# *CURRICULUM VITAE: SUZANNE MARCIA MARCEL YOUNG*

**Education:**

Harvard University, Ph.D.

Thesis: *Amino acid* *Metabolic Mechanisms and the Stable Isotope Chemistry Investigation of Ancient Diets*

Harvard University, M.A.

Archaeology/Archaeometry including Material Science (course work at MIT)

Brandeis University, M.A.

Chemistry (specialty: Organometallic Synthesis and Spectroscopy)

Regis College, A.B. *Magna cum laude*

majors: Chemistry and Mathematics

**Awards:**

*UML Teaching Excellence Award* from the Provost (May, 2021)

*NASA Achievement Award* “For outstanding performance in the planning for the execution of the science for the Phoenix Mission” (July, 2009)

**Academic Positions at UML in Addition to Teaching:**

Coordinator of Chemistry 1 & 2 (May, 2022 onward)

Graduate (Chemistry Masters) Coordinator (September, 2021 onward)

Chemistry Senior Research Coordinator (September, 2019 onward)

Honors College Liaison (September, 2021 onward)

River Hawk Review Coordinator (2018-2022)

**Teaching Experiences include:**

Chemistry (I & II)

Honors Chemistry (I & II)

Analytical Chemistry

Forensic Chemistry (lecture and laboratory)

Organic Chemistry Lab

Quantitative Methods

Materials Chemistry to Engineers

Physical Chemistry Laboratories (Tufts University)

Advanced Organic Chemistry (focused on MCAT prep) with lab

Accelerated Biochemistry

Organic Chemistry

Biogeochemistry of Light Stable Isotopes (graduate level)

Archaeometry (graduate level)

Quantitative Methods in Anthropology

Pre-med Inorganic Chemistry

and

“Marsfest” – teaching high school teachers how to teach Mars, missions, and

space sciences (University of Alaska, Fairbanks – summer)

**Research Experiences:**

Science Plan Integrator, operations job at mission control of the

NASA Phoenix Mars Scout Mission

NASA Research Associate on the Wet Chemistry Lab Team of the

NASA Phoenix Mars Scout Mission

Research and Development Analytical Chemist, VHG Labs, NH

Mass Spectrometry Technical Sales Assistant and Technical Writer

Mass Spectrometry Research Scientist (on sabbatical from Harvard),

VG Elemental, Cheshire, UK

Research Director (*NSF Fellow*) of “Dietary Tracing of Amino Acids in Bone

Collagen by Stable Isotope Analysis"

Laboratory Manager, Archaeometry Laboratories, Harvard University

Research and Development Scientist, Borden Chemicals, OPP Division

Research and Development Scientist, Borden Chemicals, PVC Division

**Books published:**

A.M. Pollard, C.M. Batt, B, Stern, S.M.M. Young *Analytical Chemistry in Archaeology*  Cambridge University Press. (2007). ISBN 978-0521655729

S.M.M. Young, A.M. Pollard, P. Budd, R. Ixer. (eds.) *Metals in Antiquity*, Archaeopress of British Archaeological Reports. (1999). ISBN 1 84171 0083.

**Most Recent conference presentations:**

Plenary Speaker on *Mission to Mars: Robots Exploring Chemistry* at Scifest Africa: Creating a Culture of Curiosity & Learning in Africa. March, 2012 (South Africa).

(Host of a *Talkshop of Mars Chemistry.* And Science Instructor in a *Science Cafe*.)

This was a major science education event, and, while there, I also spoke at Witswatersrrand University and University of Rhodes Chemistry Departments, as well.

Invited Speaker on *Adventures in Amino Acids: from Dietary Studies to Astrobiology*. Victoria College, University of Toronto. June, 2012.

Plenary Speaker on *Methods of Bio-habitability Assessment* at NH Astromony Association Annual meeting, November, 2011.

Plenary Speaker on *Discoveries of NASA’s Mars Explorer and the Implications for Bio-habitability* at Northern Division Meeting of NEACT. (New England Association of Chemisty Teachers.) October, 2010.

Plenary Speaker on *Chemistry in Space – real chemistry in the NASA initiatives* at Sigma Xi Chemistry National Honor Society meeting, April, 2010.

Chairman and organizer of **Space Exploration of Analytics** at Eastern Analytical Symposium, November, 2009.

Co-lecturer of the short course **Chemistry in Space** at Eastern Analytical Symposium, November, 2009.

Plenary Speaker *The Oscillating History in the Exploration of the Red Planet* at the joint meeting of American Physical Society and the American Association of Physics Teachers, October, 2009.

S.M.M. Young *Bio-habitability Indicators on Polar Mars found by the 2007 Phoenix Mars Scout Mission* at the joint meeting of American Physical Society and the American Association of Physics Teachers, October, 2009.

S. M. M. Young, *Exploring Biohabitability off Earth.* Presented at Lunar and Planetary Sciences Conference, 2009.

Co-Chairman of **Phoenix: Soil, Chemistry, and Habitability** at Lunar and Planetary Sciences Conference, 2009.

S. M. M. Young, C. Stoker M. Hetch. Polar Mars Biohabitability *Assessment of the Wet Chemistry Analysis of Evaporites, Red-Ox Couples and Dissolved Sulfates on the 2007 Phoenix Mars Scout Mission*. Presented at Lunar and Planetary Sciences Conference, 2009.

Stoker, Cr. R., Archer, P., Catling, D. Clark, B, Marshall, Smith, P., Young, S. *The Habitability of the Phoenix Landing Site: A Contemporary Assessment*. Presented at Lunar and Planetary Sciences Conference, 2009.

Hecht M. H. \* Catling D. C. Clark B. C. DeFlores L. Gospodinova K. Kapit J. Kounaves S. P. Ming D. W. Quinn R. C. West S. J. Young S. M. M. *Perchlorate in Martian Soil: Evidence and Implications*. Presented at Lunar and Planetary Sciences Conference, 2009.

M. H. Hecht, S. P. Kounaves, R. C. Quinn, S. J. West. S. M. M. Young, P. H. Smith, and the Phoenix Team,*Discovery of perchlorate at the Phoenix Landing Site.* Presented at American Geophysical Union meeting, 2008.

R. Quinn, M. Hecht, K. Gospodinova, S. Young, S. Kounaves,. B. Clark, S. West, P. Smith. *Voltammetric and Chronopoteniometric Soil Analysis at the Phoenix Landing Site.* Presented at American Geophysical Union meeting, 2008.

S. P. Kounaves, M. H. Hecht, R. C. Quinn, S. J. West. S. M. M. Young, B. C. Clark,

W. V. Boynton, P. H. Smith, and the Phoenix Team *The Aqueous Chemistry of the Soils at the Phoenix Landing Site.* Presented at American Geophysical Union meeting, 2008.

Shannon Stroble, Trish Hredzak, Suzanne Young, Sam Kounaves, Susanne Douglas, Chris McKay, Doug Ming, Peter Smith, Leslie Tamppari, and Aaron Zent, *Wet Chemical Analysis of Antarctica Dry Valley Soils.* Presented at American Geophysical Union meeting, 2008.

S.M.M. Young, S.P. Kounaves, M.H. Hecht, The Tufts MECA-WCL team (C.A. Cable, J.A.M. Kapit, K. Gospidinova), and The Phoenix Science Team. *Wet Chemistry Analysis of Evaporites, Red-Ox Couples, and Dissolved Sulfate on the 2007 Phoenix Mars Scout Mission.* In-Situ Planetary Chemical Analysis Lab,Presented at the Lunar and Planetary Science Conference, 2007.

Suzanne Young, M. Hecht, S, Kounaves, K. Gospodinova, J. Kapit. *Wet Chemistry Analysis of Evaporites, Red-Ox Couples, and Dissolved Sulfate on the 2007 Phoenix Mars Scout Mission.* To be presented at Eastern Analytical Symposium, 2008.

S. M. M. Young, Jason A. M. Kapit, S. P. Kounaves, and The Phoenix Team*Dissolved Sulfate Analysis on the 2007 Phoenix Mars Scout Mission* , Presented at Lunar and Planetary Institute Workshop on Martian Sulfates as Recorders of Atmospheric-fluid-Rock Interactions,. 2006.

S. P. Kounaves, W. V. Boynton, M. H. Hecht, J. J. Hoffman, D.W. Ming, S. M. M. Young, and the Phoenix Science Team,*The Phoenix Chemistry and Minerology Instruments* Presented at the International Polar Year Mars Polar Conference, 2006.

K Lynch, I, Brown, S Young, A. Hoehn, S, Kounaves, D, McKay. *Microbial Detection Array*. Presented at Astrobiological Sciences Conference, 2006.

**Publication from work at UMass Lowell:**

J Francis Thackeray and Suzanne M M Young, Forensic Botany and Historical Archaeology in the Context of Early 17th century clay ‘tobacco’ pipes. *The Digging Stick*, Volume 32(2), August, 2015

**Recent Publications (Mostly on the Chemistry of Mars):**

S. P. Kounaves, M. H. Hecht, J. Kapit, K. Gospodinova, L. DeFlores, R. C. Quinn, W. V. Boynton, B. C. Clark, D. C. Catling, P. Hredzak, D. W. Ming, Q. Moore, J. Shusterman, S. Stroble, S. J. West, and S. M. M. Young, Wet Chemistry Experiments on the 2007 Phoenix Mars Scout Lander: Data Analysis and Results *J. Geophys. Res.,* **2010***,* 115, E00E10, doi:10.1029/2009JE003424

C. R. Stoker, A. Zent, D. C. Catling, S. Douglas, J. Marshall, D. Archer, B. C. Clark, S. P. Kounaves, M. Lemmon, R. C. Quinn, N. Renno, P. H. Smith, and S. Young, Habitability of the Phoenix Landing Site J. Geophys. Res., **2010**, 115, E00E20, doi:10.1029/2009JE003421

M. H. Hecht, S. P. Kounaves, R. C. Quinn, S. J. West, S. M. M. Young, D. W. Ming, D. C. Catling, B. C. Clark, W. V. Boynton, J. Hoffman, L. P. DeFlores, K. Gospodinova, J. Kapit, and P. H. Smith, Detection of Perchlorate and the Soluble Chemistry of Martian Soil at the Phoenix Lander Site, Science, **2009,** 325, 64-67.

W. V. Boynton, D. W. Ming, S. P. Kounaves, S. M. M. Young, R. E. Arvidson, M. H. Hecht, J. Hoffman, P. B. Niles, D. K. Hamara, R. C. Quinn, P. H. Smith, B. Sutter, D. C. Catling, and R. V. Morris, Evidence for Calcium Carbonate at the Mars Phoenix Landing Site, Science, **2009**, 325, 61-64.

N. O. Renno, B. J. Bos, D. C. Catling, B. C. Clark, L. Drube, D. Fisher, W. Goetz, S. F. Hviid, H. U. Keller, J. F. Kok, S. P. Kounaves, K. Leer, M. Lemmon, M. B. Madsen, W. J. Markiewicz, J. Marshall, C. McKay, M. Mehta, M. Smith, M. P. Zorzano, P. H. Smith, C. Stoker, and S. M. M. Young, Possible physical and thermodynamical evidence for liquid water at the Phoenix landing site*, J. Geophys. Res*., 114**2009**, E00E03, doi:10.1029/2009JE003362

S. P. Kounaves, M. H. Hecht, S. J. West, J. Morookian, S. M. M. Young, R. Quinn, P. Grunthaner, X. Wen, M. Weilert, C. A. Cable, A. Fisher, K. Gospodinova, J. Kapit, S. Stroble, P. Hsu, B. C. Clark, D. W. Ming, and P. H. Smith , The MECA Wet Chemistry Laboratory on the 2007 Phoenix Mars Scout Lander*, J. Geophys. Res*., 114, **2009**, E00A19, doi:10.1029/2008JE003084

P.H. Smith, L. Tamppari, R. E. Arvidson, D. Bass, D. Blaney, W. Boynton, A. Carswell, D. Catling, B. Clark, T. Duck, E. DeJong, D. Fisher, W. Goetz, P. Gunnlaugsson, M. Hecht, V. Hipkin, J. Hoffman, S. Hviid, H. Keller, S. Kounaves, C. F. Lange, M. Lemmon, M. Madsen, M. Malin, W. Markiewicz, J. Marshall, C. McKay, M. Mellon, D. Michelangeli, D. Ming, R. Morris, N. Renno, W. T. Pike, U. Staufer, C. Stoker, P. Taylor, J. Whiteway, S. Young, and A. Zent, Introduction to special section on the Phoenix Mission: Landing Site Characterization Experiments, Mission Overviews, and Expected Science *J. Geophys. Res*., 113, E00A18, doi:10.1029/2008JE003083.

"Effects of the Phoenix Lander Descent Thruster Plume on the Martian Surface" D. H. Plemmons, B. C. Clark, S. P. Kounaves, L. L. Peach, N. O. Renno, L. Tamppari, and S. M. M. Young, *J. Geophys. Res*., 113, E00A11, doi:10.1029/2007JE003059.

A. Hoehn, K. L. Lynch, J. Clawson, J. B. Freeman, J. Kapit, S. M. M. Young, S. P. Kounaves, and I. I. Brown, Microbial Detection Array (MDA) - Unambiguous Detection of Microbial Metabolic Activity in Astrobiology Applications*, SAE Proceedings,* ICES 2007, International Conference On Environmental Systems, Proceedings, Chicago, IL, USA, **2007**SAE Document No. 2007-01-3190

**NASA (‘white paper”) Publications (Analytical Chemistry for planetary exploration):**

Hecht, M., Young SMM, Kounaves, S, and Quinn, R*, Report of Calibration, Characterization, and Cataloguing ofr MECA-WCL (Microscopy, Electrochemistry, and Conductivity Analyzer – Wet Chemistry Laboratory) on the Phoenix Mars Mission.* (2008).

Hecht, M., Young SMM, Kounaves, S, and Quinn, R*, Calibration, Characterization, and*

*Cataloguing Plan for MECA-WCL (Microscopy, Electrochemistry, and Conductivity Analyzer – Wet Chemistry Laboratory) on the Phoenix Mars Mission.* (2006).

**Earlier Publications (in the field of Analytical Chemistry of ancient materials and bone):**

S.M.M. Young. Archaeometric Analysis of Copper Swords from Kerma, Nubia. *Interregional Contacts in the Later Prehistory of Northeastern Africa* (International Symposium,1992). Polish Academy of Science. W. Poznaniu. (1996). pp. 475-490.

S.M.M. Young, D.A. Phillips, Jr., F.J. Mathien. Lead Isotope Analysis of Turquoise Sources in southwestern USA and Mesoamerica: a Preliminary report. *Proceedings of the 29th International Archaeometry Symposium, 9-14 May 1994, Ankara, Turkey.* S. Demirci, M. Ozer, G.D. Summer (eds.), Tubitak: Anakara. (1996). pp. 147-150.

S.M.M. Young, R.C. Pflaum. Lead Isotope Ratios by ICP-MS: Standardization and Application to Archaeology. *1995 Pittsburgh Spectroscopy Conference, 5-10 March 1995, New Orleans.* H.A. Barrel and M.B. Perry (eds.). p.945.

R.H. Tykot, S.M.M. Young. Archaeological Applications of Inductively Coupled Plasma-Mass Spectrometry. *Archaeological Chemistry: Organic, Inorganic, and Biochemical Analysis.*  M.V. Orna (ed.) Washington, D.C., American Chemical Society. (1995). pp. 116-130.

S.J. Brann, S.M.M. Young. Bronze Metals from Anau Depe, Turkmenistan. *Progress Report Harvard-IuTAKE Excavations at Anua South, Turkmenistan.* (1995). Peabody Museum. pp. 53-66.

W. Yi, P. Budd, R.A.R. McGill, S.M.M. Young, A.N. Halliday, R. Haggerty, B. Scaife, A.M. Pollard. Tin Isotope Studies of Experimental and Prehistoric Bronzes. *The Beginning of Metallurgy.* Der Anschnitt, Beiheft 9. (1995). pp. 253-258.

S.M.M. Young. Chemical Analysis, Technical Procedures, and Alloys. *Fire of Hephaistos*: *Large Classical Bronzes from North American Collections.* C. C. Mattusch (Ed.), (1996) pp. 171-176.

S.M.M. Young, D. Miller. The Chemical and Metallographic Analysis of Mapungubwe Gold Work. *10th Congress of the Pan African Association for Prehistory and Related Studies.* G. Pwiti (ed.) University of Zimbabwe, Harare. (presented at conference and in press since 1996.)

S.M.M. Young, P. Budd, R. Haggerty, A.M. Pollard. Inductively Coupled Plasma-Mass Spectrometry for the Analysis of Ancient Metals. *Archaeometry.* **39** no. 2 (1997) pp. 379-392.

S.M.M. Young, A.M. Pollard. Spectroscopy in Archaeometry. *Spectroscopy* **12**, No. 6 (1997) pp. 14-21.

D.J. Killick, S.M.M. Young. Archaeology and Archaeometry: From Casual Dating to a Meaningful Relationship? *Antiquity* **71,** No. 273 (1997) pp. 518-524.

S.M.M. Young, J.F. Thackeray, N.J. van der Merwe. Vanadium Concentration Variability in Plio-pleistocene Cave Deposits at Kromdraai, South Africa. *Annals of the Transvaal Museum.* **36**, No. 20. (1997) pp. 253-256.

S.M.M. Young, D.A. Phillips, Jr., F.J. Mathien. Source-tracing Turquoise of the US Southwest by Lead Isotope Analysis. *Society of American Archaeology Meetings.* (1997).

G. Ferrell, H. Lie, S.M.M. Young. Roman Sculpture Clay Analysis. *Works of Bernini.*

H. Lie (ed.) Harvard University Art Museums, Cambridge, MA. (1998.)

McGill, R.A.R., P. Budd, B. Scaife, P.Lythgoe, A.M. Pollard, R. Haggerty and S.M.M. Young. The investigation and archaeological applications of anthropogenic heavy metal isotope fractionation. In S.M.M. Young, P. A.M. Pollard, P. Budd & R.A. Ixer (eds.) *Metals in Antiquity* (1999). pp. 258-261.

P. Budd, B.L.J. Montgomery, P. Rainbird, R.G. Thomas, S.M.M.Young. Pb and Sr isotope composition of human dental enamel: an Indicator of Pacific Islander population dynamics. *The Pacific from 5000 to 2000 BP: Colonisation and transformations.* J-C Galipaud and I. Lilley (eds.) Institut de Recherche pour le Developpement, Paris. (1999). pp. 301-312.

S.M.M. Young, A.M. Pollard. Chapter 3: Atomic Spectroscopy and Spectrometry in *Modern Analytical Methods in Art and Archaeology.* E. Ciliberto, G. Spoto (eds.) John Wiley & Sons, Inc. (2000). pp. 21-54.

C.P. Thornton, C.C. Lamberg-Karlovsky, M. Liezers, and S.M.M.Young. On PIns and Needles: Tracing the evolution of Copper-based alloying at Tepe Yahya, Iran, via ICP-MS analysis of common-place items. (presented at Pittcon Spectroscopy Conference 2000, currently in press.)

J.F. Thackeray, S.M.M. Young, A. van der Venter, S. Potze, F. Senegas, and L.C Aiello. Relationships between vanadium concentrations and small mammal fauna in early Pleistocene deposits from Kromdraai A, South Africa in *Annals of the Transvaal Museum* 39. (2002). pp. 73-75.

W.A. Green, S.M.M. Young, N.J. van der Merwe, J.J. Herrman Jr.. Source-tracing Marble: Trace Element Analysis with Inductively Coupled-Plasma-Mass Spectrometry in *Asmosia 5: Interdisciplinary Studies on Ancient Stone.* J. J. Hermann, Jr., N Hetz, & R. Newman (eds.) Archetype Publications Ltd. London (2002) pp. 132-142.

M.R. Howland, L.T. Corr, S.M.M.Young, V. Jones, S. Jim, N.J. van der Merwe, A.D. Mitchell, R.P. Evershed. Expression of the Dietary Isotope Signal in the Compound-specific δ13C Values of Pig Bone Lipids and Amino Acids in *International Journal of Osteoarchaeology* **13** (2003) pp. 54-65.

**Corporate Publications (All on High Resolution-Magnetic Sector-Multi-collector Mass Spectrometry):**

*Application Note: Accuracy and Precision of Isotope Ratio Measurements using the VG Axiom Multi-collector ICP Mass Spectrometer* (2000).

*Application Note: Light Stable Isotope Analysis using the VG Axiom ICP-MS* (2000).

*Application Note: High Throughput Uranium Isotopic Analysis using the VG Axiom MC-ICP-MS* (2000).

*Application Note: B Stable Isotope Analysis using the VG Axiom MC* (2001).

*Application Note: Ca Stable Isotope Analysis using the VG Axiom MC* (2001).

*Application Note: Fe Stable Isotope Analysis using the VG Axiom MC* (2001).

*Application Note: Nd Stable Isotope Analysis using the VG Axiom MC* (2001).

*Application Note: Pb Stable Isotope Analysis using the VG Axiom MC* (2001).

*Application Note: Sr Stable Isotope Analysis using the VG Axiom MC* (2001).

*Technical Brief: ISIS II, Next Generation Inert Sample Introduction System for the X Series ICP-MS* (2001).

*Technical Brief: X Series ICP-MS High Matrix Tolerance* (2001).

*Technical Brief: Plasmascreen Plus* (2001).

*Technical Brief: Xi Interface for the X Series ICP-MS* (2001).

**Book Reviews:**

W.R. Ambrose, P. Duerden (eds.), *Archaeometry: An Australian Perspective* Australian National University Press. 1982. Reviewed for the Society of Archaeological Sciences Bulletin. 1997.

W.R. Ambrose, J.M.J. Mummery (eds.), *Archaeometry: Further Australian Studies.*

Australian National University Press. 1987. Reviewed for the Society of Archaeological Sciences Bulletin. 1997.

B.L. Frankhauser, J.R. Bird (eds.), *Archaeometry: Current Australian Research.*

Australian National University Press. 1993. Reviewed for the Society of Archaeological Sciences Bulletin. 1997.

**Conferences Organized and** **Exhibits:**

Chairman and organizer of **Space Exploration of Analytics** at Eastern Analytical Symposium, November, 2009.

Co-lecturer of the short course **Chemistry in Space** at Eastern Analytical Symposium, November, 2009.

Co-Chairman of **Phoenix: Soil, Chemistry, and Habitability** at Lunar and Planetary Sciences Conference, 2009.

S.M.M. Young, P. Budd. *Metals in Antiquity* Harvard-Bradford International Symposium at Harvard University - 175 in attendance. (September 1997)

C.C. Mattusch, H. Lie, S.M.M. Young. *The Fire of Hephaistos* (Roman Colossal Bronze Statues). Exhibit in The Fogg Museum during 1996 International Bronze Conference in Boston. (Exhibit began June, 1996, showed at the Fogg Museum for 9 months, then travelled within USA and Canada.)

T.C. O’Connell, S.M.M. Young. *Theory and Practice in Isotopic Dietary Studies* (Symposium convened within World Archaeological Congress of 1999 in South Africa).

S.M.M. Young. Chairman of “Metals and Technology” in *Archaeometry ‘98* (Budapest)

Chairman of the session: “Phoenix: Soil, Chemistry, and Habitability” Presented at Lunar and Planetary Sciences Conference, 2009.

**Films and Educational Multimedia:**

S.M.M. Young. *Chemical Signatures of Life on Mars*. **Consilience** Interview (podcasts on science)*.* [http://consiliencecast.wordpress.com](https://exchange.uml.edu/owa/redir.aspx?C=U4FB9TBY9kKN5tIHpjbUE7VU_9YvLM8IeeQL6TJb0eLkuDgnGQIhbJdSo45fn0WXR4ebOdHscbw.&URL=http%3a%2f%2fconsiliencecast.wordpress.com) May, 2012.

S.M. M. Young. *Chemical Signatures of Life in Martian Meteorites.* **Carte Blanche** Interview (South Africa’s version of 60 Minutes news program.) March, 2012.

Manuscript is on <http://beta.mnet.co.za/carteblanche/Article.aspx?Id=4521&ShowId=1>

S.M.M. Young. *Phoenix Mission Blog* <http://phoenix.lpl.arizona.edu/blogs.php>

(Written from 2006-2008 at NASA’s request.)

During and after the NASA Pheonix Mars Mission, I was a part of 4 different *Nova* programs on PBS in America, as well as some science shows on BBC and CBC.

S.M.M. Young. Archaeometry: Laboratory studies of the Minute to Answer the Enormous. *Powers of Ten, 2nd edition.* Film and CD produced by Films of Charles and Ray Eames. (Gregory Peck, narrator of the film). 1995.

**Fieldwork:**

Director of geological fieldwork, multiple turquoise mines of New Mexico

Assistant Director, Excavation of Kromdraai Caves, South Africa

Director of geological fieldwork, Villa Grove and King’s Mines, Colorado

Director of research expedition, Casas Grandes, Chihuahua, Mexico

Field Assistant, Ecological field collection, Orinoco River, Venezuela

Director of geological fieldwork, Cerrillos Mines, New Mexico

Excavator, Pottery Hill and Bailey’s Point Pueblos, Arizona