Institute of Technology Chemistry Colloquium Series, Chicago, IL (October 2009).

"Radiocarbon Dating and Chemical Characterization of Rock Paintings," FACSS, Louisville, KY (October 2009)

"'Nondestructive' Radiocarbon Dating of Textiles and Perishable Artifacts: A Review of Progress to Date" with M. W. Rowe, part of a special session "Second Impressions: Alternative Methods for Exploring Archaeological Perishables" at the 74th Annual Meeting of the Society for American Archaeology, Atlanta, GA (April 2009).

"Characterization of Organic Matter in Rock Paintings: Binder or Background?" Conservation Science Annual, Eastern Analytical Symposium, Atlantic City, NJ (November 2007).

"Chemistry and Rock Art: Dating and Characterization," Chemistry and Art Symposium, Southeastern Regional ACS Meeting, Greenville, SC (October 2007).

"Radiocarbon Analysis of Rock Paintings," Andrews University Chemistry Department Seminar Series, Benton Harbor, MI (October 2003).

"Characterization of 17th Century Bricks from Historic St. Mary's City, Maryland," Oakland University Chemistry Department Seminar Series, Rochester, MI (March 2003).

"Dating a Rock Artist: Radiocarbon Dating and Chemical Analysis of Rock Paintings," Natural Science and Mathematics Division Colloquium Series, St. Mary's College of Maryland at Historic St. Mary's City (April 2001).

PROFESSIONAL AFFILIATIONS

American Chemical Society
Divisions of Analytical Chemistry and History of Chemistry (Archaeological Chemistry)
Society for Archaeological Sciences (lifetime member)
Society for American Archaeology (associate member)
Sigma Xi, the Scientific Research Society
American Rock Art Research Association
Society for Africanist Archaeology
Mass Spectrometry and Chromatography in Art and Archaeology Working Group

PROFESSIONAL TRAINING

MaSC Workshop on Proteomics in Cultural Heritage, University of Bordeaux, September 2022

Pittcon Short Courses: Scanning and Transmission Based Electron Microscopy and Spectroscopy, 2016; GC-MS Troubleshooting, March 1999

DART-MS training course, JEOL Institute, August 2011

ACS Leadership Institute, Fort Worth, TX, January 2010

Workshop on "Chemistry and Materials Research at the Interface between Science and Art," NSF and the Andrew W. Mellon Foundation, Arlington, VA, July 2009

MaSC Workshop on GC-MS Data Analysis, National Gallery, London, April 2009

PROFESSIONAL SERVICE

Research-oriented service

Symposium organizer, Chemistry in the Service of Archaeology: Materials analysis and Dating, ACS Central Regional Meeting 2022

Co-founder, Michigan Archaeological Sciences Society (MASS), with A.R. Ventresca Miller, University of Michigan

Mentor, Radiocarbon Collaborative, 2018-present

Associate Editor, Archaeological Chemistry, *SAS Bulletin*, 2010-2017

Reviewed grant proposals for NSF and Netherlands Organisation for Scientific Research

Reviewer for ACS Symposium Series on Archaeological Chemistry, 2006 and 2013

Reviewer for *Science Advances, Analytical Chemistry, Analyst, Analytical Methods, PloS ONE, Analytica Chimica Acta, Rapid Communications in Mass Spectrometry, Archaeometry, Journal of Archaeological Science, Archaeological and Anthropological Sciences, Heritage Science, Plains Anthropologist, The Chemical Educator, Molecules, Radiocarbon, Heritage, Chemistry Select, Separations.*

Reviewed book proposals for ACS Books on analytical chemistry, archaeological chemistry, and history of chemistry

Session chair, Anachem Symposium 2017, Academic Research III

Session chair, Anachem Symposium 2015, Graduate Mass Spectrometry Research

Graduate student poster judge, Anachem Symposium, 2021

American Chemical Society Speaker's Bureau participant, 2014-present

Co-chair, 12th Archaeological Chemistry Symposium, ACS National Meeting, April 2013, New Orleans.

Chair, ACS Huron Valley Section, 2011

Panel reviewer, National Science Foundation, May 2011

Email list administrator and newsletter editor, ACS Huron Valley Section, 2010-2014

Chair-elect, ACS Huron Valley Section, 2010. Obtained Innovative Program Grant ($3000) to hold ChemExpo.

Session chair for "Spectroscopy in Cultural Heritage," Eastern Analytical Symposium 2007

Chair, Archaeological Chemistry Symposium, ACS Central Regional Meeting, 2002

Department, College and University service

Interim Graduate Coordinator, Fall 2022 semester (sabbatical replacement)

Distinguished Faculty Awards Committee, 2022

EMU Chemistry Department Instrumental Analysis Course Coordinator, ongoing.

Duties include coordinating maintenance of all instructional-use chemical instrumentation, including HPLC, FTIR, GC, AAS, electrochemistry, spectrofluorimeters and spectrometers as well as Varian GC-MS systems and JEOL AccuTOF-MS research instrumentation; responsible for ordering supplies and equipment; writing and editing of lab manual for instrumental analysis courses.

Panelist, New Faculty Research Orientation, Office of Research Development and Administration, 2019

Chemistry Department representative at Explore Eastern, Fall Major Fest, and Presidential Scholarship Competition Academic Fairs

Chemistry Department Personnel Committee, 2008-2011, 2012-2014 (Chair, 2012-2013 and 2016-17), 2015-2018, 2018-2021, winter 2022 (replacement)

Summer Student Research Initiative Planning Committee, 2014-present

Chemistry Department Graduate Committee, 2018 (sabbatical replacement), 2021-2024

Chemistry Department Seminar coordinator, 2008-2012

Chemistry Department Instruction Committee, 2002-2008

Chemistry Faculty Search Committees, 2003, 2005, 2006, 2008

Chemistry Department Assessment Committee, 2003-2010 (past chair)

COMMUNITY SERVICE AND OUTREACH

American Chemical Society Speaker's Bureau local section presentations:

"Ambient Ionization Mass Spectrometry for Characterizing Archaeological Materials"
ACS Western Carolinas Local Section, Zoom seminar (25 March 2021)
ACS Penn-Ohio Border Local Section, Greenville, PA (18 October 2019)

"Colors of the Past: Archaeological Chemistry of Natural Dyes"
ACS Cleveland Local Section, Cleveland, OH (18 April 2018)
ACS Oklahoma Local Section, Edmond, OK (28 April 2016)
ACS Tulsa Local Section, Tulsa, OK (27 April 2016)
Brewing Chemistry, ACS Detroit Local Section Science Café, Detroit, MI (November 2013)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis"
ACS Kansas Local Section, McPherson, KS (29 April 2016)
ACS Northern Oklahoma Local Section, Ponca City, OK (26 April 2016)
ACS MoKanOk Local Section, Pittsburg, KS (25 April 2016)
ACS Lake Superior Local Section, Duluth, MN (May 2014)
ACS Lexington Local Section, Lexington, KY (October 2013)
ACS Central Arizona Local Section, Phoenix, AZ (May 2013)
ACS Upper Ohio Valley Local Section, Marietta, OH (December 2012)
ACS East Texas Local Section, East Texas Baptist College, Marshall, TX (November 2012)
ACS St. Joseph Valley Section Dinner Meeting, Notre Dame, IN (May 2009).
ACS Chicago Section Dinner Meeting, Chicago, IL (June 2007).
ACS Penn-Ohio Border Section Meeting, Greenville, PA (February 2007).
ACS Detroit Section Meeting, Detroit, MI (January 2007).

"A Chemist's Adventures Outside the Lab: Chemistry and Archaeology of Rock Paintings"
ACS Detroit Local Section/Canadian Institute of Chemistry Awards Banquet, Detroit, MI (May 2011)
ACS Huron Valley Local Section, Eastern Michigan University, Ypsilanti, MI (April 2011)

"Adventures in Chemistry: Dating the Rock Art of Cueva La Conga, Nicaragua," ACS Penn-Ohio Border Section, Thiel College, Greenville, PA (October 2010)

"A 'Nondestructive' Radiocarbon Dating Method for Microgram-Sized Samples," Michigan Archaeological Society Annual Meeting, Lansing, MI (April 2010)

"The Archaeological Dating Game: Radiocarbon, Rock Art and Residues" Brewing Chemistry, ACS Detroit Section Younger Chemists Committee, Detroit, MI (November 2008)

Community outreach presentations

"Your Questions about Vitamins, Drugs and Your Health," Philanthropic Educational Organization, Milan Chapter, Milan, MI (January 2012)

"Archaeological Chemistry: Analyzing the Past"

Huron Valley Chapter of the Michigan Archaeological Society, Ann Arbor, MI (November 2011)
Saginaw Chapter of the Michigan Archaeological Society, Saginaw, MI (October 2011)

"Adventures in Chemistry: Analyzing Ancient Rock Paintings," Philanthropic Educational Organization, Milan Chapter, Milan, MI (March 2010)

"Archaeological Chemistry of Rock Paintings: Radiocarbon Dating and Chemical Analysis," Implications of Science and Technology Group, Institute for Retired Professionals, West Bloomfield, MI (May 2007).

"Dating a Rock Artist: Radiocarbon Dating and Chemical Analysis of Rock Paintings" Evenings with the Professors Program, Asbury-Solomons Community, Solomons Island, MD (April 2001).

Other outreach activities

Volunteer, River Raisin Watershed Council, 2014
Science Magic Show presenter, Peoples Presbyterian Church, July 2014
Presenter, University of Michigan Chemistry Professional Development Organization "Preparing for Life after Graduate School" Workshop, February 2012
Upward Bound Career Day presenter, 2009
CSIE/ISC workshop participant, 2007
"Take Our Daughters to Work Day" leader, 2006
Workshop leader, SummerQuest, "Chromatography in Forensic Analysis", June 2004.
Judge, Spring Arbor Academy Science Fair, April 2003
Participant, EMU Chemistry's "Saturday Morning at the Lab", 2001, 2002, 2003
FTIR demonstrator, Polymers and Coatings Summer Institute and High School Visitation Program, 2002
Judge, 3rd Annual Undergraduate Research Symposium in the Chemical and Biological Sciences, UMBC, 2000
Faculty Advisor, St. Mary's ACS Student Affiliate Chapter (SMACS) and Anime Club, 1998-2000
Judge, St. Mary's County Science and Engineering Fair, 1999

Graduate and undergraduate outreach activities
Judge, Brazos Valley Regional Science and Engineering Fair, 1997-1998
Participant, TAMU National Chemistry Week Open House, 1997
Judge, College Station Junior High School Science Fair, 1995-1997
Judge, Bryan High School Science and Engineering Fair, 1995-1997
President and Vice-president, Thiel College Chapter, ACS-Student Affiliates, 1991-1993
Columnist, Newspaper in Education Science Question Box, Greenville (PA) *Record-Argus*, 1992
Group leader, Chemistry Saturdays for Kids, Thiel College, 1990.

CONFERENCE PRESENTATIONS, EASTERN MICHIGAN UNIVERSITY

Presenter bolded; Students underlined, †graduates, ‡undergraduates. Poster unless otherwise noted.

ACS Central Regional Meeting, Ypsilanti, MI, June 2022

"Plasma-Chemical Oxidation for AMS Radiocarbon Analysis of Plant Fiber Textile Yarns with Copper Carbonate Encrustations" **Imani Peterkin**‡, Brenan Wilson‡, Kathryn Jakes, Ruth Ann Armitage (oral)

"Radiocarbon Dating of Soot Encrustations from Grotte Mandrin: Comparing Plasma-Chemical Oxidation and ABA-Combustion Pretreatment Methods for Sample Preparation" **Ruth Ann Armitage**, Ségolène Vandevelde, Jeffrey Bond‡, Adelphine Bonneau (oral)

"Residue from an Old Kingdom Mummy: A Study on Mummification Practices in Ancient Egypt" **Chelsea L. Van Buskirk**‡, Ruth Ann Armitage, Renee Stein (oral)

"Residue Analysis of Greco-Roman "Perfume" Bottles: A Collection of Double Unguentaria from the Michael C. Carlos Museum" **Samantha J. Mahan**‡, Ruth Ann Armitage, Renee Stein, Maxine Faass (oral)

"Multi-analytical Characterization of Beads from an Andean Inca Chullpa Funerary Assemblage" Adelphine Bonneau, Heather Walder, Benjamin Carter, Ruth Ann Armitage, **William A. Lovis** (oral)

"Comparing Combustion and Plasma-Chemical Oxidation Sample Preparation for AMS Radiocarbon Analysis of Known-age Materials" **Jeffrey Bond**‡, Adelphine Bonneau, and Ruth Ann Armitage (oral)

"Detection and Identification of Possible Tobacco Residues in Burnt Crusts on Hopewell Pottery from the Lower Illinois River Valley" **Clarneisha Burnside**‡, Kenneth Farnsworth, Colt Graves, G. Logan Miller, Ruth Ann Armitage (oral)

43rd International Symposium on Archaeometry, Lisbon, Portugal, May 2022

"Minimally-destructive Plasma Oxidation and AMS Radiocarbon Dating of Archaeological Textile Fragments from the Seip Mound Complex, Ohio" **R. A. Armitage**, I. Peterkin‡,, B. Wilson†, M. Repaska‡, K. Jakes, J. Southon.

"Characterization of Glue Recipes from Colonial America: Further Studies of Repaired Ceramics from Ferry Farm" **D. Fraser**, R. A. Armitage, M. Kaktins, M. Marquis.

"Method Development and Validation of AMS Radiocarbon Analysis of Microsamples with Plasma-Chemical Oxidation" **Imani Peterkin**‡, Brenan Wilson†, and Ruth Ann Armitage (virtual poster)

"Scents of the Past: Characterizing Ancient Perfume Residues of the Greco-Roman Age from the Michael C. Carlos Museum" **Samantha J. Mahan**‡, Ruth Ann Armitage, Renée Stein, and Maxine Faas (virtual poster)

"Characterization of Residue from an Egyptian Old Kingdom Mummy from the Michael C. Carlos Museum" **Chelsea Van Buskirk**‡, Renée Stein, and Ruth Ann Armitage (virtual poster)

Dyes in History and Archaeology 40, London, UK, November 15-19, 2021 (virtual)

"Widening the South American dyes database: flavonoid and lichen dyes from Antúnez de Mayolo reference collection and case studies from the Bryn Mawr College collection (Pennsylvania, US)" **Ilaria Degano,** Francesca Sabatini, Sara Bonifazi, Ruth Ann Armitage, Jocelyn Alcantara-Garcia (poster/flash talk)

Anachem Symposium, Livonia, MI, November 11, 2021 (in-person meeting)

"Comparison of Plasma Oxidation and Combustion for AMS Radiocarbon Analysis of Known-age Materials" **Jeffrey Bond**‡, Adelphine Bonneau, and Ruth Ann Armitage (poster)

"Plasma Oxidation for AMS Radiocarbon Analysis of Textiles and Rock Paintings" **Imani Peterkin**‡, Brenan Wilson†, and Ruth Ann Armitage (poster)- winner of Best Undergraduate Poster award

"Characterization of Residue from an Egyptian Old Kingdom Mummy from the Michael C. Carlos Museum" **Chelsea Van Buskirk**‡, Renée Stein, and Ruth Ann Armitage (oral)

"Compositional Residue Analysis in Double Unguentaria from the Michael C. Carlos Museum" **Samantha J. Mahan**‡, Ruth Ann Armitage, Renée Stein, and Maxine Faas (oral)

25th Biennial Meeting (Virtual) of the Society of Africanist Archaeologists, September 13, 2021
"Plasma oxidation for AMS radiocarbon dating of rock art: past, present and future for African rock art" **R. A. Armitage**, A. Bonneau, D. Pearce and P. Mitchell (oral presentation)

"Physicochemical and microbiological analyses on East African rock art. An integrated approach from the Borana zone (southern Ethiopia)" **Marina Gallinaro**, Y. Wu, F. Villa, A. Bonneau, R.A. Armitage, T. Solomon, E. Spinapollice and A. Zerboni (oral presentation)

ACS Joint Great Lakes-Central Regional Meeting, June 2021 (online)
"Characterizing ancient perfume residues in the double unguentaria from the Michael C. Carlos Museum" **Samantha Mahan**‡, R. A. Armitage, R. Stein, M. Faass†. Flash talk.

"Plasma oxidation and AMS radiocarbon dating of archaeological textile fragments: Pretreatments for removing contamination" **B. Wilson**‡, R. A. Armitage. Flash talk.

SciX-FACSS Virtual Meeting, October 2020 (held online, mini-oral presentations with poster)
"Characterization and Dating of Archaeological Textile Fragments from the Seip Mound Complex, Ohio" **R. A. Armitage**, M. Repaska‡, B. Wilson‡, K. Jakes.

"Characterization of Glue Recipes from Colonial America: Repairs on Ceramics from Ferry Farm" **D. Fraser**, R. A. Armitage, M. Kaktins, M. Marquis.

"Characterization of Beads from an Andean Inca Chullpa Funerary Assemblage" **A. Bonneau**, H. Walder, R. A. Armitage, W. Lovis.

Pittcon 2020, Chicago, IL, March 2020
"Developing a Process for Identifying the Components of a Mummy 'Resin' with Direct Analysis in Real Time Mass Spectrometry" **C. L. Van Buskirk**‡, R. Stein, and R. A. Armitage.

"Examining the Contents of Ancient 'Perfume' Bottles" **S. Mahan**‡, M. Faass‡, R. Stein, and R. A. Armitage.

"Collaborative Investigation of an Unusual Ancient Andean Textile by Multiple Techniques" **B. Wilson**‡, C. Gonzales‡, **E. Burke**‡, R. Stein, and R. A. Armitage.

Anachem Symposium, Livonia, MI, November 7, 2019
"DART and Paper Spray Mass Spectrometry to Determine the Composition of Dyes and Mordants Used in an Ancient Andean Textile" **B. Wilson**† and R. A. Armitage.

"Fourier Transform Infrared Spectroscopy of Lambayeque Textile Yarns" **E. M. Burke**‡**, J. K. Zoerman**‡, and R. A. Armitage.

"Technical Analysis of a Pre-Columbian Textile: Scanning Electron Microscopy and Energy Dispersive X-ray Spectroscopy for Fiber Morphology and composition" **D. R. Kilgore**‡**, C. L. Van Buskirk**‡, and R. A. Armitage.

ACS Central Regional Meeting 2019, Midland, MI, June 2019
"Characterization of dyes and mordants in archaeological textiles by ambient ionization mass spectrometry" **J. Campos Ayala**† and R. A. Armitage.

"DART-MS for rapid identification of logwood (*Hematoxylum campechianum*) dye: Effects of yarn composition and mordants" **T. Fairchild**‡ and R. A. Armitage.

"Investigating the effects of chemical pretreatments on binding media in rock paintings: Implications for radiocarbon dating" **A. Bower**‡ and R. A. Armitage.

"Ambient ionization mass spectrometry for characterization of historic glue recipes" **D. Fraser** and R. A. Armitage.

Pittcon 2019, Philadelphia, PA, March 2019

"Compositional Analysis and Radiocarbon Dating of the Rock Art of Guara, Cuba" **R. A. Armitage**, and S. Torres†.

"Ambient Ionization Mass Spectrometric Approaches for Analyses of Ancient Textiles" **J. Campos Ayala**† and R. A. Armitage.

"Getting a Good Date: The Effects of Chemical Pretreatments on Rock Art Binding Media and Implications for Radiocarbon Dating" **A. Bower**‡ and R. A. Armitage.

Anachem Symposium, Livonia, MI, November 1, 2018

"Direct Mass Spectrometry and HPLC: A Comparison of Methods for Purple Dyes in Ancient Textiles" **J. Campos Ayala**† and R. A. Armitage. Oral presentation. Winner of best Graduate Student Presentation.

"Chemical Analysis and Radiocarbon Dating of Charcoal Pigments from the Villevenard Hypogeum #21" **T. Fairchild**‡ and R. A. Armitage.

42nd International Symposium on Archaeometry, Mérida, Mexico, May 2018

"Chemical Characterization of the Rock Art of Guara, Cuba: Implications for Radiocarbon Dating" **R. A. Armitage**, S. Torres†, S. M. Baker, R. Arrazcaeta Delgado. Oral presentation.

"Is EDTA the Cure all for Hemastix False Positives? Considering the Chemistry of the Reaction between Tetramethylbenzidine and Heme" **D. Fraser** and R. A. Armitage.

"Paper Spray Mass Spectrometry for Peptide Analysis of Camelid Wools" **D. Bailey**‡ and R. A. Armitage.

"Purple Dyes from the Carlos Museum Pre-Columbian Textiles Collection: Direct Mass Spectrometry and HPLC Analyses" **J. Campos Ayala**†, R. Stein, R. Stone, and R. A. Armitage.

"Orange and Green Dyes from a Pre-Columbian Discontinuous Warp and Weft Textile Fragment: Direct Mass Spectrometry" C. Varney, R. Stein, E. Caris, R. Stone, and **R. A. Armitage**.

ACS Central Regional Meeting, Dearborn, MI, June 2017

"Chemical Analysis and Radiocarbon Dating of Archaeological Textile Fragments from the Seip Mound" **M. Repaska**‡, K. Jakes, and R. A. Armitage.

"Identifying Fibers in South American Paracas Period Mummy Textiles by Peptide Mass Fingerprinting" **D. Bailey**‡, M. Repaska, and R. A. Armitage.

"Mass Spectrometry for Differentiating Blue Dyes in Archaeological Textiles" **P. Humphrey**‡ and R. A. Armitage.

Pittcon 2017, Chicago, IL, March 2017

"Identification of the Contents of a Civil War-Era Bottle" **M. Repaska**‡, K. Gonzales, B. Hatch, and R. A. Armitage.

"Further Studies of Glue Residues on Mended Ceramics from George Washington's Boyhood Home" **D. Fraser**, M. Kaktins, and R. A. Armitage.

"Ambient Mass Spectrometric Characterization of South American Dyes from the Saltzman Collection" **R. A. Armitage** and D. Fraser.

41st International Symposium on Archaeometry, Kalamata, Greece, May 2016

"Peptide Mass Fingerprinting for Identification of Wild Silks in Archaeological Contexts" **R. A. Armitage**.

"Characterization of 17th-Century Glues: Further Studies of Mended Ceramics from George Washington's Boyhood Home" **D. Fraser**, M. Kaktins, and R. A. Armitage.

Pittcon 2016, Atlanta, GA, March 2-6, 2016

"Maximizing the Information Obtained from Small Archaeological Samples by Sequencing DART-MS and Plasma-Chemical Oxidation for AMS Radiocarbon Dating" **R. A. Armitage**, K. Jakes, and S. Baker.

Ohio Archaeological Council Meeting, Columbus, OH, October 2015

"Recent investigations of textiles from Seip Mound Group" **K. Jakes**, J. Cain, and R. A. Armitage.

Joint Great Lakes/Central Regional ACS Meeting, Grand Rapids, MI, May 2015
"Identification of Red Dyes by DART-MS: Examples from North and South American Archaeological Contexts" **R. A. Armitage** and K. Jakes.
"Characterizing 18th-Century Glues on Ceramics from Ferry Farm, George Washington's Boyhood Home" **D. Fraser**, R. A. Armitage, and M. Kaktins
"DART-MS: A Confirmatory Test for Heme in Bloodstains on Fabric" **S. Torres**‡ and R. A. Armitage.
"Natural Anthraquinone Dyes and Dye Mixtures: Microwave Synthesis and Characterization by Direct Analysis in Real Time (DART) Mass Spectrometry" **S. Augustin**†, T. Friebe, and R. A. Armitage.

7th MaSC Meeting, Chicago, IL, May 2015
"Identification of Red Dyes by DART-MS: Examples from North and South American Archaeological Contexts" **R. A. Armitage** and K. Jakes.

40th International Symposium on Archaeometry, Los Angeles, CA, May 2014
"Anthraquinone Dye Colorants in Red Fibers from the Seip Mound, Ohio" K. Jakes, **R. A. Armitage**, and C. Day‡.
"DART-MS for Identification of Dye Colorants in Paracas Textiles" **R. A. Armitage**, K. Jakes, and C. Day‡.
"Rapid Identification of a Blood Encrustation on an African Ritual Mask by DART-MS" **D. Fraser**, C. Selvius DeRoo, R. Cody, S. Torres‡, and R. A. Armitage

42nd Annual Meeting of the American Institute of Conservation of Historic and Artistic Works, San Francisco, CA, May 28-31, 2014
"Analysis of Organic Dyes in Textiles by Direct Analysis in Real Time – Time-of-Flight Mass Spectrometry" **C. Selvius DeRoo** and R. A. Armitage.

Pittcon 2014, Chicago, IL, March 2-6, 2014
"DART-MS Analysis of Historic Tobacco Pipes to Investigate the Preservation of Nicotine Residues" **S. Torres**‡, S. D. Hurry, and R. A. Armitage.

"Identification of Red Dyes in Archaeological Textile Fragments by DART-MS Before and After Sample Cleaning" **C. Day**‡, K. Jakes, and R. A. Armitage.

"DART-MS Applications to the Analysis of Art and Archaeological Materials" **R. A. Armitage**

Anachem Symposium, Livonia, MI, November 7, 2013
"DART-MS Analysis of Historic Tobacco Pipes to Investigate the Preservation of Nicotine Residues" **S. Torres**‡, S. D. Hurry, and R. A. Armitage.
"Identification of Red Dyes in Archaeological Textile Fragments by DART-MS Before and After Sample Cleaning" **C. Day**‡, K. Jakes, and R. A. Armitage.

ACS Spring National Meeting, 12th Archaeological Chemistry Symposium, New Orleans, LA, April 7-11, 2013
"Characterizing Organic Colorants in Mock-ups of a 15th Century Iranian Timurid Qur'an by Direct Analysis in Real Time-Time of Flight Mass Spectrometry" **C. Varney**,† R.A. Armitage, and C. Selvius DeRoo
"Recent Development in Using Direct Analysis in Real Time Mass Spectrometry for Rapid Characterization of Organic Residues on Ceramics" **J. Hopkins**‡ and R.A. Armitage (poster)
"Identification of Organic Dyes in Tapestry Fibers from the Detroit Institute of Arts by Direct Analysis in Real Time Mass Spectrometry" **C. Day**‡, R.A. Armitage, and C. Selvius DeRoo (poster)
"Characterizing Glues from the Mary Ball Washington Collection" **D. Fraser**, R. A. Armitage, and M. Kaktins
"Developments in Ambient Ionization Mass Spectrometry for Analysis of Cultural Heritage Materials" **R. A. Armitage**

Anachem Symposium, Livonia, MI, November 1, 2012
"Characterizing Organic Colorants in Mock-ups of a 15th Century Iranian Timurid Qur'an by Direct Analysis in Real Time-Time of Flight Mass Spectrometry" **C. Varney**,† R.A. Armitage, and C. Selvius DeRoo
"Recent Developments in Using Direct Analysis in Real Time Mass Spectrometry for Rapid Characterization of Organic Residues on Ceramics" **J. Hopkins**‡ and R.A. Armitage

"Developing DART-MS Methods for Identification of Organic Dyes in Historic Textiles" **C. Day**‡, C. Selvius DeRoo, and R.A. Armitage

Biennial Conference on Chemical Education, State College, PA, July 2012
"Creative Science Inquiry Experience in Organic Chemistry and Quantitative Analysis*"* **A. Flanagan Johnson**, H. Lindsay, and R.A. Armitage

IFRAO-SIARB International Congress on Archaeology and Rock Art, La Paz, Bolivia, June 2012 (due to lack of funding, these papers were presented by others as indicated)
"Chemical Characterization of the Pictographs of Cueva la Conga, Nicaragua" R.A. Armitage, R. Li†, C. Selvius DeRoo, and S. Baker. In session "Dating and chemical analysis of rock art," presented by **M. W. Rowe** (session organizer).
"Cueva La Conga: First karst cave archaeology in Nicaragua" S. Baker and R. A. Armitage. In session "Rock art and archaeological cultures of present-day Central America: a link between Mesoamerica and the Andean region," presented by **M. Strecker** (conference organizer).

ACS Central Regional Meeting, Dearborn, MI, June 2012
"Direct Analysis in Real Time Mass Spectrometry for Identification of Organic Dyes" **R.A. Armitage,** J. Geiger‡, and C. Selvius DeRoo
*"*Identification of Heme in Aged Blood by Direct Analysis in Real Time Mass Spectrometry " **D. Fraser** and R.A. Armitage

39th International Symposium on Archaeometry, Leuven, Belgium, May 2012
"Characterizing Organic Colorants in a 15th Century Iranian Timurid Qur'an by Direct Analysis in Real Time-Time of Flight Mass Spectrometry" **C. Varney**,† R.A. Armitage, and C. Selvius DeRoo
"Direct Analysis in Real Time Mass Spectrometry for Identification of Organic Dyes" **R.A. Armitage,** J. Geiger‡, and C. Selvius DeRoo
"Potential of Direct Analysis in Real Time Mass Spectrometry for Rapid Characterization of Organic Residues on Ceramics" **J. Hopkins**‡ and R.A. Armitage
"Identification of Heme in Aged Blood by Direct Analysis in Real Time Mass Spectrometry "**D. Fraser** and R.A. Armitage

Anachem Symposium, Livonia, MI, November 3, 2011
"Characterizing Organic Colorants in a 15th Century Iranian Timurid Qur'an by Direct Analysis in Real Time Time-of-Flight Mass Spectrometry" **C. Varney**,† R.A. Armitage, and C. Selvius DeRoo
"Characterizing Organic Dyes in a Textiles by Direct Analysis in Real Time Time-of-Flight Mass Spectrometry" **J. Geiger**‡, R.A. Armitage, and C. Selvius DeRoo
"Characterizing Organic Residues on Ceramics by Direct Analysis in Real Time Time-of-Flight Mass Spectrometry" **J. Hopkins**‡ and R.A. Armitage

ACS Central Regional Meeting, Indianapolis, IN, June 2011
"Determining the Survival of Potential Biomarkers in Archaeological Materials by DART-MS" **D. Fraser** and R.A. Armitage
"Development of GC-MS and DART-MS Methods for the Qualitative and Quantitative Analysis of Carbohydrates in Rock Paintings" **B. Dhakal**‡ and R.A. Armitage

Pittcon 2011, Atlanta, GA, March 2011
"Characterizing Archaeological Residues by Direct Analysis in Real Time Mass Spectrometry" **R.A. Armitage**
"Development of GC-MS and DART-MS Methods for the Qualitative and Quantitative Analysis of Carbohydrates in Rock Paintings" **B. Dhakal**‡ and R.A. Armitage

Anachem Symposium, Livonia, MI, October 28, 2010
"Characterization of Carbohydrates in Archaeological Materials" **B. Dhakal**‡ and R.A. Armitage

2010 ACS Central Regional Meeting, Dayton, OH, June 2010

"Recent developments in nondestructive radiocarbon dating of fragile organic artifacts and textiles" **R.A. Armitage** and D. Hardemon.‡
"Hemoglobin: A Reliable Indicator of Blood in Archaeological Materials?" **D. Fraser** and R.A. Armitage.
"Quantitative Analysis of Non-steroidal Anti-inflammatory Drugs in the River Raisin by GC-MS" **J. Bates**‡ and R.A. Armitage
"Qualitative and Quantitative Analyses of Lipidic Binders in Rock Paintings" **C. Phillips**‡ and R. A. Armitage.

38th International Symposium on Archaeometry, Tampa, FL, May 2010
"Cueva La Conga: Report on dating and characterization of the first known painted cave in Nicaragua" **R.A. Armitage**, S. Baker, and R. Li†. Oral presentation, Integrated site studies session
"Recent developments in nondestructive radiocarbon dating of fragile organic artifacts and textiles" **R.A. Armitage** and D. Hardemon.‡
"Further studies on the survival of hemoglobin in rock paintings" **D. Fraser** and R.A. Armitage.

Pittcon 2010, Orlando, FL, March 2010
"Characterization of the Binders in the Rock Art of Cueva La Conga, Nicaragua" **R. Li**‡ and R. A. Armitage.
"Non-destructive Sample Preparation for Radiocarbon Dating of Textiles and Other Perishable Archaeological Materials" **R. A. Armitage**. Oral presentation.
"An Integrated Analytical and Organic Chemistry Creative Scientific Inquiry Experience" **R. A. Armitage**, H. Lindsay, A. Flanagan Johnson. Oral presentation.
"Determining the Efficacy of Non-Destructive Pre-Treatment Methods on Known Age Textile Samples by Gas Chromatography-Mass Spectrometry Analysis" **D. Hardemon**‡ and R. A. Armitage.
"Methodological Study of Two Derivatization Methods for Proteinaceous Binders in Rock Paintings" **G. Maxwell**‡ and R. A. Armitage.
"Qualitative and Quantitative Analyses of Lipidic Binders in Rock Paintings" **C. Phillips**‡ and R. A. Armitage.

Anachem Symposium, Livonia, MI, October 29, 2009
"Characterization of the Binders in the Rock Art of Cueva La Conga, Nicaragua" **R. Li**‡ and R. A. Armitage. Oral presentation.
"Determining the Efficacy of Non-Destructive Pre-Treatment Methods on Known Age Textile Samples by Gas Chromatography-Mass Spectrometry Analysis", **D. Hardemon**‡ and R. A. Armitage. ****Award for Best Undergraduate Research Presentation****
"Qualitative and Quantitative Analyses of Lipidic Binders in Rock Paintings", **C. Phillips**‡ and R. A. Armitage.
"Methodological Study of Two Derivatization Methods for Proteinaceous Binders in Rock Paintings" **G. Maxwell**‡ and R. A. Armitage.

ACS Central Regional Meeting, Cleveland, OH, May 2009
"Characterization of the Rock Art of Cueva La Conga, Nicaragua: Preliminary Results" **R. A. Armitage** and R. Li†
"Qualitative and Quantitative Analyses of Proteinaceous Binders in Rock Paintings," **W. Malcolm**‡, G. Maxwell‡ and R. A. Armitage.

3rd MaSC Meeting, London, England, April 2009
"Qualitative and Quantitative Analyses of Proteinaceous Binders in Rock Paintings," W. Malcolm‡, G. Maxwell‡ and **R. A. Armitage**.

Pittcon 2009, Chicago, IL, March 2009
"Qualitative and Quantitative Analyses of Proteinaceous Binders in Rock Paintings," **G. Maxwell**‡, M. Doolin‡, W. Malcolm‡, and R. A. Armitage.
"Development of Effective Chemical Pretreatments for "Non-destructive" Radiocarbon Dating of Fragile Artifacts," **R. A. Armitage** and M. E. Ellis†.

"Determining the Efficacy of an Alternative Cleaning Method for Radiocarbon Dating Archaeological Textiles," **D. Hardemon**‡**, C. Phillips**‡**,** and R. A. Armitage.
"Analysis of Archaeological Soils After 30 Years of Storage: Implications for Site Usage Determinations," **C. Dean**‡, S. D. Hurry, and R. A. Armitage.
"Clinical test strips for rapid identification of binder materials in rock paintings," **D. Fraser** and R.A. Armitage.

Anachem Symposium, Livonia, MI, October 29, 2008
"Testing Pre-treatment Methods for Nondestructive Radiocarbon Dating of Textiles," **D. Hardemon**‡**, C. Phillips**‡, R. A. Armitage.
"Detection of DDT in the Environment: Water Analyses Using Solid-Phase Extraction and Gas Chromatography-Mass Spectrometry," **C. Van De Car**‡ and R. A. Armitage.

10th Graduate/Undergraduate Chemistry Research Symposium, Wayne State University, Detroit, MI, October 4, 2008
"Soil Analysis for Comparison of Archaeological Samples," **C. Dean**‡ and R. A. Armitage.
"Little Lost River Cave, Idaho: I. Characterization of a Black Residue and Implications for Radiocarbon Dating," **G. Maxwell**‡, J. Brown-Sinha†, C. Merrell, and R. A. Armitage.

37th International Symposium on Archaeometry, Siena, Italy, May 2008
"Qualitative THM-GC-MS and Quantitative Analysis of Proteins and Amino Acids in Rock Painting Binders," **M. Doolin**‡ and R. A. Armitage.
"Characterization of a Use Residue on a Unique Stone Tool from the Coahuila Desert," J. Van Gemert‡, J. Stambek†, **M. Rowe**, R. Mallouf, and R. A. Armitage.
"Clinical test strips for rapid identification of binder materials in rock paintings," **D. Fraser** and R.A. Armitage.
"Characterizing the Organic Material in Rock Paintings by THM- and Conventional GC-MS: Implications for Radiocarbon Dating of Rock Art," **R. A. Armitage**.
"Little Lost River Cave, Idaho: I. Characterization of a Black Residue and Implications for Radiocarbon Dating," **G. Maxwell**‡, J. Brown-Sinha†, C. Merrell, and R. A. Armitage.
"Little Lost River Cave, Idaho: II. Development of Effective Chemical Pretreatments for "Non-destructive" Radiocarbon Dating of Fragile Reed and Bark Artifacts," **M. E. Freund-Ellis**†, C. Merrell, and R. A. Armitage.

Anachem Symposium, Livonia, MI, October 2007
"THM-GC-MS analysis of rock paintings from Casa de Las Golondrinas, Guatemala: Implications for radiocarbon dating" **A. Livingston**‡ and R. A. Armitage.

2nd MaSC Meeting, Philadelphia, PA, September 2007
"The Use of THM-GC-MS for the Evaluation of Chemical Pretreatments for Removing Humic Substances from Archaeological Artifacts" **M. E. Ellis**‡ and R.A. Armitage.
"Characterization of Binder Materials in Rock Paintings by GC-MS," **R.A. Armitage**. Oral presentation.

233rd ACS National Meeting, Chicago, IL, March 2007
"GC-MS for quantitative analysis of lipids in a coating associated with rock paintings in Little Lost River Cave, Idaho" **G. Maxwell**‡ and R. A. Armitage.
"THM-GC-MS analysis of possible binders in rock paintings: comparisons to authentic pictographs and the effect of pretreatment" **M. Doolin**‡ and R. A. Armitage.
"Characterization of copal incense from Mesoamerica: Identification of residues by GC-MS" **J. Van Gemert**‡ and R. A. Armitage.
"THM-GC-MS analysis of rock paintings from Casa de Las Golondrinas, Guatemala: Implications for radiocarbon dating" **A. Livingston**‡ and R. A. Armitage.

Pittcon 2007, Chicago, IL, March 2007
"Surface Analysis of Plasma-Oxidized Materials: Implications for 'Nondestructive' Radiocarbon Dating" **J. Kirkland**† and R. A. Armitage. 43P-843

2nd Archaeological Sciences of the Americas Symposium, Tucson, AZ, September 12, 2006

"FTIR-ATR Studies of Plasma-Oxidized Materials: Implications for "Nondestructive" Radiocarbon Dating" J. Kirkland† and **R. A. Armitage**.
"Characterization of a Black Residue in Little Lost River Cave, Idaho Using Chromatographic and Spectroscopic Techniques" J. Brown†, S. Fezzey†, R. Perumplavil†, **R.A. Armitage**.

36th International Symposium on Archaeometry, Quebec City, Quebec, Canada, May 2006
"Characterization of a Black Residue in Little Lost River Cave, Idaho Using Chromatographic and Spectroscopic Techniques" J. Brown†, S. Fezzey†, R. Perumplavil†, **R.A. Armitage**.
"Characterization of building materials from the brick chapel at Historic St. Mary's City" **R. A. Armitage**, L. Minc, S.D. Hurry, D.V. Hill, and M. Doolin‡.

231st ACS National Meeting, Archaeological Chemistry Symposium, Atlanta, GA, March 2006.
"Pyrolysis and THM-GC-MS Characterization of a Black Residue in Little Lost River Cave, Idaho" **J. Brown**†, S. Fezzey†, and R. A. Armitage. Oral presentation.
"Surface Analysis of a Black Coating from Little Lost River Cave, Idaho" **R. Perumplavil**† and R. A. Armitage. Oral presentation.
"Characterization of building materials from the brick chapel at Historic St. Mary's City" **R. A. Armitage**, L. Minc, S.D. Hurry, and D.V. Hill. Oral presentation.

Anachem Symposium, Livonia, MI, October 2005
"Pyrolysis and THM-GC-MS Characterization of a Black Residue in Little Lost River Cave, Idaho" **J. Brown**†, S. Fezzey†, and R. A. Armitage. Oral presentation.

Pittcon 2005, Chicago, IL, March 2005
"Characterization of Black Deposit Associated with Rock Paintings in Little Lost River Cave, Idaho using Pyrolysis GC/MS" **S. Fezzey**† and R. A. Armitage.
"Depth Profiling and X-ray Photoelectron Spectroscopy Analysis of a Black Deposit Associated with Rock Paintings in Little Lost River Cave, Idaho" **R. Perumplavil**†, R. A. Armitage, and S. Garrett.

Anachem Symposium, Livonia, MI, October 2004
"Characterization of Black Deposit Associated with Rock Paintings in Little Lost River Cave, Idaho using Pyrolysis GC/MS" **S. Fezzey**† and R. A. Armitage. Oral presentation.
"Depth Profiling and X-ray Photoelectron Spectroscopy Analysis of a Black Deposit Associated with Rock Paintings in Little Lost River Cave, Idaho" **R. Perumplavil**†, R. A. Armitage, and S. Garrett. Oral presentation.
"Plasma Chemical Oxidation and Accelerator Mass Spectrometric Radiocarbon Analysis of Little Lost River Cave Black Residue" **T. Drane**‡ and R. A. Armitage.

Inaugural Symposium on Archaeological Sciences of the Americas, Tucson, AZ, September 2004
"Characterization of Bricks and Tiles from 17th-Century Maryland," **R. A. Armitage**, L. Minc, D. V. Hill, and S. D. Hurry.
"Re-analysis of archived archaeological soils," R. A. Armitage, S.D. Hurry, and **D. Fraser**.

36th Central Regional ACS Meeting, Indianapolis, IN (June 2004)
"Re-analysis of archived archaeological soils," R. A. Armitage, S.D. Hurry, and **D. Fraser**.
"Characterization of Black Deposit Associated with Rock Paintings in Little Lost River Cave, Idaho using Pyrolysis GC/MS" **R. A. Armitage** and S. Fezzey†.
"Characterization of Bricks and Tiles from 17th-Century Maryland" **R.A. Armitage**, S.D. Hurry, L. Minc, D. Hill.

34th International Symposium on Archaeometry, Zaragoza, Spain, May 2004
"Characterization of Bricks and Tiles from 17th-Century Maryland," **R. A. Armitage**, N. Richards‡, L. Minc, D. V. Hill, and S. D. Hurry

25th Annual Sigma Xi Student Research Symposium, Toledo, OH, April 2004

"Characterization of black deposit associated with rock paintings in Little Lost River Cave, Idaho using pyrolysis GC/MS," **S. Fezzey**† and R. A. Armitage

Anachem Symposium, Livonia, MI, November 2004
"Compositional Analysis of 17th-Century Brickmaking Technology in the Chesapeake Region" **R. A. Armitage**, L. Minc, D. V. Hill, and S. D. Hurry.

Pittcon 2003, Orlando, FL, March 2003
"Post-excavational Changes in Soil Chemistry: An Archaeological Curation Problem" R. A. Armitage and S. D. Hurry.

225th National ACS Meeting, New Orleans, LA, March 2003
"Characterization of clays and 17th century bricks from Historic St. Mary's City" **N. Houser**‡ and R. A. Armitage.
Anachem Symposium, Livonia, MI, November 2002
"Investigating the Composition of 17th Century Bricks" R. A. Armitage and **N. Houser**‡.

34th Central Regional ACS Meeting, Archaeological Chemistry Symposium, Ypsilanti, MI, June 2002
"Investigating Changes in Soil Chemistry" **R. A. Armitage**, S. Lesko‡, M. Pratt‡, B. McMullen‡, S. D. Hurry.
"Composition of 17th century brick by neutron activation analysis" C. Zalma‡, L. Minc, S. D. Hurry and **R. A. Armitage**.
"Use of Clinical Test Strips for Identification of Blood as a Rock Painting Binder Material" **D. Fraser** and R. A. Armitage.

CONFERENCE PRESENTATIONS, ST. MARY'S COLLEGE OF MARYLAND

Pittcon 2001, New Orleans, LA, March 2001
"Establishing a Plasma-Oxidation System for Radiocarbon Dating Rock Paintings," **R. A. Armitage** and M. W. Rowe.
"Development of an arson analysis laboratory experiment using SPME-GC-MS," **A. L. Leis**‡ and R. A. Armitage.
"Teaching forensic drug testing in the undergraduate laboratory" **J. L. Frahm**‡ and R. A. Armitage.
"Heavy metal exposure of white-tailed deer by GFAAS" **T. Seith**‡, R. Gonser and R. A. Armitage.
"Investigation of phosphate change in archaeological soil samples during storage" **K. Crowley**‡, S. Hurry, D. M. Fraser and R. A. Armitage.

3rd Annual Undergraduate Research Symposium in the Chemical and Biological Sciences, Baltimore, MD, October 2000
"Identifying the binder in ancient Texas rock paintings" **M. L. Pignone**‡ and R. A. Armitage,
"Radiocarbon Dating of Rock Paintings from Texas and Australia" **P. Kapur**‡ and R. A. Armitage.

220th ACS National Meeting, Washington, DC, August 2000
"Investigating 17th century brick composition" **P. Kapur**‡, and R. A. Armitage.
"Identifying the binder in ancient Texas rock paintings" **M. L. Pignone**‡, **R. Thomas**‡ and R. A. Armitage.
"Soil phosphate: A reinvestigation after 20 years of storage" **K. Crowley**‡ and R. A. Armitage.