

Curriculum Vitae of Anna Szyrkiewicz

University of Tennessee, Earth and Planetary Sciences, 1412 Circle Drive, Knoxville, TN 37996, office phone: 865-974-6006, email: aszynkie@utk.edu

Education and Professional Experience:

Aug 2013 - present *Assistant Professor (tenure track)*, University of Tennessee at Knoxville
May 2011 – Jul 2013 *Research Assistant Professor (non-tenure track)*, University of Texas at El Paso
Jul 2009 – Apr 2011 *Postdoctoral Fellow*, University of Texas at El Paso
Sep 2005 - Jun 2009 *Postdoctoral Fellow*, Bloomington, Indiana University
Feb 2004 – Aug 2005 *Assistant Professor (tenure track)*, University of Wrocław, Poland
Jan 2004 *Ph.D. in Geology*, University of Wrocław, Poland
Jun 2000 *M.Sc. in Geology*, University of Wrocław, Poland
Jun 1998 *B.Sc. in Geology*, University of Wrocław, Poland

Current research projects:

2016-2017 “*Environmental impacts of coal ash spill on nutrient cycling and surface water quality in eastern Tennessee*” – US Department of Interior & US Geological Survey grant awarded to PI-Szyrkiewicz (\$9,000).

2014-2017 “*Collaborative research: a multi-tracer (U, S, B, and Sr) approach to fingerprint and quantify anthropogenic salinity sources in the semi-arid Rio Grande watershed*” - PI – Lin Ma, University of Texas at El Paso. NSF grant awarded to Co-PI Szyrkiewicz (\$23,148).

2014-2015 “*Characterizing groundwater pollution from hydraulic fracturing using environmental tracers*” – Oak Ridge Associated Universities (ORAU) grant awarded to PI-Szyrkiewicz (\$10,000); chemical and sulfur, oxygen, carbon, and hydrogen isotope analyses of groundwater from eastern Kentucky affected by hydraulic fracturing and coal mining.

2012-2016 “*Sulfur cycling during the volcanic and climatic evolution of Valles Caldera – A geochemical analogue for sulfate-mineral deposition on Mars*” – NASA grant awarded to PI-Szyrkiewicz (\$243,895); chemical and S isotope analyses of water and sediment samples to quantify modern and historical deposition of S/SO₄ in Valles Caldera, New Mexico. Final results will be used to model sulfur cycling related to volcanic activity and weathering processes on Mars.

Past research projects:

- Postdoctoral
2009 - 2012
- Geological Sciences, University of Texas at El Paso
Research Advisor: Dr. David Borrok
- “*Application of novel isotopic techniques to define salinity sources in the Rio Grande*” – chemical and isotope (S, Zn, Sr) analyses of surface water and groundwater in the Rio Grande Valley to characterize and quantify: (i) sources of salinity in surface water and groundwater, (ii) contribution of salts from fertilizer use, and (iii) magnitude of sulfide weathering in high-mountain settings.
- Postdoctoral
2005-2009
- Geological Sciences, Indiana University
Research Advisor: Prof. Lisa Pratt
- “*Saline Lakes and Gypsum Dunes in the Rio Grande Rift System as Analogues for Sulfate Deposits on Mars*” – reconstruction of paleo-hydrological and aeolian conditions in the Tularosa and Estancia basins using sulfur geochemical cycle to understand gypsum origin in circumpolar dunes on Mars.
 - “*Abiotic synthesis of organic compounds in mantle-derived rocks, an experimental and empirical analysis*” – chemical analysis of organic compounds in Iherzolites and websterites from the Rio Puerco Volcanic Field and Kilbourne Hole (New Mexico, USA) to describe the origin of hydrocarbons in mantle xenoliths.
 - “*Sacramento Mountains Hydrogeology Study*” – Collaborative study with the New Mexico Bureau of Geology and Mineral Resources. S isotope analysis of dissolved sulfate in spring water and groundwater to determine pathways of groundwater flows and sulfuric acid weathering in the karst aquifer of Southern Sacramento Mountains.
 - “*Origin of saline intrusions in the Costa de Hermosillo aquifer, Gulf of California*” – Collaborative study with the Sonora University (Mexico). The S-O-H-C isotope analyses on groundwater from the coastal aquifer of Sonora Desert to describe sources of saline intrusions during land cultivation in semi-arid coastal areas.

Invited talks

- Oct 2015 Western Carolina University: Impacts of hydraulic fracturing and surface mining on chemical and isotope compositions of shallow groundwater in the Central Appalachian Basin, Eastern United States.
- Aug 2015 Goldschmidt Conference, Keynote Speaker: “Riverine sulfate budget in the light of sulfur isotopes – current understanding and remaining questions for future studies”
- Oct 2014 Purdue University: “Sulfur cycling on Mars from a perspective of sulfur-rich terrestrial analogs”
- Sep 2013 Indiana University at Bloomington: “Sulfur cycle on Mars from the perspective of a terrestrial geologist”
- Mar 2013 University of Tennessee at Knoxville: “Hydrological and eolian sulfur cycle on Earth – geochemical implications for Mars”
- Feb 2013 Texas Teachers Association (Public talk): “Finding Mars near El Paso”
- Feb 2013 University of Texas at El Paso: “Water salinity and environmental challenges in arid zones – examples from Sonoran and Chihuahuan Deserts”
- Jun 2012 Utah State University (Logan): “Climate, chemical weathering and sulfur cycle on Earth and their relevance for understanding geochemical history of Mars”

- Feb 2012 Kent State University (Ohio): “Geochemistry and mineralogy of Mars – looking for past water activity”
- Feb 2012 Kent State University (Ohio): “Water-rock interaction, salt loading and agriculture in the Rio Grande Valley”
- Apr 2011 Los Alamos National Laboratory (New Mexico): “Distinguishing between anthropogenic and geologic salt loads in the Rio Grande using sulfur isotope geochemistry”
- Aug 2010 White Sands National Monument Groundwater Workshop (New Mexico): “Paleo-hydrological Cycle and Evolution of the White Sands Playa and Dune Systems”
- Apr 2010 New Mexico Institute of Mining and Technology (Socorro): ” The use of sulfur isotopes to investigate saline intrusions and anthropogenic SO₄ loads in the Sonoran aquifers (northern Mexico) – Implications for the Rio Grande region”
- Feb 2010 State & Transition Modeling Workshop for White Sands National Monument (Las Cruces): “Paleo-hydrological Cycle and Evolution of the White Sands Playa and Dune Systems”
- Feb 2009 University of Texas at El Paso: “Evolution of the Tularosa Basin playas and White Sands Dune Field – Insights from sulfur isotope variations”
- Apr 2008 New Mexico Institute of Mining and Technology (Socorro): ”Origin of White Sands gypsum dunes – implications for Mars analogue studies”
- Mar 2008 New Mexico State University (Las Cruces): “Sulfur isotope geo- and biosignatures in Pleistocene/Holocene playas as indicators of the local hydrologic cycle”

Professional Affiliations and Services

Member American Geophysical Union, New Mexico Geological Society, Geochemical Society

Reviewer Peer-reviewed Journals: *Applied Geochemistry*, *Geophysical Research Letters*, *Water Research*, *Isotopes in Environmental & Health Studies*, *Journal of Agriculture Science and Technology*, *Journal of Volcanology and Geothermal Research*, *Science of the Total Environment*, *Aquatic Geochemistry*, *Environmental Science and Technology*, *Water – Special Issue “Environmental Tracers”*, *American Mineralogist*, *Atmospheric Research*, *Environmental Science and Pollution Research*, *Environmental Monitoring and Assessment*, *Icarus*, *Chemical Geology*.

NASA Review Panel Member for *MSL Participating Scientist Program*,

NASA Review Panel Member for *Exobiology Program*

NASA Review Panel Member for *Mars Data Analysis Program*

NASA External Reviewer for *Mars Fundamental Research Program*

National Park Service – White Sands National Monument.

Technical Skills

Hydrology	1) Measuring stream flows and discharges using standard current meter, 2) quantifying the mixing of surface water, groundwater, and return irrigation flows using aqueous ion mass fluxes and S-O isotope mass balance constraint.
Off-line work (vacuum lines)	Carbon, oxygen, sulfur and hydrogen isotope ratios in different types of minerals (silicates, oxides, carbonates, sulfides, sulfates) and waters (DIC, sulfate, methane).
Mass spectrometers	Off-line determination of C, O, S and H isotope ratios in minerals, liquids and gasses using mass spectrometers: Finnigan Mat CH7, Delta S, Delta E, Delta Plus XL, Finnigan Mat 252. On-line determination of carbon, sulfur, hydrogen and oxygen isotope ratios in minerals using TCEA-GC/MS and EA-GC/MS methods. Determination of Zn isotope composition using MC-ICP-MS.
Gas Chromatography	Concentration of methane in pore gases of sediments using GC methods. Determination of chemical composition of hydrocarbons in mantle-derived rocks using GC/MS method.
Chemical analysis	Physical parameters in waters (pH, Eh, electric conductivity, O ₂ concentration), concentration of sulfate and bicarbonate in waters. Total sulfur and carbon content in rocks. Sequential chemical and isotope sulfur extraction in rocks and soils. Chemical analysis of major cations and anions dissolved in waters using ion chromatography and atomic absorption methods.

Bibliography

Peer-reviewed articles:

1. LeDoux S.M., **Szynkiewicz A.**, Mayes M.A., Faiia A.M., McKinney M.L., Dean W.G. (2016 – in press): Impacts of hydraulic fracturing and surface mining on the chemical and isotope compositions of shallow groundwater in Central Appalachian basin, Eastern United States. *Applied Geochemistry* XX: XX.
2. **Szynkiewicz A.**, Borrok D.B. (2016): Isotope variations of dissolved Zn in the Rio Grande watershed, USA: The role of adsorption on Zn isotope composition. *Earth and Planetary Science Letters* 433: 293-302.
3. **Szynkiewicz A.**, Borrok D.B., Skrzypek G., Rearick M. (2015): Isotopic studies of the Rio Grande. Part 1 – Importance of sulfide weathering in the riverine sulfate budget in south Colorado and north/central New Mexico. *Chemical Geology* 411:323-335.
4. **Szynkiewicz A.**, Borrok D.B., Ganjegunte G.K., Skrzypek G., Ma L., Rearick M., Perkins G. (2015): Isotopic studies of the Rio Grande. Part 2 – Salt loads and human impact in south New Mexico and west Texas. *Chemical Geology* 411:336-350.
5. **Szynkiewicz A.**, Borrok D.M., Vaniman D.T. (2014) Efflorescence as a source of hydrated sulphate minerals in valley settings on Mars. *Earth and Planetary Science Letters* 393: 14-25.
6. **Szynkiewicz A.**, Modelska M., Rangel-Medina M., Farmer G.L., Rabago P.H., Monreal R. (2014) Age and shape of paleo-seawater intrusions in the semi-arid coastal aquifer of Sonora Desert, northern Mexico. *Geoscience Notes* 2.2: 12-38.
7. **Szynkiewicz A.**, Modelska M., Buczyński S., Borrok D.M., Merrison J.P. (2013) The polar sulfur cycle in the Werenskioldbreen, Spitsbergen: Possible implications for understanding the deposition of sulfate minerals in the North Polar Region of Mars. *Geochimica et Cosmochimica Acta* 106: 326-343.

8. **Szynkiewicz A.**, Newton B.T., Timmons S.S., Borrok D.M.(2012) The sources and budget for dissolved sulfate in a fractured carbonate aquifer, Southern Sacramento Mountains, New Mexico, USA. *Applied Geochemistry* 27: 1451-1462.
9. **Szynkiewicz A.**, Johnson A.P., Pratt L.M.(2012) Sulfur species and biosignatures in Sulphur Springs of Valles Caldera, New Mexico – implications for Mars astrobiology. *Earth and Planetary Science Letters* 321-322: 1-13.
10. **Szynkiewicz A.**, Witcher J., Modelska M., Borrok D.B., Pratt L.M. (2011) Anthropogenic sulfate loads in the Rio Grande, New Mexico. *Chemical Geology* 283: 194-209.
11. **Szynkiewicz A.**, Moore C.H., Glamoclija M., Bustos D., Pratt L.M. (2010) The origin of coarsely crystalline gypsum domes in a saline playa environment at the White Sands National Monument, New Mexico. *Journal of Geophysical Research*, 115, F02021, doi:10.1029/2009JF001592.
12. **Szynkiewicz A.**, Ewing R.C., Moore C.H., Glamoclija M, Bustos D., Pratt L.M. (2010) Origin of terrestrial gypsum dunes – implications for Martian gypsum-rich dunes of Olympia Undae. *Geomorphology*, 121: 69-83.
13. Skrzypek G., Jezierski P., **Szynkiewicz A.** (2010) Preservation of primary stable isotope signatures of peat-forming plants during early decomposition – observation along an altitudinal transect. *Chemical Geology*, 273: 238-249.
14. **Szynkiewicz A.**, Moore C.H., Glamoclija M., Pratt L.M. (2009) Sulfur isotope signatures in gypsiferous sediments of the Estancia and Tularosa Basins as paleoindicators of sulfate sources, hydrologic cycle and bacterial activity. *Geochimica et Cosmochimica Acta*, 73, 6162-6186.
15. **Szynkiewicz A.**, Modelska M., Kurasiewicz M., Jędrysek M.O., Mastalerz M. (2008) Aging of organic matter in the incubated freshwater sediments; Inferences from C and H isotopic ratios in methane. *Geological Quarterly*, 52(4): 383-396.
16. **Szynkiewicz A.**, Medina M.R., Modelska M., Monreal R., Pratt L.M. (2008) Sulfur isotopic study of sulfate in the aquifer of Costa de Hermosillo (Sonora, Mexico) in relation to upward intrusion of saline groundwater, irrigation pumping and land cultivation. Review Paper in *Applied Geochemistry*, 23: 2539-2558.
17. **Szynkiewicz A.**, Modelska M., Jędrysek M.O., Mastalerz M. (2008) The effect of acid rain and altitude on concentration, $\delta^{34}\text{S}$, and $\delta^{18}\text{O}$ of sulfate in the water from Sudety Mountains, Poland. *Chemical Geology*, 249: 36-51.
18. **Szynkiewicz A.**, Jędrysek M.O., Kurasiewicz M., Mastalerz M. (2008) Influence of sulfate input on freshwater sediments: Insights from incubation experiments. *Applied Geochemistry*, 23: 1607-1622.
19. Jezierski P., **Szynkiewicz A.**, Jędrysek M.O. (2006) Natural and anthropogenic origin sulphate in a mountainous aquatic system: S and O isotope evidences. *Water Air and Soil Pollution*, 173: 81-101.
20. **Szynkiewicz A.**, Jędrysek M.O., Kurasiewicz M. (2006) Carbon isotope effects during precipitation of barium carbonate: implications for environmental studies. *Environmental Chemistry Letters*. 4(1), 29-35.

Proceedings and extended abstracts:

21. **Szynkiewicz A.**, Mikucki J. (2016) Sulfur biosignatures in continental hot spring, stream, and crater lake sediments affected by hydrothermal H_2S gas emission. Workshop on Biosignature Preservation and Detection in Mars Analog Environments, May 16-19, Lake Tahoe, Nevada.
22. **Szynkiewicz A.**, Goff F., Faiia A.M., Vaniman D.T., Subia T., Sanchez D., Coleman J. (2015) Aqueous sulfur budget and oxidation of fumarolic H_2S in the volcanic complex of Valles Caldera, New Mexico – Geochemical implications for Mars. *46th Lunar and Planetary Science Conference, Abstract #1303*.
23. **Szynkiewicz A.**, Vaniman D.T., Goff F., Subia T., Sanchez D., Faiia A.M., Coleman J. (2014) Hydrological sulfur cycling in the volcanic complex of Valles Caldera, New Mexico –

- Geochemical implications for Mars. The 8th International Conference on Mars, Pasadena July 14-18th, Abstract # 1206.
24. **Szynkiewicz A.**, Vaniman D.T. (2014) Sulfur cycling on Mars from a perspective of sulfur-rich terrestrial analogs. The 8th International Conference on Mars, Pasadena July 14-18th, Abstract # 1204.
 25. Fenton L.K., Bishop J.L., Lafuente B., Horgan B.H., **Szynkiewicz A.**, Bustos D., King S.J. (2014) Preliminary results from a field study of the mineralogy of White Sands National Monument dune field. *45th Lunar and Planetary Science Conference, Abstract #2855.*
 26. **Szynkiewicz A.**, Vaniman D.T. (2013) Terrestrial efflorescences as analogs for the origin of sulfate minerals in valley settings on Mars. *Analog Sites for Mars Mission II Workshop, Washington DC.*
 27. **Szynkiewicz A.**, Borrok D.M., Vaniman D.T., Goff F. (2013) Hydrological sulfur cycling in the volcanic complex of Valles Caldera, New Mexico – Geochemical implications for Mars. *44th Lunar Planetary Science Conference, Houston, 18-22 March, # 1144.*
 28. **Szynkiewicz A.**, Borrok D.M., Merrison J. (2011) The role of sulfide weathering in formation of the North Polar gypsum on Mars. *Fifth Mars Polar Science Conference, #6018.*
 29. **Szynkiewicz A.**, Ewing R.C., Fishbaugh K.E., Bourke M.C., Bustos D., Pratt L.M. (2009) Geomorphological evidence of plausible water activity and evaporitic deposition in interdune areas of the gypsum-rich Olympia Undae Dune Field. *40th Lunar Planetary Science Conference, Houston, 23-27 March, # 2038 [CD-ROM].*
 30. **Szynkiewicz A.**, Pratt L.M., Glamoclija M., Moore C.H., Singer E., Bustos D. (2008) White Sands gypsum dunes – a terrestrial analog to North Polar dunes on Mars? *LPI Contribution No. 1403, Planetary Dunes Workshop: A Record of Climate Change, #7011.*
 31. **Szynkiewicz A.**, Pratt L.M., Glamoclija M., Bustos D. (2008) Gypsum dunes from White Sands National Monument – potential terrestrial analog to North Polar dunes on Mars. *39th Lunar Planetary Science Conference, Houston, 10-14 March, # 2080 [CD-ROM].*
 32. **Szynkiewicz A.**, Modelska M., Trojanowska A. (2007) Sulfate content, $\delta^{34}\text{S}(\text{SO}_4^{2-})$ and arylsulfatase activity in fresh soil and incubated soil profiles - preliminary results. *Proceedings of XXXV IAH Congress on Groundwater and Ecosystem, 17-21 September, Lisbon 2007, Paper no. 496, pp. 1-5 [CD-ROM].*
 33. **Szynkiewicz A.**, Pratt L.M., Glamoclija M. (2007) Sulfur cycling in gypsum dunes from New Mexico – terrestrial analogs to sulfate-eolian deposition and early diagenesis on Mars. *38th Lunar Planetary Science Conference, Houston, 12-16 March 2007, #2250 [CD-ROM].*
 34. Glamoclija M., Schieber J., **Szynkiewicz A.**, Beard B. (2007) Sulfur and iron geochemistry, and their relation to microbial communities from the submarine hydrothermal site North of Panera Island, Tyrrhenian Sea, Italy. *37th Lunar Planetary Science Conference, Houston, 13-17 March 2006, #2270 [CD-ROM].*
 35. **Szynkiewicz A.**, Pratt L.M. (2006) Calibration of contamination from soil organic matter in exposed mantle xenoliths – preliminary results [#2088]. *37th Lunar Planetary Science Conference, Houston, 13-17 March 2006, #2270 [CD-ROM].*