Circe Verba, Ph.D
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Education:
University of Oregon: Ph.D Geology, June 2013
Dissertation: Potential Impacts Of Formation Waters On The Integrity Of Class H Cement And Reservoir Rock In Carbon [Co-] Sequestration Settings

Northern Arizona University: MS Geology, 2009
MS Thesis: Comparison of dust devil morphologies in Gusev and Russell craters
Coursework: Arid geomorphology, sedimentary depositional systems, geophysics, physics of the solar system, structure, volcanology

Oregon State University Corvallis, Oregon: BS Earth Science with Geology focus, 2007
Senior thesis: Microbial tunnels in freshwater pillow basalt.
Coursework: Microbiology, geomorphology, coastal & biological oceanography, mineralogy/petrology/volcanology, remote sensing, Geographic Information System (GIS)

Computational Skills:
FEI Scanning Electron Microscope- Energy Dispersive Spectroscopy (SEM-EDS)
INCA microanalysis software for BSE/EDS
JADE X-ray diffraction pattern analysis (XRD)
ESRI: ArcGIS 9, ArcMap/ArcScene
Linux/unix programming and other basic computer skills
Knowledge of Integrated Software for Imagers and Spectrometers (ISIS)
Leica Application Suite (LAS) and Image ProPlus software
Geochemistry Model: CHIM-XPT/SOLVEQ/Minor geochemist workbench
Geologic Skills: Field experience (Oregon, Washington, Arizona, Italy, Spain, France)
Petrography Lab: Microscope, thin sections, mount preparation & staining skills

Professional Work Experience
Oct. 2009-Current U.S. Department of Energy- National Energy Technology Lab
Albany, OR, ORISE Research Fellowship and Federal MMIP/Pathways Student

Aug. 2007- Aug. 2009 U.S. Geological Survey, Flagstaff, AZ
Contractor, Image Analyst, NASA HiRISE Team

Experience:
June-August 2006 National Science Foundation (NSF) Funded NASA/SETI Internship: Martian Slope Streaks; Cynthia Phillips c/o SETI Institute
Jan.-June 2006 Teaching Internship: Sixth grade geology and astronomy
Wanda Carter, Corvallis, Oregon, Franklin Elementary School
Dec. 2004-April 2006 Hydrology-soil lab assistant
Dr. Roy Haggerty, Oregon State University, Geosciences Department

Memberships
American Geophysical Union (AGU)
Microscopy Society of America (MSA)
Microanalysis Society #2069 (MAS)

Volunteer Experience:

- Oregon State University- Science and Math Investigative Learning Experiences (2005, 2006)
- Salmon Bowl: Science Camp at COAS/Oregon State University (2006)
- Da Vinci Days, Corvallis, OR (Science and Math Fair for children) (2003, 2005)

Publications

Li, C., Jafari Azad, V., Rodriguez, D., Ideker, J., Isgor, B., & **Verba, C**. Elucidating Damage Mechanisms in Class H Cement from CO2 or CO2-O2 Sequestration. 14th International Congress on the Chemistry of Cement- to be presented Beijing China, 2015. **To be presented**

Wishart, J.R.Morono, Y.Ito, M.Ijiri, A.Hoshino, T.Inagaki, F.**Verba, C**.Torres, M.E.Colwell, F.S. Assessing Microbial Activity in Marcellus Shale Hydraulic Fracturing Fluids. 2014 American Geophysical Union Abstract #. **To be presented**

Colwell, F., **Verba, C**., Thurber, A., Alleau, Y., Koley, D., Peszynska, M., Torres, M. Feasibility of Biogeochemical Sealing of Wellbore Cements: Lab and Simulation Tests. American Geophysical Union Abstract #. **To be presented**

Yang, J., Torres, M., Kim, J.H., **Verba, C**. Investigation Rare Earth Element Systematics in the Marcellus Shale. American Geophysical Union Abstract #. **To be presented**

Verba, C., Lieuallen, AE., Yang, J., Torres, M., Hakala, A. Evaluating the Influence of Chemical Reactions on Wellbore Cement Integrity and Geochemical Tracer Behavior in Hydraulically-Fractured Shale Formations. American Geophysical Union Abstract #. **To be presented**

Li, C., Jafari Azad, V., Rodriguez, D., Ideker, J., Isgor, B., & **Verba, C.** Experimental and Thermodynamic Modeling Approach To Elucidating Damage Mechanisms In Cement-Well Casting-Host Rock Settings For Underground Storage of CO_2. American Geophysical Union Abstract #. **To be presented**

Li, C., Jafari Azad, V., Rodriguez, D., Ideker, J., Isgor, B., & **Verba, C.** Numerical investigation of class H cement deterioration under CO_2-O_2 co-exposure in down-well conditions. American Geophysical Union Abstract #. **To be presented**

Mordensky, S. Rabjohns, K., Lieuallen, A., **Verba, C.** *Characterization of the Oriskany and Berea Sandstones: evaluating the microbial degradation pathways and potential sandstone-hydraulic fracturing chemical reactions*; NETL-PUB-XXX; NETL Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Albany, OR, 2014; p XX. **Internal NETL review.**

Mordensky, S., Schubert, B., **Verba, C.,** Hakala, A. *Isotope Concentrations in the Appalachian Basin: A Review*; NETL-PUB-XXX; NETL Technical Report Series; U.S. Department of

Energy, National Energy Technology Laboratory: Albany, OR, 2014; p XX. **Submitted**

Wilson, B., Verba, C., Rabjohns, K., Colwell, R. An Evaluation of Subsurface Microbial Likelihood Based on Permeability, Porosity, and Temperature. NETL-TRS-XX-2014; Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Morgantown, WV, 2014; p XX.

Rodriguez, R.; Crandall, D.; Song, X.; **Verba**, C.; Soeder, D. *Imaging Techniques Applied to Unconventional Oil and Gas Shales*; NETL-TRS-XX-2014; Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Morgantown, WV, 2014; p XX.

Verba, CA., Reed, MH., Ideker, JH., Kutchko, B. Geomechanical Strength Tests for Portland Cement for Sequestration Purposes. NETL-TRS-X-2014; NRAP Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Morgantown, WV,2013; p XX. **Waiting internal approval**.

Verba, CA., O'Connor, W., Rush, G. (201X-in submission) The Influence of Brine on Class H Portland Cement Paste with CO2 Injection. In Review in International Journal of Greenhouse Gas Control.

Verba, CA., O'Connor, W., Rush, G., Palandri, J. (2014) Basalt and Sandstone Host Rock with Class H Portland Cement Under CO_2 Sequestration Conditions. International Journal of Greenhouse Gas Control. 23. pp. 119-134.

Verba, CA. (2013) Potential Impacts Of Formation Waters On The Integrity Of Class H Cement And Reservoir Rock In Carbon [Co-] Sequestration Settings. Doctoral Dissertation.

Verba, CA., Kutchko, B, Reed, MH. (2012) Co-Sequestration Geochemical Modeling: Simple Brine Solution + CO_2-O_2-SO_2. American Geophysical Union, Fall Meeting 2012, Abstract H23A-1313.

Lavalleur, H.J., **Verba, C.A**., Disenhof, C.R., O'Connor, W.K., Colwell, F.S. (2012-revision). Changes in natural microbial communities exposed to geological carbon sequestration conditions in basalts. Submission to International Journal of Greenhouse Gas Control.

O'Connor, W., Rush, G., **Verba, C.** (2012) The NETL Aqueous Mineralization Process and Recent Developments. AIChE 2012 Annual Meeting Pittsburgh, PA. Oct. 28- Nov. 2, 2012.

Verba, CA., O'Connor, W., Ideker, J. (2012) Advances in Geological CO_2 Sequestration and Co-Sequestration with O_2. ACI-CANMET Special Publication in Recent Advances in Concrete Technology and Sustainability Issues. Prague, Czech Republic. **Special Publication** V 298. pp. 1-16.

Verba, Circe, O'Connor, William. (2012) Potential Geologic Co-Sequestration of CO_2-O_2: Alteration in Class H Portland Cement. 11th Annual Carbon Sequestration Conference, Pittsburgh, PA, U.S.A., April 29-May 4, 2012. **Presentation**

O'Connor, W., Rush, G., **Verba, C.** (2012) The NETL Aqueous Mineralization Process: Recent Developments and Novel Applications. NETL-Publication 335 **Report**.

Colwell, F., Lavalleur, H., **Verba, C**., O'Connor, W., Fisk, M. (2011) Microbiological Characterization of a Basaltic System Targeted for Geological Sequestration of Carbon. American Geophysical Union, Fall Meeting 2011, Abstract # *B51J-0543*

Verba, Circe, O'Connor, William, Rush, G.E., Ideker, J.H., Potential Geologic Co-Sequestration of CO_2-O_2 : Alteration in Class H Portland Cement. ACERS – Cements Division, Advances in Cement-Based

Materials: Characterization, Processing, Modeling & Sensing, July 23-26, 2011, Vanderbilt University. **Oral Presentation**

Verba, C.A., O'Connor W.K., Rush, G.E. (2011) Implications of Geologic CO_2 sequestration for Basaltic and Siliceous Host Rocks and Class H cement. 10th Annual Carbon Sequestration Conference, Pittsburgh, PA, U.S.A., May 2-5, 2011.

Verba, CA., O'Connor, W., Ideker, J. (2011) Advances in Geological CO_2 Sequestration and Co-Sequestration. ACI-CANMET Prague, Czech Republic 2012 **Abstract Oral Presentation.**

Verba, Circe, O'Connor, William, Ideker, J.H., "Cement Seal Integrity: Microstructural Characterization of CO2 Alteration Zones in Class H Portland Cement," ACERS – Cements Division, Advances in Cement-Based Materials: Characterization, Processing, Modeling & Sensing, July 11-13, 2010, Purdue University, West Lafayette, IN,Recipient of **Best Poster Award**

Verba, CA., O'Connor, W. (2010) CO_2-Alteration Rates for Class H Portland Cement. 9th Annual Carbon Sequestration Conference. Abstract #996. **Oral Presentation.**

Verba, CA., Geissler, PE., Titus, & T., Waller, D. (2010) Observations from High Resolution Imaging Science Experiment (HiRISE): Martian dust devils in Gusev and Russell craters. Journal of Geophysical Reviews. 2009JE003498R.

Verba, CA. & Fisk, M. (2009) Suggested Evidence of Freshwater Microbial Activity Preserved in Columbia River Basalt. Submitted to *Geobiology* May 2009.

Verba, CA., Geissler, PE. & the HiRISE Team (2009) Comparative Analysis of Martian Dust Devil Track Morphologies in Gusev and Russell Craters LPSC XXXVIIII Abstract 1979. **Oral Presentation.**

Geissler, PE, Arvidson, R., Bell, J., Bridges, N. de Souza, P. Golombek, M. Greenberger, R.. Greeley, R., Herkenhoff, K,. Lahtela, H., Landis, G., Li, R., Moersch, J., Richter, L., Sims, M., Soderblom, J., Sullivan, R., Thompson, B., **Verba, C.**, Waller, D., Wang, A., HiRISE Team, MER Team. (2009) Constraints on Aeolian Degradation Rates on Mars from Erasure of Rover Tracks. LPSC XXXVIIII Abstract 2257

Hayward, RK., Titus, TN., Michaels, TI., Colaprete A., **Verba, CA**., & Christensen, PR. (2009) Aeolian dunes as ground truth for GCM and mesoscale modeling on Mars. LPSC XXXVIIII Abstract # 1212.

Lahtela, H., Titus, T., Geissler, P., Roach LH., **Verba, C**., Mustard, JF., Murchie, SL., Brown, AJ., Seelos, F., Seelos, K., Calvin, WM., Parente, & M., Cornwall, C. (2009) Coordinated HiRISE/CRISM observation on Gypsum signature in Martian polar dunes. LPSC XXXVIIII Abstract 2254

Milazzo MP., Keszthelyi LP., Jaeger, WL., Rosiek, M., Mattson, S., **Verba, C**., Beyer, RA., Geissler, PE., McEwen, AS. HiRISE Team (2009) The Distribution of Columnar Lavas on Mars as seen by HiRISE. LPSC XXXVIIII Abstract # 2159

Verba, CA., Geissler, PE. (2008) Comparison of dust devil morphologies in Gusev and Russell craters. American Geophysical Union, Fall Meeting 2008, Abstract #P41B-1368. **Poster presentation.**

Geissler, PE, Arvidson, R., Bell, J., Bridges, N. de Souza, P. Golombek, M. Greenberger, R.. Greeley, R., Herkenhoff, K,. Lahtela, H., Landis, G., Li, R., Moersch, J., Richter, L., Sims, M., Soderblom, J., Sullivan, R., Thompson, B., **Verba, C.**, Waller, D., Wang, A. (2008) Constraints on aeolian degradation rates on Mars from erasure of rover tracks. American Geophysical Union, Fall Meeting 2008, Abstract #P53A-1434.

Geissler, PE., Tornabene L., **Verba, C.,** Bridges, N. (2008) HiRISE observations of Martian albedo boundaries. LPSC XXXIX Abstract # 2352.

Milazzo MP., Keszthelyi LP., Jaeger, WL., Rosiek, M., Mattson, S., **Verba, C**., Beyer, RA., Geissler, PE., McEwen, AS. HiRISE Team (2009) Discovery of columnar jointing on Mars. Geology, 37(2). pp.171–174.

Verba CA., & Phillips, CB. (2006) Formation of Martian Slope Streaks: Implications for Aqueous Processes. Eos Trans. AGU. 87(52) fall Meet. Abstract #P34B-05. **Oral Presentation.**