

# Francisco Cáceres Acevedo, Dr. rer. nat.

## DFG Research Grant Fellow

Department of Earth & Environmental Sciences  
Ludwig-Maximilians-Universität (LMU) München  
Theresienstr. 41, 80333 Munich, Germany  
Chilean citizenship

## Education

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- Dr. rer. nat. (Ph.D.)** **12/2016-07/2020**  
**Ludwig-Maximilians-Universität (LMU) München** **Munich, Germany**  
**Thesis topic** *The role of nano- to millimetre sized crystals on the dynamic evolution of shallow silica-rich magma: Implications for volcanic eruptions*  
Supervisors Prof. Dr. Bettina Scheu & Prof. Dr. Donald B. Dingwell
- M.Sc. in Geology** **08/2013-07/2016**  
**Universidad de Chile** **Santiago, Chile**  
**Thesis topic** *Magma storage conditions and eruptive dynamics of post-glacial effusive volcanism at Laguna del Maule volcanic field*  
Supervisors Dr. Ángelo Castruccio & Dr. Miguel Á. Parada
- B.Sc. in Geology** **03/2008-07/2013**  
**Universidad de Chile** **Santiago, Chile**  
**Thesis** *shared with M.Sc. in Geology.*

## Experience

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- DFG (German Research Foundation) Research Grant Fellow (current)** **05/2021-04/2023**  
**Ludwig-Maximilians-Universität München** **Munich, Germany**  
**Ongoing projects:**  
  - Nanolites crystallisation in magma and rheology of nanolite-bearing magma
  - The explosive eruptive cycle 2021-2022 of Etna volcano
  - Heterogeneous bubble nucleation in magma: roles of different mineral phases in 4D analyses
  - Generation and evolution of magma in multi-compositional volcanic fields
- Postdoctoral researcher** **08/2020-04/2021**  
**Ludwig-Maximilians-Universität München** **Munich, Germany**  
**Project:**  
  - Role of crystals during degassing of silicic magma
- Ph.D. researcher** **12/2016-07/2020**  
**Ludwig-Maximilians-Universität München** **Munich, Germany**  
**Projects:**  
  - The effect of nanolites on degassing of silicic magma
  - Nanolites crystallisation at oxidizing conditions
  - Magmatic fragmentation under slow decompression
- Research Internship** **01/2015-02/2015**  
**School of Earth Sciences, University of Bristol** **Bristol, United Kingdom**  
Petrographic and chemical analyses of Laguna del Maule volcanic field (SEM and EPMA).
- Research Internship** **01/2013-03/2013**  
**Glaciology and Climate Change Laboratory, Centre for Scientific Studies (CECs)** **Valdivia, Chile**  
Study of the changes in the ice cover of Hudson volcano, Chile, driven by the eruption of October 2011 and implications for meltwater-driven Lahars. Work with Digital Elevation Models (DEM) and airborne Aerial Photography.
- Internship period in the mining industry** **02/2012-03/2012**  
**Chuquicamata and Ministro Hales copper mines, CODELCO** **Calama, Chile**  
Study of the ore mineralogy by using Near-Infrared spectroscopy.

## Research Visits and Stays

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- ETH Zurich, Switzerland. High-T and High-P cold-seal pressure vessel experiments Oct 2022
- Dep. of Chemistry LMU Munich, Germany. FE-Scanning Electron Microscopy (FE-SEM) Oct 2022
- University of Cambridge, UK. Transmission Electron Microscopy (TEM) Aug 2022
- Swiss Light Source (SLS), PSI, Switzerland. 4-D in-situ synchrotron X-ray CT (PI) Apr 2022
- Swiss Light Source (SLS), PSI, Switzerland. 4-D in-situ synchrotron X-ray CT (Collab.) May 2019
- Swiss Light Source (SLS), PSI, Switzerland. 4-D in-situ synchrotron X-ray CT (Collab.) Nov 2017
- ETH Zurich, Switzerland. Hot Isostatic Press (HIP) Oct 2017

## Projects Granted

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- Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) 2021-2023  
*Conditions for nanocrystals formation in Krafla shallow rhyolitic magma: A potential site for explosive eruptions*
- Swiss Light Source, Paul Scherrer Institut. Synchrotron light source, TOMCAT Beamline 2022  
*Heterogenous bubble nucleation and bubble coalescence during degassing of natural crystal-bearing magma: eruption dynamics controllers in active volcanoes*
- Transnational Access (TNA) EXCITE network 2022  
*Nanocrystal formation in natural magmas (NANOFOAM)*

## Additional Funding Awarded

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- Ludwig-Maximilians-Universität (LMU), 2022 LMU Excellence PostDoc Support Fund
- Ludwig-Maximilians-Universität (LMU), 2021 LMU Excellence PostDoc Support Fund
- Ludwig-Maximilians-Universität (LMU), 2019-2023 Geosciences mentoring program
- American Geophysics Union AGU 2015 Fall Meeting Student Travel Grant
- Universidad de Chile 2015 Graduate Studies Grant for international research stays
- M.Sc. Grant for studies in Chile 2013 CONICYT, Government of Chile

## Teaching Experience

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Ludwig-Maximilians-Universität	Munich, Germany
Lecture:	
• Petrology (co-teaching with Prof. Dr. Corrado Cimarelli)	2018
Teaching assistant in:	
• Petrophysics	2021
• Melts, Glasses, Magmas course (laboratory assistance)	2022
Universidad de Chile	Santiago, Chile
Teaching assistant in:	
• Physical Volcanology	2013 - 2016
• Igneous and Metamorphic Petrology	2012 - 2016
• Geochemistry Fundamentals	2012 & 2016
• General Geology	2011 & 2013
• Petrology Fundamentals	2013
• Crystallography and Mineralogy	2011
• Introduction to Astrobiology (Geology sub-subject)	2011

## Students supervised

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- Sophia Bachmayer B.Sc thesis at Ludwig-Maximilians-Universität München 2022  
Thesis topic *Texturale Analyse exotischer Pyroklasten des 2021 Cumbre Vieja Ausbruchs (La Palma). Co-supervised.*
- Javiera Terán Arias B.Sc. thesis at Universidad de Chile 2022 (ongoing)  
Thesis topic *Condiciones de almacenamiento y ascenso magmático para el ciclo eruptivo iniciado en febrero 2021 del volcán Etna, Italia. Supervised.*
- Joaquín Flores Castillo B.Sc. thesis at Universidad de Chile 2022 (ongoing)  
Thesis topic *Condiciones syn-eruptivas durante el ciclo eruptivo Febrero 2021-presente del volcán Etna, Italia. Supervised.*

## Laboratory and Analytical Experience

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- Scanning Electron Microscope (SEM)
- Electron Probe Micro-Analysis (EPMA)
- Transmission Electron Microscope (TEM)
- Micro-Raman Spectrometer (Raman)
- Magnetic Hysteresis Analyses *Natural and experimental glasses and powders*
- X-Ray Computed Tomography (CT)
- Differential Scanning Calorimeter (DSC) *T<sub>g</sub>, crystallisation/melting temperatures*
- Helium Pycnometer
- Fragmentation Apparatus / Externally heated autoclave
- Optical Dilatometer *Magma heating and cooling at low pressure in air, Ar and CO<sub>2</sub> atmospheres*
- High temperature furnaces *Magma synthesis and annealing. (Re-)melting (up to 1600°C)*
- Rheometer *Viscosity of magmas and magma analogues*
- *In-situ* experiments at synchrotron 4D experiments. *Three times at SLS, Switzerland*
- Rapid-quench pressure vessels *High P-High T crystallisation experiments*

## Modelling and Computational Experience

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- Thermodynamic modelling *Rhyolite-MELTS / PELE / Conflow*
- Image processing *ImageJ / JMicroVision*
- Other software for analyses *FOAMS / Avizo / Blob3D / LabSpec / Origin*

## Conference sessions convened

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- 2023 Convener at XVI Chilean Geological Congress 2023 for session *Los volcanes más allá de sus depósitos / Volcanoes beyond their deposits.*
- 2022 Convener at Goldschmidt 2022 for session *4f - Reconstructing high-temperature processes by characterizing the kinetics of crystallization, mineral reactions and diffusion.*

## Reviewer for

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- Communications Earth and Environment
- Bulletin of Volcanology
- American Mineralogist

## Courses, Schools and Workshops

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|---|-------------------------------------|
| • Public Engagement in Geosciences Workshop<br>European Geosciences Union (EGU)   | 2022<br>Online                      |
| • Magma and Fluids Workshop<br>Institut des Sciences de la Terre d'Orléans, Université d'Orléans  | 2022<br>Orléans, France             |
| • Quantitative Analysis of Geological X-Ray Computed Tomography (CT) Data<br>High-Resolution X-ray CT Facility at The University of Texas at Austin (UTCT)      | 2021<br>Online                      |
| • Raman spectroscopy seminar: Theory of Raman scattering and geochemical applications<br>Université de Lorraine, France & Leibniz Universität Hannover, Germany | 2020<br>Online                      |
| • 11 <sup>th</sup> Silicate Melt Workshop<br>Ludwig-Maximilians-Universität & Institut de Physique du Globe de Paris  | 2019<br>La Petite-Pierre, France    |
| • Melts, Glasses, Magmas Course<br>Ludwig-Maximilians-Universität München   | 2017<br>Munich, Germany             |
| • International Course on Techniques for the Study of Active Volcanoes<br>Universidad Nacional de Río Negro   | 2014<br>Caviahue-Copahue, Argentina |
| • Science Communication Course<br>Andean Geothermal Centre of Excellence & Universidad de Chile   | 2014<br>Santiago, Chile             |

## Scientific Outreach

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- **Interview for magazine *Physics World*, UK** (<https://physicsworld.com/a/nanocrystals-could-drive-explosive-volcanic-eruptions/>) Interviewed by the science-magazine journalist Ian Randall about the role of nanocrystals in volcanic eruptions. September 2020.
- **AMÜSE 2018** (Annual MUnich Earth SciencE PhD Conference). **Organization of meeting**. 19-21 October 2018. Hinterrif, Austria.
- **European Geosciences Union, Natural Hazards division** Editor since 2017 for the science communication site of the Natural Hazards division in the European Geosciences Union (EGU) aimed to the scientific community in Earth sciences. Highlights and reviews of key research and topics related to natural hazards in different aspects of geosciences. Examples of my articles (among others):
  - **Stromboli: The Lighthouse of the Mediterranean**  
(<https://blogs.egu.eu/divisions/nh/2019/09/18/stromboli-the-lighthouse-of-the-mediterranean/>)
  - **Let the ash fall, but get ready for its consequences**  
(<https://blogs.egu.eu/divisions/nh/2019/05/27/let-the-ash-fall-but-get-ready-for-its-consequences/>)
  - **Volcanic eruptions: Sometimes natural spectacles, but other times disasters**  
(<https://blogs.egu.eu/divisions/nh/2018/10/22/volcanic-eruptions-sometimes-natural-spectacles-but-other-times-disasters/>)
- **1000 científicos, 1000 aulas (1000 scientists, 1000 classrooms)** 2014 Explora CONICYT, Chile. Talk: Los volcanes: nuestros antepasados, vecinos y sucesores (*Volcanoes: Our ancestors, neighbours and successors*).

## Memberships

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- **EGU** *European Geosciences Union*
- **AGU** *American Geophysical Union*
- **IAVCEI** *International Association of Volcanology and Chemistry of the Earth's Interior*
- **ALVO** *Asociación Latinoamericana de Volcanología*

## Languages

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**Spanish** (native), **English** (fluent/advanced), **German** (intermediate), **French** (intermediate)  
**Python and Matlab** (basic coding skills)

## Others

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**Field work** Vast experience in remote and rough terrain: **Laguna del Maule Volcanic Field Chile** / **Copahue Volcano Argentina** / **Krafla Volcano Iceland** / **Vatnajökull Glacier Iceland** / **Etna Volcano Italy** / **Lipari Volcano Italy** / **Tajogaite Volcano (La Palma) Canary Islands, Spain**

**General Interests other than Volcanology, Petrology and Geochemistry** Natural Hazards / Volcano-Glacier interactions / Extraplanetary Volcanism and Cryovolcanism / Worldview of native peoples on geological processes / Climate Change.

**Sports** Bouldering / Climbing / Hiking / Mountain Bike / Rowing

**Photography** Landscapes / Black and White

**Cooking**

## Publications

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- 11 Romero, J.E., Morgado, E., Pisello, A., Boschetty, F., Petrelli, M., **Cáceres, F.**, Alam, M.A., Polacci, M., Palma, J.L., Arzilli, F., Vera, F. Gutiérrez, R. & Morgavi, D. 2023. *Pre-eruptive Conditions of the 3 March 2015 Lava Fountain of Villarrica Volcano (Southern Andes)*. **Bulletin of Volcanology** 85:2. <https://doi.org/10.1007/s00445-022-01621-0>
- 10 Colombier, M., Bernard, B., Wright, H., Le Pennec, J-L, **Cáceres, F.**, Cimarelli, C., Heap, M.J., Samaniego, P., Vasseur, J. & Dingwell, D.B. 2022. *Conduit processes in crystal-rich dacitic magma and implications for eruptive cycles at Guagua Pichincha volcano, Ecuador*. **Bulletin of Volcanology** 84:105. <https://doi.org/10.1007/s00445-022-01612-1>
- 9 Romero, J.E., Burton, M., **Cáceres, F.**, Taddeucci, J., Civico, R., Ricci, T., Pankhurst, M.J., Hernández, P.A., Bonadona, C., Llewellyn, E.W., Pistolesi, M. Polacci, M., Solana, C., D'Auria, L., Arzilli, F., Andronico, D., Rodríguez, F., Asensio-Ramos, M., Martín-Lorenzo, A., Hayer, C., Scarlato, P. & Perez, N.M.. 2022. *The initial phase of the 2021 Cumbre Vieja ridge eruption (Canary Islands): products and dynamics controlling edifice growth and collapse*. **Journal of Volcanology and Geothermal Research** 431, 107642. <https://doi.org/10.1016/j.jvolgeores.2022.107642>
- 8 **Cáceres, F.**, Scheu, B., Colombier, M., Hess, K-U., Feisel, Y., Ruthensteiner, B. & Dingwell, D.B. 2022. *The roles of microlites and phenocrysts during degassing of silicic magma*. **Earth and Planetary Science Letters** 577, 117264. <https://doi.org/10.1016/j.epsl.2021.117264>
- 7 Colombier, M., Vasseur, J., Houghton, B.F., **Cáceres, F.**, Scheu, B., Kueppers, U., Thivet, S., Gurioli, L., Montanaro, C., Soldati, A., Di Muro, A. & Dingwell, D.B. 2021. *Degassing and gas percolation in basaltic magmas*. **Earth and Planetary Science Letters** 573, 117134. <https://doi.org/10.1016/j.epsl.2021.117134>
- 6 **Cáceres, F.**, Scheu, B., Hess, K-U., Cimarelli, C., Vasseur, J., Kaliwoda, M. & Dingwell, D.B. 2021. *From melt to crystals: The effects of cooling on Fe-Ti oxide nanolites crystallisation and melt polymerisation at oxidising conditions*. **Chemical Geology**. <https://doi.org/10.1016/j.chemgeo.2021.120057>
- 5 Colombier, M., Shea, T., Burgisser, A., Druitt, T.H., Gurioli, L., Müller, D., **Cáceres, F.**, Hess, K-U., Boivin, P., Miallier, D. & Dingwell, D.B. 2020. *Rheological change and degassing during a trachytic Vulcanian eruption at Kilian volcano, Chaîne des Puys, France*. **Bulletin of Volcanology** 82:78. <https://doi.org/10.1007/s00445-020-01420-5>
- 4 **Cáceres, F.**, Wadsworth, F.B., Scheu, B., Colombier, M., Madonna, C., Cimarelli, C., Hess, K-U., Kaliwoda, M., Ruthensteiner, B. & Dingwell, D.B. 2020. *Can nanolites enhance eruption explosivity?* **Geology** 48, 997–1001. <https://doi.org/10.1130/G47317.1>
- 3 Colombier, M., Wadsworth, F.B., Scheu, B., Vasseur, J., Dobson, K.J., **Cáceres, F.**, Allabar, A., Marone, F., Schlepütz, C. & Dingwell, D.B. 2020. *In situ observation of the percolation threshold in multiphase magma analogues*. **Bulletin of Volcanology** 82: 32. <https://doi.org/10.1007/s00445-020-1370-1>
- 2 Wadsworth, F.B., Unwin, H.E., Vasseur, J., Kennedy, B.M., Holzmueller, J., Witcher, T., Adolf, J., **Cáceres, F.**, Casas, A.S., Cigala, V., Clement, A.M., Colombier, M., Cronin, S., Cronin, M., Dingwell, D.B., Freitas Guimarães, L., Höltingen, L., Kueppers, U., Seropian, G., Stern, S., Teissier, A., Vossen, C.E.J. & Weichselgartner, N. 2018. *Trashcano: Developing a quantitative teaching tool to understand ballistics accelerated by explosive volcanic eruptions*. **Volcanica** 1(2), 107-126. <https://doi.org/10.30909/vol.01.02.107126>
- 1 **Cáceres, F.**, Castruccio, A. & Parada, M.A. 2018. *Morphology, effusion rates and petrology of postglacial lavas of Laguna del Maule Volcanic Field, Chilean Andes, and implications for their plumbing system*. **Geochemistry, Geophysics, Geosystems** 19, 4925-4944. <https://doi.org/10.1029/2018GC007817>

## Main Conference Presentations

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- 2022 **Cáceres, F.**, Hess, K-U., Eitel, M., Colombier, M., Scheu, B., Kaliwoda, M. & Dingwell, D.B. **Oxide nanolites formation and subsequent viscosity changes in Krafla magma. ICDP Colloquium 2022**, Potsdam, Germany. P. 29.
- 2021 **Cáceres, F.**, Scheu, B., Colombier, M., Hess, K-U., Feisel, Y., Ruthensteiner, B. & Dingwell, D.B. **What roles do microlites and phenocrysts play during degassing of silicic magma?. AGU Fall Meeting 2021**, Hybrid at New Orleans (USA) & Online. Abstract V21B-02.
- 2020 **Cáceres, F.**, Scheu, B., Hess, K-U., Cimarelli, C., Vasseur, J., Kaliwoda, M., & Dingwell, D.B. **Effects of cooling on Fe-Ti oxide nanolites crystallisation and melt polymerisation at low pressure and oxidising conditions. Goldschmidt 2020**, Hawaii, USA. *Moved online*. Abstract GOLD2020-298. <https://doi.org/10.46427/gold2020.298>
- Cáceres, F.**, Wadsworth, F.B., Scheu, B., Colombier, M., Madonna, C., Cimarelli, C., Hess, K-U., Kaliwoda, M., Ruthensteiner, B. & Dingwell, D.B. **The effect of nanolites on degassing of silica-rich magma. EGU General Assembly 2020** (European Geosciences Union), Vienna, Austria. *Moved online*. Abstract EGU2020-17732. <https://doi.org/10.5194/egusphere-egu2020-17732>
- Cáceres, F.**, Wadsworth, F.B., Scheu, B., Colombier, M., Madonna, C., Cimarelli, C., Hess, K-U., Kaliwoda, M., Ruthensteiner, B. & Dingwell, D.B. **¿Los nanolitos pueden inducir erupciones explosivas? 1er Congreso ALVO** (Asociación Latinoamericana de Volcanología) 2020, Antofagasta, Chile. *Moved online*. Abstract 392.
- 2019 **Cáceres, F.**, Scheu, B., Wadsworth, F.B., Colombier, M., Hess, K-U., Madonna, C., Cimarelli, C., Kaliwoda, M., Ruthensteiner, B. & Dingwell, D.B. **Controls on the formation of impermeable networks vs outgassing during vesiculation in rhyolitic magma. EGU General Assembly 2019**, Vienna, Austria. Abstract EGU2019-6064.
- 2018 **Cáceres, F.**, Wadsworth, F.B., Scheu, B., Colombier, M., Hess, K-U., Ruthensteiner, B. & Dingwell, D.B. **Vesiculation processes in rhyolitic magma as a response to heating and slow decompression. EGU General Assembly 2018**, Vienna, Austria. Abstract EGU2018-3767.
- 2017 **Cáceres, F.**, Castruccio, A., Parada, M. A. & Scheu, B. **Laguna del Maule Magma feeding system and construction of a shallow silicic magma reservoir. EGU General Assembly 2017**, Vienna, Austria. Abstract EGU2017-10511.
- 2015 **Cáceres, F.**, Castruccio, A. & Parada, M.A. **Revealing the eruptive dynamics of post-glacial effusive volcanism in the western part of Laguna del Maule Volcanic Field: Insights into a complex magmatic system. AGU Fall Meeting 2015**, San Francisco, California. Abstract V13B-3113.
- Cáceres, F.** & Castruccio, A. **Eruptive dynamics of Quaternary effusive volcanism from Laguna del Maule Volcanic Field. 26th IUGG Assembly 2015**, Prague, Czech Republic. Abstract VS02p-448.
- 2014 **Cáceres, F.**, Rivera, A., & Muñoz, C. **Cambios en la cubierta glacial del volcán Hudson, sur de Chile, en relación a la erupción de octubre de 2011. XIX Congreso Geológico Argentino 2014**. Córdoba, Argentina. Abstract E1-5.