

Application For Leadership of the IAVCEI Commission on Volcano Geology

Dear Commission Members,

My name is Anke Zernack, and I am a volcanologist at Massey University in New Zealand. I wish to apply for leadership of the Commission on Volcano Geology so I can use my passion for physical volcanology and 20+ years' experience in volcano mapping to develop and implement advances in the field that serve the volcanological and wider science community as well as end-users.

About me. I grew up in Germany exploring the volcanoes of the Eifel and ultimately mapping the proximal pyroclastic sequences of the 12.9 ka Laacher See eruption during my MSc. For my PhD, I moved from correlating individual phases of a single explosive eruption to investigating thick successions of debris-avalanche and lahar deposits that represent >200,000 years of volcanic activity. Since then, most of my research has involved stratigraphic mapping of volcanic and sedimentary deposits, combined with geomorphic, sedimentological and geochemical approaches, computer simulation and probabilistic modelling to better understand volcanic eruption histories and future hazards alongside landscape processes and evolution. Currently I am working closely with archaeologists, paleoecologists, and glaciologists on transdisciplinary studies of pumice artefacts and ocean-rafterd pumice as well as leading a large research programme focused on mapping New Zealand's pumice resources to match potential uses and applications together with researchers from engineering, ecological economics and indigenous entrepreneurship.

Continuing the legacy. Having conducted volcano mapping in a range of settings and participated in numerous field trips/courses worldwide, I understand how our approaches differ from other types of geological mapping and the challenges around defining a common stratigraphic nomenclature and methodology. I am thus grateful for the efforts the outgoing commission leadership has invested into starting the process of developing consistent guidelines and a new lithostratigraphic concept for mapping and describing volcanic structures and the surrounding terrain. As new co-leader I would provide continuity to carry on with the original objectives and philosophy of the commission and build on these past achievements to progress the establishment of standardised guidelines. Similarly, I would continue the tradition of providing meaningful workshops, special volumes and papers, and sessions at international conferences to actively engage with the volcanological community, including other IAVCEI commissions, and across related disciplines. These activities all contribute to underpinning the importance of volcano geology as foundation for many research areas and bringing researchers from a range of backgrounds together to discuss new tools and drive advances in the field.

New strategies. Conversations during the recent workshop in Greece have highlighted two issues that I would like to address and support mitigation where possible. Ongoing cuts in Geosciences around the world mean that the next generation of volcanologists might be lacking the fundamental fieldwork training and associated skillsets required to tackle the complexity of volcano mapping. The commission and its experienced members need to take some responsibility to ensure succession by providing mentorship for upcoming volcanologists, continuing to offer conference field trips and mapping workshops, and establishing field schools to pass on their expertise. However, funding limitations also impede members from poorer countries/institutions to attend such events. While we can provide some form of travel assistance to improve participation from underrepresented nations, I suggest we also (further) develop accessible, cost-neutral online resources such as the commission website, a regular webinar series, and social media presence to allow for ongoing knowledge exchange and mentorship. This could be aided by actively involving members from different continents and various career stages in the commission governance, for example in roles like ECR representative, webmaster and/or event coordinator.

CV - Anke Verena Zernack

Nationality	German Citizen / New Zealand Permanent Resident
Present position	Senior Research Officer, Volcanic Risk Solutions (volcanic.massey.ac.nz) Massey University, Palmerston North, New Zealand
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Academic Qualifications

- 2009 PhD Earth Sciences** Massey University, Palmerston North, New Zealand
“A sedimentological & geochemical approach to understanding cycles of stratovolcano growth and collapse at Mt. Taranaki, New Zealand.”
Chief supervisor: SJ Cronin
- 2003 MSc (Diplom) Geology** Rheinische-Friedrich-Wilhelms Universität Bonn, Germany
“Stratigraphy & origin of fine-grained proximal ash layers in the Middle Laacher See Tephra (12.9 ka), East Eifel Volcanic Field/Germany.”
Chief supervisor: H-U Schmincke

Professional Positions Held

- 2023- Senior Research Officer Range 2 in Volcanology, Massey University, NZ
- 2019-23 Research Officer in Volcanology, Massey University, NZ
- 2017-18 Postdoctoral Researcher Volcanology/Archaeology, Laboratory for Past Disaster Science (LAPADIS), Aarhus University, Denmark
- 2012-17 Project Manager, TMI/Rangitaane iwi (Māori tribe), Palmerston North, NZ
- 2011-12 Research Officer in Volcanology, Massey University, NZ
- 2010 Postdoctoral Research Fellow, Laboratoires Magmas et Volcans, Université Blaise-Pascal, Clermont-Ferrand, France
- 2009 Research Assistant in Volcanology, Sedimentology and Geology, Massey University, NZ
- 2004-08 PhD Research Student, Massey University, NZ
- 2000-03 Electron Microprobe Facility coordinator, University of Bonn, Germany.

Current Research Specialities

Physical volcanology, volcanic stratigraphy and volcanoclastic sedimentology;
Explosive eruptions, pyroclastic deposits and tephrochronology;
Volcanic mass-flow generation, flow mechanisms and hazards;
Pumice as a natural resource, including modern use in construction and horticulture;
Provenance of pumice artefacts and ocean-rafted pumice in Norway and New Zealand;
Human, environmental and climate impacts of volcanic eruptions, including landscape evolution.

Scholarships / Grants / Honours / Distinctions (selected)

- 2023-28** MBIE Endeavour Research Programme “Pungapunga Auaha: Partnering with tangata whenua to develop a new low-carbon pumice economic sector for Aotearoa-NZ” – **Science Lead (\$8 M)**
- 2023-26** Royal Society of NZ Marsden Fund Fast-Start “Merging ancient Roman knowledge and Te Ao Māori to create self-healing and sustainable concrete using natural materials” - AI
- 2022-23** Royal Society of NZ Catalyst Fund “Reducing the carbon footprint of concrete through cement substitution with natural volcanic materials” - AI
- 2021-24** Royal Society of NZ Catalyst Fund “Tracing Māori pumice artefacts to their volcanic source: implications for spatiotemporal variations of pumice use in NZ archaeology” – **PI** (\$80 K)

- 2021-23 Gold-rated** MBIE Vision Mātauranga Capability Fund Connect “He Whenua Pungapunga - Exploring the sustainable use of Te Arawa's natural pumice resources” – **PI** (\$250 K)
- 2019** Massey University Research Fund (MURF) “Fingerprinting the 12,900 BP Laacher See Tephra, Germany” – **PI** (\$12 K)
- 2016-18** MBIE Vision Mātauranga Capability Fund Placement grant – **PI** (\$180 K)
- 2013-16** Sustainable Farming Fund (Ministry for Primary Industries) “Tuna (Eel) Aquaculture – Overcoming the Hurdles” – **Project Manager** (\$870 K)
- 2013-16** Te Wai Ora Fund “Establishing an enviro-cultural GIS-database and web-catalogue for Rangitaane’s freshwater resources, assets and taonga.” – **PI**
- 2013-14** Te Puni Kokiri Māori Potential Investment Fund “Scoping economic opportunities for Māori around the proposed iron sand mining activity by TransTasman Resources Ltd” – **AI**
- 2010** Postdoctoral Fellowship Pôle de recherche et d'enseignement supérieur (PRES) Clermont Université “Stratigraphy, geochemistry and emplacement mechanisms of large-volume rhyolitic ignimbrites in Peru”
- 2009 Massey University Research Medal - Team Award**
- 2008** IAVCEI Travel Grant to attend IAVCEI 2008 General Assembly, Iceland
- 2006 Best Student Poster Award**, Geological Society of NZ Annual Conference
- 2006** IAS and ISC Travel Grants to attend 17th International Sedimentological Congress, Japan
- 2004 Student Poster Merit Award**, Geological Society of NZ Annual Conference
- 2004-07** Massey University Doctoral Scholarship
- 2004-07** DAAD (German Academic Exchange Service) Doctoral Scholarship
- 2001** M.Sc. Grant, Deutsche Vulkanologische Gesellschaft (German Volcanological Society)

Invited presentations (selected)

- 09/2023 Invited presentation “Aotearoa/New Zealand’s volcanic resources”, Concrete NZ pre-conference workshop on Using natural pozzolana as a partial cement replacement for sustainable concrete, Hamilton/NZ
- 10/2022 Invitation to present “Reconstructing long-term eruption histories of andesite stratovolcanoes from medial volcanoclastic successions: Challenges and opportunities” ECORD Magellan Plus workshop (IODP) on The Coupling of Volcanic, Climatic and Sedimentary Processes across the Lifetime of Arc Volcanic Systems in Lecco/Italy
- 07/2019 Invited seminar at LMU, Munich/Germany “Post-depositional disturbance of distal tephra records and potential precursor eruptions of Laacher See Volcano/Germany”
- 2016 Māori Fisheries conference Auckland/NZ “Project Tuna - Overcoming the Hurdles”
- 2015 PLACE, Māori GIS conference, Waitangi/NZ “The role of GIS in advancing Project Tuna”

Professional memberships: IAVCEI, European Geosciences Union, Geoscience Society of NZ

Other Contributions to the scientific community

- 04/2024 Session co-convener at EGU2024, Vienna (IAVCEI Commission on Volcanogenic Sediments)
- 01/2023 Session lead convener at IAVCEI 2023, Rotorua
- 01/2023 Pre-conference field trip leader for IAVCEI 2023, Rotorua
- 11/2022 Conference lead convener Geosciences NZ Annual Conference 2022 Massey Palmerston North
- 06/2022 Session co-convener at Cities on Volcanoes 11, Crete/Greece
- 11/2021 Conference convener Geosciences NZ Annual Conference 2021 (postponed due to covid)

Reviewer for Geology, Bulletin of Volcanology, Journal of Volcanology and Geothermal Research, Geomorphology, Geological Society of London, Journal of Geophysical Research - Earth Surface, Frontiers in Earth Science, Geosciences

Teaching Responsibilities: 233.105 Our Dynamic Earth (first year); 233.212 Earth Surface Processes (second year); 233.312 Natural Hazards (third year); PhD and MSc student supervision.

Selected Publications (journal articles & book chapters)

- Cronin S, **Zernack A**, Ukstins I, Turner M, Torres-Orozco R, et al. (2021) The geological history and hazards of a long-lived stratovolcano, Mt. Taranaki, NZ. *NZJGG* 64: 456-478.
- Neall V, McGee L, Turner M, O'Neill T, **Zernack A**, Athens JS (2021) Geochemical fingerprinting of Holocene tephra in the Willaumez Isthmus District of West New Britain, Papua New Guinea. *Technical Reports of the Australian Museum online* 34: 5-24.
- Procter JN, **Zernack AV**, Mead S, Cronin S (2021) A review of lahars from Mt. Ruapehu and Mt. Taranaki, NZ; Past deposits, historic events and present-day simulations. *NZJGG* 64: 479-503.
- Zemeny A, Procter J, Nemeth K, Zellmer GF, **Zernack AV**, Cronin SJ (2021) Elucidating stratovolcano construction from volcanoclastic mass-flow deposits: The medial ring-plain of Taranaki Volcano, NZ. *Sedimentology* 68: 2422-2449.
- Chapters in Roverato M, Dufresne A, Procter JN (eds.) Volcanic debris avalanches: from collapse to hazards. Springer Book Series "Advances in Volcanology":*
- Dufresne A, **Zernack A**, Bernard K, Thouret JC, Roverato M (2021) Sedimentology of volcanic debris avalanche deposits. *p. 175-210.*
 - Procter J, **Zernack A**, Cronin S (2021) Computer simulation of a volcanic debris avalanche from Mt Taranaki. *p. 281-310.*
 - **Zernack AV** (2021) Volcanic debris-avalanche deposits in the context of volcanoclastic ring plain successions - A case study from Mt. Taranaki. *p. 211-253.*
 - **Zernack AV**, Procter JN (2021) Cyclic growth and destruction of volcanoes. *p. 311-356.*
- Riede F, Tegner C, Timmreck C, Niemeier U, Schmidt A, Oppenheimer C, **Zernack A** (2019) Laacher See-vulkanudbruddet og effekten på klimaet. *Kvant* 30: 19-23.
- Cronin SJ, Stewart C, **Zernack AV**, Brenna M, Procter JN, Pardo N, Christenson B, Wilson T (2014) Volcanic ash leachate compositions and assessment of health and agricultural hazards from 2012 hydrothermal eruptions, Tongariro, NZ. *JVGR* 286: 233-247.
- Pardo N, Cronin SJ, Németh K, Brenna M, Schipper CI, Breard E, White JDL, Procter J, Stewart B, Agustín-Flores J, Moebis A, **Zernack A**, Kereszturi G, Lube G, Auer A, Neall V, Wallace C (2014) Perils in distinguishing phreatic from phreatomagmatic ash; insights into the eruption mechanisms of the 6 August 2012 Mt. Tongariro eruption, NZ. *JVGR* 286: 397-414.
- Procter JN, Cronin SJ, **Zernack AV**, Lube G, Stewart RB, Nemeth K, Keys H (2014) Debris flow evolution and the activation of an explosive hydrothermal system; Te Maari, Tongariro, NZ. *JVGR* 286: 303-316.
- Zernack AV**, Cronin SJ, Bebbington M, Price R, Smith IEM, Stewart RB, Procter JN (2012) Forecasting catastrophic stratovolcano collapse: A model based on Mt. Taranaki, NZ. *Geology* 40: 983-986.
- Zernack AV**, Price R, Smith IEM, Cronin SJ, Stewart RB (2012) Temporal evolution of a high-K andesitic magmatic system: Taranaki Volcano, New Zealand. *J Pet* 53 (2): 325-363.
- Zernack AV**, Cronin SJ, Neall VE, Procter JN (2011) A medial to distal volcanoclastic record of an andesite stratovolcano: Detailed stratigraphy of the ring-plain succession of south-west Taranaki. *Int J Earth Sci* 100: 1936-1966.
- Zernack AV**, Procter JN, Cronin SJ (2009) Sedimentary signatures of cyclic growth and destruction of stratovolcanoes: A case study from Mt. Taranaki, NZ. *Sed Geol* 220: 288-305.
- Procter JN, Cronin SJ, **Zernack AV** (2009) Landscape and sedimentary response to catastrophic debris avalanches, western Taranaki, New Zealand. *Sed Geol* 220: 271-287.

Field Trip Guides

- Zernack AV**, Procter JN, Mills S (2023) How to build and destroy a stratovolcano: Mts. Ruapehu and Taranaki. Pre-conference field trip. IAVCEI 2023 Scientific Assembly, Rotorua, New Zealand, 66 p.
- Kósik S, Voloschina M, Zemeny A, Cronin SJ, Németh K, Procter JN, **Zernack A** (2019) Field Trip Guide for the IAVCEI Fifth International Volcano Geology Workshop - Volcanism in a rapidly changing environment relating to an atypical plate margin. *In: Nemeth K, Kosik S (eds.) Abstract Volume and Field Guide of the IAVCEI Fifth International Volcano Geology Workshop*, GSNZ Misc Pub 152.
- Stewart RB, **Zernack A**, Procter J, Alloway B (2006) Field trip 5: Taranaki, GSNZ Misc Pub 122D, 30 p.

Selected Conference and Workshop Abstracts relevant to volcano mapping

- Zernack AV**, Jørgensen EK, Newton A, Romundset A (2023) Distal records of Katla's explosive past: Ocean-rafted pumice found in archaeological contexts and raised shorelines in Norway. *IAVCEI Sixth Volcano Geology Commission Workshop*, 23-28 Oct 2023, Santorini & Milos / Greece.
- Zernack AV**, Jørgensen EK, Romundset A, Newton A, Riede F (2023) A multidisciplinary investigation of ocean-rafted pumice found in Northern Norway. Abstract 1454. *In: Book of Abstracts, IAVCEI 2023 Scientific Assembly, Rotorua, New Zealand*, p. 1205.
- Zernack AV**, Procter JN (2023) Landscape processes around andesite stratovolcanoes – A case study of the volcanoclastic ring-plain succession at Mt. Taranaki, New Zealand. Abstract 1453. *In: Book of Abstracts, IAVCEI 2023 Scientific Assembly, Rotorua, New Zealand*, p. 1204.
- Mills S, Procter J, **Zernack A**, Kereszturi G, Mead S, Zellmer G, Cronin S, Schipper I (2022) Using tephra records as a proxy to discern the response of stratovolcanoes to edifice collapse. COV11, Crete, Greece, June 2022.
- Zernack AV**, Jørgensen EK, Newton A, Riede F (2021) The geoarchaeological significance of ocean-rafted pumice found in Mesolithic to Medieval contexts in Northern Norway. NZ Archaeological Association annual conference, Taupo, 4-7 July 2021.
- Zernack AV**, Procter JN (2020) Large-scale mass-wasting processes after the 232 CE Hatepe Eruption of Taupo Volcano, New Zealand - Sedimentary features and dispersal of reworked Taupo Ignimbrite in the Ongarue River valley. *Geophysical Research Abstracts* 22: EGU2020-11852.
- Zernack AV**, Cronin SJ, Bebbington M, Price R, Smith I, Stewart B, Procter J (2019) Frequent cycles of growth and catastrophic collapse at Mt. Taranaki. *In: Nemeth K, Kosik S (eds.) Abstract Volume and Field Guide of the IAVCEI Fifth International Volcano Geology Workshop*. Palmerston North, New Zealand, 25 February to 4 March 2019. GSNZ Misc Pub 152: 103-104.
- Zernack AV**, Riede F, Enevold R, Küppers U, Bakken Thastrup M, Schmid M, Munch Kristiansen S, Tegner C (2019) Evaluating post-depositional disturbance of distal tephra records and potential precursor eruptions from Laacher-See Volcano through multidisciplinary investigations at Paddenluch, Germany. INQUA 2019, Dublin, Ireland, July 2019.
- Riede F, Timmreck C, **Zernack A**, Schmidt A, Oppenheimer C (2018) Revisiting the climate impact of the c. 12,900 yr BP Laacher See eruption. *Cities on Volcanoes 10*, Naples, Italy, Sept 2018.
- Sauer F, Hoggard C, **Zernack A**, Riede F (2018) An archaeological predictive model for locating rock shelter sites in Hesse (Germany) that contain both Final Palaeolithic archaeology and Laacher See tephra. *Geophysical Research Abstracts* 20: EGU2018-19191.
- Zernack AV** (2018) Transition from Plinian to unstable eruption conditions recorded in fine-grained proximal ash layers of the Middle Laacher See Tephra (12,900 a BP), East Eifel Volcanic Field, Germany. *Geophysical Research Abstracts* 20: EGU2018-17634.
- Zernack AV**, Hoggard C, Sauer F, Tegner C, Riede F (2018) A critical evaluation of the evidence for multiple Late Pleistocene eruptions of Laacher See Volcano. *Geophysical Research Abstracts* 20: EGU2018-19140.
- Zernack AV**, Procter JN, Cronin SJ, Singh E (2017) A complex interplay of sediment erosion and deposition during the 18 March 2007 crater-lake breakout lahar at Mt. Ruapehu, NZ. *In: Abstracts, IAVCEI 2017 General Assembly, Portland, USA*, p. 1261.
- Procter J, **Zernack AV**, Keys H, Cronin S, Patra A, Sheridan M, Leonard G, Jolly G (2013) Geomorphic analysis of eruptive vents, landslide and debris flows of the 2012 Te Maari eruption from Mt. Tongariro, NZ. 8th IAG International Conference on Geomorphology, 27-31 Aug 2013, Paris, France.
- Neall VE, Hogg AG, **Zernack A** (2012) Revision of volcanoclastic stratigraphy in eastern Egmont National Park, Taranaki. *In: GSNZ Misc Pub 134A*: 67.
- Procter J, Philips E, Cronin S, Cordova G, Patra A, Sheridan M, Leonard G, Jolly G, **Zernack A** (2012) Titan2D as an emergency management tool for flow hazard zone determination. *In: Abstract volume, Cities on Volcanoes 7*, 18-23 Nov, Colima, Mexico.
- Zernack AV**, Cronin S, Brenna M, Stewart C, Christenson B, Pardo N, Wilson T (2012) Mt. Tongariro 2012 eruption - complex ash leachate compositions and implications for volcanic health hazard evaluation. *In: GSNZ Misc Pub 134A*: 96.

- Zernack AV**, Neall VE, Tinkler R (2012) Using the physical properties of the 30-25 ka Poto Tephras from Mt. Taranaki, NZ, as a tool for correlation between outcrop and core records. *In: GSNZ Misc Pub 134A: 97.*
- Procter JN, **Zernack AV**, Fuller I, Philips E, and Cronin SJ (2011) GIS analysis of LiDAR data to determine geomorphic controls on the erosion and deposition patterns of a lahar. *In: GSNZ Misc Pub 130A: 87.*
- Zernack AV**, Procter JN, and Cronin SJ (2007) Revised stratigraphy of the ring-plain succession surrounding Mt. Taranaki. *In: GSNZ Misc Pub 123A: 186.*
- Zernack AV**, Procter JN, and Cronin SJ (2006) Cyclic volcanoclastic sedimentation at Mt. Taranaki, NZ - A history of growth and destruction. *In: GSNZ Misc Pub 122A: 96-97.*

Stakeholder Engagement, Public lectures and End-User Symposia (selected)

- Neall V **et al.** (2014) Interpreting the Deposits of Volcanic Ring Plains for Volcanic Risk Analysis. Public Lecture hosted by the Geoscience Society of New Zealand Annual Conference, Pukekura Function Centre, New Plymouth, 25 November 2014.
- Presentations at Te Maari Day: A workshop to discuss scientific advances from the 2012 Te Maari eruptions, held at Taupo District Council Offices, Turangi 22 March 2013:
- Pardo N, Cronin SJ, Nemeth K, Brenna M, Schipper CI, Kereszturi G, Breard E, White JDL, Stewart B, Agustin-Flores J, **Zernack A**, Auer A, Irwin M, Neall V, Wallace C (2013) Unravelling the ash generation mechanism of the 6 August 2012 Mt. Tongariro eruption: was it phreatic or phreatomagmatic? *GNS Science Miscellaneous Series 66, 35p.*
 - Procter JN, **Zernack AV**, Keys H, Irwin M, Cronin S (2013) Analysis and computer simulation of landslides, debris flows and mass flow hazards from the 2012 Te Maari eruption from Mt. Tongariro, New Zealand. *GNS Science Miscellaneous Series 66, 35p.*
 - Schipper CI, Pardo N, Brenna M, Nemeth K, Moebis A, **Zernack A**, Cronin S, White JDL, Auer A, Stewart B (2013) "They grow up so fast": Challenges to identifying juvenile magmatic components in Tongariro's Te Maari 2012 ash. *GNS Science Miscellaneous Series 66, 35p.*
 - **Zernack AV**, Cronin S, Brenna M, Stewart C, Christenson B, Pardo N, Procter JN, Wilson T (2013) Complex ash leachate compositions of the 6 August 2012 Mt. Tongariro eruption, New Zealand, and implications for volcanic health hazard evaluation. *GNS Science Miscellaneous Series 66, 35p.*
- Procter J, Cronin S, **Zernack A**, Sheridan M, Neall V (2011) Applying Titan2D to New Zealand's Stratovolcanoes for Hazard Analysis. Probabilistic Analysis of Volcanic Hazards: Current methodologies and vision for future efforts. Workshop at SUNY Buffalo, 16-19 May 2011.
- Cronin **et al.** (2007) The initial scientific debriefing workshop on the 18 March 2007 Mt. Ruapehu lake-breakout lahar for Department of Conservation, Horizons Manawatu-Wanganui Regional Council and GNS Science. Held at Massey University, Palmerston North, April 2007.
- Zernack AV** (2007) Rebuilding the volcano from its pieces: A history of repeating collapse and regrowth of Mt Taranaki. Taranaki Volcanic Hazards Workshop for civil defence stakeholders organised by the Taranaki Regional, New Plymouth, September 2007.
- Zernack AV** (2006) A History of Growth and Collapse of Mt Taranaki. Public Lecture at Puke Ariki, New Plymouth, hosted by the George Mason Trust, October 2006.
- Neall VE, Procter JN, Cronin SJ, Lecointre JA, **Zernack AV** (2004) Volcanic Risk to Taranaki Infrastructure. *Interactive CD-ROM Map Browser*. Commissioned by the Natural Gas Corporation of NZ, Shell-Todd Oil Services, Taranaki Regional Council, New Plymouth District Council, South Taranaki District Council, Stratford District Council.