Dr. Einat Lev

CONTACT INFORMATION	Lamont Assistant Research Professor Lamont-Doherty Earth Observatory Columbia University 61 Route 9W Palisades, NY 10964 USA	*Mobile:* +1-617-794-0660 *Fax:* +1-845-365-8510 einatlev@ldeo.columbia.edu http://www.ldeo.columbia.edu/~einatlev/

RESEARCH INTERESTS

- Physical volcanology
- Rheology of geologic materials
- Numerical modeling of geodynamic processes
- Tectonics of plate boundaries
- Seismic and viscous anisotropy
- Analog fluid experiments

ACADEMIC APPOINTMENTS

- **Lamont Assistant Research Professor**   September 2013 to present

  Lamont-Doherty Earth Observatory, Columbia University
  Focus: Physical Volcanology and Numerical Geodynamics

- **Visiting Professor**   September to December 2014

  Earthquake Research Institute, University of Tokyo
  Focus: Modeling the 2011 Shinmoedake dome-building eruption

- **Postdoctoral Research Fellow/Scientist**   October 2009 to August 2013

  Lamont-Doherty Earth Observatory, Columbia University
  Supervisor: Professor Marc Spiegelman
  Focus: Quantitative investigation of lava rheology and flow dynamics

- **Graduate research assistant**   2003-2009

  Department of Earth, Atmospheric and Planetary Sciences, MIT
  Supervisor: Professor Bradford H. Hager
  Focus: Seismic and viscous anisotropy in the Earth's mantle

EDUCATION

- **Ph.D., Geophysics, May 2009**

  Massachusetts Institute of Technology, Cambridge, MA,
  Thesis Topic: *Seismic and Viscous Anisotropy in the Earth's Mantle: Observations and Implications*
  Adviser: Professor Bradford H. Hager

- **B.Sc., June 2001**

  Tel-Aviv University
  Cum laude, Double major: Geophysics and Computer Science

REFEREED JOURNAL PUBLICATIONS

[1] Patrick, M., Orr T., Sutton, A.J., **Lev, E.**, Thelen, W. and Fee, D., *Gas pistoning and episodic outgassing in the lava lake at Halema'uma'u Crater, Kīlauea Volcano, during 2010Ð2014*, Earth and Planetary Science Letters, V. 433, p. 326-338 (2015) doi:10.1016/j.epsl.2015.10.052

[2] Dietterich, H., Cashman, K., Rust, A. and **Lev, E.** *Diverting lava flows in the laboratory*, Nature Geoscience, v. 8, no. 7, (2015), doi: 10.1038/ngeo2470

[3] Cordonnier, B., **Lev, E.** and Garel, F., *Benchmarking volcanic mass flow models.* In: Detecting, Modeling and Responding to Effusive Eruptions, Geological Society, London, Special Publications,V. 426 (2015), doi: 10.1144/SP426.7

[4] **Lev, E.** and James, M. R., *The Influence of Cross-sectional Channel Geometry on Rheology and Flux Estimates for Active Lava Flows*, Bull. Volcanol., v. 76 (2014), doi: 10.1007/s00445-014-0829-3

[5] Edwards, B., J. Karson, R. Wysocki, **E. Lev**, U. Keuppers, *Experimental Insights on Natural Lava-Ice/Snow Interactions*, Geology, v. 41, p. 851-854 (2013) doi: 10.1130/G34305.1

[6] **Lev, E.** , M. Spiegelman, J. Karson and R. Wysocki, *Investigating lava flow rheology using video analysis and numerical flow models*, Journal of Volcanology and Geothermal Research, v. 247-248, p. 62-73 (2012) doi:10.1016/j.jvolgeores.2012.08.002

[7] **Lev, E.** and B.H. Hager, *Anisotropic viscosity changes the thermal structure of subduction zone wedges*, Geochem. Geophys. Geosys., v. 12 (2011), Q04009, doi:10.1029/2010GC003382

[8] Grove, T. L. , C. B. Till, **E. Lev**, N. Chatterjee and E. Médard, *Kinematic variables and water transport control the formation and location of arc volcanoes*, Nature, v. 459 (2009), doi:10.1038/nature08044.

[9] **Lev, E.** and B.H. Hager, *Prediction of anisotropy from flow models – a comparison of three methods*, Geochem. Geophys. Geosys., v. 9 (2008), Q07014, doi:10.1029/2008GC002032

[10] **Lev, E.** and B.H. Hager, *Rayleigh-Taylor Instabilities with anisotropy lithospheric viscosity*, Geophys. Jour. Int., v. 173 (2008), p. 806-814

[11] Sol, S., Meltzer, A., Burgmann, R., van der Hilst, R.D., King, R., Chen, Z., Koons, P.O., **Lev, E.**, Liu, Y.P., Zeitler, P.K., Zhang, X., Zhang, J., Zurek, B., *Geodynamics of the southeastern Tibetan Plateau from seismic anisotropy and geodesy*, Geology, v. 35 (2007), p. 563-566.

[12] **Lev, E.**, M. D. Long and R.D. van der Hilst, *Seismic anisotropy in eastern Tibet from shear wave splitting reveals changes in lithospheric deformation*, Earth. Planet. Sci. Lett., v. 251 (2006), p. 293-304.

PAPERS IN PREPARATION

[13] **Lev, E.** and Ruprecht, P. *Characterizing Circulation Regimes in Active Lava Lakes using Video Analysis*

[14] Patrick, M., Orr, T., Swanson, D.A. and **Lev, E.** *Shallow and deep controls on lava lake surface motion at Kʔlauea Volcano*

[15] **Lev, E.** and Ford, C. *Skin deep: the physical properties of lava crusts*

[16] **Lev, E.** and Dietterich, H. *Experimental and numerical simulations of lava flows diversion*

GRANTS AND AWARDS

"Lunar Impact Melt Flows: Geological Mapping, Experimental Simulation, and Numerical Modeling", NASA award 14-SSW14-2-0067 ($106,000)

"Active Lava Lakes as a Window into Magma and Volcano Dynamics" NSF award EAR-1348022 ($310,000)

Visiting professorship exchange program, Earthquake Research Institute (ERI), University of Tokyo, 2014 (est. worth $25,000)

Research Assistance award, Flow-3D by Flow Science (est. worth $5,000)

"Collaborative Proposal: Evolution of Lava Channel Networks: Implications for Lava Flow Hazards and Mitigation", Lead PI: Katherine Cashman. NSF award EAR-1250554 ($40,000)

"Connecting Lava Rheology and Flow Dynamics Using Novel Field and Modeling Techniques", NSF, award EAR-1118943 ($150,000).

Brinson Foundation funding for extension of postdoctoral fellowship at LDEO ($40,000)

LDEO Advisory Board Innovation Award – Lava rheology field experiment ($20,000)

Lamont-Doherty Postdoctoral Fellowship

EAPS (MIT) award for excellence in teaching ($1000)

Best student presentation award, AGU Fall meeting, 2005, San Francisco

MIT Presidential Fellowship, 2003-2004

Best Programming Project Award, Tel-Aviv University, 2000

Rafi Katzman Award for Excellence in Freshmen Year Studies, Tel-Aviv University, 1999

CONFERENCE TALKS

[17] Dietterich, H. **Lev, E.**, Jiangzhi, C., Cashman, K. and Honor, C., *Benchmarking Computational Fluid Dynamics Models for Application to Lava Flow Simulations and Hazard Assessment*, AGU Fall Meeting, 2015

[18] Rumpf, E.M. and *Lev, E.*, *Investigating lava-substrate interactions through flow experiments with syrup, wax, and molten basalt*, AGU Fall Meeting, 2015

[19] Patrick, M., Orr, T., Swanson, D. and *Lev, E.*, *Shallow outgassing changes disrupt steady lava lake activity, Kilauea Volcano*, AGU Fall Meeting, 2015

[20] **Lev, E.** and James, M.R., *The influence of cross-sectional channel geometry on rheology and flux estimates for active lava flows*, AGU Fall Meeting, 2013

[21] **Lev, E.**, M. Spiegelman, J. Karson and R. Wysocki, *Investigating lava flow rheology using video analysis and numerical flow models*, IAVCEI meeting, Japan 2013 (INVITED)

[22] **Lev, E.** , M. Spiegelman, J. Karson and R. Wysocki, *Investigating Lava Rheology Using Video Analysis and Flow Models*, IUGG/IAVCEI meeting, Australia, 2011

[23] **Lev, E.**, *Numerical modeling of lava flows*, PASI Open Vent volcanoes workshop, Costa Rica, 2011

[24] **E. Lev** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models*, Gordon Research Conference on Rock Deformation, NH, August 2008 (INVITED)

[25] **E. Lev** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models*, CIG Mantle convection and lithospheric dynamics, UC-Davis, July 2008 (INVITED)

[26] **E. Lev** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models*, AGU Fall meeting, 2007. (Part of a special session dealing with rheological anisotropy in earth sciences, held jointly by the tectonophysics, seismology, cryosphere and mineral physics sections).

[27] **E. Lev**, M.D. Long and R.D. van der Hilst, *Seismic anisotropy in Eastern Tibet from shear-wave splitting*, AGU Fall meeting, 2005)(Received Best Student Presentation Award)

CONFERENCE
POSTERS

[28] **Lev, E.,**, Ruprecht, P., Patrick, M., Oppenheimer, C., Peters, N., Spampinato, L., Hernandez, P., Unglert, K. and Barreyre, T., *A Rare Window Into Magmatic Conduit Processes: Time Series Observations From Active Lava Lakes* , AGU Fall Meeting 2015

[29] Ford, C. and **Lev, E.**, *Red Hot: Determining the Physical Properties of Lava Lake Skin*, AGU Fall Meeting, 2015

[30] **Lev, E.** *Circulation patterns in active lava lakes*, Gordon Research Conference, 2015

[31] **Lev, E.** and Redmond, T.C., *Circulation patterns in active lava lakes*, AGU Fall Meeting 2014

[32] Edwards, B.R., J. Karson, R. Wysocki, **E. Lev**, I.N. Bindeman, and U. Kueppers. *Experimental Insights on Natural Lava-Ice/Snow Interactions and Their Implications for Glaciovolcanic and Submarine Eruptions*, AGU Fall Meeting, 2012

[33] **Lev, E.**, M. Spiegelman, J. Karson, R. Wysocki, *Investigating Lava Properties using Experiments, Video Analysis, Infrared Thermometry and Numerical Flow Models*, AGU Fall Meeting, 2012

[34] **Lev, E.**, M. Spiegelman, J. Karson, R. Wysocki, *Investigating Lava Rheology Using Man-Made Lava Flows, Computer Vision, and Flow Models*, Chapman Conference on Hawaiian Volcanism, 2012

[35] **Lev, E.**, M. Spiegelman, J. Karson, R. Wysocki, *Investigating Lava Rheology Using Man-Made Lava Flows, Computer Vision, and Flow Models*, AGU Fall Meeting, 2011

[36] Tarlow, S., **E. Lev**, C.J. Zappa, J. Karson, R. Wysocki, *Investigating Cooling Rates of a Controlled Lava Flow using Infrared Imaging and Three Heat Diffusion Models*, AGU Fall Meeting, 2011

[37] **Lev, E.**, *Extracting Lava Velocity and Rheology from Computer-Vision Analysis of Lava Flow Videos*, IUGG/CMG meeting, Pisa, Italy, 2010

[38] **Lev, E.** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models – Rayleigh-Taylor instabilities as a test example*, The Cutting Edge "Preparation for an academic career in geosciences" workshop, Madison, WI

[39] **Lev, E.** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models – Rayleigh-Taylor instabilities as a test example*, International school of geophysics, 2007, Carry-Le-Rouet, France

[40] **Lev, E.** and B.H. Hager, *Anisotropic viscosity in geodynamical flow models – Rayleigh-Taylor instabilities as a test example*, Gordon Research Conference on Interior of the Earth, June 2007

[41] **Lev, E.**, M.D. Long and R.D. van der Hilst, *Seismic anisotropy in Eastern Tibet from shear-wave splitting*, International workshop on seismic anisotropy, Trest, Czech Republic, 2006

[42] **Lev, E.**, M.D. Long and R.D. van der Hilst, *Seismic anisotropy in Eastern Tibet from shear-wave splitting*, MYRES II, Verbana, Italy, July 2006

[43] **Lev, E.** and B.H. Hager, *Mixing of Differentiated Oceanic Crust in a Convecting Mantle with Depth and Temperature Dependent Properties*, International Workshop on Numerical Modeling of Mantle Convection and Lithospheric Dynamics, Erice, Italy 2005

INVITED LECTURES AND SEMINARS

[44] Department of Geological Sciences, University of Oregon, February 2014

[45] The Levich Institute for Physico-chemical Hydrodynamics, City University of New York, February 2014

[46] Department of Geophysics, Stanford University, February 2014

[47] Earthquake Research Institute, Tokyo University, November 2014

[48] National Institute of Earth Science and Disasters (NIED), Japan, October 2014

[49] Geological Sciences department ,Tokyo University, September 2014

[50] Geology department, Yale University, April 2014

[51] Division of Geological and Planetary Sciences, California Institute of Technology, January 2013

[52] Dept. of Geology and Planetary Science, University of Pittsburgh, November 2012

[53] Department of Environmental Sciences and Energy Resources, Weizmann Institute of Science, Israel, May 2012

[54] American Museum of Natural History, March 2012

[55] SUNY-Stony Brook Geology Colloquium, 2010

[56] Physics Department, Colorado University-Boulder, March 2009

[57] Department of Geosciences, Princeton University, 2008

[58] Department of Earth, Environmental and Planetary Sciences, Brown University, 2007

[59] Geology and Geophysics department, Woods Hole Oceanic Institute, 2006

ADVISING AND MENTORING

Anna Barth, Graduate student, LDEO

Danial Rasmussen, Graduate student, LDEO

Dr. Elise M. Rumpf, Postdoctoral researcher
Laboratory investigation of lava flows on variable substrates

Mark Cooper (Columbia University), LDEO undergraduate work-study student
Modifying laboratory setup to accommodate a range of fluids

Camera Ford (Brown University), LDEO undergraduate summer intern
Cooling of vesicular lava in a lake

Asha Grossberndt, High-school science project intern
Laboratory investigation of lava flows

Alanna Williams (Columbia University), Earth Institute Intern
Image analysis of lake paterns

Taylor Redmond (George Washington University) LDEO undergraduate summer intern
Lava lake circulation patterns; Experimental lava flow velocity measurements

Xiaoliang Li (Chinese Academy of Science) Visiting postdoctoral researcher
Emplacement of lava flows and domes on rough surfaces

José Mendez (Columbia University), Columbia University Work-Study student
Analysis of Lava Lake Footage to Detect Circulation Patterns

Caitlin Meadows (U. of Michigan), LDEO undergraduate summer intern, Lead mentor: Dr. Tim Creyts
Experimental study of subglacial drainage systems using gelatin

Scott Tarlow (Wheaton College), LDEO undergraduate intern, Lead Mentor: Dr. Chris Zappa
Investigating Cooling Rates of a Controlled Lava Flow using Infrared Imaging and Three Heat Diffusion Models

TEACHING EXPERIENCE

Lamont-Doherty Earth Observatory

Co-instructor
- Volcanic systems: from the magma chamber to post-eruption

Massachusetts Institute of Technology

New class development
- Earth Science, Energy, and the Environment (MIT 12.021)

Teaching assistant
- Geodynamics – Graduate level (MIT 12.520)
- Application of Continuum Mechanics in Earth Sciences – Undergraduate level (MIT 12.005)

Co-teacher
- "Introduction to geology" at MIT's High-School Summer Program (HSSP)

UNIVERSITY SERVICE

- Division representative at the LDEO Campus Life Committee, 2013-present
- Member of the LDEO special task force on diversity, 2011
- Co-organizer of LDEO Geodynamics seminar, 2009-present
- Organizer of LDEO's Geophysics seminar (joint SGT and MG&G), 2010-201
- Graduate students representative for the EAPS Visiting Committee, 2007-2009
- Secretary of EAPS graduate students advisory council (EGSAC), 2006-2007
- Organizer of the MIT Geology and Geophysics weekly students seminar, 2005-2006
- Coordinator of EAPS Graduate Student Mentoring program, 2005-2009
- Organizing Committee of Geophysics monthly seminar, 2004

PROFESSIONAL SERVICE

Peer reviewer for:
- *Geophysical and Astrophysical Fluid Dynamics*
- *Geology*
- *Tectonophysics*
- *Earth and Planetary Science Letters*
- *G-Cubed*
- *Geophysical Journal International*
- *NSF*
- *NASA*

Conference Service

- Organizer of session: "Styles of volcanism: Forecasting, pattern recognition and monitoring developing eruptions" at AGU 2015 Fall Meeting

- Organizer of session: 'Lava Flows: Integrating Field and Remote Sensing Observations, Laboratory Experiments, and Modeling", AGU Fall Meeting 2014

- Organized a workshop about magma and lava rheology at the 2013 IAVCEI meeting, Kagoshima, Japan

- Organizer of special session: "Volcanic Flow and Magma Properties: Field, Laboratory and Hazard Assessment", AGU Fall Meeting, 2013 (cosponsored by EGU-GMPV and MSA)

- AGU Fall meetings Outstanding Student Paper Award Judge , 2009-present

- AGU Fall meetings Session chair for Tectonophysics/Seismology, 2006-2009

- Organizer of special session: "Rheological Anisotropy in the Earth Sciences", AGU Fall Meeting, 2007

LAB EXPERIENCE

- Since 2015   Lead the construction of a Fluid Mechanics Laboratory at LDEO and performed analog fluid flow experiments
- 2014   Analog multiphase experiments and rheology measurements at Tokyo University
- Since 2010   Experimental lava flows at Syracuse University facility (at least twice a year)

FIELD WORK EXPERIENCE

- 2015   Aerial photography using unmanned aerial vehicles (UAVs) of the 2014-2015 Holuhraun lava flow, Iceland
- 2015   Thermal imaging and mapping of recent lava flow and lava lake activity, Hawaii
- 2014   UAV aerial survey of the Shinmoedake lava dome of Kirishima volcano, Japan
- 2014   UAV aerial survey of the 1986 lava flows on Izu Oshima island, Japan
- 8/2012   Infrared and visible video recording of lava flows in Hawaii
- 1/2010   PASI Field Course on Open Vent Volcanoes, Costa Rica
- 8/2009   Mapping lava channels on Mauna Loa, Hawai'i using LiDAR (P.I.s: Kathy Cashman and Adam Soule)
- 6/2008   WHOI Geodynamics field trip, Costa Rica
- 7/2006   Deployment of a PASSCAL-Earthscope seismic network in the Cascades, WA (P.I.s: Ken Creager, Geoff Abers, Stephane Rondenay)
- 1/2006   Geologic Mapping Field Camp, Southern Arizona
- 9/2004   Geology field trip to Sichuan province (Eastern Tibet), China (P.I.: Leigh Royden)
- 2004, 2008   Geophysics Field Camp, Riverside Mountains, Southern California

COMMUNITY AND OUTREACH

- Teaching three lectures about plate tectonics and geophysics at the Lycée High-school, NY, 2015
- Contributed a post for the Earth Institute blog "State of the Planet" about field work in Iceland, 2015
- Interviewed for Science regarding the Bárðarbunga eruption, 2014
- Academic Minute program about lava flows, NPR, 2013

- Scientific Consultant to LEGO First League (Natural Hazards) team from Dobbs Ferry, NY (January 2014, contact: Jen Cadenhead)
- Interviewed to Discovery Channel Canada regarding lava experiments (June 2013, contact: Maja Klempner)
- Interviewed to New Scientist regarding lava experiments (Article published August 2013, contact: Julian Smith)
- Geoscience Congressional Visit Day, NY state team, September 2011
- NYC Science and Engineering Fair, Earth and Planetary Science, Head judge, March 2011, 2012, 2014
- "Dynamics of Lava Flows" display at the LDEO Open House, 2010, 2012
- Assisted in mentoring an undergraduate summer interns at LDEO, 2011, 2012
- Assisting a high-school student on a science research project about volcanoes, November 2009-2010
- Teacher of "Introduction to geology"class, MIT's High-School Summer Program (HSSP), Summer 2007
- Mentor in KEYs (Keys to Empowering Youth) project at MIT, 2005-2008

COMPUTER
EXPERIENCE

Programming Languages:
- Matlab (fluent)
- C (fluent)
- shell scripting (good)
- C++ (some)
- Fortran (some)
- Python (some)

Numerical modeling codes:
- Finite Elements: Elmer, Fluidity, Underworld/Gale, Citcom, Conman, Adina
- Finite Volume/Elements: OpenFOAM
- Volume-Of-Fluid: Flow-3D, VolcFlow

Photogrammetry tools:
- PhotoScan (Agisoft)
- Pix4D
- Matlab's Computer Vision and Structure form Motion packages

Seismology:
- SAC, Seismic Handler, IRIS SeismoQuery, OBSpy

Mapping, imaging and meshing:
- ArcGIS, Paraview, ImageJ, GMsh, MeshLAB

Crystallography:
- D-Rex, ImageSXM

Version Control and Software Configuration Management:
- Mercurial, Git, SVN

MORE
INFORMATION

More information and auxiliary documents can be found at
http://ldeo.columbia.edu/~einatlev/.