

Newsletter

College of Physical and Mathematical Sciences

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Dr. Jani Radebaugh leads Discovery of Mountains on Saturn's Largest Moon

By: Jessica Witt

By analyzing images from NASA's Cassini Radar instrument, a Brigham Young University professor helped discover and analyze mountains on Saturn's largest moon, additional evidence that it has some of the most earthlike processes of any celestial body in the solar system.

Planetary scientist Jani Radebaugh is lead author of the discovery paper in the December issue of the astronomy journal *Icarus*. The images retrieved by the Cassini Radar are the first images showing the details of Titan's surface – previous spacecraft and telescopes could not pierce the haze and clouds surrounding the moon to the surface.

The discovery of mountains on Titan grew out of Radebaugh's collaboration with a research team that recently found sand dunes and methane lakes on Titan. Radebaugh was a coauthor on the *Science* magazine study that introduced Titan's sand dunes in May 2006 as well as the *Nature* study that introduced Titan's methane lakes in January 2007.

"Since this is the first time humans have been able to see through the haze to Titan's surface, it was shocking to find these mountains, channels, dunes, and cryo-lava flows," Radebaugh said. "We had to wait until we got all the way to Titan to see these landforms that are so similar to Earth."

Upon receiving the images from NASA, Radebaugh, in collaboration with the Cassini Radar Team, discovered the mountains and began analyzing their characteristics. With no instrument to precisely measure the mountains' height, Radebaugh looked at the light and shadows in the radar images to calculate the mountains' slope and then derive their height.

According to the study, Titan's mountains are most likely made of water ice and are relatively small in height, at most 2 km (1.25 mi) from base to peak. That's about half as tall as Mount Timpanogos near BYU's campus. The consistently short height of Titan's mountains provides evidence that they have been subject to similar amounts of erosion, that they are roughly the same age or that the materials are behaving in a way that prevents them from growing taller.

"Dr. Radebaugh's work represents an important advance in our understanding of that icy moon and the Earth," said Dr. Jason Barnes, a research scientist at the NASA Ames Research Center. "Her discovery tells us about the mountain-building process in general and about Titan's crust in particular."

Prior to Cassini, scientists assumed that most of the topography on Titan would be impact structures, yet these new findings reveal that similar to Earth, the mountains were formed through geological processes on the moon.

Radebaugh proposes four possible explanations for the formation of the mountains on Titan. The first possibility is that the mountains were thrust up from crustal compression, horizontal forces smashing the crust together and upward. Alternatively, Titan's mountains may have formed through spreading or separation of the crust, in the same way that Utah's Wasatch Mountains separated from the Oquirrh Mountains to the west.



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It's also possible some of the mountains have been created by impact craters that threw out blocks of material, or that erosion stripped away a preexisting layer of material and left high-standing features like the mountains.

"The hard work of collecting simple facts is the key to understanding strange new worlds, and from these facts, Jani has discovered a whole new type of feature," said Richard Ghail, a planetary scientist for JMP Consulting, UK.

Since the processes on Titan are so similar to Earth's, Radebaugh also concluded in the study that Titan may be an interesting laboratory for studying Earth. Like Earth, Titan possesses the primary ingredients for life, namely energy, water and organics. Information from Titan will help scientists better understand the Earth's origin, formative processes and development of life.

"We still don't understand exactly how life began on Earth, so if we

can understand how the fundamentals of these processes may be starting in some laboratory like Titan, it will help us understand the Earth a lot better," Radebaugh said.

In addition to analyzing images from space, Radebaugh also looks on planet earth for clues about the geology of other planets, moons and objects in the solar system. Two years ago Radebaugh scoured Antarctica for meteorites with the Antarctic Search for Meteorites (ANSMET) program. Through field work at Hawaiian volcanoes, she has also worked with students to utilize a technique for using a camcorder to measure eruption temperatures in the hope of learning more about volcanoes on Io, a moon of Jupiter.

Radebaugh, an assistant professor of geological sciences, received her undergraduate in physics and astronomy and a master's degree in geology at BYU. In 2005, she received her Ph.D. in planetary science from the University of Arizona.

Important Dates & Events in the College

Spring Research Abstracts Submittal
January 15 - February 29, 2008

College Annual Banquet
January 18, 2008 WSC Ballroom

Dr. Gilbert W. Fellingham Receives Department Fellowship Award



Dr. Gilbert W. Fellingham has been selected as one of two recipients of the Statistics Department Fellowship for 2007. Dr. Fellingham has always been ready and willing to do his best in all that is asked of him; he sets high standards for himself and expects everyone to do likewise. He is a committed scholar and researcher who strives for excellence in everything he does. His research and analysis has been published not only in the best statistical simulation, actuarial science, and sports analysis venues, but also in the best scientific sports journals associated with physiology, exercise, training, rehabilitation, medicine, metabolism, and nutrition.

Since his arrival in the department in 1990, Dr. Fellingham has brought an energy to the classroom that resonates well with his students. In recent years he has devoted his energies to Stat 337, the second course of our introductory statistical methods sequence. He was honored by our students in 2002, 2004, and 2006 with the department's Teacher of the Year award.

Dr. Fellingham has had numerous department committee assignments, all of which he fulfills with commitment and distinction. He has served the profession by working on committees, organizing meetings, and serving in all the offices of the local Chapter of the American Statistical Association; he was recently elected as President of the American Statistical Association's Section of Statistics in Sports.

Most of Dr. Fellingham's achievements are the result of dedicated hard work, setting a good example for all who follow in his footsteps in receiving this award. He has earned the department's respect and this nomination.

Dr. Scott Grimshaw Receives Department Fellowship Award



Dr. Scott Grimshaw is one of two 2007 recipients of the Statistics Department Fellowship. Dr. Grimshaw has proved himself to be an innovative and dedicated scholar, an outstanding and exciting teacher, and a dependable and active citizen of the university. He is a dedicated scholar with high standards. He has provided insightful and innovative extensions to the statistical body of

knowledge and has demonstrated the relevance of these extensions by using them to solve practical problems. The breadth of Dr. Grimshaw's contributions to the statistical literature is particularly impressive. He has contributed to the literature in process mentoring and experimental design, as well as in the area of likelihood inference, statistical education, and various areas of application.

Dr. Grimshaw's teaching averages have been consistently above department, college, and university averages. In 2005, he was honored by our students with the department's Teacher of the Year award. Dr. Grimshaw has served the department well. He currently serves the department as Associate Chair and Graduate Coordinator. He has done particularly well in his assignment as Graduate Coordinator overseeing the revision of the graduate program.

No one has higher academic standards than those that he sets for himself and expects from his colleagues and students. Dr. Grimshaw has earned the recognition this award carries.

Elsevier/Spectrochimica Acta Atomic Spectroscopy Award 2006

Nicolò Omenetto

Greet de Loos



This is to announce the 2006 Elsevier/Spectrochimica Acta Award, the annual award honoring the most significant article(s) published in a volume. Elsevier makes this award on behalf of Spectrochimica Acta, Part B, to encourage the publication of top articles in this journal. All papers published during one year are considered for this award and the Editorial Advisory Board and the Guest Editor(s) of the special issues are responsible for the selection. The award consists of a monetary prize of \$1000 together with a presentation certificate.

We have the pleasure to announce the 2006 Award for the articles published in Spectrochimica Acta Part B, Volume 61. The votes of the jury accumulated for a series of three papers dedicated to the investigation of the supersonic expansion into the first vacuum stage of an inductively coupled plasma mass spectrometer and to the imaging of the plasma composition near the sampling cone.

The work was performed in the laboratory of Prof. Farnsworth at Brigham Young University in Provo (Utah).

The papers selected for the Award are the following:

W. Neil Radicic, Jordan B. Olsen, Rebecca V. Nielson, Jeffrey H. Macedone, Paul B. Farnsworth.

Characterization of the supersonic expansion in the vacuum interface of an inductively coupled plasma mass spectrometer by high-resolution diode laser spectroscopy.

Spectrochimica Acta Part B 61 (2006) 686–695. Jeffrey H. Macedone, Paul B. Farnsworth.

Changes in plasma composition during the expansion into the first vacuum stage of an inductively coupled plasma mass spectrometer.

Spectrochimica Acta Part B 61 (2006) 1031–1038. Andrew A. Mills, Jeffrey H. Macedone, Paul B. Farnsworth

High

resolution imaging of barium ions and atoms near the sampling cone of an inductively coupled plasma mass spectrometer.

Spectrochimica Acta Part B 61 (2006) 1039–1049.

As usual, since the introduction of the award, many other papers scored high on the jury's list. For the 2006 volume, this list, in alphabetical order of the first authors, looks as follows:

William J. Balsanek, Gulay Ertas, James A. Holcombe.

The use of concomitant elements to evaluate an Ar–N₂ mixed-gas plasma by electrothermal vaporization inductively coupled plasma orthogonal time-of-flight mass spectrometry.

Spectrochimica Acta Part B 61 (2006) 732–742.

J. Bengoechea, J.A. Aguilera, C. Aragón.

Application of laser-induced plasma spectroscopy to the measurement of Stark broadening parameters.

Spectrochimica Acta Part B 61 (2006) 69–80.

Davide Bleiner, Annemie Bogaerts.

Multiplicity and contiguity of ablation mechanisms in laser-assisted microanalysis.

Spectrochimica Acta Part B 61 (2006) 421–432.

Ricardo Henrique Moreton Godoi, Sanja Potgieter-Vermaak, Johan De Hoog, Ralf Kaegi, Rene Van Grieken.

Substrate selection for optimum qualitative and quantitative single atmospheric particles analysis using nano-manipulation, sequential thin-window electron probe X-ray microanalysis and micro-Raman spectrometry.

Spectrochimica Acta Part B 61 (2006) 375–388. James A. Holcombe, Gulay Ertas. Monte Carlo

simulation of transport from an electro-

thermal vapor-

izer.

Spectrochimica Acta Part B 61 (2006) 743–752.

Marie-Pierre Isaure, Barbara Fayard, Géraldine Sarret, Sébastien Pairis, Jacques Bourguignon.

Localization and chemical forms of cadmium in plant samples by combining analytical electron microscopy and X-ray spectromicroscopy.

Spectrochimica Acta Part B 61 (2006) 1242–1252.

John W. Olesik, Jeffery A. Kinzer.

Measurements of monodisperse droplet desolvation in an inductively coupled plasma using droplet size dependent peaks in Mie scattering intensity.

Spectrochimica Acta Part B 61 (2006) 696–704.

Edward B.M. Steers, Petr Smíd, Zdenek Weiss.

Asymmetric charge transfer with hydrogen ions—an important factor in the “hydrogen effect” in glow discharge optical emission spectroscopy.

Spectrochimica Acta Part B 61 (2006) 414–420.

E.A. Stefaniak, A. Worobiec, S. Potgieter Vermaak, A. Alsecz, S. Török, R. Van Grieken.

Molecular and elemental characterisation of mineral particles by means of parallel micro-Raman spectrometry and Scanning Electron Microscopy/Energy Dispersive X-ray Analysis.

Spectrochimica Acta Part B 61 (2006) 824–830.

College Publications

Chemistry & BioChemistry

Merritt B. Andrus, Michael A. Christiansen, Eric J. Hicken, Morgan J. Gainer, Karl D. Bedke, Kaid C. Harper, Shawn R. Mikkelsen, Daniel S. Dodson and David T. Harris, APhase-Transfer-Catalyzed Asymmetric Acylimidazole Alkylation@, *Organic Letters*, **9**, 4865-4868.(2007).

Steven A.Fleming, Alexander A. Parent, Ephraim E. Parent, James A. Pincock and Lise Renault, AMechanistic Analysis of the Photocycloaddition of Silyl-Tethered Alkenes@, *JOC Article*, **72**, 9464-9470.(2007).

Morad Alawneh, Douglas Henderson, Christopher W. Outhwaite, and L. Bari Bhuiyan, AThe Effect of Dielectric Polarization on Anomalous Temperature Effects in the Electrical Double Layer@, *Molecular Simulation*, **33**, 1279-1284.(2007).

Binghe Gu, Yun Li, and Milton L. Lee, "Polymer Monoliths with Low Hydrophobicity for Chromatography of Peptides and Proteins, *Anal. Chem.*, **79**, 5848 (2007).

Geological Sciences

Keszthelyi, L., W. Jaeger, M. Milazzo, J. Radebaugh, A. Davies, K. Mitchell 2007. New Estimates for Io Eruption Temperatures: Implications for the Interior. *Icarus* 192, 491-502.

Barnes, J., J. Radebaugh, R. H. Brown, S. Wall, L. Soderblom, J. Lunine, D. Burr, C. Sotin, S. Le Mouelic, S. Rodriguez, B. J. Buratti, R. Clark, K. H. Baines, R. Jaumann, P. D. Nicholson, R. L. Kirk, R. Lopes, R. Lorenz, K. Mitchell, and C. A. Wood 2007. Near-infrared spectral mapping of Titan's mountains and channels. *Journal of Geophysical Research* 112, E11006, doi:10.1029/2007JE002932.

Kowallis, B.J., 2007, Finding the parents of John Moore of Orange County: *New York Genealogical & Biographical Record*, v. 138, p. 273-283.

Mathematics

Roger Baker. 2007. Euler Reconsidered: Tercentenary essays. Kendrick Press