

# PATRICIA A. NADEAU

## RESEARCH AND EDUCATION FELLOW

Department of Earth and Planetary Sciences  
Department of Education  
American Museum of Natural History  
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### RESEARCH INTERESTS

- Volcanic gases
- Remote sensing
- Science education
- Volcano seismology
- Eruption mechanisms
- Eruption forecasting
- Igneous petrology
- Experimental petrology
- Education policy

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### CURRENT APPOINTMENT

*American Museum of Natural History* *New York, NY, USA*  
**Kathryn W. Davis Research and Education Fellow** **2012 - present**  
Scientific researcher and faculty member in a pilot Master of Arts in Teaching Earth Science program

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### EDUCATION

*Michigan Technological University* *Houghton, MI, USA*  
**Ph.D. in Geology** **2011**  
Dissertation: "Ultraviolet digital imaging of volcanic plumes: Implementation and application to studying magmatic processes at basaltic volcanoes" Supervisors: Drs. Simon Carn and Gregory Waite

*Simon Fraser University* *Burnaby, BC, Canada*  
**M.Sc. in Earth Sciences** **2006**  
Thesis: "A multi-parameter investigation of volcanic plume behavior and resultant environmental impact at a persistently degassing volcano, Masaya, Nicaragua" Supervisor: Dr. Glyn Williams-Jones

*McGill University* *Montreal, QC, Canada*  
**B.Sc. Honours in Earth Sciences** **2004**  
Honours Thesis: "Initial field trials of a mini-ultraviolet spectrometer and comparisons to the standard spectrometer for volcanic emissions" Supervisor: Dr. John Stix

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### PREVIOUS APPOINTMENTS

- **Research Assistant**, *Michigan Technological University*, 2007 - 2011
- **Volcanic Emissions Group Volunteer**, *Hawaiian Volcano Observatory*, 2006
- **Research Assistant**, *Simon Fraser University*, 2004 - 2006
- **Teaching Assistant** in Physical Geology, Mineralogy, and Volcanology, *Simon Fraser University*, 2004 - 2006
- **Hydrologic Technician**, *United States Geological Survey*, 2004

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### PUBLICATIONS

Rodríguez, L.A. and **Nadeau, P.A.** (accepted), *Monitoreo terrestre de gases volcánicos*. Central American Journal of Geology.

**Nadeau, P.A.**, Flores, K.E., Ustunisik, G., Zirakparvar, N.A., Grcevich, J., Pagnotta, A., Sessa, J.A., Kinzler, R.J., Macdonald, M., Mathez, E., and Mac Low, M.M. (2013), *Pilot Program for Teaching Earth Science in New York*, Eos Trans. AGU, 94(23), 205.

- Waite, G.P., **Nadeau, P.A.**, and Lyons, J.J. (2013), *Variability in eruption style and associated very long period events at Fuego volcano, Guatemala*, *J. Geophys. Res.: Solid Earth*, 118, 1526-1533, doi:10.1002/jgrb.50075.
- Nadeau, P.A.**, Palma, J.L., and Waite, G.P. (2011), *Linking volcanic tremor, degassing, and eruption dynamics via SO<sub>2</sub> imaging*. *Geophys. Res. Lett.*, 38, L01304, doi:10.1029/2010GL045592.
- Dalton, M.P., Waite, G.P., Watson, I.M., and **Nadeau, P.A.** (2010), *Multiparameter quantification of gas release during weak Strombolian eruptions at Pacaya Volcano, Guatemala*, *Geophys. Res. Lett.*, 37, L09303, doi:10.1029/2010GL042617.
- Dalton, M.P., Watson, I.M., **Nadeau, P.A.**, Werner, C., Morrow, W., and Shannon, J.M. (2009), *Assessment of the UV camera sulfur dioxide retrieval for point source plumes*, *J. Volcanol. Geotherm. Res.*, 188:358-366, 10.1016/j.jvolgeores.2009.09.013.
- Nadeau, P.A.**, and G. Williams-Jones (2009), *Apparent downwind depletion of volcanic SO<sub>2</sub>: Lessons from Masaya Volcano, Nicaragua*, *Bull. Volcanol.*, 71(4), 389-400, doi:10.1007/s00445-008-0251-9.
- Nadeau, P.A.** and Williams-Jones, G. (2008) *Beyond COSPEC: Recent advances in SO<sub>2</sub> monitoring technology*. In: Stix, J., Williams-Jones, G., and Hickson, C. (Editors), *The COSPEC Cookbook: Making SO<sub>2</sub> Gas Measurements at Active Volcanoes*, Proceedings of Volcanology, IAVCEI.
- Williams-Jones, G., Stix, J., and **Nadeau, P.A.** (2008) *Using the COSPEC in the field*. In: Stix, J., Williams-Jones, G., and Hickson, C. (Editors), *The COSPEC Cookbook: Making SO<sub>2</sub> Gas Measurements at Active Volcanoes*, Proceedings of Volcanology, IAVCEI.

***In review:***

- Nadeau, P.A.**, Werner, C.A., Waite, G.P., Brewer, I.D., Carn, S.A., Elias, T., and Sutton, A.J., *Examining the Role of Degassing in Recent Summit Activity, Kilauea Volcano, Hawaii*. *J. Volcanol. Geotherm. Res.*

***In preparation:***

- Nadeau, P.A.**, Webster, J.D., Mandeville, C.W., Goldoff, B.A., Shimizu, N, and Monteleone, B. *A glimpse into Augustine volcano's pre-glacial past: Insight from a massive rhyolite deposit*. *J. Volcanol. Geotherm. Res.*

***Theses:***

- Nadeau, P.A.** (2011), *Ultraviolet digital imaging of volcanic plumes: Implementation and application to studying magmatic processes at basaltic volcanoes*, Ph.D. Dissertation.
- Nadeau, P.A.** (2006), *A Multi-Parameter Investigation of Volcanic Plume Behavior and Resultant Environmental Impact at a Persistently Degassing Volcano, Masaya, Nicaragua*, M.Sc. Thesis.
- Nadeau, P.A.** (2004), *Initial field trials of a mini-ultraviolet spectrometer and comparison to the standard spectrometer for volcanic emissions*, B.Sc. Honours Thesis.

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**AWARDS AND HONORS**


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- Outstanding Student Paper Award, AGU Fall Meeting, VGP section, **2011**
  - Sigma Xi Grant-In-Aid of Research, **2010**
  - GSA North-Central Section Meeting Student Presenter Award, **2009**
  - Michigan Space Grant Consortium Graduate Fellowship, **2009**
  - Sigma Xi Grant-In-Aid of Research, **2009**
  - Geological Society of America Graduate Fellowship, **2008**
  - De Vlieg Fellowship, Michigan Technological University, **2007**
  - Léopold Gélinas Silver Medal, Geological Association of Canada, **2007**
  - Simon Fraser University Graduate Research Fellowship, **2005**
  - David Harrigan Memorial Prize, McGill University, **2004**
  - GEOTOP Undergraduate Research Grant, **2003**
  - James McGill Award, McGill University, **2003**
  - Montréal Women's Association of the Canadian Institute of Mining, Metallurgy, and Petroleum Award, **2003**
  - George M. Moffett Scholarship, BestFoods International/Whitehall Foundation, **2000 - 2004**
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**INVITED PRESENTATIONS**


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**Nadeau, P.A.** (2013), Departmental seminar, Department of Astrophysics, American Museum of Natural History.

**Nadeau, P.A.** (2013), Departmental seminar, Department of Earth and Planetary Sciences, American Museum of Natural History.

**Nadeau, P.A.**, Werner, C.A., Waite, G.P., Brewer, I.D., Carn, S.A., Elias, T., Poland, M.P., Sutton, A.J., and Wilson, D. (2010), *Ultraviolet imaging of volcanic SO<sub>2</sub>: Implementation as part of a multidisciplinary approach to studying summit activity at Kilauea Volcano, Hawaii*, Abstract V21C-2344 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.

Williams-Jones, G., and **Nadeau, P.A.** (2007), *SO<sub>2</sub> flux measurements at Masaya volcano, Nicaragua - apparent downwind depletion due to topography*, Eos Trans. AGU, 88(23), Jt. Assem. Suppl., Abstract V42B-02.

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**CONTRIBUTED PRESENTATIONS**


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**Nadeau, P.A.**, Webster, J.D., Mandeville, C.W., Goldoff, B.A., Shimizu, N., and Monteleone, B. (2013), *A glimpse into Augustine volcano's pre-glacial past: Insight from a massive rhyolite deposit*, Fall Meeting, AGU, San Francisco.

**Nadeau, P.A.**, Ebel, D.S., Harlow, G.E., Landman, N., Pagnotta, A., Sessa, J.A., Shara, M., Ustunisik, G.K., Webster, J.D., Blair, D., and Shumer, M. (2013), *Putting teachers-to-be in the field and the lab: Hands-on research at the American Museum of Natural History*, Fall Meeting, AGU, San Francisco.

Zirakparvar, N.A., Sessa, J.A., Ustunisik, G.K., Flores, K.E., **Nadeau, P.A.**, and Ebel, D.S. (2013), *Alternative pathways to improved university level Earth science teaching and developing the future geoscience workforce: Outcomes of postdoctoral research faculty involvement in a clinical teacher preparation at the AMNH*, Fall Meeting, AGU, San Francisco.

**Nadeau, P.A.**, Flores, K.E., Zirakparvar, N.A., Grceвич, J., Ustunisik, G.K., Kinzler, R.J., Macdonald, M., Mathez, E.A., and Mac Low, M. (2012), *Collaboration between research scientists and educators in implementation of a Masters program for training new Earth Science teachers in New York State*, Abstract ED11C-0751 presented at 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.

Waite, G.P., Brill, K.A., Lyons, J.J., and **Nadeau, P.A.** (2012), *Subtle and Not-So-Subtle Variability in Very-Long-Period Earthquakes at Fuego Volcano, Guatemala Reveal Details on Vent Location and Eruption Style*, Abstract V31G-05 presented at 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.

Flores, K.E., **Nadeau, P.A.**, Zirakparvar, N.A., Grceвич, J., and Ustunisik, G.K. (2012), *Unique post-doctoral positions in Master of Arts in Teaching Earth Science program at the American Museum of Natural History: Involving early-career research scientists in Earth science education*, Abstract ED52A-05 presented at 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.

**Nadeau, P.A.**, Werner, C.A., Waite, G.P., Brewer, I.D., Carn, S.A., Elias, T., and Sutton, A.J. (2012), *Examining the Role of Degassing in Recent Summit Activity, Kilauea Volcano, Hawaii*, Abstract TH-30 presented at AGU Chapman Conference on Hawaiian Volcanoes: From Source to Surface, Waikoloa, HI, 20-24 Aug.

**Nadeau, P.A.**, Werner, C.A., Waite, G.P., Brewer, I.D., Carn, S.A., Elias, T., Fee, D., Garces, M.A., and Sutton, A.J. (2011), *High temporal resolution SO<sub>2</sub> emission rate data as part of a multiparameter approach to studying summit vent activity at Kilauea volcano*, Abstract V41A-2487 presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec.

Waite, G.P., **Nadeau, P.A.**, and Lyons, J.J. (2011), *The quantitative relationship between gas puffing and very-long-period earthquakes at Fuego volcano, Guatemala*, Abstract V22A-03 presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec.

Brewer, I.D., Werner, C.A., and **Nadeau, P.A.** (2010), *Refining the workflow of UV camera measurements: Data collection from low emission rate volcanoes under variable conditions*, Abstract V21E-2369 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.

Lyons, J.J., Waite, G.P., and **Nadeau, P.A.** (2010), *Sealing the deal? Vent dynamics and strombolian eruptions recorded with broadband seismic, acoustic, and gas observations at Fuego Volcano, Guatemala*, Abstract V53B-2260 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.

- Patrick, M.R., Orr, T.R., Wilson, D., Sutton, A.J., Elias, T., Fee, D., and **Nadeau, P.A.** (2010), *Evidence for gas accumulation beneath the surface crust driving cyclic rise and fall of the lava surface at Halema`uma`u, Kilauea Volcano*, Abstract V21C-2339 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.
- Werner, C.A., **Nadeau, P.A.**, Brewer, I.D., Sealing, C.R., Elias, T., and Sutton, A.J. (2010), *Comparison of rapid SO<sub>2</sub> emission rates from a dual ultraviolet camera system with those of FLYSPEC traverses at Kilauea Volcano, May 2010*, Abstract V21C-2343 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.
- Nadeau, P.A.**, Waite, G.P., Palma, J.L., and Dalton, M.P. (2009), *Investigating the link between outgassing and seismicity at a persistently active volcano: Fuego, Guatemala*, Geological Society of America Abstracts with Programs, Vol. 41, No. 7, p. 482.
- Dalton, M.P., Waite, G.P., Watson, I.M., and **Nadeau, P.A.** (2009), *Investigating degassing mechanisms at Pacaya Volcano, Guatemala with concurrent UV camera gas measurements and seismo-acoustic records*, Geological Society of America Abstracts with Programs, Vol. 41, No. 7, p. 483.
- Nadeau, P.A.**, Waite, G.P., Palma, J.L., and Dalton, M.P. (2009), *Integration of high temporal resolution SO<sub>2</sub> emission rates and geophysical data at Central American volcanoes*, Geological Society of America Abstracts with Programs, Vol. 41, No. 4, p. 55.
- Dalton, M.P., Waite, G.P., **Nadeau, P.A.**, and Watson, I.M. (2009), *Improving the UV camera technique to correlated volcanic SO<sub>2</sub> emission, seismic, and acoustic measurements at Pacaya Volcano, Guatemala*, Geological Society of America Abstracts with Programs, Vol. 41, No. 4, p. 55.
- Nadeau, P.A.**, Waite, G.P., Palma, J.L., Dalton, M.P., and Watson, I.M. (2008), *Comparison of High Temporal Resolution SO<sub>2</sub> Emission Rates and Geophysical Data at Central American Volcanoes*, Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract V11C-2074.
- Rose, W.I., **Nadeau, P.A.**, Carn, S., and Schneider, D.J. (2008), *Aged volcanic clouds – Are they an aviation hazard and why?*, Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract A52A-04.
- Nadeau, P.A.**, Dalton, M.P., Waite, G.P., Rose, W.I., and Palma, J.L. (2008), *Towards integration of high-resolution SO<sub>2</sub> and geophysical data: Examples from Central American volcanoes*, IAVCEI Commission on the Chemistry of Volcanic Gases 10th Gas Workshop, Mexico City, Mexico.
- Nadeau, P.A.**, Dalton, M.P., Waite, G.P., Rose, W.I., and Palma, J.L. (2008), *Ultraviolet Digital Imaging of Volcanic Plumes: Implementation and Integration*, IAVCEI General Assembly, Reykjavik, Iceland.
- Nadeau, P.A.**, Bluth, G.J.S., Dalton, M.P., and Shannon, J.M. (2007), *Ultra-Violet Digital Imaging: Application to Volcanic SO<sub>2</sub> Plumes*, Workshop to Integrate Subduction Factory and Seismogenic Zone Studies in Central America, NSF MARGINS, Heredia, Costa Rica.
- Nadeau, P.A.**, and Williams-Jones, G. (2006), *Interaction of a volcanic plume with downwind topography at a persistently degassing volcano, Masaya, Nicaragua*, Geological Association of Canada Program with Abstracts, Vol. 31, p. 108.
- Nadeau, P.A.**, Williams-Jones, G., and Simpson, K. (2005), *Downwind dispersal and scavenging of volcanic SO<sub>2</sub> at a persistently degassing volcano, Masaya, Nicaragua*, IAVCEI Commission on the Chemistry of Volcanic Gases 9th Gas Workshop, Palermo, Italy.

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## RESEARCH AND FIELD EXPERIENCE

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*American Museum of Natural History, Department of Earth Sciences*

*New York, NY, USA*

### **Research Fellow**

**2012 - present**

Currently studying samples from a previously unknown large pumice deposit at Augustine volcano (Alaska), including analysis of mineral assemblages and melt inclusions; employing methods such as SIMS, EMP, FTIR, IHPV, LAICMPS to understand magma's origin, the role of volatiles, and relevance to hazards at Augustine; conducting high temperature IHPV experiments on dacite from Usu (Japan) volcano to construct a model of multi-volatile (H<sub>2</sub>O-CO<sub>2</sub>-S-Cl) solubility behavior in intermediate-silicic magmas.

*Michigan Technological University*

*Houghton, MI, USA*

### **Research Assistant**

**2007 - 2011**

Refined field methodology for UV camera data acquisition; developed programs for extracting SO<sub>2</sub> emission rates semi-automatically from UV imagery; conducted and/or participated in multiple field campaigns for multiparameter data acquisition at Fuego (Guatemala), Kilauea (Hawaii), Masaya (Nicaragua), Pacaya (Guatemala), and Santiaguito (Guatemala) volcanoes; synthesized geophysical and geochemical data from Fuego and Kilauea volcanoes to develop new models of volcanism.

*Hawaiian Volcano Observatory**Volcano, HI, USA***Volunteer, Volcanic Emissions Group****2006**

Conducted weekly samplings of fumarole gases at summit of Kilauea volcano; performed routine remote measurements of SO<sub>2</sub> emission rate via UV spectrometer; created preliminary map of SO<sub>2</sub> and CO<sub>2</sub> emissions in Kilauea caldera using LICOR and INTERSCAN instruments; aided in GPS survey of Mauna Loa volcano summit crater.

*Simon Fraser University**Burnaby, BC, Canada***Research Assistant****2004 - 2006**

Conducted two field campaigns at Masaya (Nicaragua) volcano to measure SO<sub>2</sub> emission rates via UV spectrometer; aided in field campaigns at Masaya and Poas (Costa Rica) volcanoes to conduct microgravity and GPS surveys; used field data and satellite imagery to show complex interaction between the volcanic plume and the ground surface at Poas and Masaya.

*United States Geological Survey**Troy, NY, USA***Hydrologic Technician, National Water Quality Assessment Program****2004****Student Contractor, Watersheds Research Program****2002-2003**

Completed water sample collection, filtration, and preparation for analysis.

*McGill University**Montreal, QC, Canada***Undergraduate Researcher****2003 - 2004**

Conducted field trials comparing baseline behavior of COSPEC and mini-DOAS spectrometers by measuring SO<sub>2</sub> emission rate at a coal-fired power plant (Tonawanda, NY) and a paper mill (Cornwall, ON, Canada).

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**TEACHING EXPERIENCE**

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*American Museum of Natural History, Department of Education**New York, NY, USA***Education Fellow****2012 - present**

Faculty in pilot Master of Arts in Teaching (MAT) Earth Science program; evaluated and interviewed incoming applicants; developed science practicum course; taught 7-week practicum in which 20 students participate in 2 weeks of geological field work followed by laboratory research culminating in a final research project and presentation; co-supervised 5 students in experimental petrology research project; visited high-needs high schools to conduct a lab exercise on lava viscosity and volcanoes; taught sessions in seminar course for incoming students.

*Michigan Technological University**Houghton, MI, USA***Workshop Organizer/Instructor****2011**

Organized and presented class and laboratory sessions held at an NSF PASI workshop at the University of Costa Rica on ground-based remote sensing of volcanic sulfur dioxide.

*Michigan Technological University**Houghton, MI, USA***Guest Lecturer****2009 - 2010**

Taught lectures periodically in courses, "Fundamentals of Remote Sensing" and "Topics in Volcanology", both upper-level undergraduate and graduate classes.

*Michigan Technological University**Houghton, MI, USA***Peer Mentor****2008 - 2010**

Instructed undergraduate, visiting summer, and graduate students in the use of the UV camera at volcanoes.

*Michigan Technological University**Houghton, MI, USA***Workshop Instructor****2007**

Organized and presented class and laboratory sessions held at the University of Costa Rica on satellite-based measurements of volcanic ash clouds.

*Simon Fraser University**Burnaby, BC, Canada***Teaching Assistant****2004 - 2006**

Taught laboratory section for upper-level undergraduate course, "Volcanology"; laboratory section for two consecutive years of "Introduction to Mineralogy", a course for second-year undergraduates with a declared Earth Sciences major; and laboratory section for introductory course, "Physical Geology".

*McGill University**Montreal, QC, Canada***Exam Grader****2003 - 2004**

Administered /graded multiple choice, short answer, and essay exams in introductory course, "Terrestrial Planets"

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