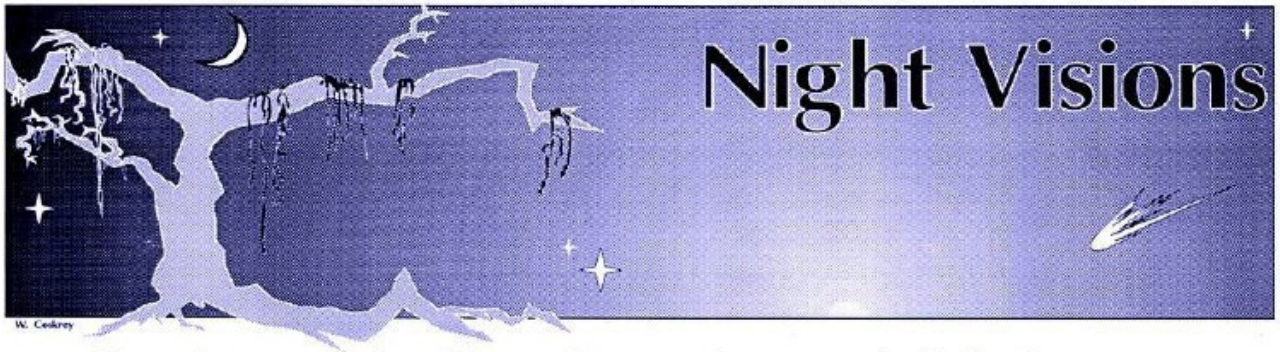


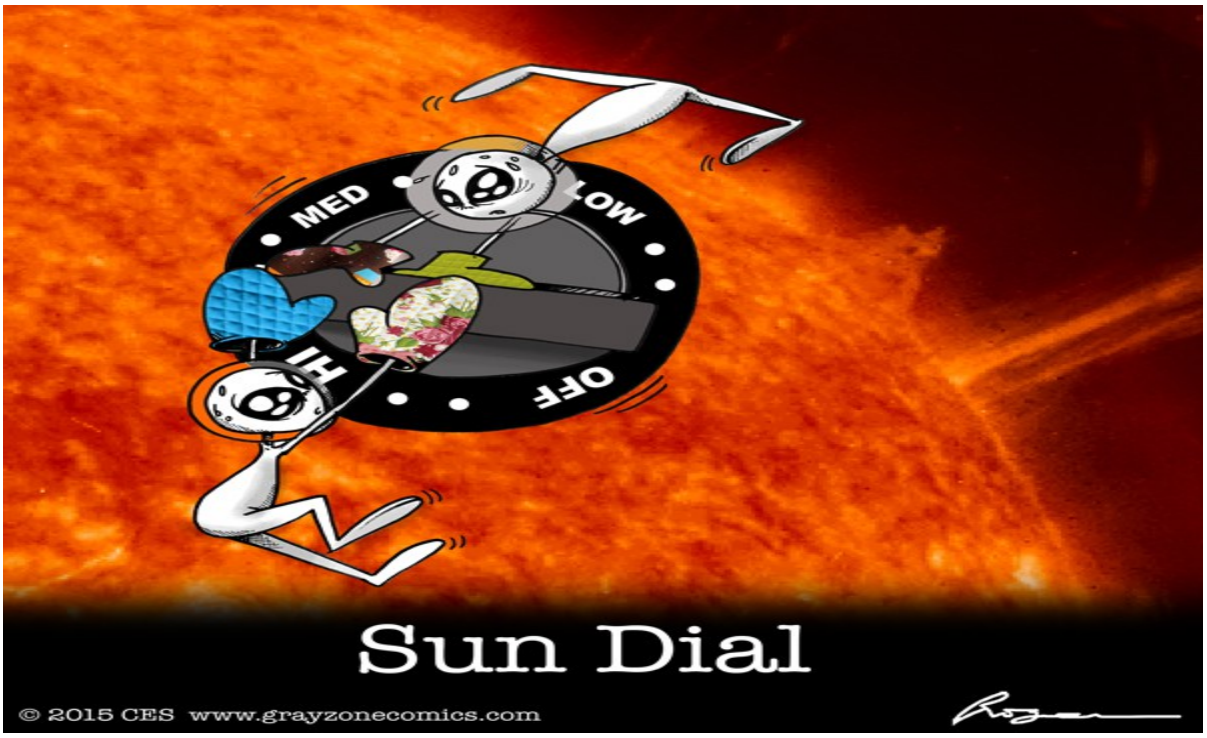
Newsletter of the Baton Rouge Astronomical Society

February, 2016

Next Meeting: Monday, Feb 8th at 7PM at HRPO

BRAS is a recent addition to the Night Sky Network. Click on the image to go to its website and learn what it's all about.

What's In This Issue?



HRPO

FRIDAY NIGHT LECTURE SERIES

all start at 7:30pm

5 February: "Challenger—Thirty Years Later" The tragedy that claimed (at that time) the greatest number of American astronauts!

12 February: "A New Ninth Planet?" We'll sift through the available evidence suggesting there may be a fifth gas giant in our Solar System!

19 February: "LIGO—The Search for Gravitational Waves" Dr. Amber Stuver will describe the amazing cutting-edge science in progress here in Louisiana, and how history might be made soon.

26 February: "The 20/20 Vision Campaign" This update on the BRAS initiative to darken the skies in Baton Rouge will outline successes and identify hurdles still to conquer.

SCIENCE ACADEMY

Saturdays from 10am to 12pm

For ages eight to twelve. $5/$6 per child.

6 February: "Periodic Table"

13 February: "Amazing Alchemy"

20 February: "Expedition 5"

27 February: "Exoplanets!"

SOLAR VIEWING

For all ages. Free admission.

27 January, 12pm to 2pm

CALL FOR VOLUNTEERS

*Saturday, 14 May from 3pm to 11pm. *Fifteen to twenty volunteers.* **International Astronomy Day.** Various tasks. Moderately difficult.

*Monday, 9 May from 6am to 2pm. *Six volunteers familiar with at least one telescope.* **Transit of Mercury.** Solar viewing. Moderately difficult.

Secretary's Summary of January Meeting

- Meeting opened

-Announcement the club dues were due January 1st and to please pay if haven't already

-Announcement of upcoming events involving the club

-Don Weinell spoke about upcoming Rockefeller and Hodges Gardens star parties. He noted that pre-registration will be required for the first time this year for Hodges

-Chris Kersey spoke about Globe at Night and announced that he would be giving a talk at the Civic Association meeting regarding light pollution. He also spoke about upcoming events at the HRPO

-BRAS Moon Watchers Award given to Trey Anding. It was the first time it was given

-Craig Brenden demonstrated one of the new Night Sky Network activities

-Scale models of the solar system were discussed as future projects

-Craig Brenden and Wally Pursell spoke about cleaning telescope mirrors

-Don Weinell demonstrated how to collimate a dobsonian telescopes

-It was announced that Dr. Brad Schaefer will be speaking at the February meeting

-No raffle was held this month

-Meeting adjourned

Ben Toman
BRAS Secretary

Drying Out the Moon?

For decades, planetary scientists and geologists assumed that the Moon was about the driest and dustiest place in the solar system. Then around 2010, a spate of independent observations from spacecraft and elsewhere uncovered evidence of hydrogen in lunar rocks. Taking hydrogen as a proxy for water (H_2O), the evidence suggested that ice might be buried at the lunar poles—and that indeed, the material from which the Moon formed might have been as wet as that which formed Earth.

The lunar mineral richest in hydrogen is apatite: a compound of calcium, phosphorus, and oxygen that also incorporates either fluorine, chlorine, or hydroxyl (an oxygen-hydrogen group). For those who like chemical formulas, apatite is written as $Ca_5(PO_4)_3(F, Cl, OH)$.

Apatite is attractive as a tracer of volatile elements in many environments because it appears in many rocks brought back by the *Apollo* astronauts, ranging from the relatively young lunar maria (lava seas) to the ancient highlands. Thus, apatite was regarded as a good tracer of hydrogen. Indeed, apatite was the *only* hydrous mineral (one with water or water's constituents) in lunar samples.

A new computational model of how apatite crystalizes, devised by Jeremy W. Boyce in the Department of Earth, Planetary, and Space Sciences at UC Los Angeles and four coauthors now indicates that apatite is a misleading indicator of water in the Moon.

No appetite for apatite

Boyce's model simulates how apatite crystalizes out of cooling molten lunar magma, incorporating fluorine, chlorine, or hydrogen into its structure. Modeling revealed that during fractional crystallization—in which newly formed crystals separate from the melt—apatite preferentially incorporates fluorine first.

"Early-forming apatite is so fluorine-rich that it vacuums all the fluorine out of the magma, followed by chlorine," explained Boyce. "Apatite forming later doesn't see fluorine or chlorine and becomes hydrogen-rich because it has no choice."

The model also makes specific testable predictions. For example, it predicts that apatite crystals grown at different times in the same magma should have different abundances of fluorine, chlorine, and hydrogen—abundance differences observed almost ubiquitously in lunar rocks. It also suggests that if crystallization is quick or diffusion slow, the core of a crystal should be rich in fluorine while its rim is fluorine-poor and hydrogen rich—zoning indeed observed in basalts brought back from *Apollo* missions 11, 12, and 14.

Most importantly, the model demonstrates how apatite could form with orders of magnitude more hydrogen than expected from a melt actually having little water. "Because it is not required that late stage H_2O_{melt} [the amount of water in the melt] be elevated in order to explain the elevated abundances of H_2O_{ap} [the amount of water in the apatite], hydrogen-rich apatite cannot be cited as evidence for elevated H_2O_{melt} a priori," state Boyce and his co-authors in their paper in the April 25, 2014 issue of *Science.*

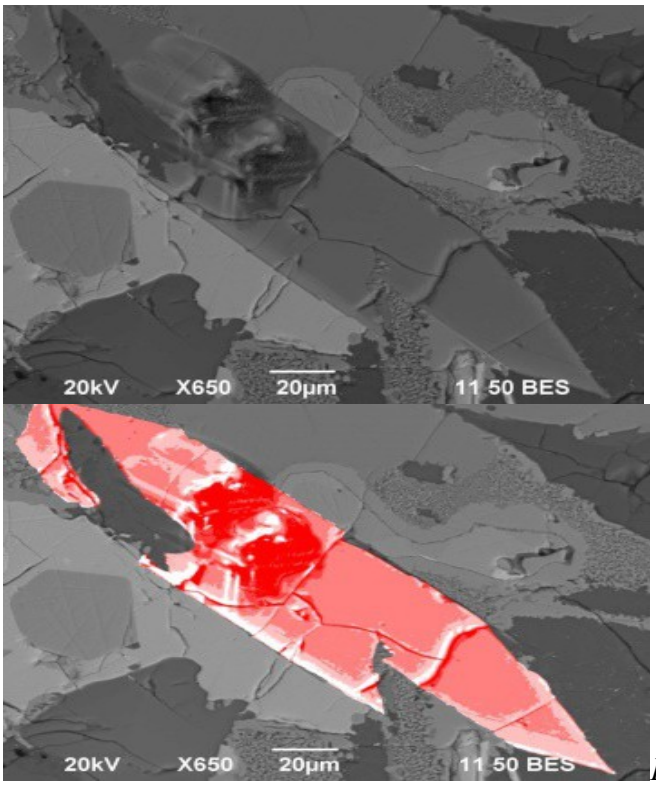
So does the Moon have water?

Does this finding about apatite mean the Moon is as arid as thought before about 2010? Likely, no, says commentator Mahesh Anand in a perspective article in the same issue of *Science.* Olivine crystals, "which were some of the earliest-formed crystals in lunar volcanic glasses, point to a wet lunar interior," Anand pointed out, as does spectroscopic analysis of plagioclase crystals and other observations

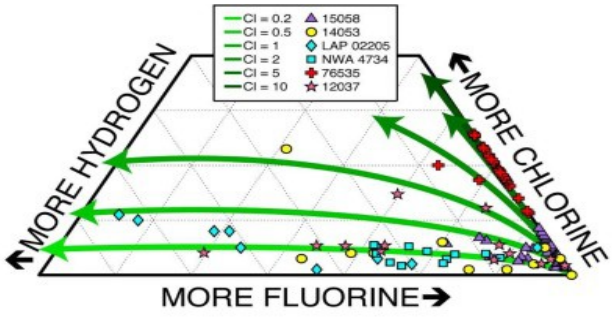
What the finding does mean is that apatite—the most widely used method for estimating water in lunar rocks—"cannot be trusted," Boyce declared.

"We're knocking out one of the most important pillars of evidence regarding the conditions of the formation and evolution of the Moon," he concluded. "Next, we plan to determine how badly apatite

has distorted our view of the Moon and how we can best see past it to get at the Moon's origin." – *Trudy E. Bell, M.A.*



Photomicrograph of Apollo 11 lunar sample 10044,644 maps density of its polished surface: denser materials reflect more electrons and look lighter gray. Pinkscale version of image highlights density variations for a crystal of apatite. Such variations would be expected had the crystal formed through fractional crystallization—a process that ruins apatite's ability to record volatiles, including hydrogen. *Credit: Jeremy Boyce, UCLA*



Measurements of hydrogen, fluorine, and chlorine in different lunar samples are shown as different symbols. Green curves represent how composition of apatite changes because of fractional crystallization. Shades of green depict models with different amounts of Cl, but all models have identical water. Changing the amount of fractional crystallization and the Cl content, one can model any apatite found now on the Moon, whether water rich or water poor—but all could have come from magmas with the same water content. Thus, apatite is a poor indicator of magmatic water. *Credit: Jeremy Boyce, UCLA*

Recent Entries in the Forum

Below are selected recent additions to the BRAS Forum. There are also nine active polls.

Jane Houston Jones Reminds Viewers of the "Winter Hexagon"
HRPO Hosts Field Trip for Junior Science and Humanities Symposium
Burbank Soccer Complex's Newer and (Hopefully) Better Lighting
Six Visible Passes Spotted in Seven Nights at HRPO
All Five Unaided-Eye Planets in the Morning Sky Until 7 February
Scientists Claim Evidence for Fifth Gas Giant
Learn an Easy Trick to Find the Celestial Equator
One-Year Mission has Two Months to Go
ISS Resupply Launch Schedule Announced by NASA
Jason-3 Now in Orbit
Mars Now Brighter Than +1 Magnitude
February Great Red Spot Viewing Times Posted
45th Anniversary of Apollo 14
BRAS Member Witnesses 13 January Fireball
HRPO Patrons See Comet Catalina
Algol Reaches Minima on 29 January
Strange Stellar Explosion(?) Confuses Astronomers

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20/20 Vision Campaign

GLOBE at Night: 1 February to 10 February
2016 GOAL: 200 Measurements. CURRENT: 19

BRAS' presentation to the Federation of Great Baton Rouge Civic Associations on 14 January at the Main Library was successful; a number of audience members requested BRAS contact information and asked for tips on identified sky-friendly nighttime lighting.

BRAS is in the process of assisting a student at St. Joseph's Academy acquire raw data. The student needs descriptions of views of five Messier objects—Pleiades, Orion Nebula, Andromeda Galaxy, Beehive Cluster, Whirlpool Galaxy—together with that location and date's GaN measurement. An alert will be sent out describing this exercise in more details. The student needs very much this information with *at least three sky views (different limiting magnitudes)*.

At least six of the nineteen Louisiana measurements sent to GaN so far have come from BRAS.

Transit of Mercury

Solar-knowledgeable BRAS Volunteers Needed.

Monday, 9 May from 6:00 am to 2:00 pm
First one in ten years!
No admission fee. For all ages.

A "transit" is the phenomenon of viewing a smaller body crossing in front of a larger one. On 9 May, for the first time in ten years, the disk of Mercury will traverse the disk of the Sun. A Transit of Mercury is not visible to the unaided eye. At least 30x magnification is needed to easily see the phenomenon. Several telescopes (at least six) will be in operation on HRPO grounds. HRPO will be open for the duration of the event. The Sun will actually be rising here in Baton Rouge as the transit gets started!
CAUTION: Viewing a Transit across the Sun can be dangerous for one's eyesight if not performed correctly. The BRAS Forum thread lists a number of safe ways to view the transit (and actually, to view the Sun in general). Do *not* use sunglasses, do *not* attempt to use your hand to cover a portion of the Sun, and do *not* attempt to "glance quickly" in the direction of the Sun. At any rate, a Transit of Mercury☿ is not visible to the unaided eye. If a first-timer is in *any doubt* whether he will be performing the viewing safely, viewing of the Transit should be attempted only with someone with previous solar viewing experience.