Laura Powers

PRINCIPAL PETROGRAPHER + MATERIALS SCIENTIST

Ms. Powers has extensive experience in evaluating geological and building materials using polarized-light microscopy and other petrographic methods, scanning electron microscopy with x-ray spectroscopy, electron microprobe analysis, x-ray fluorescence, x-ray diffraction, physical testing, and chemical testing methods. Her expertise includes assessing the composition and condition of historical building materials for restoration and conservation purposes, identification of defects and deficiencies in precast and cast-in-place concrete, analysis of non-portland cement-based building materials, assessing damage caused by fire and explosion, and evaluating performance of materials in aggressive environments.

Throughout her career, Ms. Powers has worked with a wide variety of building materials including: concrete, mortar, stucco, gypsum plaster, dimension stone, adobe, fired clay products, natural and synthetic fibers, metals, and coatings. She has also participated in research in sequestration of biohazardous and low-level radioactive materials in cementitious systems, radionuclide migration in concrete, laser ablation cleaning of stone, expansion mechanism of delayed ettringite formation (DEF), and autogenous shrinkage of high-performance concrete (HPC).

Ms. Powers has coordinated and performed numerous field and laboratory forensic investigations of materials behavior and performance issues, and provided expert testimony at trial, arbitration, and mediation. She is a frequent speaker at professional conferences and has presented topics on cement-based materials, aggregates, and petrography for courses at the Portland Cement Association and for courses and seminars at multiple universities.

Academic Credentials

M.S. in Geology
University of Saskatchewan - Saskatoon, Canada, 1985

B.S. in Geology
University of Massachusetts - Amherst, 1977

Contact Information

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Representative Project Experience

Petrographic + SEM/EDS Analysis

- Performed field investigation and laboratory studies including petrographic and SEM/EDS studies to assess the condition of a section of early 1900s-era concrete aqueduct that was partially buried in sulfate soils.
- As part of a team of petrographers, conducted rapid turn-around petrographic examinations of more than 200 concrete cores taken to assess fire damage to the interior of a highway tunnel caused by a fuel tanker fire.
- Conducted petrographic examinations and coordinated chemical analyses of historic mortars, concrete, and stone from 1800s-era lighthouses and fortifications. Results were used to assess in-place condition and formed the basis for repairs.
- Experienced in the application of petrographic methods, including polarized-light and electron microscopy, and integration of chemical and physical tests in investigations of building materials performance. Materials studied include: concrete, mortar and masonry assemblies, dimension stone, stucco, gypsum-based materials, and individual material components.

Litigation Support

- Evaluated individual constituent materials in pre-bagged concrete product and performed detailed microscopical analyses to correlate the product with concrete fragments found with a murder victim.
- Analyzed debonded stucco and bonding compound from multi-story residential tower. The analyses were used to support repair claims.
- Analyzed individual construction materials and conducted detailed microanalysis of clogs in drains in newly renovated military barracks to determine the origin of clogs and likely responsible party.

Laura Powers

Forensic Investigation

- Conducted on-site petrographic studies of concrete cores in a nuclear power plant to investigate the cause of cracking and source of secondary deposits.
- Performed microscopical analyses of deposits collected from damaged paint finishes on automobiles downwind of industrial facilities to determine the source of fugitive particulate matter.
- Analyzed concrete fragments from a jet engine damaged in transit to a maintenance facility and performed comparative analyses of concrete from the underside of multiple damaged bridges to determine possible match.
- Researched the effects of high-temperature fires on concrete performance and performed petrographic analysis of fire damage in concrete, masonry, stucco, and gypsum plaster.
- Performed forensic microscopy to identify sources of airborne and waterborne particulates from floods, explosions, fires, and stack emissions.

Materials Science

- Developed a course in concrete and aggregate petrography for the Portland Cement Association and served as principal instructor. Frequent speaker at professional society meetings, university seminars, workshops, and forums.
- Conducted geochemical, petrologic, and field investigations of gold, uranium, chromium, nickel, cobalt, copper, lead, zinc ore deposits in Canada, Australia, and the United States. Constructed paragenetic models for ore deposition.
- Conducted research on sequestration of biohazardous and low-level radioactive materials in cementitious systems (waste forms).
- Assessed service environment degradation mechanisms such as acid-attack, cyclic freezing and thawing, aggressive chemical exposure, and thermal cycling.

Masonry + Historical Structures

- Investigated composition and condition of historic building materials in multiple locations for the National Park Service to assist restoration and conservation efforts.
- Conducted an evaluation of original and later exterior repair mortars and interior plaster at a historic church in Atlanta, Georgia for a restoration and repair campaig.
- Evaluated the composition and condition of multiple generations of mortar for the rehabilitation and re-purposing of the 1880s structure into artist's lofts.
- Evaluated the original 1920s stone masonry mortar to formulate a durable compatible mortar for restoration and rehabilitation of the structure at Paradise Inn Annex in Mt. Rainier, Washington.
- Evaluated the composition and condition of mortar from the 1880s textile mill to formulate a compatible mortar for rehabilitation of the structure and conversion into loft apartments.
- Conducted site observations of the condition of the 1870s stone masonry at the American Museaum of Natural History in New York, New York. Evaluated original and later repair mortars, as well as trial mixtures for compatible replacement mortars to be used in a repair campaign.
- Conducted laboratory, quarry, and field investigation of stone to assess historical performance as part of an evaluation for its potential use in new construction at Whitman College, Princeton University.
- Evaluated select characteristics of multiple proprietary repair mortars marketed for restoration purposes to assess potential compatibility issues with existing masonry mortars at Battelle Memorial Institute.
- Assessed the effectiveness of different laser cleaning trials on soiled marble at the New York Public Library in New York, using polarized-light microscopy and scanning electron microscopy with x-ray spectroscopy.
- Conducted field and laboratory evaluation of stone and mortar deterioration and color variation to assist architects in mitigating distress and restoring appearance of the masonry at the Indian Community School in Franklin, WI.

Laura Powers

Structural Assessment

- Investigated defects and deficiencies in precast concrete and cast-in-place concrete.
- Principal investigator on the project team for a Middle Eastern dam grout evaluation where she was responsible for performing petrographic and SEM/EDX analysis of grout, coordinating organic and inorganic chemical tests, and preparing a comprehensive report on grout composition and condition. The analyses concluded the weak grout had been over-watered and the composition did not conform to project specifications.
- Principal petrographer for the petrographic examination of concrete cores from tank supports, where she investigated the cause of cracking and spalling of concrete support columns for water tanks. Analyzed the characteristics of concrete cores from distressed and non-distressed locations to determine the pattern and depth of damage. The cracking and spalling were attributed to cyclic freezing and thawing of critically saturated, non-air-entrained concrete.
- As principal petrographer, performed field investigation of the condition of the interior and exterior of a 100-year-old concrete aqueduct, determined core locations for laboratory analysis, conducted petrographic examinations of more than sixty cores, and coordinated chemical analyses and mechanical testing to assess the condition of the aqueduct. The investigation showed that critical portions of the structure exhibited severe loss of section caused by a combination of cyclic freeze/thaw damage and the thaumasite form of sulfate attack (TSA) related to sulfate soils.
- Performed on-site petrographic examinations of cores taken from the containment structure at a nuclear power facility to assess the cause of cracking and associated water leakage. Analysis determined that cracking occurred at a cold joint, formed during the initial construction, that had opened due to expansion of wood debris from formwork and corrosion products of metallic debris.

Publications

Building Materials Information Sheet 11: Early Cements. Built Environment Journal, Powers, Laura J., Royal Institution of Chartered Surveyors, London, 62, April/May 2020.

Petrographic Examination and SEM/EDX Analysis of Ultra-High Performance Concrete, Powers, Laura J. and Ferraro, Jaclyn, Proceedings, 17th Euroseminar on Microscopy Applied to Building Materials, Toronto, Ontario, CANADA, 2019, Extended Abstracts.

How Clean? A Methodology to Assess Progress of CCR Removal in Real Time, Powers, Laura and Jennings, Victoria, World of Coal Ash 2019, St. Louis, Missouri, Electric Power Research Institute First Place Poster Award

Thaumasite Sulfate Attack: Case Studies and Implications, Hou, Xiaoqiang, Powers, Laura, Lawler, John, Tureyen, Koray, Proceedings of the 37th International Conference on Cement Microscopy, ICMA, Seattle, Washington, 2015.

Radionuclide Migration through Sediment and Concrete: 16 Years of Investigations, Golovich, E. C., Mattigod, S. V., Snyder, M. M. V., Powers, L. J., Whyatt, G. A., and Wellman, D. M., Pacific Northwest National Laboratory report to U. S. Department of Energy, National Technical Information Service, November 2014.

Effect of Internal Curing on Freeze-Thaw Durability of Dry-Cast Concrete Segmental Retaining Wall Units and Solid Interlocking Concrete Paving Units, Walloch, Craig, Speck, Jeff, and Powers, Laura, ASTM STP 1577, 2014, 29 p.

Petrographic Analysis of Historic Mortars, Powers, Laura J., Papas, Susanne M., Masonry Edge/Story Pole. V. 6 n. 2, 2011.

Microscopical Studies of Mortar Made with Lunar Aggregate, Powers, L. J, Proceedings of the Thirty-Third International Conference on Cement Microscopy, ICMA, San Francisco, California, 2011.

The Importance of Petrographic Examination in Compositional Analysis of Mortar, Powers, L. J. and Papas, S. M., Proceedings of the Thirty-Second International Conference on Cement Microscopy, ICMA, New Orleans, Louisiana, 2010.

Cementitious Wasteforms for Immobilization of Low-Activity Radioactive Wastes, Wellman, D. M., Bovaird, C. C., Mattigod, S. V., Parker, K. E. Clayton, L. N., Powers, L. and Wood, M. I. in Concrete Materials: Properties, Performance and Applications, editor: J. T. Sentowski, Nova Science Publishers, Inc., 2009, Chapter 5.

Effect of Iron and Carbonation on the Diffusion of Iodine and Rhenium in Waste Encasement Concrete and Soil Fill Material under Hydraulically Unsaturated Conditions, Wellman, D. M., Parker, K. E., Powers, L., Whyatt, G. A., Clayton, L. N., Mattigod, S. V., and Wood, M. I., Applied Geochemistry, Vol. 23, Issue 8, August 2008, pp. 2256 - 2271.

Comparison of Field Testing with Laboratory Testing of the Durability of Dimension Stone, Bortz, S. A., Powers, L., and Wonneberger, B., ASTM STP 1499, Dec. 2007, pp 138-153.

The Potential Use of Laser Ablation for Selective Cleaning of Indiana Limestone, K.C. Normandin, L. Powers, D. Slaton, and M.J. Scheffler, Springer proceedings in physics, 2007, Vol. 116, Lasers in the Conservation of Artworks - LACONA VI Proceedings, Vienna, Austria, Sept. 21-25, 2005, pp 65-73.

Quantification of ASR in Concrete: An Introduction to the Damage-Rating Index Method, Powers, L. J. and Shrimer, F. T., SCP Symposium and Proceedings of the Twenty-Ninth International Conference on Cement Microscopy, ICMA, Quebec City, Quebec, Canada, 2007.

Microchemical Tests for Concrete Petrography, Powers, L. J., SCP Symposium and Proceedings of the Twenty-Ninth International Conference on Cement Microscopy, ICMA, Quebec City, Quebec, Canada, 2007.

A Discussion of the Benefits and Problems of ASTM C 1324 for Analyzing Hardened Masonry Mortars, Powers, L., Coleman, A., and Papas, S., Journal of ASTM International, Mar. 2007, Vol. 4, No. 2.

Relationship Between Indentation Hardness and Water-to-Cement Ratio of Hardened Mortar and Concrete, Cong, D. X., Reed, M. H., Powers, L. J., Shotwell, B. L. and Brown, B. D., Journal of ASTM International, Feb. 2006, Vol. 3, No. 2.

The Power of Petrography, Powers, L. J., Structure Magazine, Jan. 2006, Vol. 3, No. 2, pp 25-28.

A New Look at an Old Cement, Powers, L. J. and Walsh, J., Proceedings of the Twenty-Seventh International Conference on Cement Microscopy, ICMA, Victoria, British Columbia, Canada, 2005.

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No. 5, May 2002, pp 49-52.

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Assessment of Concrete in Sulfate Soils, Detwiler, R. J., Taylor, P. C., Powers, L. J., Corley, W. G., Delles, J.B., and Johnson, B. R., Journal of Performance of Constructed Facilities, August 2000, pp. 89-96.

Investigation of Deteriorated Concrete in Pavements, Miller, F. M., Detwiler, R. J., and Powers, L. J., Research and Development Serial No. 2197, Portland Cement Association, Skokie, IL, 2000.

Developments in Alkali-Silica Gel Detection, Powers, L. J., Concrete Technology Today, Vol. 20, No 1, April 1999, pp. 5-7.

Effect of Sulfates in Concrete on Their Resistance to Freezing and Thawing, Detwiler, J. R., and Powers-Couche, L. J., Ettringite The Sometimes Host of Destruction, ACI SP 177, Bernard Erlin Editor, 1999, pp. 219-247.

Investigation of an Historic Portland Cement Stucco, Powers, L. J., Proceedings, Seventh Euroseminar on Microscopy Applied to Building Materials, Delft, The Netherlands, 1999.

Investigation of Discoloration of Concrete Slabs, Miller, F., M., Powers, L. J., and Taylor, P. C., Research and Development Bulletin RD 2228, Portland Cement Association, Skokie, Illinois, 1998.

Lunar and Martian Resource Utilization - Cement and Concrete, Lin, T. D., Bhattacharja, S., Powers-Couche, L., Skaar, S. B., Horiguchi, T., Saeki, N., Munaf, D., Peng, Y. N., and Casanova, I., Abstracts, Workshop on Using in situ Resources for Construction of Planetary Outposts, April 30-May 1, 1998, Albuquerque, New Mexico. p 35.

Effect of Ettringite on Frost Resistance, Detwiler, R. J., and Powers-Couche, L. J., Concrete Technology Today, Vol. 18, No. 3, December 1997, pp. 1-4.

Behavior of Fresh Mortar in a Vacuum and Microstructure of Mortar Hardened in a Vacuum, Powers-Couche, L. J., and Lin, T. D., in Proceedings of the Fifth International Conference on Space, Vol. 1, 1996, pp 608-613.

Effect of Shotcrete Quality on Cracking of Swimming Pools, Gebler, S. H., Litvin, A., and Powers-Couche, L. J., Proceedings of the Concrete for Infrastructure and Utilities, E&FN Spon, London, England, 1996, pp. 275-285.

Microstructures of Fire-Damaged Concrete, Lin, W. M., Lin, T. D., and Powers-Couche, L. J., American Concrete Institute, Materials Journal, Vol.93, No. 3, 1996, pp. 199-205.

A Tale of Two Kiln Burners, Powers-Couche, L. J., and Miller, F. M., Proceedings of the Eighteenth International Conference on Cement Microscopy, ICMA, Duncanville, Texas, 1996, pp. 74-84.

Observations of Concrete Exposed to Very High Temperature, Powers-Couche, L. J., Proceedings of the Sixteenth International Conference on Cement Microscopy, ICMA, Duncanville, Texas, 1994, pp. 369-376.

Fire-Damaged Concrete - Up Close, Powers-Couche, L. J., Concrete Repair Digest, December 1992/January 1993.

Petrographic Analysis of Concrete and Related Building Materials, Powers-Couche, L. J., Geological Society of America, North-Central Section Meeting, 29-30 March 1993, Rolla, MO, Abstracts with Programs, Vol/Issue 25:3; 27.

Microscopical Examination of a Slag Cement Concrete, Powers-Couche, L. J., Proceedings of the Fourteenth International Conference on Cement Microscopy, ICMA, Duncanville, Texas, 1992, pp. 256-258.

Petrography Provides Results; Gives Insight into Concrete Distress, Powers-Couche, L. J., Concrete Trader, June, 1991, pp. 1 and 3.

Litigation Experience

Provided expert testimony at depositions, trials and arbitrations in Alabama, Arkansas, California, Florida, Illinois, Massachusetts, Michigan, Mississippi, Missouri, Nevada, North Dakota, Texas, Virginia, and Washington.

Contact Reports

Prepared more than 6,000 contract reports related to investigations of building materials.

Professional Affiliations and Activities

American Concrete Institute (ACI) - National, Wisconsin and Illinois Chapters

Society of Concrete Petrographers - President 2010-2012

American Society for Testing and Materials (ASTM)
- Technical Committee C09 Concrete and Concrete Aggregates
  - Task Group Chair C09.65 Water-Cementitious Materials Ratio
- Technical Committee C12 Mortars and Grouts for Unit Masonry
  - Committee C12 Membership Secretary 2017 - 2019
  - Committee C12 Recording Secretary 2020 -
  - Committee C12 Editorial Committee Chair
- Technical Committee C15 Manufactured Masonry Units

Association for Preservation Technology Western Great Lakes Chapter

Geological Society of America

Mineralogical Society of America

State Microscopical Society of Illinois

Laura Powers

Prior Experience

CTLGroup (Construction Technology Laboratories), Skokie, Illinois
Principal Petrographer and Materials Scientist, 2017 - Present

Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois
Associate Principal, 2008 – 2017
Consultant, 2003 - 2008

Construction Technology Laboratories, Skokie, Illinois
Principal Microscopist, 2000-2003
Senior Microscopist, 1997-2000
Senior Petrographer, 1995-1997
Petrographer, 1992-1995
Associate Petrographer, 1990-1992

Manville Sales Corporation, Waukegan, Illinois
QA/QC Manager, Refractory Ceramics, 1990
Quality Control Senior Technician, XRF and microscopy analyst, 1989

Macquarie University, Sydney, Australia
School of Earth Sciences Research Assistant and Instructor, 1986-1987