

BIOGRAPHICAL SKETCH

MAXIM DIONYS BALLMER

Inst. Geophysics, ETH Zurich
Sonneggstr. 5, 8092 Zurich, Switzerland

ORCID: [0000-0001-8886-5030](https://orcid.org/0000-0001-8886-5030)

E-mail: maxim.ballmer@erdw.ethz.ch
homepage: <http://jupiter.ethz.ch/~ballmer/>

BACKGROUND

- Aug 2015-...: Oberassistent (senior scientist) at Dept. Earth Sciences, ETH Zürich
Aug 2015-...: Research Affiliate at Earth-Life Science Institute
Apr 2015-Jul 2015: Project Assistant Professor at Earth-Life Science Institute
Sep 2014-Mar 2015: Research Scientist at Earth-Life Science Institute, Tokyo Inst. Technology
Jan 2010-July 2014: PostDoc at SOEST, University of Hawaii
Sep 2009-Dec 2009: PostDoc at Dept. Earth Sciences, ETH Zürich
Jul 2005-Jun 2009: Ph.D. in geodynamics at ETH Zürich with advisors Dr. Jeroen van Hunen and Prof. Paul Tackley
Okt 1999-Jun 2005: Diplom of Geology at Ruhr-University Bochum, thesis title: “numerical simulation of synkinematic cooling of a sheet-like tonalitic intrusion”

AWARDS

Swiss National Science Foundation Fellowship for
Prospective Researchers (2009) awarded for one year of
geodynamical and geochemical modeling at Univ. of Hawaii

LANGAUGES

German (native tongue)
English (fluent)
French (good skills)
Russian, Japanese (basics)

MENTORING OF STUDENTS

- main advisor for undergraduate Matthew H. Motoki (Univ. Hawaii, 2013-2014).
- co-advisor for MSc student Yang Li (BGI Bayreuth, 2015-2016).
- advisor for PhD student Long Xiaogang (Tongji Univ., visiting ETH: SEP 2016-AUG 2018)
- main advisor for PhD student Antonio Manjon (ETH Zurich, OKT 2016-...)
- main advisor of PhD student David Gebhardt (ETH Zurich, JAN 2017-...)
- main advisor of MSc student Thomas Duvernay (IPG Paris, internship at ETH: JAN-JUN '17)
- co-advisor PhD student Diogo Lourenço (ETH: defended APR 2017)
- co-advisor of PhD students Daniela Bolrão, Jun Yan, Ilya Fomin and Stefan Brändli (all ETH)

SERVICE TO THE COMMUNITY AND PUBLIC

Associate Editor: *American Mineralogist*

Conference Organization: chair of Gordon Research Seminar “Interior of the Earth” (2013),
organizing committee member: Origin and Evolution of Plate Tectonics workshop (2016)

Outstanding Student Poster Contest Coordinator: *EGU Gen. Ass.* Geodyn. section (‘13-‘16)

Session Covenor: *AGU fall meeting* (2011-2014, 2016); *EGU General Ass.* (2012, 2016)

Outstanding-Student-Poster-Award Judge: *AGU* (2010-2016), *EGU* (2012, 2013, 2015, 2016)

Seminar organization: *Geophysics Interest Group* (2010-2011, 2014), *ELSI Lunch Talk* (2014-2015), *GFD seminar* (2015-2017).

External PhD Committee Member: Juliane Dannberg (Univ. Potsdam, 2016)

Outreach activity: SOEST Open House (2011, '13); presentation at Planetarium Bochum (2015)

TEACHING EXPERIENCE

- full course “Gravimetry” and related field course at ETH Zurich (spring 2016, spring 2017)
- “Topics in Planetary Sciences” at Dept. Earth Sciences, ETH Zurich (spring 2017)

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- “Science Communication at Intl. Conferences” (Geology 610) at Univ. Hawaii (spring 2014)
- various Guest Lectures at Geography (2010), Geology&Geophysics (2012), and Mathematics (2013) Depts. of Univ. Hawaii; Dept. Earth Sciences, ETH Zurich (2015, 2017); Kapiolani Comm. College (Apr 2011, Oct 2011); School of Pacific and Asian Studies (Feb 2014)

PEER-REVIEWED PUBLICATIONS

- Ballmer, M. D., D. Lourenço, K. Hirose, R. Caracas, and R. Nomura: Reconciling Magma-Ocean Crystallization Models with the present-day Structure of the Earth’s mantle, *Geochemistry Geophysics Geosystems*, in press
- Ballmer, M. D.: Small-scale convection in the Earth’s mantle. *Reference Module in Earth and Environmental Sciences*, in press
- Ballmer, M. D., C. Houser, J. W. Hernlund, R. Wentzcovitch, K. Hirose: Persistence of Strong Silica-Enriched Domains in the Earth’s Lower Mantle. *Nature Geoscience*, doi:10.1038/ngeo2898
- Ballmer, M. D., L. Schumacher, V. Lekic, C. Thomas, and G. Ito (2016): Compositional layering within the Large Low Shear-wave Velocity Provinces in the lower mantle, *Geochem. Geophys. Geosys.*, 17, doi:10.1002/2016GC006005
- Kato, C., K. Hirose, R. Nomura, M. D. Ballmer, A. Miyake, and Y. Ohishi (2016): Melting in the FeO–SiO₂ system to deep lower-mantle pressures: Implications for subducted Banded Iron Formations. *Earth and Planetary Science Letters*, 440, 56-61, doi:10.1016/j.epsl.2016.02.011
- Ballmer, M. D., N. C. Schmerr, T. Nakagawa, and J. Ritsema (2015): Compositional mantle layering revealed by slab stagnation at ~1,000 km depth, *Science Advances*, doi:10.1126/sciadv.1500815
- Ballmer, M. D., C. P. Conrad, E. I. Smith, R. Johnsen (2015): Intraplate volcanism at the edges of the Colorado Plateau sustained by a combination of edge-driven and shear-driven upwelling, *Geochemistry Geophysics Geosystems*, 16, doi:10.1002/2014GC005641.
- Motoki, M. H. and M. D. Ballmer (2015): Convective instability of Stagnant Slabs in the Mantle Transition Zone, *Geochem. Geophys. Geosys.*, 16, doi:10.1002/2014GC005608.
- Ballmer, M. D., G. Ito, and P. van Keken (2015): Hotspots, Large Igneous Provinces and Melting Anomalies. in: *Mantle Dynamics*, edited by G. Schubert and D. Bercovici, Elsevier, *Treatise of Geophysics 7.10, 2nd edition*, pp. 393-459
- Ballmer, M. D., G. Ito, and C. Cheng: Asymmetric Dynamical Behavior of Thermochemical Plumes and Implications for Hawaiian Lava Composition (2015). in: *Hawaiian Volcanism, From Source to Surface*, edited by R. Carey, M. Poland, V. Cayol and D. Weis; *AGU Monograph 208*, 36-57p., doi:10.1002/9781118872079.ch3
- Cheng, C., R. M. Allen, R. W. Porritt, and M. D. Ballmer (2015): Seismic constraints on a double-layered asymmetric whole-mantle plume beneath Hawaii, in: *Hawaiian Volcanism, From Source to Surface*, edited by R. Carey, M. Poland, V. Cayol and D. Weis; *AGU Monograph 208*, 19-34p., doi:10.1002/9781118872079.ch2
- Sakamaki, T., Suzuki, A., Ohtani, E., Terasaki, H., Urakawa, S., Katayama, Y., Funakoshi, K.-I., Wang, Y., Hernlund, J. W., Ballmer, M. D. (2013): Ponded melt at the boundary between the lithosphere and asthenosphere, *Nature Geoscience*, doi:10.1038/ngeo1982
- Ballmer, M. D., G. Ito, Wolfe, C. J., and Solomon, S. C. (2013): Double layering of a thermochemical plume in the upper mantle beneath Hawaii, *Earth and Planetary Science Letters*, 376, 155-164, doi:10.1016/j.epsl.2013.06.022

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- Bianco, T. A., G. Ito, J. van Hunen, J. J. Mahoney, and M. D. Ballmer (2013): Geochemical variations at ridge-centered hotspots caused by variable melting of a veined mantle plume, *Earth and Planetary Science Letters*, 371, pp: 191-202, doi: 10.1016/j.epsl.2013.03.050
- Ballmer, M. D., C. P. Conrad, E. I. Smith, and N. Harmon (2013): Non-hotspot volcano chains produced by migration of shear-driven upwelling toward the East Pacific Rise, *Geology*, 41, 479-482, doi:10.1130/G33804.1
- Cadio, C., M. D. Ballmer, I. Panet, M. Diament, and N. Ribe (2012): New constraints on the origin of the Hawaiian swell from wavelet analysis of the geoid to topography ratio, *Earth and Planetary Science Letters*, 359, 40-54, doi:10.1016/j.epsl.2012.10.006
- Ballmer, M. D., G. Ito, J. van Hunen, and P. J. Tackley (2011): Spatial and temporal variability in Hawaiian hotspot volcanism induced by small-scale convection, *Nature Geoscience*, 4, 7, 457-460, doi:10.1038/ngeo1187
- Bianco, T. A., G. Ito, J. van Hunen, M. D. Ballmer, and J. J. Mahoney (2011): Geochemical variations at intraplate hot spots caused by variable melting of a veined mantle plume, *Geochemistry Geophysics Geosystems*, 12, Q0AC13, doi:10.1029/2011GC003658.
- Ballmer, M. D., G. Ito, J. van Hunen, and P. J. Tackley (2010): Small-scale sublithospheric convection reconciles geochemistry and geochronology of ‘Superplume’ volcanism in the western and south Pacific, *Earth and Planetary Science Letters*, 290, 224-232, 10.1016/j.epsl.2009.12.025
- Ballmer, M. D., J. van Hunen, G. Ito, T. A. Bianco, and P. J. Tackley (2009): Intraplate volcanism with complex age-distance patterns – a case for small-scale sublithospheric convection, *Geochemistry Geophysics Geosystems*, 10, doi:10.1029/2009GC002386
- Bianco, T. A., G. Ito, J. van Hunen, M. D. Ballmer, and J. J. Mahoney (2008): Geochemical variation at the Hawaiian hot spot caused by upper mantle dynamics and melting of a heterogeneous plume, *Geochem. Geophys. Geosys.*, 9, doi: 10.1029/2008gc002111
- Ballmer, M. D., J. van Hunen, G. Ito, P. J. Tackley, and T. A. Bianco (2007): Non-hotspot volcano chains originating from small-scale sublithospheric convection, *Geophysical Research Letters*, 34, doi:10.1029/2007GL031636

PhD THESIS

- Ballmer, M. D. (2009). Small scale convection - an alternative mechanism for oceanic intraplate volcanism, *Diss. ETH No. 18425*

MANUSCRIPTS IN REVIEW

- Caracas, R., K. Hirose, R. Nomura, and M. D. Ballmer: Melt-crystals density crossover in a deep magma ocean, *Science*
- Conrad, C. P., K. Selway, M. M. Hirschmann, M. D. Ballmer, and P. Wessel. Constraints on Volumes and Patterns of Asthenospheric Melt from the Space-Time Distribution of Seamounts, *Geophysical Research Letters*
- Lourenço, D., A. Rozel, M. D. Ballmer, and P. J. Tackley. Plutonic-squishy lid: a new global tectonic regime generated by intrusive magmatism on Earth-like planets, *Geochemistry Geophysics Geosystems*
- Waszek, L., N. C. Schmerr, and M. D. Ballmer. The Megametre Transition: Global Observations of Reflectors Map Heterogeneity in the Mid-Mantle, *Nature Communications*

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INVITED PRESENTATIONS AT CONFERENCES AND WORKSHOPS

- Ballmer, M. D. (2017): Persistence of large-scale heterogeneity in the Earth's Mantle, *Goldschmidt*, Paris, France
- Ballmer, M. D., T. Duvernay, and J. O'Connor (2017): Evolution of whole-mantle plumes: Consequences for hotspot volcanism, *Goldschmidt*, Paris, France
- Ballmer, M. D. (2017): Large-scale compositional heterogeneity in the Earth's mantle, *IAG-IASPEI joint assembly*, Kobe, Japan
- Ballmer, M. D. (2017): Magma-ocean crystallization and the preservation of ancient crust in the lowermost mantle, *From Crust to Core*, Omishima, Ehime, Japan
- Ballmer, M. D., D. Lourenço, K. Hirose, R. Caracas, and R. Nomura (2017): Reconciling Magma-Ocean Crystallization Models with the present-day Structure of the Earth's mantle (2017): *JpGU-AGU joint assembly*, Makuhari, Chiba, Japan
- Ballmer, M. D., C. Houser, J. W. Hernlund, R. Wentzcovitch, K. Hirose: Persistence of Strong Silica-Enriched Domains in the Earth's Lower Mantle (2017): *JpGU-AGU joint assembly*, Makuhari, Chiba, Japan
- Ballmer, M. D. (2017): Large-scale compositional heterogeneity in the Earth's mantle, *Big Transition Zone and beyond*, London, UK
- Ballmer, M. D., V. Lekic, C. Thomas, L. Schumacher, and G. Ito (2016): Compositional layering within the large low shear-wave velocity provinces (LLSVPs) in the lower mantle, *EGU General Assembly*, Wien
- Ballmer, M. D., N. C. Schmerr, T. Nakagawa, J. Ritsema and M. Motoki (2015): Compositional mantle layering revealed by slab stagnation at ~1,000 km depth, *AGU fall meeting*
- Ballmer, M. D., V. Lekic, C. Thomas, L. Schumacher, and G. Ito (2015): Compositional layering within the large low shear-wave velocity provinces (LLSVPs) in the lower mantle, *AGU fall meeting*, San Francisco
- Ballmer, M. D., S. French, V. Lekic, and G. Ito (2014): Simultaneous generation of Superdomes and Superplumes in the deep Earth's mantle, *14th Symposium of SEDI*, Kanagawa, Japan
- Ballmer, M. D., C. P. Conrad, E. I. Smith, and N. Harmon (2013): Non-hotspot volcano chains produced by migration of shear-driven upwelling toward the East Pacific Rise, *AGU fall meeting*, San Francisco
- Ballmer, M. D., C. P. Conrad, N. Harmon, E. I. Smith, R. Johnsen (2013): Intraplate volcanism at the edges of the Colorado Plateau sustained by shear-driven upwelling, *EGU General Assembly*, Wien
- Ballmer, M. D., G. Ito, Wolfe, C. J., Solomon, S. C. (2012): Double layering of a thermochemical plume in the upper mantle beneath Hawaii, *EGU General Assembly*, Wien
- Ballmer, M. D., C. P. Conrad, N. Harmon, T. A. Bianco, E. I. Smith (2011): 3-D patterns and volumes of decompression melting fueled by asthenospheric flow: comparison and interaction of shear-driven upwelling with small-scale convection, *AGU fall meeting*
- Ballmer, M. D., G. Ito, Wolfe, C. J., Solomon, S. C., Laske, G. (2011): Double layering of thermochemical-plume material can reconcile upper-mantle seismic velocity structure beneath Hawaii, *AGU fall meeting*, San Francisco
- Ballmer, M. D., G. Ito, J. van Hunen, P. J. Tackley, T. A. Bianco (2011): The role of small-scale sublithospheric convection in generating and modulating oceanic intraplate volcanism, *EarthScope Inst. on the Lithosphere-Asthenosphere Boundary*, Portland

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- Ballmer, M. D., G. Ito, J. van Hunen, P. J. Tackley, T. A. Bianco (2011): The role of small-scale sublithospheric convection in generating and modulating oceanic intraplate volcanism, *GORDON research seminar*, Mount Holyoke
- Ballmer, M. D., G. Ito, J. van Hunen, P. J. Tackley (2010): Small-scale convection induces temporal and spatial variability in Hawaiian plume volcanism, *AGU fall meeting*, San Francisco
- Ballmer, M. D., G. Ito, J. van Hunen, P. J. Tackley (2009): Small-scale sublithospheric convection reconciles geochemistry and geochronology of 'Superplume' volcanism in the western and south Pacific, *AGU fall meeting*, San Francisco

INVITED LECTURES

- Dept. Earth Sciences, Univ. Cambridge, Cambridge, UK (MAY 2017)
- Institut du Physique du Globe (IPG Paris), *Univ. Paris 7*, Paris, France (NOV 2016)
- Dept. Earth Sciences, *University College London*, London, UK (NOV 2016)
- Dept. Earth and Planetary Sciences, Univ. Tokyo, Tokyo, Japan (JUL 2016)
- Centre of Earth Evolution and Dynamics, Oslo, Norway (NOV 2015)
- Institut für Geophysik, *Univ. Frankfurt*, Frankfurt, Germany (NOV 2015)
- Bayerisches Geoinstitut, *Univ. Bayreuth*, Bayreuth, Germany (OCT 2015)
- Inst. Geophysics, *ETH Zurich*, Zurich, Switzerland (SEP 2015)
- Institut für Geophysik, *Westfälische Wilhelms Univ. Münster*, Münster, Germany (APR 2015)
- Planetarium Bochum, Bochum, Germany (APR 2015)
- Berkeley Seismological Laboratory, *Univ. California Berkeley*, Berkeley, USA (MAR 2014)
- SOEST, *Univ. of Hawaii*, Honolulu HI, USA (JAN 2014)
- Earth Life Science Institute, *Tokyo Inst. Technology*, Meguro, Tokyo, Japan (JAN 2014)
- FAST, *Univ. Paris-Sud*, Orsay, France (APR 2013)
- Dept. Sciences de la Terre, *Univ. Lyon 1*, Lyon, France (APR 2013)
- Kavli Inst. Theoretical Physics, *Univ. California Santa Barbara*, Goleta, USA (AUG 2012)
- Inst. Geophysics, *ETH Zurich*, Zurich, Switzerland (MAY 2012)
- Helmholtz Centre, *Geoforschungszentrum (GFZ) Potsdam*, Potsdam, Germany (APR 2012)
- Hawaiian Volcano Observatory, *US Geological Survey*, Volcano NP, USA (JUL 2011)
- Dept. Terrestrial Magnetism, *Carnegie Inst. Washington*, Washington DC, USA (JUN 2011)
- SOEST, *Univ. of Hawaii*, Honolulu HI, USA (FEB 2009)
- Department of Earth Sciences, *Univ. of Durham*, Durham, UK (SEP 2007)
- SOEST, *Univ. of Hawaii*, Honolulu HI, USA (JAN 2007)
- Inst. Geophysics, *ETH Zurich*, Zurich, Switzerland (DEC 2006)

RECENT COLLABORATORS

Daniela La Paz Bolrão (ETH); Stefan Brändli (ETH); Cecilia Cadio (Yale); Razvan Caracas (ENS Lyon); Cheng Cheng (Berkeley); Clinton Conrad (Univ. Hawaii); Sanne Cottaar (Univ. Cambridge); Thomas Duvernay (IPGP); Esteban Gazel (Virginia Tech); Gregor Golabek (BGI Bayreuth); Nicholas Harmon (Univ. Southampton); John Hernlund (ELSI); Marc Hirschmann (Univ. Minnesota); Christine Houser (ELSI); Kei Hirose (ELSI); Garrett Ito (Univ. Hawaii); Chie Kato (ELSI); Peter van Keken (Univ. Michigan); Matthieu Laneuville (ELSI); Vedran Lekic (Univ. Maryland); Xiaogang Long (Tongji Univ., ETH); Matthew Motoki (Univ. Hawaii); Miki Nakajima (Carnegie, DTM); Takashi Nakagawa (JAMSTEC); Ryuichi Nomura (ELSI); John O'Connor (AWI Bremerhaven; VU Amsterdam); Eiji Ohtani (Tohoku Univ.); Jeroen

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Ritsema (Univ. Michigan Ann Arbor); Antoine Rozel (ETH); Tatsuya Sakamaki (Tohoku Univ.); Nicholas Schmerr (Univ. Maryland); Lina Schumacher (Univ. Münster); Eugene Smith (Univ. Nevada Las Vegas); Sean Solomon (Lamont-Doherty Earth Obs.); Alex Song (Univ. College London); Paul Tackley (ETH); Christine Thomas (Univ. Münster); Renata Wentzcovich (Columbia); Paul Wessel (Univ. Hawaii); Cecily Wolfe (USGS)

MEDIA APPEARANCE

Deschamps, F. (2017), Surviving Mantle Convection, *Nature Geoscience* (Focus), 10, 161, doi:10.1038/ngeo2905

Wright, M. (2015), Twin studies provide first explanations for boundary within Earth's mantle

Witze, A. (2013), Under The Volcano, *Nature* (News), 504, 206-207

Morton, M. C. (2013), East Pacific Rise volcanoes finally line up, *Earth Magazine*, June, 17-18

Koppers, A. A. P. (2011), Mantle Plume Persevere, *Nature Geoscience* (Focus), 4, 12, 816-817

SEA AND FIELD EXPERIENCE

geologic mapping in Ahlsburg mountains, Dörringsen, Germany (1 week in 2000)

geologic mapping in Ardennes mountains, Comblain-Fairon, Belgium (2 weeks in 2003)

geologic mapping in the Alps (Asten/Laste, Penserjoch, Tatschspitze), Italy (4 weeks in 2004)

R/V Kilo Moana cruise to Hawaiian N-arch (Mohole Project), central Pacific (1 week in 2010)

REFERENCES

Clinton P. Conrad <c.p.conrad@geo.uio.no>

John W. Hernlund <hernlund@gmail.com>

Kei Hirose <kei@elsi.jp>

Garrett Ito <gito@hawaii.edu>

Paul J. Tackley <ptackley@ethz.ch>

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Scopus: **9***; Web of Science: **9***; Google Scholar: **11**

(*h=10 as Ballmer et al. [Science Advances, 2015] is considered)