

## Curriculum Vitae

Brandon Lee Drake  
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### Education

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University of New Mexico - Department of Anthropology - Albuquerque, NM  
 Doctorate (Ph.D.) - Anthropology - July, 2012

University of New Mexico - Department of Anthropology - Albuquerque, NM  
 Masters of Science (M.S.) - Anthropology - May, 2009

University of Wyoming - Department of Anthropology - Laramie, WY  
 Bachelors of Arts (B.A.) - Anthropology - May, 2007

University of Wyoming - Department of Biology - Laramie, WY  
 Bachelor of Science (B.S.) - Biology - May, 2007

### Appointment and Employment History

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Decision Tree, LLC (Greeley, CO) <i>Founder</i>	2018 - Present
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University of New Mexico, Department of Anthropology (Albuquerque, NM) <i>Adjunct Faculty</i>	2012 - Present
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Paleoresearch Institute (Golden, CO) <i>Vice-President</i>	2017 - 2018
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Bruker Nano (Berlin, DE) <i>Senior Applications Scientist</i>	2013 - 2017
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Robert Wood Johnson Foundation for Health Policy (Albuquerque, NM) <i>Writing and Statistical Support for Dissertation Fellows</i>	2010 - 2012
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University of New Mexico, Department of Education (Albuquerque, NM) <i>Data Analyst</i>	2009 - 2010
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University of New Mexico, Museum of Southwestern Biology (Albuquerque, NM) <i>GIS Technician/Data Analyst</i>	2007 - 2009
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### Professional Publications

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Towett, E.K., **Drake, B.L.**, Acquah, G.E., Halfele, S., McGrath, S.P., Shepherd, K.D.  
 2020 Comprehensive nutrient analysis in agricultural organic amendments through non-destructive assays using machine learning. PLoS One: e0242821. doi: 10.1371/journal.pone.0242821

Sapkota, Y., **Drake, B.L.**, McDonald, L.M., Griggs, T.C., Basden, T.J.  
 2020 Elemental composition and moisture predictions in manure by portable X-ray fluorescence spectroscopy using random forest regression. Journal of Environmental Quality 49(2): 472-482. Doi:10.1002/jeq2.20013

- Sapkota, Y, McDonald, L.M., Griggs, T.C., Basden, T.J., **Drake, B.L.**  
 2019 Portable X-ray fluorescence spectroscopy for rapid and const-effective determination of elemental composition of ground forage. *Frontiers in Plant Science* (10): 317. doi: 10.3389/fpls.2019.00317
- Sapkota, Y., **Drake, B.L.**, McDonald, L.M., Griggs, T.C., Basden, T.J.  
 2019 Trends in X-ray techniques. *Spectroscopy* 34(7): 28-33.
- Blanco-Gonzalez, A., Lillios, K.T., López-Sáez, **Drake, B.L.**  
 2018 The 4.2 ky BP event in Iberia. An interregional multiproxy comparison of cultural, demographic and environmental dynamics of the Copper and Bronze Ages (3300-1500 BC). *Journal of World Prehistory*. doi:10.1007/s10963-018-9113-3
- Drake, B.L.**  
 2018 Source & Sourceability: Towards a probabilistic framework for dendroprovenance based on hypothesis testing and Bayesian inference. *Dendrochronologia* 47: 38-47. doi:10.1016/j.dendro.2017.12.004
- Hamilton, M.I., **Drake, B.L.**, Wills, W.H., Jones, E.L., Conrad, C., Crown, P.L.  
 2018 Stable oxygen isotope sourcing of archaeological fauna from Chaco Canyon, New Mexico. *American Antiquity* 83(1): 163-175
- Drake, B.L.**, Blanco-Gonzalez, A., Lillios, K.  
 2017 Regional dynamics in the Neolithic Transition in Iberia: Results from Summed Calibrated Date Probability Distributions. *Journal of Archaeological Method and Theory* 24(3): 796-812. doi: 10.1007/s10816-016-9286-y
- Marwick, B., Guedes, J.A., Barton, C.M., Bates, L.A., Baxter, M., Bevan, A., Bollwerk, E.A., Bocinsky, R.K., Brughmans, T., Carter, A.K., Conrad, C., Contreras, D.A., Costa, S., Crema, E.R., Daggett, A., Davies, B., **Drake, B.L.**, Dye, T.s., France, P., Fullagar, R., Giusti, D., Graham, S., Harris, M.D., Hawks, J., Heath, S., Huffer, D., Kansa, E.C., Kansa, S.W., Madsen, M.E., Melcher, J., Negre, J., Neiman, F.D., Opitz, R., Orton, D.C., Przystupa, P., Raviele, M., Riel-Salvatore, J., Riris, P., Romanowska, I., Smith, J., Strupler, N., Ullah, I.I., Van Vlack, H.G., VanValkenburgh, N., Watrall, E.C., Webster, C., Wells, J., Winters, J., Wren, C.D.  
 2017 Open science in archaeology. *The SAA Archaeological Record*, September 2017: 8-14. DOI: 10.17605/OSF.IO/3D6XX
- Drake, B.L.**  
 2017 Changes in North Atlantic Oscillation drove Population Migrations and the Collapse of the Western Roman Empire. *Nature Scientific Reports* 7: 1227 doi:10.1038/s41598-017-01289-z
- Brent, R.N., Wines, H., Luther, J., Irving, N., Collins, J., **Drake, B.L.**  
 2017 Validation of handheld X-ray fluorescence for in situ measurement of mercury in soils. *Journal of Environmental Chemical Engineering*. 768-776
- Drake, B.L.**, Hansen, D.T., Lowrey, T., Sharp, Z.  
 2017 The carbon fertilization effect over a century of anthropogenic CO<sub>2</sub> emissions: higher intracellular CO<sub>2</sub> and more drought resistance among invasive and native grass species contrasts with increased water use efficiency for woody plants in the US Southwest. *Global Change Biology* 23(2): 782-792 doi: 10.1111/gcb.13449

- Towett, E.K., Shephard, K., **Drake, B.L.**,  
 2016 Plant elemental composition and portable X-ray fluorescence (pXRF) spectroscopy: Quantification under different analytical parameters? *X-Ray Spectrometry* 45(2): 117-124
- Homsher, R.S. Tepper, Y., **Drake, B.L.**, Adams, M.J., David, J.  
 2015 From the Bronze Age to the “Lead Age”: Observations on sediment analysis at two archaeological sites in the Jezreel Valley, Israel. *Mediterranean Archaeology and Archaeometry* 16(1): 187-204
- Lillios, K., Blanco-Gonzalez, A., **Drake, B.L.**, López-Sáez, J.A.  
 2016 Holocene climate, demography, and cultural dynamics in Iberia: a multi-proxy approach. *Quaternary Science Reviews* 135: 138-153
- Vogel, M., Fowler, J., **Drake, B.L.**  
 2015 Geochemical Evidence for the Use of Lead in Prehispanic Metallurgy at El Purgatorio, Casma Valley, Peru. *Journal of Archaeological Science: Reports* 4: 326-335
- Wills, W.H., **Drake, B.L.**, Dorshow, W.B.  
 2014 Prehistoric Deforestation in Chaco Canyon? *PNAS* 111(32): 11584-11591
- Drake, B.L.**, Wills, W.H., Hamilton, M.I., Dorshow, W.B.  
 2014 Strontium Isotopes and the Reconstruction of the Chaco Regional System: Evaluating Uncertainty with Bayesian Mixing Models. *PLoS One*: DOI: 10.1371/journal.pone.0095580
- Drake, B.L.**  
 2014 Using Models of Carbon Isotope Fractionation During Photosynthesis to Understand the Natural Fractionation Ratio, *Radiocarbon* 56(1): 29-38
- Drake, B.L.**  
 2013  $\delta^{13}\text{C}$  Values from Radiocarbon-Dated Plant Matter as an Important but Underexploited Resource for Terrestrial Paleoclimate Analysis and Archaeology, *Radiocarbon* 55 (2-3): 1702-1711
- Drake, B.L.**  
 2012 The Influence of Climatic Change on the Late Bronze Age Collapse and the Greek Dark Ages, *Journal of Archaeological Science* 39: 1862 - 1870
- Drake, B.L.**, Wills, W.H., Eckhard, E.B.  
 2012 The 5.1 ka Aridization Event, Expansion of Piñon-Juniper Woodlands, and the Introduction of Maize (*Zea mays*) in the American Southwest, *The Holocene* 22(12): 1353-1360
- Drake, B.L.**, Hanson, D.T., Boone, J.L.  
 2012 The Use of Radiocarbon-Derived  $\Delta^{13}\text{C}$  as a Paleoclimate Indicator: Applications in the Lower Alentejo of Portugal, *Journal of Archaeological Science* 39: 2888 - 2896
- Nazaroff, A.J., Prufer, K.M., **Drake, B.L.**  
 2010 Assessing the Applicability of Portable X-ray Fluorescence Spectrometry for Obsidian Provenance Research in the Maya Lowlands, *Journal of Archaeological Science*, 37(4): 885-895
- Drake, B.L.**, Nazaroff, A.J., Prufer, K.M.  
 2009 Error Assessment of Portable X-Ray Fluorescence Spectrometry in Geochemical Sourcing, *Society of Archaeological Science*, 32(3): 14-17

## Published Book Chapters

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### **Drake, B.L.**

2016 Portable XRF: A (very) brief introduction. In: Homem, P.M. (ed.) Lights On... Cultural Heritage and Museums. Porto: LabCR | FLUP, pp. 140-161

## Manuscripts In Preparation

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### **Drake, B.L.**

Megafauna Populations Increased with Late Pleistocene Warming, Decreased with Rapid Expansion of *Homo sapiens*. Quaternary International

Jusseret, S., Besonen, M., Cline, E., **Drake, B.L.**, Langgut, D., Moody, J., Macklin, M., Roberts, N., Rohling, E., Wenniger, B., Driessen, J.

The Late Bronze Age Collapse: Collapse by Climate Change? Intended for Quaternary Science Reviews

Martindale, L.J., **Drake, B.L.**, Prufer, K.M., Brandt, S.A.

Reproducibility and Validity of ED-XRF Equipment: A Comparison of Spectral and Quantitative Results from Homogeneous, Partially Homogeneous, and Heterogeneous Samples. Intended for Journal of Archaeological Science

**Drake, B.L.**, Ingram, W., Kaiser, B., Nelson, N., Fellows, S., DeGraffenried, J.

Megadrought in the Bølling-Allerød? A Holocene/Pleistocene lake core from Dugway Proving Grounds, north-central Utah. Intended for Quaternary International

**Drake, B.L.**, Stora, J., Goderis, S., Claeys, P., Tocheri, M.

Rare-Earth Saturation into Bone as a Chronological Tool: Case Studies from Motala-Stradvagen, Sweden and Liang Bua, Indonesia. Intended for PLoS

## Student Committees Served

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2020 Barket Jones, K. Dissertation: Paleocological Reconstructions of the Bonneville Basin.

## Project Collaborations

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2015 - Present Collaborative Research Three Dimensional Archaeological Landscape Reconstruction and Land Use Modeling at Chaco Canyon, New Mexico. Wills, W.H. and Dorshow, W. National Science Foundation (US)

2015 - Present Investigating premodern and modern human dispersals to island southeast Asia: the evidence from Liang Bua, Flores. Tocheri, M. Social Sciences and Research Council of Canada (CA)

2013-2015 Assessing the Role of Ecological Change on Economic and Demographic Transformations Between the Late Neolithic and Early Bronze Age in the Sizandro River Valley, Portugal. Lillios, K. National Science Foundation (US) #1153568

## Published Abstracts and Conference Presentations

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2016 MicroLIBS analysis of archaeological objects: Elemental analysis and fingerprinting. 11th LACONA Conference. Krakow, Poland

- 2016 Handheld XRF as a spectrometer: Quantitative, qualitative, and everything in between. 41st International Symposium on Archaeometry. Kalamata, Greece
- 2015 Waste as a Hedge to Variation. Session: Exploring Human Geography: Global Case Studies in Landscape Archaeology. 114th Annual Meeting of the American Anthropological Association. Denver, Colorado.
- 2015 Assessing the 4.2 kya event in the Iberian Peninsula and its Relationship to Culture Change Using a Large Dataset of Radiocarbon Dates and Associated Delta 13C Values. Session: What Have Isotopes Done for Archaeology Lately? With Lillios, K., Blanco-Gonzalez, A., and Lopez-Saez, A. 21st Annual Meeting of the European Association of Archaeologists. Glasgow, UK
- 2015 The Onset of Agriculture in Early Neolithic Iberia (5500-3500 CAL BC). Fresh Research Lines from Summed Probability Radiocarbon Distributions. Poster: SA1. with Blanco-Gonzalez, A. and Lillios, K. 21st Annual Meeting of the European Association of Archaeologists. Glasgow, UK
- 2015 X-ray fluorescence: Principles and Practice. Lights On: Cultural Heritage and Museums. Universidade do Porto. Porto, Portugal
- 2015 Quantitative, qualitative, and everything in between: XRF and non-homogenous materials. Portable X-Ray Fluorescence Spectrometry (Handheld and Macro): Friend or Foe? Stichting Restauratie Atelier Limburg. Maastricht, Netherlands.
- 2013 X-ray fluorescence in archaeology. Hellenic Society for Archaeometry Symposium 2013. Athens, Greece, Presentation
- 2012 Using reported  $\delta^{13}\text{C}$  values from radiocarbon dates to calculate  $\Delta^{13}\text{C}_p$  rates for terrestrial paleoclimate analysis. 21st Annual Radiocarbon Conference. Paris, France, Presentation
- 2012 Sea Surface Temperatures and Archaeology: Identifying Climatic Change in Bronze Age Greece. Society of American Archaeology, Memphis, TN, Presentation
- 2011 Isotopic Chemistry & You: New Ways to Detect Drought. Society of American Archaeology, Sacramento, CA, Presentation
- 2009 Examining the Validity of PXRF for Obsidian Sourcing in the Maya Lowlands (co-author), Society of American Archaeology, Atlanta, Presentation
- 2009 The Effects of Pig Husbandry in the Pacific on Long-Term Reproductive Fitness, Society of American Archaeology, Atlanta, Presentation
- 2005 A Preliminary Analysis of Cranial Suture Variation in *Allosaurus*, Society of Vertebrate Paleontology, Denver, CO, Poster Presenter
- 2004 A New Specimen of *Allosaurus* from North Central Wyoming, Society of Vertebrate Paleontology, St. Paul, MN, Poster Presenter

### Special Skills

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- Created a spectrum viewer using HTML5 and R for laser induced breakdown spectroscopy (LIBS) that allows users to upload spectra, produce count data for select elemental lines, and perform principle components analysis.
- Designed an x-ray fluorescence community website for art conservators and archaeologists, [www.xrf.guru](http://www.xrf.guru), which receives thousands of page views each week and plays a critical role in the training of both experienced and new scientists.
- Proficiency with x-ray fluorescence (XRF) analysis, including qualitative analysis, development of new quantitative calibrations, and Bayesian deconvolution. Applications of XRF in research settings include art conservation, artifact sourcing, metallurgical analysis, identification of toxins, and rare earth elemental analysis.
- Past work on Geographic Information Systems (GIS), which includes field data collection using a variety of equipment such as base station and rover GPS systems, handheld GPS systems, and total stations. Data analysis abilities include importation of GPS data from a wide variety of devices into ArcGIS (versions 10.1 - 3), the synthesis of multiple types of data (soil, terrain, vegetation, etc.), and the creation of 3-dimensional spatial terrains.
- Knowledge of software coding for data analysis and the creation of graphics for scientific publications in the R language.
- Fluency in Spanish, Proficiency in French

#### Software

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- 2018 CloudCal: Open-source XRF calibration system using traditional and machine-learning approaches. <https://github.com/leedrake5/CloudCal>
- 2018 CloudFTIR: System for peak identification, association, and quantification for FTIR systems. <https://github.com/leedrake5/cloudFTIR>
- 2017 CloudCore: Core analysis software with Bayesian age modeling. <https://github.com/leedrake5/CloudCore>
- 2017 Cezanne: XRF mapping system with integrated quantification. <https://github.com/leedrake5/Cezanne>
- 2017 sheetCrunch: Data analytics employing cluster analysis & variable selection via machine learning. <https://github.com/leedrake5/sheetCrunch/pulse>

#### Workshops Organized

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- 2017 Paleoclimatic Analysis of Cores: Integration of Bayesian <sup>14</sup>C Chronologies and Geochemistry. September 25-29. Red Lab, The University of Utah. Salt Lake City, UT
- 2017 Advanced X-Ray Fluorescence Analysis in Architectural Conservation. August 26-29. Hong Kong, H.K.
- 2015 X-Ray Fluorescence as a Diagnostic Tool for In-Situ Identification of Radioactive Wound Contamination. September 14. National Institute for Radiological Sciences. Chiba, Japan
- 2015 X-Ray Fluorescence, Principles and Practice. July 22nd. Departamento de Ciências e Técnicas do Património, Universidade do Porto.
- 2015 World Agroforestry Center X-Ray Fluorescence Workshop: XRF and Plant Nutrition. January 20-23rd. Soil-Plant Spectral Diagnostics Laboratory. United Nations Avenue. Nairobi, Kenya.

- 2014 X-Ray Fluorescence Applications in Food and Soil Science. August 21-22, Department of Environmental Science and Technology, University of Maryland, College Park. Maryland, US.
- 2013 Forbes Advanced X-Ray Fluorescence Workshop, September 10-11th, Freer Gallery, Smithsonian Institution, Washington DC. Co-taught with Bruce Kaiser, Chief Applications Scientist, Bruker Elemental
- 2013 Workshop on X-Ray Fluorescence Physics, August 26-27th, Chhatrapati Shivaji Maharaj Vastu Sangrahalaya Museum, Mumbai, India. Co-taught with Anupam Shah, Head of Art Conservation, Research, and Training, CSMVS Museum, and Aviva Burnstock, Head of Department of Conservation and Technology, The Cortauld Institute of Art
- 2013 Las Systemas de Rayas-X y Sus Utilization en Arcaeologia. July 30-31, Instituto Nacional de Antropología e Historia, Moneda 16, Col. Centro, México D.F. 06060
- 2013 La Physica de la Fluorecensia de las Rayas-X, April 22nd, Ministerio de Cultura, Museo de la Nacion, San Borja, Peru. Co-taught with Bruce Kaiser, Chief Applications Scientist, Bruker Elemental, and Isolda Maria de Castro Mendes, Intituto de Ciências Exatas, Unversidade Federal de Minas Gerais
- 2013 University of Massachusetts Advanced X-Ray Fluorescence Workshop, March 19-20th, Boston, MA. Co-taught with Bruce Kaiser, Chief Scientist, Bruker Elemental.

#### Courses Taught

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- 2012 Problems ARR (ANTH 597) University of New Mexico
- 2012 Data Analysis in Anthropology (ANTH 450) University of New Mexico
- 2012 World Archaeology (ANTH 220) University of New Mexico
- 2010 Human Anatomy Lab (BIO 247IL) University of New Mexico
- 2009 - 2010 Introduction to Archaeology Lab (ANTH 121L) University of New Mexico

#### Research & Travel

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- 2016 - present Obsidian Sourcing in Kyushu Island, Japan, research with Atshushi Uemine, Hakubi Scholar at the University of Kyoto
- 2013 - present Diagenesis as a tool for chronology, research with Janne Stora of the University of Stockholm
- 2013 - present Recovery of World War II remains, identifying US and Japanese soldiers using X-ray fluorescence. Research with Mark Noah of Historical Flights.
- 2013 - present Analysis of <sup>13</sup>C Discrimination of C<sub>3</sub> plants in Neolithic and Early Bronze Age Iberia, research with Dr. Katina Lillios of the University of Iowa.
- 2012 - 2013 Re-appraisal of Strontium Isotope data from Chaco Canyon, New Mexico, with Dr. Wirt Wills, Dr. Wetherbee Dorshow, and Marian Hamilton

- 2010 - 2012 Linear modeling of vegetation patterns using pollen data, *with Dr. Wirt Wills*
- 2010 - 2012 Site assessments in Chaco Canyon Cultural Park, *with Dr. Wirt Wills*
- 2009 Hawaiian Archaeological Research Project, archaeological excavation, *with Dr. Michael Graves*
- 2009 - 2010 Assessment of PXRF accuracy and precision in obsidian sourcing, *with Dr. Keith Prufer*
- 2008 - 2010 Stable carbon isotope composition of atmospheric CO<sub>2</sub>, *with Dr. Zach Sharp and Dr. David Hanson*
- 2008 Proyecto Ynalche, Peru, archaeological survey *with Dr. Frances Hayashida*
- 2006 Megiddo Expedition, Israel, Archaeology excavation and documentation, *with Dr. Israel Finkelstein*

#### Service to the Profession: Activity

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- 2014 Created interactive website with animated tutorials and videos to help users of X-ray fluorescence equipment ([www.xrf.guru](http://www.xrf.guru)).
- 2010 - 2012 Organized writing workshops for graduate students in multiple departments, including sociology, psychology, economics, political science, and anthropology.
- 2010 Served on the Student Fee Review Board and with 8 other students oversaw the allocation of \$9 million USD in funding requests
- 2009 - 2012 Assisted archaeological field schools for undergraduate students in Hawaii and New Mexico
- 2008 - 2010 Served on the Graduate and Professional Students Association as representative for the Department of Anthropology

#### Service to the Profession: Peer Review

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- Nature: Scientific Reports (1)
- National Geographic Explorer Grant (1)
- Journal of Archaeological Science (2)
- Journal of Archaeological Science: Reports (7)
- Journal of Historical Sociology (1)
- PLoS One (3)
- X-Ray Spectrometry (1)
- Archaeometry (1)
- Latin American Antiquity (1)
- Quaternary International (1)

#### Theses

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- 2012      Doctoral Dissertation: New Paleoclimate Reconstruction Techniques in Archaeology: Applications in Greece, New Mexico, and Portugal. July 2012, University of New Mexico. Advisors: Wirt H. Wills, Frances Hayashida, James Boone, David Hansen
- 2007      Honors Thesis: Multivariate Regression Analysis of Consumer Trends, Gas Prices, and Presidential Approval. May 2007, University of Wyoming. Advisors: Duncan Harris.