

Microscopy Used to Discover New, Cool Mineral!

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It is relatively infrequent these days for a novel mineral to be discovered in the natural environment (in this context, this implies on the Earth). On the rare events of such a discovery, the new mineral is typically found in milligram quantities. In an article by Ronald Peterson, William Nelson, Bruce Madu, and Herbert Shervell,² they describe the discovery of kilograms of a mineral that had only been synthesized previously, but never before detected in the natural environment. As if that were not impressive enough, they went looking for this mineral because they thought it had been observed on Mars!

The Mars Exploration Rover Opportunity sent back data indicating that some of the soils on the surface of Mars near the meridian were rich in magnesium and sulfate. Peterson *et al.* looked at the relevant phase diagrams and saw that a material with composition $\text{MgSO}_4 \cdot 12\text{H}_2\text{O}$ would be a possible mineral under Martian conditions. This compound was first synthesized in 1837, and was called Fritzsche's salt after the chemist who first synthesized it. This is similar to Epsom salts, technically called epsomite ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$), but $\text{MgSO}_4 \cdot 12\text{H}_2\text{O}$ had never been found in the natural environment. It can only exist when and where conditions of temperature and humidity allow. Peterson and a colleague had previously performed low temperature experiments and discovered that the compound was $\text{MgSO}_4 \cdot 11\text{H}_2\text{O}$, not $\text{MgSO}_4 \cdot 12\text{H}_2\text{O}$ and was only stable below 2°C.

Peterson *et al.*, using their knowledge of chemistry and geology, reasoned that hydrated magnesium sulfates could exist on the surface of the Earth where a saturated solution of magnesium sulfate could be found at temperatures below 2°C. Therefore, they went looking for it in central British Columbia (latitude 50° North) at ponds that contained magnesium salts. These ponds had been mined in the past to obtain epsomite. In one of these ponds they found a tree trunk with a white precipitate adhering to

it. The conditions at this site allowed for a saturated solution of magnesium sulfate to be "wicked up" the tree and precipitate as $\text{MgSO}_4 \cdot 11\text{H}_2\text{O}$ in the cold winter air.

Since their quest was the result of suspecting that this mineral existed near the meridian of Mars, they named it meridianite. Meridianite has been approved as a valid mineral species by the Commission on New Mineral Names of the International Mineralogical Association. An important part of establishing the unique composition of meridianite involved the use of a petrographic microscope to determine the refractive indices to complete the description of this material. They also used a microscope in the field to distinguish between epsomite and meridianite based on extinction angle and Becke line tests for refractive index contrast with oils. They also used a spindle stage to study a single crystal of meridianite to accurately determine the three refractive indices and 2V of this biaxial (triclinic) mineral. All this had to be done below 2°C. The photograph shows Professor Peterson examining meridianite with a petrographic microscope outside on a cold day. The inset micrograph is of crystals of meridianite, but one has incongruently melted to shards of epsomite and solution. The maximum dimension of the crystals is about 1 mm.



Professor Peterson and his colleagues are to be congratulated for reasoning correctly that conditions on Mars could result in the existence of $\text{MgSO}_4 \cdot 11\text{H}_2\text{O}$ and extending that to predict that it could be found in our natural environment!

- 1 The author gratefully acknowledges Professor Ronald Peterson for reviewing this article.
- 2 Peterson, R.C., W. Nelson, B. Madu, and H.F. Shervell, Meridianite: A new mineral species observed on Earth and predicted to exist on Mars, *American Mineralogist* 92:1756-1759, 2007.

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ABOUT THE COVER

A549 (lung cancer) cells were treated with TRAIL to produce apoptosis, as part of a study by Drs. Lisa Johansson, Jarek Meller, Marian Miller and Marshall Anderson, to identify the function of a new gene believed to regulate some aspects of cell survival. TRAIL, which is sometimes used to enhance the efficacy of chemotherapeutic drugs, induces a classic apoptotic phenotype, with typical segregation and digestion nuclear and nucleolar elements, and cytoplasmic blebbing (shown here). Variations in apoptotic phenotypes provide a window into the myriad pathways that are activated or suppressed during that complex process. Besides, considering the season, the image made us think of snowflakes.

COMING EVENTS

2008

- ✓ **PITTCON 2008**
March 3-6, 2008, New Orleans, LA
www.pittcon.org
- ✓ **American Soc. for Biochemistry and Molecular Biology**
April 3-9, 2008, San Diego, CA
www.asbmb.org
- ✓ **Histochemical Society Immunocytochemistry Short Course**
April 5, 2008, San Diego, CA
immunocytochem.wordpress.com
- ✓ **Scanning 2008**
April 14-16, 2008, Washington, DC
www.fams.org
- ✓ **Course: Analytical & Quantitative Light Microscopy**
May 7-16, 2008, Woods Hole, MA
lightmicroscopy@GMAIL.COM
- ✓ **Light Microscopy for the Biosciences**
May 18-23, 2008 Charleston, SC
middleh@musc.edu
- ✓ **MAS EBSD Topical Workshop**
May 20-22, 2008, Madison, WI
johnf@geology.wisc.edu
- ✓ **MSC/SMC 2008**
May 21-23, 2008, Montreal, QC, Canada
msc-smc2008.rsvs.ulaval.ca
- ✓ **Lehigh Microscopy School**
June 1-13, 2008, Bethlehem, PA (Multiple Choices)
www.lehigh.edu/microscopy
- ✓ **13th Annual Short Course on 3D Microscopy of Living Cells
12th Workshop on 3D Image Processing***
June 14-26 & *June 29-30, 2008 Vancouver, BC, Canada
www.3dcourse.ubc.ca/2008/
- ✓ **5th Annual CARS Workshop**
June 25-27, 2008, Boston, MA
bernstein.harvard.edu/events/carsworkshop.html
- ✓ **SEB 2008 (Society for Experimental Biology)**
July 6-10, 2008, Marseille, France
www.sebiology.org/meetings
- ✓ **Microscopy and Microanalysis 2008**
August 3-7, 2008, Albuquerque, NM
www.msa.microscopy.com
- ✓ **American Chemical Society**
August 17-21, 2008, Philadelphia, PA
help@acs.org
- ✓ **EMC 2008 Symposium**
August 18-22, 2008, Detroit, MI
www.emc2008.org/
- ✓ **14th Electron Microscopy Congress, EMC 2008**
September 1-5, 2008, Aachen, Germany
www.euremicsoc.org/emc2008.html
- ✓ **Neuroscience 2008**
November 15-19, 2008, Washington, DC
www.sfn.org

2009

- ✓ **Microscopy and Microanalysis 2009**
August 3-6, 2009, Richmond, VA
www.msa.microscopy.com

Please check the "Calendar of Meetings and Courses" in the MSA journal "Microscopy and Microanalysis" for more details and a much larger listing of meetings and courses.

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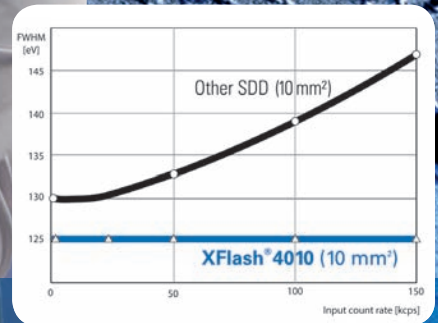
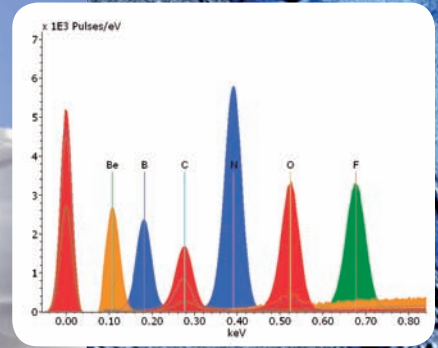
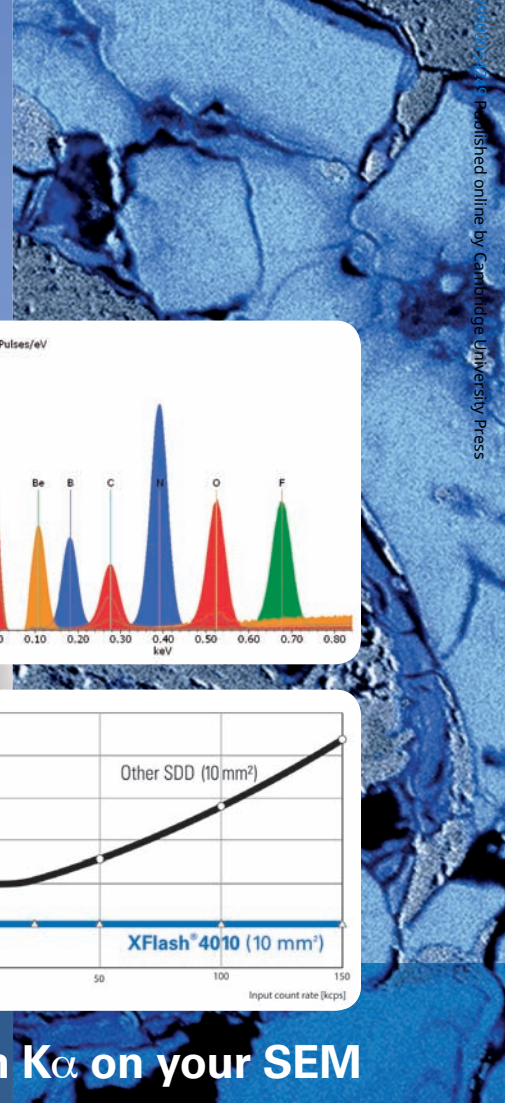
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