

# Tyler Louise Spano

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Oak Ridge National Laboratory  
National Security Sciences Directorate  
Nuclear Nonproliferation Division  
Nuclear Security Advanced Technologies

## **EDUCATION**

### **Ph.D., Uranium Mineralogy and Nuclear Forensics**

University of Notre Dame, Notre Dame, IN – January 2018

### **B.A., Earth Science, Chemistry, *summa cum laude***

Kean University, Union, NJ – May 2012

## **EXPERIENCE**

### ***Oak Ridge National Laboratory, Oak Ridge, TN***

**Postdoctoral Associate in Solid-Phase Uranium Chemistry** December 2018- Present

- Synthesized uranium oxide and hydroxide materials for crystal chemical and vibrational spectroscopic investigations.
- Designed and implemented experimental protocols for exploring structure-property relations and phase transformations in solid-state uranium materials.
- Established and enhanced synthetic laboratory capabilities.

### ***University of Notre Dame, Notre Dame IN***

**Postdoctoral Research Fellow** December 2017- December 2018

- Conducted textural and structural investigations of strain and differential aging of nuclear materials for forensic applications.
- Determined trace element and U and Pb isotope signatures of UO<sub>2</sub> fuel pellets.
- Utilized transition element signatures to determine the origin of UO<sub>2</sub> fuel pellets.
- Analyzed B isotope signatures in uranium ores and developed advanced models for U geochemical cycling.
- Explored paragenesis of U minerals as analogues for fractionation of trace elements and isotopes during fabrication of nuclear fuel.

### ***University of Notre Dame, Notre Dame IN***

**Graduate Research and Teaching Assistant** August 2012- December 2017

**Eilers Graduate Student Fellow** May 2016- December 2017

**Lecturer** Fall 2016

- Performed extensive research in actinide geochemistry and mineralogy.
- Mastered techniques in inorganic chemistry, analytical chemistry, geochemistry, and mineralogy.

## **EXPERIENCE (Continued)**

- Developed procedures for hydrothermal synthesis of uranyl vanadate minerals and novel mineral analogues.
- Designed calculations for determining the structural stability of minerals.
- Advanced methods for quantifying crystal structure stability with normalized charge deficiency per anion calculations.
- Analyzed hyalite opal for uranium distribution and concentration and related results to paragenetic sequences.
- Discovered and described new uranyl mineral species.
- Completed trace element analyses on uranium-rich materials for source attribution and nuclear forensic applications.
- Developed novel methods for forensic analysis of nuclear materials.
- Advised undergraduate and high school students in laboratory-based research.
- Developed and conducted lectures and laboratory sessions for an upper level Environmental Mineralogy course.
- Contributed to community outreach and research goals of the Center for Sustainable Energy at the University of Notre Dame.

### ***Kean University, Union NJ***

#### **Undergraduate Research Assistant May 2010- May 2012**

- Collected and analyzed water samples from estuarine environments using field and laboratory methods.
- Developed and performed procedures using pH as a multiple indicator of water quality.
- Conducted detailed petrographic analyses of Jurassic flood basalts.
- Completed an extensive review of radioactive mineral occurrences in New Jersey.
- Managed the Kean University Fossil and Mineral Collection.

## **PUBLICATIONS IN PREPARATION**

**2019 Spano, T.L.**; Aksenov, S.; Turner, M.; Burns, P.C. *Synthesis and structural properties of novel praseodymium uranyl vanadate and praseodymium uranyl hydroxide mineral analogues.* **Journal of Solid State Chemistry.** In preparation.

**2019 Spano, T.L.**; Kuebler, C.; Simonetti, A. *Boron isotope analysis: a new technique for nuclear forensic investigations.* **Geology.** In preparation.

## **PUBLICATIONS**

**2019 Dorais, C.**; Simonetti, A.; Corcoran, L.; **Spano, T.L.**; Burns, P.C. *Happy Jack uraninite: a new reference material for high spatial resolution analysis of U-rich matrices* **Geostandards and Geoanalytical Research.** In review.

**2019 Spano, T.L.**; Simonetti, A.; Corcoran, C.; Lewis, S.R.; Dorais, C.; Burns, P.C. *Comparative nuclear forensic analysis of two uranium dioxide fuel pellets.* **Journal of Nuclear Materials.** In press.

## **PUBLICATIONS (Continued)**

2018 Lewis, S.R.; Simonetti, A.; Corcoran, L.; **Spano, T.L.**; Chung, B.W.; Teslich, N.E.; Burns, P.C. *Characterization of uraninite using a FIB-SEM approach and its implications for LA-ICP-MS analyses.* **Journal of Radioanalytical and Nuclear Chemistry.** 318(2), 1389-1400.

2018 Megaw, P.; Fritsch, E.; **Spano, T.L.**; Gray, M. *Geology and mineralogy of electric opal: Green daylight-luminescing hyalite opal from Zacatecas, Mexico.* **Rocks & Minerals.** 93, 404-413.

2018 Smith, P.A., **Spano, T.L.**; Burns, P.C. *Synthesis and structural characterization of a series of uranyl-betaine coordination complexes.* **Zeitschrift für Kristallographie.** 233(7), 507-513.

2018 Olds, T.A.; Plášil, J.; Kampf, A.R.; **Spano, T.L.**; Haynes, P.; Carlson, S.M.; Burns, P.C.; Simonetti, A.; Mills, O.P. *Leesite,  $(H_2O)_2[(UO_2)_4O_2(OH)_5] \cdot 3H_2O$ , a new K-bearing schoepite-family mineral from the Jomac mine, San Juan County, Utah, USA.* **American Mineralogist.** 103, 143-150.

2017 Zhang, Z.; Senchyk, G.; Liu, Y.; **Spano, T.L.**; Szymanowski, J.; Burns, P. *Porous uranium diphosphonate frameworks with trinuclear units template by organic ammonium hydrolyzed from amine solvents.* **Inorganic Chemistry.** 56, 13249-13256.

2017 **Spano, T.L.**; Olds, T.A.; Hall, S.M.; Kampf, A.R.; Lowers, H.; Burns, P.C. *Finchite, IMA 2017-052.* CNMNC Newsletter No. 39, October 2017, page 1282; **Mineralogical Magazine.** 81, 1279-1286.

2017 Balboni, E.; Simonetti, A.; **Spano, T.L.**; Cook, N.; Burns, P. *Rare earth fractionation in uranium ore and its U(VI) alteration minerals.* **Applied Geochemistry.** 87, 84-92.

2017 **Spano, T.L.**; Simonetti, A.; Wheeler, T.; Carpenter, G.; Freet, D.; Balboni, E.; Dorais, C.; Burns, P. *A novel nuclear forensic tool involving deposit type normalized rare earth element signatures.* **Terra Nova.** 29 (5), 294-305.

2017 **Spano, T.L.**; Simonetti, A.; Balboni, E.; Dorais, C.; Jones, N.; Monaco, B.; Burns, P. *Trace element and isotopic analysis of uranium ore concentrates: applications for nuclear forensic analysis.* **Applied Geochemistry.** 84, 277-285.

2017 **Spano, T.L.**; Dzik, E.; Sharifironizi, M.; Dustin, M.; Turner, M.; Burns, P. *Thermodynamic investigation of uranyl vanadate minerals: implications for structural stability.* **American Mineralogist.** 102 (6), 1149-1153.

2016 Olds, T.A.; Haynes, P.; Kampf, A.R.; **Spano, T.L.**; Plášil, J.; Carlson, S.M.; Burns, P.C.; Simonetti, A.; Mills, O.P. *Leesite, IMA 2016-064.* CNMNC Newsletter No. 34, **Mineralogical Magazine.** 80, 1315-1321.

### **PUBLICATIONS (Continued)**

2016 Qiu, J.; **Spano, T.L.**; Dembowski, M.; Kokot, A.; Szymanowski, J.; Burns, P. C. *Sulfate-Centered Sodium-Icosahedron-Templated Uranyl Peroxide Phosphate Cages with Uranyl Bridged by  $\mu$ - $\eta$ 1: $\eta$ 2 Peroxide*. **Inorganic Chemistry**. 56(4), 1874-1880

2016 Balboni, E.; Jones, N.; **Spano, T.L.**; Simonetti, A.; Burns, P.C. *Chemical and Sr isotopic characterization of North American uranium ores: nuclear forensic applications*. **Applied Geochemistry**. 74, 24-32.

2015 Fritsch, E.; Megaw, P.; **Spano, T.L.**; Rondeau, B.; Gray, M.; Hainschwang, T.; Renfro, N. *Green-luminescing hyalite opal from Zacatecas, Mexico*. **Journal of Gemmology**. 34(6), 490-508

2015 Fritsch, E.; **Spano, T.L.**; Megaw, P. *Green daylight-fluorescent hyalite opal from Mexico*. **Journal of Gemmology**. 34(4), 294-296.

### **TEACHING EXPERIENCE**

**University of Notre Dame: Lecturer (Instructor of Record)** - Environmental Mineralogy

**Brookhaven National Lab: Nuclear and Radiochemistry Summer School Invited Lecturer-**  
Nuclear Forensics Research at the University of Notre Dame

**University of Notre Dame: Teaching Assistant-** Mineralogy, Engineering Geology,  
Environmental Climate Change, Environmental Mineralogy

**Kean University: Peer Tutor-** Physics I-II, General Chemistry I-II, Introduction to Geology,  
Mineralogy, Structural Geology, Geomorphology

**Middlesex Borough Board of Education-** Substitute Teacher 2006-2009

### **POSTERS AND PRESENTATIONS**

2018 **Goldschmidt** Poster “*Boron content and isotopic composition of uraninite and U(VI) alteration minerals for nuclear forensic applications*”

2018 **MARC XI** Poster “*Investigation of uranium dioxide fuel pellets for nuclear forensic applications*”

2018 **Annual Meeting of the American Chemical Society** Presentation “*Nuclear forensic analysis of uranium dioxide fuel pellets*”

2017 **Annual Meeting of the American Chemical Society** Presentation “*Deposit type average rare earth element signatures for nuclear forensics*”

## **POSTERS AND PRESENTATIONS (Continued)**

**2016 EFRC All Hands Meeting** Presentation “*Advances in crystal chemistry and thermodynamics of uranyl vanadate minerals*”

**2016 Women in Science Conference** Poster “*Structural stability and thermodynamics of uranyl vanadate minerals*”

**2016 Annual Meeting of the Geological Society of America** Poster “*Structural stability and thermodynamics of uranyl vanadate minerals*”

**2016 Annual Meeting of the Geological Society of America** Poster “*Trace element and isotopic fractionation in the nuclear fuel cycle*”

**2016 Annual Meeting of the American Chemical Society** Presentation “*Trace element and isotopic fractionation in the nuclear fuel cycle*”

**2016 ACS-CERM** Presentation “*Trace element analysis of uranium ore concentrates: source attribution, provenance indicator, and proof of concept*”

**2016 UND Graduate Student Union Research Symposium** Poster “*Synthesis and materials properties of uranyl vanadate mineral analogues*”

**2015 PINDU** Poster “*Synthesis and structural properties of novel praseodymium uranyl vanadate and praseodymium uranyl hydroxide mineral analogues*”

**2015 Annual Meeting of the Geological Society of America** Poster “*Trace element analysis of uranium ore concentrates: source attribution, provenance indicator, and proof of concept*”

**2015 Annual Meeting of the Geological Society of America** Presentation “*Materials properties of synthetic uranyl vanadate mineral analogues possessing the francevillite anion topology*”

**2015 Annual Meeting of the American Chemical Society** Poster “*Distribution of uranium and uranyl minerals near and within hyalite opal*”

**2015 DHS-DNDO-ARI Program Review Meeting** Poster “*Trace element signatures of UOCs: Provenance Indicator*”

**2014 EFRC All Hands Meeting** Poster “*Ion exchange properties of uranyl vanadate minerals and new synthetic phases possessing the francevillite anion topology*”

**2013 Annual Meeting of the Geological Society of America** Poster “*Synthesis of and applications for the curienite-francevillite mineral series*”

## **VOLUNTEER AND LEADERSHIP ACTIVITIES**

**Art2Science Volunteer:** Worked with local summer camp students on projects that bridge the gap between art and science. July 2018.

**TRIO Presenter:** Spoke with high school students about career paths as a geologist. July 2018.

**Guest Speaker: EdTech in the Bend:** Taught local educators how to utilize Google Docs and energy-related datasets in public school curricula. August 2017.

**South Bend LGBTQ Center Volunteer:** Contributed to outreach goals of the LGBTQ center by assisting at community events and center activities. June 2017- present.

**Research Mentor:** Introduced and guided undergraduates and high-school students in laboratory-based research. University of Notre Dame, 2013-2017(Mentored 10 students).

**Presenter: Winter Sports Weekend Energy Demonstrations:** Spoke with alumni and families about energy research at the University of Notre Dame. January 2017.

**Judge: You be The Chemist Challenge:** Oversaw adherence to rules and judged competitors in chemistry challenge for children. February 2017.

**STEMentor:** Worked with female STEM students to explore career options. Fall 2016-present.

**Mentor: Boys and Girls Club of America:** Led weekly activities and discussions. Aided club members in design and execution of a community-based project. Summer 2016.

**Tour Guide: Junior Parents Weekend:** Conducted lab tours for families visiting the University of Notre Dame and explained ongoing energy research at the University of Notre Dame. (February 2016)

**Letters to a Pre-Scientist:** Exchanged monthly letters with an assigned pen pal. Introduced concepts of my research and encouraged my pen-pal to engage in science. September 2015-May 2016.

**Science Fair Volunteer:** Presented mineral identification techniques to students. Northpoint Elementary School, 2014.

**Science Alive! Volunteer:** Instructed children on methods of detecting and observing ionizing radiation. South Bend Public Library, 2014, 2015, 2016.

**Visiting Speaker:** Spoke with high-school students about career options in geology. Clay High School, 2014.

## **VOLUNTEER AND LEADERSHIP ACTIVITIES (Continued)**

**Mole Day Presenter:** Created interactive science exhibits for children. Liberty Science Center, 2010-2011.

**President, Kean University Student Chapter of the American Chemical Society:** Organized weekly meetings, community outreach events, and campus-wide activities. Kean University, 2010-2012.

## **SELECTED COURSEWORK**

### **University of Notre Dame**

- Environmental and Aquatic Chemistry
- ICP-MS Analytical Methods
- Chemistry of Lanthanides and Actinides
- Chemical Crystallography
- Geochemistry
- Actinide Mineralogy

### **Kean University**

- Geomorphology
- Structural Geology
- Mineralogy
- Petrology
- Instrumental Methods of Chemical Analysis
- Quantitative Chemical Analysis

## **ADDITIONAL COURSEWORK**

**ACA Crystallography Summer School-** American Crystallographic Association, July 2014

**Uranium: Cradle to Grave-** Mineralogical Association of Canada Short Course, May 2013

**Student Leadership Summit-** Kean University, September 2010

## **PROFESSIONAL SOCIETIES**

Geological Association of America (GSA)

American Chemical Society (ACS)

Mineralogical Society of America (MSA)

Association for Women Geoscientists (AWG)

Women in Nuclear (WiN)

## **AWARDS AND HONORS**

ND Energy Postdoctoral Fellowship

Eilers Graduate Student Fellowship

Graduate Student Union Research Symposium (1<sup>st</sup> Place- Poster Competition)

Graduate Student Union Conference Presentation Grant Award

Zahm Research Travel Grant Award

New Minerals and Mineralogy in the 21<sup>st</sup> Century: Student Grant Award

## **REFEREE/ PEER REVIEW**

American Mineralogist

Ore Geology Reviews

Research on Chemical Intermediates

Journal of Rare Earths

Periodico di Mineralogia

ACS Earth and Space Chemistry

## **SELECTED SKILLS AND TECHNIQUES**

### **Synthetic Chemistry Techniques**

Hydrothermal Synthesis  
Solid-state Synthesis

### **Crystallographic Techniques & Software**

Single crystal X-ray Diffraction  
Powder X-ray Diffraction  
Bruker SHELX  
FullProf Suite  
Powder Diffraction File (PDF4)  
Platon  
CrystalMaker  
Mercury

### **Analytical Chemistry Techniques**

Raman Spectroscopy  
Infrared Spectroscopy  
Inductively Coupled Plasma Optical Emission Spectrometry  
Inductively Coupled Plasma Mass Spectrometry  
Multicollector Inductively Coupled Plasma Mass Spectrometry  
X-ray Fluorescence Spectroscopy  
Electron Microprobe Analysis  
Scanning Electron Microscopy  
Thermogravimetric Analysis  
BET Analysis  
Ion-Exchange Chromatography (REE, U, Pb, and B and separations)

### **Other Skills**

Geologic Thin Section Preparation  
Petrographic Microscopy  
Reflected Light Microscopy  
Handling of Radioactive Materials  
OriginPro 9.0 Software Suite  
Microsoft Office Suite