

CURRICULUM VITAE

FABIO ARZILLI

SUMMARY OF ACADEMIC CURRICULUM VITAE

Current academic position: **Post Doctoral Research Assistant** at the University of Manchester, Department of Earth and Environmental Sciences, Manchester (UK)

Professional and academic competences: **Petrology, Volcanology, Geochemistry, Mineralogy, Synchrotron X-ray tomography, Experimental Petrology combined with synchrotron techniques**

Peer-reviewed articles: **31**

Citations: **578** (Google Scholar: <https://scholar.google.it/citations?hl=en&user=rNwdxBIAAAAJ>)

h index: **15** (Google Scholar)

International Conferences and Seminars: Convener of **2** EGU sessions (2019, 2020) and **1** SIMP session (2019). **1** keynote speaker at SGI-SIMP Congress 2014, Milan (Italy), **1** keynote speaker at EGU 2016, Vienna (Austria), **1** invited talk at Rittmann conference 2020, Catania (Italy). In total **9** oral presentations in international conferences (EGU, AGU, IAVCEI, Goldschmidt, VMSG, Rittmann). In total **50** proceedings presented in international conferences (EGU, AGU, IAVCEI, Goldschmidt, EMPG, VMSG, Rittmann, SIMP). **2** invited talks for seminars in international universities.

Reviewer: reviewer of 33 scientific articles for Geosciences and Synchrotron journals (Elsevier, Springer Nature; Oxford University Press; IUCr Journals; EGU Journals; AGU Journals).

Editor: Guest Editor in *Frontiers in Earth Science* for 2 special issues:

- *Recent Advancements in X-Ray and Neutron Imaging of Dynamic Processes in Earth Sciences* (2019-2020; <https://www.frontiersin.org/research-topics/8649/recent-advancements-in-x-ray-and-neutron-imaging-of-dynamic-processes-in-earth-sciences>);
- *Pre- and Syn-Eruptive Conditions in Volcanic Systems* (2020; <https://www.frontiersin.org/research-topics/15076/pre-and-syn-eruptive-conditions-in-volcanic-systems>).

Languages: **Italian** (mother tongue) and **English** (fluent)

WORK EXPERIENCE

01/01/2018 - present: **Post Doctoral Research Assistant** at the University of Manchester, Department of Earth and Environmental Sciences, Manchester (UK). Project: RCUK NERC DisEqm project (NE/N018575/1; PI: Prof. Mike Burton). Responsibilities: Quantifying disequilibrium processes in basaltic volcanism combining *in situ* 4D X-ray microtomography high pressure, high temperature experiments with numerical modeling of volcanic conduit processes.

15/03/2015 - 31/12/2017: **Post Doctoral Research Assistant** at the University of Manchester, Department of Earth and Environmental Sciences, Manchester (UK). Project: CO₂ VOLC (ERC grant; PI: Prof. Mike Burton). Responsibilities: Quantifying the geochemical cycling of carbon on Earth through subduction zones. Decarbonation of the subducting slab was quantified with the thermodynamic model (Perple_X).

Jan-Mar 2015: **Post Doctoral Research Assistant** at Istituto Nazionale di Geofisica e Vulcanologia (INGV), section of Pisa (Italy). Project: CO₂ VOLC (ERC grant; PI: Prof. Mike Burton). Scientific collaboration with Prof. Colin Macpherson at the University of Durham, Department of Earth Sciences, Durham (UK) to develop a thermodynamic model with Perple_X to simulate decarbonation of the active subducting slabs on Earth.

16/10/2014 - 14/03/2015: **Post Doctoral Research Assistant** at Istituto Nazionale di Geofisica e Vulcanologia (INGV), section of Pisa (Italy). Project: CO₂ VOLC (ERC grant; PI: Prof. Mike Burton). Responsibilities: Develop a thermodynamic model with Perple_X to simulate decarbonation of the active subducting slabs on Earth. The aim of the project is to quantify the deep carbon cycle on Earth through subduction zones.

15/05/2012 - 03/10/2014: **Post Doctoral Research Assistant** at the Elettra-Sincrotrone Trieste S.C.p.A. - Beamline: SYRMEP. Supervisor: Dr. Lucia Mancini. Responsibilities: Develop an imaging processing procedure to texturally quantify volcanic and sedimentary rocks in 3D using synchrotron X-ray microtomography data.

EDUCATION

2009 - 2012: **Ph.D. in Earth Sciences (XXIV cycle)** at the University of Camerino (School of Sciences and Technologies – Geology Division), Camerino (Italy). Supervisor: Prof. Mike R. Carroll. Title of the thesis: Experimental study of crystallization kinetics and eruption dynamics in Campi Flegrei trachytic melts.

May - Aug 2010: **ERASMUS** at the Ludwig Maximilian University (LMU), Department of Earth and Environmental Sciences, Munich (Germany).

2007 - 2008: **Visiting period during the Master course** at the Istituto Nazionale di Geofisica e Vulcanologia (INGV), section of Roma (Italy).

2006 - 2008: **Master Degree in Geoenvironmental Resources and Risks** at the University of Camerino (School of Sciences and Technologies – Geology Division), Camerino (Italy).

2005 - 2006: **Visiting period during the Bachelor course** at the Osservatorio Vesuviano – Istituto Nazionale di Geofisica e Vulcanologia (INGV), section of Napoli (Italy).

2000 - 2006: **Bachelor Degree in Earth Sciences** at the University of Camerino (School of Sciences and Technologies – Geology Division), Camerino (Italy).

RESEARCH

SUMMARY OF MY RESEARCH

My research career began with a PhD (awarded April 2012) on experimental petrology working with Prof. Mike R. Carroll of the University of Camerino, Italy, on high pressure, high temperature experiments on trachytes, to reveal the kinetics of crystal nucleation and growth in trachytic magmas. The aim of my PhD thesis was to estimate the magma residence time within the Campi Flegrei volcanic system using the experimentally-derived crystallization kinetics and quantitatively constrain the eruption dynamics of the Campi Flegrei volcanic system. Here I learned high pressure, high temperature experimental techniques and analytical approaches.

Following this work during my PhD, I joined the Munich group in collaboration with Prof. Don Dingwell at the Ludwig Maximilian University of Munich (Germany), where I focussed on viscosity and rheological experiments. During my PhD, I was also awarded a research grant that allowed me to develop an experimental petrology project in collaboration with Prof. Max W. Schmidt at the Institute of Geochemistry and Petrology (ETH), Zurich Switzerland. I focused on the effect of diffusive re-equilibration time on trace element partitioning between alkali feldspar and trachytic melts. During the periods in Munich and Zurich, I developed my experimental and analytical experience using high pressure, high temperature apparatus and several advanced analytical techniques to characterize the compositions of silicate rocks.

Following my PhD, I worked as a post-doc at the Elettra-Sincrotrone Trieste S.C.p.A. (SYRMEP beamline) where I developed a fantastic experience in X-ray computed microtomography and 3D image analysis of complex multiphase samples. I worked with a variety of groups, gaining experience in a breadth of natural and materials sciences, and giving me enormous versatility and confidence in using beam-line techniques to address a wide range of scientific questions. This work relied on cutting-edge developments in phase contrast imaging, which have opened the possibility of deploying *in situ* 4D high pressure, high temperature X-ray microtomography, which has only recently been demonstrated. In this view, my expertise in high pressure, high temperature experiments has proven fundamental during my current post doctoral position at University of Manchester (Manchester, UK) funded by the large NERC grant “DisEqm”, to develop an apparatus in collaboration with Diamond Light Source (Harwell, UK) and University of Bristol (Bristol, UK). This apparatus allows me to perform low-intermediate pressure and high temperature synchrotron experiments aimed at unravelling volcanic processes in basaltic systems. The results of my research with this new apparatus include the first *in situ* 4D x-ray microtomographic investigation of crystallisation kinetics in a basaltic melt at magmatic conditions and discovering the mechanism leading to basaltic Plinian eruptions, one of the major unclear phenomena in volcanology in the last couple of decades.

Recently, I started to investigate for the first time crystallization in volcanic melts at nanoscale using the Ptychography technique in collaboration with the I13 beamline of Diamond Light Source (Harwell, UK). Ptychography allows me to perform 3D analysis of nanocrystals within a volcanic sample at nanoscale.

Between 2015 to 2018 during my post doctoral position at University of Manchester I was funded by the ERC grant “CO₂Vole”, to study the deep CO₂ cycling on Earth in collaboration with University of Durham (Durham, UK) and Carnegie Institution for Science (Washington, US). Particularly, I developed and adapted a pre-existing thermodynamic model to investigate decarbonation processes in subduction zones.

I have been working on several volcanic systems during my career such as Campi Flegrei (Italy), Stromboli (Italy), Etna (Italy), Pantelleria (Italy), Calbuco (Chile), Villarrica (Chile), Yellowstone (U.S.) and Masaya (Nicaragua), with the aim to constrain, from a petrological and geochemical point of view, the triggering conditions of eruptions and the pre- and syn-eruptive conditions of these volcanic systems. My approach is to combine observations, cutting-edge experiments and thermodynamic and numerical models to quantify the chemical and physical processes of volcanic systems.

PROFESSIONAL COMPETENCES

- Experimental facilities: Synchrotron X-ray Computed Microtomography at SYRMEP beamline (Elettra Sincrotrone Trieste, Italy), at TOMCAT beamline (Swiss Light Source, Villigen, Switzerland) and at I12 beamline (Diamond Light Source, Harwell, UK); Ptychography at I13 beamline (Diamond Light Source, Harwell, UK); CSPV (cold seal pressure vessels); TZM pressure vessels; Piston Cylinder apparatus; Vertical Pushrod Dilatometer BHR DIL 802 V; Vertical furnace at ambient pressure.
- Analytical instruments: SEM (scanning electron microscope); EMPA (electron microprobe analysis): Cameca SX100 and Jeol JXA 8539F; Laser Ablation (LA-ICP-MS); Wet Chemistry.
- Image analysis: Avizo software; ImageJ (NHI Image); Pore3D software library; SYRMEP Tomo Project (STP) software; X-Tract software; ANKA phase software; Amira software; VGstudio; CSDcorrections 1.3.
- Thermodynamic programs: MELTS; Perple_X program.

SCIENTIFIC ARTICLES

- La Spina G., **Arzilli F.**, Llewellyn E.W., Burton M.R., Clarke A.B., de' Michieli Vitturi M., Polacci M., Hartley M.E., Di Genova D. and Mader H.M. (2020). Explosivity of basaltic lava fountains is controlled by magma rheology, ascent rate and outgassing. *Earth and Planetary Science Letters*, 116658.
- Di Genova D., Brooker R.A., Mader H.M., Drewitt J.W., Longo A., Deubener J., Neuville D.R., Fanara S., Shebanova O., Anzellini S., **Arzilli F.**, Bamber E.C., Hennem L., La Spina G. and Miyajima N. (2020). In situ observation of nanolite growth in volcanic melt: A driving force for explosive eruptions. *Science Advances*, 6, 413.
- **Arzilli F.**, Stabile P., Fabbrizio A., Landi P., Scaillet B., Paris E. and Carroll M.R. (2020). Crystallization kinetics of alkali feldspar in peralkaline rhyolitic melts: implications for Pantelleria volcano. *Frontiers in Earth Science*, 8, 177.
- Bamber E.C., **Arzilli F.**, Polacci M., Hartley M.E., Fellowes J., Di Genova D., Chavarría, D., Saballos J.A. and Burton M.R. (2020). Pre- and syn-eruptive conditions of a basaltic Plinian eruption at Masaya Volcano, Nicaragua: The Masaya Triple Layer (2.1 ka). *Journal of Volcanology and Geothermal Research*, 392, 106761.
- **Arzilli F.**, La Spina G., Burton M.R., Polacci M., Le Gall N., Hartley M.E., Di Genova D., Cai B., Vo N.T., Bamber E.C., Nonni S., Atwood R., Llewellyn E.W., Brooker R.A., Mader H.M. and Lee P.D. (2019). Magma fragmentation in highly explosive basaltic eruptions induced by rapid crystallization. *Nature Geoscience*, 12, 1023-1028.
- **Arzilli F.**, Morgavi D., Petrelli M., Polacci M., Burton M., Di Genova D., Spina L., La Spina G., Hartley M.E., Romero J.E., Fellowes J., Diaz-Alvarado J. and Perugini D. (2019). The unexpected explosive sub-Plinian eruption of Calbuco volcano (22–23 April 2015; southern Chile): Triggering mechanism implications. *Journal of Volcanology and Geothermal Research*, 378, 35-50.
- Moretti R., Arienzo I., Di Renzo V., Orsi G., **Arzilli F.**, Brun F., D'Antonio M., Mancini L. and Deloule E. (2019). Volatile segregation and generation of highly vesiculated explosive magmas by volatile-melt fining processes: The case of the Campanian Ignimbrite eruption. *Chemical Geology*, 503, 1-14.
- **Arzilli F.**, Fabbrizio A., Schmidt M.W., Petrelli M., Maimaiti M., Dingwell D.B., Paris E., Burton M. and Carroll M.R. (2018). The effect of diffusive re-equilibration time on trace element partitioning between alkali feldspar and trachytic melts. *Chemical Geology*, 495, 50-66.
- Romero J.E., Vera F., Polacci M., Morgavi D., **Arzilli F.**, Ayaz Alam M., Bustillos J.E., Guevara A., Johnson J.B., Palma J.L., Burton M., Cuenca E. and Keller W. (2018). Tephra from the 3 March 2015 sustained

column related to explosive lava fountain activity at Volcán Villarrica (Chile). *Frontiers in Earth Science*, 6, 98.

- Pardini F., Burton M., **Arzilli F.**, La Spina G. and Polacci M., (2018). SO₂ emissions, plume heights and magmatic processes inferred from satellite data: The 2015 Calbuco eruptions. *Journal of Volcanology and Geothermal Research*, 361, 12-24.
- Polacci M., **Arzilli F.**, La Spina G., Le Gall N., Cai B., Hartley M.E., Di Genova D., Vo N.T., Nonni S., Atwood R.C., Llewellyn E.W., Lee P.D. and Burton M.R. (2018). Crystallisation in basaltic magmas revealed via in situ 4D synchrotron X-ray microtomography. *Scientific reports*, 8, 1-13.
- Zambrano M., Tondi E., Mancini L., Lanzafame G., Xavier Trias F., **Arzilli F.**, Materazzi, M. and Torrieri, S. (2018). Fluid flow simulation and permeability computation in deformed porous carbonate grainstones. *Advances in Water Resources*, 115, 95-111.
- Polacci M., de' Michieli Vitturi M., **Arzilli F.**, Burton M.R., Caricchi L. et al. (2017). From magma ascent to ash generation: investigating volcanic conduit processes by integrating experiments, numerical modeling, and observations. *Annals of Geophysics*, 60 (SO666).
- Queißer M., Granieri D., Burton M., **Arzilli F.**, Avino R. and Carandente A. (2017). Increasing CO₂ flux at Pisciarelli, Campi Flegrei, Italy. *Solid Earth*, 8, 1017.
- Queißer M., Burton M.R., **Arzilli F.**, Chiarugi A., Marliyani G.I., Anggara F. and Harijoko A. (2017). CO₂ flux from Javanese mud volcanism. *Journal Geophysical Research: Solid Earth*, 122, 4191-4207.
- Zambrano M., Tondi E., Mancini L., **Arzilli F.**, Lanzafame G., Materazzi M., and Torrieri S. (2017). 3D Pore-network quantitative analysis in deformed carbonate grainstones. *Marine and Petroleum Geology*, 82, 251-264.
- Berg S.E., Troll V.R., Deegan F.M., Burchardt S., Krumbholz M., Mancini L., Polacci M., Carracedo J.C., Soler V., **Arzilli F.** and Brun F. (2016). Heterogeneous vesiculation of 2011 El Hierro xeno-pumice revealed by X-ray computed microtomography. *Bulletin of Volcanology*, 78, 85.
- La Spina G., Burton M., de' Michieli Vitturi M. and **Arzilli F.** (2016). Role of syn-eruptive plagioclase disequilibrium crystallization in basaltic magma ascent dynamics. *Nature Communications*, 7, 1-10.
- **Arzilli F.**, Polacci M., Landi P., Giordano D., Baker D.R. and Mancini L. (2016). A novel protocol for resolving feldspar crystals in synchrotron X-ray microtomographic images of crystallized natural magmas and synthetic analogs. *American Mineralogist*, 101, 2301-2311.
- **Arzilli F.**, Piochi M., Mormone A., Agostini C. and Carroll M.R. (2016). Constraining pre-eruptive magma conditions and unrest timescales during the Monte Nuovo eruption (1538 ad; Campi Flegrei, Southern Italy): integrating textural and CSD results from experimental and natural trachy-phonolites. *Bulletin of Volcanology*, 78, 72.
- Álvarez-Valero A.M., Okumura S., **Arzilli F.**, Borrajo J., Recio C., Ban M., Gonzalo J.C., Benítez J.M., Douglas M., Sasaki O., Franco P., Gómez-Barreiro J. and Carnicero A. (2016). Tracking bubble evolution inside a silicic dike. *Lithos*, 262, 668-676.
- Morgavi D., **Arzilli F.**, Pritchard C., Perugini D., Mancini L., Larson P. and Dingwell D.B. (2016). The Grizzly Lake complex (Yellowstone Volcano, USA): Mixing between basalt and rhyolite unraveled by microanalysis and X-ray microtomography. *Lithos*, 260, 457-474.
- Romero J.E., Morgavi D., **Arzilli F.**, Daga R., Caselli A., Reckziegel F., Viramonte J., Díaz-Alvarado J., Polacci M., Burton M. and Perugini D. (2016). Eruption dynamics of the 22–23 April 2015 Calbuco volcano (Southern Chile): Analyses of tephra fall deposits. *Journal of Volcanology and Geothermal Research*, 317, 15-29.
- **Arzilli F.**, Cilona A., Mancini L. and Tondi E. (2016). Using synchrotron X-ray microtomography to characterize the pore network of reservoir rocks: a case study on carbonates. *Advances in Water Resources*, 95, 254–263.
- **Arzilli F.**, Agostini C., Landi P., Fortunati A., Mancini L. and Carroll M.R. (2015). Plagioclase nucleation and growth kinetics in a hydrous basaltic melt by decompression experiments. *Contribution to Mineralogy and Petrology*, 170, 55.
- Pistone M., **Arzilli F.**, Dobson K.J., Cordonnier B., Reusser E., Ulmer P., Marone F., Whittington A. G., Mancini L., Fife J. L. and Blundy J. D. (2015). Gas-driven filter pressing in magmas: Insights into in-situ melt segregation from crystal mushes. *Geology*, 43, 699-702.
- Chevrel M.O., Cimarelli C., deBiasi L., Hanson J.B., Lavallée Y., **Arzilli F.** and Dingwell, D.B. (2015). Viscosity measurements of crystallizing andesite from Tungurahua volcano (Ecuador). *Geochemistry, Geophysics, Geosystems*, 16, 870-889.
- **Arzilli F.**, Mancini L., Voltolini M., Cicconi M.R., Mohammadi S., Giuli G., Mainprice D., Paris E., Barou F. and Carroll M.R. (2015). Near-liquidus growth of feldspar spherulites in trachytic melts: 3D morphologies and implications in crystallization mechanisms. *Lithos*, 216–217, 93–105.

- **Arzilli F.** and Carroll M.R. (2013). Crystallization kinetics of alkali feldspars in cooling and decompression-induced crystallization experiments in trachytic melt. *Contribution to Mineralogy and Petrology*, 166, 1011-1027.
- Agostini C., Fortunati A., **Arzilli F.**, Landi P., and Carroll M.R. (2013). Kinetics of crystal evolution as a probe to magmatism at Stromboli (Aeolian Archipelago, Italy). *Geochimica and Cosmochimica acta*, 110, 135–151.
- Calzolaio M., **Arzilli F.** and Carroll M.R. (2010). Growth rate of alkali feldspars in decompression-induced crystallization experiments in the trachytic melt of the Phlegraean Fields (Napoli, Italy). *European Journal of Mineralogy*, 22, 485-493.

RESEARCH GRANTS

- *Oct-Dec 2010*: **Grant for a research period in a non-European country** at the Institute of Geochemistry and Petrology (ETH), Zurich (Switzerland). The amount of the grant: 1800 €
- *2019*: **EUROVOLC grant** (Principal Investigator - project title: *Understanding large volume effusive silicic eruption at Mt. Amiata (Tuscany, Italy): an experimental volcanology and petrology study*).

SYNCHROTRON PROPOSAL GRANTED

- Elettra-Sincrotrone Trieste S.C.p.A, SYRMEP beamline (Basovizza Italy): 9 proposals granted
- Diamond Light Source, I12 beamline, (Harwell, UK): 5 proposals granted
- Diamond Light Source, I13 beamline, (Harwell, UK): 1 proposal granted
- Swiss Light Source, TOMCAT beamline, (Villigen, Switzerland): 2 proposals granted

AWARDS

- 2011 Award of the School Advanced Studies for outstanding research performance during the Ph.D. period at University of Camerino.

TEACHING AND SUPERVISION

TEACHING COURSES

- Academic year 2019-2020: **Teaching assistant in the Volcanology course** at the University of Manchester, Department of Earth and Environmental Sciences, Manchester (UK)
- Academic year 2018-2019: **Teaching assistant in the Volcanology course** at the University of Manchester, Department of Earth and Environmental Sciences, Manchester (UK)
- Academic year 2017-2018: **Teaching assistant in the Volcanology course** at the University of Manchester, School of Earth and Environmental Sciences, Manchester (UK)

STUDENT SUPERVISOR

Co-supervisor of Ph.D. thesis:

- Dr. Federica Pardini. Period: 2016-2019. University of Manchester. PhD in Volcanology (Satellite Remote Sensing, observing gas emissions in volcanic plumes).
- Dr. Claudia Agostini. Period: 2010-2013. University of Camerino. PhD in Petrology and Volcanology (Experimental petrology).

Co-supervisor of one Bachelor thesis and two Master theses in Petrology and Volcanology.