

The High Desert Observer

The Bulletin of the Astronomical Society of Las Cruces

August, 2008

Presidential Pause

Hello, fellow astronomers – been doin’ much stargazing lately? It’s kinda obvious but the middle of monsoon season tends to be our slowest time in the club - it’s just hard to see much clear sky. So hopefully we are using this time to catch up on projects and prepare ourselves for a busy fall season. A note of caution – if anyone plans to buy some new equipment, better do so in the next few weeks...we don’t want to cause the monsoon to last longer now, do we....! ;~)

And we may just have a really busy fall, especially in the public outreach arena. Our award-winning webmaster Rich has ‘signed up’ over 160 local teachers to receive regular emails as part of an astronomy news/info network. Also Andy Kaczmarek at Onate has agreed to pointedly encourage teachers visiting the planetarium to contact our Society for follow-up star parties. So Rich has put out a plea for several willing volunteers, to speak to classes about astronomy (even high schools), and also more helpers to man evening star parties at our schools. Please plan to join us if you can – we always strive to live up to our motto, to get out there and “share the universe with our community.”

Speaking of public outreach - as you may have heard, we are once again moving forward on our LDSP observatory project. It may be some time before we break ground for our structure, but Rich & Jerry are solving problems as they are encountered. Thanks, guys!

Does the possibility exist of a new super-dark star party up in the VLA/Datil area? I think so. Our esteemed HDO editor George has been scouting the area and coordinating plans to get a group of our members out there. Interest in a joint event there exists in the ABQ club also. Finally, on the way back from the Grand Canyon Bonnie & I swung into the Datil campground George visited and found some Dallas-area astronomers set up for the week – they were evaluating the potential for a super-dark star party there. I wonder who else out there might be thinking like this?!

WSSPIX is rapidly approaching and the ASLC is a big player this year. Early registration deadline is Aug. 22, so let’s all get our applications in the mail right away. Then consider joining those of us in the volunteer workforce putting the event on – it could save you half your registration fee! Right now we especially could use more mini-workshop presenters willing to give a short talk to other attendees – do you have an interesting & concise subject you would like to share with your fellow amateurs? Please let me know ASAP!

Finally, this has been a tough year health-wise for Las Cruces astronomers. Recently Bert Stevens & Dave Dixon were hospitalized; we lost our friends Philip Herron and Marion Seibyl (Walt’s best friend and supporter); and Chuck Sterling’s daughter was hit hard by leukemia (but on a positive note is doing much better now). Thanks in advance to all who are able to offer caring & support to Walt, Chuck, and any of our folks who find themselves in a tough situation.

Stellar Stargazin’! -- Nils



Nils at the ASLC Earth Day Exhibit (Photo from Chuck Sterling)

The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding members and public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties, and provides opportunities to work on club and public educational projects. Members receive *The High Desert Observer*, our monthly newsletter, membership in the Astronomical League, including AL's quarterly *A.L. Reflector*. Club dues are \$35 per year. Those opting to receive the ASLC newsletter electronically, receive a \$5 membership discount. Send dues, payable to ASLC with an application form or a note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004.

ASLC members are entitled to a \$10 discount on subscriptions to *Sky and Telescope* magazine.

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This Month's Observer

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Next Meeting

The next monthly meeting will be held August 22th at 7:30pm in the usual place (Main Campus of the Dona Ana Community College, room 77). The speaker will be Dr. Paul Mason: "Black Holes, Neutron Stars and White Dwarfs in Binary Systems."

The Imagers Group (contact: also Rich Richins) will meet prior to the June meeting at 7:00 pm. Anyone is welcome to attend these special interest group pre-meetings.

Other events planned for August and September include:

Dark Sky Observing at the Upham dark sky site, Saturday, August 31st, at dusk.

MoonGaze, Saturday, September 6th, at dusk.

Please see the ASLC website for further information:

<http://www.aslc-nm.org>.

September Issue of the *HDO*

Articles for the September issue should be sent to Tony Gondola by Saturday, September 13th. Text should be sent as email (acgna@comcast.net) or as an attached Microsoft Word document. Images should be sent in jpg format.

If you have any questions about submitting something to the *HDO*, please don't hesitate to contact me at 571-5118 or via email. Thanks in advance!
Tony Gondola, Editor, ASLC Newsletter

Minutes, July 2008 ASLC Meeting

Call to Order:

Nils Allen, President, Astronomical Society of Las Cruces (ASLC), called the meeting to order at 7:35 pm., 25 July 2008, Rm. 75, Dona Ana Community College.

President's Comments:

Nils Allen, Club President, welcomed the group, then recognized & greeted Jeff Jenkins, a repeat visitor; Tom Krajci, our featured speaker, and Andy Solidis, visiting from Cloudcroft, NM.

Secretary's Report:

The minutes for the June meeting were submitted as published in the current issue of the Club newsletter, the High Desert Observer (HDO). A motion to accept the minutes as published and dispense with the reading of same was offered by Janet Stevens and seconded by Bert Stevens. The motion passed by acclamation of the members present.

Treasurer's Report:

The treasurer reported on the status of the Club's accounts. She also reported that delivery of the Club's Meade SolarScope was expected by September. The primary cause for delay has been attributed to the double-stack option. She will continue to try to push delivery of the order and will look into any price reductions. The treasurer also had copies of the member directory to distribute to any members that had not received theirs at the first distribution in May.

Committee Reports:

Observatory Committee:

Jerry Gaber, Construction Sub-Committee Chairman, Observatory Committee, reported that he had received information from Dan Lilly, the professional engineer working on the formal drawing package for the permitting process. The structural drawings have been approved but the electrical specifications are still outstanding. The electrical drawings will be complete in about a week and then committee members will meet with park personnel.

White Sands Star Party (WSSP) IX, 26-27 September 2008:

Jerry Gaber was not able to attend the WSSP planning meeting on 24 July as it was held during the work day. He did report that volunteer Saturday speakers and workshop coordinators are still needed. Rich Richins suggested providing multiple "tracks" of presentations as a possibility. However, there is only one room available in the Visitor's Center available for presentations. Nils Allen envisions providing five (5) hours of presentations/workshops (10 presenters, 30 minutes each). There will also be the Comet Hale-Bopp Star Party on 25 September in Cloudcroft. The New Mexico Museum of Space History hopes to raise \$5000 via the Hale-Bopp event, but Project Astro may not be the beneficiary.

George Hatfield asked about opportunities for other star parties in the Cloudcroft area. Tom Krajci said there are other sites available in the area, but that May is a better time of year. Fred Pilcher volunteered to participate as a speaker/presenter. Rich stated that many entry-level astronomers attend WSSP so that the level of presentations does not have to be “PhD or professional astronomer-level”. WSSP will not be held in the traditional Area 19 but rather in the West Film Area of the dunes. Nils suggested that members mention WSSP to the general public as often as possible.

Old Business:

1. Meade SolarMax telescope – see Treasurer’s Report above for status update.
2. Club logo/insignia apparel – Steve Henderson is willing to put together another order of Club apparel. A follow-on order for more shirts & hats (or other types of apparel, i.e., jackets, sweatshirts, vests, etc.), is possible if there is sufficient Club member interest. Members should contact Steve or Nils Allen to express their interest(s).

New Business:

1. High Desert Observer (HDO) mailing – Nils Allen noted that the extra \$5 membership fee to receive the HDO via US Mail no longer covers the costs of reproduction and mailing. George Hatfield, newsletter editor, and John McCullough, Club secretary, were directed by the Board of Directors to inform members of the increasing costs and encourage members to remove themselves from the mailing list. Nils encourages any members that can to receive the newsletter via email. Fred Pilcher pointed out the predicted decay/deterioration of electronic media and queried if it was sensible to archive newsletter issues in paper form. Discussion followed pointing out that paper is also considered ephemeral and storage and future access would also have to be considerations. Bert Stevens asked if the position of Club Historian should be an official post and include responsibilities of archivist. Joseph Mancilla will continue to maintain copies of the newsletter pending a decision.
2. New Mexico Space Grant Consortium – Jeff Jenkins stated that National Public Observatory (NPO) has funding through Nov 2008 that provides \$60 per program presented and 50¢ per mile traveled. Is the Club interested in partnering with NPO as a presenter for the next grant period? Nils Allen responded he will work with John Gilkison, NPO coordinator, on the details.

Rich Richins offered a motion to adjourn and George Hatfield seconded. The business portion of the meeting was adjourned at 8:15 pm by acclamation of those present.

Announcements:

1. Telescopes – Dave Dockery and Jerry Gaber have added new 14" scopes to their respective inventories. George Hatfield has purchased a new mount.
2. Awards – The Club's website was ranked third among Astronomical League member club websites. Congratulations to Club web master Rich Richins.
3. Astronomical League (AL) Outreach Award – Club members need to fill out the Excel spreadsheet and submit them as soon as possible.
4. Sad News – Philip Herron, a former participant in Club events, passed away recently. Jerry Gaber is working with Philip's ex-wife to catalog and help dispose of Philip's numerous telescopes and other observing equipment. Jerry will post more information via the ASLC yahoo group.

Club member Chuck Sterling's daughter Melissa has been diagnosed with AML, a form of leukemia. Chuck and his wife will be spending a significant portion of their time with her in Albuquerque and he will update members on her status via the yahoo group.

Club members Walt and Marion Seibyl have both been in poor health recently. Marion especially is not doing well and is in hospital in Albuquerque.

5. August HDO – George Hatfield will be out of town next month. During his absence, Tony Gondola will edit the newsletter.
6. MoonGaze - A monthly MoonGaze was held 12 July at International Delights Café on El Paseo. The August MoonGaze will be 08 August.

Observations:

There were no observational reports offered.

Presentation:

This month's program was presented by Tom Krajci, an astronomer and scientist situated in Cloudcroft, NM. His topic was "The In's and Out's of Amateurs Doing Real Science by Doing Stellar Photometry." Tom followed this with an informal demonstration of his "Mirror-o-Matic" mirror grinding machine (not recorded for rebroadcast). Other meeting presentations can be accessed on the web at <http://www.aicsresearch.com/lectures/aslcnm/>.

The July 2008 monthly meeting concluded at 9:30 pm.

-Respectfully submitted by John McCullough, ASLC Secretary

The Grand Canyon Star Party Experience

By Bonnie, the “astro widow”

Recently Pat Hatfield (George’s wife) told me about “The Heavenly Bodies,” a 1943 Heddy Lamar comedy movie about a neglected wife of an astronomer who seeks the advice of an astrologer. Pat, Carol Sherick (Mike’s wife) and I have discussed the idea of a new group being formed of neglected astronomers/ASLC wives. We could watch old movies and share our own comedy. Anyone is interested in joining us please let us know. Even after two star parties in one month I don’t see myself ever bundled against the elements of a DSO and would find a chick-flick still more fun...

I did have a great time at the GCSP, meeting lots of interesting people and enjoying the beauty of the canyon. It was very different from the TSP. With tighter grouping of astronomers and lines of visitors, to me, it was more of a craft fair atmosphere, with each astronomer showing off his version of the way each particular jewel should be displayed. It could be a planet with a small unique homemade scope, or an individual nebula with a variety of dobs, or an obscure something that no one could really see but the eye of the proud owner of the large Go-To with more red lights hanging on it than stars above.

The word for the week was “wind.” The odd thing was that back in camp there was barely a breeze while at the same time the rim was blowing scopes to the point that Nils (and others) was hugging the scope to hold it steady enough for viewers. The same phenomena of winds coming up at dusk occurred every evening, decreasing daily, until the last night we were there when the winds only included occasional mild gusts. Despite the wind, the lines of people (several hundred nightly, maybe 100 at our scope) were patient as they waited their turns and the last exclamation was as enthusiastic as the first. There were some trees on the lower field where we were and the Milky Way framed itself between them for a beautiful picture.

The almost daily planned social gatherings of astronomers allowed us to get acquainted with many people. There was an afternoon pizza social/meeting, a breakfast burrito (late) morning gathering, a spaghetti thank-you lunch for the Forest Rangers, whose help was invaluable, and a wrap-up pot luck/cookout at the home of one of the rangers. The evening public talk/slide shows were held outdoors near the rim of the canyon, right after the magnificent beauty of the sunset each evening. They were over with just as it was dark enough for the observing to begin. Then the crowds would descend on the parking lot full of telescopes & their owners – let the “Ooh, Aw” games begin!

The extra-curricular activities we enjoyed included a few days with family who joined us camping, observing the Condors, the elk, a trip to the I-Max, the trips to the \$2 camp showers, and helping a semi-truck driver who had made a wrong turn and ended up in the middle of a campground with no way to go forward or back up the big rig without taking out a tree. After about 2 hours, he and the trees successfully departed company. Then there were the crows, which I really wished I’d seen, that pecked their way through our styrofoam ice chest to find it full of ice water from the ice stored in it. Most fun for me were the many people, each with their own story of what brought them to the canyon and where they were going from there. Astronomers do tend to be a diverse group of folks.

Overall, it was a great week, with time for fun, relaxation, and making new friends.

Grand Canyon Star Party - Comments from the “widow-maker”, Nils

My wife is incredible – she survived her second week-long star party in June (and I lived to tell about it!) We were some of the few first-timers attending, so we had to learn “the drill.” Overall, it was fascinating to be part of such a large group (around 75) of public-outreach-focused amateur astronomers. Let’s face it - it takes a certain type of astronomer to show hundreds of people the same few objects night after night, and enjoy it (most of the time). Yet it’s the people (public & astronomers) that really make this event unique. I’ve never had so many folks looking through my scope who couldn’t understand English (just try explaining a planetary nebula with your hands & sound-effects!)

Initially we found the atmosphere to be a little competitive in the main parking lot (too many scopes in too small of a space). Wisely we chose to move down to the roomy lower field, where the situation was easier overall: my Dob could stay up all week, the crowds were much less, and the winds were (somewhat) more manageable. The 22-inch did act like a sail at times, but overall it performed quite well - one viewer thought its images were better than those in the 28" back up in the main lot. Considering the conditions, the seeing was typically quite good...better than TSP on average. I got my fill of gawking at the splendors of the southern Milky Way from a dry, dark high altitude site after the public left at 11pm - and didn’t have to stay up till 2 or 3am to do it. Bonnie was patient & very helpful, even aiming the scope & explaining the view at times (never thought I’d see the day!)...a little teamwork really helps at an event like this. As at TSP, after many clear nights we started to get worn out with the routine, but it was a good sort of tired. Having the whole week (a prerequisite for the free campsite) really helped - we just took the night off when we got too tired. I was inspired by my observing neighbor from Alabama – he operated a custom-built rolling astro-show...live-in warm room (with couch & plasma TV), 14" Meade SCT in a POD, all mounted on a 30’ flat-bed trailer that he takes from star party to the next year-round. Sweet!

So would we do it again? Sure, why not! Maybe even try the North Rim version, which I hear is really special with fewer downsides. Boy, I can’t wait to be retired.... :~)

— Bonnie & Nils Allen

Astronomy's Impact on Biology

By Wirt Atmar

At the end of June, there was a discussion on the ASLC's listserver whether or not the fire at the base of the Organ Mountains (Fig. 1) was caused by a meteorite or not, as was suggested by an article in the Las Cruces Sun-News. It was properly pointed out on the list that meteorites that strike the ground are often found not to be hot but cold. Their transit through the atmosphere is so brief that nothing but a millimeter or two of the meteorite's surface is heated to a molten temperature, and that thin veneer quickly cools in response to the much colder temperature of the space-borne rock beneath. But this isn't the first time that meteorites have been suspected of causing fires, and whether they do or not must depend on a number of factors, including their sizes, their entry angles and the condition of the dry vegetation on which they land.



Figure-1

An image of the Organ Mountain fire forwarded to the ASLC list by Dave Dockery in late June. The Las Cruces Sun-News suggested that the fire was ignited by a meteorite, but there is good reason to doubt that explanation.

Perhaps the most controversial episode occurred in 1871 when four large fires simultaneously erupted in the area of Lake Michigan, in the states of Michigan, Wisconsin and Illinois. The Chicago Fire, which was initially blamed on Mrs. O'Leary's cow, was a part of those fires. Michael Ahern, the *Chicago Republican* reporter who created the cow story, admitted in 1893 that he had made the story up because he thought it would make a colorful copy, but he otherwise had no idea what the cause of the fire was. The Wisconsin portion of the fire is now called the Peshtigo Fire and is believed to have been the deadliest in North American history, killing somewhere between 1,200 and 2,400 people. The Chicago Fire added several hundred more souls to that tally.

Meteor trails were observed in the sky that night. It was a windy night in October following an exceptionally dry summer. The fact that four very large fires all began simultaneously is certainly suspicious, but meteor-induced fires, although they've been repeatedly reported, have proven to be notoriously difficult to pin down as to the actual cause, and the fires of 1871 are no different.

But there's no doubt about the cause of the 1908 fires in Tunguska, Siberia. An airburst impactor set at least a small part of Siberia afire. The testimony of an observer who was 40 miles away the morning of the airburst was this:

“At breakfast time I was sitting by the house at Vanavara trading post. I suddenly saw that directly to the North, over Onkoul's Tunguska road, the sky split in two and fire appeared high and wide over the. The split in the sky grew larger, and the entire northern side was covered with fire. At that moment I became so hot that I couldn't bear it, as if my shirt was on fire; from the northern side, where the fire was, came strong heat. I wanted to tear off my shirt and throw it down, but then the sky shut closed, and a strong thump sounded, and I was thrown a few yards. I lost my senses for a moment, but then my wife ran out and led me to the house. After that such noise came, as if rocks were falling or cannons were firing, the earth shook, and when I was on the ground, I pressed my head down, fearing rocks would smash it. When the sky opened up, hot wind raced between the houses, like from cannons, which left traces in the ground like pathways, and it damaged some crops. Later we saw that many windows were shattered, and in the barn a part of the iron lock snapped.”

What effect did this impact have on life on Earth? Very little. It's hard to make much of a dent in the history of life on this planet with an impactor. Life is resilient, and it's best to think of an ecology as a stretchable web. Life recovers surprisingly quickly from disturbances, if they're not too large.

Susceptibilities to extinction vary greatly among species. Species can be driven below their minimum viable population sizes for a raft of reasons. But even more importantly, species that occupy refugia less affected by the catastrophe will be the species that first rebound to repopulate the evacuated arena, while species that fall below their minimum viable population sizes everywhere are those that will be permanently extinct.

To some degree, permanent extinction is simply a matter of luck, but it is also highly correlated to body size and food chain considerations as well. Large-bodied animals are more susceptible to permanent extinction, as are top predators. Both require large areas and large prey populations to prosper, and if those conditions disappear, so do they. But the Tunguska event wasn't large enough to do any harm to either, and thus life in Siberia rapidly recovered and filled the biological hole left by the bolide.

But what of a larger event? It's been recently proposed that the megafaunal extinctions of North America at the end of the last ice age, when we lost mammoths, camels, horses and lions, were caused by a similar but much larger airburst impactor over Canada 12,900 years ago. This hypothesis has certainly not been greeted with open arms. A review in January's Geological Society of America's *GSA Today* wrote: "The 12.9-ka impact story has struggled to bring its disparate evidence under a single umbrella. The impact story originated in Firestone and Topping (2001) and the Firestone et al. (2006) book, both of which contain observations and claims so wild that other work by these authors invites careful scrutiny."

That's about as harsh a public rebuke as you're ever likely to read in the scientific literature, and it's almost certainly not warranted. A more recent press release just a few weeks ago from the University of Cincinnati was more positive in its assessment. They wrote:

"Geological evidence found in Ohio and Indiana in recent weeks is strengthening the case to attribute what happened 12,900 years ago in North America – when the end of the last Ice Age unexpectedly turned into a phase of extinction for animals and humans – to a cataclysmic comet or asteroid explosion over top of Canada.

"A comet/asteroid theory advanced by Arizona-based geophysicist Allen West in the past two years says that an object from space exploded just above the earth's over modern-day Canada, sparking a massive shock wave and heat-generating event that set large parts of the northern hemisphere ablaze, setting the stage for the extinctions."

Clearly, the final story hasn't been told in regards to this latest hypothesis. Indeed, the discussions are just heating up. But there is little doubt now about the effects of life on this planet from the Chicxulub impact 65 million years ago, although that too wasn't always the case. When the Alvarez-Alvarez hypothesis of an asteroidal impact being the cause of the Cretaceous/Tertiary (K/T) extinction event was first being argued, there was an exceptionally heated and prolonged argument about whether the hypothesis was true. The alternative idea was that the K/T boundary was actually due to the eruption of the Deccan Traps, an almost continental-sized lava flow half the size of modern India. Either event had the power to completely alter the Earth's biosphere, and the Deccan Traps hypothesis being the cause of the K/T extinction event had a fair number of supporters for quite a time.

Increasingly it appears that both events could be true, a double whammy, so to speak, and that the Chicxulub impact crater and the Deccan Traps are simply consequences of one another. There is good evidence to support the contention that the Deccan Traps are an antipodal ("opposite side of the earth") geological rebound event caused by the Chicxulub impact. In this hypothesis, seismic waves created by the impact travel through the Earth and are intensely focussed at the antipode, producing a massive mantle plume that breaks through the skin of the Earth.

Originally the Deccan Traps lava flows had been thought to have occurred over a period of millions of years, but new evidence appearing just this summer strongly suggests that the flows appeared as "single eruptive events" over a short period of time, perhaps decades, precisely the behavior you would expect to see from a planetary impact rebound event.

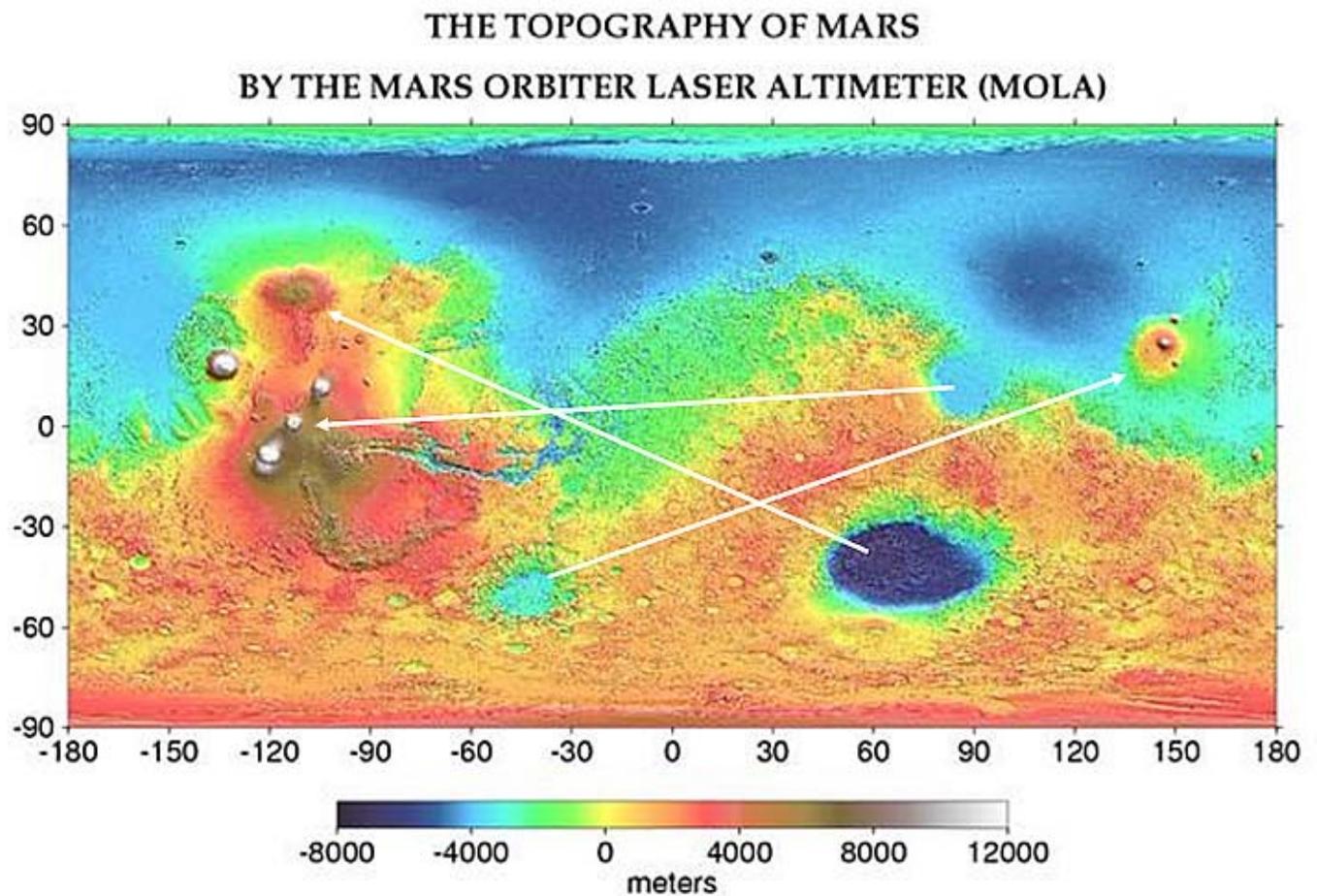
Seventy percent of the species present on Earth at the time of the K/T event went extinct, but even it wasn't the largest extinction event in the history of life on Earth. That happened 190 million years earlier. The "Great Dying" occurred at the Permian/Triassic (P/T) boundary 250 million years ago, when more than 90% of the species alive at the time disappeared. Of interest, another continental-sized lava flow also appeared at the same time, and it was five times larger than the Deccan Traps.

The Siberian Traps of the P/T boundary have been similarly linked to a putative asteroidal impact somewhere in the Antarctic/Australian/Japanese area (land masses which were contiguous at the time), although there is currently far less evidence for such an impact at this boundary, even though the effect on life on this planet was much greater.

While we only have these two possible major impacts on Earth during a period in which rebound events could even hoped to be measured before they would be erased by continental motions, the Earth is no longer the only planet that we available to us to look for these antipodal rebound effects.

Mars is now geologically dead, having had its molten interior core cool perhaps within the first billion years of its existence. As a consequence, Mars lost in turn its molten core, its magnetic dynamo, its magnetosphere, its protection against the solar wind, and ultimately its hydrogen, and thus its water. But what that means to us is that Mars' early geological history has been frozen in place in a manner that Earth long ago lost.

Figure 2 below is a recent MOLA topographic map of Mars. The deep purple circular region in the lower righthand portion of the image is the Hellas Basin, the deepest depression on the Martian surface. It is almost certainly an impact crater, likely created by a glancing impactor. Of great interest, there is also a sizable elevated plateau precisely at the antipode to the Hellas Basin, Alba Patera. Indeed, there are a number of such elevated areas that are antipodal to matching depressions on Mars, and I've indicated some of them by the white arrows.



Mars is an odd planet. Half of its surface retains the ancient cratering events following the initial sweep of the protoplanetary disc debris from which the planets evolved. The other half of Mars is almost completely devoid of impact craters, colored in ocean blue in the image. More odd yet, the ocean blue part of Mars lies in a 4 km deep depression that is otherwise completely discontinuous with the remainder of the Martian surface.

Twenty years ago, Don Wilhelms and Steven Squyres, the current principal investigator for the two rovers that are now walking across the surface of Mars, proposed that the Martian surface discontinuity was the result of a major impact, following the time of primary cratering. The only problem with the hypothesis was that it is very hard to imagine how such an impact could have occurred without melting both planetary bodies.

The solution of course was to have the impact be a glancing blow, but even that didn't explain everything. The Tharsis Ridge is in the wrong place. It shouldn't be where it is. In the News & Views section of the April 11, 2008 issue of *Science*, Richard Kerr wrote the following about recent studies of the Martian discontinuity:

“Last month, planetary geophysicist Jeffrey Andrews-Hanna of the Massachusetts Institute of Technology in Cambridge and colleagues presented their test of the giant-impact hypothesis at the Lunar and Planetary Science Conference (LPSC) in Houston, Texas. In 1984, planetary scientists Donald Wilhelms, now retired from the U.S. Geological Survey, and Steven Squyres of Cornell University first proposed that a huge impactor had blasted out the Borealis basin. Fitting a circle to the ‘dichotomy boundary’ between the basin and the highlands, they suggested that the circle could mark the outer edge of a huge crater. But the fit was too rough to win many converts.

“So Andrews-Hanna and his colleagues looked for a better way to trace out the dichotomy boundary. The great Tharsis volcanic complex had obscured much of the boundary when it smothered one-quarter of the planet with lava hundreds of millions of years after the lowlands formed. To ‘remove’ Tharsis, they drew on measurements of martian gravity and surface height from the past decade of Mars orbiters. Subtle variations in the pull of gravity – evidenced in variations of a spacecraft’s orbit – reflect the added mass of Tharsis lavas as well as the extent of the deep, less-dense crustal rock buoying up the highlands. The height of the surface constrains the volume of added lavas.

“By combining the data in a model, the researchers erased Tharsis’s contribution to the present surface and traced the topographic edge of the Borealis basin right under Tharsis. Rather than a circle, the best shape for the basin turns out to be a 10,650-kilometer-long ellipse, they reported at the LPSC meeting. That’s a familiar look for big impact basins. The 2300-kilometer Hellas impact basin in the southern highlands, for example, is also elliptical and also underlain by a uniformly thin crust. And there’s no particular reason, Andrews-Hanna said, why the giant-impact theory’s only serious rival – a peculiar sort of churning deep within the planet – would produce an elliptical basin or the observed sharp boundary between thin and thick crust.”

The rebound hypothesis remains controversial for the Chicxulub/Deccan Traps pair, and is even more debated for the P/T-impactor/Siberian Traps event among Earthly geologists, but surprisingly perhaps, the antipodal rebound hypothesis is relatively well-accepted by astronomers as an explanation for the topography of Mars.

The sequence of the evolution of the Martian surface is thus believed to be this: intensive cratering over the entirety of its surface for the first half billion years of its existence, just as it was for the Earth, Moon, Venus and Mercury.

The Moon, Mercury and Mars however retain that evidence due to the absence of further geological activity. Some short time later, Mars was whacked by the glancing blow of a very large impactor, creating the hemispheric discontinuity of the Borealis Basin. Some time later yet, Mars was hit again by the smaller Hellas Basin impactor, creating the Alba Patera as a rebound event.

We can't see that deep in time on Earth with accuracy. But we can look back across the span of time that encompassed fossilized life. On Earth, the Age of the Dinosaurs was apparently ushered into existence following the P/T event 250 million years ago, and the dominance of the dinosaurs was extinguished by a bookend event at the K/T boundary, 65 million years ago.

Because of the knowledge we're retrieving from Earth and Mars over the last several decades, the argument that both events were caused by asteroidal impacts has been substantially strengthened (but in the minds of many, still jumping the gun a bit). Nonetheless, because of this, the geological history of both Earth and Mars is beginning to make more sense and tell a more consistent story than we've previously understood, particularly about the evolution of life on this planet. But the most extraordinary consequence is yet to be discussed. We may well owe a good portion of our intelligence to these impacts.

Next month: How Astronomy Changed My Life, and Millions of Other Species as Well

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