Application Report for Chenguang Sun

General Information

Name	Chenguang Sun
Applicant ID	673077
Applicant Type	External Applicant
Applicant Status	010 Active
Job Opening	46341 - Assistant Professor, 9 Month Salaried (Earth, Ocean and Atmospheric Science)
Highest Education Level	J-Doctorate (Academic)
Date Submitted	2019-11-14T10:49:59.000000-0500
Total Years of Experience	0.0

Contact Information

Name Prefix		**Address**	
First Name	Chenguang		
Middle Name		**Preferred Contact**	Not Specified
Last Name	Sun		
Name Suffix			

Phone Numbers

Phone Type	Telephone	Extension	Country Code	Preferred
Home	+14012150432			Yes

Email Addresses

Email Type	Email Address	Preferred
Home	csun@rice.edu	Yes

Vita/Resume and Attachments

Sun.CV.2019.pdf
Sun.Teaching.2019.pdf
Sun.Research.2019.pdf
Sun.References.2019.pdf
Sun.Cover_Letter.2019.pdf

Personal Information

POI Type	Unknown
Are you a former employee	No
Previous Termination Date	

Preferences

Desired Start Date			
Regular/Temporary			
Full/Part-Time			
Willing to Relocate			
Willing to Travel			
Travel Percentage			
Desired Work Days	☐ Monday	☐ Tuesday	☐ Wednesday
	☐ Thursday	☐ Friday	☐ Saturday
	☐ Sunday		
Minimum Pay	0.00 USD		
Desired Shift(s)			
Hours Per Week	0.00		

Additional Skills

First Choice

Second Choice

Comments

Referral Sources

No Referral Sources have been added to this applicant's profile

Work Experience

No Work Experience have been added to this applicant's profile

Training

No Training have been added to this applicant's profile

Degrees

Effective Date	05/24/2014
Degree	Doctor of Philosophy (PHD)
School Description	BROWN UNIVERSITY
Graduated	Yes
Terminal Degree for Discipline	Yes
Major Code	A15 - Geology

High School/Other Education

No High School/Other Education have been added to this applicant's profile

Licenses and Certifications

No Licenses and Certifications have been added to this applicant's profile

Memberships

No Memberships have been added to this applicant's profile

References

No References have been added to this applicant's profile

Questionnaire

Preliminary:

There are no questions associated with the screening level.

Final:

There are no questions associated with the screening level.

Pre Screening:

There are no questions associated with the screening level.

Additional Questions:

Question: In compliance with the Immigration Reform and Control Act, employees must be legally eligible to work in the U.S.; therefore, will you be able to provide proof of citizenship or authorization to work in the U.S. within 3 business days of being hired?

Answers		
Possible Answer	**Correct Answer**	**Selected Answer**
No		
Yes	✔	✔

Question: Will you now or in the future require sponsorship for employment visa status (e.g., H-1B visa status)?

Answers		
Possible Answer	**Correct Answer**	**Selected Answer**
No	✔	
Yes		✔

Question: Selective Service Question: [NOTE: If you are a Female; OR a Lawful non-immigrant on a visa (i.e. a foreign student, a tourist with unexpired Form I-94, or Border Crossing Document DSP-150); OR if you were born before January 1, 1960, select "Not Applicable". Documentation of exemption may be required.] If you are a Male who is or was required to register under the Selective Service Act, are you able to provide proof of Selective Service Registration? (Please select one answer only.) For more information, see the Selective Service System--Who Must Register chart at: https://www.sss.gov/Registration-Info/Who-Registration, or call (850) 644-6034.

Answers		
Possible Answer	**Correct Answer**	**Selected Answer**
No		
Yes	✔	
Not Applicable	✔	✔

Question: Do you have a relative [spouse, parent, grandparent, child, grand-child, sibling, aunt/uncle, or niece/nephew--whether related by blood, adoption, marriage ("in-laws" or "step"), or other legal action] currently employed by FSU?

Answers		
Possible Answer	**Correct Answer**	**Selected Answer**
No	✔	✔
Yes	✔	

Resume

CHENGUANG SUN

Postdoctoral Research Associate
Department of Earth, Environmental, and Planetary Sciences
Rice University, 6100 Main Street, MS-126, Houston, TX 77005

Website: earth-sun.weebly.com
Cell Phone: +1 (401) 215-0432
E-mail address: csun@rice.edu

RESEARCH INTERESTS

Deep volatile cycle; planetary differentiation and habitability; early solar system; magmatic and metamorphic processes; thermal and magmatic histories of Earth and planetary materials

EDUCATION

Ph.D., Geological Sciences, Brown University, Providence, RI, USA 2014
B.Sc., Geology, China University of Geosciences, Beijing, China 2007

PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate, Rice University 09/2016 – Present
Postdoctoral Research Associate, Brown University 04/2016 – 08/2016
Postdoctoral Investigator, Woods Hole Oceanographic Institution 03/2016
Postdoctoral Scholar, Woods Hole Oceanographic Institution 09/2014 – 02/2016
Research/Teaching Assistant, Brown University 08/2008 – 08/2014
Research Assistant, China University of Geosciences (Beijing) 07/2007 – 07/2008

HONORS/AWARDS/FUNDING

NSF-OCE: Documenting dynamic accretion in the lower ocean crust: ocean drilling holes U1473A and 735B, SW Indian Ridge. PI: H. Dick; Co-PI: C. Sun.
Total awarded: $ 495,003 to WHOI 09/2016 – 08/2019
Devonshire Postdoctoral Scholar, Woods Hole Oceanographic Institution
Total awarded: $ 92,250 to C. Sun 09/2014 – 02/2016
Dissertation Fellowship, Brown University 01/2013 – 05/2013
GSA Student Travel Grant 10/2013
AGU Outstanding Student Paper Award, VGP Section 12/2012
Outstanding Student Paper Award, National Annual Symposium on Petrology & Geodynamics, China 11/2007
Best Senior Thesis Award, China University of Geosciences (Beijing) 06/2007

THESES

Ph.D. Thesis: Trace element partitioning between mantle minerals and basaltic melts with applications to subsolidus re-equilibration and thermobarometry. Brown University, May 2014. Committee: Yan Liang (advisor), Alberto Saal, Marc Parmentier, Reid Cooper, Steve Parman, Bruce Watson (outside reader)

B.Sc. Thesis: Geochronology and geochemistry of Sailipu ultrapotassic volcanic rocks, Southern Tibet. China University of Geosciences (Beijing), June 2007. Advisor: Zhidan Zhao

PUBLICATIONS

Submitted/In revision

Sun C, Dasgupta R. Kimberlite thermobarometry reveals secular thinning of cratonic lithosphere through time. *Nature Geoscience*. Revision submitted on 10/02/2019

Dasgupta R, Chowdhury P, Eguchi J, **Sun C**, Saha S. Volatile-bearing partial melts in the lithospheric and sub-lithospheric mantle on earth and other rocky planets. *Review in Mineralogy and Geochemistry*. Submitted on 10/22/2019

2012–present

Sun C. (2019) Trace element geothermometry and geospeedometry for cumulate rocks: Quantitative constraints on thermal and magmatic processes during igneous crust formation. *Geophysical Monograph Series (AGU)*. *In press*. [*Invited contribution*]

Grewal DS, Dasgupta R, **Sun C**, Tsuno K, Costin G. (2019) Delivery of carbon, nitrogen and sulfur to the silicate Earth by a giant impact. *Science Advances*, 5(1), p.eaau3669. doi:10.1126/sciadv.aau3669

Sun C, Dasgupta R. (2019) Slab-mantle interaction, carbon transport, and kimberlite generation in the deep upper mantle. *Earth and Planetary Science Letters*, 506: 38–52. doi:10.1016/j.epsl.2018.10.028

Sun C, Lissenberg CJ. (2018) Caveats and challenges in geospeedometry: A reply to Faak et al.'s critique of the Mg-REE coupled geospeedometry. *Earth and Planetary Science Letters*, 502: 287–290. doi:10.1016/j.epsl.2018.08.044

Sun C, Lissenberg CJ. (2018) Formation of fast-spreading lower oceanic crust as revealed by a new Mg-REE coupled geospeedometer. *Earth and Planetary Science Letters*, 487: 165–178. doi:10.1016/j.epsl.2018.01.032

Sun C. (2018) Partitioning and partition coefficients. In Encyclopedia of Geochemistry. *Editor: W. White*. Springer. doi:10.1007/978-3-319-39193-9_347-1 [*Invited contribution*]

Sun C. (2018) Onuma diagrams. In Encyclopedia of Geochemistry. *Editor: W. White*. Springer. doi:10.1007/978-3-319-39193-9_344-1 [*Invited contribution*]

Sun C, Liang Y. (2017) A REE-in-plagioclase-clinopyroxene thermometer for crustal rocks. *Contributions to Mineralogy and Petrology*, 172(24). doi:10.1007/s00410-016-1326-9

Sun C, Graff M, Liang Y. (2017) Trace element partitioning between plagioclase and silicate melt: the importance of temperature and plagioclase composition, with implications for terrestrial and lunar magmatism. *Geochimica et Cosmochimica Acta*, 206: 273–295. doi:10.1016/j.gca.2017.03.003

Shimizu K, Liang Y, **Sun C**, Jackson C, Saal A. (2017) Parameterized lattice strain models for REE partitioning between amphibole and silicate melt. *American Mineralogist*, 102: 2254–2267.

Le Roux V, Nielsen S, **Sun C**, Yao L. (2016) Dating layered websterite formation in the lithospheric mantle. *Earth and Planetary Science Letters*, 454: 103–122

Sun C, Liang Y. (2015) A REE-in-garnet-clinopyroxene thermobarometer for eclogites, granulites

and garnet peridotites. *Chemical Geology*, 393: 79–92. doi:10.1016/j.chemgeo.2014.11.014

Sun C, Liang Y. (2014) An assessment of subsolidus re-equilibration on REE distribution among mantle minerals, olivine, orthopyroxene, clinopyroxene, and garnet in peridotites. *Chemical Geology*, 372: 80–91. doi:10.1016/j.chemgeo.2014.02.014

Dygert N, Liang Y, **Sun C**, Hess P. (2014) An experimental study of trace element partitioning between augite and Fe-rich basalts. *Geochimica et Cosmochimica Acta*, 132: 170–186

Liu D, Zhao Z, Zhu DC, Niu Y, DePaolo DJ, Harrison TM, Mo X, Dong G, Zhou S, **Sun C**, Zhang Z, Liu J. (2014) Postcollisional potassic and ultrapotassic rocks in southern Tibet: Mantle and crustal origins in response to India-Asia collision and convergence. *Geochimica et Cosmochimica Acta*, 143, 207–231

Sun C, Liang Y. (2013) The importance of crystal chemistry on REE partitioning between mantle minerals (garnet, clinopyroxene, orthopyroxene and olivine) and basaltic melts. *Chemical Geology*, 358: 23–36. doi:10.1016/j.chemgeo.2013.08.045

Sun C, Liang Y. (2013) Distribution of REE and HFSE between low-Ca pyroxene and lunar picritic melts around multiple saturation points. *Geochimica et Cosmochimica Acta*, 119: 340–358. doi:10.1016/j.gca.2013.05.036

Liang Y, **Sun C**, Yao L. (2013) A REE-in-two-pyroxene thermometer for mafic and ultramafic rocks. *Geochimica et Cosmochimica Acta*, 102: 246–260

Yao L, **Sun C**, Liang Y. (2012) A parameterized model for REE distribution between low-Ca pyroxene and basaltic melts with applications to REE partitioning in low-Ca pyroxene along a mantle adiabat and during pyroxenite-derived melt and peridotite interaction. *Contributions to Mineralogy and Petrology*, 164: 261–280

Sun C, Liang Y. (2012) Distribution of REE between clinopyroxene and basaltic melt along a mantle adiabat: effects of major element composition, water, and temperature. *Contributions to Mineralogy and Petrology*, 163: 807–823. doi:10.1007/s00410-011-0700-x

2007–2009

Zhao Z, Mo X, Dilek Y, Niu Y, DePaolo DJ, Robinson P, Zhu D, **Sun C**, Dong G, Zhou S, Luo Z, Hou Z. (2009) Geochemical and Sr-Nd-Pb-O isotopic compositions of the post-collisional ultrapotassic magmatism in SW Tibet: Petrogenesis and implications for India intra-continental subduction beneath southern Tibet. *Lithos*, 113: 109–212

Yang Z, Luo Z, Zhang H, Zhang Y, Huang F, **Sun C**, Dai J. (2009) Petrogenesis and Geological Implications of the Tianheyong Cenozoic Basalts, Inner Mongolia China. *Earth Science Frontiers*, 16(2): 90–106. doi:10.1016/S1872-5791(08)60083-4

Zhu DC, Mo XX, Zhao ZD, Xu JF, Zhou CY, **Sun CG**, Wang LQ, Chen HH, Dong GC, Zhou S. (2008) Zircon U-Pb geochronology of Zenong group volcanic rocks in Coqen area of the Gangdese, Tibet and tectonic significance. *Acta Petrologica Sinica*, 24(3): 401–412

Sun CG, Zhao ZD, Mo XX, Zhu DC, Dong GC, Zhou S, Chen HH, Xie LW, Yang YH, Sun JF, Yu F. (2008) Enriched mantle source and petrogenesis of Sailipu ultrapotassic rocks in southwestern Tibetan Plateau: constraints from zircon U-Pb geochronology and Hf isotopic 8 compositions. *Acta Petrologica Sinica*, 24(2): 249–264

Zhao ZD, Mo XX, **Sun CG**, Zhu DC, Niu YL, Dong GC, Zhou S, Dong X, Liu YS. (2008) Mantle xenoliths in southern Tibet: geochemistry and constraints for the nature of the mantle. *Acta Petrologica Sinica*, 24(2): 193–202

Sun CG, Zhao ZD, Mo XX, Zhu DC, Dong GC, Zhou S, Dong X and Xie GG. (2007) Geochemistry and origin of the Miocene Sailipu ultrapotassic rocks in western Lhasa block, Tibetan Plateau. *Acta Petrologica Sinica*, 23(11): 2715–2726

Zhao Z, Mo X, Dong G, Zhou S, Zhu D, Liao Z, **Sun C**. (2007) Pb isotopic geochemistry of Tibetan plateau and its implications. *Geoscience*, 21(2): 265–274

RECENT CONFERENCE ABSTRACTS

Sun C, Dasgupta R. (2019) Thermobarometry of silica-poor intraplate magmas as a probe into the melting depth and thermal vigor of the Earth's mantle. AGU Fall Meeting, V13B-08

Dasgupta R, **Sun C**. (2019) Generation of kimberlitic melts – experimental and natural thermobarometric constraints and insights into materials transfer across mantle transition zone. AGU Fall Meeting, DI24A-01

Sun C, Dasgupta R. (2019) Kimberlite evidence for the evolution of cratonic lithosphere. Gordon Research Conference: Interior of the Earth. South Hadley, MA, USA.

Liang Y, Cherniak D, **Sun C**. (2018) Some remarks on the multiple time scales of diffusion in minerals and melts. GSA Annual Meeting in Indianapolis, Indiana, USA. Vol. 50, No. 6

Sun C, Dasgupta R. (2018) Slab-mantle interaction, carbon transport, and kimberlite generation in the deep upper mantle. Gordon Research Conference: Deep Carbon Science in the Context of Geologic Time. Smithfield, RI, USA.

Sun C, Dasgupta R. (2017) Reactive transport of slab-derived carbonatitic melts in the deep upper mantle and generation of kimberlites. AGU Fall Meeting, abstract# V33F–0580

Grewal DS, Dasgupta R, **Sun C**, Tsuno K. (2017) Simultaneous alloy-silicate fractionation of carbon, nitrogen, and sulfur at high pressures and temperatures: Implications for establishing the volatile budget of the Earth. AGU Fall Meeting, abstract# V14B–05

Sun C, Liang Y. (2017) The importance of temperature on REE and other trace element partitioning in plagioclase with applications to lunar magma ocean solidification. 48th Lunar and Planetary Science Conference, abstract# 1535

Sun C, Dick H, Hellebrand E, and Snow J. (2015) Magma supply at the Arctic Gakkel Ridge: constraints from peridotites and basalts. AGU Fall Meeting, abstract# V11B–3068

Liang Y, **Sun C**, Yao L, Dygert N, Wang C. (2015) Some remarks on the interpretation of the REE-in-two-mineral thermobarometers. AGU Fall Meeting, abstract# V13A–3093

Le Roux V, **Sun C**, Nielsen S, Yao L. (2015) Timing of frozen melt fronts preserved in the mantle. AGU Fall Meeting, abstract# V11B–3061

Shimizu K, Liang Y, **Sun C**, Jackson C, Saal A. (2015) Parameterized lattice strain models for REE partitioning between amphibole and silicate melt, AGU Fall Meeting, abstract# V13A–3091

Sun C, Liang Y. (2015) HFSE partitioning in pyroxenes and olivine: parameterized models with implications to HFSE fractionation in the upper mantle. Goldschmidt, abstract # 2052

Liang Y, **Sun C**. (2015) Temperature and thermal history of HED and SNC meteorites as deduced from the REE-in-plagioclase-clinopyroxene thermometer. 46th Lunar and Planetary Science Conference, abstract# 1244

Sun C, Liang Y. (2014) Crystallization temperatures of Lunar FANs revealed by a new REE-in-plagioclase-clinopyroxene thermometer. Goldschmidt, abstract # 2412

Sun C, Liang Y, Ashwal L, and VanTongeren J. (2013) Temperature variations along stratigraphic height across the Bushveld complex with implications for magma chamber processes in layered intrusions. GSA Annual Meeting in Denver: 125th Anniversary of GSA (27-30 October 2013)

Sun C, Yao L, Liang Y. (2013) Thermobarometers based on REE partitioning between mantle minerals. GSA Annual Meeting in Denver, Colorado, USA. Vol. 45, No. 7

Sun C, Liang Y. 2013. Distribution of REE between garnet and clinopyroxene: a new thermobarometry for garnet peridotites and eclogites. AGU Fall Meeting, abstract# V51B–2649

Liang Y, **Sun C**, Ashwal L, VanTongeren J. (2013) Spatial variations in temperature across the Bushveld layered intrusion revealed by REE-in-plagioclase-pyroxene thermometers with implications for magma chamber processes. AGU Fall Meeting, abstract# V54B–07

Sun C, Liang Y. (2013) A REE-in-plagioclase-clinopyroxene thermometer for mafic and ultramafic rocks from the Earth, Moon, and other planetary bodies. 44th Lunar and Planetary Science Conference, abstract# 1627

Sun C, Liang Y, Hess P. (2013) A parameterized thermodynamic model for ilmenite solubility in silicate melts. 44th Lunar and Planetary Science Conference, abstract# 2295

Graff M, **Sun C**, Liang Y. (2013) Internally consistent REE partitioning models for anorthite and low-Calcium pyroxene: a reappraisal of subsolidus reequilibration with applications to parent magma compositions of lunar ferroan anorthosites. 44th Lunar and Planetary Science Conference, abstract# 1641

Sun C, Liang Y, Yao L. (2012) A REE-in-two-pyroxene thermometer and a REE-in-garnet-cpx thermometer for mafic and ultramafic rocks. AGU Fall Meeting, abstract# V33C–2888

TEACHING EXPERIENCE

Guest Lectures in Advanced Petrology, Rice University	09/2016 & 02/2018 & 10/2019
Supervisor for Lauren Oquinn (REU intern), Rice University	06/2018 – 07/2018
Supervisor for Michael Dean (REU intern), Rice University	06/2017 – 08/2017
Supervisor for Michelle Graff (senior thesis), Brown University	08/2012 – 05/2013
Supervisor for Emma Soucy (co-op intern), WHOI	07/2015 – 12/2015
Teaching Assistant in Mineralogy, Brown University	09/2011 – 12/2011
Instructor of Field Geology, China University of Geosciences (Beijing)	07/2008

FIELD EXPERIENCE

Field work in South Tibet, China for mapping and sampling 08/2006
Field camp in Zhoukoudian, Beijing, China for training field methods 07/2005
Field camp in Beidaihe, Hebei, China for training field methods 07/2004

SKILLS

High-temperature experiments: Multi-Anvil, Piston Cylinder, & Gas-mixing furnace
Analytical tools: SIMS, Electron Microprobe, LA-ICP-MS
Computational tools: MATLAB, COMSOL, VBA/VB/Fortran/C
(*VBA/Matlab programs for my papers are available at http://earth-sun.weebly.com/tools.html*)

SERVICES

Conference Convener

"Quantities, Movements, Forms, and Origins of Carbon and Other Volatile Elements in Earth and Planetary Bodies", AGU Fall Meeting, 2019
"Advances in geothermobarometry and geospeedometry", AGU Fall Meeting, 2015
"Peridotite records of mantle dynamics", AGU Fall Meeting, 2015
"Advances in trace element partitioning", Goldschmidt conference, 2015

Journal/Proposal Reviewer

Geochimica et Cosmochimica Acta; Chemical Geology; Journal of Geophysical Research (Solid Earth); Geochemistry, Geophysics, Geosystems; Geochemical Perspectives Letters; Lithos; American Journal of Science; American Mineralogist; Tectonophysics; Earth-Science Review; Minerals; Nature Communications; Science Advances; Earth and Planetary Science Letters; National Science Foundation (US NSF)

INVITED SEMINARS

Princeton University 04/2019
Tulane University 03/2018
University of Missouri at Columbia 02/2018
University of Texas at Austin 11/2016
Texas A&M University 04/2016
Stanford University 03/2016
Dartmouth College 02/2016
Rice University 02/2016
Rensselaer Polytechnic Institute 10/2015
China University of Geosciences (Beijing) 07/2015
University of Chicago 02/2015
University of Chicago 04/2014
Woods Hole Oceanographic Institution 01/2014
Boston University 03/2013

References

Contact Information of References

CHENGUANG SUN

Postdoc advisor: Professor **Cin-Ty Lee**
Department of Earth, Environmental, and Planetary Sciences, Rice University
6100 Main Street, MS-126
Houston, TX 77005
Phone: +1 713 348 5084
Email: ctlee@rice.edu

Postdoc advisor: Professor **Rajdeep Dasgupta**
Department of Earth, Environmental, and Planetary Sciences, Rice University
6100 Main Street, MS-126
Houston, TX 77005
Phone: +1 713 348 2664
Email: Rajdeep.Dasgupta@rice.edu

Academic advisor (PhD Thesis Committee): Professor **Bruce Watson**
Department of Earth and Environmental Sciences, Rensselaer Polytechnic Institute
Troy, New York 12180-3590
Phone: +1 518 276 8838
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PhD Supervisor: Professor **Yan Liang**
Department of Earth, Environmental and Planetary Sciences, Brown University
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Providence, RI 02912
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Cover Letters

Chenguang Sun, Postdoc Research Associate
Earth, Environmental and Planetary Sciences
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11-14-2019

Faculty Search Committee
Department of Earth, Ocean and Atmospheric Sciences
Florida State University

Dear Faculty Search Committee,

I am writing to apply for the position of tenure-track Assistant Professor in Solid Earth Processes of the Lithosphere at Florida State University. I am now a postdoctoral research associate at Rice University. After received my PhD in Geological Sciences at Brown University in 2014, I also worked at Woods Hole Oceanographic Institution as a Devonshire Postdoctoral Scholar.

My research is motivated by quantitatively understanding the thermal and chemical histories of Earth and planetary materials. I am particularly interested in volatile cycling, magmatic and metamorphic processes, planetary differentiation, and planet habitability, as well as early solar system processes. To approach these problems, I develop geochemical/petrological models through laboratory experiments and further apply these models to natural samples/observations for decoding the temperatures, pressures, redox conditions, rates, and chemical tracers of these processes. Specifically, my research focuses mostly on deep volatile cycle, thermobarometry and speedometry of Earth and planetary materials, and equilibrium/kinetic fractionation of trace elements (and stable isotopes).

In the past, I have developed a series of models for trace element partitioning in mantle/crustal minerals during magmatic processes, a new type of thermometers and barometers based on the partitioning of slowly diffusing rare earth elements between coexisting minerals, and a new speedometry for unique constraints on the full cooling paths (i.e., initial temperatures and cooling rates) of crustal rocks. At Rice, from my experimental studies on deep carbon cycle. I have defined a new concept (i.e., carbonation freezing front) to quantify the transport of CO_2-rich magmas above the slab-mantle interface and have also developed a new liquid thermobarometer for kimberlite and other silica-poor volatile-rich melts. Applying this thermobarometer to global kimberlites, I have established a new framework for understanding the extent and mechanism of global cratonic lithosphere destabilization through time.

In addition, I have gained a wide range of teaching experience by instructing undergraduate courses and mentoring undergraduate and graduate students. My teaching and research experiences have well prepared me to teach introductory and advanced courses in Geology, Geochemistry and Earth Materials and also to supervise students with various backgrounds. As an assistant professor at Florida State University, I will dedicate my career to leverage diversity and to enhance inclusion in my research group and the community at large. Enclosed are my curriculum vitae, detailed statements of research, teaching, and diversity/inclusion, and contact information of references.

Thank you for your time and consideration. I look forward to hearing from you.

Sincerely,
Chenguang Sun

Teaching Philosophy

Teaching Statement

CHENGUANG SUN

My interest in pursuing an academic career in Earth Sciences was enlightened by several great teachers during my college and PhD studies. From them, I learned that quality teaching should convey fundamental concepts by leading students to develop critical thinking and problem-solving skills. I was fortunate to establish my own methods and to grain direct experience through teaching and working with undergraduate and graduate students over the years.

Geology classes naturally involves field observations, so it is easy to stimulate discussion with students by asking what, why, how, and when regarding the observations. These simple questions are my first step to initiate curiosities of students about the fundamental basics behind the observations. Depending on the size of the class, I encourage individual students or representatives of individual groups to share their own speculations or hypotheses. Their initial thoughts are rather valuable to further make them involved in the class subjects. This is the second but most important step of my teaching. Once they have their own ideas, I guide them to collect and find supporting evidence through hands-on work. Some of the fundamental basics are delivered naturally to students when summarizing and reviewing their evidence, while remaining parts can be addressed and highlighted consecutively. Although it requires more preparations, this three-step approach has been proven to be very efficient while I was teaching *Field Geology* at CUGB, *Mineralogy* at Brown, and guest-lecturing *Advanced Petrology* at Rice.

Mentoring students is also valuable teaching experience. I have mentored several undergraduate students and junior graduate students at Brown, WHOI and Rice for working on research projects related to trace element partitioning, magma generations, and planetary accretion. In fact, my undergraduate students had few or even no prior science backgrounds, but some of them decided to pursue graduate degrees in physical sciences. By working with these students, I found that my three-step teaching approach in one-on-one mentoring could also efficiently foster students to make progress in their research projects. The first and second steps could involve them in research with their own motivating questions, while the third step could train them with necessary problem-solving skills. My initial goal of mentoring is to make students become increasingly independent of bringing new thoughts and running new experiments when they are more involved in the projects. Once the initial goal achieves, I provide suggestions and make clarification to help them frame their own ideas that can further motivate them to move forward with the research projects. Because the research process is not always straightforward, it is also important to be patient, open-minded, and supportive while leading students to go through difficult times.

Overall, teaching and mentoring students have been enjoyable and always motivating me to think deeply about the fundamental questions of my research, from where I benefit most. As an Assistant Professor at Florida State University, I would be willing to teach classes ranging from introductory to advanced levels in Geology, Geochemistry and Earth Materials, such as *Physical Geology* (GLY 2010C), *Energy, Resources, and the Environment* (GLY 3039), *Mineralogy and Crystallography* (GLY 3200C), *Igneous and Metamorphic Petrology* (GLY 3310C), *Principles of Geochemistry* (GLY 4240), *Ore Deposits* (GLY 4812C), *Advanced Topics in Geochemistry* (GLY 5297r), *and Advanced Topics in Petrology* (GLY 5395r). As quantitative analyses and problem-solving skills are of fundamental importance for modern physical geology, I would be willing to contribute my quantitative skills to new or existing courses. In addition, I am also interested in developing new courses or add new components to existing courses on thermal and magmatic processes from planetary crustal formation to early Solar system. My experience in teaching and mentoring has well prepared me to interact with students with various backgrounds.

Statement of Diversity and Inclusion

CHENGUANG SUN

The diversity and multicultural nature of our society require leaders and individuals to establish a supportive and inclusive workplace. Essential elements of this environment include accountability, fairness, and respect. The first two elements are the basic missions of leaders. When the leaders provide the first two elements, the latter can be achieved by treating each other with respect and dignity. Because individuals have their unique capabilities and experiences, it is also important for leaders to recognize and to include their characteristics for maintaining a more effective workplace. Only in such a work environment, individuals may feel comfortable to seek out different ideas, to learn from colleagues, and to maximize their potentials. Thus, enhancing diversity and inclusion is essential for a high-performance organization as well as a creative research group.

Science community in general is open and liberal. Because of this, I was fortunately offered the opportunity to pursue my PhD degree in the United States. Moving from a foreign country to the States, I did encounter some challenges at the beginning of my graduate study mostly due to the cultural shock. Through interactive classes and many activities organized by the department and university, I gradually realized the support and inclusion from the open and friendly faculty, staff, and fellow graduate students at Brown University. Although trained as a geologist with emphases on field study and geochemistry during my college, I also gained a wide range of experience in computational programing for my personal interest. At Brown, my computational skills were well recognized by professors and fellow students and further became the uniqueness of my PhD research in experimental petrology/geochemistry. Helping other students with their MATLAB codes for class or research projects became one of my voluntary jobs for the Geochemistry group in the department. After hours code debugging, I really enjoyed the moments when I solved the issues for others. New research ideas were also developed through these processes, and some of these ideas turned into publications with me as a co-author. During my six-year graduate school, the supportive and inclusive environment in the department not only helped my fellow students and me with fruitful accomplishments but also imprinted in my mind the essential elements (i.e., accountability, fairness, and respect) for maintaining a creative research group.

After finished my PhD study, I have stayed in two other prodigious research institutes, which both impressed me by their diverse but inclusive environments. As a Devonshire Postdoctoral Scholar at Woods Hole, I was treated the same as staff scientists and was able to interact with other scientists with different research and cultural backgrounds. Working together with them, I have gained more practical experience regarding how to put a scientific idea into a grant proposal, a major component of research that was not included in my PhD training. My postdoctoral research groups at Rice University have students and postdocs from several different countries, while our research subjects cover a wide range of high-temperature processes from the surface volatile budgets to the deep mantle dynamics. Through helping students develop quantitative models, I also expanded my research to early planetary processes. Overall, in these supportive and inclusive work environments, all members of the group could benefit from others by sharing ideas and expertise.

As an Assistant Professor at Florida State University, I will dedicate my career to leverage diversity and to enhance inclusion in my research group and the science community. Through continuously seeking funds, I would actively recruit students with various backgrounds and create research opportunities for them, particularly for those from underrepresented groups. I would also be more than happy to work with the department and the University to maintain a supportive and inclusive environment for the community at large.

Research Interest

Research Statement

CHENGUANG SUN

My research is motivated by a strong interest in quantitative understanding the thermal and chemical histories of Earth and other planetary materials. I am particularly interested in the origin and distribution of volatiles in terrestrial planets, influences of volatile (re)cycling on planetary magmatism and habitability, generation and differentiation of various magmas, planetary differentiation (e.g., formation of crust, lithosphere and core), and early solar system processes. To approach these problems, I develop testable geochemical/petrological models through high-temperature, high-pressure laboratory experiments and further apply these models to field samples (or observations) for decoding the temperatures, pressures, redox conditions, rates, and chemical tracers of these processes. The fundamental aspects of my research include deep volatile cycle, thermobarometry and speedometry of Earth and planetary materials, and equilibrium fractionation of trace elements and stable isotopes.

1. Deep volatile cycle

Deep cycle of life-essential volatile elements (e.g., C, H, N, S, and P) has a great influence on the long-term evolution of planetary habitability and tectonics. Outstanding questions concern their origin in terrestrial planets, their distribution and interaction among different reservoirs through time, and their chemical and dynamic consequences. The experimental approach to these questions includes (1) phase equilibria of volatile-bearing petrological systems, (2) interaction of volatile-rich magmas with mantle and crustal materials, and (3) partitioning and diffusion of volatile elements and their isotopes in various terrestrial materials. ***The goal of my research in volatile cycle*** is to address the aforementioned questions and particularly their influences on planetary habitability through a combination of laboratory experiments and field samples for planetary bodies of distinct compositions and redox conditions. My postdoc research at Rice focuses mostly on (1) and (2) for understanding carbon cycle and CO_2-rich magmatism[1,2] but also involves (3) on C-N-S partitioning in metal-silicate systems[3] for understanding the origin of Earth's volatile elements.

Carbon transport between Earth's surface and its interior mainly through subduction of carbon-bearing materials into the mantle and emission of carbon-bearing volatiles from deep liquids. The timescales of such deep carbon cycling, however, depends on the fate of slab-derived carbonatite melts in the overlying mantle peridotites, which remains unclear. Using multi-anvil experiments and parameterized phase relation models[2], I found that through dissolution-precipitation reactions, slab-derived carbonatite melts become kimberlitic in the ambient mantle and could form channelized melt flows for rapid transport; however, reactive melting at the slab-mantle interface can only commence when the slab-released carbonatite melt conquers the *carbonation freezing front*, a new concept for describing peridotite solidi suppressed by infiltrating CO_2-rich melts of various compositions in an open peridotitic system. Depending on temperatures and local influxes, reactive melting and freezing can both occur above the slab-mantle interface, yielding heterogeneous lithologies and redox conditions as well as various timescales of carbon transport in Earth's mantle[2].

Using experimental data, I also developed a new liquid-based thermobarometer for garnet-peridotite partial melts with various amounts of volatiles[1]. This new thermobarometer is particularly useful to constrain the mantle equilibration temperature-pressure conditions of primary kimberlite magmas and other silica-undersaturated volatile-rich melts, which otherwise is unable to accurately constrain through existing thermobarometers. As unique mantle-derived melts at ancient continents, kimberlites are ideal records to constrain the temporal variation of cratonic lithosphere thickness and 20 the processes affecting the lithosphere root. Applying this new thermobarometer to a global kimberlite dataset, I found that (1) the depths of kimberlite generation indicate a decrease of up to ~150 km in the lithosphere thickness of global cratons during the past ~2 Gyr and that (2) such lithosphere thinning is primarily controlled by increasing CO_2-rich melts from deep subduction of carbonated oceanic crusts. These findings[1] set a new framework for understanding global lithosphere stability through time.

2. Thermobarometry and speedometry of Earth and planetary materials

Quantitative extraction of temperature and pressure from rock records relies on thermometers and barometers that are calibrated experimentally based on temperature- and pressure-sensitive partitioning of elements (or isotopes) of interest between coexisting phases. Because rocks readily undergo subsequent cooling or heating, the distribution of these elements is readily reset to various closure temperatures depending on their diffusivities and thermal histories[4]. With the knowledge of diffusivities and reliable thermobarometers, the extents of diffusive resetting could then be used as speedometers to constrain the thermal histories of Earth and planetary materials. Previous thermometers are based on the partitioning of major cations (e.g., Ca, Mg, and Fe) between coexisting minerals. Since these major cations have rapid diffusion rates in minerals, temperatures derived from these thermometers are incapable of constraining earlier temperatures of rock formation.

Following my crystal-melt partitioning studies[5–9], I have developed a new set of thermometers and thermobarometers based on the partitioning of slowly diffusing rare earth elements (REE) in different petrological systems[10–12]. These new thermobarometers could make use of all REE as a group to simultaneously constrain robust temperatures and pressures of earlier thermal events. Specifically, REE thermometry records earlier cooler events for thermally perturbed rocks[11] but documents earlier hotter events for those experiencing cooling[10–12]. A striking feature of the REE thermometry for cumulate rocks[12] is that it can determine temperatures close to crystallization. This enables one to directly track magma chamber dynamics[16] and to further shed light on ore deposition in large layered mafic intrusions. Using experimentally determined diffusion coefficients, REE thermometry can also determine the cooling times (i.e., ages) of heterogeneous components in lithosphere mantle[13].

An important implication of the newly developed REE thermometry is that a combination of fast and slowly diffusing elements provides a unique solution to simultaneously constrain the two thermal parameters[4,14], i.e., the initial temperature and cooling rate, which are otherwise difficult to obtain both using single-element based thermometry. The major challenges, however, include (a) experimentally measuring the partition and diffusion coefficients of the elements or isotopes of interest and (b) numerically modeling multi-component chemical diffusion in the relevant system. ***My future research along this line*** will overcome these challenges by (1) designing new partitioning/diffusion experiments and (2) developing new diffusion models with a focus on geological applications to different tectonic settings (e.g., cratonic mantle, oceanic lithosphere, and subduction zone) or planetary materials (e.g., FAN, SNC, HED, and CAI).

A particular geological setting that I have started to work with is the Earth's oceanic crust. Ocean crust is mainly composed of gabbros and solidifies from mantle-derived magmas beneath mid-ocean ridges. These gabbros record the styles of igneous accretion and subsequent cooling at the spreading centers. In a recent paper[14], I have developed a new Mg–REE coupled speedometer based on the differential diffusive closures of Mg and REE in oceanic gabbros. To accurately determine Mg closure temperatures, I have also calibrated a new Mg-exchange thermometer. Applications of this Mg–REE coupled speedometer to Hess Deep gabbros support in situ solidification of the lower oceanic crust in crystal mushes and efficient heat extraction by deep hydrothermal circulation at fast-spreading ridges[14].

Results of my speedometry also reveal off-axial magma lenses with anomalously rapid cooling rates in the lower oceanic crust and further depict a new model of ocean crust formation at fast-spreading ridges. This new speedometer can also be applied to slowly spreading oceanic crusts, layered mafic intrusions, and other planetary materials for a comprehensive understanding of their thermal histories.

3. Partitioning of trace elements and stable isotopes

Partitioning determines the equilibrium fractionation of a chemical species or an isotope between coexisting phases. The main theme of partitioning studies focuses on three systems[15], crystal-melt, metal-silicate, and sulfide-silicate. Crystal-melt partition coefficients are fundamental for understanding chemical differentiation and physical conditions during magmatic processes. Metal-silicate partition coefficients can be used to constrain the composition and formation of metallic cores. Sulfide-silicate partition coefficients have great implications for the fractionation of sulfide-loving elements during ore deposition, magma differentiation and core formation. However, changes in temperature, pressure, composition, and redox condition give rise to orders of magnitude variations in partition coefficients[15]. Thus, a major goal of partitioning studies is to experimentally calibrate accurate partitioning models for quantitively tackling chemical fractionation during planetary differentiation.

The crystal-melt system involves many different minerals in the mantle and crust (e.g., olivine, clinopyroxene, orthopyroxene, garnet, and plagioclase). Each mineral has unique characteristics of partition coefficients mainly due to its crystal structure. To quantify trace element fractionation by major rock-forming minerals in the upper mantle and lower crust, I have developed a series of self-consistent lattice strain models based on experimentally determined partitioning data[5–9]. These models demonstrate that the effects of temperature and mineral composition compete with each other during adiabatic mantle melting[5] but become enhanced during solidification of global-scale magma oceans[9]. The interplays between the two factors result in nearly constant partition coefficients in the former case[5,7] but significant variations of partition coefficients in the latter case[9]. Hence, variable partition coefficients have to be considered for modeling magma ocean differentiation. In addition, my mineral-melt partitioning models are testable using field samples and further reveal significant subsolidus redistribution of trace elements among minerals in mantle peridotites[8].

<u>My future research along this line</u> will cover the crystal-melt, metal-silicate, and sulfide-silicate systems with particular foci on two major subjects:

(1) Crystal-melt partitioning of slowly diffusing multivalent elements and their isotopes: Multivalent element partitioning (and isotopic fractionation) is sensitive to redox conditions and thus can be calibrated as oxybarometers. Different from the widely used redox sensors based on Fe^{2+}/Fe^{3+} fractionation, oxybarometers based on slowly diffusing trace elements or isotopes are more resistant to secondary alternations and can potentially track primary redox records. The anticipated results can be used to assess redox evolution during magma chamber differentiation in layered mafic intrusions and redox histories of Earth and other planetary materials (e.g., FAN, SNC, HED, & CAI).

(2) New theoretical models for metal-silicate and sulfide-silicate partitioning: Numerous experiments have been performed to investigate chemical fractionation in metal-silicate and sulfide-silicate systems during core formation and planetary accretion; however, controversies on early planetary differentiation remains unresolved. With my background in mineral-melt partitioning studies, I am planning to provide a resolution by developing a new theoretical framework for trace element partitioning in metal-silicate and sulfide-silicate systems.

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