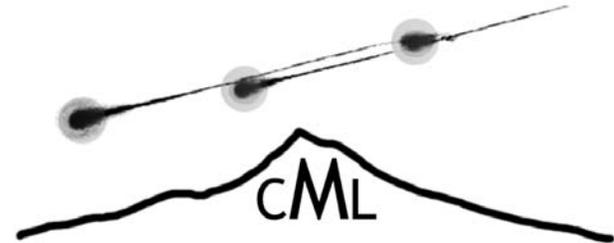


# Cascadia Meteorite Laboratory

Eighth Newsletter, April 2015 (prepared by M. Hutson)  
<http://meteorites.pdx.edu>, e-mail: [cmlpsu@pdx.edu](mailto:cmlpsu@pdx.edu)  
<https://www.facebook.com/CascadiaMeteorite>



Cascadia Meteorite Laboratory

## ***Mission Statement***

The mission of our laboratory is to conduct meteorite research to help understand our place in the universe, and to share this knowledge with the wider community.

Meteorites provide vital clues about the origin of the Earth and other planets, our solar system, and the molecules that serve as precursors to life. Meteorite research contributes to the larger field of planetary science which can help society evaluate how to utilize extraterrestrial resources, how to protect our planet from the devastating effects of a major cosmic impact, and how planetary climate change might occur. Our lab maintains and increases a carefully curated collection of meteorites which can be used for research and education. Through mentoring, classes, and outreach programs, laboratory personnel help inspire and educate students of all ages, teachers and the general public, and help to prepare a new generation of scientists.

## **Welcome to our very late annual newsletter!**

We missed 2014, as Melinda was mostly out of the lab due to major back surgery. Since the last newsletter, the Cascadia Meteorite Laboratory (CML) has expanded into social media, with a Facebook Page (at <https://www.facebook.com/CascadiaMeteorite>), and a blog (at <http://cmlpsu.wordpress.com>).

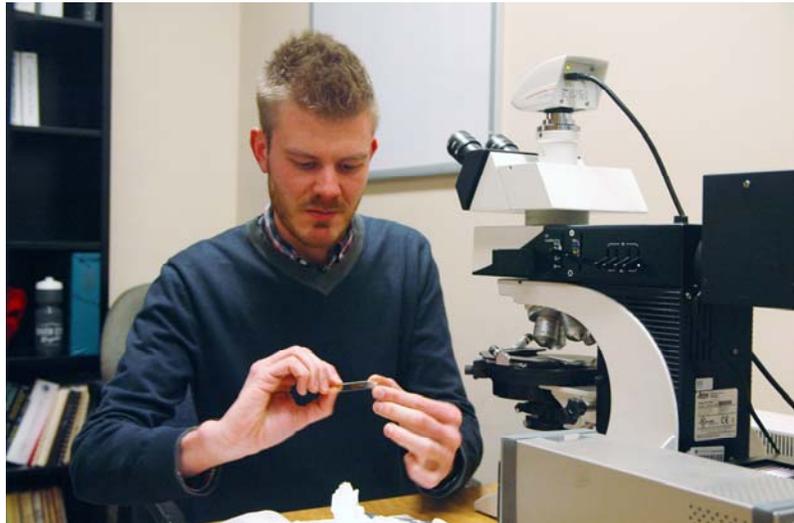
### **Student Transitions:**

In June 2013, Master's student Katherine (Kat) Armstrong won \$1250 from the Planetary Studies Foundation to attend the Annual Meeting of the Meteoritical Society in Edmonton, Alberta, where she presented a poster on her thesis work. Two months later, she got married, and then in December 2014, she defended her Master's thesis. Kat continued to work in the lab on igneous inclusions for another half a year, and has now moved on to a Ph.D. program at the Bavarian Geoinstitute in Bayreuth, Germany, where she is working with Dan Frost. She returned to the U.S. in March 2015 to present her M.S. results at the Lunar and Planetary Science Conference (LPSC) in Houston.



*Left: CML student Kat Armstrong married Joe Fitzgerald at Forest Park in Portland Oregon on September 1, 2013.*

Undergraduate Ryan Brown finished his Bachelor's Degree in December 2013. He presented a poster with his work at the American Geophysical Union (AGU) meeting in San Francisco that same month. Ryan attracted the interest of Tracy Rushmer, who invited Ryan and Alex to submit a paper to a special issue of American Mineralogist. The manuscript has just been revised and re-submitted.

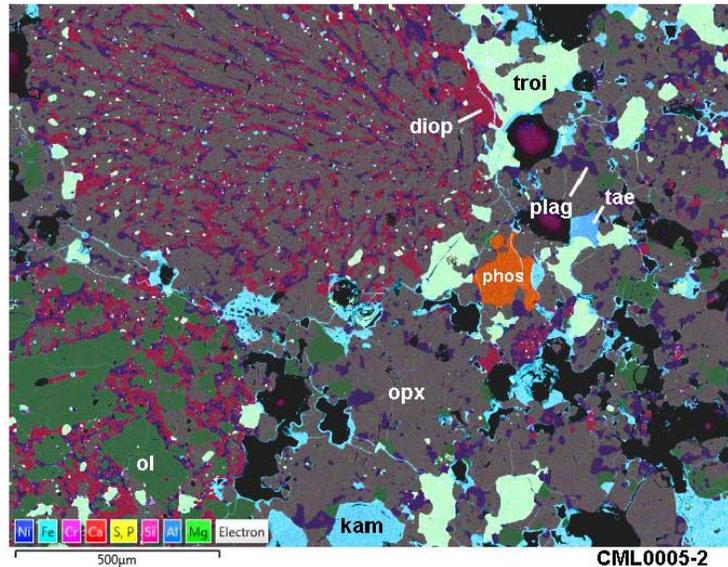


Kristy Schepker received her M.S. degree at the end of the 2013-2014 academic year. She spent the summer working to turn her M.S. thesis (Complex Thermal Histories of L Melt Breccias NWA 5964 and NWA 6580) into a manuscript for publication.

She applied to the Ph.D. program and was accepted. She'll continue to work in the lab, and is picking up where Kat left off on the large igneous inclusions project.



In June 2014, Karla received her B.A. and presented her Undergraduate Honors Thesis, titled “Classification of four meteorite samples”, which included work on three chondrites and a winonaite (NWA 8614). NWA 8614 was a surprise, and turns out to be the least heated winonaite. Karla presented this work as a poster at the 2015 Lunar and Planetary Science Conference in Houston. Karla has returned to CML as a Master’s student, starting Fall 2014.



**Figure 1.** False-color EDS map of NWA 8614 showing two chondrules (left side). Phases include olivine (ol, green), orthopyroxene (opx, brown), diopside (diop, purple red), plagioclase (plag, purple), kamacite or weathered low-Ni metal (kam, light blue), taenite (tae, dark blue), troilite (troi, light yellow), phosphate (phos, orange), and chromite (pink, too small to see clearly here). Dark areas with or without purple centers are pits produced by mineral plucking. Scale bar at lower left is 0.5 mm.

### Milestones:

#### METEORITE SAMPLES



The number of samples in the lab increased by almost 100 different meteorites (from CML 0758 to CML 0850) since the last newsletter. We’d like to thank the many people who donated samples: Dick Pugh, Edwin and Patrick Thompson, Big Kahuna Meteorites, Nary Suon, John Shea, Art Johnstone, Larry Sloan, Pete Zemeckas, Jim Wooddell, Blaine Schmeer, Scott Johnson.

*Left: Pieces of the NWA 7678 chondrite (a CV3 chondrite with large white CAIs—calcium-aluminum-rich-inclusions) donated by Dick Pugh.*

## EQUIPMENT



*Above (left to right): Rick Hugo watching a technician preparing the Zeiss Scanning Electron Microscope (SEM) to receive the new Electron Backscatter Diffraction (EBSD) detector (center). Alex Ruzicka (right) sitting in front of the new computer system with fast processor and terabytes of memory.*

It is always slow getting new equipment up and running, and that was the case with the new EBSD detector. We finally started getting good quality data at the beginning of 2014. The data files were so large (100s of Gb) that we had to get a new computer system that is just for processing SEM/EBSD data. All of this was funded by a grant from NASA's Planetary Major Equipment Program received by Alex in late 2012.

## METEORITE CLASSIFICATION

In the past year and a half, we've classified 18 new meteorites—all but one (Karla's winonaite) were ordinary chondrites. Most were from northwest Africa (NWAs), but five were from two dry lake beds in Nevada (Jungo 004, 005, 006, Diamond Valley 002, 003) and six were from a sand sea in the Lut desert in Iran (Lut 002, 003, 004, 005, 006, 007). The Iranian stones included three different and unusual type 3 ordinary chondrites.



*Right: Image of the Lut sand dunes from one of the finders.*

## CONFERENCES

Since the last newsletter, we've had presentations and posters at two Meteoritical Society meetings (2013 Edmonton and 2014 Casablanca), two Lunar and Planetary Science Conferences, one American Geophysical Union meeting, and the Workshop on Planetesimal Formation and Differentiation. A list of conference abstracts is below.

Farley, K.R. and A.M. Ruzicka (2015) NWA 8614: The least heated winonaite? *46th Lunar Planet. Sci. Conf.*, Abstract #1821.

Hutson M.L., R.N. Pugh and A.M. Ruzicka (2015) Lessons learned from meteorite public outreach and education in the Pacific Northwest. *46th Lunar Planet. Sci. Conf.*, Abstract #1690.

Armstrong, K. and A.M. Ruzicka (2015) Major-element geochemistry of large, igneous-textured inclusions in ordinary chondrites. *46th Lunar Planet. Sci. Conf.*, Abstract #1572.

Ruzicka, A., J.M. Friedrich, R. Hugo and M. Hutson (2015) Macro- and microstructures in ordinary chondrites: Implications for impact deformation and annealing processes. *46th Lunar Planet. Sci. Conf.*, Abstract #1544.

Hutson, M.L., A.M. Ruzicka and M. Nazari (2014) Diverse and unusual O-chondrites from the Lut desert, Iran. *Meteorit. Planet. Sci.*, Abstract #5180.

Ruzicka A. and R. Hugo (2014) Microstructures in olivine from ordinary chondrites: Evidence for post-shock thermal annealing and syn-metamorphic shock. *45th Lunar Planet. Sci. Conf.*, Abstract #1306.



*Meteoritical Society Meeting in Edmonton in August 2013. Above: Dick Pugh, Melissa Strait, Alex Ruzicka, and Lauren Likkel. Right: Melinda Hutson getting ready to tour Chris Herd's lab.*

## Page 6

### CONFERENCES CONTINUED

Brown R., A.M. Ruzicka, M. Hutson, J.M. Friedrich and M.L. Rivers (2013) Micro-tomography and electron microscopy of a shock dike in the Buck Mountains 005 L6 chondrite, Abstract P31B-1808 presented at 2013 Fall Meeting, AGU, San Francisco, Calif., 9-13 Dec.

Ruzicka A. and M. Hutson (2013) Evidence from silicate-bearing irons for the nature of asteroidal differentiation. *Workshop on Planetesimal Formation and Differentiation*, Carnegie Institution of Science, Washington D.C. October 27-29.

Armstrong K. and A. Ruzicka (2013) Survey of large, igneous-textured inclusions in O chondrites. *Meteorit. Planet. Sci.*, Abstract #5278.

Likkel L., A.M. Ruzicka, M. Hutson, K. Schepker, and T.R. Yeager (2013) Cohenite in chondrites: Further support for a shock-heating origin. *Meteorit. Planet. Sci.*, Abstract #5145.

Brown R., A. Ruzicka, J. Friedrich, M. Hutson and M. Rivers (2013) A shock melt dike in 3D: Shear and melt migration in the Buck Mountains 005 L6 chondrite. *Meteorit. Planet. Sci.*, Abstract #5078.

### PEER-REVIEWED PUBLICATIONS



Alex spent months writing a huge, comprehensive invited review of silicate bearing iron meteorites for *Chemie der Erde*. Alan Rubin was one of the paper's reviewers. Here he is waving the 90 page manuscript at passersby at breakfast in Edmonton in 2013. This was followed by an invitation to write a manuscript for an upcoming special issue of *American Mineralogist*, and another to be the lead author on a chapter for a book on asteroidal differentiation (Alex hasn't started this one yet).

Ruzicka A., R. Hugo and M. Hutson (2015) Deformation and thermal histories of ordinary chondrites: Evidence for post-deformation annealing and syn-metamorphic shock. *Geochim. Cosmochim. Acta* (revised March 2015).

Ruzicka A., R. Brown, J. Friedrich, M. Hutson. R. Hugo and M. Rivers (2014) Shock-induced mobilization of metal and sulfide in planetesimals: Evidence from the Buck Mountains 005 (L6 S4) dike-bearing chondrite. *Am. Mineralogist* (revised March 2015).

Ruzicka A. (2014) Silicate-bearing iron meteorites and their implications for the origin of asteroidal parent bodies. *Chemie der Erde* 74, 3-48 (Invited Review).

Friedrich J.M., A. Ruzicka, M.L. Rivers, D.S. Ebel, J.O. Thostenson and R.A. Rudolph (2013) Metal veins in the Kernouve (H6 S1) chondrite: Evidence for pre- or syn-metamorphic shear deformation. *Geochim. Cosmochim. Acta* 116, 71-83.

### New Time of Year for Fundraiser



After receiving suggestions from several of our lab supporters, we are changing the date of our annual fundraiser from sometime in the Fall to the last week of May each year.

*Left: images from the 2012 fundraiser.*

The 2015 CML fundraiser/party/auction/pot luck will be on Saturday May 30, 2015 from 2:00-7:00 pm. Information can be found at <http://meteorites.pdx.edu/fundraiser.htm>. If you are thinking about participating, please let us know by e-mailing [cmlpsu@pdx.edu](mailto:cmlpsu@pdx.edu).

Yes, I/we want to support meteorite research and curation at Portland State University with a pledge or payment of:

- \$50     
  \$100     
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  \$1,000     
  Other \_\_\_\_\_

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Please designate your gift to the fund of your choice:

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My preferred method of payment is:

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I would like information about including PSU in my estate plans.

*Thank you for your generosity!*

Mail to: Cascadia Meteorite Laboratory, Dept. of Geology (GEOL), Portland State University, P.O. Box 751, Portland OR 97207-0751. 2015 newsletter

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17 Cramer Hall, 1721 SW Broadway  
Portland OR 97207-0751

**RETURN SERVICE REQUESTED**



Dick Pugh on a field excursion in Morocco, September 2014, image courtesy of Christine Floss.

For more information about the Cascadia Meteorite Laboratory  
visit <http://meteorites.pdx.edu>

## CML's eighth newsletter

Inside you'll find out what we've been doing since the last newsletter. We'd also like to take this opportunity to thank all of you for your interest in and support of the Cascadia Meteorite Laboratory. We wouldn't be here without you.