

## Keith Daniel Putirka

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### **PERSONAL**

Born: Los Angeles, CA, 7/30/62

Married: to Heather Bacon-Putirka; three daughters, Noelani Ann (b. 8/9/87), Sarah Elizabeth (b. 4/15/02), and Naomi, Marie (b. 6/20/04).

### **EDUCATION**

#### Degrees:

10/97      Ph.D., Geological Sciences, Columbia University, New York, NY  
11/92      M.S., Geology, California State University, Los Angeles, CA  
8/86        B.S., Geology, California State University, Northridge, CA

#### Other Institutions Attended:

7/83        Texas Tech University, Lubbock, TX (Field Camp in Salida CO)  
1981-1983    Glendale Community College, Glendale, CA

### **PRESENT POSITION**

7/02-present    **Assistant Professor, California State University, Fresno**

#### **Department of Earth and Environmental Sciences**

Courses Taught: Mineralogy, Crystallography, Optical Mineralogy, Igneous & Metamorphic Petrology. Departmental Activities Chair, Department search committee, Chair, departmental curriculum committee – to oversee development of a new Environmental Science B.S. program, Graduate Program Coordinator, Member of College Space and Budget committee, Geology Club Coordinator. University Undergraduate Curriculum Committee.

### **PRIOR POSITIONS**

8/99-7/02      **Assistant Professor, Indiana University of PA Geoscience Department**

Courses Taught: Mineralogy, Geochemistry, Physical Geology, Research Techniques in the Geosciences, Igneous and Metamorphic Petrology, Dynamic Earth, Mathematical Applications to the Geosciences. University Activities Member, University Senate (1999-2002), University-wide Undergraduate Curriculum Committee (1999-2002) Major Departmental Activities Faculty Search Chair, Tectonics/Structural Geology Position (2002); Faculty Search Committee, Geophysics/Hydrogeology Position (1999); Chair, departmental curriculum committee overseeing program and course revisions instituted during 1999-2001.

10/97-8/99      **Post-Doctoral Research Staff Member, Lawrence Livermore National Laboratory, Livermore, CA.**

IGPP: Institute of Geophysics and Planetary Physics/Geophysics and Global Security.  
 Frederick Ryerson, Post-doctoral Advisor)  
 9/92-5/95 **Teaching Assistant, Columbia University, New York, NY.** Igneous  
 and Metamorphic Petrology Labs  
 9/92-5/95 **Teaching Assistant, California State University, Los Angeles, CA.**  
 Oceanography Lab, Geology of National Parks  
 8/86-6/91 **Teacher, Los Angeles Unified School District, Sun Valley, CA**  
 Courses Taught: Algebra, Physical Science

**GRANTS – IN REVIEW**

2003 **NSF-Research at Undergraduate Institutions (PI); Amount Requested: \$271,460; Topic:** RUI: Collaborative Proposal: A field and geochemical analysis of the Cascadia-Basin and Range Transition in the central Sierra Nevada, CA. Co-PIs: Cathy Busby (UC Santa Barbara)

**GRANTS (& AWARDS) – FUNDED (\$573,390 total since 2002)**

2004-2005 **NSF-Research at Undergraduate Institutions (PI); Award: \$105,188**  
*Topic:* RUI: An investigation of the Mauna Kea magma plumbing system: insights from mineral composition from the HSDP core

2004 **CSU Award For Research, Scholarship and Creative Activities: \$5,000**

2004 **NSF-Major Research Instrumentation Initiative (PI); Award: \$148,105**  
*Topic:* Acquisition of an X-ray Diffraction Instrument: Developing an Interdisciplinary; Research/Teaching X-ray Diffraction Laboratory; Co-PIs: Zhi Wang (CSU Fresno, DEES); Horacio Ferriz (CSU Stanislaus, Geology and Physics Dept.)

2004 **College Minigrant Award: \$3,050**  
*Topic:* Magma storage and volcanic hazards: an assessment of the magma plumbing system of the Springerville Volcanic Field, AZ

2004 **College of Science & Mathematics' Performance Award: \$1,200**

2003 **Claude Laval Jr. Award for Innovative Technology and Research; Award (PI): \$5,000**  
*Topic:* "Some New Instrumental Techniques applied to Hawaiian Volcanism".

2002-2003 **NSF-Major Research Instrumentation Initiative (PI); Award: \$303,297**  
 (NSF Contribution: \$198,106; Matching Funds: \$105,191); *Topic:* "Development of an X-ray Fluorescence Laboratory: Integrating Geology Undergraduate Coursework with Geochemical Research"; *Co-PI's:* Steve Hovan (Geoscience), Charles Lake (Chemistry), Devki Talwar (Physics). Lab is currently being developed at Cal State Fresno

2002-2003 **College of Science and Mathematics min-grant award (PI); Award: \$2,500**  
 CSU Fresno, College of Sciences and Mathematics; *Topic:* In Interior View of the Yellowstone Plume Hot-Spot Track

2002-2002 **Proposal Development Incentive Program (PI); Award: \$4000**  
 Indiana University of Pennsylvania, Indiana, PA; *Topic:* "Evolution of a Volcanic Plumbing System: A case study based on samples recovered from the Hawaii Scientific Drilling Project (HSDP)". A preliminary geochemical study of minerals recovered from the HSDP.  
*Co-PI's:* none

2000-2001 **IUP Senate Fellowship Grant (PI); Award: \$3,500**

Indiana University of Pennsylvania, Indiana, PA; *Topic*: "Plumbing the Depths of the Yellowstone Plume"; will fund preliminary geochemical work in the eastern Snake River Plain, Idaho, focused on the Craters of the Moon magma plumbing system and other easternmost Snake River Plain lavas. *Co-PI's*: Mel Kuntz, U.S. Geological Survey, Denver CO.

1998-2001 **Laboratory-Directed Research and Development Grant (PI); Award: \$732,000**

Lawrence Livermore National Laboratory/University of California, Santa Cruz. *Topic*: "Mantle Dehydration and the Global Water Cycle"; an experimental study of the mineral-melt partitioning of hydrogen. *Co-PI's*: At LLNL—Frederick Ryerson, Ian Hutcheon, Henry Shaw, Adam Kent; At UCSC: Quentin Williams, Henry Scott.

### **RECOGNITION**

- College of Science & Mathematics 'Performance Award, 2004 (\$1,200)
- Invited Talk: to the Nov. 2004 meeting of the IAVCEI in Pucon, Chile (section: 9b. Geophysical evidence for mid crustal intrusions and implications for crustal rheology).
- Invited Talk: "A cross section of magma plumbing system at the Springerville Volcanic field (east-central AZ): conjectures based on mineral-melt thermobarometers" (U.S.G.S. Volcanic Hazards Team Seminar, Menlo Park, Feb. 17, 2004).
- Article in *The Economist* (Science & Technology: "Plumbing the depths", Aug. 16<sup>th</sup>-22<sup>nd</sup> issue, 2003)
- Claude Laval Jr. Award for Innovative Technology and Research, 2003 (\$5,000 )
- News & Views Article in *Nature* ("Mantle geochemistry: Unmixing Hawaiian cocktails", A. Halliday, v. 399, p. 733, 1999).
- Invited Talk: "Calibration of garnet + and clinopyroxene + liquid saturation surfaces, and some preliminary applications to komatiite petrogenesis" (AGU , v. 79, p. S378, 1998).
- IBM Graduate Fellowship Award (1993-1994)
- Cal State Northridge Geology Dept. Scholarships (3) (1985-1987)
- Mineralogical Society of Southern California Scholarship (1984)

### **ACTIVE MEMBERSHIPS**

1992-present	American Geophysical Union
1997-present	American Association for the Advancement of Science
1997-present	Geological Society of America
1997-present	Mineralogical Society of America
1998-present	Sigma Xi, Columbia University Chapter
2000-present	New Hampshire Geological Society

### **Ph.D. AND M.S. THESES**

**Garnet+liquid and clinopyroxene+liquid equilibrium:** *Ph.D. Thesis, Columbia University, NY, NY, 1997*, David Walker, John Longhi and Charles Langmuir, thesis advisors. An experimental study of pressure- and temperature- sensitive mineral-liquid equilibria. Magma transport depths were calculated for basaltic rocks from Hawaii. Transport depths were discovered to correlate with the elastic properties of the lithosphere, rather than density contrasts. Garnet saturation experiments were used to calculate garnet compositions crystallizing

from a chondrite magma ocean. Such compositions contain less majorite than commonly assumed, and indicate that substantial Na and Ti may be stored by garnet in the mantle.

**Petrography and geochemistry of intermediate and bi-modal volcanic rocks of the central western Mojave Desert, California:** *M.S. Thesis, California State University Los Angeles, CA, 1992*, Perry Ehlig and Robert Stull, thesis advisors. A geochemical and field study of Basin and Range-style volcanism, and the relationships between eruptive style and tectonics. Field and petrographic relationships show that heterogeneous magma chambers existed during both early, calc-alkaline, and later, bi-modal (basalt + rhyolite) volcanic episodes. Magma mixing is prevalent only in earlier volcanic episodes, and magma stagnation depths may influence the degree of mixing. Stagnation depths appear to be greater for early andesite magmas; a change to shallow stagnation depths for the later, bi-modal volcanics, is hypothesized to result from an evolving state of lithosphere stress.

## **PUBLICATIONS**

### **Papers in Preparation**

Putirka, K. and Kuntz, M. (2005) Mantle Temperatures and Magma Conduits beneath the Snake River Plain, ID: Mineral-Melt Equilibria From the Craters of the Moon and Neighboring Volcanic Fields.

Putirka, K., Plumbing the depths of mantle heterogeneity, to be submitted to *G<sup>3</sup>* (Geochemistry, Geophysics, Geosystems), in preparation.

### **Field Guides**

Putirka, K. and Kuntz, M. (2005) A Mineralogic View Into the Magma Plumbing Systems of the Craters of the Moon and Neighboring Volcanic Lava Fields in the Snake River Plain, ID. Goldschmidt Meeting, Moscow ID, post-meeting trip.

Busby, C., Skilling, I., Wood, D., DeOreo, S., Gans, P., Putirka, K. (2004) Cenozoic volcanology and structural geology of the Carson Pass – Sonora Pass areas, central Sierra Nevada, California: Field trip in honor of Garniss Curtis and Burt Slemmons. Volcanological Society of Sacramento, July 22-25, 2004.

<http://www.geol.ucsb.edu/faculty/busby>.

### **Papers in Print or in Press**

Putirka, K. (2005a) Mantle potential temperatures at Hawaii, Iceland, and the mid-ocean ridge system, as inferred from olivine phenocrysts: Evidence for thermally-driven mantle plumes, *Geochemistry, Geophysics, Geosystems*, Paper # 2005GC000915

Putirka, K., (2005b) Igneous thermometers and barometers based on plagioclase + liquid equilibria: test of some existing models and new calibrations, *American Mineralogist*, v. 90, p. 336-346.

Putirka, K. and Condit, C. (2003) A cross section of a magma conduit system at the margins of the Colorado Plateau, *Geology*, v. 31, 701-704.

Putirka, K., Ryerson, F. J., and Mikaelian, H. (2003) New igneous thermobarometers for mafic and evolved lava compositions, based on clinopyroxene + liquid equilibria, *American Mineralogist*, v. 88, p. 1542-1554.

- Putirka, K. (1999a) Melting depths and mantle heterogeneity beneath Hawaii and the East Pacific Rise: Constraints from Na/Ti and REE ratios, *Journal of Geophysical Research*, v. 104, p. 2817—2829.
- Putirka, K. (1999b) Clinopyroxene+liquid equilibrium to 100 kbar and 2450 K, *Contributions to Mineralogy and Petrology*, v. 135, p. 151-163.
- Putirka, K. (1998a) Garnet+liquid equilibrium, *Contributions to Mineralogy and Petrology*, v. 131, p. 273—288.
- Putirka, K. (1997a) Magma transport at Hawaii: inferences from igneous thermobarometry, *Geology*, v. 25, p. 69—72.
- Putirka, K., M. Johnson, R. Kinzler, and D. Walker (1996) Thermobarometry of mafic igneous rocks based on clinopyroxene-liquid equilibria, 0-30 kbar, *Contributions to Mineralogy and Petrology*, v. 123, p. 92-108.

**Abstracts (CSU Fresno student authors are underlined):**

- Putirka, K.D. (2005) Estimates of Mantle Temperatures based on olivine phenocrysts and olivine-melt equilibria. Goldschmidt Conference Abstracts, 2005, *Geochimica et Cosmochimica Acta*, in press
- Putirka, K.D., Smart, C., and Polfer, K. (2004) Mineral Compositions from the Hawaii Scientific Drilling Project (HSDP): Preliminary Results Part III – Olivine, American Geophysical Union, fall meeting, 2004.
- Polfer, K., Smart, C., and Putirka, K.D. (2004) Mineral Compositions from the Hawaii Scientific Drilling Project (HSDP): Preliminary Results Part I – Clinopyroxene, American Geophysical Union, fall meeting, 2004.
- Rood, D.H., Busby, C.J., Putirka, K.D., and Gans, P., Range Front Faulting and Ancestral Cascades Arc Magmatism in the Central Sierra Nevada at 10 Ma: Onset of Basin and Range Extension or Sierran Root Delamination? American Geophysical Union, fall meeting, 2004.
- Smart, C., Polfer, K., and Putirka, K.D. (2004) Mineral Compositions from the Hawaii Scientific Drilling Project (HSDP): Preliminary Results Part II – Plagioclase, American Geophysical Union, fall meeting, 2004.
- Putirka, K. and Kuntz, Mel (2004) Temperature-pressure (depth) estimates of magmas from the Craters of the Moon and nearby lava fields, ID, based on mineral-melt equilibria: preliminary results, Geological Society of America Abstracts with Program, Cordilleran/Rocky Mountain section joint meeting, Boise ID, submitted.
- Putirka, K. (2003) New igneous thermobarometers based on plagioclase + liquid equilibria, *Eos, Transactions, American Geophysical Union*, v. 84, fall 2003, V41C-0312.
- Putirka, K., Condit, C. (2002) An interior view of the Springerville Volcanic Field, AZ Magma Plumbing System, *Eos, Transactions, American Geophysical Union*, v. 83, F1431.
- Putirka, K. (2001) New Igneous Thermobarometers for Evolved Lava Compositions Based on Clinopyroxene + Liquid Equilibria, *Eos, Transactions, American Geophysical Union*, v. 82, p. S430.
- Smith, S. and Putirka, K. (2001) "Crystallization depths for Holocene basaltic lavas from Craters of the Moon National Monument, ID, Sigma Xi Undergraduate Research Symposium, Indiana, Pa.

- Putirka, K. (2000) Mapping the depths of mantle components, *Eos, Transactions, American Geophysical Union, Spring meeting, 2000, Washington, DC., v. 81, p. 217.*
- Putirka, K., A. Kent, I. Hutcheon I., and F. Ryerson (1999c) Preliminary results regarding phlogopite-melt saturation and water partitioning, *Eos, Transactions, American Geophysical Union, Spring, 1999, Boston, v. 80.*
- Putirka, K. (1999d) Estimating the Mineralogy of the Upper Mantle, and Partial melting Depths and Temperatures of Oceanic Basalts, in *Institute of Geophysics and Planetary Physics, 1999 Annual Report, F. J. Ryerson ed., Lawrence Livermore National Laboratory.*
- Putirka, K. (1998b) Estimates of Mantle Heterogeneity and Initial Melting Depths at Hawaii and the East Pacific Rise, *Eos, Transactions, American Geophysical Union, Fall, 1998, v. 79, p. F939.*
- Putirka, K (1998c) Melting Depths and Heterogeneity Beneath Earth's Ocean Basins, *Institute of Geophysics and Planetary Physics, Annual Meeting, Los Alamos, NM.*
- Putirka, K. (1998d) Calibration of garnet + and clinopyroxene + liquid saturation surfaces, and some preliminary applications to komatiite petrogenesis (Invited), *Eos, Transactions American Geophysical Union, v. 79, p. S378.*
- Putirka, K. (1997b) Melt productivity during fractional melting and the apparent conflict between inferred melting depths and crustal thickness, *Eos, Transactions, American Geophysical Union, v. 78, p. F837-F838.*
- Putirka, K., M. Johnson, R. Kinzler, and D. Walker (1992) Thermobarometry of mafic igneous rocks based on pyroxene-liquid equilibria, 0-25 kb, *Eos, Transactions, American Geophysical Union, v. 74, p. 658.*
- Putirka, K. and P. Weigand (1987) Miocene volcanic rocks of the western Mojave Desert, California: evidence for magma-mixing, *Geological Society of America, Abstracts with Program, v. 19, p. 441.*