

Volume 21.4
Winter 2011
Fourth Quarter

PSF NEWS

Planetary Studies Foundation

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UPCOMING EVENTS

Winter Constellations

January 21

1:00–2:00 p.m.

How to Use Your Telescope Workshop

January 28

1:00–2:00 p.m.

This One's Got Sole: The History of Shoes

February 4

1:00–2:00 p.m.

Ernest Shackleton: A Life of Exploration

& Book Signing by Paul Sipiера

February 11

1:00–2:00 p.m.

Victorian Purse Making Workshop

February 18

10:00–2:00 p.m.

DESTINATION: BLUE ICE

On Saturday, November 12th the Planetary Studies Foundation hosted an Antarctic Social Gathering in Elizabeth, IL. Numerous participants shared their rare experience of this unique continent, bringing along friends, memories, photos and more.



(From Left to Right) David Butts, Sindy Main, Diane & Don Kussmaul and Paul Sipiера

Paul Sipiера shared PSF's expeditions, 1998, 2000 and 2002. Paul explained these various expeditions through a slide show presentation. Other speakers included PSF member David Butts (expeditions 2000 & 2002) who spoke of his responsibilities and contributions to those expeditions. Sindy Main, also a PSF member, shared her expedition experiences with other members.

Don and Diane Kussmaul of East Dubuque attended the gathering as well, having visited Antarctica in 2005. They spoke about their perilous cruise down the Drake Passage and voyage along the way. The Antarctic Social Gathering of 2011 was open to both PSF members and the general public.

EVIDENCE OF LIFE:

Richard A. Hoover Explains His Findings

The idea of life existing outside Earth is as controversial as ever with many people still believing it is near impossible for life to exist elsewhere. However, PSF Member and NASA scientist, Richard A. Hoover, discovered evidence of fossils within meteorites years ago. He has done extensive research and is well-versed on this topic.

In a recent email he received from seventh grade students from Sweden, he goes into great detail, that is easy to understand, to answer their questions as well as explain his findings and what these microorganisms mean to our Universe. Richard was kind enough to share this email with the PSF, which we have published in its entirety on pages 9–11.

PRESIDENT'S MESSAGE

As we close out 2011, I can look back on a very successful year and be extremely proud of our organization. I would first like to thank our Associate Board member **COL (IL) James N. Pritzker IL ARGN (retired)** for his continuing generosity in providing PSF with a major educational program grant. Without his support, PSF could not provide the educational services it does for the community, and that would be a great loss. Our 1876 Banwarth House and Museum has become an integral component of the Elizabeth, Illinois community that draws both local, state, and international visitors. Over 800 people toured our facility and enjoyed their guided tours and various special events. The Banwarth House also hosted several PSF "members only" events that included the Annual Members Meeting held in August. During the warmer months (April through October) hundreds of people joined us for our stargazing parties at the **Apple River Fort State Historic Site** located just a half mile east of the Banwarth House. Additional astronomy events, hosted by PSF members **Jim Dole and Jerome Clair** were held at the JETS Astronomical Observatory in Freeport, Illinois. Our *Starlab* portable planetarium is once again in popular demand providing educational programs to various schools and community groups throughout Jo Daviess, Stevenson, and Carroll counties. As I look back on twenty years of PSF's *Starlab* programs, we can accurately estimate that we have educated and entertained over 60,000 people. What a magnificent accomplishment! **Diane Szipiera** and her staff will make every effort to carry that success well into the future. Another area that PSF has made a significant scientific contribution to is our continuing meteorite research. Our affiliation with the **Robert A. Pritzker Center for Meteoritics and Polar Studies** at Chicago's Field Museum of Natural History continues to provide PSF with new opportunities. I also have the privilege of working with two of our senior research associates **Drs. Ted Bunch and Tony Irving**. Together we have classified over 100 new meteorites and have presented scientific papers at the annual Lunar and Planetary Science Conference (LPSC) in March and at the annual meeting of the Meteoritical Society this past August. Included in this group of meteorites are 23 specimens from the PSF's 2002 Antarctic Expedition to the Pecora Escarpment. Five of these meteorites are extremely significant finds and their descriptions will be presented at the 2012 LPSC conference this March. Among the other meteorites being studied are several rare specimens from North Africa and Oman that have been provided by PSF member **Blaine Reed** and our French colleague, **Fabien Kuntz**.

Looking ahead to 2012, we can anticipate another event-filled year of historical, astronomical and community-related activities. Our 2011 "Year-end Giving Program" has raised sufficient funds to construct a stairway that will connect the Apple River Fort's Interpretative Center parking lot to the entrance of the Banwarth House. This will create easier access to the Banwarth House and encourage more visitors. PSF is also working with the **Elizabeth Area Chamber of Commerce** to get local businesses to offer a "good and services" discount to our members. Hopefully this will bring more of our Chicago area members out to participate in our programs and enjoy a beautiful dark night sky.

Wishing you all a very happy and healthy New Year!

Paul P. Szipiera

DONOR'S SPOTLIGHT

\$50,000

COL(IL) J.N. Pritzker, IL ARNG (Retired)

\$20—\$200

Sophie & Jim Abemante

M. Jaffe

End of the Year Giving “Stairway to the Heavens”

\$1,000—\$2,000

COL(IL) J.N. Pritzker, IL ARNG (Retired)

Tawani Foundation

\$500—\$999

Jennifer Schwartz

(Yahoo! Employee Matching Donation)

\$100—\$250

Bill & Claudia Gruber

Jim Hagan

Larry W. Knight

David M. Lauerman

Paul & Diane Sipiera

Linda Virag

\$0—\$99

Leo & Karen Baran

Cecilia Cooper

Jess & Kathie Farlow

(Farmers Guest House)

Phil & Nancy Hablutzel

Bill & Alice Hack

James A. Lovell

Richard & Alimae Persons

Marilyn Quas

RENEWING MEMBERS

Cecilia Cooper
Connie Kane
Richard Persons
Dan & Pam Tindell Family
Dottie Voetberg
Sharon Westenfelder

MEMBER'S CORNER

- After one full year of hard work preparing an intensive portfolio and sitting for six long exams, both **Debra and David Kahn** have been awarded National Board Teaching Certification. Debra's certification is in Special Education and David's certification is in Science. Only 0.4% of teachers nationwide have been certified by the National Board! David was also recently accepted by Olivet Nazarene University into their Doctorate in Education graduate program. Congratulations!
- Congratulations to **Jerry and Elena Marty**, PSF members from California, this past September as they celebrated their 40th wedding anniversary. They celebrated this special occasion by going on vacation to Greece, the Aegean Sea, and Turkey. Also, a special congratulations to Elena, her jewelry designs will soon be featured in Belle Armoire Jewelry and Jewelry Affaire magazines.
- Alabama members **Owen and Eve Garriott** had an exciting year traveling the world seeing Alexandria, Switzerland, and Italy. Even with all the travels, Owen and Eve are most proud that they are expanding their grandchildren to the number eleven.
- **Bill and Mary Sue Coates** attended a black tie reception of a Boston College-Yale art Exhibit of the artifacts from the Dura-Europos excavation on the Euphrates, where Mary Sue's father was field director for five years in the 1930's. The exhibit featured the three most important finds: The Mithraeum, a temple of secretive, mystical, Persian religion; the earliest-dated Christian chapel (232 A.D.) and a Synagogue with brilliantly-colored frescos of Old Testament verses. Mary Sue also had the opportunity to travel to Namibia, where the highest sand dunes are located in the world. The dunes are bright rusty red and 1,000 feet high rising above from the surface of some of the world's oldest rocks. She also attended a convention of the Society of Women Geographers in Boulder, CO.
- PSF's best wishes to **Bill and Alice Hack** who live in Texas. Their families went on a cruise to Hawaii to help them celebrate their 50th wedding anniversary. They needed this celebration after a wildfire this past spring almost took their house.
- Good lucky to our PSF's Alaskan member **Art Mortvedt** on his Polar Flight 90 attempts in April 2012. To follow Art please check out Art's website at www.polarflight90.com. You will be in our thoughts for a safe flight.
- **Richard and Elle Leary** from Springfield, Illinois celebrated their 50th Anniversary by taking a bus/train tour through the Canadian Rockies. Also this year, they had an opportunity to visit Ethiopia for 22 days.
- Montana members **Evelyn and Loren Acton** had a full year of adventure. They visited Cuba for two weeks with a group of 16 who traveled there on a humanitarian license from the U.S. Dept. of State. Evelyn and Loren did a 66-day trip driving from sea to shining sea here in the U. S. in their '89 Chevy Pick-up. Also, they went to Nairobi, Kenya where Loren did an astronaut program for children to celebrate and encourage dialog between children and government officials. Loren wanted to make their government aware of the severe corruption and exploitation of children by poorly regulated schools and children's homes.

- Wedding congratulations to **Richard & Laetia Garriott** who were married this year in Paris. We wish you the very best luck for the future!
- PSF's Austrian member **Birgit Sattler** was in Freeport, Illinois to work with PSF member and teacher **Sindy Main** on their "Sparkling Science" project this past December. After the organizational meeting, Birgit along with JN Pritzker came to Elizabeth for the museum tour. Some of Birgit and Sindy's experiments will be going with **Art Mortvedt's** project "*Polar Pumpkin*" this coming April to the North Pole. Sindy will be presenting a program in March about what their project is about at the 1876 Banwarth House and Museum.

2012 WINTER LECTURE SERIES

January 21st - 1:00 to 2:00 p.m.

Winter Constellations

There is no better time to view constellations than the winter months. Cold, crisp and clear nights make for nighttime skies that are brilliant. Diane Sipiera will share her knowledge of the universe and solar system for people to learn about and appreciate the winter sky. Her slide presentation will introduce you to Orion the Great Hunter, Taurus the Bull, Canis Major, and Gemini the Twins. The cost for attending this lecture is FREE for PSF members and \$3 for non-members.

January 28th - 1:00 to 2:00 p.m.

'How to Use Your Telescope' Workshop

Maybe you got a telescope for the holidays? Or maybe you have one and aren't sure how to use it properly. Amateur astronomer, Chris Zirtzman, will share his knowledge and expertise to guide you how to best use your telescope. From viewing the moon to using filters in the daylight, this workshop will help. The cost for attending the workshop is FREE for PSF members and \$3 for non-members.

February 4th - 1:00 to 2:00 p.m.

This One's Got Sole: The History of Shoes

Take a step back into the wonderful world of footwear. Diane Sipiera will explore the history of shoes, the variations in both style and purpose and much more. A presentation will follow the path of this rarely thought of, but essential item, throughout history. The cost for attending is FREE for PSF members and \$3 for non-members.

February 11th - 1:00 to 2:30 p.m.

Ernest Shackleton: A Life of Antarctic Exploration & Book Signing

In a race to the South Pole, one man proved determination and courage in the midst of adversity. Hear the stories of Shackleton's icy treks and see photos of his travels. His unique life story will be told by fellow Antarctic explorer, Dr. Paul Sipiera. Dr. Sipiera has also authored a book on Shackleton's life and will be holding a book signing following his lecture. The cost for attending is FREE for PSF members and \$3 for non-members.

February 18th - 10:00 a.m. to 2:00 p.m.

Victorian Purse Making Workshop (10:00 a.m. to 2:00 p.m.)

This popular one-day workshop returns once again and just in time to brighten the winter mood. Jolene Foat will guide you through making a Victorian purse. This purse is a simple sewing project for anyone. The cost for this workshop is \$15 for PSF members and \$25 for non-members. This will cover supplies for the class such as cloth, ribbon, cording, flowers and thread. Please RSVP for this event at dsipiera@planets.org so as to have a final count of how much supplies are needed.

MEMBER SPOTLIGHT: DAVID KAHN

David Kahn has been a PSF member for many years and a lot of you may remember the *Astronomy 101* column he wrote for the *PSF News* for numerous issues.

David grew up in Arlington Heights, Illinois and other than a brief time living in Boston after college, he has always lived about one mile from his childhood home. Debra, David's wife, is a middle school special education teacher and together they have two daughters Jami and Talia. Jami is a high school junior and Talia is currently in middle school. David and his entire family have been long-time supporters of the Planetary Studies Foundation.

Planetary Studies Foundation (PSF):

Where did you go to college and what was your primary area of study?

David Kahn (DK): I received my undergraduate degree in sociology from Brandeis University in Waltham, Massachusetts. I spent the first twenty years of my career working in several areas of healthcare and pharmacy administration.

PSF: What is your current profession and what inspired into that career path?

DK: While studying for a Master's in Pharmacy Administration at the University of Illinois at Chicago, I simultaneously enrolled in a Master's in Education program in order to further my goal of working in continuing education for pharmacists. However, it was during these studies that I came to realize that my true calling was in teaching younger students. So, switching paths, I obtained my high school teaching certification and a Master's in Teaching from National-Louis University. Currently I am a science teacher and the head Boys Bowling coach at Libertyville High

School in Libertyville, Illinois. I teach both Earth Science and Physical Science during the school year, as well as Astronomy during summer school.

PSF: What are some of your hobbies?

DK: I have been studying and teaching Okinawan Uechi-ryu Karate for almost 30 years. I own a small school where I have taught hundreds of students over the years, many of whom have attained the rank of Black Belt.

PSF: Where is your favorite place you have traveled and why?

DK: I spent a week in the Summer of 2010 studying the geology of Arizona to fulfill the final requirement of my Master's in Geosciences through Mississippi State University. Having never seen the Grand Canyon, I was not only in awe of its beauty, but spellbound at the magnitude of the natural forces that created it. In addition to hiking a short way down the Canyon, we also explored many geological formations



David at the Grand Canyon



David and his daughter Jami with Dr. Paul Sipiera



David teaching Newton's Laws at Libertyville H.S.

around Arizona. We hiked around a few volcanoes and through a ¾ mile long lava tube. Another highlight of the trip was seeing the small display on Dr. Sipiera in the visitor center at Meteor Crater.

PSF: What is your favorite area of science and why?

DK: I truly love all areas of science, both biological and physical. My main driving force is the overwhelming desire to understand our universe, our place within it, and the relationships between all its components.

PSF: How did you become involved with the Planetary Studies Foundation?

DK: While studying for my teaching certification, I enrolled in two courses at Harper College in order to fulfill some physical science requirements. I was lucky enough to have Dr. Sipiera as my professor in both Intro to Geology and Intro to Astronomy, as well as mentoring my independent study course in Advanced Astronomy. Dr. Sipiera invited me to attend a PSF sponsored lecture by William Hartmann and I became hooked. I was quite impressed with PSF's dedication to science education.

PSF: You have been involved with the PSF for many years, what are some things you have been involved with?

DK: Over the years I have tried to attend as many PSF sponsored lectures and stargazing events as possible. One of my first projects for PSF was working with Diane to create an information packet to send to schools highlighting the Starlab Portable Planetarium System. I also spent many years writing the Astronomy 101 column for the PSF newsletter.

PSF: What advice would you give to our younger readers and science enthusiasts?

DK: I know it sounds cliché, but never stop learning. There has never been a period of my life of more than a year or two when I have not been enrolled in a college course or graduate program. After three (and a half) master's degree programs I am finally taking the plunge next spring and beginning a program to earn my doctorate in education. Finally, never be afraid to ask a question. There is nothing wrong with not knowing, but there is something wrong with not wanting to know.♦

Geology Word Search

Find the names of various rocks hidden in the puzzle.

T	N	X	E	J	F	Q	W	N	P	Y	N	O	C	R	I	Z	AMETHYST BERYL BORAX COPPER CUPRITE DIAMOND FELDSPAR FLUORITE GALENA GARNET GOLD GRANITE GRAPHITE GYPSUM HALITE JADEITE LEUCITE MALACHITE MICA PLATINUM PYRITE QUARTZ RUBY SILVER SULFUR TOPAZ TURQUOISE ZIRCON
I	O	R	I	E	U	E	S	I	O	U	Q	R	U	T	G	F	
E	A	Z	J	A	T	O	L	K	P	M	N	W	N	A	L	A	
T	W	X	R	A	T	I	E	D	K	Y	H	I	R	D	Z	R	
I	P	T	D	Z	H	T	H	H	S	O	R	N	H	A	K	S	
E	Z	L	R	N	I	O	A	C	W	P	E	I	P	S	O	U	
D	M	S	A	C	O	L	A	D	A	T	A	O	T	B	X	L	
A	S	U	U	T	I	M	P	M	I	L	T	R	E	E	K	F	
J	I	E	S	T	I	A	A	R	E	L	A	R	Z	B	A	U	
G	L	A	E	P	N	N	O	I	Z	T	Y	M	B	M	C	R	
R	V	N	N	J	Y	U	U	X	D	L	H	Z	Y	M	I	U	
A	E	E	Z	R	L	G	L	M	E	Q	B	Y	M	Y	M	G	
N	R	L	S	F	H	S	G	K	I	H	O	O	S	E	K	R	
I	D	A	B	G	E	R	U	B	Y	Y	R	O	V	T	H	W	
T	L	G	E	T	I	R	P	U	C	N	A	J	X	C	P	F	
E	O	E	T	I	H	P	A	R	G	A	X	K	B	E	Q	T	
K	G	G	C	K	Y	B	C	O	P	P	E	R	A	X	J	B	

All About Puzzles

puzzles.about.com

IN MEMORY OF ROBERT A. PRITZKER

The Planetary Studies Foundation board and directors would like to extend their sincere sympathy wishes to the Pritzker family. On October 27, 2011, PSF member Robert A. Pritzker passed away from Parkinson's disease at the age of 85. Robert Alan Pritzker was born in Chicago on June 30, 1926. His wife, Mayari, survives him. Bob also has five children, James, Linda, Karen, Matthew and Liesel; 10 grandchildren; and two great-grandchildren.

Robert (Bob) Pritzker was a very unique person, at the young age of 19 he graduated with a university degree in industrial engineering from the Illinois Institute of Technology ("IIT") in Chicago. As a young man, Bob delighted in visiting and learning the technologies of manufacturing companies. His business curiosity, operations expertise and knowledge provided the basis for his ability to improve the operating efficiencies of various companies.

Bob built what became the enormously successful privately held Marmon Group – an international conglomerate of manufacturing and service companies – which formed the core and has been the foundation of the Chicago-based Pritzker family business. Bob led, nurtured and developed the Marmon Group based on his principles of fairness, honesty and ethical business behavior which he instilled throughout the companies' worldwide businesses.

In 2002, as Chairman and President of the Marmon Group (the company was subsequently sold in 2008 to Berkshire Hathaway), Bob acquired several caster, hardware and medical device companies creating Colson Associates. Taking on the new challenge at age 76 of creating and building the Colson Associates group of companies, Bob turned the businesses into thriving, highly

successful enterprises with a global reach into all the major markets around the world. The Colson Medical Companies have developed into respected and highly successful businesses. They focus on the constant advance of innovative medical technologies, which are continuing to lead to higher standards of medical care throughout the world.

For more than fifty years, hundreds of acquisitions were made, including the 1980 acquisition of Trans Union Corporation, then one of the nation's oldest and most respected New York Stock Exchange companies. During those fifty years, his principles of doing business coupled with his creative and astute business judgment resulted in an astounding increase in the level of combined revenues.

In 1984, in recognition of his many outstanding contributions and achievements since his graduation in 1946 with a degree in industrial engineering, the Illinois Institute of Technology ("IIT") bestowed upon him an honorary Doctor of Engineering degree and in 2002 he was inducted into the University's Hall of Fame. His continual commitment to the future of engineering education led to critical innovations in research and teaching throughout the years.

As Chairman of the IIT Board of Trustees for many years, Bob presided over the reinvigoration of the University, lending his personal leadership, management advice and generous philanthropic support. His foresight and financial support also led to the creation of the Pritzker Institute for Medical Engineering in 1981, now a focal point for the University's biomedical engineering education and research.

Throughout his career, Mr. Pritzker strongly believed that well-educated engineering minds would long be essential to the ability of the United States to compete in world markets. He advanced his cause not only through his leadership roles at IIT but also through his service as Chairman of the National Association of Manufacturers and through various roles with the National Academy of Engineering. At various times during his long and respected career, he taught management and engineering courses at IIT, the University of Chicago and Oxford University.

Bob served on many civic and cultural Boards, including the American Enterprise Institute, Chicago Jazz Ensemble, Junior Achievement International, MPN Research Foundation, and National Academy of Engineering. He was a life Trustee of the Chicago Symphony Orchestra and Rush University Medical Center, an honorary Director of the Lincoln Park Zoological Society, and past Chairman of the Board of Trustees at the Field Museum of Natural History. Mr. Pritzker was also inducted into the Junior Achievement of Chicago's Business Hall of Fame.

Bob and his wife Mayari were gracious in hosting a private event at their home to promote PSF's 2000 Expedition to Antarctica. They were hoping other benefactors would help in making this expedition to the frozen continent a dream come true. The two of them believed in PSF's mission and goals.

Many of us will miss his analytical thinking, his enthusiasm and quest to learn more. We will miss you significantly.♦

EVIDENCE OF LIFE: Richard A. Hoover Explains His Findings

Dear Mr. Hoover,

We are a group of kids in seventh grade in Sweden. We're working with a project about life in space and saw you in a Swedish newspaper. Would you answer some questions for us? We would be thankful for your time if you could answer these questions well.

1. Is there life in space?
2. If so, what is your evidence?
3. Is the only life (if there is any) small cells or mammals like us?

Thank you!

Kasper, Hanna, Jesper & Christian

1. Is there life in space?

I interpret your question to mean: Does life exist elsewhere in the Universe and not only on Earth? My answer to this question is Yes.

2. If so, what is your evidence?

My evidence is the fossils that I have found embedded freshly broken surfaces of meteorites.

3. Is the only life (if there is any) small cells or mammals like us?

All of the fossils that I have found in the meteorites are of microorganisms. Most are bacteria. Many are cyanobacteria. They grow with many cells in long filaments. For a long time they were considered plants and known as "Blue-Green Algae". These filaments are big enough to be seen without a microscope. None of the fossils I have found in the meteorites are mammals. Some appear to be protozoa, which are microscopic animals.

I will now explain in detail the reasons why I am convinced there are fossils of once living organisms that were present in the meteorites while they were in

space. This is important, because many people---even many scientists--- think that these are either "*shapes or squiggles that mean nothing*" or that they the forms that are clearly recognizable as microorganisms "*simply crawled into the meteorites after they landed on Earth.*"

I am convinced that these are fossils of living organisms because I have spent my entire life studying the microscopic world. I was only 8 years old on Christmas Day in 1951 when I got my first microscope. This was a great treasure. Capable of magnification of 100X to 1000X---

it opened the doorway to a new world. Salt crystals became perfect cubes and the eyes and legs of flies and spiders in 3D were more terrifying than any movie monster. Each drop of pond water was my own personal jungle. The giant, ferocious amoebae and paramecia devoured smaller animals and helpless bacteria and long strands of green and blue-green algae. Everything moved---vorticellids twirled giant wheels to suck in their food and Volvox rolled past like great green balls with spikes. Diatoms were tiny little golden-brown plants with beautiful ornamented shells, but they could swim with grace and elegance. Many years later, I met my wife, Miriam. She had inherited a wonderful collection of microscope slides of diatoms from her great-grandfather Cornelius Onderdonk. He studied diatoms from 1850 to 1900 and traded slides with the great diatomists of the day. Miriam and I were married in 1970 and she still tells friends that I only married her to get her diatoms. They know that is not true. But it is true that her diatoms truly changed my life. They gave me the opportunity to learn the system for classification of organisms. They also

led me to collaborate with the great Astronomer, Sir Fred Hoyle, on a paper about the possibility that diatoms might be able to live on comets. We published that paper in 1986. When I started studying meteorites I hoped that I might find them to contain diatoms. But to this day, I have yet to discover a single diatom shell in a meteorite. The study of the Onderdonk diatoms gave me sufficient knowledge about the field that in 1973, I was invited to conduct an Inventory of the diatoms of Henri van Heurck Museum of the Royal Society of Zoology of Antwerp, Belgium. This work resulted in my Article "Those Marvelous Myriad Diatoms" that was published in National Geographic Magazine in June, 1979. Perhaps it is in your school library. The work on diatoms also provided the foundation for my move from work on X-Ray Telescopes at NASA to my current work in Microbiology and Astrobiology.

Diatoms are classified entirely by the shape and detailed features of their shells. Those who believe that "*shapes or squiggles mean nothing*" certainly no nothing about diatoms or micropaleontology since the identification of the genus and species of the diatom (or bones of a dinosaur) depend almost entirely on the details of the shape, size and appearance of the fossil.

My microscope truly changed my life. If you and your friends who are young scientists do not have one, I strongly urge you to get one. With my microscope, I learned that worlds exist that cannot be seen with the unaided human eye. I learned that you must observe the natural world in order to understand it. I also learned that you must be willing to change old ideas when new evidence is discovered. That is the

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foundation of good science. We now know that for centuries Ptolemy's idea that the Earth was the center of the Universe and that the Sun, planets and stars revolved about the Earth is wrong. But it required the Copernican Revolution to change this idea that was held by almost everyone. Today, many scientists adhere to the idea that life exists only on Earth and strongly oppose any evidence for microfossils in meteorites, even if these microfossils are only the mineralized remains of cyanobacteria. So let me now tell you about the revolution of cyanobacteria.

For almost 200 years, scientists thought that cyanobacteria were plants. These "algae" were the blue-green pond-scum that floats on the surface of a pond in summer. They had chlorophyll and they carried out photosynthesis—so it was thought that they had to be plants! Scientists called them "Cyanophytes" – meaning "blue-green plants". But algae, flowers, trees and other plants as well as humans and other mammals are all "eukaryotes". They are considered higher life forms because all of their genetic material is contained within a distinct nucleus. The "lower" life forms have their genetic material distributed throughout the cell rather than in a distinct nucleus. They are called "prokaryotes" and they include two domains--the bacteria and the archaea. We now know that these "blue green algae" are not algae (plants) at all. They are really bacteria, so they are now called "cyanobacteria" in recognition of their blue-green (cyan-like) color. But what wonderful bacteria these cyanobacteria are! They first appeared on Earth over 3 billion years ago. Ancient cyanobacteria can be recognized because of special chemical fossils they left behind in ancient rocks. They also built stromatolites, very similar to those being built today in Shark Bay, Australia by living colonies of cyanobacteria. Some species of

cyanobacteria use special cells (called heterocysts) to convert atmospheric nitrogen gas (which can not be used by living organisms) into the organic nitrogen that can be used by life. This process is called "nitrogen fixation". About 2.7 billion years ago, the cyanobacteria began to flourish in tremendous numbers in the ancient oceans. By their photosynthesis, vast amounts of oxygen were released into the Earth's atmosphere and nitrogen was made useable for life. Before that, our planet was unsuitable for life forms that need to breathe oxygen in order to live! Anaerobic bacteria ruled the world. But the oxygen released into the atmosphere by cyanobacteria (and later by diatoms) made it possible for fish, trilobites and larger animals to live on Earth.

And now the EVIDENCE!

The meteorites that I have studied are called carbonaceous meteorites. They are called that because they contain high levels of carbon that have been proven to be extraterrestrial. They also contain extraterrestrial amino acids, nucleobases and many other complex organic chemicals that are essential for all life on Earth. They have water and it is possible to prove that this water is also extraterrestrial. It is certain that these meteorites did not come from the Earth. They also did not come from the moon or from Mars. They most probably are the remains of comets or "water-bearing asteroids".

The carbonaceous meteorites contain diamonds that are older than the Solar System. And these meteorites also contain microfossils of filaments. During the past 15 years, I have found many filaments in these carbonaceous meteorites, but they are absent in the many other kinds of meteorites I have studied. Some of the filaments can be clearly recognized as filamentous cyanobacteria because they have heterocysts. The filaments are

embedded in the inner parts of the meteorite rocks. When I break the stones, the filaments are sometimes exposed. They are clearly embedded in the rocks. I break the stones and then put them in a special type of Scanning Electron Microscope. This microscope scans the surface of the sample with an electron beam and then produces very high resolution and high magnification images of tiny features on the meteorite. When the electrons hit the surface they cause x-rays to be produced. These x-rays can be analyzed to determine the chemical elements at any point in the sample.

How do I know that these filaments are biological? I know this because I have studied cyanobacteria and microbiology. I can recognize these filaments just as easily as I can recognize the genera and species of the filaments of cyanobacteria that I collect from the lake behind my house or that I have growing in culture in my lab. This is based on knowledge of the details of the filament features and the precise size and shape of the internal cells and heterocysts. And I know this because I have shown these images to some of the world's greatest experts on cyanobacteria, who have also recognized the same features that are very familiar.

How do I know that these filaments are not modern Earth life contaminants that somehow invaded the stones after they landed on Earth?

I know the filaments cannot be modern Earth life. *The X-ray analysis I have done shows the filaments in the meteorites have no detectable nitrogen.* This means the nitrogen in the meteorite filaments is less than 0.5% (atomic).

However, every living cell contains nitrogen. Nitrogen is in every amino acid in every protein in every cell. It is in every DNA and every RNA molecule in every cell. Living cells usually are between 4 and 10% (atomic) nitrogen.

I have found it to be as low as 2% (in wood bark) and as high as 18% (in rapidly dividing cells of an extremophile from Antarctica). After cells die, the organic nitrogen is broken down and very slowly returned to the as the N₂ nitrogen molecules in the atmosphere. This is a part of the nitrogen cycle and it is essential for life to exist on Earth. However, this process is very slow -- taking place over millions rather than thousands of years. I know this because I have measured nitrogen in ancient mummies from Peru (2000 years old) and Egypt (5000 years old) and Woolly Mammoths from Siberia (40,000 years old). They all have nitrogen in the range of 4 to 10%. However, 8 million years old fossil seashells and 100 million year old dinosaur bones contain no nitrogen. However, there is no doubt these animals were once alive and that they had to have contained nitrogen while they were alive.

This is evidence that the filaments in the meteorites must have died several millions (possibly even billions) of years ago. They certainly were not living within the last 40,000 years or they would contain nitrogen, just like the mammoth hair and tissues I have studied. However, these meteorites all landed on Earth fairly recently. The Alais meteorite was observed to fall in France in 1806. Orgueil was seen to fall in 1864. Ivuna fell in 1938. The Murchison meteorite fell in Australia in 1969. The fact that the filaments I have found in these meteorites do not contain nitrogen is the evidence that the filaments are not modern Earth life that invaded the stones after they landed on Earth.

This is only some of the evidence that life is not restricted to the planet Earth. There are many other lines of evidence that establish that these meteorites are not contaminated by modern biology. They only contain 3 of the 5 nucleobases and only 8 of the 20 amino acids needed for life. The others are missing, but they

are also missing from ancient fossils.

Kasper, Hanna, Jesper and Christian, I hope this helps you with your school Science Project. If you wish, I would be happy to send you scientific papers that provide images and describe these results in more detail. I encourage you to continue in your studies. You have asked exactly the right questions. This indicates that your mind is ideally suited to Science. There can be no more enjoyable or rewarding undertaking than devoting your life to trying to unravel and understand the mysteries and wonders of the Universe.

Yours,
Richard B. Hoover

January 9

Full Moon

The Moon will be directly opposite the Earth from the Sun and will be fully illuminated.

February 7

Full Moon

The Moon will be directly opposite the Earth from the Sun and will be fully illuminated.

March 3

Mars at Opposition

The red planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. This is the best time to view and photograph Mars.

March 8

Full Moon

The Moon will be directly opposite the Earth from the Sun and will be fully illuminated.

March 14

Conjunction of Venus and Jupiter

The two bright planets will be within 3 degrees of each other in the evening sky.

March 20

March Equinox

The Sun will shine directly on the equator and there will be nearly equal amounts of day and night throughout the world. This is also the first day of spring (vernal equinox) in the northern hemisphere and the first day of fall (autumnal equinox) in the southern hemisphere.

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