

## Minako RIGHTER (TAMAKI)

### *Curriculum Vitae*

*Lab Supervisor II, Department of Earth and Atmospheric Sciences  
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#### **Research Interests and Experience**

My research focuses on investigating the formation and evolution of differentiated asteroid and planetary bodies such as Vesta, Mars and Moon using various radiogenic isotope systematics and trace elements. For my PhD I studied stony-iron meteorite to investigate formation of Mesosiderite parent body. Current research at the University of Houston on various meteorites, Apollo samples aims to investigate the geochemical evolution of Moon, Mars, asteroids using various radiogenic isotope systematics (Rb-Sr, <sup>142</sup>Sm-Nd, U-Pb, Lu-Hf, Al-Mg). As a lab supervisor at University of Houston, I maintain five laboratories (the clean laboratory class 500, the Nu-plasma MC-ICP-MS research laboratory, the ICP research laboratory, rock preparation facility, the sample ashing laboratory), provide safety oversight of laboratory operations, give training to students, postdocs and researchers. I also have experience in setting up a laboratory including spike calibration, method development for chemical separation procedures for both radiogenic and stable isotopes. I also have a curator certificate and have experience and working knowledge about petrographic characterization, digital imaging, inventory and cataloging of meteorites.

#### **Education**

- 2006 Ph.D. ***The Graduate University for Advanced Studies***, (*National Institute of Polar Research*)  
Tokyo, Japan  
Thesis: Mineralogical and geochemical study of mesosiderite: Implication for the formation and differentiation history of the mesosiderite parent body.  
Advisors: Dr. Misawa Keiji
- 2002 M.S. ***Kobe University***, Department of Earth and Planetary Sciences, Graduate School of Science and Technology (Cosmochemistry), Kobe, Japan  
Thesis: Rb-Sr isotopic systematics and REE abundances of CK chondrites.  
Advisors: Prof. Noboru Nakamura
- 2000 B.A. ***Kobe University***, Department of Earth and Planetary Sciences, (Cosmochemistry), Kobe Japan  
Thesis: Rb-Sr study of R-group chondrites.  
Advisors: Prof. Noboru Nakamura

#### **Appointments**

- 1/08-present Lab Supervisor, Dept. Earth and Atmospheric Sciences, University of Houston, TX
- 5/08-9/08 Postdoctoral fellow, Dept. Earth and Atmospheric Sciences, University of Houston, TX
- 4/07-3/08 Visiting Research Scientist, Lunar and Planetary Institute, Houston, TX
- 10/06-4/07 Research Scientist, The Graduate University for Advanced Studies, Tokyo, Japan
- 4/02-11/02 Research Assistant, The Graduate University for Advanced Studies, Tokyo, Japan
- 4/00-9/00 Teaching Assistant, The Graduate University for Advanced Studies, Tokyo, Japan

#### **Certification**

Curatorial Certification

#### **Services**

- 2016-2017 The Antarctic Search for meteorites volunteer  
2014 NASA NESSF14 Planet Chsmochemistry Panel

#### **Awards and fundings**

- 2008 Student Travel Award to attend 71<sup>th</sup> Annual Meeting of the Meteoritical Society on Tennessee  
2005 Student Travel Award to attend 68<sup>th</sup> Annual Meeting of the Meteoritical Society on Tennessee  
2002-2003 Sasakawa Scientific Research Grant “Differentiated history of the mesosiderite parent body”

(\\$ 4.5K M. Tamaki, PI)

### **Laboratory and Analytical skills**

- 2014-present Refinement, sample preparation and training in the use of ICP Triple Quad (**ICP-QQQ**) for isotope ratio and isotope dilution measurement
- 2012-present Refinement, sample preparation and training in the use of Microwave Plasma Atomic Emission Spectrometry (**MP-AES**) for isotope ratio and isotope dilution measurement
- 2008-present Refinement, sample preparation and training in the use of Multi Collector Inductively Coupled Plasma Mass Spectrometry (**MC-ICP-MS**; Nu-Plasma) for isotope ratio and isotope dilution measurement
- 2008-present Refinement, sample preparation and training in the use of Laser Ablation Inductively Coupled Plasma Mass Spectrometry (**LA-ICP-MS**; Photon Machines Analyte 193 short pulse eximer laser ablation system coupled with Varian ICP-MS) for the chemical analysis of minerals
- 2002-2006 Refinement, sample preparation and training in the use of Secondary Ionisation Mass Spectrometry (**SIMS**; SHRIMP-II) at the National Institute of Polar Research, Tokyo, Japan.
- 2002-present Making grain mounts, thin and thick sections of meteorites, terrestrial rocks and minerals
- 2002-present Cutting rocks and mineral using rock saws
- 1998-present Characterizing various meteorites and Apollo samples using microscope and electron beam
- 1998-present Working experience in clean-room laboratory
- 1998-present Refinement, sample preparation and training in the use of Thermal Ionization Mass Spectrometry (**TIMS**; **Triton** and MAT-262) for the chemical analysis of minerals.
- 1998-present Refinement, sample preparation and training in the use of the scanning electron microscope (**SEM**) and electron microprobe analyzer (**EMPA**) for analysis of sample compositions.
- 1998-present Sample preparation and training in the use of inductively Coupled Plasma Optical Emission Spectrometry (**ICP-OES**) for the chemical analysis of minerals and rock powders.
- 1998-present Application of radiogenic isotope systematics (Rb-Sr, Sm-Nd, Lu-Hf and U-Pb) to study formation and differentiation ages of various meteorites and Apollo samples
- 1998-present Application of trace elements by LAICPMS, SIMS to study formation and differentiation history of various meteorites and Apollo samples

### **Research Collaborations**

Dr. Thomas J. Lapen (University of Houston); Dr. Rasmus Andreasen (Aarhus University); Dr. Yongjun Gao (University of Houston); Dr. John Casey (University of Houston); Dr. Alan D. Brandon (University of Houston); Dr. Udo Zimmermann (Universitetet i Stavanger); Dr. Justin I Simon (NASA); Dr. Brian L. Beard (University of Wisconsin); Dr. Arya Udry (University of Nevada Las Vegas); Dr. Kevin Righter (NASA); Prof. Mitsuru Ebihara (Tokyo Metropolitan University, Japan); Prof. Hiroshi Takeda (U. Tokyo, Japan); Dr. Akira Yamaguchi (National Institute of Polar Research, Japan); Dr. Hiroshi Kaiden (National Institute of Polar Research)

### **Professional Memberships**

American Geophysical Union (AGU)  
Meteoritical Society  
Geochemical Society of Japan

### **Publications**

- Righter, M.**, Andreasen, R., and Lapen, T. J. (2017) *Evidence of excess Hafnium-176 in eucrite QUE 97053*. Manuscript in preparation.
- Righter, M.**, Shaulis, B., and Lapen, T. J. (2017) *Uranium-Pb and  $^{207}\text{Pb}/^{206}\text{Pb}$  ages of zircon from Antarctic unbrecciated eucrites*. Manuscript in preparation.
- Righter, M.**, Lapen, T. J., and Righter, K. (2017) *Partitioning of Hf between oxide and silicate melts: Implications of Lu-Hf isotopic systematics*. Manuscript in preparation.
- Righter, M.**, Mikouchi, T., Righter, K., and Lapen, T. J. (2017) *Origin of QUE 93148: further constraints from mineralogy and trace element geochemistry of metal and silicates*. Manuscript in preparation.
- Reagan, M. K., Heywood, L., Goff, K., Michibayashi, K., Foster, C. T., Jicha, B., Lapen, T. J., McClelland, W. C., Ohara, Y., **Righter, M.**, Scott, S., Sims, K. W. W. (2017) Geodynamic implications of crustal lithologies from the southeast Mariana fore-arc. Submitted to Journal of Petrology.
- Lapen T. J., **Righter, M.**, Andreasen R., Irving, A.J., Satkoski, A., Beard, B.L., Nishiizumi, K., Jull, A. J. T., and Caffee, M. (2017) Two billion years of magmatism recorded from a single Mars meteorite ejection site. *Science Advances*, 3, e1600922.
- Shaulis, B. J., **Righter, M.**, Lapen, T. J., Jolliff, B. L., and Irving, A. J. (2016) 3.1 Ga crystallization age of the

- Northwest Africa 773 clan of Lunar meteorites and evidence for a 2.7 Ga brecciation event. Submitted to *Geochimica et Cosmochimica Acta*.
- Udry, A., Howarth, G.H., Lapen, T. J., and **Righter, M.** (2016) Petrogenesis of the NWA 7320 enriched martian gabbroic shergottite : Insight into the martian crust. Submitted to *Geochimica et Cosmochimica Acta*.
- Righter, K., Nickodem, K., Pando, K., Danielson, L., **Righter, M.**, and Lapen, T.J. (2016) Core-mantle partitioning and the origin of volatile elements in the Earth. Submitted to *Geochimica et Cosmochimica Acta*.
- Lapen, T. J., **Righter, M.**, Brandon, A. D., Debaille, V., Beard, B. L., Shafer, J. T., and Peslier, A. H. (2010) *A Younger Age for ALH84001 and Its Geochemical Link to Shergottite Sources in Mars. Science* 328, 347-351.
- Shafer, J. T., Brandon, A. D., Lapen, T. J., **Righter, M.**, Peslier, A. H., and Beard, B. L. 2010, *Trace element systematics and  $^{147}\text{Sm}$ - $^{143}\text{Nd}$  and  $^{176}\text{Lu}$ - $^{176}\text{Hf}$  ages of Larkman Nunatak 06319: Closed-system fractional crystallization of an enriched shergottite magma. *Geochimica et Cosmochimica Acta* 328, 347-351.*
- Tamaki, M.**, Yamaguchi, A., Misawa, K., Ebihara, M., and Takeda, H., 2006, Constraint on mesosiderite formation processes from siderophile elements in silicate clasts, *Meteoritics and Planetary Science*, 41, 1919-1928
- Hirota, Y., **Tamaki, M.**, and Nakamura, N., 2002, Rare earth element abundances in the CK chondrites including the Kobe meteorite. *Geochemical Journal* 36, 309-322

### Conference Contributions

#### **Oral presentations (lead author)**

- Righter, M.**, Lapen T. J., Andreasen R., and Irving A. J. (2016) Sm-Nd and Lu-Hf isotopic systematics of Nakhlite NWA10153. *Goldshmidt 2016*, abstract #2632.
- Righter, M.**, Lapen T. J., Andreasen R., and Irving A. J. (2016) Lu-Hf and Sm-Nd isotopic studies of nakhlite Northwest Africa 10153. *Lunar and Planetary Science XLVII*, abstract #2780.
- Righter, M.**, Andreasen R., and Lapen T. J. (2015) Lu-Hf and Sm-Nd systematics of martian meteorites Larkman Nunatak 12011 and 12095. *Lunar and Planetary Science XLVI*, abstract #2889.
- Righter, M.**, Andreasen R., Lapen T. J. and Irving, A. J. (2014) The age and source composition for depleted shergottite Northwest Africa 7635: A 2.3 Ga magmatic rock from early Amazonian Mars. *Lunar and Planetary Science XLV*, abstract #2550.
- Righter, M.**, Lapen T. J. and Andreasen R. (2013) Lu-Hf age and isotope systematics of EET 87520 and GRO 95533 Eucrites. *76<sup>th</sup> Annual Meteoritical Society Meeting*, Edmonton, Canada, abstract #5290.
- Righter, M.**, Lapen T. J. and Andreasen R. (2013) Evidence for excess Hafnium-176 in eucrite QUE 97053. *Lunar and Planetary Science XLIV*, abstract #2745.
- Righter, M.**, Shaulis, B., and Lapen, T. J. (2012) U-Pb and Pb-Pb Ages of Zircons from Polymict Eucrites. *Lunar and Planetary Science XLIII*, abstract #2562.
- Righter, M.**, Shaulis, B., and Lapen, T. J. (2011) U-Pb and Pb-Pb Ages of Zircons from Polymict eucrites and howardites. *34<sup>th</sup> Symposium on Antarctic Meteorites*, 72-73.
- Righter, M.**, Shaulis, B., and Lapen, T. J. (2011) U-Pb and Pb-Pb Ages of Zircons from Basaltic Eucrites. *Lunar and Planetary Science XLII*, abstract #2740.
- Righter, M.**, and Lapen, T. J. (2010) Petrology, mineralogy and mineral chemistry of Antarctic Monomict Eucrites CMS 04049 and QUE 97053. *Lunar and Planetary Science XLI*, abstract #2629.
- Righter, M.**, Lapen, T. J., Brandon, A. D., Beard, B. L., and Shafer, J. T. (2009) Lu-Hf and Sm-Nd isotope systematics of ALH 84001: Evidence for an ancient enriched mantle reservoir Mars. *72nd Annual Meeting of the Meteoritical Society*, Nancy, France, abstract #5428.
- Righter, M.**, Lapen, T. J., Brandon, A. D., Beard, B. L., Shafer, J. T., and Peslier, A. H. (2009) Lu-Hf age and isotope systematics of ALH 84001, *Lunar and planetary science XL*, abstract #2256.
- Righter, M.**, Lapen, T. J., Righter, K., and Brandon, A. D. (2009) Partitioning of Hf between chromite and silicate melts Implications of Lu-Hf isotopic systematics of Martian meteorite ALH 84001. *71nd Annual Meeting of the Meteoritical Society*, Matsue, Japan. abstract #5328.
- Righter, M.**, Lapen, T. J. (2008) Relationships between HED's, mesosiderites, and ungrouped achondrites: trace element analyses of mesosiderite RKPA 79015 and ungrouped achondrite QUE 93148, *Lunar and Planetary Science LXI*, abstract #2468.
- Tamaki, M.** (2006) Mineralogical and geochemical study of mesosiderites: Implication for the formation and differentiation history of the mesosiderite parent body. [Ph.D.] The Graduate University for Advanced Studies, 104 p.
- Tamaki, M.**, Yamaguchi, A., Misawa, K., and Ebihara, M. (2005) Fractionated highly siderophile elements in a

silicate clast of mesosiderite. *Meteoritics and Planetary Science*, 40, A151.

**Tamaki, M.**, Yamaguchi, A., Misawa, K., and Ebihara, M. (2005) Highly siderophile elements in silicate clast of Mount Padbury. *29<sup>th</sup> Symposium on Antarctic Meteorites*, 80-81.

### Oral presentations (others)

- Irving, A. J., Kuehner, S. M., Lapen, T. J., **Righter, M.**, Busemann, H., Wieler, R., and Nishiizumi, K. (2017) Keeping up with the Martian meteorites and constraining the number of separate launch sites on Mars. *Lunar and Planetary Science XLVIII*, abstract #2068.
- Irving, A. J., Kuehner, S. M., **Righter, M.**, Lapen, T. J., Gao, Y., Ziegler, K. Weimer, D., Busemann, H., Falls, R. J., and Hoefnagels, B. (2017) Petrologic and isotopic characterization of Northwest Africa 10961: An intermediate ultramafic poikilitic shergottite with prevalent shock melting features. *Lunar and Planetary Science XLVIII*, abstract #2712.
- Srinivasan, P., McCubbin, F. M., Lapen, T. J., **Righter, M.**, and Agee, C. B. (2017) Reassessing the formation of CK7 Northwest Africa \*NWA) 8186. *Lunar and Planetary Science XLVIII*, abstract #1995.
- Tanner, T. B., Jeffcoat, C. R., Righter, M., Berger, E. L., Lapen, T. J., Irving, A. J. Kuehner, S. M. Fujihara, G. (2017) Petrology of zircon-bearing diogenite Northwest Africa 10666. *Lunar and Planetary Science XLVIII*, abstract #2714.
- Habermann, M., Boujibar, A., Righter, K., Danielson, L., Rapp, J., **Righter, M.**, Pando, K., Ross, D., and Andreasen, R. Metal-Silicate-Sulfide partitioning of U, Th, and K: Implications for the budget of volatile elements in Mercury. *Goldshmidt 2016*, abstract #1028.
- Chen, X., Lapen, T. J., Andreasen, R., Righter, M., Irving, A. J. and Chafetz, H. S. (2016) Silicon isotope composition of ungrouped achondrite Northwest Africa 7325. *Lunar and Planetary Science XLVII*, abstract #2812.
- Habermann, M., Boujibar, A., Righter, K., Danielson, L., Rapp, J., **Righter, M.**, Pando, K., Ross, D. K., Andreasen, R., and Chidester, B. (2016) Partitioning of U, Th, K between metal, sulfide, and silicate: Insights into the volatile content of Mercury. *Lunar and Planetary Science XLVII*, abstract #2604.
- Irving, A. J., Andreasen, R., **Righter, M.**, Lapen, T. J., Busemann, H., Izawa, M., Moser, D. E. and Sipiera, P. P. (2016) Northwest Africa 4480 revisited: petrologic, isotopic and noble gas studies of an unshocked, maskelynite-free mafic shergottite with a long cosmic ray exposure age. *Lunar and Planetary Science XLVII* abstract #2330.
- Jeffcoat, C. R., Kerekgyarto, A. G., Lapen, T. J., **Righter, M.**, Simon, J. I. and Ross, D. K. (2016) New petrology, mineral chemistry and stable Mg isotope compositions of an Allende CAI: EK-459-7-2. *Lunar and Planetary Science XLVII*, abstract #2944.
- Kerekgyarto, A. G., Jeffcoat, C. R., Lapen, T. J., Andreasen, R., **Righter, M.**, Ross, D. K. and Simon, J. I. (2016) Al-Mg isotope study of Allende 5241. *Lunar and Planetary Science XLVII*, abstract #3041.
- Righter, K., Pando, K., Danielson, L. R., Humayun, M., **Righter, M.**, Lapen, T. J. and Boujibar, A. (2016) Effect of silicon on activity coefficients of siderophile elements (P, Au, Pd, As, Ge, Sb, and In) in liquid Fe, with application to core formation. *Lunar and Planetary Science XLVII*, abstract #2116.
- SHaulis, B. J., Kring, D. A., Lapen, T. J. and **Righter, M.** (2016) Petrology and distribution of U-Pb ages in Lunar meteorite breccia Miller Range (MIL) 13317. *Lunar and Planetary Science XLVII*, abstract #2027.
- Tait, K. T. Irving, A. J., Kuehner, S. M., Andreasen R., **Righter, M.**, and Lapen, T. J. (2015) Petrology, mineralogy and radiogenic isotope composition of enriched mafic Shergottite Northwest Africa 10134. *78nd Annual Meeting of the Meteoritical Society*, Berkeley, USA, abstract #5303.
- Irving, A. J., Kuehner, S. M., Ziegler, K., Andreasen R., **Righter, M.**, and Lapen, T. J. (2015) Chlorophaeite-bearing Nakhilite Northwest Africa 10153: Petrology, oxygen and hafnium isotopic composition, and implications for magmatic or crustal water on Mars. *78nd Annual Meeting of the Meteoritical Society*, Berkeley, USA, abstract #5251.
- Andreasen R., Lapen, T. J., **Righter, M.**, and Irving A. J. (2015) Constraints on the isotopic composition of the shergottite mantle sources – From observations based on the expanding rock record. *Lunar and Planetary Science XLVI*, abstract #2976.
- Lapen, T. J., **Righter, M.**, and Andreasen R. (2015) Lu-Hf and Sm-Nd isotope systematics of non-cumulate eucrites. *Lunar and Planetary Science XLVI*, abstract #2863.
- Kerekgyarto, A., Jeffcoat, C. R., Lapen T. J. Andreasen R., **Righter, M.**, Ross, D. K. and Simon, J. I. (2015) Supra-canonical initial <sup>26</sup>Al/<sup>27</sup>Al from a reprocessed Allende CAI. *Lunar and Planetary Science XLVI*, abstract #2918.
- Jeffcoat, C. R., Kerekgyarto, A., Lapen T. J. Andreasen R., **Righter, M.**, and Ross, D. K. (2014) Mineralogy and petrology of EK-459-5-1, A type B1 CAI from Allende. *Lunar and Planetary Science XLVI*,

abstract #2610.

- Andreasen R., **Righter, M.**, Lapen T. J. and Irving, A. J. (2014) Lead-lead isotope systematics and terrestrial and ejection ages of early Amazonian depleted shergottite Northwest Africa 7635. *Lunar and Planetary Science XLV*, abstract #2865.
- Jeffcoat, C. R., Kerekgyarto, A., Lapen T. J. Andreasen R., **Righter, M.**, and Ross, D. K. (2014) In situ trace element analysis of an Allende Type B1 CAI: EK-459-5-1. *Lunar and Planetary Science XLV*, abstract #2523.
- Kerekgyarto, A., Jeffcoat, C. R., Lapen T. J. Andreasen R., **Righter, M.**, and Ross, D. K. (2014) Stable magnesium isotope variation in melilite mantle of Allende Type B1 CAI: EK-459-5-1. *Lunar and Planetary Science XLV*, abstract #2874.
- Lapen, T. J., Kring, D. A., Zolensky, M. E., Andreasen R., **Righter, M.**, Swindle T. D. and Beard, S. P. (2014) Uranium-lead isotope evidence in the Chelyabinsk LL5 chondrite meteorite for ancient and recent thermal events. *Lunar and Planetary Science XLV*, abstract #2561.
- Lapen, T. J., Andreasen R., **Righter, M.**, and Irving A. J. (2013) Lu-Hf and isotope systematics of intermediate permafic olivine-phyric shergottite NEW 2990. *Lunar and Planetary Science XLIV*, abstract #2686.
- Dietderich J. E., Lapen, T. J., Andreasen R., and **Righter, M.** (2013) Isotope systematics of the type 7 eucrite Jonzac: A look into the history of the eucrite parent body using the Lutetium-Hafnium, Lead-Lead, & Urenium-Lead isotope systems. *Lunar and Planetary Science XLIV*, abstract #2879.
- Andreasen R., Simmons S. T., **Righter, M.**, and Lapen, T. J. (2013) Lutetium-Hafnium and Samarium-Neodymium systematics of Apollo 17 sample 78236. *Lunar and Planetary Science XLIV*, abstract #2887.
- Shaulis, B., **Righter, M.**, and Lapen, T. J. (2013) 3.1 Ga crystallization age of magnesian and ferroan gabbro lithologies in lunar meteorites Northwest Africa 773, 3170, 6950 and 7007, and evidence for 3.95 Ga components in NEW 773 polymict breccia. *Lunar and Planetary Science XLIV*, abstract #1781.
- Shaulis, B., **Righter, M.**, Lapen, T. J., Korotev, R. L., Irving, A. J., and Kuehner, S. M. (2012) Baddeleyite chronology of Northwest Africa 6950: A 3.1 Ga Lunar olivine gabbro paired with NWA 2977 and the cumulate mare gabbro lithology in NWA 773. *Lunar and Planetary Science XLIII*, abstract #2236.
- Lapen, T. J., **Righter, M.**, and Andreasen R. (2012) Constraints on Mars mantle evolution from Sm-Nd and Lu-Hf isotope compositions of shergottites and ALH 84001. *The Mantle of Mars: Insights from Theory, Geophysics, High-Pressure Studies, and Meteorites*, abstract #6023.
- Lapen, T. J., Brandon, A. D., **Righter, M.**, Shafer, J. T., and Irving, A. J. (2010) A hybridized Martian mantle source for Shergottites *Lunar and planetary science XLI*, abstract #2448.
- Shafer, J. T., Brandon, A. D., Lapen, T. J., **Righter, M.**, and Peslier, A. H. (2010) Sm-Nd age and REE systematics of Larkman Nunatak 06319: Closed system fractional crystallization of a shergottite magma, *Lunar and planetary science XLI*, abstract #1726.
- Lapen, T. J., **Righter, M.**, Brandon, A. D., Beard, B. L., Shafer, J. T., and Irving, A. J. (2009) Lu-Hf isotope systematics of NWA 4468 and NWA 2990: Implications for the sources of Shergottites. *Lunar and planetary science XLI*, abstract #2376.
- Shafer, J. T., Brandon, A. D., Lapen, T. J., **Righter, M.**, and Peslier, A. H. (2009) Lu-Hf age of Larkman Nunatak 06319, *Lunar and planetary science XL*, abstract #1803.
- Yamaguchi, A., **Tamaki, M.**, Kaiden, H., Misawa, K., and Ebihara, M. (2006) Thermal history of highly metamorphosed basaltic eucrites and basaltic clasts in mesosiderites: *A comparison, 30<sup>th</sup> Symposium on Antarctic Meteorites*, 121-122.

## **Reference**

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