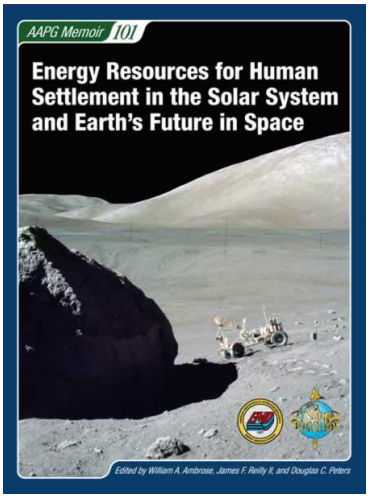
AAPG Astrogeology Committee: Taking the search for energy and mineral resources into the solar system. By Doug Cook and Bill Ambrose (Photos by Doug Cook unless noted otherwise)



The AAPG Astrogeology Committee is a small but active sector of AAPG that is interested not just in space exploration but also in future energy supplies for humanity. The primary goal of the committee is to emphasize the use of geosciences in the development of off-world exploration energy and other natural resources for development in the foreseeable future. The Astrogeology Committee compiled and edited *AAPG Memoir 101*: "All long-range programs for human exploration and settlement of the solar system recognize the vital role that extraterrestrial energy and mineral resources must play in support of human habitation of near Earth space and the Moon, Mars, and the asteroids." The Committee operates in liaison with retired AAPG astronaut-geologists Dr. Harrison H. Schmitt (Apollo 17- the only geologist and scientist to step onto the Moon) and Dr. James "Jim" Reilly (Shuttle and ISS Missions STS-89, STS-104, and STS-117).

Lunar Helium-3 resources could power Earth's future energy demands with clean nuclear fusion (*Schmitt Return to the Moon – Springer 2006)*. Water resources mined in space could be the equivalent of today's oil resources on Earth. Water costs more than its weight in gold to lift to deep space from Earth. If mined from the Moon, Mars, or asteroids, it could be used to make propellants and sustain human habitation. Other mineral resources on asteroids could have a value almost beyond measure. Based on analogous meteorite analyses, by author estimate, a two-kilometer-diameter Amor S-type near-Earth-asteroid could contain 5.2 billion metric tons of nickel, iron, cobalt worth about $5.6 trillion and 400,000 metric tons of platinum and gold worth about $18.3 trillion on today's world market. Its true value is dependent on the vagaries of future market forces and the cost of asteroid mining technology and resource transportation. Private and public enterprise is embarking on exploiting asteroid resources even now. US-based Planetary Resources and Deep Space Industries have staffed and funded the initial steps with advance probes to be as asteroid-resource scouts. The country of Luxembourg is partnering with these companies to further their foray into space. Luxembourg aims to contribute to the peaceful exploration and Sustainable utilization of space resources for the benefit of humankind.[1] Already, two percent of Luxembourg's GDP comes from space enterprise.[2] Further, they have passed space law that gives mining companies the right to keep what they mine.[3]

Where will the AAPG resource entrepreneurs be in tomorrow's asteroid mining boom?

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[1] "Luxembourg aims to contribute to the peaceful exploration and Sustainable utilization of space resources for the benefit of humankind" Space Resources Luxembourg, 15 November, 2017, http://www.spaceresources.public.lu/en.html

[2] "Luxembourg to invest $227 Million in Asteroid Mining" Fortune, 5 June 2016, http://fortune.com/2016/06/05/luxembourg-asteroid-mining/

[3] "Luxembourg's asteroid mining law takes effect August 1st", Engadget, 30 July 2017, https://www.engadget.com/2017/07/30/luxembourg-asteroid-mining-law-august-1/

AAPG ACE Houston 2017 Convention

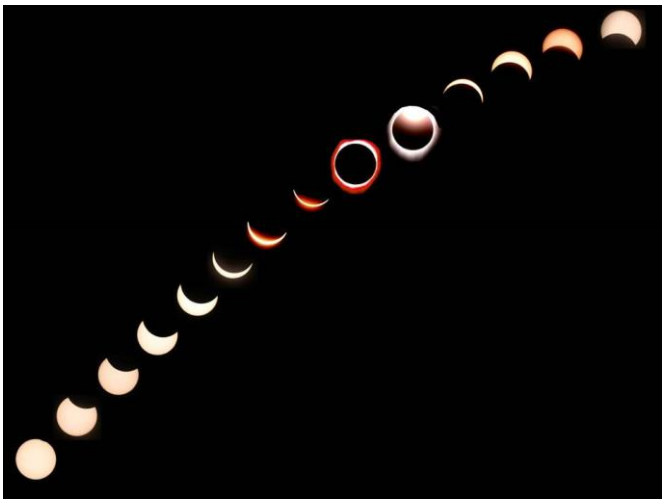
Astrogeology Technical Session at the 2017 ACE in Houston, Texas included proposed missions to the Moon as a stepping-stone to Mars, future exploitation of asteroid resources, and ongoing exploration missions to asteroids Vesta, Ceres, and Bennu. The session held a panel discussion with the presenters and fielded questions from student in the audience. The 2017 ACE meeting in Houston also included an Astrogeology field trip to Johnson Space Center Houston on April 1, 2017. The event was co-hosted by Astrogeology Committee Liaisons Dr. James Reilly, Linda Sternbach, Bill Ambrose, and Doug Cook. We were given a behind the scenes tour discussing lunar and asteroid sample archive and research facilities. The Lunar Sample Archive tour was led by Ryan Zeigler, Manager, Astromaterials Curation/Apollo Sample Curator, NASA JSC. The event was attended by 50 persons including students and AAPG industry professionals. Previous Astrogeology Field trips to Johnson Space Center Houston were co-hosted by AAPG astronaut-geologists Jack Schmitt, Jim Reilly, and Drew Feustel.

2014 AAPG Johnson Space Center Houston Tour: Space Exploration Vehicle Rover Driving Demonstration at the JSC Rock Yard Mars Simulation Terrain. Engineers pose with Harrison Schmitt and Jim Reilly.

AAPG Astrogeology Total Solar Eclipse 2017 Field Seminar

An AAPG Astrogeology Total Solar Eclipse Field Seminar was held August 18-22 in Casper, Wyoming. The event was sold out. The seminar was supported by Casper College Dr. Kent Sundell and his geology students. The seminar included sessions on solar system resources and local petroleum geology. Field sites included terrestrial impact structures, a K-T Boundary exposure, and fossil collecting permitted on private lands. The event was attended by 50 persons including students and AAPG industry professionals. NASA astronaut-geologists and committee liaisons, Dr. Schmitt and Dr. Reilly attended as leaders. From proceeds, Jack Schmitt will contribute $5000 to Casper College for impact crater studies and Jim Reilly will contribte $5000 to University of Texas at Dallas for study of planetary geology.

Dr. Jim Reilly, Dr. Kent Sundell, and Dr. Jack Schmitt experiencing the eclipse in Casper, WY.

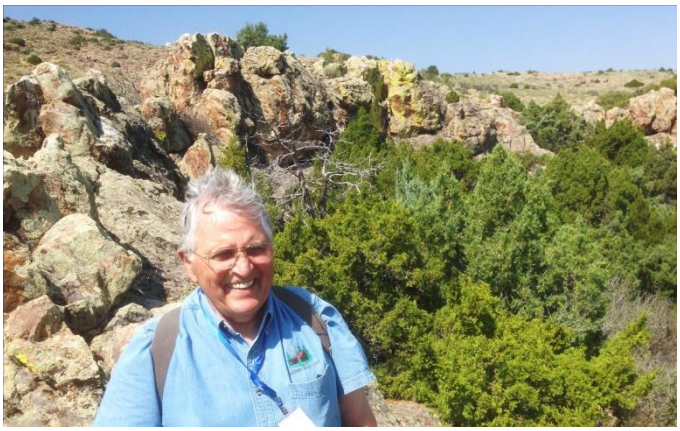


Composite of the Casper, WY total solar eclipse .

Jack Schmitt touching the KT Boundary at Linch, WY.

Below- 70 m impact crater near Douglas, WY. (Sundell image)

Below- Jack Schmitt at Douglas, WY impact crater



Jack Schmitt and Apollo 17 rover at the orange volcanic soil site at Shorty crater (NASA image)
December 12, 1972 Schmitt: "It's all over!! Orange!!!"

AAPG Astrogeology Total Solar Eclipse 2017 Field Seminar Casper, WY Group Photo (credit Ken Gray)

AAPG ACE Salt Lake City 2018 Convention

Astrogeology Technical Session "Future of Energy: New Discoveries in the Solar System: Implications for Energy and Mineral Resources" has invited papers covering Earth impact structures, lunar resources, mining water on the Moon, threat and resource assessment of near Earth Asteroids, mapping Mars water resources, and using Mars regolith as a resource to support a closed ecosystem for colonization. The session was co-chaired by Doug Cook and Bill Ambrose.

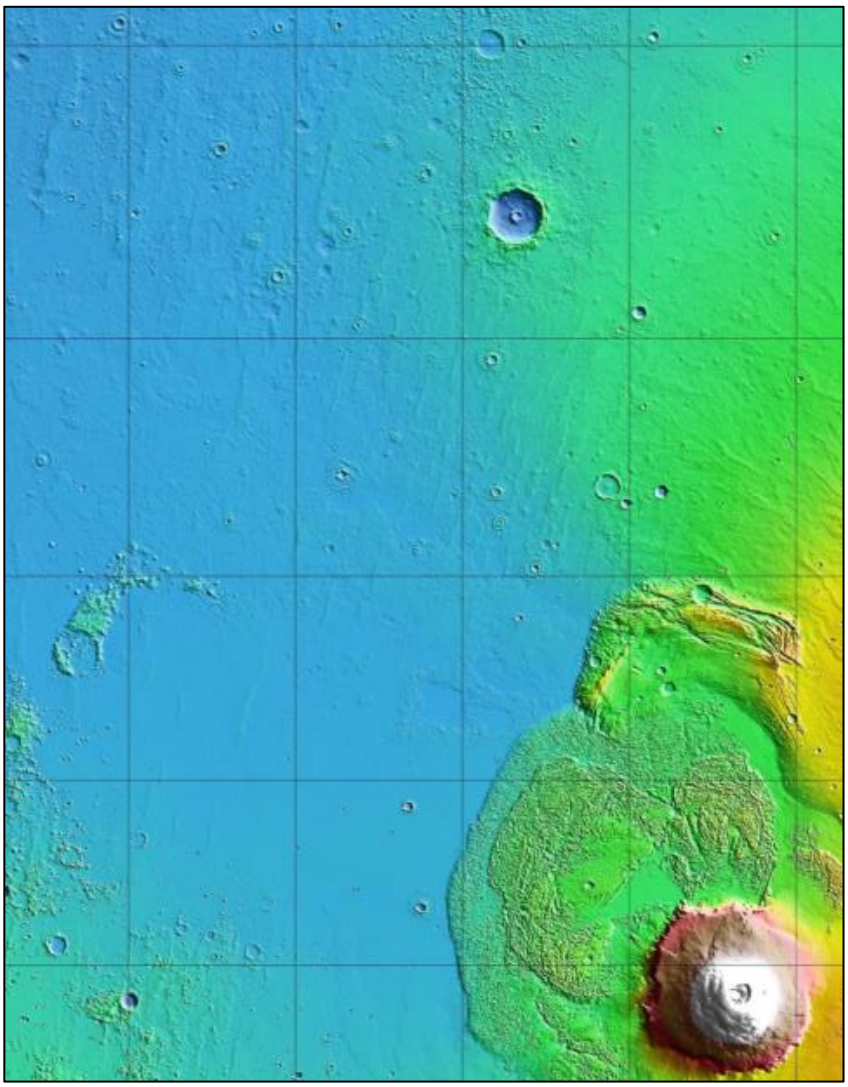


Image at left: NASA-JPL MOLA Mars Topography dataset with Olympus Mons extinct volcano lower right. The low, flat plain to the upper left is Arcadia Planitia that is interpreted to hold near surface water ice as a remnant of an ocean that once existed on Mars northern hemisphere.[4] This makes it an attractive candidate for a future Mars crew landing site. This is the topic of a paper by Colin Dundas, USGS Astrogeology Science Center, presented at the ACE Salt Lake City 2018 Astrogeology Session.

In our Salt Lake City Business meeting, we discussed a possible future Hedburg Conference themed on *Use of Economic Resources in the Solar System*.

[4] "NASA Research Suggests that Mars once had more water than Earth's Arctic Ocean" NASA, 15 March, 2015, https://www.nasa.gov/press/2015/march/nasa-research-suggests-mars-once-had-more-water-than-earth-s-arctic-ocean