

Esteban Gazel

Charles N. Mellowes Professor in Engineering

Department of Earth and Atmospheric Sciences

Graduate Fields of Geological Sciences, Material Sciences and Engineering

Cornell University

2122 Snee Hall, Ithaca, NY 14853

Lab Website: <https://gazelresearchgroup.eas.cornell.edu>

PROFESSIONAL APPOINTMENTS

- 2022-pres.** Department of Earth and Atmospheric Sciences, Cornell University
- Professor
- Atkinson Center for Sustainability, Cornell University
- Faculty Fellow
- Cornell Center for Materials Research, Cornell University
- Faculty Member
- American Museum of Natural History
- Research Associate in the Division of Physical Sciences
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- 2017-2022** Department of Earth and Atmospheric Sciences, Cornell University
- Associate Professor
- Atkinson Center for Sustainability, Cornell University
- Faculty Fellow
- Cornell Center for Materials Research, Cornell University
- Faculty Member
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- 2019-2021** Department of Earth and Atmospheric Sciences, Cornell University
- Director of Undergraduate Studies
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- 2011-2017** Department of Geosciences, Virginia Tech
- Assistant Professor
- Lamont-Doherty Earth Observatory of Columbia University
- Adjunct Assistant Research Professor
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- 2009-2011** Lamont-Doherty Earth Observatory of Columbia University
- Postdoctoral Fellowship in the Earth, Environmental, and Ocean Sciences
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- 2007** IFM-GEOMAR, Kiel, Germany
- Invited Scientist (Summer-Fall)
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- 2005-2007** Department of Earth and Planetary Sciences, Rutgers University
- Teaching Assistant: Introductory Geology, Mineralogy, Petrology
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- 2001-2005** Central American School of Geology, University of Costa Rica (UCR)
- Teaching Assistant: Geochemistry, Mineralogy and Economic Geology

- Responsible for the University's collection of rocks and minerals
- Undergraduate Research: Magmatic evolution of the Miocene Arc in Central America

2001-2004 Research Center in Nuclear Sciences, University of Costa Rica

- Undergraduate Research: Geochemistry of radioactive isotopes in active volcanic systems

EDUCATION

2005- 2009 Department of Earth and Planetary Sciences, *Rutgers University*
Ph.D. in Geological Sciences
Thesis: Interaction of the Galapagos Plume with the Southern Central American Volcanic Front.
Committee: M. J. Carr, C. Herzberg, M. Feigenson, and K. Hoernle

2001- 2004 Central American School of Geology, *University of Costa Rica*
B.S. in Geology (highest honors in 2004)
Undergraduate project: Volcanology of Poás Volcano Cinder Cones, Costa Rica.

HONORS AND AWARDS

2022 **Charles N. Mellowes Professor in Engineering**, Cornell University

2020 **Daniel M. Lazar '29 Excellence in Teaching Award**, the highest award for teaching in the College of Engineering, Cornell University.

2018 **GeoPrisms Distinguished Lecturer**

2017 **Kuno Lecture** at the European Geoscience Union meeting in 2017

2016 **Hisashi Kuno Award**, Volcanology, Geochemistry and Petrology Section of the American Geophysical Union (AGU).

2015 **Scholar of the Week**, Research Division, Virginia Tech

2014 **40 under 40** accolade from "El Financiero" the finance newspaper of Costa Rica and Central America

2009 **Postdoctoral Fellowship in the Earth, Environmental, and Ocean Sciences, Lamont-Doherty Earth Observatory**, Columbia University (only three granted in 2009)

Costa Rican National Science Award "Clodomiro Picado." This is the most prestigious scientific honor given annually by the government of Costa Rica for outstanding scientific research

- 2008** **Bevier Fellowship for Excellence in Graduate Research**, Rutgers University
- 2007** **University Excellence Fellowship**, Rutgers University
Graduate School Research Award in Sciences, Rutgers University

RESEARCH FUNDING

- 2024** *Towards Efficient Geological Hydrogen Production: Rate Determination, Control and Reactor Development*, **Department of Energy, ARPA-E program** (\$442,112 of 1.3M)
- Global Centers: A Microbe-Mineral Atlas for a Sustainable Energy Future*, **National Science Foundation** (\$ 449,152 of \$2M)
- Integrated studies of overlapping critical mineral systems in South Central Kentucky and North Central Tennessee*, **United States Geological Survey** (61,289 for PI Gazel of \$288,750).
- 2023** *Biologically accelerated CO₂ sequestration and critical elements recovery*, **Robert and Nancy Selander Foundation** (\$1,2M for co-PIs Gazel and Barstow)
- Investigating the volatile evolution and decompression rate of high-intensity basaltic eruptions* (\$348,300), Award No. EAR **2318614** Petrology and Geochemistry, **National Science Foundation**.
- 2022** *Collaborative Research: Reconstructing the geometry of magmatic plumbing systems using fluid inclusions* (\$226,509). Award No. EAR 2216738. Petrology and Geochemistry, **National Science Foundation**.
- 2021** *Reconstructing the melt composition and volatile record of Chassignite NWA 2737 (20-SSW20-0066, \$559,322). No. 80NSSC21K1806* **National Aeronautics and Space Administration**.
- 2020** *Volcanic Ash and its impact on the Earth System* (\$364,856 for PI Gazel of a total of \$1.4 million for EAS, Cornell). No. **80NSSC20K1674** **National Aeronautics and Space Administration**.
- Engineered Microorganisms for Enhanced Rare Earth Element Bio-mining and Separations* (\$317,064 for PI Gazel of \$1M) **ARPA-E program, US Department of Energy**.
- 2019** *Laboratory Exploration of Lava Worlds* (\$499,900 for PIs Gazel & Kaltenege, Cornell), **Heising-Simons Foundation**.
- 2018** *Collaborative Research: The Onset of the Galapagos Plume as a Window into the Deep Earth* (\$354,941). Award No. EAR 1826673. **Petrology and Geochemistry Program, National Science Foundation**

Sampling and Characterization of Volcanic Particulate Matter (PM_{2.5}) from the Current Hawaiian (Kilauea, NE Rift Zone) Eruption for an Assessment of their Potential as a Respiratory Hazard (\$19,980). **Rapid Response Fund of the Cornell Atkinson Center for Sustainable Future**

2017 *Solving the Mystery of Bermuda: Implications for intraplate magmatism (\$232,183).* Award No. OCE 1756349. **Marine Geology and Geophysics Program, National Science Foundation.**

Understanding diversity in Martian magmatism: Modeling the formation of felsic and alkaline igneous compositions from in-situ data collected on Mars (\$150,462 for co-PI Gazel), Award No. 16-MDAP16_2-0029, **Mars Data Analyses Program, National Aeronautics and Space Administration.**

2016 *Biology meets subduction A Collaborative and Multi-disciplinary Deep Carbon Field Initiative (\$36,898 for collaborator Gazel)* **Sloan Foundation, Deep Carbon Observatory Initiative.**

Near continent intraplate magmatism in the Atlantic: Implications for mantle dynamics and melting (\$335,000). Award No. EAR 1802012, **Collaborative Studies of the Deep Earth Interior Program, National Science Foundation**

2013 *Virginia's Volcanoes: A Window into Eastern North America Mantle Processes (\$271,682).* Award No. EAR 1249412, **GeoPrisms Program, National Science Foundation.**

2011 *Evolution of the Galapagos Mantle Plume (\$513,347).* Award No. EAR-12019033 National Science Foundation, **Petrology and Geochemistry Program, National Science Foundation.**

2010 *Geochemistry of the Cretaceous Seaway Closure in Central America (\$198,347)* Award No. EAR-1019327, National Science Foundation, **Tectonics Program, National Science Foundation.**

RESEARCH GROUP

Current Research Group

Jacob Klug, Postdoctoral Research Associate (Ph.D., University of Wisconsin Madison) Research Project: Biological acceleration of ultramafic rocks dissolution and carbonation.

Ellyn Huggins, Postdoctoral Research Associate (Ph.D., University of Nevada Reno) Research Project: Volatile budgets of Mars from novel meteorite measurements.

Maxim Gavrilenko, Postdoctoral Research Associate (Ph.D., Rutgers University) Research Project: Assessment of geologic hydrogen potential from ultramafic rocks.

Kyle Dayton, Ph.D. student. Research Project: Reconstructing the plumbing system of mafic eruptions with melt and fluid inclusions.

Jonathan Bixler, Ph.D. student. Research Project: Volatile budgets, explosivity, and plumbing system of Hawaii volcanoes.

Valentina Villanueva, Ph.D. student. Research Project: Volatile budgets and decompression rates of mafic explosive eruptions of mafic Plinian eruptions.

Peiliang Ying, MEng. Research Project: Rare Element Potential of the Adirondacks apatite-chromite deposits

Natalia Pszeniczny, undergraduate student. Research Project: Volatile fluxes and plumbing system of Mid- Ocean rifts from melt and fluid inclusions.

Former Postdocs

Jonas Biren, Postdoctoral Research Associate (Ph.D., University Orleans) Research Project: Emission Spectroscopy of Lava Planets from *in-situ* experiments. *Currently Postdoctoral Scientists at Carl Sagan Institute at Cornell University*

Adrian Hornby, Postdoctoral Research Associate (Ph.D., University of Liverpool) Research Project: Impact of Volcanic Ash in the Earth System, nano particles from volcanoes. *Currently Staff Scientist at University of Texas Health Science Center at Tyler.*

Emily First, Postdoctoral Research Associate (Ph.D., University of Hawaii) Research Project: Solid Ground – Developing a Spectral Database for Exoplanet Research. *Currently Assistant Professor at Macalester College.*

Brian Balta, Postdoctoral Research Associate (Ph.D., Caltech) Research Project: Engineered Micro-organisms for Enhanced REE Biomining Separations. *Currently Research Scientist at the Lunar and Planetary Institute, NASA.*

Chelsea Allison, Postdoctoral Research Associate (Ph.D., Arizona State University). *Currently Postdoctoral Associate at Baylor University.*

Jacob Setera, Postdoctoral Research Associate (Ph.D., Rutgers University). *Currently Research Associate NASA.*

Marc-Antoine Fortin, Postdoctoral Research Associate (Ph.D., Rensselaer Polytechnic Institute). *Currently Research and Development Scientist at Corning Inc.*

Swetha Venogopal, Postdoctoral Research Associate (Ph.D., Clermont-Ferrand University). *Currently Lecturer at Trinity College, Ireland.*

Former Graduate Students:

Wenwei Liang - MEng. Cornell ('24). Magma storage below Haleakala volcano using CO₂ densities from fluid inclusions in olivine. *Currently Ph.D. student at the University of Texas, Austin.*

Peiyu Wu – Ph.D. Cornell ('24). Currently working on independent consulting.

Charlotte DeVitre - Ph.D. Cornell ('22). *Currently Postdoctoral Associate at UC Berkeley.*

Aristides Alfaro M.S. - Cornell ('20). *Research Assistant at the Geological Research Center at the University of Costa Rica.*

Lowell Moore. – Ph.D. Virginia Tech ('19). Currently, *Electron Microprobe Laboratory Manager, Virginia Tech.*

Jarek Trela – Ph.D. Virginia Tech ('17). *Currently, State of Illinois Economic Geologist, Illinois Geologic Survey and University of Illinois Urbana-Champaign.*

Sarah Mazza - Ph.D. Virginia Tech ('16). *Currently Assistant Professor at the Geoscience Department at Smith College.*

Pilar Madrigal - Ph.D. Virginia Tech ('16). *Currently Associate Professor at the Central American School of Geology of the University of Costa Rica.*

Lisa Whalen – M.S. Virginia Tech ('16). *Ph.D. with metamorphic petrology group at Virginia Tech.*

William Whalen - M.S. Virginia Tech ('16).

Dennis Zamboni, visiting Ph.D. Virginia Tech ('16) student from University of Naples Federico II, Graduated April 26, 2016. Currently, Science high school teacher in Italy

Former Undergraduate Students

Claire Bush: undergraduate researcher (Earth and Atmospheric Sciences). Research Project: mineral characterization and chemical composition of volcanic ash - Impact of Volcanic Ash in the Earth System. Spring 2021-Spring 2022.

Jonathan Letai, undergraduate researcher (Physics. Research Project: spectroscopic signatures of granitic rocks. Spring 2022

Sophia Bergen: undergraduate researcher (Civil and Environmental Engineering). Research Project: mineral and chemical evolution on the 2021 eruption of La Palma, Canary Islands. Spring 2022

Alexander Wares, volatile constraints on intraplate volcanoes, sample curation and preparation, summer 2018-spring 2019.

Carla Walton, undergraduate researcher (Chemical Engineering), summer 2019

Christopher Owusu-Sampah (Multi-Cultural Academic Opportunities Program -summer intern 2014), olivine forsterite content determination by Raman spectroscopy. MS degree in Systems Engineering, George Mason University.

Darren Thomas, juvenile magmatic components of the current Turrialba Volcano eruption in Costa Rica, graduated Spring 2017.

Ian Godwin, high-precision olivine trace-element determinations from komatiites, large-igneous provinces and oceanic islands. Graduated in Spring 2016 and accepted a position in a consulting firm.

Lacey Costello, water contents of clinopyroxene xenocrystals from intraplate and subduction settings. Graduated in Spring 2016 and currently a graduate student at Southern Illinois University under Justin Filiberto in experimental petrology.

Leigh Shannon, geochemistry the Coastal New England Magmatic province as precursor of the break-up of Pangea, graduated Spring 2017.

Lisa Whalen, Supercontinent inheritance in the Break-up of Pangea and the Central Atlantic Magmatic Province (now PhD. student).

Lydia DeAngelis, melt inclusions studies and volatile contents of rejuvenated stage lavas from Maui, Hawaii, graduated Fall 2016.

Telemachos Manos, summer research intern 2015, Ph.D. Texas A&M in structural geology and tectonics under Nicholas Perez.

Tyler Bagley, undergraduate researcher in 2021 (Earth and Atmospheric Sciences, Cornell)

William Whalen, major and trace element composition of Galapagos accreted terranes in Central America (accepted into MS program at Virginia Tech).

TEACHING

Cornell

- EAS 6920 Forecasting **Volcanic Events** (2022)
- EAS 3090 **Earth Materials** (2021, 2022, 2024, 2025) – New course designed in 2021
- EAS 4580 **Volcanology** (2019, 2020, 2021, 2024)
- EAS 5530 **Advanced Petrology** (2018, including a field trip to the Canary Islands during the winter break)

- EAS 7570 **Current Research in Petrology and Geochemistry: Subduction Processes** (2019, 2020, 2025)
- EAS 4540 **Petrology and Geochemistry** (2018)

Virginia Tech

- GEOS 4714 **Volcanoes and volcanic processes** (2012, 2013, 2014, 2015, 2017)
- GEOS 2444 **Geoscience Field Observations** (2014, 2015, 2016, 2017)
- GEOS 5948 **Evolution of a volcanic arc: From seafloor accretion to continental crust production in Costa Rica** (2012)
- GEOS 6704 **Advanced topics in Petrology** (2013, 2015)
- GEOS 6604 **Advanced topics in geochemistry** (2012, 2014)
- **Laboratory Techniques in Geoscience** (join VT –JMU STEM course, 2014, 2015)

FIELD EXPERIENCE

- 2024** Sub-sampling the record of the most explosive Kilauea eruptions.
- 2023** Tephro-stratigraphy and sample collection of mafic Plinian eruption from Villarica and Llaima Volcanoes, Chile.
- 2021** Sample collection during the eruption in La Palma, Canary Islands. Stratigraphic sections, and in-situ volcanic particulate matter directly from the air. – Invited to join an interdisciplinary team.
- 2014-2019** Sample collection of tephtras of post-shield and rejuvenated stage magmatism in Hawaii and the Canary Islands.
- 2014-2015** Sample collection in Costa Rica for the LIP stage of the Galapagos Plume
Geologic survey of the Galapagos Islands
- 2013** Sample collection sampling of the Aeolian Islands, Italy
Sample collection in Curacao for the LIP stage of the Galapagos Plume
Hydrochemical characterization of the Santa Elena Ophiolite, Costa Rica
Sample collection of Galapagos-related terranes in Panama for the OIB stage Galapagos Plume
- 2011-2012** Sample collection in accreted Galapagos terranes in Central America
Geologic survey of shield vents and crustal xenoliths sampling in Hawaii
Sample collection and mapping of the Central Atlantic Magmatic Province in Virginia and North Carolina
- 2010-2011** Sample collection and geologic mapping of the Santa Elena Ophiolite, Costa Rica
Co-led field trip (with students) to the Adirondacks, NY

- 2009-2010** Sample collection of tephras from volcanic fields of the Basin and Range, Western USA
Sample collection and geologic mapping in the Santa Elena and Nicoya Ophiolites, Costa Rica
Sample collection from Saint Kitts and Nevis, Lesser Antilles
- 2007-2008** Volcanology mapping of Etna, Eolian Islands, Vesuvius and the Roman Volcanic Province
- 2005-2007** Sample collection and geologic mapping in Nicaragua and Costa Rica volcanic front and back-arc
- 2002-2005** Geologic mapping of the Ostional National Wildlife Reserve, Costa Rica
Volcanology mapping of Poás volcano and Sabana Redonda cinder cones
3D Seismic Geophysical Campaign of the Costa Rican –Nicaragua Margin, Meteor M54/1B (Balboa-Caldera) Bremen University-IFM-GEOMAR

LABORATORY EXPERIENCE

- In-situ LA-ICP-MS for trace-element determination in natural glasses and minerals (with methods development)
- Micro-confocal Raman and infrared spectroscopy for melt and fluid inclusion studies (with methods development)
- In-situ infrared (FTIR) spectroscopy of glasses and minerals (with methods development)
- High-resolution ICP-MS and Thermal Ionization Mass Spectrometry (TIMS) for radiogenic isotopes
- TEM for nano-characterization particles from volcanic eruptions and wildfires.
- XRD, XRF, and ICP-MS for bulk rock major and trace-element determination (with method development)
- Polarized petrographic microscope.

PUBLICATIONS

Years after Ph.D.: 15

Number of peer-reviewed publications: 85

Citations: 3761, H-index=36, i10-index=69, H-index_{15-years post Ph.D.}=2.4. Source: [Google Scholar](https://scholar.google.com/citations?user=...)

- ♦ Undergraduate student from my group
- * Graduate student from my group
- ** Graduate student external advisor/committee member
- + Postdoc from my group

Underline demarks corresponding author

In preparation

- 6- +Klug, J., **Gazel, E.**, Lamadrid, H. *Rates of carbonation of olivine and basaltic materials based on natural micro-reactors*
- 5- +Gavrilenko, M, **Gazel, E.**, Bath, A., Plank, T. ... *Magma storage during the 122 AD Etna Mafic Plinian Eruption*
- 4- *Dayton, K., **Gazel, E.**, Lynn, K. *Timing magma replenishing and mixing during the 2021 Tajonaite Eruption in La Palma*
- 2- +Hornby, A., **Gazel, E.**, *DeVitre, C., Hess, P., Mahowald, N. *Nanoparticles of ammonium sulfate aerosol in the 2018 Hawaiian eruption plume*
- 1- *DeVitre, C., Barth, A., **Gazel, E.**, Plank, T. *Solving the carbonate problem on melt inclusion bubbles*

Submitted/accepted

- 8- +Balta, B, Holycross, M., Barstow, B, **Gazel E.**, Co-generation of NaREE(MoO₄)₂ and REEPO₄ in multiple habits by solid-flux crystal growth -*submitted to **Minerals Engineering***
- 7- Plante, L., Klug, J., Lee, J., **Gazel, E.**, Barstow, B. *Cross-species Comparison of Bio-accelerated Weathering Performance on Ultramafic Rocks – submitted to **Nature Communications***
- 6- Lee, J., Pian, B., Marecos, S., Plante, L., Medin, S., +Klug, J., Gadikota, G., **Gazel, E.**, Barstow, B., *Bioleaching Capability of *Gluconobacter oxydans* on Ultramafic Materials - submitted to **Nature Communications***
- 5- +Biren, J., **Gazel E.**, Kaltenege, L., Slodczyk, A., del Campo, L. *Infrared emissivity at microscale.*
- 4- +Klug, J., Plante, L, Barstow, B., **Gazel, E.**, *Direct carbonation of olivine mediated by engineered biology – submitted to **Nature***
- 3- **Gazel, E.**, *Dayton, K, *Liang, W., Lynn, K., Hua, J., Hammer, J. *Crustal to Mantle Melt Storage During the Evolution of Hawaiian Volcanoes – submitted to **Science Advances**.*
- 2- Marecos, S., Pian, B., Medin, S., Schmitz, A.M., Wu, M., Balta, J.B., Holycross, M., Reid, M. C., **Gazel, E.**, Barstow, B. *Direct Genome-Scale Screening of *Gluconobacter oxydans* B58 for Rare Earth Element Bioleaching – submitted to **Communications Biology***
- 1- Qian, S., **Gazel, E.**, Wang, J. *Mantle transition zone water triggers lithospheric weakening and spreading – submitted to **Geology**.*

Published

- 89 - Donoso-Tapia, D., Flores, K.E., Martin, C., Hull, S., Hernández-Uribe, D., Gazel, E., 2025. Record of de-serpentinization and re-serpentinization of an exhumed slab sliver: Implications for fluid circulation in subduction zones. *Earth and Planetary Science Letters* 653.
- 88- *First, E.C., Mishra, I., **Gazel, E.**, Lewis, N.K., ♦Letai, J., Hanssen, L., 2024. Potential for observing geological diversity from mid-infrared spectra of rocky exoplanets. *Nature Astronomy*.
- 87- *First, E.C., **Gazel, E.**, 2024. Mineral and chemical detail of rocky exoplanet surfaces could be detectable. *Nature Astronomy* (research briefing).
- 87- *Fortin, M.-A., **Gazel, E.**, Williams, D.B., Thompson, J.O., Kaltenegger, L., Ramsey, M.S., 2024. Lava Worlds Surface Measurements at High Temperatures. *The Astrophysical Journal Letters*, 974.
- 86- Carr, M.J., Feigenson, M.D., **Gazel, E.**, 2024. A REE Inverse Model from Bulk Distribution Coefficients and Boundary Conditions: Results for Shield and Rejuvenated Stage Hawaiian Volcanoes. *Geochemistry, Geophysics, Geosystems*, 25.
- 85- Dayton, K., **Gazel, E.**, Wieser, P.E., Troll, V.R., Carracedo, J.C., Aulinas, M., Perez-Torrado, F.J., 2024. Magmatic Storage and Volatile Fluxes of the 2021 La Palma Eruption. *Geochemistry, Geophysics, Geosystems*, 25.
- 84- Wu, P., Dayton, K., **Gazel, E.**, Porri, T., 2024. Non-destructive quantitative analysis of melt inclusions in extraterrestrial samples: Case study of chassignite via nanoscale X-ray computed tomography. *Meteoritics & Planetary Science*.
- 83- Troll, V.R., Aulinas, M., Carracedo, J.C., Geiger, H., Perez-Torrado, F.J., Soler, V., Deegan, F.M., Bloszies, C., Weis, F., Albert, H., Gisbert, G., Day, J.M.D., Rodríguez-Gonzalez, A., **Gazel, E.**, Dayton, K., 2024. The 2021 La Palma eruption: social dilemmas resulting from life close to an active volcano. *Geology Today* 40, 96-111.
- 82- Trela, J., Freiburg, J.T., **Gazel, E.**, Nuelle, L., Maria, A.H., Malone, D.H., Molinarolo, J.M., 2024. Petrologic relationship between lamprophyres, carbonatites, and heavy rare-earth element enriched breccias at Hicks Dome. *Terra Nova* 36, 298-305.
- 81 - Donoso, D., Flores, K.E., Martin, C., **Gazel, E.**, Marsh, J., 2023. Exhumed Serpentinites and Their Tectonic Significance in Non-Collisional Orogens. *Geochemistry, Geophysics, Geosystems*. 25. e2023GC011072.
- 80- *DeVitre, **Gazel, E.**, Ramalho R. S., Venugopal, S., Steele-MacInnis, M., Hua, J., Allison, C. M., Moore, L., R., Carracedo, J. C., Monteleone, B., 2023. Volatile-rich intraplate explosive eruptions sustained from the mantle. *Proceedings of the National Academy of Sciences*, 120, 33, e2302093120.
- 79- *Dayton, K., **Gazel, E.**, Wieser, P. Troll, V. R., Carracedo, J. C., Lamadrid, H., ♦Ward, J., Aulinas Junca, M., Geiger, H., Deegan, F., M., Gisbert Pinto, G., Pérez-Torrado, F. J., 2023. Deep magma storage during the 2021 La Palma eruption. *Science Advances* 9, eade7641.
- 78- *DeVitre, **Gazel, E.**, *Dayton K., Pamuku, A., Gaetani, G. A, 2023. The effect of laser heating

- on Raman spectroscopy measurements of liquid-vapor bearing CO₂ rich melt inclusions. *Volcanica* 6, 2, 201-209.
- 77- Hornby, A., **Gazel, E.**, Bush, C., Dayton, K., Mahowald, N., 2023. Phases in fine volcanic ash. *Scientific Reports* 13, 15728.
- 76- Hua, J., Fischer, K.M., **Gazel, E.**, Parmentier, E.M., Hirth, G., 2023. Long-Distance Asthenospheric Transport of Plume-Influenced Mantle from Afar to Anatolia. *Geochemistry, Geophysics, Geosystems* 24.
- 75- Hua, J., Fischer, K.M., Becker, T.W., **Gazel, E.**, Hirth, G., 2023. Asthenospheric low-velocity zone consistent with globally prevalent partial melting. *Nature Geoscience*.
- 74- Zhang, Y., Namur, O., Li, W., Shorttle, O., **Gazel, E.**, Jennings, E., Thy, P., Grove, T.L., Charlier, B., 2023. An Extended Calibration of the Olivine–Spinel Aluminum Exchange Thermometer: Application to the Melting Conditions and Mantle Lithologies of Large Igneous Provinces. *Journal of Petrology* 64.
- 73- Walker, R.J., Mundl-Petermeier, A., Puchtel, I.S., Nicklas, R.W., Hellmann, J.L., Echeverría, L.M., Ludwig, K.D., Bermingham, K.R., **Gazel, E.**, *Devitre, C.L., Jackson, M.G., Chauvel, C., 2023. 182W and 187Os constraints on the origin of siderophile isotopic heterogeneity in the mantle. *Geochimica et Cosmochimica Acta* 363, 15-39.
- 72- Medin, S., Schmitz, A.M., Pian, B., Mini, K., Reid, M.C., Holycross, M., **Gazel, E.**, Wu, M., Barstow, B., 2023. Genomic characterization of rare earth binding by *Shewanella oneidensis*. *Scientific Reports* 13, 15975.
- 71- Medin, S., Dressel, A., Specht, D.A., Sheppard, T.J., Holycross, M.E., Reid, M.C., **Gazel, E.**, Wu, M., Barstow, B., 2023. Multiple Rounds of In Vivo Random Mutagenesis and Selection in *Vibrio natriegens* Result in Substantial Increases in REE Binding Capacity. *ACS Synthetic Biology* 12, 3680-3694.
- 70- Soderman, C.R., Shorttle, O., **Gazel, E.**, Geist, D., J., Matthews, S., Williams, H. M, 2023. The evolution of Galápagos mantle plume. *Science Advances* 9, eadd5030.
- 69- Galetto, F., Pritchard, M.E., +Hornby, A.J., **Gazel, E.**, Mahowald, N.M., 2023. Spatial and Temporal Quantification of Subaerial Volcanism From 1980 to 2019: Solid Products, Masses, and Average Eruptive Rates. *Reviews of Geophysics*, 61.
- 68- Bisson, K.M., Gassó, S., Mahowald, N., Wagner, S., Koffman, B., Carn, S.A., Deutsch, S., **Gazel, E.**, Kramer, S., Krotkov, N., Mitchell, C., Pritchard, M.E., Stamieszkin, K., Wilson, C., 2023. Observing ocean ecosystem responses to volcanic ash. *Remote Sensing of Environment* 296.
- 67-+Fortin, M., **Gazel, E.**, Kaltenecker, L., Holycross, M., 2022. Lava worlds exoplanet surfaces. *Monthly Notices of the Royal Astronomical Society*.
- 66-Sun, M-D., Xu, Y-G., **Gazel, E.**, Li, J., Zhang, W-F., Zhang, L, He, P-L., Xiao, Y-Y., Jourdan, F., Wilde, S. A. 2022. Exploring small-scale recycled mantle components with intraplate continental twin volcanoes. *Chemical Geology* 2022; 598.
- 65- Ostwald, A., Udry, A., Payré, V., **Gazel, E.**, Wu, P., 2022. The role of assimilation and fractional crystallization in the evolution of the Mars crust. *Earth and Planetary Science Letters*, 585.

- 64- Carracedo, J.C., Troll, V.R., Day, J.M.D., Geiger, H., Aulinas, M., Soler, V., Deegan, F.M., Perez-Torrado, F., Gisbert, G., **Gazel, E.**, Rodriguez-Gonzalez, A., Albert, H., 2022. The 2021 eruption of the Cumbre Vieja volcanic ridge on La Palma, Canary Islands. *Geology Today*, 38.
- 63-Sánchez-Murillo, R., Montero-Rodríguez, I., Corrales-Salazar, L., Esquivel-Hernández, G., Castro-Chacón, L., Rojas-Jiménez, L. D., Vargas-Viquez J., Pérez-Quezadas, J., Gazel, E., Boll, J. 2022. Deciphering complex groundwater age distributions and recharge processes in a tropical and fractured volcanic multi-aquifer system. *Hydrological Processes* 2022; 36(3).
- 62- Zhang, Y., **Gazel, E.**, Gaetani, G., Klein, F., 2021. Deep slab fluids control the oxidation state of the sub-arc mantle - *Science Advances*, 7 eabj2515.
- 61-Bekaert, D.V., **Gazel, E.**, Hammerstrom, A., Turner, S., Behn, M., de Moor, J. M., Zahirovic, S., Seltzer, A.M., Fischer, T.P., Kulongoski, J.T., Patel, B.S., Schrenk, M., Halldórsson, S.A., Nakagawa, M., Ramírez, C.J., Krantz, J.A., Yücel, M., Ballentine, C.J. Giovannelli, D., Lloyd K.G., Barry. P.H. 2021. High $^3\text{He}/^4\text{He}$ in western Panama reveals an asthenospheric pipeline from the Galápagos plume. *PNAS*, 47, 118.
- 60-Schmitz, A.M, Pian, B., Medin, S., Reid, M.C., Wu, M., **Gazel, E.**, Barstow, B., 2021. *Gluconobacter oxydans* Knockout Collection Finds Improved Rare Earth Element Extraction. *Nature Communications*, 12.
- 59-*DeVitre, C., Allison+, C., **Gazel, E.** 2021. A high-precision CO₂ densimeter for Raman spectroscopy using a Fluid Density Calibration Apparatus. *Chemical Geology*, 584, 120522.
- 58- Qian, S., **Gazel, E.**, Nichols, A.R.L., Cheng, H., Zhang, L., Salters, V.J., Li, J. Xiaoping, X, Zhou, H. 2021. The origin of post-spreading magmatism in the South China Sea and Southeast Asia. *Geochemistry, Geophysics, Geosystems*, 22, e2021GC009686
- 57-*Wu, P. **Gazel, E.**, Udry, A., Ostwald, A. M., 2021. Melt Inclusions in Chassignites: A Connection Between Martian Meteorites and In Situ Evolved Rocks at Gale Crater. *Meteorites and Planetary Science*, 56 (7), 1328-1349.
- 56-Long, M.D., Wagner, L.S., King, S.D., Evans, R.L., Mazza, S.E., Byrnes, J.S., Johnson, E.A., Kirby, E., Bezada, M.J., Gazel, E., Miller, S.R., Aragon, J.C., Liu, S. 2021. Evaluating models for lithospheric loss and intraplate volcanism beneath the Central Appalachian Mountains. *Journal of Geophysical Research: Solid Earth*. 126.
- 55-**Gazel E.**, Flores K.E., Carr, M.J. 2021. Architectural and Tectonic Control on the Segmentation of the Central American Volcanic Arc. *Annual Review of Earth and Planetary Sciences*, 49.
- 54-*Alfaro, A., **Gazel, E.**, White B. Jicha, B., Rasbury, T. 2021. Unravelling the genesis of young continental-arc shoshonites in the Talamanca Cordillera, Costa Rica. *Lithos*, 386-387.
- 53-*Moore L.R., **Gazel E.**, Bodnar, R.J. 2020. The volatile budget of Hawaiian magmatism: Constraints from melt inclusions from Haleakala volcano, Hawaii. *Journal of Volcanology and Geothermal Research*, 107144
- 52- Flores K.E., **Gazel E.** 2020. A 100 m.y. record of volcanic arc evolution in Nicaragua. *Island Arc*, 29.

- 51- Willhite, L. N. Jackson, M. G., Blichert-Toft, J. B. Bindeman, I., Kurz, M. D., Halldórsson, S. A., Haradóttir, S. **Gazel, E.**, Price A., Byerl, B. L. 2019. Hot and Heterogenous High-³He/⁴He Components: New Constraints from Proto-Iceland Plume Lavas from Baffin Island. ***Geochemistry, Geophysics, Geosystems***, 1525-2027
- 50- **Gazel, E.**, Hayes J.L., Ulloa, *A., Alfaro, A., Coleman, D., Carr, M., J. 2019 The record of the transition from an oceanic arc to a young continent in the Talamanca Cordillera, Central America, ***Geochemistry, Geophysics, Geosystems***, 20. 2018GC008128
- 49- *DeVitre, C., **Gazel, E.**, Madrigal, P. Lücke, O., Alvarado G.E., Soto, G. J. 2019. Geochemical evidence for multi-stage chaotic magma mixing at Turrialba volcano, Costa Rica, ***Journal of Volcanology and Geothermal Research***, 381, 330-346
- 48- *Mazza, S. E., **Gazel, E.**, Bizimis, M., Moucha, R., Béguelin, P., Johnson, E.A., McAleer, R. J., and Sobolev, A. V., 2019, Sampling the volatile-rich transition zone beneath Bermuda, ***Nature***, 569(7756), 398-403.
- 47- Barry, P.H., J. M. de Moor, D. Giovannelli, M. Schrenk, D. Hummer, T. Lopez, K. Pratt, Y. Alpízar Segura, A. Battaglia, P. Beaudry, G. Bini, M. Cascante, G. d'Errico, M. di Carlo, D. Fattorini, K. Fullerton, **E. Gazel**, G. González, S. A. Halldórsson, K. Iacovino, J.T. Kulongoski, E. Manini, M. Martinez, H. Miller, M. Nakagawa, S. Ono, S. Pathwardhan, C.J. Ramirez, F. Regoli, F. Smedile, S. Turner, C. Vetriani, M. Yucel, C.J. Ballentine. 2019. *Forearc carbon sinks reduce long-term volatile recycling into the mantle*, ***Nature***, 568 (7753), 487-492.
- 46- Ruiz, P., S. Mana, **E. Gazel**, G. J. Soto, M. J. Carr, and G. E. Alvarado, 2019. Geochemical and Geochronological Characterization of the Poas Stratovolcano Stratigraphy. ***Poás Volcano: The Pulsing Heart of Central America Volcanic Zone***, 13-43, Springer International Publishing, Cham (book chapter)
- 45- **Gazel, E.**, *Trela, J., Bizimis M., Sobolev, A., Batanova V., Class C., Jicha B. 2018, Long-Lived Source Heterogeneities in the Galapagos Mantle Plume, ***Geochemistry, Geophysics, Geosystems***, 19.
- 44- Udry, A., **Gazel, E.**, McSween, H. Y., 2018, Formation of Evolved Rocks at Gale Crater by Crystal Fractionation and Implications for Mars Crustal Composition, ***Journal of Geophysical Research: Planets***, 123(6), 1525-1540.
- 43- *Moore, L. R., Mironov, N. Portnyagin, M., Gazel, **E.**, Bodnar R. J., 2018, Volatile contents of primitive bubble-bearing melt inclusions from Klyuchevskoy volcano, Kamchatka: Comparison of volatile contents determined by mass-balance versus experimental homogenization, ***Journal of Volcanology and Geothermal Research***, 358, 124-131.
- 42- A. Ramírez-Leiva, A., **Sánchez-Murillo, R. Martínez-Cruz, M., Calderón, H., Esquivel-Hernández, G., V. Delgado, V., C. Birkele, C., **Gazel, E.**, Alvarado-Induni, G., Soulsby, C., 2017 Stable isotopes evidence of recycled subduction fluids in the hydrothermal/volcanic activity across Nicaragua and Costa Rica. ***Journal of Volcanology and Geothermal Research***,
- 41- *Trela, J., **Gazel, E.**, Sobolev, A., Moore, L., Bizimis, M., Jicha, B., Vatanova, V., 2017 The hottest Phanerozoic magmas and the Survival of Archean Reservoirs. ***Nature Geoscience***, 10, 451-456.
- 40- *Mazza, S. E., **Gazel, E.**, Johnson, E. A., Bizimis, M., McAleer, R., Biryol, C. B., 2017. Post-rift

- magmatic evolution of the eastern North American "passive-aggressive" margin. ***Geochemistry, Geophysics, Geosystems***, 18.
- 39-*Zamboni, D., *Trela, J., **Gazel, E.**, Sobolev, A. V., Cannatelli, C., Lucchi, F., Batanova, V. G., De Vivo, B., 2017. New insights into the Aeolian Islands and other arc source compositions from high-precision olivine chemistry. ***Lithos***, 272-273, 185-191.
- 38- *Madrigal, P., **Gazel, E.** Flores, K., Bizimis, M. Jicha, B. 2016. Record of Massive Cyclical Upwellings from the Pacific Large Low Shear Velocity Province. ***Nature Communications*** 7
- 37- Whattam, S. A., **Gazel, E.**, Yi, Denyer, P., 2016. Origin of plagiogranites in oceanic complexes: A case study of the Nicoya and Santa Elena terranes, Costa Rica. ***Lithos*** 262, 75-87.
- 36- Carr, M. J., **Gazel, E.**, 2016 Interactive exercises using Igpert, a program customized for geochemical forward modeling of igneous processes. ***Mineralogy and Petrology***.
- 35-*Zamboni, D. **Gazel, E.**, Ryan, J., Cannatelli, C., Atlas, Z., Mazza, S., Lucchi, F., De Vivo, B., 2016. A sediment melt component at the edges of the Aeolian Arc. ***Geochemistry, Geophysics, Geosystems***.
- 34-Schwarzenbach, M.E., Gill, B. **Gazel, E.**, *Madrigal P., 2016. Sulfur and carbon geochemistry of the Santa Elena peridotites: Comparing oceanic and continental processes during peridotite alteration, ***Lithos***, 253-254, 92-108.
- 33-Aster, E., Wallace, P., *Moore, R., Watkins, J., **Gazel, E.**, Bodnar R., J. 2016. Reconstructing CO₂ concentrations in basaltic melt inclusions using Raman analysis of vapor bubbles. – ***Journal of Volcanology and Geothermal Research***, 323, 148-162.
- 32-*Whalen, L., **Gazel, E.**, **Vidito, C., Caddick, M., Puffer J, Bizimis, M, Henika, W. 2015. Supercontinental inheritance and its influence on supercontinental breakup: The Central Atlantic Magmatic Province and the breakup of Pangea, ***Geochemistry, Geophysics, Geosystems***, 16.
- 31- **Gazel, E.**, Hayes, J., Hoernle, K., Everson, E., Holbrooke, W. S., Kelemen, P., Hauff, F., van den Bogaard, P., Vance, E., Chu, S., Calvert A., Carr M. J., Yogodzinski, G. 2015; Generation of continental crust in oceanic arcs, ***Nature Geoscience***, 8, 321-327.
- 30-*Trela, J., **Vidito, C., **Gazel, E.**, Herzberg, C., Class, C., Jicha, B., Bizimis, M., Alvarado, G. A., 2015. A pyroxenite source in the Galapagos Plume at 70 Ma: Implications for plume evolution, ***Earth and Planetary Science Letters***, 425, 268-277.
- 29-*Madrigal, P., **Gazel, E.** Denyer, P., Smith, I., Jicha, B., Coleman, D., Snow, J., 2015. A melt-focusing zone on the lithospheric mantle preserved in the Santa Elena Ophiolite, Costa Rica, ***Lithos*** 230, 189–205
- 28-*Moore, L., **Gazel, E.** Tuohy, R., Lloyd, A., Esposito, R., Wallace, P., Plank, T., Bodnar, R. J., 2015. Bubbles matter: An assessment of the contribution of vapor bubbles to magma volatile budgets, ***American Mineralogist***, 100, 806-823.
- 27- *Mazza, S. E., **Gazel, E.** Johnson, E. A., McAleer, R., Kunk, M., Spotila, J. A, Bizimis, M., Coleman, D. S., 2014. Volcanoes of the passive margin: The youngest magmatic event in Eastern North America, ***Geology*** (42) 6, 483-489.

- 26- Schwarzenbach, E. M., **Gazel, E.**, Caddick, M.J., 2014. Hydrothermal processes in partially serpentinized peridotites from Costa Rica: Evidence from native copper and complex sulfide assemblages, *Contributions to Mineralogy and Petrology*, 168:1079
- 25- McClellan, E., **Gazel, E.**, 2014. The Cryogenian intra-continental rifting of Rodinia: Evidence from the Laurentian Margin in Eastern North America, *Lithos* (206-207), 321-337.
- 24- ****Sánchez-Murillo, R., Gazel, E.,** Schwarzenbach, E., Gill, B. G., Boll, J., 2014. Geochemical evidence for active serpentinization in the Santa Elena Ophiolite, Costa Rica: An analogue of an early humid Earth or Mars? *Geochemistry, Geophysics, Geosystems*, 15.
- 23- ****Sánchez-Murillo, R., Brooks, E. S., Elliot, W. J., Gazel, E., Boll, J.,** 2014. Baseflow recession analysis in the inland Pacific Northwest of the United States, *Hydrogeology Journal*.
- 22- Walker, J.A., **Gazel, E.**, 2014. Focusing on the Central American Volcanic Front, *Geoscience Canada*, 41, 1-17, *invited by the Geologic Association of Canada*.
- 21- Abers, G. A., Fischer, K. M., Hirth, G., Wiens, D. A., Plank, T., Holtzman, B. K., McCarthy, C., **Gazel, E.**, 2014. Reconciling mantle attenuation-temperature relationships from seismology, petrology, and laboratory measurements, *Geochemistry, Geophysics, Geosystems* 15.
- 20- Samadi, R., **Gazel, E.**, Mirnejad, H., Kawabata, H., Shirdashtzadeh, N., Harris, C., 2014. Paleo-Tethys subduction in the center of the Alpine-Himalayan orogenic system in the Triassic, *NJGPA (Neues Jahrbuch für Geologie und Paläontologie)* 271(3), 285-306.
- 19- Carr, M. J., Feigenson, M. D., Bolge, L.L., Walker, J. A., **Gazel, E.**, 2014. RU_CAGeochem v.3, a database and sample repository for Central American volcanic rocks at Rutgers University, *Geoscience Data Journal*.
- 18- Samadi, R., Mirnejad, H., Kawabata, H., Harris, C., Valizadeh, M. V., **Gazel, E.**, 2014. Magmatic garnet in the Triassic (215 Ma) Dehnow Pluton of NE Iran and its petrogenetic significance, *International Geology Review* 56 (05), 596-621.
- 17- Shirdashtzadeh, N., Torabi, G., Meisel, T., Arai, S., Bokhari, S. N. H., Samadi, R., **Gazel, E.**, 2014. Origin and evolution of metamorphosed mantle peridotites of Darreh Deh (Nain Ophiolite, Central Iran): Implications for the Eastern Neo-Tethys evolution, *NJGPA (Neues Jahrbuch für Geologie und Paläontologie)* 273 (1), 89-120.
- 16- ****Vidito, C., Herzberg, C., Gazel, E., Geist D., Harpp, K.,** 2013. Lithological structure of the Galapagos Plume, *Geochemistry, Geophysics, Geosystems*, 14.
- 15- Saginor, I., **Gazel, E.**, Condie, C., Carr, M. J., 2013. Evolution of the geochemical variations along the Central American Volcanic Front, *Geochemistry, Geophysics, Geosystems*, 14.
- 14- **Gazel, E.**, Plank, T., Forsyth, D. W., Bendersky, C., Lee, C., Hauri, E., 2012. Lithosphere vs. asthenosphere mantle sources at Big Pine Volcanic Field, *Geochemistry, Geophysics, Geosystems*, 13.
- 13- **Gazel, E.**, Abbott, R., Draper, G., 2011. Garnet-bearing ultramafic rocks from the Dominican Republic: Fossil mantle plume fragments in an UHP oceanic complex? *Lithos* 25, 393-404.

- 12- Saginor, I., **Gazel, E.**, Carr, M. J., Swisher III, C., Turrin, B., 2011. Miocene to recent volcanic history of western Nicaragua: Insights from geochemistry and geochronology, *Journal of Volcanology and Geothermal Research* 202 (1-2), 143-152.
- 11- **Gazel, E.**, Hoernle, K., Carr, M. J., Herzberg, C., Saginor, I., van den Bogaard, P. Hauff, F., Feigenson, M. D, Swisher III, C., 2011. Arc-plume interaction in Central America: Influx of Galapagos asthenosphere and slab melting, *Lithos* 121, 117-134.
- 10- Saginor, I., **Gazel, E.**, Carr, M. J., 2011. Progress and challenges using $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology in Costa Rica and Nicaragua. *Journal of Central American Geology* 45, 75-85.
- 9- Herzberg, C. and **Gazel, E.**, 2009. Petrological evidence for secular cooling in mantle plumes, *Nature* 458, 629-622.
- 8- **Gazel, E.**, Carr, M.J., Hoernle, K., Feigenson, M.D., Hauff, F., Szymanski, D., van den Bogaard, P., 2009. The Galapagos-OIB signature in southern Central America: Mantle re-fertilization by arc-hotspot interaction. *Geochemistry, Geophysics, Geosystems*, 10.
- 7- **Gazel, E.** and Denyer, P., 2009. Jurassic to Miocene Costa Rican oceanic complexes: Description, structures and relationships, *Journal of South American Earth Science* 8, 429-442.
- 6- **Gazel, E.**, Denyer, P., Baumgartner, P. O., 2006. Magmatic and geotectonic significance of Santa Elena Peninsula, Costa Rica, *Geologica Acta* 4(1-2), 193-202.
- 5- Denyer, P., Baumgartner, P. O., **Gazel, E.**, 2006. Characterization and tectonic implications of Mesozoic-Cenozoic oceanic assemblages of Costa Rica and western Panama, *Geologica Acta* 4 (1-2), 219-235.
- 4- **Gazel, E.**, Ruiz, P., 2005. The pyroclastic cones of Sabana Redonda: Enriched magmatic component of Poas Volcano, Costa Rica, *Journal of Central American Geology* 33, 45-60.
- 3- **Gazel, E.**, Alvarado, G.E., Obando, J., Alfaro, A., 2005. Magmatic evolution of the Sarapiquí Miocene Arc, Costa Rica, *Journal of Central American Geology* 32, 13-33.
- 2- García-Vindas, J.R. and **Gazel, E.**, 2004. Presence of radionuclides in the hydrothermal system of Turrialba volcano, Costa Rica, *Journal of Central American Geology* 30, 149-155.
- 1- **Gazel, E.**, 2003. The Pliocene alkaline series, distribution and relation with a OIB source, *Journal of Central American Geology* 29, 87-94.

INVENTION DISCLOSURES AND PATENTS

- 3- Non-acid Mechanisms of Bioleaching by *Gluconobacter oxydans* - docket 10669
- 2- Non-acid Mediated Mechanisms for Critical Elements Bioleaching Microbes for Biomining Ultramafic Materials – submitted
- 1- Co-generation of $\text{NaREE}(\text{MoO}_4)_2$ and REEPO_4 in multiple habits by solid-solid flux synthesis reactions – provisional patent filled

INVITED TALKS

- 2024**
- Intraplate explosive eruptions fed directly from the mantle**
- University of Arizona, Department of Geosciences
 - University of North Carolina Chapel Hill, Department of Earth, Marine, and Environmental Sciences.
- Crustal to Mantle Melt Storage During the Evolution of Hawaiian Volcanoes**
- Lamont Doherty Earth Observatory
- Syntetic Biology + Mineralogy solution for the Energy Transition Challenges**
- University of North Carolina Chapel Hill, Department of Earth, Marine, and Environmental Sciences.
- 2023**
- New fluid inclusions frontiers for Volcanic Eruptions**
- University of California Santa Barbara, Department of Earth Science
 - University of Oregon, Department of Earth Sciences
 - Woods Hole Oceanographic Institution
 - Universidad de Chile en Santiago, Departamento de Ciencias Geológicas
 - Georgia Tech, Department of Earth and Atmospheric Sciences
 - Centro de Geofísica, Universidad Autónoma de Mexico, México, DF
- Mineralogy + Synthetic Biology Solutions for the Energy Transition**
- Department of Chemical Engineering, Columbia University
 - Department Seminar, Material Science and Engineering, Cornell University
- Contrasting the Crustal Composition of Earth and Mars**
- University of California Santa Barbara, Department of Earth Science
- 2022**
- Solving the mystery of Bermuda**
- University of Wyoming, Department of Geology and Geophysics, *Distinguished Lecture*
- New Frontiers in Melt and Fluid Inclusions for Volcanic Eruptions**
- University of Rochester, Department of Earth, and Environmental Sciences Seminar Series
 - Lamont Doherty Earth Observatory, Geochemistry Seminar
- 2021**
- Active serpentinization in the Santa Elena ophiolite (Costa Rica) as a testbed for in-situ carbon storage**
- ARPA-E CO₂ Mineralization for *in situ* Storage and *ex situ* Enhanced Metals Recovery Workshop.
- 2019**
- Phanerozoic komatiites from a reservoir at the core-mantle boundary**
- Goldschmidt Conference, Barcelona, Spain.
- Element Recycling in the Deep Earth**

- Gordon Research Conference on the Interior of the Earth

2018 The secular evolution of the Galapagos mantle plume

- *Key Note Talk*, Goldschmid Conference, Boston, US.

Using major and trace elements to understand mantle melting

- Invited lecture, Collaborative Institute for the Deep Earth Interior (CIDER)

Life cycles of mantle plumes

- Syracuse University, departmental seminar.

Making juvenile continental crust.

- University of Miami, Ohio, departmental seminar

2017 The hottest Phanerozoic magmas and the survival of Archean reservoirs

- *Kuno Lecture* at the European Geophysical Union, Vienna, Austria

Life cycles of mantle plumes

- Lamont-Doherty Earth Observatory of Columbia University, Institutional Colloquium
- Earth and Planetary Science Department, University of Tennessee, departmental seminar

2016 Freshly brewed continental crust.

- School of the Earth and Ocean Sciences, University of Hawaii Departmental Seminar
- Stanford University, Geology Department Seminar
- Brown University, Department of Earth, Planetary and Environmental Sciences, Departmental Seminar
- University of Tennessee, Earth and Planetary Science Department seminar
- Penn State, Department of Geosciences Colloquium Series

2015 Freshly brewed continental crust.

- American Geophysical Union Fall Meeting, San Francisco.

Sediment melting at the edge of the Aeolian Slab: Implications for hot vs cold subduction zone models

- Invited Talk Subduction Theoretical and Experimental Institute, GeoPrisms, Redondo Beach, California

CO₂ in melt inclusion bubbles

- Deep Carbon Observatory: Fluxes and Reservoirs meeting, Berkeley, California

The youngest magmatic event in the Eastern North American Margin

- Invited talk, Earth Scope National Meeting, Stowe, Vermont.

Generation of Continental Crust in oceanic arcs: Department Seminars

- California Institute of Technology, Division of Earth and Planetary Sciences Seminar Series
- Texas A&M, Department of Geoscience Seminar Series
- University of South Carolina, School of the Earth, Oceans and Environment, Colloquium Series

2014 Evolution of Mantle Plumes.

- Princeton University, Earth Science Department Seminar.

The Central American Isthmus Closure and Generation of Continental Crust.

- Smithsonian Tropical Research Institute, Panama, Institute Seminar Series.

Coast to Coast Intraplate Magmatism and the Composition of North American Mantle

- Rutgers University, Department of Earth and Planetary Sciences, Departmental Colloquium.

The Intra-continental Rift of Rodinia: Neoproterozoic equivalents in the Manhattan Prong,

- Invited talk, Manhattan Prong Workshop, Columbia University.

2013 Recycled oceanic crust and the thermal evolution of mantle plumes.

- Gordon Research Seminar, Frontiers of Science in the Interior of the Earth, Mount Holyoke College, Massachusetts.

Melting processes in the Basin and Range, Western United States: Implications for the evolution of the lithosphere-Asthenosphere boundary.

- Cornell University, Department of Earth and Atmospheric Sciences Colloquium.
University of New Mexico, Department of Earth and Planetary Sciences Seminar Series.
- University of Southern Florida, School of Geosciences Colloquium.
- University of California, Santa Cruz, Department of Earth and Planetary Sciences Colloquium.

2012 Calibration of thermobarometry (T - P) estimates with H_2O and fO_2 data from melt inclusions: Results from the Big Pine Volcanic Field, Western USA. Goldschmidt Conference, Montreal, 2012.

The extensive record of Galapagos-tracks interaction with the Central American subduction system: A natural laboratory for the evolution of continental crust, Final SFB-574 Colloquium, Lübeck, Germany, May, 2012.

Lithosphere vs. Asthenosphere mantle sources at Big Pine Volcanic Field Results from the Basin and Range, Western USA. **University of North Carolina Chapel Hill** and **James Madison University**, Departmental Seminar.

2011 *What is the Lithosphere-Asthenosphere boundary from a petrological perspective: Results from the Basin and Range, Western USA.* **Lithosphere-Asthenosphere Institute**, Portland Oregon, Sept. 2011.

Melting Conditions with PRIMELT: Examples and Future Work. **Goldschmidt Conference** (abs:2198), Prague, 2011.

Secular cooling in mantle plumes. **Smithsonian Institution**. Mineralogy Department Seminar.

Making continental crust by subduction-plume interaction. **Northern Illinois University and University of Houston**. Departmental Colloquium.

2010 *Lithosphere-Asthenosphere boundary from a petrological perspective: Results from the Basin and Range, Western USA.* **AGU Fall Meeting**.

Effects of the long-term interaction of the Central American Subduction Zone with Galapagos Plume tracks. **Goldschmidt Conference**, Knoxville, Tennessee.

2009 *Life cycles of mantle plumes: A perspective from the Galapagos Plume.* **Circum-Caribbean Tectonics**, Cardiff, Wales, United Kingdom and **AGU Fall Meeting**.

SELECTED MEETING PRESENTATIONS (last 2 years)

- ♦ Undergraduate student from my group
- * Graduate student from my group
- ** Graduate student external advisor/committee member
- + Postdoc from my group

*Kyle Dayton, **Esteban Gazel**, Penny E Wieser, Valentin R Troll, Juan-Carlos Carracedo, Meritxell Aulinas, Francisco Jose Perez-Torrado. Revealing Magma Reservoirs: Melt and Fluid Inclusions of the 2021 Tajogaite Eruption. **American Geophysical Union Fall Meeting**, Washington DC, USA.

Michael, J. Carr, Feigenson, M., **Esteban Gazel**. Source Composition and Melt Fraction for Shield and Rejuvenation Stage Hawaiian Volcanoes from a New REE Inverse Model. **American Geophysical Union Fall Meeting**, Washington DC, USA.

Hope Elliott, Edmund Blades, Haley Royer, Cliff Buck, Charlotte Kollman, Ravi K Kukkadapu, Swarup China, Zezhen Cheng, Nurun Nahar Lata, Mark Engelhard, Mark E Bowden, Nabajit Lahiri, Rebecca Parham, Lauren Meagher, Andrew P Ault, Adrian Hornby⁺, Kyle Dayton*, **Esteban Gazel**, Amanda Oehlert, Kimberly J. Pependorf, Cassandra Gaston, 024. *Constraining Iron Solubility in Volcanic Ash: Do ash-derived nutrients fertilize the surface ocean?*. **American Geophysical Union Fall Meeting**, Washington DC, USA.

- Mahowald et al. (58 coauthors including **Esteban Gazel**) 2024. Model estimates of atmospheric Al, Ca, Fe, Si and Ti concentrations and deposition using EMIT surface mineralogy and comparison to observations. *American Geophysical Union Fall Meeting*, Washington DC, USA.
- Damian Donoso Tapia**, Kennet E Flores, Celine Martin, Sarah Hull, David Hernández-Uribe, Esteban Gazel, Jeffrey Marsh. *Record of Deserpentinization and Re-serpentinization of an Exhumed Slab Sliver: Implications for Fluid Circulation in Subduction Zones. American Geophysical Union Fall Meeting*, Washington DC, USA.
- Alexandra May, Ricardo Sanchez-Murillo, **Esteban Gazel**, Sarah Gonzalez Henao, Matthew O Schrenk, Maarten J de Moor, María Marta Chavarría, 2024. *Monsoonal Rainfall and Natural Recharge 'Stimulation' Drive Seasonal GeoH₂ and CH₄ Production. American Geophysical Union Fall Meeting*, Washington DC, USA.
- +Emily First, Ishan Mishra, **Esteban Gazel**, Nikole K Lewis, Jonathan Letai, Leonard Hanssen, 2024. *Mid-Infrared Spectra of Natural Basalts Applied to Rocky Exoplanets American Geophysical Union Fall Meeting*, Washington DC, USA.
- Meegan Soulsby, Kasper van Wijk, Hugo Chevallier, Jennifer Dawn Eccles, Martha K Savage, Calum John Chamberlain, Jenni L Hopkins, Finnigan Illsley-Kemp, Ting Yang, Jason P Morgan, Zhen Guo, Geoffrey A Abers, Karen M Fischer, Michael C Rowe, Esteban Gazel. *Imaging of the Auckland Volcanic Field Crust with Body Waves from Local and Relocated Seismic Events. American Geophysical Union Fall Meeting*, Washington DC, USA.
- Michael R Hudak, David Vincent Bekaert, Peter H Barry, Kan Li, Michael Ward Broadley, Molly Anderson, John A Krantz, Forrest Horton, James M Day, **Esteban Gazel**, Mark D Kurz, Joshua Curtice. *Nitrogen isotopes in mafic lavas reveal the extent of nitrogen recycling to the deep mantle. American Geophysical Union Fall Meeting*, Washington DC, USA.
- May, A., Sánchez-Murillo, R., Gonzalez Heno, S., Schrenk, M., **Gazel. E.**, 2024. Exploring natural GeoH₂ generation in a monsoonal serpentinization environment, in *Proceedings of the Goldschmidt Conference*, Geochemical Society, Chicago, USA.
- Elliott, E., H., Gaston, C., Blades, E., Royer, H., Amanda Oehlert, A., Kukkadapu, R., China, S., Cheng, Z., Nahar Lata, N., Buck, C., Kollman, C., **Gazel, E.**, Hornby, A., Parham, R. Meagher, L., Ault, A. 2024. Iron in Volcanic Ash: Iron-Specific Mineralogy Explains Solubility, in *Proceedings of the Goldschmidt Conference*, Geochemical Society, Chicago, USA.
- Hwang, J., Park J-W, Jegal, Y., Gazel, E., Hoernle K., Influence of subduction component oxidation state on platinum group element geochemistry of arc magmas, in *Proceedings of the Goldschmidt Conference*, Geochemical Society, Chicago, USA.
- +Biren, J., **Gazel, E.**, Kaltenegger, L., 2024. Characterizing Lava Worlds – Critical Laboratory Work for Observations. AASTCS10, Extreme Solar Systems V, id. 203.05. *Bulletin of the American Astronomical Society*, Vol. 56, No. 4 e-id.
- *Wu, P., Dayton, K., **Gazel, E.**, Porry, T. 2024. Micro X-Ray Computed Tomography of Melt Inclusions in Chassignite Northwest Africa (NWA) 2737. 55th Lunar and Planetary Science Conference, The Woodlands, Texas. LPI Contribution No. 3040, id.1734
- Elliott, E., H., Gaston, C., Blades, E., Royer, H., Amanda Oehlert, A., Kukkadapu, R., China, S., Cheng, Z., Nahar Lata, N., Buck, C., Kollman, C., **Gazel, E.**, Hornby, A., Parham, R. Meagher, L., Ault, A. 2024. Single-Particle Analysis of Volcanic Ash Reveals Differences in Fe Minerology, Speciation, and Solubility. *Ocean Sciences Meeting*.

- Gazel, E.**, Weiser, P., Lamadrid, H. 2023. New fluid inclusions frontiers for volcanic eruptions. **80th Anniversary of the Eruption of Parícutin**, International Association of Volcanology and Chemistry of the Earth's Interior, Morelia, Mexico.
- Gazel, E.**, Weiser, P., Lamadrid, H. 2023. New fluid inclusions frontiers for volcanic eruptions. **XVI Congreso Geológico Chileno**, Santiago de Chile.
- ♦Ward, J. M., *Dayton, K., **Gazel, E.**, 2023. Raman and Infrared Spectroscopy of Martian Meteorite Northwest Africa 2737. **54th Lunar and Planetary Science Conference**, 2023. LPI Contribution No. 2806, id.1002
- Wu, P., Dayton, K., Gazel E., 2023. Quantitative Analysis of Melt Inclusions in Extraterrestrial Samples Using Nano-Scale X-Ray Computed Tomography. **54th Lunar and Planetary Science Conference**, 2023. LPI Contribution No. No. 2806, id.2436
- Wieser, P., Kent, A., Devitre, C., **Gazel, E.**, Till, C.B., Johnson, E.R., Wallace, P.J., Couperthwaite, F., 2023. Bubble Trouble: Raman measurements of Cascade melt inclusion vapor bubbles indicate substantial underestimation of magma storage depths in legacy data. **AGU Fall Meeting 2023**.
- Wieser, P., Kent, A., Devitre, C., **Gazel, E.**, Till, C., Wallace, P., Johnson, E., Abers, G.: Magma Storage depths along the Cascade Arc: Knowns and Unknowns, **EGU General Assembly 2023**, Vienna, Austria, EGU23-10236.
- Gruender, K., Barker, S., Rowe, M., Conway, C., Gazel, E. 2023. From Source to Surface: Magmatic Timescales and Processes Leading to Eruptions from Red Crater (Tongariro, New Zealand). **Goldschmidt Conference**, Geochemical Society, 2022.
- van Wijk, K., Morgan, J.P., Abers, G.A., Fischer, K.M., Yang, T., Guo, Z., Savage, M.K., Eccles, J.D., Illsley-Kemp, F., Chamberlain, C.J., **Gazel, E.**, Hopkins, J., Rowe, M., Solsbuy, M. 2023. Probing the depths of Auckland's Volcanic Field: An integrated geophysical investigation into the intraplate volcanism of Tāmaki Makaurau. **AGU Fall Meeting 2023**.
- *DeVitre, C. *Dayton, K., **Gazel, E.**, Barth, A. Plank, T.A., Pamukcu, A., Gaetani, G. Monteleone, B. Accounting for Multi-Phase Carbon in Melt Inclusion Bubbles, in Proceedings of the **Goldschmidt Conference**, Geochemical Society, 2022.
- Soderman, C.R., Shorttle, O., **Gazel, E.**, Geist, D., Matthews, S., Williams, H.M. 90 million years of the Galapagos plume: the evolution of lithological heterogeneity, in Proceedings of the **Goldschmidt Conference**, Honolulu, Geochemical Society, 2022.
- Flores, K.E., **Gazel, E.**, Bonnet, G. Martin, C.Cai, Y., Hemming, S. Brueckner K.H. Harlow, G. Record of fluid-rock interaction in a long-lived subduction channel, in Proceedings of the **Goldschmidt Conference**, Honolulu, Geochemical Society, 2022.
- Zhang, Y., Namur, Bernard Charlier, B., Li, W. Shorttle, O., **Gazel, E.**, Jennings, E., Thy, P. Grove, T. A re-evaluation of the Al-in-Olivine, in Proceedings of the **Goldschmidt Conference**, Honolulu, Geochemical Society, 2022.
- +First E.C., **Gazel E.**, Mishra I., Lewis N. K., ♦Letai J. What's in a (Rock) Name? Infrared Laboratory Spectra of Terrestrial "Basalts" Can Inform Interpretations of Rocky Exoplanet Surfaces [#2879], Lunar and Planetary Science Conference, 2022.

WORKSHOPS (last five years)

2024 **Geologic Hydrogen, Massachusetts Institute of Technology**

-GeoH₂ from serpentinization reactions (invited talk)

Future of the Continental Drilling Program – Alexandria, Virginia, USA.

- 2023** **ARPA-E, Department of Energy**, Geologic Hydrogen, Washington DC.
DARPA, Department of Defense, Separation and Purification of Rare Earth Elements (SPREE) Workshop -Department of Defense, Washington D.C.,
- 2021** **ARPA-E, Department of Energy**, Ssequestering Carbon with Hybrid Employment of Mineral Assets (remote) – **Invited talk**
- 2019** **Exoplanets Research** – Joint American Geophysical Union (AGU) and American Astronomy Society workshop on progress and challenges on exoplanet search with the goal of integrating the fields of planetary science with astronomy. Reykjavik, Iceland

Water in the Mantle, how much water is in the mantle and how it is stored in the biggest reservoir of our planet? Lamont Doherty Earth Observatory, Palisades, NY.

SERVICE AND SYNERGISTIC ACTIVITIES (last 5 years)

Professional Service

2021-2023

- Committee member of the Magmatic Drives of Eruption working group, Subduction Zone 4D (SZ4D)
- SZ4D and Andes Net array definition workshop in Chile (2023)

University Service

2023-

- Co-director of Global Centers: A Microbe-Mineral Atlas for a Sustainable Energy Future

2022-2023

- Committee Chair for the Open Rank Faculty Search in Critical Elements Geoscience
- College of Engineering Design Directions committee member

2021-present

- Director of the [Cornell Mass Spectrometry Facilities](#) (CMaS)
- Curator of the Earth Science Heasley Museum
- Member of the EAS Strategic Planning and Curriculum Committee and reporting
- Design and supervision of the construction and use of the new microscopy teaching laboratory in Snee 1149.

- Systematic organization of the teaching and museum collections in the summer of 2021 and the supervision of graduate student assistants Kyle Dayton and Peiyu Wu involved in this project
- Mentoring Committee Member for early career faculty.
- CoE Facilities and Renovation Assessment Committee

PROFESSIONAL MEMBERSHIPS

- American Geophysical Union, Geochemical Society, Geologic Society of America, International Association of Volcanology and Chemistry of the Earth's Interior, Mineralogical Society of America.