

**CAROLINE BOUVET DE MAISONNEUVE – CV**

PRINCIPAL INVESTIGATOR, VOLCANO GROUP | EARTH OBSERVATORY OF SINGAPORE &  
 ASSISTANT PROFESSOR | ASIAN SCHOOL OF THE ENVIRONMENT |  
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**MAIN RESEARCH INTERESTS**

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My research focuses on reconstructing eruptive histories and investigating controls on eruption styles in order to improve hazards assessments and eruption forecasts. I combine methodologies such as field work, petrology, petrophysics, mineralogical and textural analyses, morphometry, numerical computational studies, and tephrochronology. The following projects are some examples:

1. Assessing the volcanic hazard for Singapore, with a special emphasis on Sumatran volcanoes, using a combination of morphometry (Digital Elevation Model analysis), field work, petrology, geochronology and tephrochronology.
2. Investigating magma degassing processes and controls on eruption style through mineralogical and textural analyses, petrophysics, petrology and geochemistry using Rabaul (Papua New Guinea) and Pinatubo (Philippines) as case studies.
3. Investigating caldera unrest: Linking magmatic processes to geophysical signals by means of petrology and numerical modeling and evaluating cycles of caldera formation, e.g. at Rabaul (Papua New Guinea), Maninjau (Sumatra) and the Kos-Nisyros volcanic complex (Greece).

**EDUCATION**

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**08.2007 – 10.2011** PhD thesis at University of Geneva

- Petrologic and numerical modeling study of Strombolian eruption dynamics at Volcán Llaima (Chile), under the co-supervision of Prof. M.A. Dungan (University of Geneva), Prof. O. Bachmann (University of Washington, Seattle), and Dr. A. Burgisser (ISTO, CNRS-Orléans).

**07.2005 – 07.2007** MSc. thesis at University of Geneva

- Volcanology (Under the supervision of Dr. Olivier Bachmann).

**10.2002 – 07.2005** Bachelors in Earth Sciences degree at University of Geneva

**GRANTS & AWARDS**

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**2018** NTU Institute of Advanced Studies (IAS) Frontier Science Program funding for a 2-day workshop on “Advances in Tephrochronology in Southeast Asia”. ~10 kSGD

**2016** Meteorological Service Singapore funding (renewed for 1 year) on “How many times has volcanic ash reached Singapore?”, hiring one postdoctoral research fellow. Total 300 kSGD

**2016** Ministry of Education (MOE) Academic Research Fund Tier 1 grant for 2 years on “Investigating cycles of caldera formation at Rabaul, Papua New Guinea”, hiring one postdoctoral research fellow. 150 kSGD

- 2015** Singapore National Research Foundation (NRF) Fellowship for 5 years on “Assessing the Volcanic Hazard for Singapore”, hiring five postdoctoral research fellows, three PhD students and three research associates. ~2.9 Million SGD
- 2015** Meteorological Service Singapore funding for 1 year (renewable) on “How many times has volcanic ash reached Singapore?”, hiring one postdoctoral research fellow. ~150 kSGD
- 2014** Two EOS research grants for 3 years on “Magma degassing and controls on eruption style” and “Assessing the hazard from Sumatran volcanoes”, hiring one research associate, two PhD students, and two postdoctoral researchers. ~590 kSGD and ~630 kSGD
- 2012-2013** Postdoctoral grant from the Swiss National Science Foundation (16 months), shared time between EOS, NTU and Georgia Tech., Atlanta, GA, USA. ~70 kUSD
- 2008** Grant from the Schmidheiny foundation to attend the IAVCEI meeting and pre-meeting field excursion in Iceland
- 2007** Lombard Award (Ecole Lémanique des Sciences de la Terre et de l’Environnement ; outstanding Master thesis)
- 2007** Grant from the Swiss Academy of Sciences to conduct field work in Chili
- 2006** Grant Augustin Lombard to conduct field work in Kos, Greece

## SCIENTIFIC & OTHER SKILLS

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### Field work:

- Field work in the Aegean Arc, Southern Volcanic Zone of the Andes, Papua New Guinea, Sumatra, Bali, Java (Indonesia). Field camps in the Sierra Nevada of California and the Southern Volcanic Zone of the Andes.
- Coring, sonar and sub-bottom profiler imaging of lake bathymetry and sediment structures in lakes Maninjau, Diatas, and Kerinci (Sumatra).

### Analytical/Laboratory skills:

- Petrophysics: Setup of a textural analysis lab equipped with a Particle Size and Shape analyser, an Ar-Pycnometer, and a Permeameter
- Tephrochronology: Overseeing the setup of a lab for the extraction of (cryptic) glass shards for geochemical analyses + foraminifers and minerals (zircon, sanidine) for dating. Magnetic Susceptibility and XRF scanning of sediment cores.
- Geochronology: Overseeing and contributing to tephra dating using <sup>14</sup>C on charcoal, plant remains or foraminifer shells, U-Pb, U-Th, and U-Th/He dating of zircons, and Ar-Ar dating of sanidine, plagioclase and groundmass.
- X-ray Tomography: Overseeing and contributing to 3D imaging and spatial analysis of minerals and bubbles in rocks, and melt inclusions in individual crystals.
- Regular analysis using the Scanning Electron Microscope (SEM) and Electron Microprobe (EPMA), Cathodoluminescence (CL) imaging of zircons and quartz crystals, and determination of pyroxene and olivine crystallographic orientations using Electron Back-Scatter Diffraction (EBSD).
- Mineral and glass trace element analyses, isotope ratios, and zircon dating using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS).

- Secondary Ion Mass Spectrometer (SIMS) for volatile analyses in melt inclusions and apatite minerals (in development).

**Computational skills:** Familiar with Microsoft and Linux (Red Hat and Open Suse) operating systems, programming with Matlab (e.g. diffusion chronometry in olivine) and Fortran, and the use of specialized algorithms like MELTS for thermodynamics or MORVOLC & NETVOLC for morphometry.

**Languages:** French, English – fluent; Spanish, Italian, German – early intermediate, can rapidly improve with practice.

## TEACHING

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### Lectures and Labs:

- Teaching of “Environmental Earth Systems Science” ES8005/7005, an E2S2 undergraduate/ graduate class at the Asian School of the Environment, NTU (2018): Thirteen 3h-lectures on the general topic of Planet Earth, open to all.
- Teaching of “Earth Materials” ES2002, an E2S2 undergraduate class at the Asian School of the Environment, NTU (2017-19): Thirteen 6h-lectures and tutorials on the identification and study of magmatic, metamorphic and sedimentary rocks and minerals using the petrographic microscope.
- Co-teaching the undergraduate/ graduate class in “Volcanology” ES4904/7007 at the Asian School of the Environment, NTU (2015, 2019): Four, 3-hour lectures and labs on physical volcanology and textural and mineral analyses of volcanic samples. I was the 2019 class coordinator.
- Co-taught “Introduction to Geochemistry” ES3003, an E2S2 undergraduate/ graduate class at the Asian School of the Environment, NTU (2016-17): Four, 3-hour lectures and 1-hour tutorials on element transport, mineral reactions, the geochemistry of the solid earth, and modern geochemistry. I was the 2017 class coordinator.
- Taught “Planet Earth” SP0004/SP0064 for the undergraduate University Scholars Program (2015-17): Thirteen 3h-lectures, twice (two groups of students) on processes in and interactions between the geosphere, atmosphere, hydrosphere, biosphere and anthroposphere.
- Lecturer during the workshops of the Asian Consortium of Volcanology in 2015 and 2017, Japan: Half-day course on physical volcanology with the opportunity to look at volcanic samples up close.
- Primary responsibility for the microscopy labs (2-4h/week over four semesters, 2008-2011) associated with the course in Magmatic Petrology for the 3<sup>rd</sup> year Bachelors students of Geneva. These consisted in learning how to recognize magmatic rocks, textures, and processes using an optical microscope.
- Participated in the Magmatic Petrology and Volcanology class of the 2<sup>nd</sup> year Bachelor’s degree at the University of Geneva (Feb 2011) with two 3-hour lectures on magma rheology.

### Field work:

- Co-leader of the first year introductory geology undergraduate field trip to Bali (Indonesia) for the Earth and Environmental Systems Science program of the Division of Earth Sciences, NTU (2016).

- Accompanied the 2<sup>nd</sup> year Bachelors students of Geneva to the Massif Central for a one-week Volcanology field camp during which they learned how to identify and map volcanic deposits (four trips from 2007-2010, trip leader in 2010).

## OUTREACH

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- Exchanging with the Community Engagement Office of EOS to provide material for the “Earth Alive!” exhibit at the new Singapore Science Centre: (i) Liaising with the British Geological Survey and the Building and Construction Authority of Singapore to provide selected rock cores for the exhibit, (ii) providing feedback on the proposed exhibit activities, and (iii) contributing short movies explaining Singapore rocks in thin section through my Earth Materials class,
- Working with the Community Engagement Office of EOS to build outreach material (e.g. information boards or posters) that will communicate our research outcomes with the relevant local communities in Sumatra, Indonesia, and explain major outcrops of Singapore.
- Gave various talks, e.g. at the Singapore Art Museum, in order to educate about Volcanic Hazards and raise awareness about the existence of an Undergraduate program in Earth and Environmental Systems Science (new to Singapore) at the Asian School of the Environment, NTU.
- Developing the general knowledge of geology in the curriculum of Singapore schools. This consisted in accompanying a group of Singapore Geography teachers for a one-week field excursion to Merapi volcano, Indonesia, (June 2012) as well as participating in the pre- and post-excursion workshops.

## STUDENT MENTORING

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**Undergraduate students (E2S2 - Earth and Environmental Systems Science Program):**  
Final Year Projects (3), CN Yang Research Projects (7), Summer internships (7).

**Graduate students:**

1. Jay Hahjung Chin (Research Associate): Sample preparation specialist for cryptotephra and radiocarbon dating work. (February 2019 – present)
2. Fairuz Razali (Research Assistant): Field and lab coordinator for the tephrostratigraphy project on reconstructing eruption histories of Sumatran volcanoes. (January 2018 – present)
3. Marcus Phua (Research Associate, PhD student since Aug 2017): Reconstructing eruptive histories of Sumatran volcanoes through tephrostratigraphy and a petrologic study of the Bukittinggi tuff produced by the Maninjau caldera (June 2016 - present)
4. Olivier Bernard (PhD student): Investigating the inner controls on explosive eruptions using textural analysis and petrology (January 2017 - present)
5. Constance Chua (PhD student): Investigating the likelihood of volcanic flank collapses and large-scale debris avalanches in Sumatra using volcano morphometry (August 2015 – December 2016)
6. Dini Nurfiani (Research Assistant, PhD student since Aug 2016): Hazard assessments of Marapi volcano (Sumatra) and quantitative shape analysis of volcanic ash (Aug 2014 - present).
7. Christopher A. McCallum (Research Associate): Petrological studies of Merapi and Marapi volcanoes (Indonesia) and morphometric investigation of Sumatran volcanoes (Oct 2013 – March 2016).

8. David A. Heptinstall (Research Associate): Comparing ascent rates of lava flows and pumice during the 2006 eruption of Tavurvur, Rabaul (May 2014 – May 2015).

**Postdoctoral research fellows:**

1. Harisma Andikagumi: Tectonic-Volcanic interactions in Sumatra and their control on caldera formation (March 2020 – present).
2. Mélissa Drignon: The source of Sulfur in the 1991 Pinatubo eruption (Aug 2019 – present)
3. Steffen Eisele: Reconstructing the eruptive history of Sumatran volcanoes (May 2018 – present)
4. Francesca Forni: Geochemistry and ages of the calderas of Sumatra (Mar 2018 – present)
5. Jeff Oalmann: SEM and LA-ICP-MS lab manager, involved in geochemistry and geochronology for tephrochronology projects (Aug 2017 – present)
6. Sean Pyne-O'Donnell: Tephrostratigraphy of Sumatra: implications for eruption histories and environmental change? (Jan-Dec 2017)
7. Olga Bergal-Kuvikas: How many times did volcanic ash reach Singapore in the past? (Dec 2015 – June 2018)
8. Gareth Fabbro: Magma storage, recharge, and the caldera cycle at Rabaul, Papua New Guinea (Nov 2014 – Feb 2019)

PUBLICATIONS

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Researcher ID E-7470-2013

<http://orcid.org/orcid.org/0000-0003-4123-9336>

ARTICLES PUBLISHED

1. G. Fabbro, C. McKee, M. Sindang, S. Eggins, C. Bouvet de Maisonneuve, 2020: Variable mafic recharge across a caldera cycle at Rabaul, Papua New Guinea (JVGR, <https://doi.org/10.1016/j.jvolgeores.2020.106810>)
2. C. Bouvet de Maisonneuve, O. Bergal-Kuvikas, 2019: Timing, magnitude and geochemistry of major Southeast Asian volcanic eruptions: identifying tephrochronologic markers (J. Quaternary Sci., DOI: 10.1002/jqs.3181)
3. O. Bachmann, S. Allen, C. Bouvet de Maisonneuve, 2019: The Kos–Nisyros–Yali volcanic field (Elements, <https://doi.org/10.2138/gselements.15.3.191>)
4. C. Bouvet de Maisonneuve, S. Eisele, F. Forni, Hamdi, E. Park M. Phua, R. Putra, 2018: Bathymetric survey of lakes Maninjau and Diatas (West Sumatra) and Lake Kerinci (Jambi) (Proceedings of the 2018 ICRLP Conference, doi:10.1088/1742-6596/1185/1/012001).
5. D. Ruth, F. Costa, C. Bouvet de Maisonneuve, L. Franco, J.A. Cortes, E.S. Calder, 2018: Crystal and melt inclusion timescales reveal the evolution of magma migration before eruption (Nature Communications, DOI: 10.1038/s41467-018-05086-8)
6. D. Nurfiyani, C. Bouvet de Maisonneuve, 2017: Furthering the investigation of eruption styles through quantitative shape analyses of volcanic ash particles, (J. of Volcanology and Geothermal Res., <https://doi.org/10.1016/j.jvolgeores.2017.12.001>)
7. C. Bouvet de Maisonneuve, F. Costa, C. Huber, P. Vonlanthen, O. Bachmann, M. Dungan, 2016: How do olivines record magmatic events? Insights from major and trace element zoning (Contributions to Mineralogy and Petrology, DOI 10.1007/s00410-016-1264-6)

8. C. Bouvet de Maisonneuve, F. Costa, H. Patia, C. Huber, 2015: Unrest and eruption in a caldera setting: Insights from the 2006 eruption of Rabaul (Papua New Guinea). (Geological Society, London, Special Publications, <http://doi.org/10.1144/SP422.2>)
9. M. Polacci, C. Bouvet de Maisonneuve, D. Giordano, M. Piochi, L. Mancini, W. Degruyter, O. Bachmann, 2014: Permeability measurements of Campi Flegrei pyroclastic products: an example from the Campanian ignimbrite and Monte Nuovo eruptions (J. of Volcanology and Geothermal Res., <http://dx.doi.org/10.1016/j.jvolgeores.2013.12.002>).
10. F. Costa, S. Andreastuti, C. Bouvet de Maisonneuve, J.S. Pallister, 2013: Petrological insights into the storage conditions, magmatic processes, and time scales that yielded the centennial 2010 Merapi explosive eruption (Journal of Volcanology and Geothermal Research, Merapi Eruption Special Issue, DOI 10.1016/j.jvolgeores.2012.12.025).
11. C. Bouvet de Maisonneuve, M.A. Dungan, O. Bachmann, A. Burgisser, 2012: Petrological insights into shifts in eruptive styles at Volcán Llaima (Chile) (Journal of Petrology, DOI 10.1093/petrology/egs073).
12. C. Bouvet de Maisonneuve, M.A. Dungan, O. Bachmann, A. Burgisser, 2011: Insights into shallow magma storage and crystallization at Volcán Llaima (Chile) (Journal of Volcanology and Geothermal Research, DOI 10.1016/j.jvolgeores.2011.09.010).
13. C. Bouvet de Maisonneuve, O. Bachmann, A. Burgisser, 2009: Characterization of juvenile pyroclasts from the Kos Plateau Tuff (Aegean Arc): insights into the eruptive dynamics of a large rhyolitic eruption (Bulletin of Volcanology, 71:643-658, DOI 10.1007/s00445-008-0250-x).

#### ARTICLES IN REVISION / SUBMITTED / IN PREPARATION

1. O. Bernard, C. Bouvet de Maisonneuve: Controls on eruption style at Rabaul, Papua New Guinea – Insights from microlites, porosity and permeability measurements (JVGR, under revision)
2. S. Jenkins, M. Phua, J.F. Warren, S. Biass, C. Bouvet de Maisonneuve: Reconstructing eruptions from historical accounts: Makaturing c. 1765, Philippines (submitted to JVGR)
3. D. Nurfiani, Wang Xin, Kristianto, H. Triastuty, D. Hidayat, Wei Shengji, B. Taisne, C. Bouvet de Maisonneuve: Combining petrologic and seismic studies to constrain magma storage conditions beneath Marapi volcano, West Sumatra, Indonesia (for J. Volcanology and Geothermal Res or J. Geophy. Res.)
4. C. Bouvet de Maisonneuve, F. Forni, G. Fabbro, O. Bachmann: Cycles of catastrophic caldera-forming eruptions: A generalizable model? (for Earth Science Reviews)

#### PHD THESIS

Petrologic and numerical modeling study of Strombolian eruption dynamics at Volcán Llaima (Chile): accessible online at <http://archive-ouverte.unige.ch/unige:18950>.

#### CONFERENCE ABSTRACTS

58 abstracts presented at international conferences (full list available upon request).

## SYNERGISTIC ACTIVITIES

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### Scientific reviews:

- NSF proposals (USA), The Icelandic Research Fund.
- Journal articles: For Computers & Geosciences, Geomorphology, Geochimica et Cosmochimica Acta, Lithos, J. of Volcanology and Geothermal Research, J. of Petrology, Geological Society of London (Spec. Pubs.), American Mineralogist, Geophysical Research Letters, J. of Asian Earth Sciences.

### Workshop organization:

“Workshop on Advances in Tephrochronology in Southeast Asia”, funded by the Institute of Advanced Studies and the Earth Observatory of Singapore, hosted by the Asian School of the Environment, Nanyang Technological University (Singapore).

Invited speakers: Dr. Karen Fontijn (Université Libre de Bruxelles, Belgium), Dr. Chris Newhall (ex-USGS and EOS), Dr. Mitsuru Okuno (Fukuoka University, Japan), Dr Ros Fatimah Muhammad (University of Malaya, Malaysia), and Dr. Ruly Setiawan (Centre for Geological Survey, Indonesia). ~40 participants from Singapore, Malaysia, Indonesia, The Philippines, India, Japan, and Belgium.

### Session convening:

- **February 2021, IAVCEI Meeting, Rotorua, New Zealand, co-convenor:**  
“Architecture and dynamics of volcanic plumbing systems”: Hélène Balcone-Boissard, Janine Kavanagh, Helena Albert, Caroline Bouvet de Maisonneuve, Steffi Burchardt and Chiara Montagna
- **August 2017, IAVCEI Meeting, Portland, OR, USA, co-convenor:**  
“How good are volcanoes at sampling magmatic systems in space and time?”: T. Sheldrake, E. Hartung, C. Deering, C. Bouvet de Maisonneuve
- **August 2017, AOGS Conference, Singapore, Lead convenor:**  
“Tephrochronology and lake studies of environmental change”: C. Bouvet de Maisonneuve, S. Pyne-O'Donnell, C. Gouramanis
- **December 2016, AGU Conference, San Francisco, USA, Lead convenor:**  
“Using Tephrostratigraphy to Reconstruct the Eruptive History of a Volcanic Region”: C. Bouvet de Maisonneuve, O. Bergal-Kuvikas, V. Ponomareva, M. Nakagawa
- **June 2015, IUGG-IAVCEI Conference, Prague, Czech Republic, co-convenor:**  
“Collapse Calderas”: A. Geyer Traver, N. Geshi, C. Bouvet de Maisonneuve, O. Bachmann
- **December 2012, AGU Conference, San Francisco, USA, Lead convenor:**  
“Petrologic insights on magmatic processes controlling shifts in eruption style”: C. Bouvet de Maisonneuve, F. Costa, K. Cashman
- **July 2013, IAVCEI Meeting, Kagoshima, Japan, co-convenor:**  
“Dynamics of Volcanic Processes”: H. Wright, C. Bouvet de Maisonneuve, L. Caricchi, M.A. Dungan, E. Llewellyn, T. Miwa, J. Taddeucci

### Active collaborations:

- **Adrian Fiege**, formerly at American Museum of Natural History, USA – Sulfur isotopes and the source of sulfur in the 1991 Pinatubo eruption.

- **Benoit Taisne**, EOS, NTU, Singapore – Volcano plumbing systems, eruption precursors, structural controls on caldera formation.
- **Chris McKee**, PMGO, & **Rabaul Volcano Observatory**, Papua New Guinea – Eruption dynamics at Rabaul.
- **Fidel Costa**, EOS, NTU, Singapore – Volcano plumbing systems and timescales of events from diffusion in minerals
- **Hamdi Rifai**, Universitas Negeri Padang (Sumatra), **CGS colleagues**, **CVGHM colleagues**, **Rina Zuraida**, Marine Geological Institute, Indonesia – Eruption histories of Sumatran volcanoes and plumbing system and eruption dynamics of Marapi volcano.
- **Karen Fontijn**, Universite Libre de Bruxelles, Belgium, **Ros Muhammad**, University of Malaya, Malaysia – Tephrochronology.
- **Kyle Bradley**, EOS, NTU, Singapore – Volcanic-Tectonic interactions and controls.
- **Olivier Bachmann**, ETHZ, Switzerland – Cyclic activity at calderas
- **Satish Singh**, IPG, Paris France, **Nicolas Waldmann**, University of Haifa, Israel – Seismic imaging and interpretation of lake sediments and their structure.
- **Rienk Smittenberg**, University of Stockholm, Sweden – Synchronizing paleoclimate records (using biologic proxies) with volcanic eruptions in Sumatra.

#### SERVICE

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- PhD evaluation committees: Qualifying exams (9) and Final exams (5)
- Member of the evaluation panel for the Stephen Riady Geosciences Scholars Funds at EOS (2016-present)
- Volcano Group representative for EOS management meetings and proposal evaluations (2017-2018)
- Member of the ASE Undergraduate Committee – application reviews, interviews, recruitment, etc. (2014-2017)
- Participated in the establishment of the Standard Operating Procedures and requirements for undergraduate field trips at ASE.