PSI NEWSLETTER

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PSI MAKES GOOD SHOWING

by William K. Hartmann

The last few years at PSI have been exciting, with the new Northwest Division forming, new staff arriving in Tucson and the search for adequate office space. In the tumult, however, we should not lose sight of our ultimate scientific mission, for which I use this rule of thumb: The only thing that counts is what goes out the door.

As a measure of our "scientific product," our showing at the annual Lunar and Planetary Science Conference (LPSC) was encouraging. The LPSC started in the years just after Apollo as a forum to report on analysis of rocks brought back from the moon. This "rock festival" (as it was known then) was partly a venue to report to NASA program managers, to prove you were doing something useful with taxpayer dollars.

Image from NASA's Galileo spacecraft showing Jupiter's satellite, Ganymede, which is larger than the planet Mercury. PSI Northwest Division staff reported on Ganymede at this year's LPSC (see accompanying article).

Three decades later, it is one of the main venues for all disciplines of planetary science to report to each other.

PSI's 2003 abstracts to this meeting provide a good snapshot of what we are doing scientifically (in the odd moments when we are not writing new proposals and worrying about office space).

SOLAR SYSTEM ORIGIN

In the area of planet formation, Stu Weidenschilling reported on his computer models of the aggregation of icy grains into planetary building blocks within the dusty "solar nebula" surrounding the early Sun. He worked previously on this process, but the new models are more accurate because they include gas drag -- the effect of the grains being resisted by gas in the nebula, causing the grains to spiral inward. He calculates that the final size of the planet-forming region was only about half that of the nebula. The inward-spiraling grains "pile up" at a distance where the planetesimals reach a critical size. Interestingly, the place where Stu calculates that this happens is just where we see the Kuiper Belt of comet nuclei, on the outer edge of the solar system today -- good support for his model.

GANYMEDE

Karl Hibbitts, with three co-authors from the NW Division and Germany, reported studies of craters on Jupiter's moon Ganymede, the largest moon in the solar system, using data from the spectrometer on the Galileo orbiter. Certain craters on Ganymede ejected dark streamers, or rays. Hibbitts and his colleagues show that the dark material is a mixture of Ganymede icy soil and carbonaceous chondrite meteoritic material -- indicating that the dark ray craters are sites of impacts of carbonaceous asteroids -- an asteroid type common in the outer solar system. (continued on page 5)

Inside this issue:

Tom McCord Honored By AGU

by Karl Hibbitts

At the December American Geophysical Union (AGU) session "Fundamental Discoveries in Planetary Science: The Color of Worlds," attendance was large to overflowing, an unusual occurrence for an 8:30 session on a Friday morning. We were gathered there to listen to a man who had a defining role in many of our careers, Tom McCord. Tom was being honored with the AGU 2002 Planetary Section Fred A. Whipple award for his contributions to planetary science.

Born in Pennsylvania, driving a truck in sleet and snow following high school and serving in Greenland as a supply sergeant in the Air Force, Tom realized there had to be more to life. To the benefit of our profession, and to those of us fortunate enough to know him, he chose the then nascent field of planetary science. Tom enrolled in Penn State in 1962, where he rocketed his way through a physics degree in just two years, and somehow even found the time (and was lucky enough!) to meet his wife-to-be, Carol. In short order, a NASA graduate fellowship was awarded and they relocated to Pasadena. There, Tom charged his way through the academic rigors of a Caltech M.Sc. and a Ph.D. and began his journey in planetary science. At Caltech, he set a precedent for hard work and inventiveness that would characterize his entire career and culminate in this acknowledgment of his lifetime dedication and superior contribution to the field of planetary geology.

I met Tom in 1995, during the Fall AGU meeting, where we had agreed to rendezvous at the end of the session in which I was presenting. It was my interview for graduate school. The world shrunk a little bit upon my return to the University of New Mexico, when I asked the Director of the Institute of Meteoritics, Jim Papike, if he knew who this Tom McCord was! He did. Apparently, they went way back to 1968 when they met vying for the same position at MIT. Little did I realize then the significant contributions Tom had made to planetary science. Even while a graduate student at Caltech, Tom had begun to develop a national reputation as someone doing top-notch, novel research with planetary spectroscopy. He published some of the first spectra of the Moon, Mars, and the Jovian satellites, and targeted the telescope at any other object in our solar system that reflected enough light. Tom carried this reputation and drive with him to MIT where he built a team of planetary scientists at MITPAL (MIT Planetary Astronomy Laboratory). Tom quickly took on his first student, Clark Chapman, in 1972, and has mentored 20 students over 30 years. Tom has either chaired the committee for these students or provided significant guidance in their graduate careers: Clark Chapman (1972), Bob Huguenin (1972), Carl Pilcher (1973), Larry Lebofsky (1973), Mike Gaffey (1974), Carle Pieters (1977), Jay Elias (MS 1972), Roger Clark (1980), Bob Singer (1980), Mike Feierberg (BS ~1976), Bonnie Buratti (BS 1976), Lucy McFadden (MS 1977), Faith Vilas (MS 1975), Bob Brown (1982), Sue Gaffey (1984), Jeff F. Bell (1984), Paul Lucey (1986), Diana Blaney (1990), Pam Blake (1991), Jim Bell III (1992),and Karl Hibbitts (2001).

Tom is a builder. In the late 70's, he, Carle Pieters, John Adams, Jim Head and Stan Zisk formed what was informally known as "The Forse" (sic). Together, they came up with ideas for interesting research and attempted to direct the focus of planetary research with interdisciplinary studies. He brought his team from MIT to Hawaii and, after a few years at the Institute for Astronomy, created the Planetary Geoscience Division of the Hawaii Institute of Geophysics—now known as the Hawaii Institute of Geophysics and Planetology (HIGP)—at one time numbering over sixty personnel.

Tom McCord, while observing in Chile, engages in a test of wills with an Andean condor.

Tom has continued to lead the field in visible and infrared spectroscopy of the planets. During one of his infamous telescope runs, his mantra was born: "Just take the !#% data, we can throw it away later!" As it turned out, that particular data were quite useful. Tom went on to be a Co-Investigator on both the Near Infrared Mapping Spectrometer (NIMS) aboard the Galileo spacecraft and on the Visual and Infrared Mapping Spectrometer (VIMS) that is aboard Cassini (the PI is a former student of his). Today, Tom is more active in space missions than ever before: VIMS is about to send back gigabytes of data, the Rossetta comet mission is ready for flight, the HRSC (High Resolution Stereo Camera) on Mars Express will be launched shortly, and the Dawn mission has been selected. After over 30 years in planetary science, Tom is just reaching his stride.

Belle Goes to New Mexico

Dr. Kunegunda Belle has taken a Postdoc Research Associate position in the Thermonuclear Applications group (part of the Applied Physics Division) at the Los Alamos National Laboratory (NM). She is working on magnetohydrodynamic and spectroscopic modeling of magnetic cataclysmic variables. (We are pleased to report she is enjoying the mountain scenery and cool weather there.)

While here at PSI Tucson, she completed her Ph.D. dissertation research, which focused on the analysis of multi-wavelength observations of magnetic cataclysmic variables.

Kunegunda Belle, here with Bill Hartmann, at the PSI tea last December, where we wished her a reluctant farewell. Our gatherings are not the same without her.

Photo Gallery

February was a busy month at the Tucson office; we hosted two social events — PSI's 31st Anniversary Party, which took place at the main office following the annual Board of Trustees meeting, and a retreat, held at the historic YWCA on 5th Ave. Here are a few snapshots from those events.

Dr. Brent Archinal (new PSI board member) traveled from Flagstaff to attend the board meeting and anniversary party.

Attendees at PSI's 31st anniversary party at the Tucson office (from left): Ken Scoville, Kelly Yoder (PSI), David Crown (PSI) holds daughter Jessie, Amy Crown shaking hands with Jay Melosh (LPL), Tim Swindle (LPL) chats with Candace Kohl (new PSI board member from San Diego).

We are always delighted to see longtime board member John Mason (at right), who came from southern California for the PSI anniversary gathering.

Enjoying the PSI retreat at the YWCA are (from left): Carol McCord, Tom McCord (both from PSI NW) and Don Davis.

At the anniversary party, light-fingered Board Chairman Byron Groves demonstrated his art acquisition tactics on a painting by William K. Hartmann. Hmmm...

Carol Neese listens as Stu Weidenschilling explains the formation of planetisimals in the solar nebula during the PSI retreat at the historic YWCA.

Vic Baker came from LPL to help celebrate PSI's anniversary.

PSI board members at the party (from left) Ben Smith, Byron Groves and Don Davis.

Partygoers from left, Peter Bigot, Betty Pierazzo (PSI) and Joe Plassman (LPL) enjoy the company at the anniversary event.

Editor's Note: A Short History of PSI, Part 2, was originally scheduled for this issue, but due to the abundance of good science being produced at PSI and the recognition of our scientists to report on, it is been postponed until the summer publication. We apologize for any disappointment.

Karl Hibbitts chaired the PSI Northwest workshop at the new facility in Winthrop, WA (left).

View from the deck at PSI Northwest (right).

PSI Northwest Workshop

by Tom McCord

The Planetary Science Institute, Pacific Northwest Division, hosted a workshop on January 17 and 18, 2003, at their new facilities near Winthrop, Washington. The purpose was to bring together scientists and technical staff from several institutions and disciplines in an attempt to find common interests and identify new funding opportunities to expand the research interests with the goal of producing at least two new proposals.

Twenty people attended the workshop each day for 9 a.m. to 5p.m., with time off to hike and snowshoe through the surrounding wilderness. The institutions represented were: PSI NW, University of Washington, Seattle (several departments), Pacific Biodiversity Institute (PBI) Winthrop, WA, and Pacific NW National Laboratory (PNNL), Richland, WA. The workshop program was developed and chaired by Karl Hibbitts, who also moderated the program and the discussions. This was the first workshop held at the new PSI NW complex and the setting and facilities supported the workshop very well. Several attendees expressed interest in utilizing the PSI NW facilities for future gatherings and perhaps submitting new proposals through PSI.

As a result of the workshop, all the PSI NW personnel will be involved in new proposals:

Carol McCord will extend her recent work in using high performance computer facilities to develop and utilize climate and smoke tracking models for wildfire management in collaboration with the Forestry Service (through Dave Demyan) and the Pacific Biodiversity Institute.

Dave Demyan will also be utilizing the remote sensing techniques, developed at University of Washington and Geographical Information System facilities of PBI, to apply new monitoring and assessment approaches to a large forestry management project in the Okanogan Valley, WA.

John Adams, Tom McCord and Gary Hansen will be participating in a new proposal, led by Karl Hibbitts, to understand the sulfur chemistry of Mars and how it relates to the desert varnish and other coating processes here on Earth.

Karl, Gary and Tom will also be involved in developing several other new proposals applying the PNNL high vacuum irradiation facilities to solar system surface chemistry problems.

Director's Notes

2003 is off to an ominous start: the loss of the shuttle Columbia shocked and saddened PSI staff. I rose early on February 1, hoping to glimpse the trail of Columbia as it passed over northern Arizona and, while I was not successful in a sighting, I was rewarded with a splendid winter sunrise in the desert. Only an hour later did I learn of the disaster. Having worked with NASA engineers in Mission Control during Apollo, I know that the agency will leave no clue unexamined in tracking down the cause of this disintegration.

Spaceflight is never without risk — nothing in life is — but the thought of allowing this tragedy to drive us back into the cave of abandoning space exploration by humans is simply not acceptable. Doing so would render meaningless the sacrifice made by the astronauts.

The Federal Budget for FY2003, including the NASA budget, was finally passed in February, 2003 — only some four months late — and after the FY2004 budget proposal was released. NASA fared relatively well, receiving a 3.3% budget increase in FY04 compared with 2003, while the Solar System Exploration Division is slated to receive $1.36 billion in 2004, up 39%. However, most of this increase will go to big missions, not the science programs that fund most PSI scientists. As with all budgets, the devil is in the details.

And now, war in the Middle East threatens unknown consequences for the U.S. and the world. The new U.S. strategic doctrine of pre-emption of a foe, a dramatic shift from the Cold War policy of containment, is being field tested in Iraq and is causing major stresses with many traditional U.S. allies. I am co-organizer of a workshop on "Catastrophic Disruption in the Solar System" (hardly a propitious title in these times) that is to be held in Cannes, France in June, and we are seeing the effects of international stress. Registration is much lower than we had hoped; in fact, several people have already dropped out. My hope is that scientific and educational bonds prove stronger than politics and will provide elements of a framework that can lead to a more stable and enlightened world situation. Maybe the next Catastrophic Disruption Workshop can be held in Baghdad with the blessings of all governments. After all, a previous workshop was held successfully in Belgrade, a city that has been catastrophically destroyed many times in the past, and over time has been rebuilt as a better city.

Donald R. Davis
Director

PSI Makes Good Showing (continued from front page)

MARS: ICE

PSI'S Mars group, headed by David Crown and myself, is beginning to jell into a productive team as shown by our abstracts. Melissa Lane is first author of "Investigating the Martian Gullies for Possible Brine Origin" (with Phil Christensen of Arizona State University). She uses data from the THEMIS spectrometer on the current Mars Odyssey mission to search for telltale signs of salty deposits near the newly discovered Martian hillside gullies. The work is only beginning and no deposits had been found at the time of the abstract writing, but the prospects are exciting for finding places where ancient Martian water flowed or ponded.

Many of our efforts relate to ice-rich materials and their deformation. David Crown, working with co-authors from the Universities of Pittsburgh and Texas, studied debris aprons, which resemble molasses-like puddles surrounding the bases of many mountains in Martian mid latitudes. They are believed to be masses of ice and debris, which may flow like glaciers. Crown's group found examples of these aprons flowing up against impact craters. The aprons are typically a few hundred meters thick; evidence of apron ice melting included drainage channels extending from one apron.

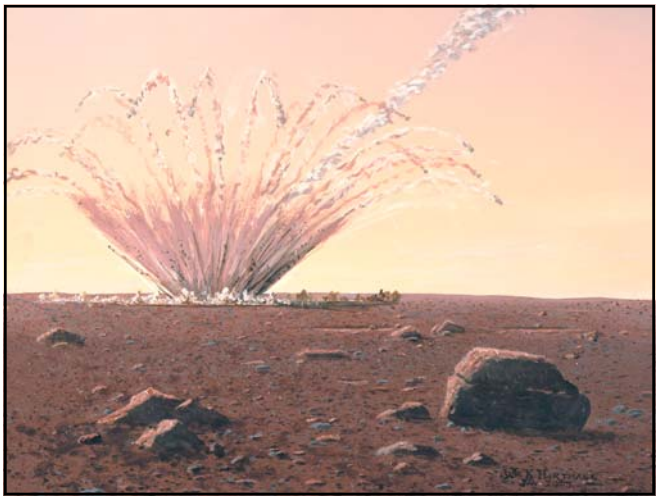
Elizabeth Turtle (with five co-authors, including PSI's Crown and Hartmann, and UCLA's Asmin "Oz" Pathare) reported computer models of viscous flow of ice-rich debris aprons and layers below the Martian surface. Oz recently visited PSI and ran new models. They found that the final morphologies strongly depend on the distribution of the underground ice, but that significant deformation of the topography can occur in as little as 10,000 years. Models of ice-rich debris aprons show how the flow slows down as the slope flattens out. Deformation can take as long as a few million years when the slope reaches shallow angles like 5-10 degrees, as in observed aprons. These timescales are young and fast, in terms of total Martian history.

Consistent with this, Dan Berman (with Crown and Hartmann) has counted impact craters on observed Martian debris aprons and related features. His data support ages of a few million years or less for the features on apron surfaces, and thus support the above view that the debris aprons are geologically young. Berman's data also suggest multiple episodes of ice flow in some aprons. If many Martian debris aprons are young, as suggested by PSI work, this raises questions of how ice-rich masses are forming in recent geologic time. Why didn't all the ice flow and reach equilibrium billions of years ago? Does this mean mobile water is forming new ice masses in modern times on Mars?

MARS: IMPACTS

Elisabetta Pierazzo, working with Chris Chyba of NASA's SETI Institute, studied possible delivery of organic molecules to Mars by means of impacts. Organics such as amino acids are known to exist in some asteroids and are likely in comets. Contrary to results from earlier two-dimensional computer models of impacts, their three-dimensional models showed that in oblique impacts, shock effects are lower than in vertical impacts, and a larger fraction of original organics would survive in the material ejected onto Mars from the impacting body. This provides a mechanism for Mars to have organic precursors to life, even if such material did not form in early Martian rivers, lakes, or oceans.

Our Russian colleague, Natasha Artemieva, visiting PSI and working with English researcher Phil Bland, presented a poster on breakup of meteoroids in the atmospheres of Earth, Mars and Venus.



A meteoroid crashes into Mars. Such impact phenomena on Mars were described by PSI staff Elisabetta Pierazzo and Bill Hartmann along with Russian co-workers Natasha Artemieva, Olga Popova and Ivan Nemtchinov at the LPSC. (see accompanying article)

Painting by William K. Hartmann

Hartmann presented an abstract with Russian colleagues Olga Popova and Ivan Nemtchinov, updating our work on meteorite impacts on Mars. We describe our estimates of the smallest impact craters on Mars (about a meter or less) and our explanation of clusters of 500-meter scale craters scattered around Mars. We think the latter are due to breakup of large blocks of Martian material ejected from impact craters, ejected upward through the atmosphere into space, and then falling back to Mars in about one half hour.

Based on this wide diversity of research activity, we can say that science marches on at PSI!

Congratulations to PSI Board member, Dr. Carolyn Shoemaker, who was recently elected to the status of Fellow by the distinguished members of the American Association for the Advancement of Science. Well done, Carolyn!

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